SCIENTIFIC NOTEBOOK

Development of TPA Code - Importance Analysis Version

by

Ron Janetzke

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Ron Janetzke

Southwest Research Institute
Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

INITIAL ENTRIES

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Participants: Ron Janetzke

Objectives:
This task will use the TPA3.1.2 code to perform Importance Analysis of the TPA repository components as directed by B. Sagar and N. Eisenberg.

Technical Approach:
An independent workspace will be used to maintain the TPA code, where it will be modified for use in the importance analysis.

Configuration Management Status: controlled

Platform: SUN/Solaris

Language: FORTRAN 77

Compiler: f77

Jan. 20, 1998

Work on this project has been suspended until further notice.

Apr 6, 1998 - Introduction

This project will undertake the importance analysis of various parameters of the TPA code. The baseline code will be TPA version 3.1.4 and will be maintained in a separate directory on /home2/mammoth/janetzke/ia. It will then be modified to accommodate new input flags which indicate the components of the system to analyze for a given run. In a follow-on effort these flags may be grouped to form barriers, and barriers may be grouped to form sub-systems. Although an importance analysis can be preformed relative to any calculation result, the primary result initially used for analysis activities will be dose.

The method of implementation will be to ignore the sampled value of the parameters which represent the component under analysis and replace it with a value that represents the absence of the component. This action will be performed automatically in the code and controlled by the newly created importance analysis flags at the beginning of the tpa.inp file.

Modification of the TPA code will be controlled via the SCCS configuration control mechanism of the SUN/SOLARIS system on scratchy1.

Apr 7, 1998 Inner and Outer Containers.

The tpa.inp file was modified to include the following new flags:

ImportanceAnalysisFlag

This is the master flag to control the importance analysis process. If this flag is 0 all importance analysis is skipped regardless of the other component flag values.

InnerContainerPresenceFlag

This component is modeled in EBSFAIL for corrosion properties and in NFENV for thermal properties. InnerWPThickness represents the inner container and is set to 1.0e-22 when the component is removed from the system. Note that SEISMO has a Package_Stiffness parameter which appears to be uncorrelated with the InnerWPThickness.

OuterContainerPresenceFlag

This component is only modeled in EBSFAIL for corrosion and mechanical properties and in NFENV for thermal properties. OuterWPThickness represents the outer container and is set to 1.0e-22 when the components is removed from the system. Note that SEISMO has a Package_Stiffness parameter which appears to be uncorrelated with the OuterWPThickness.

CladdingPresenceFlag

This component is not handled by the code at this time.

Apr. 7, 1998 EBSFAIL Container Thickness

EBSFAIL was modified to handle the importance analysis flags. If the outer container is removed cthick1 is set to 1.0e-22. If the inner container is removed, cthick2 is set to 1.0e-22. Four sections need to be added to a module to add importance analysis functionality.

I. Use a save statement to preserve flag index and flag values.

II. Retrieve IA flag indices from the database. (ispquery)

III. Retrieve IA flag input values from database. (ivaluesp)

IV. Insert logical IF statement to use the IA flag as a control.

Apr. 10, 1998 Calculate SEISMO Package_Stiffness

It was found that SEISMO used an input parameter from tpa.inp for WP stiffness. This means it is not dependent on inner or outer wall thickness. SEISMO was modified to get the inner and outer wall thickness from tpa.inp and use them to calculate the package stiffness. The equation for WP stiffness is on page 4-42 of the 3.1.4 User's Guide. WP Young's Modulus and WP diameter and length are also required for the equation and are obtained from tpa.inp. This change makes WPStiffnessforSEISMO[Pa] in tpa.inp defunct.

NFENV uses two different variable names for WP length (wplength and alengthwp)! NFENV was modified to handle the importance analysis flags. If the outer container is removed 'tcs' is set to 1.0e-22. If the inner container is removed, 'tss' is set to 1.0e-22.

Mechanical failure is not modeled for the inner container in EBSFAIL.

A mean value input file was generated using preptpa and the corresponding run results were put in subdirectory 'mean'. The results of a run with mean input with outer container removed are in '000meanoc'.

The following runs were completed, shown to Budhi S. and e-mailed to Norm E.

Subdirectory	Inner	Outer
mean	yes	yes
000meanic	no	yes
000meanoc	yes	no
000meanocic	no	no

Future sampled runs will be with 50 vectors, 20 km critical group, and 10,000 year simulation time.

April 14, 1998 50 Vectors runs

Fifty vector runs were completed for base case, ic, oc and icoc as test for the ia procedures.

April 17, 1998 EXCEL Spreadsheet.

First version of the EXCEL spreadsheet was finished. Initial design as specified by B. Sagar will not work, since it does not account for zeroes in the denominator of the ratios. Other features were implemented except for the normalization of quantities.

April 20, 1998 New design for IA implementation.

A new design for implementing the overwriting of sampled parameters was

implemented. With the use of the iafilter.f set of routines a simple one line entry for each variable to be changed in the consequence module is all that is now necessary. An example is:

OuterWPThickness = aiafilter(name, OuterWPThickness)

This technique was implemented in EBSFAIL, NFENV, and SEISMO.

April 21, 1998 Double Precision Functions

Double precision functions with double precision arguments failed when using aiafilter in UZFLOW. Declaring aiafilter with

external double precision aiafilter

is not sufficient to cast it as a double precision function. It must only be declared using explicit or implicit typing.

UZFLOW was changed to allow the removal of the soil component. There is no input parameter for soil thickness, so an approach was used which simulates the effect of no soil. An artificial parameter name 'MinimumInfiltrationPrecipitationRatio' is used to identify the desired value to the routine aiafilter. The effect of soil in the system is that it permits evaporation of the precipitation and thus lowers the infiltration amount. By removing the soil the infiltration should be equal to precipitation since UZFLOW does not account for transpiration or diversion. The routine which was modified is calc_mai. In this routine the infiltration, pixAAI, is bounded by the precipitation value, pixAAP. To remove the effect of soil, pixAAI is set equal to pixAAP after all of the original adjustments to pixAAI have been made.

```
name = 'MinimumInfiltrationPrecipitationRatio'
aIPratio = pixAAI / pixAAP
aIPratio = aiafilter( name, aIPratio)
if (aIPratio .NE. pixAAI / pixAAP) then
   pixAAI = aIPratio * pixAAP
end if
```

The value produced by aiafilter for the soil component removed case is 1. This is then used as a factor to set the infiltration equal to the precipitation.

April 21, 1998 Excel Spreadsheet.

File gwpkdos.res from each of the four cases run so far was used to transfer peak dose rate times and values to the appropriate worksheets in the spreadsheet. The last column of the worksheets was changed to its reciprocal at the suggestion of B. Sagar.

A soil removed case of 50 vectors was initiated.

April 23, 1998 Upper Unsat Zone

When removing the upper unsat zone the soil is also removed, particularly for heat transfer purposes, since there appears to be no way of disassociating the two.

April 23, 1998 Well Removal

Ingestion is independent of pumping rate, so wells can be removed by setting well pumping rates to zero.

April 23, 1998 NEFTRAN legs

All NEFTRAN layers can be removed by setting their leg lengths to zero.

April 29, 1998 Upper Unsaturated Layer

The implementation of the UUL component involved variables in NFENV,

EBSREL, and EXEC. As discussed in the User's Guide for 3.1.4 in section 4.2.1 NFENV considers several parameters that are properties of the UUL, namely:

rock temperature
relative humidity
downward flow rate of groundwater
pH and chloride concentration

For the purposes of importance analysis the following concepts were implemented.

rock temperature

The tpa.inp file contains several parameters which affect rock temperature. The ones considered for importance analysis are:

AmbientRepositoryTemperature[C]
MassDensityofYMRock[kg/m^3]
SpecificHeatofYMRock[J/(kg-K)]
ThermalConductivityofYMRock[W/(m-K)]
EmissivityOfDriftWall[-]
ElevationOfGroundSurface[m]

When considering the UUL removed case the repository essentially becomes a surface facility. That is , it is exposed to wind and rain. Lightning and wind driven hail and sand are not considered. The canisters are considered to be in a ditch (drift) at the surface with a semicircular cross section , submerged to 50% of their height at emplacement with base case wall clearances.

The ambient repository temperature is not changed for this case since this is considered a starting temperature for the host rock.

The mass density of the rock is set to 1.0e-27 to reflect the low density of air.

The specific heat of the rock is set to 0.1 to reflect the low specific heat of air.

The thermal conductivity of rock is set to 1000.0 to reflect the large cooling effect of the atmosphere.

The emissivity of the drift wall was set to 0.4 which is half of the original value. This may be ignored by the code for the backfill case.

The elevation of the ground surface was set to 1072.0 to match the repository elevation.

relative humidity

No adjustments are made to the handling of relative humidity, since it is calculated from the temperature which is already adjusted.

downward flow rate of groundwater

Both NFENV and EBSREL were modified to affect the UUL removal. The call to 'nfdrip' was changed in NFENV to base the amount of water entering a drift on the WP proportional precipitation in a subarea rather than account for reflux or other diversions.

EBSREL parameters FMULT, FOW, and SubareaWetFraction are adjusted to remove local diversions of water due to dripping. FMULT is set to 0.1 = 1.0*1.0*0.3*0.35. That is, the reduction of water hitting WP due to diversion around drift via the capillary barrier is 1.0. The reduction of water hitting the WP due to diversion to sheet flow is 1.0. The fraction of water dripping due to a drip not hitting an open hole is 0.3. The fraction of water entering a corrosion hole due to closure by corrosion products is 0.35. The latter two values are means of the distributions in the base case.

FOW is set to 1.0 since it represents the fraction infiltration participating in the wetting process.

The latter two parameters are also changed in EXEC.

SubareaWetFraction is set to 1.0 since 100% of the WP will receive precipitation.

pH and chloride concentration

The pH remains hard coded at 9.0 as requested by S. Mohanty.

The chloride concentration was set to 0.0 to reflect atmospheric conditions. A newly created name 'ChlorideConcentration" is used to modify the 'xmfcl' variable in NFENV for the UUL removal case.

May 1, 1998 Pumping Well

The pumping rate in dcagw.f was set to zero to reflect the absence of the pumping well. The following input parameters are filtered by the aiafilter function:

WellPumpingRateAtCriticalGroup5km[gal/day]
WellPumpingRateAtCriticalGroup20km[gal/day]

May 4, 1998 Disk Crash

After office cabling upgrade over the weekend the working directory on mammoth was trashed and no files relative to the IA effort were available. Ray K. says that this disk was not backed up! He worked to recover most of the files from the bad disk. Casualties are:

ia/data/elevdem.dat trashed.

000pw50v entire directory missing.

May 4, 1998 Excel

The 000uu50v and 000pw50v peak dose files were saved to scratchy1 before the crash, so they were copied to the PC and added to the spreadsheet.

May 5, 1998 Recovery

Most files look OK. Initiated rerun of the 000pw50v case with the code changed for the UZ and SZ layers.

May 6, 1998 Recovery

File gwpkdos.res compares ok with the file saved in /export/home/janetzke/pwpkdos.res generated before the crash. Output file sere moved to 000pw50v. Run took about 6 hours instead of the expected 4.

May 6, 1998 UZ and SZ

Code changes to implement IA for UZ and SZ layers was checked with the debugger. The following variables were used to implement the change:

UZ
'TswStudyFlag(yes=1,no=0)'
'ChnvStudyFlag(yes=1,no=0)'
'ChnzStudyFlag(yes=1,no=0)'
'PpwStudyFlag(yes=1,no=0)'
'UCFStudyFlag(yes=1,no=0)'
'BfwStudyFlag(yes=1,no=0)'

SZ
'STFFStudyFlag(yes=1,no=0)'
'SAVStudyFlag(yes=1,no=0)'

May 6, 1998 tpa.inp

This is a list of the new tpa.inp parameter names used for importance analysis, note that the STUDY flags are not used at this time but are provided for future use:

iflag
ImportanceAnalysisFlag(yes=1,no=0)
1

**
iflag
InnerContainerPresenceFlag(yes=1,no=0)
1
**
iflag
OuterContainerPresenceFlag(yes=1,no=0)
1
**
iflag
CladdingPresenceFlag(yes=1,no=0)
1
**
iflag
SoilPresenceFlag(yes=1,no=0)
1
**
iflag
UpperUnsaturatedLayerPresenceFlag(yes=1,no=0)
1
**
iflag
TSwPresenceFlag(yes=1,no=0)
0
**
iflag
CHnvPresenceFlag(yes=1,no=0)
1
**
iflag
CHnzPresenceFlag(yes=1,no=0)
1
**
iflag
PPwPresenceFlag(yes=1,no=0)
1
**
iflag

UCFPresenceFlag(yes=1,no=0)
1
**
iflag
BFwPresenceFlag(yes=1,no=0)
1
**
iflag
STFFPresenceFlag(yes=1,no=0)
1
**
iflag
SAVPresenceFlag(yes=1,no=0)
1
**
iflag
PumpingWellPresenceFlag(yes=1,no=0)
1
**
iflag
InnerContainerStudyFlag(yes=1,no=0)
0
**
iflag
OuterContainerStudyFlag(yes=1,no=0)
0
**
iflag
CladdingStudyFlag(yes=1,no=0)
0
**
iflag
SoilDepthStudyFlag(yes=1,no=0)
0
**
iflag
UpperUnsaturatedLayerStudyFlag(yes=1,no=0)
0

```
**
iflag
TSwStudyFlag(yes=1,no=0)
1
**
iflag
CHnvStudyFlag(yes=1,no=0)
0
**
iflag
CHnzStudyFlag(yes=1,no=0)
0
**
iflag
PPwStudyFlag(yes=1,no=0)
0
**
iflag
UCFStudyFlag(yes=1,no=0)
0
**
iflag
BFwStudyFlag(yes=1,no=0)
0
**
iflag
STFFStudyFlag(yes=1,no=0)
0
**
iflag
SAVStudyFlag(yes=1,no=0)
0
**
iflag
PumpingWellStudyFlag(yes=1,no=0)
0
**
```

May 6, 1998 ia.f

Here is the final form of the ia.f file:

```
      subroutine iasetup()

      implicit double precision (a-h,o-z)
      implicit integer (i-n)

      include 'ia.i'

      character*60 name

      aiacompctrlvalue(1) = 1.0d-22
      aiacompctrlvalue(2) = 1.0d-22
      aiacompctrlvalue(3) = 1.0d-22
      aiacompctrlvalue(10) = 0.0d+00
      aiacompctrlvalue(11) = 0.0d+00
      aiacompctrlvalue(12) = 0.0d+00
      aiacompctrlvalue(13) = 0.0d+00
      aiacompctrlvalue(14) = 0.0d+00
      aiacompctrlvalue(15) = 0.0d+00
      aiacompctrlvalue(17) = 0.0d+00
      aiacompctrlvalue(23) = 1.0d+00
      aiacompctrlvalue(25) = 1.0d-27
      aiacompctrlvalue(26) = 0.0d+00
      aiacompctrlvalue(27) = 0.0d+00
      aiacompctrlvalue(31) = 1.0d-01
      aiacompctrlvalue(32) = 1.0d+03
      aiacompctrlvalue(33) = 4.0d-01
      aiacompctrlvalue(34) = 1072.0d+00
      aiacompctrlvalue(35) = 0.0d+00
      aiacompctrlvalue(36) = 1.0d-01
      aiacompctrlvalue(37) = 1.0d+00
      aiacompctrlvalue(38) = 1.0d+00

      ciacompname( 1) = 'Cladding'
      ciacompname( 2) = 'InnerContainer'
```

ciacompname(3) = 'OuterContainer'
ciacompname(4) = 'CeramicCoating'
ciacompname(5) = 'Backfill'
ciacompname(6) = 'DripShield'
ciacompname(7) = 'DriftLiner'
ciacompname(8) = 'WPSupport'
ciacompname(9) = 'DamagedRockZone'
ciacompname(10) = 'TopopahSpringw'
ciacompname(11) = 'CalicoHillsnv'
ciacompname(12) = 'CalicoHillsnz'
ciacompname(13) = 'ProwPassw'
ciacompname(14) = 'UpperCraterFlat'
ciacompname(15) = 'BullFrogw'
ciacompname(16) = 'Atmosphere'
ciacompname(17) = 'PumpingWell'
ciacompname(18) = 'GroundWater'
ciacompname(19) = 'DirectRelease'
ciacompname(20) = 'GlassWasteForm'
ciacompname(21) = 'SpentFuelWasteForm'
ciacompname(22) = 'LandSurfaceSlope'
ciacompname(23) = 'Soil'
ciacompname(24) = 'Invert'
ciacompname(25) = 'UpperUnsaturatedLayer'
ciacompname(26) = 'SaturatedTuff'
ciacompname(27) = 'SaturatedAlluvium'
ciacompname(28) = 'Vegetation'

ciacompabbr(1) = 'CLD'
ciacompabbr(2) = 'IC'
ciacompabbr(3) = 'OC'
ciacompabbr(4) = 'CC'
ciacompabbr(5) = 'BF'
ciacompabbr(6) = 'DS'
ciacompabbr(7) = 'DL'
ciacompabbr(8) = 'SUP'
ciacompabbr(9) = 'DRZ'
ciacompabbr(10) = 'TSw'
ciacompabbr(11) = 'CHnv'

```
ciacompabbr(12) = 'CHnz'
ciacompabbr(13) = 'PPw'
ciacompabbr(14) = 'UCF'
ciacompabbr(15) = 'BFw'
ciacompabbr(16) = 'ATM'
ciacompabbr(17) = 'PW'
ciacompabbr(18) = 'GW'
ciacompabbr(19) = 'DIR'
ciacompabbr(20) = 'GWF'
ciacompabbr(21) = 'SFW'
ciacompabbr(22) = 'LSS'
ciacompabbr(23) = 'SL'
ciacompabbr(24) = 'INV'
ciacompabbr(25) = 'UUL'
ciacompabbr(26) = 'STFF'
ciacompabbr(27) = 'SAV'
ciacompabbr(28) = 'VEG'

ciabarrname( 1) = 'WasteForm'
ciabarrname( 2) = 'WastePackage'
ciabarrname( 3) = 'Backfill'
ciabarrname( 4) = 'EngineeredComponents'
ciabarrname( 5) = 'UpperUnsaturatedZone'
ciabarrname( 6) = 'LowerUnsaturatedZone'
ciabarrname( 7) = 'SaturatedZone'

ciabarrabbr( 1) = 'WF'
ciabarrabbr( 2) = 'WP'
ciabarrabbr( 3) = 'BF'
ciabarrabbr( 4) = 'EC'
ciabarrabbr( 5) = 'UUZ'
ciabarrabbr( 6) = 'LUZ'
ciabarrabbr( 7) = 'SAT'

ciasubsname( 1)= 'EngineeredSubsystem'
ciasubsname( 2)= 'NaturalSubsystem'

ciasubsabbr( 1) = 'ES '
```

```
ciasubsabbr( 2) = 'NS '

numcomp = 0
numbarr = 0
numsubs = 0

call clearchar( 60, name )

name = 'ImportanceAnalysisFlag(yes=1,no=0)'
iaflag =  ivaluesp( ispquery( name ) )
call clearchar( 60, name )

name = 'CladdingStudyFlag(yes=1,no=0)'
iacompstudyflag(1) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(1) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'InnerContainerStudyFlag(yes=1,no=0)'
iacompstudyflag(2) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(2) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'OuterContainerStudyFlag(yes=1,no=0)'
iacompstudyflag(3) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(3) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'SoilDepthStudyFlag(yes=1,no=0)'
iacompstudyflag(23) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(23) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'UpperUnsaturatedLayerStudyFlag(yes=1,no=0)'
iacompstudyflag(25) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(25) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'PumpingWellStudyFlag(yes=1,no=0)'
```

```
iacompstudyflag(17) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(17) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'TSwStudyFlag(yes=1,no=0)'
iacompstudyflag(10) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(10) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'CHnvStudyFlag(yes=1,no=0)'
iacompstudyflag(11) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(11) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'CHnzStudyFlag(yes=1,no=0)'
iacompstudyflag(12) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(12) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'PPwStudyFlag(yes=1,no=0)'
iacompstudyflag(13) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(13) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'UCFStudyFlag(yes=1,no=0)'
iacompstudyflag(14) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(14) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'BFwStudyFlag(yes=1,no=0)'
iacompstudyflag(15) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(15) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )

name = 'STFFStudyFlag(yes=1,no=0)'
iacompstudyflag(26) =  ivaluesp( ispquery( name ) )
if (iacompstudyflag(26) .eq. 1) numcomp = numcomp + 1
call clearchar( 60, name )
```

```
      name = 'SAVStudyFlag(yes=1,no=0)'
      iacompstudyflag(27) =  ivaluesp( ispquery( name ) )
      if (iacompstudyflag(26) .eq. 1) numcomp = numcomp + 1
      call clearchar( 60, name )
cc
cc    Currently the study flags are not used.
cc
       name = 'CladdingPresenceFlag(yes=1,no=0)'
       iiclpf =  ispquery( name )
       call clearchar( 60, name )

       name = 'InnerContainerPresenceFlag(yes=1,no=0)'
       iicpf =  ispquery( name )
       call clearchar( 60, name )

       name = 'OuterContainerPresenceFlag(yes=1,no=0)'
       iiocpf =  ispquery( name )
       call clearchar( 60, name )

       name = 'SoilPresenceFlag(yes=1,no=0)'
       iislpf =  ispquery( name )
       call clearchar( 60, name )

       name = 'UpperUnsaturatedLayerPresenceFlag(yes=1,no=0)'
       iiuupf =  ispquery( name )
       call clearchar( 60, name )

       name = 'PumpingWellPresenceFlag(yes=1,no=0)'
       iipwpf =  ispquery( name )
       call clearchar( 60, name )

       name = 'TSwPresenceFlag(yes=1,no=0)'
       iitspf =  ispquery( name )
       call clearchar( 60, name )

       name = 'CHnvPresenceFlag(yes=1,no=0)'
       iicvpf =  ispquery( name )
       call clearchar( 60, name )
```

```
name = 'CHnzPresenceFlag(yes=1,no=0)'
iiczpf =  ispquery( name )
call clearchar( 60, name )

name = 'PPwPresenceFlag(yes=1,no=0)'
iipppf =  ispquery( name )
call clearchar( 60, name )

name = 'UCFPresenceFlag(yes=1,no=0)'
iicfpf =  ispquery( name )
call clearchar( 60, name )

name = 'BFwPresenceFlag(yes=1,no=0)'
iibfpf =  ispquery( name )
call clearchar( 60, name )

name = 'STFFPresenceFlag(yes=1,no=0)'
iistpf =  ispquery( name )
call clearchar( 60, name )

name = 'SAVPresenceFlag(yes=1,no=0)'
iisapf =  ispquery( name )
call clearchar( 60, name )

iacompctrlflag(1) =   1- ivaluesp( iiclpf )

iacompctrlflag(2) =   1- ivaluesp( iicpf )

iacompctrlflag(3) =   1- ivaluesp( iiocpf )

iacompctrlflag(10) =   1- ivaluesp( iitspf )

iacompctrlflag(11) =   1- ivaluesp( iicvpf )

iacompctrlflag(12) =   1- ivaluesp( iiczpf )

iacompctrlflag(13) =   1- ivaluesp( iipppf )
```

```
      iacompctrlflag(14) =   1- ivaluesp( iicfpf )

      iacompctrlflag(15) =   1- ivaluesp( iibfpf )

      iacompctrlflag(17) =   1- ivaluesp( iipwpf )

      iacompctrlflag(23) =   1- ivaluesp( iislpf )

      iacompctrlflag(25) =   1- ivaluesp( iiuupf )

      iacompctrlflag(26) =   1- ivaluesp( iistpf )

      iacompctrlflag(27) =   1- ivaluesp( iisapf )

    return
    end
ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc

    function aiafilter( param_name, sample_value)

    implicit double precision (a-h,o-z)
    implicit integer (i-n)

    double precision aiafilter
    double precision sample_value

    character*(*) param_name

    include 'ia.i'

    if (iaflag .eq. 1 ) then

    if (param_name .eq. 'ThicknessOfCladding[m]') then
       if (iacompctrlflag(1) .eq. 1) then
          aiafilter = aiacompctrlvalue(1)
       else
          aiafilter = sample_value
       end if
```

```
      else if (param_name .eq. 'InnerWPThickness[m]') then
         if (iacompctrlflag(2) .eq. 1) then
            aiafilter = aiacompctrlvalue(2)
         else
            aiafilter = sample_value
         end if
      else if (param_name .eq. 'OuterWPThickness[m]') then
         if (iacompctrlflag(3) .eq. 1) then
            aiafilter = aiacompctrlvalue(3)
         else
            aiafilter = sample_value
         end if
      else if (param_name .eq.
     &        'MinimumInfiltrationPrecipitationRatio') then
         if (iacompctrlflag(23) .eq. 1) then
            aiafilter = aiacompctrlvalue(23)
         else
            aiafilter = sample_value
         end if
cc
cc    Upper Unsaturated Layer
cc
      else if (param_name .eq. 'MassDensityofYMRock[kg/m^3]') then
         if (iacompctrlflag(25) .eq. 1) then
            aiafilter = aiacompctrlvalue(25)
         else
            aiafilter = sample_value
         end if
      else if (param_name .eq. 'SpecificHeatofYMRock[J/(kg-K)]') then
         if (iacompctrlflag(25) .eq. 1) then
            aiafilter = aiacompctrlvalue(31)
         else
            aiafilter = sample_value
         end if
      else if (param_name .eq.
     &        'ThermalConductivityofYMRock[W/(m-K)]') then
         if (iacompctrlflag(25) .eq. 1) then
            aiafilter = aiacompctrlvalue(32)
```

```
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'EmissivityOfDriftWall[-]') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(33)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'ElevationOfGroundSurface[m]') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(34)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'ChlorideConcentration') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(35)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'FmultFactor') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(36)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'FowFactor') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(37)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'SubAreaWetFraction') then
      if (iacompctrlflag(25) .eq. 1) then
        aiafilter = aiacompctrlvalue(38)
      else
        aiafilter = sample_value
```

```
        end if
cc
cc Pumping Well
cc
      else if (param_name .eq.
     &         'WellPumpingRateAtCriticalGroup5km[gal/day]') then
         if (iacompctrlflag(17) .eq. 1) then
           aiafilter = aiacompctrlvalue(17)
         else
           aiafilter = sample_value
         end if
      else if (param_name .eq.
     &         'WellPumpingRateAtCriticalGroup20km[gal/day]') then
         if (iacompctrlflag(17) .eq. 1) then
           aiafilter = aiacompctrlvalue(17)
         else
           aiafilter = sample_value
         end if
cc
cc Lower Unsaturated Zone
cc
      else if (param_name .eq. 'TSw_Thickness_1SubArea[m]') then
         if (iacompctrlflag(10) .eq. 1) then
           aiafilter = aiacompctrlvalue(10)
         else
           aiafilter = sample_value
         end if
      else if (param_name .eq. 'TSw_Thickness_2SubArea[m]') then
         if (iacompctrlflag(10) .eq. 1) then
           aiafilter = aiacompctrlvalue(10)
         else
           aiafilter = sample_value
         end if
      else if (param_name .eq. 'TSw_Thickness_3SubArea[m]') then
         if (iacompctrlflag(10) .eq. 1) then
           aiafilter = aiacompctrlvalue(10)
         else
           aiafilter = sample_value
```

```
    end if
  else if (param_name .eq. 'TSw_Thickness_4SubArea[m]') then
    if (iacompctrlflag(10) .eq. 1) then
      aiafilter = aiacompctrlvalue(10)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'TSw_Thickness_5SubArea[m]') then
    if (iacompctrlflag(10) .eq. 1) then
      aiafilter = aiacompctrlvalue(10)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'TSw_Thickness_6SubArea[m]') then
    if (iacompctrlflag(10) .eq. 1) then
      aiafilter = aiacompctrlvalue(10)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'TSw_Thickness_7SubArea[m]') then
    if (iacompctrlflag(10) .eq. 1) then
      aiafilter = aiacompctrlvalue(10)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'CHnvThickness_1SubArea[m]') then
    if (iacompctrlflag(11) .eq. 1) then
      aiafilter = aiacompctrlvalue(11)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'CHnvThickness_2SubArea[m]') then
    if (iacompctrlflag(11) .eq. 1) then
      aiafilter = aiacompctrlvalue(11)
    else
      aiafilter = sample_value
    end if
  else if (param_name .eq. 'CHnvThickness_3SubArea[m]') then
```

```
      if (iacompctrlflag(11) .eq. 1) then
        aiafilter = aiacompctrlvalue(11)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnvThickness_4SubArea[m]') then
      if (iacompctrlflag(11) .eq. 1) then
        aiafilter = aiacompctrlvalue(11)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnvThickness_5SubArea[m]') then
      if (iacompctrlflag(11) .eq. 1) then
        aiafilter = aiacompctrlvalue(11)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnvThickness_6SubArea[m]') then
      if (iacompctrlflag(11) .eq. 1) then
        aiafilter = aiacompctrlvalue(11)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnvThickness_7SubArea[m]') then
      if (iacompctrlflag(11) .eq. 1) then
        aiafilter = aiacompctrlvalue(11)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_1SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_2SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
```

```
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_3SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_4SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_5SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_6SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'CHnzThickness_7SubArea[m]') then
      if (iacompctrlflag(12) .eq. 1) then
        aiafilter = aiacompctrlvalue(12)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'PPw_Thickness_1SubArea[m]') then
      if (iacompctrlflag(13) .eq. 1) then
        aiafilter = aiacompctrlvalue(13)
      else
        aiafilter = sample_value
```

```
    end if
else if (param_name .eq. 'PPw_Thickness_2SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'PPw_Thickness_3SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'PPw_Thickness_4SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'PPw_Thickness_5SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'PPw_Thickness_6SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'PPw_Thickness_7SubArea[m]') then
    if (iacompctrlflag(13) .eq. 1) then
      aiafilter = aiacompctrlvalue(13)
    else
      aiafilter = sample_value
    end if
else if (param_name .eq. 'UCF_Thickness_1SubArea[m]') then
```

```
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_2SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_3SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_4SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_5SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_6SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'UCF_Thickness_7SubArea[m]') then
      if (iacompctrlflag(14) .eq. 1) then
        aiafilter = aiacompctrlvalue(14)
```

```
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_1SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_2SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_3SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_4SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_5SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
      end if
    else if (param_name .eq. 'BFw_Thickness_6SubArea[m]') then
      if (iacompctrlflag(15) .eq. 1) then
        aiafilter = aiacompctrlvalue(15)
      else
        aiafilter = sample_value
```

```
        end if
      else if (param_name .eq. 'BFw_Thickness_7SubArea[m]') then
        if (iacompctrlflag(15) .eq. 1) then
          aiafilter = aiacompctrlvalue(15)
        else
          aiafilter = sample_value
        end if
cc
cc Saturated Zone
cc
      else if (param_name .eq. 'STFF') then
        if (iacompctrlflag(26) .eq. 1) then
          aiafilter = aiacompctrlvalue(26)
        else
          aiafilter = sample_value
        end if
      else if (param_name .eq. 'SAV ') then
        if (iacompctrlflag(27) .eq. 1) then
          aiafilter = aiacompctrlvalue(27)
        else
          aiafilter = sample_value
        end if
      end if

      else
        aiafilter = sample_value
      end if

      return
      end
```

May 6, 1998 ia.I

Here is the final ia.I file:

```
      parameter (maxcomp=60)
      parameter (maxbarr=40)
```

```
      parameter (maxsubs=20)

      parameter (maxccntrl=2*maxcomp)
      parameter (maxbcntrl=2*maxbarr)
      parameter (maxscntrl=2*maxsubs)

      dimension iacompstudyflag(maxcomp), iacompctrlflag(maxcomp)
      dimension iabarrstudyflag(maxbarr), iabarrctrlflag(maxbarr)
      dimension iasubsstudyflag(maxsubs), iasubsctrlflag(maxsubs)

      common /iia/ iaflag, numcomp, iacompstudyflag, iacompctrlflag,
     &                    numbarr, iabarrstudyflag, iabarrctrlflag,
     &                    numsubs, iasubsstudyflag, iasubsctrlflag

      dimension aiacompctrlvalue(maxccntrl)
      dimension aiabarrctrlvalue(maxbcntrl)
      dimension aiasubsctrlvalue(maxscntrl)

      common /ria/ aiacompctrlvalue,
     &             aiabarrctrlvalue,
     &             aiasubsctrlvalue

      character*60 ciacompname(maxcomp)
      character*60 ciabarrname(maxbarr)
      character*60 ciasubsname(maxsubs)

      character*4  ciacompabbr(maxcomp)
      character*4  ciabarrabbr(maxbarr)
      character*4  ciasubsabbr(maxsubs)

      common /cia/ ciacompname, ciacompabbr,
     &             ciabarrname, ciabarrabbr,
     &             ciasubsname, ciasubsabbr
```

May 6, 1998 000ts50v run

Completed on scratchy1.

7679.0u 1005.0s 5:29:19 43% 0+0k 0+0io 0pf+0w

CCDF trace is on top of base case CCDF, but the gwpkdos.res file shows some differences in the 3rd and 4th decimal place.

May 7, 1998 000cv50v

Completed on scratchy1.

8938.0u 989.0s 5:08:04 53% 0+0k 0+0io 0pf+0w

May 7, 1998 000cz50v

Completed on scratchy1.

7507.0u 971.0s 5:00:15 47% 0+0k 0+0io 0pf+0w

May 8, 1998 000pp50v

Completed on scratchy1.

8521.0u 1024.0s 5:08:21 51% 0+0k 0+0io 0pf+0

May 8, 1998 000uc50v

On scratchy1.

Aborted in vector 27 subarea 1 with message:

list read: [-1] end of file
logical unit 14, named 'sotnef.dat'
lately: reading sequential list external IO

part of last format: ext list io
part of last data: 34955215065^?|
Abort
Note: the following IEEE floating-point arithmetic exceptions
occurred and were never cleared; see ieee_flags(3M):
Inexact; Underflow;
Sun's implementation of IEEE arithmetic is discussed in
the Numerical Computation Guide.

[1] Done tpa.e > tpa.out
4002.0u 533.0s 2:42:31 46% 0+0k 0+0io 0pf+0w

The sotnef.dat file was incomplete.

May 9, 1998 000uc50v

Completed on scratchy1.

7671.0u 1000.0s 4:59:57 48% 0+0k 0+0io 0pf+0w

May 10,1998 000bf50v

On scratchy1.

NFS setattr failed for server mammoth: error 5 (RPC: Timed out)
write sfe: [145] Connection timed out
logical unit 46, named 'ebstrhc.inp'
lately: writing sequential formatted external IO

[1] Abort tpa.e > tpa.out
648.0u 82.0s 51:32 23% 0+0k 0+0io 0pf+0w

Abort at subarea 3 of 7, vector 5 of 50.

May 15,1998 000bf50v.

Completed on bigbend.

4607.0u 319.0s 2:39:45 51% 0+0k 0+0io 0pf+0w

May 15, 1998 000st50v

Completed on bigbend.

4529.0u 324.0s 1:53:43 71% 0+0k 0+0io 0pf+0w

May 17, 1998 000sa50v

Completed on bigbend.

5599.0u 334.0s 2:14:24 73% 0+0k 0+0io 0pf+0w

May 17, 1998 Volcano scenario.

The volcano module does use the ArealMassLoading input parameter which is also used by nfenv, but fortunately nfenv does not alter this value for any of the component runs used for the non-disruptive base case. Therefore no changes in the code are needed to perform the 00v scenario runs. However, the gwpkdos.res file can no longer be used directly for input to the spreadsheet. The spreadsheet requires peak total dose. This was fine when there was no contribution from the gsccdf.res file, but now this must be accounted for. So a new scheme will be needed to find the total peak dose for all vectors that retains the vector numbers, they do not need to be in ccdf form for use in the spreadsheet. The file airpkdos.res has information similar to gspkdos.res, but these cannot be added since the peak times in each file may not be the same. Consider either writing a new file called totpkdos.res or modify tccdf.f to include vector number output.

May 20, 1998 00vic50v

Completed on bigbend.

No timing information available.

May 20, 1998 00voc50v

Completed on bigbend.

5630.0u 335.0s 2:28:50 66% 0+0k 0+0io 0pf+0w

May 21, 1998 00vicoc50v

Completed on bigbend.

6300.0u 327.0s 3:09:07 58% 0+0k 0+0io 0pf+0w

May 21, 1998 00vsl50v

Completed on bigbend.

4883.0u 295.0s 2:28:21 58% 0+0k 0+0io 0pf+0w

May 22, 1998 00vuu50v

Completed on bigbend.

5707.0u 362.0s 2:57:56 56% 0+0k 0+0io 0pf+0w

May 22, 1998 00vts50v

Completed on bigbend.

5313.0u 323.0s 2:11:12 71% 0+0k 0+0io 0pf+0w

May 22, 1998 00vcv50v

Completed on bigbend.

5527.0u 321.0s 2:13:43 72% 0+0k 0+0io 0pf+0w

May 22, 1998 00vcz50v

Completed on bigbend.

5005.0u 311.0s 2:05:17 70% 0+0k 0+0io 0pf+0w

May 22, 1998 00vpp50v

Completed on bigbend.

5723.0u 330.0s 2:25:48 69% 0+0k 0+0io 0pf+0w

May 23, 1998 00vuc50v

Completed on bigbend.

5225.0u 326.0s 2:09:35 71% 0+0k 0+0io 0pf+0w

May 24, 1998 00vbf50v

Completed. On bigbend.

5351.0u 329.0s 1:58:08 80% 0+0k 0+0io 0pf+0w

May 24, 1998 00vst50v

Completed on bigbend.

5281.0u 311.0s 1:56:25 80% 0+0k 0+0io 0pf+0w

May 25, 1998 00vsa50v

Completed on bigbend.

6834.0u 330.0s 2:25:39 81% 0+0k 0+0io 0pf+0w

May 25, 1998 00vpw50v

Completed on bigbend.

5297.0u 330.0s 2:08:34 72% 0+0k 0+0io 0pf+0w

May 25, 1998 Backfill

Backfill cannot be studied as a component since it is not present in the nominal case. To prepare a study for backfill a new nominal case must be prepared, and all runs regenerated.

May 25, 1998 000sluu50v

Completed on bigbend.

3725.0u 293.0s 1:32:56 72% 0+0k 0+0io 0pf+0w

gwpkdos.res is directly in the spreadsheet for peak dose by vector.

totdose.res is used by tccdf.e to generate two dose ccdfs, one for total dose (tdosccdf.res) and one for peak dose (tpkdccdf.res).

May 26, 1998 000uz50v

Completed on bigbend.

3809.0u 249.0s 1:27:11 77% 0+0k 0+0io 0pf+0w

May 26, 1998 000sz50v

Aborted on bigbend because szft cannot run nefmks with 0 legs. This problem was solved for uzft and a comparable fix can be implemented in szft.

May 27, 1998 000sz50v

Completed on bigbend.

4133.0u 230.0s 1:28:06 82% 0+0k 0+0io 0pf+0w

May 28, 1998 000sluuuz50v

Completed on bigbend.

3663.0u 253.0s 1:27:01 74% 0+0k 0+0io 0pf+0w

May 28, 1998 000szpw50v

Completed on bigbend.

4172.0u 227.0s 1:36:10 76% 0+0k 0+0io 0pf+0w

MAY 28, 1998 000nat50v

Natural components turned off.

Completed on bigbend.

3274.0u 163.0s 1:06:43 85% 0+0k 0+0io 0pf+0w

I have reviewed this scientific notebook and find it in compliance with QAP-001. There is sufficient information regarding procedures used for conducting tests, acquiring and analyzing data so that another qualified individual could repeat the activity.

Gordon Wittmeyer July 1, 1999

Gordon Wittmeyer Date

This notebook is complete. All further work on Importance Analysis will be conducted under scientific notebook #170. This notebook is closed.

Ron Janetzke 11-8-99