# Total-system Performance Assessment (TPA) Code Development and Analysis

by

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The table of contents provides work descriptions for the initial entry. The objectives and approaches taken are contained in the individual entries below. [added by R. Benke on January 11, 2007]

[No entries below this line]

Entries for Sections 6.1 to 6.4 retain their original dates and were transferred together into this scientific notebook on September 24, 2004.

## 6.1 Investigation of a Simple Method for Calculating Inhalation Dose

[entry made by R. Benke on April 13, 2004]

This entry describes the investigation into the simple method for calculating inhalation dose by Ryan et al. (2001). The simple calculation was applied to the volcanic eruption scenario for an eruption at 100 years after closure of the repository. The inhalation dose results from the simple calculation were compared to the inhalation doses from the TPA Version 4.1j Code. The results of the comparison are shown in a figure on Page 4 of Sheet 2 in RyanSpreadsheetInhalationCalc.xls.

The Ryan et al. method was entered into a spreadsheet, RyanSpreadsheetInhalationCalc.xls. The specific activities were calculated for a unit Derived Air Concentration (1 DAC), as shown on Page 3 of Sheet 2 in RyanSpreadsheetInhalationCalc.xls. Four prominent radionuclides for the 100-yr volcanic eruption were considered (Am-241, Pu-238, Pu-239, and Pu-240). For each radionuclide, the ratio of the airborne specific activities from contaminated ash to the specific activities at 1 DAC was used to calculate the inhalation dose:

$$D_{inh} = \frac{SA_{ash}}{SA_{1\mathrm{DAC}}} \times 5 \text{ rem} \qquad 6.1\text{-}1$$

where $D_{inh}$ represents the dose (rem) from the inhalation of resuspended contaminated ash,
$SA_{ash}$ represents the airborne specific activity (pCi/g) of contaminated ash, and
$SA_{1\mathrm{DAC}}$ represents the specific activity (pCi/g) corresponding to 1 DAC.

The spreadsheet calculation of the airborne specific activities of the four radionuclides required intermediate outputs from the TPA code on (1) the deposited ground surface activity per square meter, (2) the areal ash density (g/cm$^2$), and (3) the dilution factor for ash blankets thinner than the resuspendable layer thickness.

The necessary input and output files for the TPA Version 4.1j Code are saved in the subdirectories /Section_6.1/TPA_Input_Files/ and /Section_6.1/TPA_Ouput_Files/.

Several changes were required to the TPA inputs for this comparison. To ensure that TPA Version 4.1j Code only calculated inhalation doses, the dose conversion factors for the other pathways were assigned values of zero for all radionuclides (see /Section_6.1/TPA_Input_Files/gs_cb_ad.dat). The 4 dose conversion factor files (gs_cb_ad.dat, gs_cb_ci.dat, gs_pb_ad.dat, gs_pb_ci.dat) originated from the TPA run subdirectory called /data. This comparison, however, only used the dose conversion factor file for the current biosphere climate for the Amargosa Desert receptor, gs_cb_ad.dat. Changes were made to the TPA input file, tpa.inp, as well and are identified in Table 6.1-1.

**Table 6.1-1.** Changes made to tpa.inp.

| Change from the Default tpa.inp Setting in TPA Version 4.1j | Effect of Change |
|---|---|
| `iflag`<br>`VolcanismDisruptiveScenarioFlag(yes=1,no=0)`<br>`1` | Turns on direct release |
| `iflag`<br>`DirectReleaseOnlyFlag(yes=1,no=0)`<br>`1` | Only perform direct release calculation; reduces computation time |
| `iconstant`<br>`NumberOfRealizations`<br>`20` | 20 realizations |
| `iconstant`<br>`StopAtRealization`<br>`0` | Append output for all realizations |

| | |
|---|---|
| iconstant<br>OutputMode(0=None,1=All,2=UserDefined)<br>1 | Append all extra outputs |
| iconstant<br>SelectAppendFiles<br>12 | Not used when All output mode is selected |
| constant<br>DrinkingWaterConsumptionRate6[L/yr]<br>0.0<br>**<br>constant<br>LeafyVegetableConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>OtherVegetableConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>FruitConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>GrainConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>BeefConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>PoultryConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>MilkConsumptionRate6[kg/yr]<br>0.0<br>**<br>constant<br>EggConsumptionRate6[kg/yr]<br>0.0 | Ensure no ingestion doses; overkill since the dose conversion factors files for ingestion were set to zero |
| constant<br>InhalationExposureTime6[hr]<br>0.0<br>**<br>constant<br>InhalationRate6[cm3/s]<br>0.0 | Ensure no inhalation dose from the gentpa module |

| | |
|---|---|
| constant<br>SoilContaminationExposureTime6[hr]<br>0.0 | Ensure no ground surface doses; overkill since the dose conversion factors files for ground surface exposure were set to zero |
| iconstant<br>VolcanoModel(1=Geometric,2=Distribution)<br>2 | Allows user to specific a distribution for the number of waste packages entrained by the eruption |
| constant<br>TimeOfNextVolcanicEventinRegionOfInterest[yr]<br>100.0 | Fixes eruption time at 100 years |
| constant<br>NumberOfWPsEntrainedByEjecta[]<br>10 | Fixes number of waste packages entrained by the eruption at 10 |
| constant<br>AirborneMassLoadAboveFreshAshBlanket[g/m3]<br>5e-3 | Ensures constant airborne mass load at 0.005 grams per cubic meter |
| constant<br>OccupancyFactorForVolcanismDoseCalculation[-]<br>0.228 | Corresponds to a 2000-hr exposure time (i.e., 1 occupational year) |
| constant<br>AirborneMassLoadAboveSoil[g/m3]<br>5e-3 | Ensures constant airborne mass load at 0.005 grams per cubic meter |

Reference
Ryan, M.T., K.W. Skrable, C.S. French, C.A. Potter. A Simple Method for Assessing Exposure to Internal Emitters. Operational Radiation Safety, Supplement to Health Physics, Vol. 80, No. 5, p. S51, May 2001.

[entry made by R. Benke on April 19, 2004]

Note: TPA Version 4.1j selected the radionuclide chemical class that resulted in the highest dose conversion factors (e.g., Class W for Am and Pu). The spreadsheet calculation used the same chemical classes to be consistent with what was used in the TPA code.

[No entries below this line]

## 6.2 Evaluation of the Effects of Natural Backfill on Igneous Consequences

[entry made by R. Benke on August 3, 2004]

This section documents the supporting material cooresponding to the analysis described in Chapter ~~11~~10, Natural Backfill and Igneous Consequences, of the CNWRA Milestone, "Risk Analysis for Risk Insights Progress Report," submitted in ~~August~~December 2004. This section is indended to be supplement to the detailed descriptions provided in Chapter ~~11~~10, Natural Backfill and Igneous Consequences, of the CNWRA Milestone. [Changes to chapter numbers and date were made by R. Benke on March 3, 2005]

All files named in this section are stored in the \Section_6.2\ subdirectory. The figure depicting the minimum cross-sectional area of rock debris is stored in **Fig_MinAreaOfRockDebris.doc**. The hand calculation for the minimum cross-sectional area of rock debris is stored in **MinRockDebrisArea_HandCalc_pages1-5.pdf** [This sentence was added by R. Benke on August 25, 2004]. Calculations were performed using Mathematica® Version 4.1 (Wolfram Research, Inc. 100 Trade Center Drive Champaign, IL 61820-7237, USA, www.wolfram.com) and the TPA Version 4.1j code.

Mathamatica® Version 4.1 Calculations

The numerical model for simulating natural backfill and the results for a 1-m gap height are stored in **NumericalBackfillSimulator_final.nb**. Additional analyses testing different gap heights of 0.5 m and 2 m are stored in **NumericalBackfillSimulator_test0.5m.nb** and **NumericalBackfillSimulator_test2m.nb**, respectively.

TPA Version 4.1 Code Calculations

The script from D. Codell (NRC) was used for calculating igneous risk through time. The files related to this script are stored in the \Section_6.2\IgneousRiskCalc\ subdirectory. A description of the script is provided in **igneous_convo.doc** (unabbridged) and **Codell_IA_risk_calc.doc** (abbridged). The FORTRAN files (**combinef.for** and **cvolc4.f**) and executatables (**combined.e** and **cvolc4.e**). The batch file (**run.bat**) has also been archived [This sentence was added by R. Benke on September 24, 2004]. Note, the filenames **combinf.exe** and **cvolc4.exe** are mentioned in the description documents but coorespond to the filenames **combined.e** and **cvolc4.e** in this work.

A test was performed for the direct release scenario using the default TPA Version 4.1j parameter values. The files are stored in the \Section_6.2\BasecaseDirectRelease\ subdirectory. The basecase igneous risk curve was computed from 400-realization simulations of volcanic eruptions (at Years 100, 200, 300, 400, 500, 700, 1000, 1500, 2500, 4000, 6000, 8000, and 10000). A spreadsheet, **TPA41jBasecaseIgneousRiskTest.xls**, contains a plot of the basecase igneous risk curves for the TPA Version 4.1j code. This curve was visually compared to previous results, Figure 3-~~34~~43(b) of Mohanty et al. (page 3-80, 2004) [figure number corrected by R. Benke, 1/28/2005], and was determined to be in agreement with those previous results, which provides confidence that the script was functioning properly. The batch file (.bat), input files (.inp), and output files (.dat) are stored in the \Section_6.2\BasecaseDirectRelease\ subdirectory.

The igneous risk was also calculated for the "dog-leg" alternative conceptual mode (i.e., VolcanoModel=2 for the distirbution source term). The files are stored in the \Section_6.2\DogLegACM\ subdirectory. The igneous risk curve was computed from 400-realization simulations of volcanic eruptions (at Years 100, 200, 300, 400, 500, 700, 1000, 1500, 2500, 4000, 6000, 8000, and 10000). The spreadsheets, **UnburiedFraction.xls** and **DogLegRiskCurves_to10ka.xls**, contain all the results presented in the Chapter 11, Natural Backfill and Igneous Consequences, of the CNWRA Milestone, Risk Analysis for Risk Insights Progress Report. The batch file (.bat), input files (.inp), and output files (.dat) are stored in the \Section_6.2\DogLegACM\ subdirectory.

Reference:

Mohanty, S., R. Codell, J. M. Menchaca, R. Janetzke, M. Smith, P. LaPlante, M. Rahimi, A. Lozano. "System-Level Performance Assessment of the Proposed Repository at Yucca Mountain using the TPA Version 4.1 Code." CNWRA 2002-05. Revision 2. San Antonio, Texas: CNWRA. March 2004.

[entry made by R. Benke on November 23, 2004]
In response to NRC comments, the word, "Estimated," was added to the y-axis label in the spreadsheet, **UnburiedFraction_Rev1.xls**.

### 6.3 Updated Values and Justification for the Mass Load and Occupancy Fraction Parameters in the DCAGS Module of the TPA Version 5.0.1 Code

[entry made by R. Benke on August 25, 2004]

In the \Section_6.3\ subdirectory, the spreadsheet, **DCAGS_MassLoad_OccFract_FIN.xls**, contains the updated values and their justification.

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### 6.4 Modification to the Inhalation Dose Calculation in the DCAGS Module for the TPA Version 5.0.1 Code

[entry made by R. Benke on August 25, 2004]

The following change is included as part of SCR-~~482~~526 [change made by R. Benke on March 3, 2005]. A summary of the approach taken in the TPA Version 4.1j code is provided first, which is followed by the proposed change for the TPA Version 5.0.1 code. The proposed change only applies to the calculations invoked when the new flag in the TPA input file, AshEvolutionMode, is set to a value of zero.

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**TPA Version 4.1j Approach for Calculating the Inhalation Dose in the DCAGS Module**

The inhalation dose per year (rem/yr) in DCAGS for the i[th] radionuclide was calculated as:

$$D_{inh,i}(t) = B \cdot I_i \cdot \eta_i \cdot f_e \cdot f_R(t) \cdot \left[ (S_0 - S_\infty)\exp(-\lambda_r t) + S_\infty \right]$$

where

$B$ = breathing rate ($m^3$/yr),

$I_i$ = Inhalation-to-dose conversion factor for the i[th] radionuclide (rem/Ci),

$f_e$ = occupancy factor for time fractions the individual is exposed to indoor and outdoor contaminated air (-),

$f_R$(t) = time-dependent fraction of resuspended mass that emanated from the contaminated volcanic layer (-), equal to the ratio of the ash blanket thickness as a function of time to the thickness of the resuspendable layer, (Note: no code changes were made to this variable, and therefore, it is not described further)

$\eta_i$ = activity per mass of ash for the i[th] radionuclide (Ci/g)

$S_0$ = airborne mass load above fresh ash blanket in the year following deposition (g/$m^3$) = AirborneMassLoadAboveFreshAshBlanket[g/m3],

$S_\infty$ = airborne mass load at long times after the event (g/$m^3$) = AirborneMassLoadAboveSoil[g/m3], and

$\lambda_r$ = rate of reduction of airborne mass load (1/yr) = RateOfReductionOf MassLoadingFactor[1/yr].

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**TPA Version 5.0.1 Approach for Calculating the Inhalation Dose in the DCAGS Module**

The inhalation dose per year (rem/yr) in DCAGS for the i[th] radionuclide was calculated as:

$$D_{inh,i}(t) = B \cdot I_i \cdot \eta_i \cdot f_R(t) \cdot \left[ C_1 \cdot \exp(-\lambda_r t) + C_2 \right]$$

with

$$C_1 = \begin{bmatrix} f_{out-H}\left(S_{ash-H} - S_{out-H}\right) + f_{out-L}\left(S_{ash-L} - S_{out-L}\right) \\ + f_{in-H}S_{in-H} + f_{in-L}S_{in-L} + f_{offsite}S_{offsite} \end{bmatrix}$$

and

$$C_2 = f_{out-H}S_{out-H} + f_{out-L}S_{out-L}$$

where

$S_{ash-H}$ = mass load above fresh ash deposit with heavy disturbance (g/$m^3$) = AirborneMassLoadAboveFreshAshBlanketHeavyDisturbance[g/m3],

$S_{ash-L}$ = mass load above fresh ash deposit with light disturbance (g/$m^3$) = AirborneMassLoadAboveFreshAshBlanketLightDisturbance[g/m3],

$S_{out-H}$ = outdoor mass load for dust with heavy disturbance (g/$m^3$) = AirborneMassLoadOutsideHeavyDisturbance[g/m3],

$S_{out-L}$ = outdoor mass load for dust with light disturbance (g/$m^3$) = AirborneMassLoadOutsideLightDisturbance[g/m3],

$S_{in-H}$ = indoor mass load for dust with heavy disturbance (g/$m^3$) = AirborneMassLoadInsideHeavyDisturbance[g/m3],

$S_{in-L}$ = indoor mass load for dust with light disturbance (g/$m^3$) = AirborneMassLoadInsideLightDisturbance[g/m3],

$S_{offsite}$ = offsite mass load (g/$m^3$) = AirborneMassLoadOffsite[g/m3],

$f_{out-H}$ = fraction of time receptor spends outdoors with heavy disturbance = OccupancyFractionOutsideHeavyDisturbance[-],

$f_{out-L}$ = fraction of time receptor spends outdoors with light disturbance = OccupancyFractionOutsideLightDisturbance[-],

$f_{in-H}$ = fraction of time receptor spends indoors with heavy disturbance = OccupancyFractionInsideHeavyDisturbance[-],

$f_{in-L}$ = fraction of time receptor spends indoors with light disturbance = OccupancyFractionInsideLightDisturbance[-], and

$f_{offsite}$ = fraction of time receptor spends offsite = OccupancyFractionOffsite[-].

**6.5 Estimating the Sensitivity to the Tephra Deposit Cutoff in the ASHREMOB Lookup Table**
[entry made by R. Benke on August 30, 2006]

For the TPA Version 5.1BetaC Code, the lookup table for the ASHREMOB module, named *remob_lut.dat*, contains a tephra deposit cutoff of 120 g/m$^2$ (see Scientific Notebook 755E). In order to assess the relative sensitivity of inhalation dose to the tephra deposit cutoff (i.e., percent loss of inhalation dose for some value of the tephra deposit cutoff relative to the inhalation dose without a cutoff), a previous version of the lookup table without a deposit cutoff, Revision 2 dated 3/30/2005, was used for this sensitivity investigation.

Supporting files are archived in the /Section_6.5/ subdirectory. The results of the computations are presented in the spreadsheet named **LUTCutoffSensitivity.xls**. Input files (*tpa.inp* & *remob_lut.dat*) and output files (*tpa.out* & *rgssa.tpa*) are saved for the individual TPA code runs. All runs were performed using the Version 5.1BetaC code for 1024 realizations with the Direct Release Only flag turned on and eruption times fixed at 500 years. Airborne mass load and fluvial yield parameters were set to constants at the mean value of their default distributions. The two parameters for outside airborne mass load were set to the constant values requested in SCR-654. Refer to the archived input files for details on other settings and input values. Table 6.5-1 lists the subdirectory name and provides a brief description for the individual TPA code runs. The small difference of approximately 1 percent in the peak of the mean inhalation dose (*tpa.out*) for the unsorted and sorted runs (\33005LUT_NoSort\ and \33005LUT_SortedOnly\) is attributed to pairing sampled values from the VOLCANO module with different rows of the lookup table.

**Table 6.5-1.** Subdirectory names and description for individual TPA code runs

| Subdirectory Name | Description |
|---|---|
| \Section_6.5\DefaultLUT wiwfwe\ | Test run using the default lookup table for the TPA Version 5.1BetaC code and default values for the weighting factors in *tpa.inp* |
| \Section_6.5\DefaultLUT wi1wfwe0\ | Test run using the default lookup table for the TPA Version 5.1BetaC code and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _NoSort\ | Test run using the previous lookup table (dated 3/30/2005), without sorting of rows and no tephra deposit cutoff, and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _SortedOnly\ | Sensitivity run using the previous lookup table (dated 3/30/2005), sorted by decreasing values of the initial ash deposit at the receptor location (c_ash_i in g/m$^2$) and no tephra deposit cutoff, and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _1umCutoff\ | Sensitivity run using the previous lookup table (dated 3/30/2005), sorted by decreasing values of the initial ash deposit at the receptor location (c_ash_i in g/m$^2$) and with a tephra deposit cutoff of 1.2 g/m$^2$ (equivalent to a 1 μm thickness for an ash bulk density of 1.2 g/cm$^3$) and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _10umCutoff\ | Sensitivity run using the previous lookup table (dated 3/30/2005), sorted by decreasing values of the initial ash deposit at the receptor location (c_ash_i in g/m$^2$) and with a tephra deposit cutoff of 12 g/m$^2$ (equivalent to a 10 μm thickness for an ash bulk density of 1.2 g/cm$^3$) and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _100umCutoff\ | Sensitivity run using the previous lookup table (dated 3/30/2005), sorted by decreasing values of the initial ash deposit at the receptor location (c_ash_i in g/m$^2$) and with a tephra deposit cutoff of 120 g/m$^2$ (equivalent to a 100 μm thickness for an ash bulk density of 1.2 g/cm$^3$) and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |
| \Section_6.5\33005LUT _1000umCutoff\ | Sensitivity run using the previous lookup table (dated 3/30/2005), sorted by decreasing values of the initial ash deposit at the receptor location (c_ash_i in g/m$^2$) and with a tephra deposit cutoff of 1200 g/m$^2$ (equivalent to a 1000 μm thickness for an ash bulk density of 1.2 g/cm$^3$) and modified values for the weighting factors in *tpa.inp* ($w_i$ = 1, $w_f$ = 0, $w_e$ = 0) |

## 6.6 ASHREMOB Lookup Table Analysis

[entry made by R. Benke on May 23, 2007]

Comparisons of input data were made between the current version of the lookup table (i.e., auxiliary input data file for the TPA code named *remob_lut.dat*) and an earlier version dated March 30, 2005. Implications on estimated doses from different lookup table data sets and for different random number seeds using the current lookup table were evaluated using TPA Version 5.1BetaV code. Supporting files are archived in the \Section_6.6\ subdirectory. Table 6.6-1 provides descriptions for each of the supporting files. Input and output files from simulations using the TPA Version 5.1BetaV code are contained in the \Section_6.6\TPACodeSimulationFiles\ subdirectory. Table 6.6-2 provides descriptions for each of these simulations.

**Table 6.6-1.** Supporting file names and descriptions. All files are located in the \Section_6.6\ subdirectory.

| Filename | Description |
|---|---|
| LUT_Comparison.ppt | PowerPoint slide showing (1) the conversion of the March 30, 2005 lookup table data to a normalized source term of 1 metric ton of high-level waste ejected, (2) regenerated data for a modified version of the "current" lookup table with the tephra cutoff removed for the initial deposit column, and (3) scatter-plot-overlay comparison of the two data sets on the same basis. |
| ModifiedLUT_DoseResults.ppt | PowerPoint slides comparing estimated doses and intermediate outputs from the TPA Version 5.1BetaV code with "current" and "modified" lookup tables to evaluate the effect of a tephra cutoff at 120 g $m^{-2}$ for the initial deposit columns. |
| SeedAnalysis_CurrentLUT.ppt | PowerPoint slide comparing time histories of estimated doses from the TPA Version 5.1BetaV code with the unmodified "current" lookup table for different random number seeds. |
| LUT_DataComparison.xls | Spreadsheet containing comparisons of input data from different versions of the lookup table. For the March 30, 2005 lookup table data, the summed mass of high-level waste deposited in the fluvial and eolian source regions was used as an estimator for the mass of high-level waste ejected, so that the data could be normalized to 1 metric ton of high-level waste ejected. |
| rgssa-tpa_100yrEvent_Compare.xls | Spreadsheet containing estimated conditional doses from the TPA Version 5.1BetaV code with "current" and "modified" lookup tables. Two cases were evaluated: a special case only for any initial deposit at the receptor location and a case where all three source regions contribute to the calculated dose. |
| SeedAnalysis_ rgssa-tpa_100yrEvent.xls | Spreadsheet containing time histories of estimated conditional doses from the TPA Version 5.1BetaV code for different random number seeds. |
| remob_lut-InitialDepCutoffRemoved.dat | New auxiliary input data file constructed using modified data for the initial deposit columns without a tephra cutoff at 120 g $m^{-2}$. Airborne Transport Integrated Subissue staff generated the modified lookup table data for the initial deposit columns without a tephra cutoff (refer to Scientific Notebooks 820E and 755E for more information about the TEPHRA Version 1.0 code and offline calculations to generate the lookup table data). |
| \TPACodeSimulationFiles\1_P15Test4Run100yr_OrigLUT\ashremob-out_SORTED_100Yr.xls | Spreadsheet containing intermediate results from *ashremob.out* that have been averaged over the 1024 realizations (See Table 6.6-2 for more information about the \1_P15Test4Run100yr_OrigLUT\ simulation) |
| \TPACodeSimulationFiles\2_P15Test4Run100yr_InitialDepCutoffRemovedLUT\ashremob-out_SORTED_100Yr.xls | Spreadsheet containing intermediate results from *ashremob.out* that have been averaged over the 1024 realizations (See Table 6.6-2 for more information about the \2_P15Test4Run100yr_InitialDepCutoffRemovedLUT\ simulation) |

**Table 6.6-2.** Subdirectory names and description for individual TPA code simulations. Each subdirectory contains *tpa.inp*, *remob_lut.dat*, *rgssa.tpa*, and *tpa.out* files from the simulation. All simulations were performed for a fixed eruption time at 100 years.

| Subdirectory | Description |
|---|---|
| \Section_6.6\TPACodeSimulationFiles\1_P15Test4Run100yr_OrigLUT | Software validation test (Task P-15, Test 4) simulation using an unmodified version of the current lookup table. Subdirectory also contains intermediate results in the *ashremob.out* file. |
| \Section_6.6\TPACodeSimulationFiles\2_P15Test4Run100yr_InitialDepCutoffRemovedLUT | Same as \1_P15Test4Run100yr_OrigLUT\ simulation except a modified lookup table was used without a tephra cutoff for the initial deposit columns. Subdirectory also contains intermediate results in the *ashremob.out* file. |
| \Section_6.6\TPACodeSimulationFiles\3_InitialDepositOnly_OrigLUT_MLsampled_101timesteps | Special-case simulation only for any initial deposit at the receptor location. Weighting factors for fluvial and eolian source regions were set to zero in *tpa.inp*. An unmodified version of the current lookup table was used. |
| \Section_6.6\TPACodeSimulationFiles\3_SeedAnalysis\Seed 1456789101.0 | Simulation using the current lookup table data and the random seed value of 1456789101.0 (reference-case value). These results are the same as results from the \3_InitialDepositOnly_OrigLUT_MLsampled_101timesteps\ simulation. |
| \Section_6.6\TPACodeSimulationFiles\3_SeedAnalysis\Seed 1292712012.2 | Simulation using the current lookup table data and a new random seed value of 1292712012.2 |
| \Section_6.6\TPACodeSimulationFiles\3_SeedAnalysis\Seed 1531522389.2 | Simulation using the current lookup table data and a new random seed value of 1531522389.2 |
| \Section_6.6\TPACodeSimulationFiles\3_SeedAnalysis\Seed 1935999423.4 | Simulation using the current lookup table data and a new random seed value of 1935999423.4 |
| \Section_6.6\TPACodeSimulationFiles\4_InitialDepositOnly_IntDepCutoffRemovedLUT | Special-case simulation only for any initial deposit at the receptor location. Weighting factors for fluvial and eolian source regions were set to zero in *tpa.inp*. Same as \3_InitialDepositOnly_OrigLUT_MLsampled_101timesteps\ simulation except a modified lookup table was used without a tephra cutoff for the initial deposit columns |

[No entries below this line]

## 6.7 Brute-Force Calculational Approach for Volcanic Risk

[entry made by R. Benke on September 13, 2007]

The purpose of this entry is to investigate a brute-force approach for calculating volcanic risk, which scales TPA code output directly in a spreadsheet rather than using postprocessing code. TPA Version 5.1 was used for these calculations. Supporting files are archived in the \Section_6.7\ subdirectory. Table 6.7-1 describes the supporting spreadsheet file. Input (*tpa.inp*) and output files (*tpa.out*, *rgssa.tpa*, *ashout.res*) from simulations using the TPA Version 5.1 code are contained in the \Section_6.7\TPACodeSimulationFiles\ subdirectory. Table 6.7-2 provides descriptions for each of these simulations.

**Table 6.7-1.** Supporting file names and descriptions. The supporting file is located in the \Section_6.7\ subdirectory.

| Filename | Description |
|---|---|
| 10kaDCAGS_Risk_Curve.xls | Spreadsheet containing the extracted TPA Version 5.1 code output and volcanic risk calculations |

**Table 6.7-2.** Subdirectory names and description for individual TPA Version 5.1 code simulations. Each subdirectory contains *tpa.inp*, *ashout.res*, *rgssa.tpa*, and *tpa.out* files from the simulation. Each direct-release-only simulation invoked the ASHPLUMO/ASHRMOVO/DCAGS module calculation and was performed for 1000 realizations. Refer to the *tpa.inp* files for details on specific flag settings.

| Subdirectory | Description of Simulation Difference |
|---|---|
| \Section_6.7\TPACodeSimulationFiles\ 0-1ka_DCAGS | Volcanic event times were sampled between 0 and 1000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 0-200yrDCAGS_r1000 | Volcanic event times were sampled between 0 and 200 years. |
| Section_6.7\TPACodeSimulationFiles\ 200yr-1kaDCAGS_r1000 | Volcanic event times were sampled between 200 and 1000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 1-2ka_DCAGS | Volcanic event times were sampled between 1000 and 2000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 2-3ka_DCAGS | Volcanic event times were sampled between 2000 and 3000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 3-4ka_DCAGS | Volcanic event times were sampled between 3000 and 4000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 4-5ka_DCAGS | Volcanic event times were sampled between 4000 and 5000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 5-6ka_DCAGS | Volcanic event times were sampled between 5000 and 6000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 6-7ka_DCAGS | Volcanic event times were sampled between 6000 and 7000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 7-8ka_DCAGS | Volcanic event times were sampled between 7000 and 8000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 8-9ka_DCAGS | Volcanic event times were sampled between 8000 and 9000 years. |
| \Section_6.7\TPACodeSimulationFiles\ 9-10ka_DCAGS | Volcanic event times were sampled between 9000 and 10,000 years. |

[No entries below this line]

**ENDING STATEMENTS**
[section created on September 21, 2004; end date and page number are periodically updated]

Entries into Scientific Notebook No. 612-6E for pages 6-1 to 6-11 in the period between April 1, 2004 to September 13, 2007 have been made by Roland Benke. No original text entered into this Scientific Notebook has been removed.

Roland R. Benke — 2/11/2010

Roland Benke — Date

I have reviewed this scientific notebook and find it in ~~compliance~~ agreement [change made by R. Benke on August 2, 2006] with QAP-001. ~~There is sufficient information regarding methods used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity.~~ [deleted by R. Benke on August 2, 2006, additional text no longer required by QAP-001]

J. Winterle — 2/11/2010

J. Winterle, Element Manager — Date

[No entries below this line]