Attachment III
TH Abstraction Routine
(maxtwp)

This attachment contains documentation of the hand-check to demonstrate that the Subroutine **maxtwp** works correctly. This routine was written in Fortran 77 and reads in the 623 files whose names are in the file "csnflow," "csnfmean," or "csnfhigh" and searches for and prints out the peak waste package temperature from each of the individual files. Once the subroutine has looped through all of the temperatures, then the waste package name, location, time (at peak temperature), and peak temperature are printed out. The name of the output file is "output."

There are three versions of the routine **maxtwp** used in this AMR. A version of this subroutine was created for each of the three infiltration flux cases; version 1.00 for the mean case, version 1.01 for the high case, and version 1.02 for the low case **(Note: a comment line in the source code below for maxtwp version 1.01 incorrectly indicates that it applies to the low case, a comment line in the source code below for maxtwp version 1.02 incorrectly indicates that it applies to the high case)**. The only code change in the routine was changing the name of the input file and changing the number of entries in one of the loops since the number of time entries for the three different cases were not the same. All three subroutines are presented on this and the next five pages.

A copy of versions 1.00, 1.01, and 1.02 of this routine can be found in DTN: SN0001T0872799.006 in the Zip file called source_routines.ZIP. The output files for the CSNF low infiltration flux case with backfill can be found in the same DTN in the file called: wptemp_pillert_out.ZIP.

Versions 1.00, 1.01, and 1.02 of maxtwp are printed out on the next three pages. Differences in the code are located in the "open" file statement and the do loop.

```
maxtwp version 1.00

c234567890123456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 1/12/00
c
c   maxtwp v 1.00 software routine.   Written to extract max temps
c      from mean infiltration files of the MSTH model
c
c.....Nomenclature for this processor
c       timeyr --time in years as taken from the multiscale results
c        tempwp --wastepackage temperature
c        tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c234567890123456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
c        output files
c
        open(3,file='csnfmean', status='old')
        read(3,*)
        open(4,file='output',status='new')
c
```

```
c...... start main loop
c
 50     read(3,'(a)') infile1
        if (infile1 .eq. 'end') goto 100
        open(5,file=infile1,status='old')
 40     read(5,10) name
c
c...... isolate coordinate locations
c
 10     format (a4)
        if(name .ne. 'Loca') goto 40
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for Pillar Temps
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum pillar temps.
c
         tmaxwp = 0.
         do I = 1,352
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

maxtwp version 1.01

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 1/12/00
c
c   maxtwp v 1.01 software routine.   Written to extract max temps
c      from low infiltration files of the MSTH model
c
c.....Nomenclature for this processor
c       timeyr --time in years as taken from the multiscale results
c        tempwp --wastepackage temperature
c        tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
c       output files
c
        open(3,file='csnflow', status='old')
        read(3,*)
        open(4,file='output',status='new')
c
c...... start main loop
c
 50     read(3,'(a)') infile1
        if (infile1 .eq. 'end') goto 100
        open(5,file=infile1,status='old')
 40     read(5,10) name
c
c...... isolate coordinate locations
c
 10     format (a4)
        if(name .ne. 'Loca') goto 40
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for Pillar Temps
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum pillar temps.
c
         tmaxwp = 0.
         do I = 1,442
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

maxtwp version 1.02

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 1/12/00
c
c   maxtwp v 1.02 software routine.   Written to extract max temps
c      from high infiltration files of the MSTH model
c
c.....Nomenclature for this processor
c       timeyr --time in years as taken from the multiscale results
c        tempwp --wastepackage temperature
c        tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
c       output files
c
        open(3,file='csnfhigh', status='old')
        read(3,*)
        open(4,file='output',status='new')
c
c...... start main loop
c
 50     read(3,'(a)') infile1
        if (infile1 .eq. 'end') goto 100
        open(5,file=infile1,status='old')
 40     read(5,10) name
c
c...... isolate coordinate locations
c
 10     format (a4)
        if(name .ne. 'Loca') goto 40
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for Pillar Temps
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum pillar temps.
c
         tmaxwp = 0.
         do I = 1,365
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

To verify that the subroutines were working correctly, a spot check was performed on several of the entries of the files to verify that the peak waste package temperatures were being captured in the

output files. Each output file contained an entry for each of the 623 waste package. A section of two individual CSNF data files (locations X1_Y20 and X15_Y17) at each infiltration flux case is shown below at times near when the temperature peaks. The peak waste package temperature in the file is in bold type.

Mean infiltration case flux subroutine. (maxtwp V 1.00)

Excerpt from file: `csnf_x1_y20_data`

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	6.657310e+01	7.845000e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	2.361726e+02	7.589400e-02	2.305107e+02	8.407500e-02
5.100000e+01	2.706794e+02	3.432300e-02	2.660268e+02	3.693000e-02
5.200000e+01	**2.738024e+02**	2.706200e-02	2.694496e+02	2.895800e-02
5.300000e+01	2.710059e+02	2.792200e-02	2.668118e+02	2.982200e-02
5.500000e+01	2.614215e+02	2.887500e-02	2.574163e+02	3.082100e-02
6.000000e+01	2.250090e+02	3.281900e-02	2.212326e+02	3.524200e-02

Excerpt from mean infiltration flux case output file for X1_Y20:

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	170208.780	234316.700	52.000	**273.802**

Excerpt from file: `csnf_x15_y17_data`

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	8.220609e+01	7.438060e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	1.023986e+02	1.013430e-01	9.673669e+01	1.241350e-01
5.100000e+01	2.159479e+02	4.863900e-02	2.112953e+02	5.330500e-02
5.200000e+01	2.432497e+02	4.314800e-02	2.388969e+02	4.656700e-02
5.300000e+01	2.600193e+02	4.427400e-02	2.558252e+02	4.742200e-02
5.500000e+01	2.705654e+02	3.941300e-02	2.665602e+02	4.197600e-02
6.000000e+01	**2.752484e+02**	3.443700e-02	2.714719e+02	3.650600e-02
6.500000e+01	2.736104e+02	3.438400e-02	2.699619e+02	3.639000e-02
7.000000e+01	2.694624e+02	3.332400e-02	2.659086e+02	3.524600e-02

Excerpt from mean infiltration flux case output file for X15_Y17:

WP loc	Easting	Northing	Time	Peak WP Temp
x15_y17	170693.530	233796.500	60.000	**275.248**

The peak waste package temperature and the time of the peak was found correctly and printed out in the output file for both cases.

High infiltration flux case subroutine (maxtwp V 1.01)

Excerpt from file: `csnf_x1_y20_data`

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	6.429750e+01	7.811210e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	2.264506e+02	7.729200e-02	2.207887e+02	8.599500e-02
5.100000e+01	2.634177e+02	3.746500e-02	2.587651e+02	4.039500e-02
5.200000e+01	**2.665676e+02**	3.259000e-02	2.622148e+02	3.493700e-02
5.300000e+01	2.638432e+02	2.877200e-02	2.596491e+02	3.078700e-02

5.500000e+01	2.540628e+02	2.983800e-02	2.500575e+02	3.190900e-02
6.000000e+01	2.168745e+02	3.696700e-02	2.130981e+02	3.980100e-02

Excerpt from high infiltration flux case output file for X1_Y20:

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	170208.780	234316.700	52.000	**266.568**

Excerpt from file: csnf_x15_y17_data

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	8.052612e+01	7.350380e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	1.007864e+02	9.816500e-02	9.512450e+01	1.204720e-01
5.100000e+01	2.122181e+02	4.862700e-02	2.075655e+02	5.337000e-02
5.200000e+01	2.372458e+02	4.452500e-02	2.328930e+02	4.814400e-02
5.300000e+01	2.538464e+02	4.134100e-02	2.496523e+02	4.435600e-02
5.500000e+01	2.655702e+02	3.957000e-02	2.615650e+02	4.219400e-02
6.000000e+01	**2.704116e+02**	3.421800e-02	2.666352e+02	3.631400e-02
6.500000e+01	2.684012e+02	3.347300e-02	2.647528e+02	3.546700e-02
7.000000e+01	2.634180e+02	3.503300e-02	2.598641e+02	3.710100e-02

Excerpt from high infiltration flux case output file for X15_Y17:

WP loc	Easting	Northing	Time	Peak WP Temp
x15_y17	170693.530	233796.500	60.000	**270.412**

The peak waste package temperature and the time of the peak was found correctly and printed out in the output file for both cases.

Low infiltration flux case subroutine (maxtwp V 1.02)

Excerpt from file: csnf_x1_y20_data

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	7.780746e+01	4.952560e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	2.924384e+02	2.008300e-02	2.870254e+02	2.173300e-02
5.100000e+01	**3.101013e+02**	1.104700e-02	3.057005e+02	1.173500e-02
5.200000e+01	3.100339e+02	9.012000e-03	3.059125e+02	9.536000e-03
5.300000e+01	3.059053e+02	1.132700e-02	3.019289e+02	1.197100e-02
5.500000e+01	2.952192e+02	1.202500e-02	2.914128e+02	1.270200e-02
6.000000e+01	2.569320e+02	1.466900e-02	2.533272e+02	1.557100e-02

Excerpt from low infiltration flux case output file for X1_Y20:

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	170208.780	234316.700	51.000	**310.101**

Excerpt from file: csnf_x15_y17_data

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.000000e+01	9.154845e+01	5.416440e-01	-9.990000e+01	-9.990000e+01
5.020000e+01	1.335545e+02	3.723800e-02	1.266476e+02	4.578500e-02
5.100000e+01	2.597624e+02	2.530800e-02	2.540703e+02	2.779100e-02
5.200000e+01	2.868616e+02	2.498800e-02	2.815082e+02	2.705700e-02
5.300000e+01	2.952561e+02	2.219700e-02	2.900791e+02	2.391900e-02
5.500000e+01	3.012744e+02	1.982600e-02	2.963049e+02	2.126900e-02
6.000000e+01	**3.033349e+02**	1.773800e-02	2.986136e+02	1.895300e-02
6.500000e+01	3.003757e+02	1.698700e-02	2.957907e+02	1.812800e-02
7.000000e+01	2.952851e+02	1.761200e-02	2.907930e+02	1.879100e-02

Excerpt from low infiltration flux case output file for X15_Y17:

WP loc	Easting	Northing	Time	Peak WP Temp
x15_y17	170693.530	233796.500	60.000	**303.335**

The peak waste package temperature and the time of the peak was found correctly and printed out in the output file for both cases.

A copy of versions 1.03, 1.04, and 1.05 of this routine can be found in DTN: SN0007T0872799.014 in the Zip file called maxtwp.ZIP. The output files are in the same DTN in the file called: maxtwp.ZIP.

Version 1.03. 1.04, and 1.05 of maxtwp are printed out on the next few pages.

Routine maxwp version 1.03.

This routine is a modification of routine maxwp version 1.00. Modifications to the routine were made so that it could be used with the no-backfill SR base case mean infiltration flux case thermal-hydrologic simulation results. A change was made from version 1.00 because the input files had fewer time print statements in the waste package data files than were present in the backfill thermal-hydroologic simulation results. This routine was written in Fortran 77 and reads in the 610 files whose names are in the file "csnfmean" and searches for the peak waste package temperature. The output file contains the following variables: the waste package name, the easting (m) location, the northing (m) location, the time for peak waste package temperature (years), and the peak waste pacakge temperature (°C).

For this subroutine to function correctly, the routine must have a file named "csnfmean" that contains the locations of all of the 610 waste package files. The name of the output file is "output."

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 5/04/00
c
c   maxtwp v 1.03 software routine.   Written to extract max temps
c      from mean infiltration files of the MSTH model results for the
c      TSPA-SR base case design without backfill simulation results.
c
c.....Nomenclature for this processor
c        timeyr --time in years as taken from the multiscale results
c        tempwp --wastepackage temperature
c        tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
```

```
c       output files
c
        open(3,file='csnfmean', status='old')
        read(3,*)
        open(4,file='output.wptemp',status='new')
c
c...... start main loop
c
 50     read(3,'(a)') infile1
        if (infile1 .eq. 'end') goto 100
        open(5,file=infile1,status='old')
 40     read(5,10) name
c
c...... isolate coordinate locations
c
 10     format (a4)
        if(name .ne. 'Loca') goto 40
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for correct data block
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum WP temps.
c
         tmaxwp = 0.
         do I = 1,90
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

Sample output from the output file. The seven data columns for the two locations listed below contain, waste package name, easting (m), northing (m), time when the peak waste package temperature is reached (year), and peak waste package temperature (°C).

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	**170208.780**	**234316.700**	**53.000**	**169.609**

```
x5_y7        170206.880  232174.000      60.000      172.059
```

The relevant output from mean file for *csnf_x1_y20_data* file are presented below. The first column of data contains the time (years) and the second column of data contains the waste package temperature (°C). The peak waste package temperature of 170°C is reached at 53 years.

```
easting (NV central):          170208.78
northing (NV central):         234316.72

...

5.100001e+01      1.566270e+02      2.662014e-01      1.386100e+02
      4.343278e-01
5.199999e+01      1.660853e+02      2.471770e-01      1.491531e+02
      3.824581e-01
5.300000e+01      1.696091e+02      2.447977e-01      1.533708e+02
      3.689282e-01
5.500000e+01      1.685666e+02      1.987110e-01      1.531944e+02
      2.933555e-01
6.000000e+01      1.550155e+02      1.746570e-01      1.408757e+02
      2.562693e-01
```

The relevant output from mean file for *csnf_x5_y7_data* file is presented below. The peak waste package temperature of 172°C is reached at 60 years.

```
easting (NV central):          170206.88
northing (NV central):         232174.02

...

5.300000e+01      1.626044e+02      2.237926e-01      1.463661e+02
      3.424097e-01
5.500000e+01      1.701441e+02      1.718432e-01      1.547718e+02
      2.529055e-01
6.000000e+01      1.720590e+02      1.271560e-01      1.579192e+02
      1.805702e-01
6.500000e+01      1.678362e+02      1.370431e-01      1.545086e+02
      1.919911e-01
7.000000e+01      1.591625e+02      1.473457e-01      1.464421e+02
      2.061828e-01
```

A comparison of the input and output files verified that the routine ran correctly. It was also verified that there were 610 waste package entries in the output file.

Routine maxwp version 1.04.

This routine is a modification of routine maxwp version 1.03. Modifications to the routine were made so that it could be used with the no-backfill SR base case high infiltration flux case thermal-hydrologic simulation results. A change was made from version 1.03 so that the routine would read in the files that are called out in the file "csnfhigh." This routine was written in Fortran 77 and reads in the 610 files whose names are in the file "csnfhigh" and searches for the peak waste package temperature. The output file contains the following variables: the waste package name, the easting (m) location, the northing (m) location, the time for peak waste package temperature (years), and the waste package temperature (°C).

For this subroutine to function correctly, the routine must have a file named "csnfhigh" that contains the locations of all of the 610 waste package files. The name of the output file is "output."

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 5/04/00
c
c   maxtwp v 1.04 software routine.   Written to extract max temps
c      from high infiltration files of the MSTH model results for the
c      TSPA-SR base case design without backfill simulation results.
c
c.....Nomenclature for this processor
c        timeyr --time in years as taken from the multiscale results
c        tempwp --wastepackage temperature
c        tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
c        output files
c
         open(3,file='csnfhigh', status='old')
         read(3,*)
         open(4,file='output.wptemp',status='new')
c
c...... start main loop
c
 50      read(3,'(a)') infile1
         if (infile1 .eq. 'end') goto 100
         open(5,file=infile1,status='old')
 40      read(5,10) name
c
c...... isolate coordinate locations
c
 10      format (a4)
         if(name .ne. 'Loca') goto 40
```

```
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for correct data block
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum WP temps.
c
         tmaxwp = 0.
         do I = 1,90
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

Sample output from the output file. The seven data columns for the two locations listed below contain, waste package name, easting (m), northing (m), time when the peak waste package temperature is reached (year), and peak waste package temperature (°C).

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	**170208.780**	**234316.700**	**53.000**	**161.514**
x5_y7	**170206.880**	**232174.000**	**60.000**	**168.148**

The relevant output from mean file for *csnf_x5_y7_data* file are presented below. The first column of data contains the time (years) and the second column of data contains the waste package temperature (°C). The peak waste package temperature of 169°C is reached at 60 years.

```
easting (NV central):        170206.88
northing (NV central):       232174.02
```

...

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.300000e+01	1.590030e+02	2.140312e-01	1.427647e+02	3.301569e-01
5.500000e+01	1.662273e+02	1.925112e-01	1.508550e+02	2.855826e-01
6.000000e+01	**1.681484e+02**	1.410399e-01	1.540086e+02	2.017149e-01
6.500000e+01	1.637739e+02	1.504749e-01	1.504463e+02	2.123245e-01

7.000000e+01	1.559551e+02	1.572689e-01	1.432347e+02	2.214102e-01

Relevant output from mean file for *csnf_x1_y20_data* file. The peak waste package temperature of 162°C is reached at 53 years.

```
easting (NV central):        170208.78
northing (NV central):       234316.72
```

...

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.100001e+01	1.522163e+02	2.784664e-01	1.341992e+02	4.597262e-01
5.199999e+01	1.584977e+02	2.303792e-01	1.415656e+02	3.627956e-01
5.300000e+01	**1.615138e+02**	2.430674e-01	1.452755e+02	3.728699e-01
5.500000e+01	1.614465e+02	2.330136e-01	1.460742e+02	3.490441e-01
6.000000e+01	1.482244e+02	2.232337e-01	1.340846e+02	3.322833e-01

A comparison of the input and output files verified that the routine ran correctly. It was also verified that there were 610 waste package entries in the output file.

Routine maxwp version 1.05.

This routine is a modification of routine maxwp version 1.03. Modifications to the routine were made so that it could be used with the no-backfill SR base case high infiltration flux case thermal-hydrologic simulation results. A change was made from version 1.03 so that the routine would read in the files that are called out in the file "csnflow." This routine was written in Fortran 77 and reads in the 610 files whose names are in the file "csnflow" and searches for the peak waste package temperature. The output file contains the following variables: the waste package name, the easting (m) location, the northing (m) location, the time for peak waste package temperature (years), and the waste pacakge temperature (°C).

For this subroutine to function correctly, the routine must have a file named "csnflow" that contains the locations of all of the 610 waste package files. The name of the output file is "output."

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c....This routine pulls the maximum waste package temperatures
c    from the output files.
c
c    MT Itamura 5/04/00
c
c   maxtwp v 1.05 software routine.   Written to extract max temps
c      from low infiltration files of the MSTH model results for the
c      TSPA-SR base case design without backfill simulation results.
c
c.....Nomenclature for this processor
c       timeyr --time in years as taken from the multiscale results
c       tempwp --wastepackage temperature
c       tmaxwp --maximum waste package temperature
c
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 text10
      character*80 infile1
c
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c...... open the file containing the THMSM file names and the
c       output files
c
        open(3,file='csnflow', status='old')
        read(3,*)
        open(4,file='output.wptemp',status='new')
c
c...... start main loop
c
 50     read(3,'(a)') infile1
        if (infile1 .eq. 'end') goto 100
        open(5,file=infile1,status='old')
 40     read(5,10) name
c
c...... isolate coordinate locations
c
 10     format (a4)
        if(name .ne. 'Loca') goto 40
```

```
        read(5,20) coord1
        read(5,20) coord2
 20     format(23x,f9.2)
c
c...... Search files for correct data block
c
 60      read(5,30) text10
         if(text10 .ne. 'TSPA data ') goto 60
 30      format(3x,A10)
         read(5,*)
c
c...... Loop to find the maximum WP temps.
c
         tmaxwp = 0.
         do I = 1,90
           read(5,*) timeyr,tempwp
           if (tempwp .ge. tmaxwp) then
             tmaxwp =  tempwp
             time = timeyr
           endif
         end do
         close (5)
c
c...... print out the name/location of WP Temps
c
        if(infile1(11:12) .eq. '_d') infile1(11:12)='  '
        if(infile1(12:12) .eq. '_') infile1(12:12)=' '
        write (4,80) infile1(6:12),coord1,coord2,time,
     &    tmaxwp
 80     format(A7,3x,4F12.3)
        goto 50
100     continue
        close (4)
        stop
        end
```

Sample output from the output file. The seven data columns for the two locations listed below contain, waste package name, easting (m), northing (m), time when the peak waste package temperature is reached (year), and peak waste package temperature (°C).

WP loc	Easting	Northing	Time	Peak WP Temp
x1_y20	**170208.780**	**234316.700**	**53.000**	**186.156**
x5_y7	**170206.880**	**232174.000**	**60.000**	**181.668**

Relevant output from mean file for *csnf_x5_y7_data* file.

```
easting (NV central):        170206.88
northing (NV central):       232174.02
```

...

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.300000e+01	1.784920e+02	1.200819e-01	1.622537e+02	1.776998e-01
5.500000e+01	1.816162e+02	1.066491e-01	1.662439e+02	1.535495e-01
6.000000e+01	**1.816681e+02**	9.584361e-02	1.675283e+02	1.338723e-01
6.500000e+01	1.762468e+02	1.011963e-01	1.629193e+02	1.397974e-01
7.000000e+01	1.671058e+02	1.030795e-01	1.543853e+02	1.422781e-01

Relevant output from mean file for *csnf_x1_y20_data* file.

```
easting (NV central):          170208.78
northing (NV central):         234316.72

...
```

Time	WP Temp	WP Rel Hmdty	DS Temp	DS Rel Hmdty
5.100001e+01	1.811951e+02	1.414833e-01	1.631781e+02	2.177211e-01
5.199999e+01	1.852862e+02	1.222798e-01	1.683541e+02	1.816434e-01
5.300000e+01	**1.861557e+02**	1.121774e-01	1.699174e+02	1.635929e-01
5.500000e+01	1.842874e+02	1.025909e-01	1.689151e+02	1.470287e-01
6.000000e+01	1.704136e+02	9.971988e-02	1.562738e+02	1.420268e-01

A comparison of the input and output files verified that the routine ran correctly. It was also verified that there were 610 waste package entries in the output file.

Attachment IV
Abstraction Routine Testing and Verification (TH-msmabs_ver_2)
(No Backfill Repository Design)

The initial TH abstraction routine is modified from version 1.0 (TH-msmabs_ver_1) to version 2.0 (TH-msmabs_ver_2). This software routine is documented in accordance with AP-SI.1Q, *Software Management*, Section 5.1.1. Both versions of this software routine are intended for use with a FORTRAN 77 (SUN platform) compiler UNIX OS. Version 1 of the TH abstraction routine was developed for the backfilled repository design, version 2 for the no backfill repository design. The differences between the software routines are described below with the testing and verification of version 2 detailed in this attachment (refer to Attachment I for version 1.0 of the routine). The primary difference between versions 1 and 2 is the computation and output format of new average quantities for use by the TSPA model:

- bin average drift wall temperature
- bin average drift wall relative humidity

are explicitly calculated and written to an output file by version 2 for each of the infiltration rate bins populated by the abstraction routine (note: version 1 computed these averages as well; however, the output was not specifically written to an output file intended for use by the TSPA model). It is noted that the testing and validation of version 1 of the TH abstraction routine applies to this version 2 as well. The lines of code that restructure the raw data and compute the averages remained unchanged from version 1. Therefore, the results of the testing exercise performed previously (in Attachment I) applies here as well.

An example is given below for implementation of version 2.0 of the TH abstraction software routine. This illustration is the for mean infiltration flux case for the csnf results.

- Go to the TDMS with DTN: SN0007T0872799.014 to obtain the TH-msmabs_ver_2-files.ZIP file.
- Use TH-msmabs_ver_2 (Version 2.0). Unlike in the previous case including backfill, npts=99 for all three infiltration flux cases.
- The 612 input files required for the routine (for the mean case) are the following:
  - csnfmean (note: this file contains the list of input filenames, 610 total, starting with the word csnfmean ending with the word end).
  - THabstraction.fil (note that –csnfmean was removed from the extension). The filenames contained in this "driver" file must be given in the exact order in which they are found in this file contained within the TDMS.
  - 610 input files for the (csnf) case obtained from LL000509112312.003.
- The routine prompts the user for the infiltration ranges by: 'Enter bin ranges starting from lowest mm/yr.' The user should enter 0, the prompt again, then enter, 3, etc. until 60 (refer to Section 5.1.1). The prompt occurs five times (e.g., the number of infiltration bins). Additionally, the

routine prompts the user (during runtime) for the rate of change factor: enter 0% for all three infiltration flux cases.

- The output files generated by the routine are the following:

  bin0-3
  bin3-10
  bin10-20
  bin20-60
  bin-60
  binmembers.dat
  csnf_d1050100_bin0-3_mean_avg
  RIP_csnf_d1050100_bin0-3_mean
  RIP_csnf_qperc_d1050100_bin0-3_mean
  csnf_d1050100_bin3-10_mean_avg
  RIP_csnf_d1050100_bin3-10_mean
  RIP_csnf_qperc_d1050100_bin3-10_mean
  csnf_d1050100_bin10-20_mean_avg
  RIP_csnf_d1050100_bin10-20_mean
  RIP_csnf_qperc_d1050100_bin10-20_mean
  csnf_d1050100_bin20-60_mean_avg
  RIP_csnf_d1050100_bin20-60_mean
  RIP_csnf_qperc_d1050100_bin20-60_mean
  csnf_d1050100_bin-60_mean_avg
  RIP_csnf_d1050100_bin-60_mean
  RIP_csnf_qperc_d1050100_bin-60_mean
  RIP_Tavg_csnf_d1050100_bin0-3_mean
  RIP_SLavg_csnf_d1050100_bin0-3_mean
  RIP_qpercavg_csnf_d1050100_bin0-3_mean
  RIP_Tmax_csnf_d1050100_bin0-3_mean
  RIP_Tmin_csnf_d1050100_bin0-3_mean
  RIP_Tinvavg_csnf_d1050100_bin0-3_mean
  RIP_RHinvavg_csnf_d1050100_bin0-3_mean
  RIP_Qevap_invavg_csnf_d1050100_bin0-3_mean
  RIP_TtopDSavg_csnf_d1050100_bin0-3_mean
  RIP_qpercinvavg_csnf_d1050100_bin0-3_mean
  RIP_TDWavg_csnf_d1050100_bin0-3_mean
  RIP_RHDWavg_csnf_d1050100_bin0-3_mean
  RIP_Tavg_csnf_d1050100_bin3-10_mean
  RIP_SLavg_csnf_d1050100_bin3-10_mean
  RIP_qpercavg_csnf_d1050100_bin3-10_mean
  RIP_Tmax_csnf_d1050100_bin3-10_mean
  RIP_Tmin_csnf_d1050100_bin3-10_mean
  RIP_Tinvavg_csnf_d1050100_bin3-10_mean
  RIP_RHinvavg_csnf_d1050100_bin3-10_mean
  RIP_Qevap_invavg_csnf_d1050100_bin3-10_mean
  RIP_TtopDSavg_csnf_d1050100_bin3-10_mean

RIP_qpercinvavg_csnf_d1050100_bin3-10_mean
RIP_TDWavg_csnf_d1050100_bin3-10_mean
RIP_RHDWavg_csnf_d1050100_bin3-10_mean
RIP_Tavg_csnf_d1050100_bin10-20_mean
RIP_SLavg_csnf_d1050100_bin10-20_mean
RIP_qpercavg_csnf_d1050100_bin10-20_mean
RIP_Tmax_csnf_d1050100_bin10-20_mean
RIP_Tmin_csnf_d1050100_bin10-20_mean
RIP_Tinvavg_csnf_d1050100_bin10-20_mean
RIP_RHinvavg_csnf_d1050100_bin10-20_mean
RIP_Qevap_invavg_csnf_d1050100_bin10-20_mean
RIP_TtopDSavg_csnf_d1050100_bin10-20_mean
RIP_qpercinvavg_csnf_d1050100_bin10-20_mean
RIP_TDWavg_csnf_d1050100_bin10-20_mean
RIP_RHDWavg_csnf_d1050100_bin10-20_mean
RIP_Tavg_csnf_d1050100_bin20-60_mean
RIP_SLavg_csnf_d1050100_bin20-60_mean
RIP_qpercavg_csnf_d1050100_bin20-60_mean
RIP_Tmax_csnf_d1050100_bin20-60_mean
RIP_Tmin_csnf_d1050100_bin20-60_mean
RIP_Tinvavg_csnf_d1050100_bin20-60_mean
RIP_RHinvavg_csnf_d1050100_bin20-60_mean
RIP_Qevap_invavg_csnf_d1050100_bin20-60_mean
RIP_TtopDSavg_csnf_d1050100_bin20-60_mean
RIP_qpercinvavg_csnf_d1050100_bin20-60_mean
RIP_TDWavg_csnf_d1050100_bin20-60_mean
RIP_RHDWavg_csnf_d1050100_bin20-60_mean
RIP_Tavg_csnf_d1050100_bin-60_mean
RIP_SLavg_csnf_d1050100_bin-60_mean
RIP_qpercavg_csnf_d1050100_bin-60_mean
RIP_Tmax_csnf_d1050100_bin-60_mean
RIP_Tmin_csnf_d1050100_bin-60_mean
RIP_Tinvavg_csnf_d1050100_bin-60_mean
RIP_RHinvavg_csnf_d1050100_bin-60_mean
RIP_Qevap_invavg_csnf_d1050100_bin-60_mean
RIP_TtopDSavg_csnf_d1050100_bin-60_mean
RIP_qpercinvavg_csnf_d1050100_bin-60_mean
RIP_TDWavg_csnf_d1050100_bin-60_mean
RIP_RHDWavg_csnf_d1050100_bin-60_mean
RIP_qpercinvavg_ABS_csnf_d1050100_bin0-3_mean
RIP_qpercinvavg_ABS_csnf_d1050100_bin3-10_mean
RIP_qpercinvavg_ABS_csnf_d1050100_bin10-20_mean
RIP_qpercinvavg_ABS_csnf_d1050100_bin20-60_mean
RIP_qpercinvavg_ABS_csnf_d1050100_bin-60_mean

- The bin* (e.g., bin3-10, etc.) file is a printout by the routine that indicates what input files (read in from the filename: csnfmean) get sorted into the predefined infiltration bins. Note: the number of infiltration rate bins (ninf=5 in this TH abstraction) can be changed to any number in the parameter statement (ninf=?), but the input file THabstraction.fil has to be modified for the additional filenames that would be required if there are more than 5 infiltration bins predefined by the user. A runtime message is printed to the screen indicating how many filenames need to be provided (in THabstraction.fil) to the routine when the number ninf is selected.
- The binmembers.dat file gives a number count (of total input files) that fall within each bin. The sum of all populated bins is 610. This file is specified to ensure that all input files are processed by the routine during the abstraction.
- The RIP* files (e.g., RIP_qpercavg_csnf_d1050100_bin20-60_mean, etc.) are the files passed by this AMR to the TSPA model. This assemblage of files is found in the TDMS under SN0007T0872799.014 in the ZIP file: mean_noBF.ZIP.
- The csnf*avg files (e.g., csnf_d1050100_bin3-10_mean_avg) represent averaged information not used by the TSPA model but that may be used for various data visualization purposes. This assemblage of files is found in the TDMS under SN0007T0872799.014 in the file name avgfiles_noBF.ZIP.

An analogous sequence of steps is followed for the hlw for the mean flux case, and the csnf & hlw from the low and the csnf & hlw for the high flux cases. It is re-emphasized here that version 2.0 of this routine is **ONLY** applicable to the no backfill process-level model results. The abstraction routine to be used for the with backfill results is given in detail in Attachment I.

So, to summarize, the TH abstraction routine follows these general steps:

1) User predefines the number of infiltration bins and bin ranges (TDMS files are set-up for 5 infiltration bins as specified in Section 5.1.1 in the AMR).
2) Read in the input files obtained from the process-level model and sort them into appropriate predefined infiltration bins.
3) Perform, on a per bin basis, computation of variable averages, variable reformatting, variable sorting, and calculation of the bin fractions.
4) Print, on a per bin basis, the outputs for general results and the abstraction results passed to the TSPA model.

Since new variables are needed (in addition to those included in version 1) and the format for others may have changed in the raw files used as input in the abstraction, some changes to the routine were required and hence the development of version 2 of the primary TH abstraction routine. Those changes are tested and validated in this attachment. Those required changes that allow the abstraction software routine to pull and compute the appropriate averages are visualized in a "diff" comparison between version 1 and predecessor version of version 2. The results of the "diff" are listed below. The changes to the initial routine are made sequentially in order to reduce the possibly for error.

Therefore, this "diff" result is based on an intermediate version between version 1 and the final version 2 routine (e.g., version 2 in this "diff" is not the final working version 2 checked below). The less than (<) indicator signifies the new version 2 routine line(s) while the greater than (>) signifies the line(s) in version 1 of the abstraction routine.

"diff" Results to Ensure Implementation of New Average Quantities

```
11,12d10
< c    version 2 used for no backfill design
< c    ndf  03/07/00- TSPA-SR, Rev00
53,55c51
<       character*80 resultsbinfile11(ninf)
<       character*80 resultsbinfile12(ninf)
<       character*80 resultsbinfile13(ninf)

---
>       character*80 resultsbinfile11(ninf)


130,131c126
<      @ T_dwtop9a(npts), ql_invavgRIP(ninf,npts),ql_invavgabs(ninf,npts),
<      @ TavgRIPdw(ninf,npts), RHavgRIPdw(ninf,npts)
---
>      @ T_dwtop9a(npts), ql_invavgRIP(ninf,npts),ql_invavgabs(ninf,npts)
199,200d193
<     write(*,*) 'bin1RIP-TDWavg file'
<     write(*,*) 'bin1RIP-RHDWavg file'
212,213d204
<     write(*,*) 'ninfRIP-TDWavg file'
<     write(*,*) 'ninfRIP-RHDWavg file'
221c212
<      ifiles = ninf+1+3*ninf+13*ninf
---
>      ifiles = ninf+1+3*ninf+11*ninf
866d856
<       TavgRIPdw(k,j)=s5T_dw
896d885
<       RHavgRIPdw(k,j)=s1RH_dw
1587,1588d1575
<  93   format(';', 'The Average Drift Wall Temp (C)')
<  94   format(';', 'The Average Drift Wall RH')
2100,2179d2086
< c.....Average drift wall T
<
<         write (*,*) 'Writing T_DW value file for RIP'
<
       read(3,'(a)') resultsbinfile12(k)
<
      open(850+k,file=resultsbinfile12(k),status='new')
<
<     write(850+k,93)
<     write(850+k,7) resultsbinfile12(k)
<     write(850+k,13) facttb(k)
<     write(850+k,14) outfile(k)
```

```
<
<
<
<       if (noent(k) .ne. 0) then
<            write(850+k,*) 'No Entries for this Bin'
<       else
<
<        do j = 1,npts
<       if ( j .eq. 1 ) then
<        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
<        jtag = j
<       else if (j .eq. npts) then
<        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
<       else
<        crate= ( (TavgRIPdw(k,j)-TavgRIPdw(k,jtag))
<       @       /TavgRIPdw(k,jtag) ) *100.
<
<
<            if(abs(crate) .ge. prntfac) then
<                   write(850+k,928) timeyr(j), TavgRIPdw(k,j)
<                   jtag = j
<                  end if
<
<       end if
<
<            end do
<           end if
<      close(850+k)
<
< c.....Average Drift Wall RH
<
<
<          write (*,*) 'Writing RH_DW value file for RIP'
<
        read(3,'(a)') resultsbinfile13(k)
<
       open(950-k,file=resultsbinfile13(k),status='new')
<
<      write(950-k,94)
<      write(950-k,7) resultsbinfile13(k)
<      write(950-k,13) facttb(k)
<      write(950-k,14) outfile(k)
<
<
<
<
<       if (noent(k) .ne. 0) then
<            write(950-k,*) 'No Entries for this Bin'
<       else
<
<        do j = 1,npts
<       if ( j .eq. 1 ) then
<        write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<        jtag = j
<       else if (j .eq. npts) then
<        write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<       else
<        crate= ( (RHavgRIPdw(k,j)-RHavgRIPdw(k,jtag))
<       @       /RHavgRIPdw(k,jtag) ) *100.
<
<
```

```
<            if(abs(crate) .ge. prntfac) then
<                   write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<                   jtag = j
<                  end if
<
<       end if
<
<            end do
<           end if
<      close(950-k)
<
2183d2089
< c
```

The above "diff" result indicates that these two new variables are computed for each infiltration rate bin and saved in an appropriately named file created for TSPA model input. The results of the actual routine computations will be tested for a hand selected case as shown below.

Additional changes were also required to version 1 of the abstraction routine since the process-level model output results (used as input to the TH abstraction routine) changed slightly. New variables were added, others removed, and still others were regrouped into different primary data blocks. Version 2 of the abstraction routine was developed to be able to handle these simple changes in raw data formats (note: raw data files are also referred to as location dependent result files). A "diff" result between the documented version 1 and the working final version 2 (source code documented below) is shown below. This "diff" will show both the results already shown above and the new changes to various data inputs modified, deleted, or added. The less than (<) indicator signifies the new version 2 line(s) while the greater than (>) signifies the line(s) in version 1 of the abstraction routine.

The "diff" result shown below indicates where changes occurred in transitioning from version 1 of the routine to version 2 of the routine. (It is noted that the results of the "diff" shown above are also included in the results shown below.) The changes delineated below highlight the changes in the raw data formats read in by the TH abstraction routine. The following brief description summarizes the formatting changes incorporated into version 2 of the abstraction routine in order to be able to handle the new changes in the raw data.

The temperature data block in the raw data files was reduced by two entries. The top (T_dwtop) and lower (T_dwtop) drift wall temperatures were removed from the raw data files. Therefore, they (and their associated variables) were removed from the TH abstraction routine as well. The liquid flux data block in the raw data files was increased by one entry and a previous entry was altered. The liquid flux at the drift wall (ql_dw) was replaced by a liquid flux at the top (ql_dwtop) and bottom (ql_dwbot) of the drift wall. Associated variables (to compute averages) for these two new quantities were also added to the routine. The gas-phase pressure (P_ds) data block was incorporated into the capillary pressure data block (Pc_*). The water vapor and air mass flows over the drift wall were split out into separate data blocks in the raw data files. The TH abstraction routine is modified to handle both (pressure and mass flow) data block changes. The evaporation rate data block expanded by two new variables: drift wall top (qvpdwTp) and bottom (qvpdwBt). Associated variables (to

compute averages) for these two new quantities were also added to the routine. Finally, some pillar temperature locations were removed while others were added. A net increase of pillar temperatures was the result of the changes to the raw data files (11 pillar temperature locations in version 2 as opposed to 8 pillar temperatures in version 1). Another change in the raw data location dependent files occurred in the indicator for a dummy variable. The change from version 1 to version 2 of the TH abstraction routine is that the dummy variables are now –999.9 instead of –99.9 and the backfill peak portion of the "if statement" is removed since it is no longer needed in this version. Also, the preclosure relative humidity in the invert was reset from 0.0 to the standard dummy indicator (– 999.9).

(The text underlined and in italics are actual changes in lines of code and how the routine performs an operation. Text without highlighting are superficial changes in spacing only without change in how the line of code performs an operation.)

"diff" Between Final Version 1 and Final Version 2 TH Abstraction Routines

```
11,12d10
< c     version 2 used for no backfill design
< c     ndf  03/07/00- TSPA-SR, Rev00
30c28
<      parameter(npts=99, ninf=5, nbinm=650)
---
>      parameter(npts=442, ninf=5, nbinm=650)
□
32,36c30,34
<       implicit double precision (a-h,l,o-z)
<       character*4 name
<       character*10 label
<       character*80 infile1
<       character*80 infile2
---
>       implicit double precision (a-h,l,o-z)
□
>       character*4 name
□
>       character*10 label
□
>       character*80 infile1
□
>       character*80 infile2
□
38c36
<       character*80 infile4
---
>       character*80 infile4
□
40c38
<       character*80 resultsbinfile(ninf)
---
>       character*80 resultsbinfile(ninf)
□
46c44
```

```
<       character*80 resultsbinfile4(ninf)
---
>       character*80 resultsbinfile4(ninf)
□
50c48
<       character*80 resultsbinfile8(ninf)
---
>       character*80 resultsbinfile8(ninf)
□
53,55c51
<       character*80 resultsbinfile11(ninf)
<       character*80 resultsbinfile12(ninf)
<       character*80 resultsbinfile13(ninf)
---
>       character*80 resultsbinfile11(ninf)


□
76,77c72,73
< c23456789012345678901234567890123456789012345678901234567890123456789012
<     dimension timeyr(npts), PAwpT(nbinm,npts), PAwpRH(nbinm,npts),
---
> c23456789012345678901234567890123456789012345678901234567890123456789012
□
>     dimension timeyr(npts), PAwpT(nbinm,npts), PAwpRH(nbinm,npts),
□
80c76
<      @ PAdsT3a(npts), PAdsRH4a(npts), T_wp(nbinm,npts),
---
>      @ PAdsT3a(npts),
PAdsRH4a(npts), T_wp(nbinm,npts),
83c79
<      @ T_inv(nbinm,npts), RH_dw(nbinm,npts),
---
>      @ T_inv(nbinm,npts), T_dwlow(nbinm,npts), RH_dw(nbinm,npts),
87c83
<      @ ql_dwtop(nbinm,npts), ql_dsT(nbinm,npts), ql_dsS(nbinm,npts),
---
>      @ ql_dw(nbinm,npts), ql_dsT(nbinm,npts), ql_dsS(nbinm,npts),
93c89
<      @ T_ds4a(npts), T_dw5a(npts), T_inv6a(npts),
---
>      @ T_ds4a(npts), T_dw5a(npts), T_inv6a(npts), T_dwlow7a(npts),
96c92
<      @ ql_5m1a(npts), ql_3m2a(npts), ql_dwtop3a(npts), ql_dsT4a(npts),
---
>      @ ql_5m1a(npts), ql_3m2a(npts), ql_dw3a(npts), ql_dsT4a(npts),
101c97
<      @ factbin(ninf,nbinm), PAwpTf(nbinm,npts), PAwpRHf(nbinm,npts),
---
>      @ factbin(ninf,nbinm), PAwpTf(nbinm,npts), PAwpRHf(nbinm,npts),
□
105c101
<      @ T_invf(nbinm,npts),  RH_dwf(nbinm,npts),
---
>      @ T_invf(nbinm,npts), T_dwlowf(nbinm,npts), RH_dwf(nbinm,npts),
108,110c104,105
<      @ Sl_invf(nbinm,npts), ql_5mf(nbinm,npts), ql_3mf(nbinm,npts),
< c23456789012345678901234567890123456789012345678901234567890123456789012
<      @ ql_dwtopf(nbinm,npts), ql_dsTf(nbinm,npts), ql_dsSf(nbinm,npts),
```

```
---
>       @ Sl_invf(nbinm,npts), ql_5mf(nbinm,npts), ql_3mf(nbinm,npts),
>       @ ql_dwf(nbinm,npts), ql_dsTf(nbinm,npts), ql_dsSf(nbinm,npts),
121,126c116,121
<       @ Tpl689f(nbinm,npts), Tpl689(nbinm,npts), Tp1039f(nbinm,npts),
<       @ Tp1039(nbinm,npts), Tp1664f(nbinm,npts), Tp1664(nbinm,npts),
<       @ Tp2768f(nbinm,npts), Tp2768(nbinm,npts),
<       @  Tpl2991a(npts), Tpl3692a(npts),
<       @ Tpl4893a(npts), Tpl6894a(npts), Tp10395a(npts), Tp16646a(npts),
<       @ Tp27687a(npts),  coordl(ninf,nbinm),
---
>       @ Tpl689f(nbinm,npts), Tpl689(nbinm,npts), Tpl1014f(nbinm,npts),
>       @ Tpl1014(nbinm,npts), Tpl1514f(nbinm,npts), Tpl1514(nbinm,npts),
>       @ Tpl2264f(nbinm,npts), Tpl2264(nbinm,npts), Tpl3382f(nbinm,npts),
>       @  Tpl3382(nbinm,npts), Tpl2991a(npts), Tpl3692a(npts),
>       @ Tpl4893a(npts), Tpl6894a(npts), Tpl10145a(npts), Tpl15146a(npts),
>       @ Tpl22647a(npts), Tpl33828a(npts), coordl(ninf,nbinm),
129,140c124,126
<       @ Tminrip(ninf,npts), TavgRIPdstop(ninf,npts),
<       @  ql_invavgRIP(ninf,npts),ql_invavgabs(ninf,npts),
< c23456789012345678901234567890123456789012345678901234567890123456789012
<       @ TavgRIPdw(ninf,npts), RHavgRIPdw(ninf,npts),
<       @ ql_dwbotf(nbinm,npts),
<       @ ql_dwbot(nbinm,npts), qvpdwTp(nbinm,npts), qvpdwBt(nbinm,npts),
<       @ qvpdwTpf(nbinm,npts), qvpdwBtf(nbinm,npts),ql_dwbot8a(npts),
<       @ qvpdwTp5a(npts),qvpdwBt6a(npts), Tp10148a(npts), Tp15149a(npts),
<       @ Tp226410a(npts), Tp241411a(npts), Tp1014(nbinm,npts),
<       @ Tp1514(nbinm,npts), Tp2264(nbinm,npts), Tp2414(nbinm,npts),
<       @ Tp1514f(nbinm,npts), Tp2264f(nbinm,npts), Tp2414f(nbinm,npts),
<       @ Tp1014f(nbinm,npts)
---
>       @ Tminrip(ninf,npts), TavgRIPdstop(ninf,npts)
>       @ ,T_dwtopf(nbinm,npts), T_dwtop(nbinm,npts),
>       @ T_dwtop9a(npts), ql_invavgRIP(ninf,npts),ql_invavgabs(ninf,npts)
143d128
<
157c142
< c     bin while for k=1 iinf is the low infiltration bin
---
> c     bin while for k=1 iinf is the low infiltration bin
□
209,210d193
<     write(*,*) 'bin1RIP-TDWavg file'
<     write(*,*) 'bin1RIP-RHDWavg file'
222,223d204
<     write(*,*) 'ninfRIP-TDWavg file'
<     write(*,*) 'ninfRIP-RHDWavg file'
231c212
<      ifiles = ninf+1+3*ninf+13*ninf
---
>      ifiles = ninf+1+3*ninf+11*ninf
244,251c225,232
< c.....Begin to read in the ranges of infiltration bins
<       do k = 1, ninf
<       write(*,*) 'Enter bin ranges starting from lowest mm/yr'
<       read(*,*) qinf0(k)
<       end do
<     do k = 1,ninf
<           read(3,'(a)') outfile(k)
```

```
<     end do
---
> c.....Begin to read in the ranges of infiltration bins
□
>       do k = 1, ninf
□
>       write(*,*) 'Enter bin ranges starting from lowest mm/yr'
□
>       read(*,*) qinf0(k)
□
>       end do
□
>     do k = 1,ninf
□
>           read(3,'(a)') outfile(k)
□
>     end do
□
462,467c443,448
< c
<         write (*,*) 'Computing all averages for E0130'
< c       write (*,*) k
<         read(3,'(a)') resultsbinfile(k)
<     open(206-k,file=resultsbinfile(k),status='new')
<     open(106-k,file=outfile(k),status='old')
---
> c

>
       write (*,*) 'Computing all averages for E0130'
> c
       write (*,*) k
>
       read(3,'(a)') resultsbinfile(k)
>
      open(206-k,file=resultsbinfile(k),status='new')
>
      open(106-k,file=outfile(k),status='old')
478,493c459,474
< c       write (*,*) k
<         read(3,'(a)') resultsbinfile2(k)
<     open(306-k,file=resultsbinfile2(k),status='new')
<     write(306-k, *) 'Infiltration Bin:'
<     write(306-k,*) xinfillabel

<     write(306-k,*) resultsbinfile2(k)
< c23456789012345678901234567890123456789012345678901234567890123456789012
<     write(306-k,*)'Time (yr), Waste Pack Temp.(C), Drip shield temp.
<      @ (C), Drift wall temp.(C), Invert temp. (C), Waste pack RH, Drip
<      @ shield RH, Drift wall RH, Backfill RH, Invert RH, Liquid Satr. @
<      @ Drip Shield, Liquid Satr.@Invert, Air mass Frac, Water Vapor flux
<      @ at Dwall (kg/yr/m of drift), Air flux at Dwall(kg/yr/m of drift),
<      @ A Drip Shield Evapo. rate (m3/yr), Backfill Evapo. Rate (m3/yr),
<      @ Invert Evapo. Rate (m3/yr), Percolation Flux at 5 m (mm/yr), Vol
<      @ume flow at top dripshield (m3/yr), volume flow at invert (m3/yr),
<      @ Top of the dripshield Temp (C)'
---
> c
       write (*,*) k
>
       read(3,'(a)') resultsbinfile2(k)
```

```
>
      open(306-k,file=resultsbinfile2(k),status='new')
>
      write(306-k, *) 'Infiltration Bin:'
>
      write(306-k,*) xinfillabel

>
      write(306-k,*) resultsbinfile2(k)
> c23456789012345678901234567890123456789012345678901234567890123456789012
□
>
      write(306-k,*)'Time (yr), Waste Pack Temp.(C), Drip shield temp.
>
    @ (C), Drift wall temp.(C), Invert temp. (C), Waste pack RH, Drip
>
    @ shield RH, Drift wall RH, Backfill RH, Invert RH, Liquid Satr. @
>
    @ Drip Shield, Liquid Satr.@Invert, Air mass Frac, Water Vapor flux
>
    @ at Dwall (kg/yr/m of drift), Air flux at Dwall(kg/yr/m of drift),
>
    @ A Drip Shield Evapo. rate (m3/yr), Backfill Evapo. Rate (m3/yr),
>
    @ Invert Evapo. Rate (m3/yr), Percolation Flux at 5 m (mm/yr), Vol
>
    @ume flow at top dripshield (m3/yr), volume flow at invert (m3/yr),
>
    @ Top of the dripshield Temp (C)'
504,510c485,491
<        read(3,'(a)') resultsbinfile2p(k)
<     open(306+k,file=resultsbinfile2p(k),status='new')
<     write(306+k, *) 'Infiltration Bin:'
<     write(306+k,*) xinfillabel
<     write(306+k,*) resultsbinfile2p(k)
< c23456789012345678901234567890123456789012345678901234567890123456789012
<     write(306+k,*) ' Time (yr),  Percolation Flux at 5 m (mm/yr),
---
>
       read(3,'(a)') resultsbinfile2p(k)
>
      open(306+k,file=resultsbinfile2p(k),status='new')
>
      write(306+k, *) 'Infiltration Bin:'
>
      write(306+k,*) xinfillabel

>
      write(306+k,*) resultsbinfile2p(k)
> c23456789012345678901234567890123456789012345678901234567890123456789012
□
>
      write(306+k,*) ' Time (yr),  Percolation Flux at 5 m (mm/yr),
520c501
< c
---
> c

570c551,552
<       @   T_ds(i,j), Tdstop(i,j), T_wp(i,j), T_inv(i,j)
---
```

```
>       @    T_ds(i,j), Tdstop(i,j), T_wp(i,j), T_inv(i,j), T_dwlow(i,j)
>       @    , T_dwtop(i,j)
578c560
< c    T_dwlowf(i,j) = T_dwlow(i,j)*fact
---
>      T_dwlowf(i,j) = T_dwlow(i,j)*fact
580c562
< c    T_dwtopf(i,j) = T_dwtop(i,j)*fact
---
>      T_dwtopf(i,j) = T_dwtop(i,j)*fact
642,643c624
<       @    ql_dwtop(i,j), ql_dwbot(i,j), ql_dsT(i,j), ql_dsTag(i,j),
<       @    ql_dsS(i,j),
---
>       @    ql_dw(i,j), ql_dsT(i,j), ql_dsTag(i,j), ql_dsS(i,j),
648,649c629
<      ql_dwtopf(i,j) = ql_dwtop(i,j)*fact
<      ql_dwbotf(i,j) = ql_dwbot(i,j)*fact
---
>      ql_dwf(i,j) = ql_dw(i,j)*fact
674,686c654,666
< c        (see next block.ndf)
< c
< c 807       read(777,6) name
< c    if(name .ne. 'time') goto 807
< c
< c
< c         do j = 1,npts
< c    read(777,*) timeyr(j), P_ds(i,j)
< c
< c    P_dsf(i,j) = P_ds(i,j)*fact
< c         end do
< c
< c
---
> c
>
>  807       read(777,6) name
>      if(name .ne. 'time') goto 807
>
>
>           do j = 1,npts
>      read(777,*) timeyr(j), P_ds(i,j)
>
>      P_dsf(i,j) = P_ds(i,j)*fact
>           end do
>
>
689c669
< c        read the eighth block--gas phase & Capillary pressure data
---
> c        read the eighth block--Capillary pressure data
697c677
<      read(777,*) timeyr(j), P_ds(i,j), Pc_ds(i,j), Pc_inv(i,j),
---
>      read(777,*) timeyr(j), Pc_ds(i,j), Pc_inv(i,j),
700,701c680
<           P_dsf(i,j) = P_ds(i,j)*fact
<      Pc_dsf(i,j) = Pc_ds(i,j)*fact
```

```
---
>      Pc_dsf(i,j) = Pc_ds(i,j)*fact
717c696
<      read(777,*) timeyr(j), qw_dw(i,j)
---
>      read(777,*) timeyr(j), qw_dw(i,j), qa_dw(i,j)
720,729d698
<            end do
<
<
<  812       read(777,6) name
<      if(name .ne. 'time') goto 812
<
<
<            do j = 1,npts
<      read(777,*) timeyr(j), qa_dw(i,j)
<
733d701
<
745c713
<       @   qvpbfp(i,j), qvpinv(i,j), qvpdwTp(i,j), qvpdwBt(i,j)
---
>       @   qvpbfp(i,j), qvpinv(i,j)
751,752d718
<      qvpdwTpf(i,j) = qvpdwTp(i,j)*fact
<      qvpdwBtf(i,j) = qvpdwBt(i,j)*fact
761c727
<  811       read(777,6) name
---
> 811       read(777,6) name
767,769c733,734
<       @   Tp1489(i,j), Tp1689(i,j), Tp1014(i,j), Tp1039(i,j),
<       @   Tp1514(i,j), Tp1664(i,j), Tp2264(i,j), Tp2414(i,j),
<       @   Tp2768(i,j)
---
>       @   Tp1489(i,j), Tp1689(i,j), Tp11014(i,j), Tp11514(i,j),
>       @   Tp12264(i,j), Tp13382(i,j)
775,783c740,743
<      Tp1039f(i,j) = Tp1039(i,j)*fact
<      Tp1664f(i,j) = Tp1664(i,j)*fact
<      Tp2768f(i,j) = Tp2768(i,j)*fact
<
<      Tp1014f(i,j) = Tp1014(i,j)*fact
<      Tp1514f(i,j) = Tp1514(i,j)*fact
<      Tp2264f(i,j) = Tp2264(i,j)*fact
<      Tp2414f(i,j) = Tp2414(i,j)*fact
<
---
>      Tp11014f(i,j) = Tp11014(i,j)*fact
>      Tp11514f(i,j) = Tp11514(i,j)*fact
>      Tp12264f(i,j) = Tp12264(i,j)*fact
>      Tp13382f(i,j) = Tp13382(i,j)*fact
869c829
< c    s7T_dwlow = 0.
---
>      s7T_dwlow = 0.
871c831
< c    s9T_dwtop = 0.
---
```

```
>       s9T_dwtop = 0.
880c840
< c       s7T_dwlow=s7T_dwlow+T_dwlowf(i,j)
---
>         s7T_dwlow=s7T_dwlow+T_dwlowf(i,j)
882c842
< c       s9T_dwtop = s9T_dwtop + T_dwtopf(i,j)
---
>         s9T_dwtop = s9T_dwtop + T_dwtopf(i,j)
893c853
< c       T_dwlow7a(j) = s7T_dwlow
---
>         T_dwlow7a(j) = s7T_dwlow
895c855
< c       T_dwtop9a(j) = s9T_dwtop
---
>         T_dwtop9a(j) = s9T_dwtop
897d856
<         TavgRIPdw(k,j)=s5T_dw
927d885
<         RHavgRIPdw(k,j)=s1RH_dw
961,962c919
<       s3ql_dwtop = 0.
<       s8ql_dwbot = 0.
---
>       s3ql_dw = 0.
972,973c929
<         s3ql_dwtop = s3ql_dwtop + ql_dwtopf(i,j)
<         s8ql_dwbot = s8ql_dwbot + ql_dwbotf(i,j)
---
>         s3ql_dw = s3ql_dw + ql_dwf(i,j)
984,985c940
<         ql_dwtop3a(j)= s3ql_dwtop
<         ql_dwbot8a(j)= s8ql_dwbot
---
>         ql_dw3a(j)= s3ql_dw
1079,1081d1033
<       s5qvpdwTp = 0.
<       s6qvpdwBt = 0.
<
1088,1089d1039
<         s5qvpdwTp = s5qvpdwTp + qvpdwTpf(i,j)
<         s6qvpdwBt = s6qvpdwBt + qvpdwBtf(i,j)
1097,1098d1046
<         qvpdwTp5a(j) = s5qvpdwTp
<         qvpdwBt6a(j) = s6qvpdwBt
1113,1119c1061,1064
<       s5Tp1039 = 0.
<       s6Tp1664 = 0.
<       s7Tp2768 = 0.
<       s8Tp1014 = 0.
<       s9Tp1514 = 0.
<       s10Tp2264 = 0.
<       s11Tp2414 = 0.
---
>       s5Tp11014 = 0.
>       s6Tp11514 = 0.
>       s7Tp12264 = 0.
>       s8Tp13382 = 0.
```

```
1121d1065
<
1127,1136c1071,1074
<       s5Tp1039 = s5Tp1039 + Tp1039f(i,j)
<       s6Tp1664 = s6Tp1664 + Tp1664f(i,j)
<       s7Tp2768 = s7Tp2768 + Tp2768f(i,j)
<       s8Tp1014 = s8Tp1014 + Tp1014f(i,j)
<       s9Tp1514 = s9Tp1514 + Tp1514f(i,j)
<       s10Tp2264 = s10Tp2264 + Tp2264f(i,j)
<       s11Tp2414 = s11Tp2414 + Tp2414f(i,j)
<
<
<
---
>       s5Tp11014 = s5Tp11014 + Tp11014f(i,j)
>       s6Tp11514 = s6Tp11514 + Tp11514f(i,j)
>       s7Tp12264 = s7Tp12264 + Tp12264f(i,j)
>       s8Tp13382 = s8Tp13382 + Tp13382f(i,j)
1143,1151c1081,1084
<       Tp10395a(j) = s5Tp1039
<       Tp16646a(j) = s6Tp1664
<       Tp27687a(j) = s7Tp2768
<
<       Tp10148a(j) = s8Tp1014
<       Tp15149a(j) = s9Tp1514
<       Tp226410a(j) = s10Tp2264
<       Tp241411a(j) = s11Tp2414
<
---
>       Tp110145a(j) = s5Tp11014
>       Tp115146a(j) = s6Tp11514
>       Tp122647a(j) = s7Tp12264
>       Tp133828a(j) = s8Tp13382
1208,1209c1141,1142
<       write(306-k,*) 'Coordinate Location:'
<       write(306-k,128) coord1(k,i)
---
>
        write(306-k,*) 'Coordinate Location:'
>
        write(306-k,128) coord1(k,i)
1211c1144
<       write(306-k,129) coord2(k,i)
---
>
        write(306-k,129) coord2(k,i)
1225,1229c1158,1160
<           if (qvpdsT(i,j) .eq. -999.9 ) then
<
<                if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                 RH_inv(i,j) = -999.9
<                end if
---
>           if (qvpdsT(i,j) .eq. -999.9 .or. qvpbfp(i,j)
>      @            .eq. -99.9 ) then
>
1242,1246d1172
<                if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                 RH_inv(i,j) = -999.9
```

```
<                 end if
<
<
1261,1266d1186
<
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
<
<
1279,1284c1199,1200
<           if (qvpdsT(i,j) .eq. -999.9 ) then
<
<                if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                 RH_inv(i,j) = -999.9
<                end if
<
---
>           if (qvpdsT(i,j) .eq. -99.9 .or. qvpbfp(i,j)
>      @              .eq. -99.9 ) then
1298,1300d1213
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
1318c1231,1232
<                  if (qvpdsT(i,j) .eq. -999.9 ) then
---
>                  if (qvpdsT(i,j) .eq. -99.9 .or. qvpbfp(i,j)
>      @              .eq. -99.9 ) then
1320,1322d1233
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
1338,1340d1248
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
1368c1276,1277
<                if (qvpdsT(i,j) .eq. -999.9 ) then
---
>                if (qvpdsT(i,j) .eq. -99.9 .or. qvpbfp(i,j)
>      @              .eq. -99.9 ) then
1370,1373d1278
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
<
1386,1389d1290
<                 if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<                  RH_inv(i,j) = -999.9
<                 end if
<
1390a1292
>
1469c1371,1372
<      @ temp(C), dripshield top temp (C)'
---
>      @ temp(C), lower drift wall (C), dripshield top temp (C), drift wal
>      @l top temp (C)'
```

```
1475c1378,1379
<       @   Tdstop8a(j)
---
>       @   T_dwlow7a(j), Tdstop8a(j)
>       @, T_dwtop9a(j)
1478c1382
<       @    5x, E13.6, 5x, E13.6, 5x, E13.6)
---
>       @    5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, E13.6)
1520c1424
<       @ (mm/yr), liquid flux top driftW (mm/yr),  liquid flux top Dshield
---
>       @ (mm/yr), liquid flux drift W (mm/yr),  liquid flux top Dshield
1522,1523c1426
<       @(mm/yr), liquid flux top DS average (mm/yr), liquid flux bot drift
<       @W (mm/yr)'
---
>       @ (mm/yr), liquid flux top DS average (mm/yr)'
1528,1529c1431,1432
<       @   ql_dwtop3a(j), ql_dsT4a(j), ql_dsS5a(j), ql_inv6a(j),
<       @   ql_dsTag7a(j), ql_dwbot8a(j)
---
>       @   ql_dw3a(j), ql_dsT4a(j), ql_dsS5a(j), ql_inv6a(j),
>       @   ql_dsTag7a(j)
1532c1435
<       @    5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, e13.6)
---
>       @    5x, E13.6, 5x, E13.6, 5x, E13.6)
1602,1603c1505
<       @backfill pk (m3/yr), Evaporation rate invert (m3/yr), Evaporation
<       @rate top DW (m3/yr), Evaporation rate bot DW (m3/yr)'
---
>       @backfill pk (m3/yr), Evaporation rate invert (m3/yr)'
1605,1606c1507
<  910     format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6, 5x, e13.6,
<       @ 5x, e13.6)
---
>  910     format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6)
1613c1514
<       @  qvpinv4a(j)/rho, qvpdwTp5a(j)/rho, qvpdwBt6a(j)/rho
---
>       @  qvpinv4a(j)/rho
1623,1624c1524,1525
<       @(C), Tx=6.89 m (C), Tx=10.14 (C), Tx=10.39m (C), Tx=15.14m,
<       @Tx=16.64m (C), Tx=22.65 (C), Tx=24.14m (C), Tx=27.68 (C)'
---
>       @(C), Tx=6.89 m (C), Tx=10.14m (C), Tx=15.14m (C), Tx=22.64 (C),
>       @Tx=33.82m (C)'
1629,1631c1530,1531
<       @  Tp14893a(j), Tp16894a(j), Tp10148a(j), Tp10395a(j),
<       @  Tp15149a(j), Tp16646a(j), Tp226410a(j), Tp241411a(j),
<       @  Tp27687a(j)
---
>       @  Tp14893a(j), Tp16894a(j), Tp110145a(j), Tp115146a(j),
>       @  Tp122647a(j), Tp133828a(j)
1635,1636c1535
<       @    5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, e13.6,
<       @ 5x, e13.6, 5x, e13.6, 5x, e13.6)
---
```

```
>       @     5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, E13.6)
1677,1678d1575
<  93    format(';', 'The Average Drift Wall Temp (C)')
<  94    format(';', 'The Average Drift Wall RH')
1878,1879c1775,1776
<         read(3,'(a)') resultsbinfile5(k)
<      open(606-k,file=resultsbinfile5(k),status='new')
---
>
       read(3,'(a)') resultsbinfile5(k)
>
      open(606-k,file=resultsbinfile5(k),status='new')
1975,1979d1871
<
<              if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<               RHavgRIPin(k,j) = -999.9
<              end if
<
1983,1987d1874
<
<              if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<               RHavgRIPin(k,j) = -999.9
<              end if
<
1990,1995d1876
<
<              if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
<               RHavgRIPin(k,j) = -999.9
<              end if
<
<
2032c1913
<          qvpavgRIPinv(k,j)=-999.9
---
>          qvpavgRIPinv(k,j)=-99.9
2044c1925
<             if ( qvpavgRIPinv(k,j)  .eq. -999.9) then
---
>             if ( qvpavgRIPinv(k,j)  .eq. -99.9) then
2063,2066c1944
<                if ( qvpavgRIPinv(k,j)  .ge. -1001.
<       @                .and. qvpavgRIPinv(k,j) .le. -999.   ) then
<
<                      qvpavgRIPinv(k,j)=-999.9
---
>                if ( qvpavgRIPinv(k,j)  .eq. -99.9) then
2090,2094c1968
<                if ( qvpavgRIPinv(k,j)  .ge. -1001.
<       @                .and. qvpavgRIPinv(k,j) .le. -999.   ) then
<
<                      qvpavgRIPinv(k,j)=-999.9
<
---
>                      if ( qvpavgRIPinv(k,j)  .eq. -99.9) then
2213,2292d2086
< c.....Average drift wall T
<
<          write (*,*) 'Writing T_DW value file for RIP'
```

```
<
        read(3,'(a)') resultsbinfile12(k)
<
       open(850+k,file=resultsbinfile12(k),status='new')
<
<      write(850+k,93)
<      write(850+k,7) resultsbinfile12(k)
<      write(850+k,13) facttb(k)
<      write(850+k,14) outfile(k)
<
<
<
<       if (noent(k) .ne. 0) then
<            write(850+k,*) 'No Entries for this Bin'
<       else
<
        do j = 1,npts
       if ( j .eq. 1 ) then
        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
       else
        crate= ( (TavgRIPdw(k,j)-TavgRIPdw(k,jtag))
       @       /TavgRIPdw(k,jtag) ) *100.
<
<
<            if(abs(crate) .ge. prntfac) then
<                    write(850+k,928) timeyr(j), TavgRIPdw(k,j)
<                    jtag = j
<                   end if
<
       end if
<
            end do
<           end if
<      close(850+k)
<
< c.....Average Drift Wall RH
<
<
<          write (*,*) 'Writing RH_DW value file for RIP'
<
        read(3,'(a)') resultsbinfile13(k)
<
       open(950-k,file=resultsbinfile13(k),status='new')
<
<      write(950-k,94)
<      write(950-k,7) resultsbinfile13(k)
<      write(950-k,13) facttb(k)
<      write(950-k,14) outfile(k)
<
<
<
<
<       if (noent(k) .ne. 0) then
<            write(950-k,*) 'No Entries for this Bin'
<       else
<
```

```
<        do j = 1,npts
<       if ( j .eq. 1 ) then
<        write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<        jtag = j
<       else if (j .eq. npts) then
<        write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<       else
<        crate= ( (RHavgRIPdw(k,j)-RHavgRIPdw(k,jtag))
<       @       /RHavgRIPdw(k,jtag) ) *100.
<
<
<            if(abs(crate) .ge. prntfac) then
<                    write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
<                    jtag = j
<                   end if
<
<       end if
<
<            end do
<           end if
<      close(950-k)
<
2296d2089
< c
2374c2167
<
---
>
```

Testing and Verification

The following pages indicate computed generated results for the input files (excerpts only due to the large input file sizes) and computer generated evidence of the programmed algorithms (also excerpts due to file sizes). Since the structure of the routine version 2.0 is primarily the same as version 1.0, only the changes made to version 1.0 are checked below. The testing and validation process performed on version 1.0 also applies to this version 2.0 based on the "diff" testing just performed above.

As an example of the implementation of the changes made to version 1.0, the case for the mean infiltration flux without backfill repository design, the 60 + mm/yr infiltration rate bin containing 3 location dependent (raw) data entries (refer to Table 5 in the AMR) is selected for testing. The abstraction routine is tested using a precursor set of data. The precursor data set is not used in the TH abstraction described in this AMR; it is used to ensure that this abstraction routine (TH-msmabs_ver_2) identifies, sorts, reformats, and computes averages as intended for the eventual application to the working TH abstraction (input files names and DTNs given in Table 2 Section 4 of the AMR). The precursor data set is in the exact format as the actual data set used as input to the abstraction routine and can subsequently be used in this testing capacity. Since this data set is intended as test data and is not actually used for abstraction purposes, this data is not treated as controlled data and is used (and documented) herein to demonstrate the correct usage of this one-time use software routine. It is emphasized that the test cases shown below may not represent the

working input files used in the TH abstraction. They do, however, contain the exact same format of the raw location dependent files used in the final abstractions for TSPA. The precursor data file names located within this infiltration rate bin are as follows:

- csnf_x1_y20_data
- csnf_x2_y20_data
- csnf_x3_y20_data

Consider first the computation for the average drift wall temperature for this particular infiltration rate bin. Excerpts (not complete files) from the raw data files (read by the abstraction routine) named above are the following:

```
file:        csnf_x1_y20_data

data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):         170208.78
northing (NV central):        234316.72

Area:
fraction of repository area
represented by cell  1,20 =         0.000586

Infiltration:
cell  1,20 infiltration:            61.004459   (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m

...

time    T_dw    T_5m    T_bfpeak       T_ds    T_ds_top       T_wp    T_invert
```

```
0.000000e+00   2.228091e+01   2.214463e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       2.228293e+01   2.230695e+01
1.000000e+00   6.529402e+01   2.868543e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       7.860538e+01   6.959058e+01
2.000000e+00   7.221127e+01   3.499641e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.458594e+01   7.633411e+01
5.000000e+00   7.890969e+01   4.494005e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.977450e+01   8.257661e+01
1.000000e+01   7.959724e+01   5.178629e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.896761e+01   8.264103e+01
1.500000e+01   7.795670e+01   5.470237e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.639661e+01   8.064236e+01
2.000000e+01   7.555257e+01   5.605523e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.324245e+01   7.793475e+01
2.500000e+01   7.304754e+01   5.631755e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       8.013593e+01   7.522044e+01
3.000000e+01   7.043839e+01   5.610666e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       7.695779e+01   7.237453e+01
4.000000e+01   6.544493e+01   5.491376e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       7.095518e+01   6.693619e+01
5.000000e+01   6.009770e+01   5.318512e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02
       6.468165e+01   6.111965e+01
5.019998e+01   1.038825e+02   5.892619e+01   -9.999000e+02  1.222197e+02   1.214927e+02
       1.369236e+02   1.235835e+02
5.100001e+01   1.144265e+02   6.525249e+01   -9.999000e+02  1.339153e+02   1.332711e+02
       1.469866e+02   1.346465e+02
5.199999e+01   1.257111e+02   7.211626e+01   -9.999000e+02  1.447744e+02   1.441706e+02
       1.570012e+02   1.453131e+02
5.300000e+01   1.308368e+02   7.770815e+01   -9.999000e+02  1.491785e+02   1.486026e+02
       1.608647e+02   1.495893e+02
5.500000e+01   1.321599e+02   8.355626e+01   -9.999000e+02  1.493095e+02   1.487672e+02
       1.603009e+02   1.496209e+02
6.000000e+01   1.230362e+02   8.454208e+01   -9.999000e+02  1.374293e+02   1.369342e+02
       1.474385e+02   1.376600e+02
6.500000e+01   1.123293e+02   8.774113e+01   -9.999000e+02  1.247118e+02   1.242476e+02
       1.340785e+02   1.249373e+02
...
```

file: csnf_x2_y20_data

```
data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):         170228.75
northing (NV central):        234315.67

Area:
fraction of repository area
represented by cell  2,20 =         0.000976

Infiltration:
cell  2,20 infiltration:            60.793499   (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
```

```
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m


...

time    T_dw    T_5m    T_bfpeak        T_ds    T_ds_top        T_wp    T_invert
0.000000e+00    2.228698e+01    2.215130e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        2.228900e+01    2.231302e+01
1.000000e+00    6.110997e+01    2.869178e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        7.496062e+01    6.594582e+01
2.000000e+00    6.886970e+01    3.500264e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.172340e+01    7.347158e+01
5.000000e+00    7.730989e+01    4.494752e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.861829e+01    8.142039e+01
1.000000e+01    7.983687e+01    5.179443e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.955875e+01    8.323216e+01
1.500000e+01    7.839980e+01    5.471073e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.707694e+01    8.132269e+01
2.000000e+01    7.616609e+01    5.606268e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.402593e+01    7.871823e+01
2.500000e+01    7.345540e+01    5.632465e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.062357e+01    7.570808e+01
3.000000e+01    7.088567e+01    5.611346e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        7.745287e+01    7.286961e+01
4.000000e+01    6.597197e+01    5.491940e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        7.148193e+01    6.746294e+01
5.000000e+01    6.050390e+01    5.319101e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        6.500671e+01    6.144471e+01
5.019998e+01    1.040555e+02    5.893128e+01    -9.999000e+02   1.224034e+02    1.216763e+02
        1.371073e+02    1.237672e+02
5.100001e+01    1.132338e+02    6.525772e+01    -9.999000e+02   1.326013e+02    1.319572e+02
        1.456727e+02    1.333325e+02
5.199999e+01    1.227272e+02    7.212388e+01    -9.999000e+02   1.420399e+02    1.414361e+02
        1.542667e+02    1.425786e+02
5.300000e+01    1.302109e+02    7.771452e+01    -9.999000e+02   1.489059e+02    1.483300e+02
        1.605921e+02    1.493167e+02
5.500000e+01    1.327403e+02    8.356174e+01    -9.999000e+02   1.502025e+02    1.496602e+02
        1.611939e+02    1.505139e+02
6.000000e+01    1.252184e+02    8.454845e+01    -9.999000e+02   1.398230e+02    1.393280e+02
        1.498322e+02    1.400538e+02
6.500000e+01    1.130541e+02    8.774702e+01    -9.999000e+02   1.252009e+02    1.247367e+02
        1.345676e+02    1.254265e+02
...
```

file: **csnf_x3_y20_data**

```
data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):         170256.20
northing (NV central):        234314.20

Area:
fraction of repository area
```

```
represented by cell  3,20 =          0.001171

Infiltration:
cell  3,20 infiltration:             60.375038    (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m
...

time    T_dw    T_5m    T_bfpeak        T_ds    T_ds_top        T_wp    T_invert
0.000000e+00    2.229967e+01    2.216402e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        2.230169e+01 · 2.232571e+01
1.000000e+00    5.913351e+01    2.873111e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        7.324175e+01    6.422695e+01
2.000000e+00    6.699601e+01    3.494251e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.012576e+01    7.187393e+01
5.000000e+00    7.596065e+01    4.487531e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.766803e+01    8.047014e+01
1.000000e+01    7.958281e+01    5.180995e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.979629e+01    8.346970e+01
1.500000e+01    7.930813e+01    5.472667e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.849538e+01    8.274112e+01
2.000000e+01    7.778741e+01    5.607684e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.616062e+01    8.085292e+01
2.500000e+01    7.567845e+01    5.633833e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.336297e+01    7.844748e+01
3.000000e+01    7.332933e+01    5.612672e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        8.039978e+01    7.581653e+01
4.000000e+01    6.636151e+01    5.493098e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        7.187152e+01    6.785253e+01
5.000000e+01    6.450779e+01    5.320321e+01    -9.999000e+02   -9.999000e+02   -9.999000e+02
        6.962502e+01    6.606302e+01
5.019998e+01    1.023656e+02    5.894223e+01    -9.999000e+02   1.208124e+02    1.200853e+02
        1.355163e+02    1.221762e+02
5.100001e+01    1.110806e+02    6.526890e+01    -9.999000e+02   1.302658e+02    1.296217e+02
        1.433372e+02    1.309970e+02
5.199999e+01    1.180600e+02    7.213952e+01    -9.999000e+02   1.377319e+02    1.371282e+02
        1.499588e+02    1.382707e+02
5.300000e+01    1.256859e+02    7.772802e+01    -9.999000e+02   1.448334e+02    1.442575e+02
        1.565196e+02    1.452442e+02
5.500000e+01    1.321180e+02    8.357363e+01    -9.999000e+02   1.502778e+02    1.497355e+02
        1.612693e+02    1.505892e+02
6.000000e+01    1.311935e+02    8.456174e+01    -9.999000e+02   1.471994e+02    1.467043e+02
        1.572086e+02    1.474301e+02
6.500000e+01    1.225585e+02    8.775935e+01    -9.999000e+02   1.361995e+02    1.357353e+02
        1.455662e+02    1.364250e+02
...
```

The average (drift wall temperature) is computed with the following equations. The raw temperature values used in the computation are marked in bold above. The areal weight of each location dependent result is also used in the computation of the average quantity. The appropriate weighting

factor is obtained from the header information contained within the raw data file used as input to the abstraction routine.

$$f_{avg-i} = \frac{f_i}{\sum_{bin-i} f_i}$$

$$X_{avg}(j) = \sum_{bin-i} f_{avg-i} X_i(j)$$

At j = 65 years, the average drift wall temperature is computed using the above equations as:

T(j=65years) = (0.000586/0.002733)* **1.123293e+02** + (0.000976/0.002733)* **1.130541e+02** + (0.001171/0.002733)* **1.225585e+02** = **<u>116.971°C</u>**.

An excerpt of the resultant output file obtained from the TH abstraction routine gives the following drift wall average temperature:

```
;The Average Drift Wall Temp (C)
;RIP_TDWavg_csnf_d1041700_bin-60_mean
;Time(yr), Bin Weight=  0.273300E-02
;bin-60
      0.00, 0.222911E+02
      1.00, 0.611603E+02
      2.00, 0.687834E+02
      5.00, 0.770748E+02
     10.00, 0.796766E+02
     15.00, 0.786940E+02
     20.00, 0.767292E+02
     25.00, 0.743205E+02
     30.00, 0.718368E+02
     40.00, 0.660259E+02
     50.00, 0.621323E+02
     50.20, 0.103294E+03
     51.00, 0.112567E+03
     52.00, 0.121367E+03
     53.00, 0.128406E+03
     55.00, 0.132349E+03
     60.00, 0.127311E+03
     65.00, 0.116971E+03
     70.00, 0.995107E+02
     80.00, 0.859940E+02
    100.00, 0.804352E+02
    120.00, 0.775194E+02
    140.00, 0.721316E+02
    160.00, 0.693779E+02
    180.00, 0.681843E+02
    200.00, 0.669569E+02
...
```

The abstraction routine is functioning as intended as shown in the test calculation. It is also noted that the total bin weight (for the 60 + mm/yr bin for the mean infiltration flux case) supplied by the abstraction routine in the output file header as (Bin Weight = 0.273300E-02) is also verified by this hand calculation to be correct. The same check is performed for the average drift wall relative humidity. Excerpts from the same location dependent files are shown below.

file: csnf_x1_y20_data

data file creation date: Mon Apr 10 23:47:19 2000
MSTHM version: MSTHM_rev_6.2
base EXTfile creation date: Mon Apr 10 23:33:16 2000

Type:
average WP type: bwr1

Location:
easting (NV central): 170208.78
northing (NV central): 234316.72

Area:
fraction of repository area
represented by cell 1,20 = **0.000586**

Infiltration:
cell 1,20 infiltration: 61.004459 (mm/yr)

...

...

time	RH_dw	RH_bfpeak	RH_ds	RH_wp	RH_invert		
0.000000e+00		9.999522e-01	-9.999000e+02		-9.999000e+02	9.991367e-01	0.000000e+00
1.000000e+00		9.999573e-01	-9.999000e+02		-9.999000e+02	4.545135e-01	0.000000e+00
2.000000e+00		9.999582e-01	-9.999000e+02		-9.999000e+02	5.003818e-01	0.000000e+00
5.000000e+00		9.984284e-01	-9.999000e+02		-9.999000e+02	5.604920e-01	0.000000e+00
1.000000e+01		9.972738e-01	-9.999000e+02		-9.999000e+02	6.065378e-01	0.000000e+00
1.500000e+01		9.968060e-01	-9.999000e+02		-9.999000e+02	6.330904e-01	0.000000e+00
2.000000e+01		9.968498e-01	-9.999000e+02		-9.999000e+02	6.540437e-01	0.000000e+00
2.500000e+01		9.970302e-01	-9.999000e+02		-9.999000e+02	6.719723e-01	0.000000e+00
3.000000e+01		9.972565e-01	-9.999000e+02		-9.999000e+02	6.891673e-01	0.000000e+00
4.000000e+01		9.977682e-01	-9.999000e+02		-9.999000e+02	7.216719e-01	0.000000e+00
5.000000e+01		9.983247e-01	-9.999000e+02		-9.999000e+02	7.524950e-01	0.000000e+00
5.019998e+01		9.925216e-01	-9.999000e+02		6.187423e-01	3.981338e-01	6.453106e-01
5.100001e+01		7.492421e-01	-9.999000e+02		4.742486e-01	3.279620e-01	4.795737e-01
5.199999e+01		6.266077e-01	-9.999000e+02		4.133590e-01	2.982844e-01	4.188174e-01
5.300000e+01		5.840880e-01	-9.999000e+02		3.973182e-01	2.928206e-01	4.010577e-01
5.500000e+01		4.478400e-01	-9.999000e+02		3.148038e-01	2.361552e-01	3.198069e-01
6.000000e+01		3.699237e-01	-9.999000e+02		2.749679e-01	2.079031e-01	2.785259e-01
6.500000e+01		3.298608e-01	-9.999000e+02		2.550320e-01	1.924727e-01	2.578385e-01
7.000000e+01		3.256705e-01	-9.999000e+02		2.758440e-01	2.020975e-01	2.782357e-01
8.000000e+01		3.532605e-01	-9.999000e+02		3.127680e-01	2.304957e-01	3.143938e-01
1.000000e+02		**4.513094e-01**	-9.999000e+02		4.088576e-01	3.104340e-01	4.084610e-01
1.200000e+02		5.547317e-01	-9.999000e+02		5.137575e-01	3.967099e-01	5.106735e-01

...

file: csnf_x2_y20_data

data file creation date: Mon Apr 10 23:47:19 2000
MSTHM version: MSTHM_rev_6.2
base EXTfile creation date: Mon Apr 10 23:33:16 2000

Type:
average WP type: bwr1

Location:
easting (NV central): 170228.75

northing (NV central): 234315.67

Area:
fraction of repository area
represented by cell 2,20 = **0.000976**

Infiltration:
cell 2,20 infiltration: 60.793499 (mm/yr)

...

...

time	RH_dw	RH_bfpeak	RH_ds	RH_wp	RH_invert	
0.000000e+00	9.999522e-01	-9.999000e+02	-9.999000e+02	9.991371e-01	0.000000e+00	
1.000000e+00	9.999554e-01	-9.999000e+02	-9.999000e+02	4.348887e-01	0.000000e+00	
2.000000e+00	9.999557e-01	-9.999000e+02	-9.999000e+02	4.834293e-01	0.000000e+00	
5.000000e+00	9.980901e-01	-9.999000e+02	-9.999000e+02	5.480447e-01	0.000000e+00	
1.000000e+01	9.966823e-01	-9.999000e+02	-9.999000e+02	5.990496e-01	0.000000e+00	
1.500000e+01	9.961122e-01	-9.999000e+02	-9.999000e+02	6.275998e-01	0.000000e+00	
2.000000e+01	9.961658e-01	-9.999000e+02	-9.999000e+02	6.507192e-01	0.000000e+00	
2.500000e+01	9.963861e-01	-9.999000e+02	-9.999000e+02	6.705744e-01	0.000000e+00	
3.000000e+01	9.966621e-01	-9.999000e+02	-9.999000e+02	6.876241e-01	0.000000e+00	
4.000000e+01	9.972861e-01	-9.999000e+02	-9.999000e+02	7.220634e-01	0.000000e+00	
5.000000e+01	9.979650e-01	-9.999000e+02	-9.999000e+02	7.555515e-01	0.000000e+00	
5.019998e+01	9.916365e-01	-9.999000e+02	6.182927e-01	3.979999e-01	6.448071e-01	
5.100001e+01	7.490476e-01	-9.999000e+02	4.741264e-01	3.268769e-01	4.794502e-01	
5.199999e+01	6.265867e-01	-9.999000e+02	4.075463e-01	2.926639e-01	4.130056e-01	
5.300000e+01	5.840168e-01	-9.999000e+02	3.929586e-01	2.894389e-01	3.967054e-01	
5.500000e+01	4.476216e-01	-9.999000e+02	3.122606e-01	2.346247e-01	3.172612e-01	
6.000000e+01	3.697740e-01	-9.999000e+02	2.741935e-01	2.080698e-01	2.775917e-01	
6.500000e+01	3.297236e-01	-9.999000e+02	2.570698e-01	1.941735e-01	2.598763e-01	
7.000000e+01	3.255186e-01	-9.999000e+02	2.787487e-01	2.047378e-01	2.811407e-01	
8.000000e+01	3.530589e-01	-9.999000e+02	3.175144e-01	2.353367e-01	3.191417e-01	
1.000000e+02	**4.509728e-01**	-9.999000e+02	4.177489e-01	3.188863e-01	4.173596e-01	
1.200000e+02	5.541943e-01	-9.999000e+02	5.150605e-01	4.022593e-01	5.119914e-01	

...

file: csnf_x3_y20_data

data file creation date: Mon Apr 10 23:47:19 2000
MSTHM version: MSTHM_rev_6.2
base EXTfile creation date: Mon Apr 10 23:33:16 2000

Type:
average WP type: bwr1

Location:
easting (NV central): 170256.20
northing (NV central): 234314.20

Area:
fraction of repository area
represented by cell 3,20 = **0.001171**

Infiltration:
cell 3,20 infiltration: 60.375038 (mm/yr)

...

time	RH_dw	RH_bfpeak	RH_ds	RH_wp	RH_invert	
0.000000e+00	9.999521e-01	-9.999000e+02	-9.999000e+02	9.991378e-01	0.000000e+00	
1.000000e+00	9.999514e-01	-9.999000e+02	-9.999000e+02	4.257053e-01	0.000000e+00	
2.000000e+00	9.999501e-01	-9.999000e+02	-9.999000e+02	4.740278e-01	0.000000e+00	
5.000000e+00	9.975723e-01	-9.999000e+02	-9.999000e+02	5.369061e-01	0.000000e+00	
1.000000e+01	9.956613e-01	-9.999000e+02	-9.999000e+02	5.869440e-01	0.000000e+00	
1.500000e+01	9.949149e-01	-9.999000e+02	-9.999000e+02	6.165009e-01	0.000000e+00	
2.000000e+01	9.949853e-01	-9.999000e+02	-9.999000e+02	6.401997e-01	0.000000e+00	

2.500000e+01	9.952742e-01	-9.999000e+02	-9.999000e+02	6.599711e-01	0.000000e+00
3.000000e+01	9.956362e-01	-9.999000e+02	-9.999000e+02	6.776425e-01	0.000000e+00
4.000000e+01	9.964543e-01	-9.999000e+02	-9.999000e+02	7.218252e-01	0.000000e+00
5.000000e+01	9.973442e-01	-9.999000e+02	-9.999000e+02	7.409095e-01	0.000000e+00
5.019998e+01	9.899740e-01	-9.999000e+02	6.123969e-01	3.924837e-01	6.388102e-01
5.100001e+01	7.486397e-01	-9.999000e+02	4.737909e-01	3.251417e-01	4.791127e-01
5.199999e+01	6.265091e-01	-9.999000e+02	3.986315e-01	2.840314e-01	4.040928e-01
5.300000e+01	5.838761e-01	-9.999000e+02	3.839501e-01	2.809307e-01	3.877108e-01
5.500000e+01	4.471916e-01	-9.999000e+02	3.056993e-01	2.297114e-01	3.106953e-01
6.000000e+01	3.694746e-01	-9.999000e+02	2.660044e-01	2.040191e-01	2.690011e-01
6.500000e+01	3.294545e-01	-9.999000e+02	2.489915e-01	1.912576e-01	2.517982e-01
7.000000e+01	3.252165e-01	-9.999000e+02	2.576282e-01	1.967390e-01	2.600208e-01
8.000000e+01	3.526558e-01	-9.999000e+02	3.068524e-01	2.311781e-01	3.084827e-01
1.000000e+02	**4.503009e-01**	-9.999000e+02	4.102801e-01	3.174390e-01	4.099044e-01
1.200000e+02	5.531495e-01	-9.999000e+02	5.155333e-01	4.053478e-01	5.124924e-01

...

The average drift wall relative humidity is calculated using the equations described above. The relative humidity values selected for routine results testing and verification are marked in bold above. For j = 100 years, the average drift wall relative humidity is computed from the equations as:

RH(j=100 years) = (0.000586/0.002733)* **4.513094e-01** + (0.000976/0.002733)* **4.509728e-01** + (0.001171/0.002733)* **4.503009e-01** = **<u>0.450757</u>**.

An excerpt of the resultant output file obtained from the TH abstraction routine gives the following drift wall average relative humidity:

```
;The Average Drift Wall RH
;RIP_RHDWavg_csnf_d1041700_bin-60_mean
;Time(yr), Bin Weight=  0.273300E-02
;bin-60
      0.00, 0.999952E+00
      1.00, 0.999954E+00
      2.00, 0.999954E+00
      5.00, 0.997941E+00
     10.00, 0.996372E+00
     15.00, 0.995748E+00
     20.00, 0.995807E+00
     25.00, 0.996048E+00
     30.00, 0.996350E+00
     40.00, 0.997033E+00
     50.00, 0.997776E+00
     50.20, 0.991114E+00
     51.00, 0.748915E+00
     52.00, 0.626558E+00
     53.00, 0.583972E+00
     55.00, 0.447484E+00
     60.00, 0.369678E+00
     65.00, 0.329638E+00
     70.00, 0.325422E+00
     80.00, 0.352929E+00
    100.00, 0.450757E+00
    120.00, 0.553862E+00
...
```

The implementation is correct. It is also possible to check the individual weight of each infiltration rate bin based on the software routine header information contained in each of the files (5 total, one

per infiltration bin) in any one of the TSPA averaged quantity files. An example for the mean infiltration flux case is the following:

- Bin1 0-3 mm/yr = 0.3124E-02
- Bin2 3-10 mm/yr = 0.139089E+00
- Bin3 10-20 mm/yr = 0.321208E+00
- Bin4 20-60 mm/yr = 0.533827E+00
- Bin5 60+ mm/yr = 0.273300E-02

With the total weight (for all infiltration rate bins combined) summing to 1.0 as it should.

Ranges of Validity

The abstraction routine is functioning as intended as shown in the test calculation and test results. It is also noted that the total bin weight (for the 60 + mm/yr bin for the mean infiltration flux case) supplied by the abstraction routine in the output file header as (Bin Weight = 0.273300E-02) is also verified (as before) by this hand calculation to be correct.

The range of input parameter values for which the results were verified is dictated by the parameter statement given in the routine. Version 2 parameter statement is the following:

```
parameter(npts=99, ninf=5, nbinm=650)
```

This statement in the TH abstraction routine indicates that (ninf=5) bins are processed for (npts=99) different time entries for each large block of data. The maximum total number of location dependent files that can be read in by this routine is (nbinm=650). The process model gives 610 location dependent result files (which is less than 650) so this statement is valid as specified. However, although this routine uses the statement indicated above, the software routine is flexible. The parameter statement (npts, ninf, and nbinm) can be changed to any value needed and re-compiled (in SUN OS FORTRAN 77) for complete software routine flexibility. Changes to the parameter statement do not require any changes to lines of code within the routine. However, if the parameter value for ninf changes, the input file required by the abstraction routine to read in the filenames for the abstraction output must be modified by the user. That is, if ninf is either increased or decreased, the total number of file names (provided by the user in the input file called: THabstraction.fil) needed to write the output data for TSPA will change according to the following line in the abstraction routine:

```
ifiles = ninf+1+3*ninf+13*ninf
```

where ifiles are the total number of filenames required in the first input file (THabstraction.fil) used to run the TH abstraction routine. A second input file required to run the TH abstraction routine contains the names of the location dependent results from the process model. As indicated for the

no backfill repository design, this routine required input file contains the individual filenames for 610 different location dependent result files. The input file format for the routine must have the name of the input file (e.g., csnfmean) on the first line and the word end on the last line (with 610 location dependent filenames in-between). Finally, 610 location dependent files must be available for input to the routine. Each file contains the process model raw data given in blocks of specific data (e.g., a temperature block containing the temperature results of different repository components).

Since the format of the raw data files used as inputs to the TH abstraction routine (e.g., the 610 location dependent result files just described) changed from version 1 to version 2, the description of the changes and required implementations to the routine are now discussed.

Further Testing

The reformatted (for TSPA) raw (location dependent) data is also checked. In particular, the water vapor and air mass flow variables are checked since these changed since version 1 testing. The data file **csnf_x2_y20_data** is randomly selected for testing. An excerpt of the location dependent data file from the process model results is the following:

```
file:       csnf_x2_y20_data

data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):         170228.75
northing (NV central):        234315.67

Area:
fraction of repository area
represented by cell  2,20 =         0.000976

Infiltration:
cell  2,20 infiltration:            60.793499   (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
```

81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m

...

time	Q.water.gas_dr
0.000000e+00	0.000000e+00
1.000000e+00	2.057522e+01
2.000000e+00	2.549621e+01
5.000000e+00	3.019270e+01
1.000000e+01	2.307018e+01
1.500000e+01	2.130392e+01
2.000000e+01	2.242238e+01
2.500000e+01	1.855212e+01
3.000000e+01	1.671089e+01
4.000000e+01	1.432393e+01
5.000000e+01	1.134147e+01
5.019998e+01	4.924160e+01
5.100001e+01	2.682539e+01
5.199999e+01	6.215224e+01
5.300000e+01	4.831441e+01
5.500000e+01	3.636036e-01
6.000000e+01	-5.197782e-01
6.500000e+01	-4.755112e-01
7.000000e+01	-3.347610e-01
8.000000e+01	**-1.663193e-01**
1.000000e+02	7.378884e-02
1.200000e+02	-1.168824e-01
1.400000e+02	-1.570289e-01
1.600000e+02	-3.777865e-02
1.800000e+02	7.056073e+00
2.000000e+02	2.381224e+00
2.200000e+02	3.161203e+00
2.400000e+02	9.999848e+00
2.600000e+02	1.253925e+01
2.800000e+02	1.330594e+01
3.000000e+02	1.160480e+01
3.199999e+02	1.172690e+01
3.399998e+02	1.146927e+01
3.600002e+02	1.038249e+01
3.800001e+02	1.057177e+01
4.000000e+02	1.032006e+01
4.199999e+02	9.311381e+00
4.399998e+02	8.785549e+00
4.600002e+02	8.108940e+00
4.800001e+02	7.634698e+00
5.000000e+02	7.188816e+00
5.199999e+02	6.873438e+00
5.399999e+02	6.473174e+00
5.600001e+02	6.089323e+00
5.800001e+02	5.827170e+00
6.000000e+02	5.445510e+00
6.199999e+02	5.195153e+00
6.399999e+02	4.874517e+00
6.600001e+02	4.633087e+00
6.800001e+02	4.410353e+00
7.000000e+02	4.275900e+00
7.199999e+02	4.094176e+00
7.399998e+02	3.924825e+00
7.600001e+02	3.801509e+00
7.800001e+02	3.697027e+00
8.000001e+02	3.490320e+00
8.500000e+02	3.541758e+00
9.000000e+02	3.021803e+00
9.500000e+02	3.008528e+00
1.000000e+03	3.052846e+00
1.050000e+03	3.085337e+00
1.100000e+03	3.132087e+00
1.150000e+03	2.999519e+00
1.200000e+03	3.035408e+00
1.300000e+03	2.767647e+00
1.400000e+03	2.502055e+00

1.500000e+03	1.959083e+00
1.600000e+03	2.021813e+00
1.700000e+03	1.990109e+00
1.800000e+03	1.758732e+00
1.900000e+03	1.739018e+00
2.000000e+03	1.481966e+00
2.200000e+03	1.472653e+00
2.400000e+03	1.298766e+00
2.600000e+03	1.188322e+00
2.800000e+03	9.378335e-01
3.000000e+03	9.985707e-01
3.500000e+03	8.881460e-01
4.000000e+03	7.809032e-01
4.500000e+03	7.089492e-01
5.000000e+03	6.224238e-01
6.000000e+03	5.379070e-01
7.000000e+03	4.436177e-01
8.000000e+03	3.492301e-01
9.000000e+03	3.654869e-01
1.000000e+04	1.479841e-01
1.500000e+04	4.207988e-02
2.000000e+04	1.315629e-01
3.000000e+04	3.024989e-02
4.000000e+04	5.138005e-03
5.000000e+04	**2.845075e-02**
1.000000e+05	8.852145e-03
2.000000e+05	8.899453e-04
3.000000e+05	4.174010e-03
4.000000e+05	3.926774e-03
5.000000e+05	3.519753e-03
6.000000e+05	3.260504e-03
8.000000e+05	2.721595e-03
1.000000e+06	2.154443e-03

end section

time	Q.air.gas_dr
0.000000e+00	0.000000e+00
1.000000e+00	1.026118e+01
2.000000e+00	1.089306e+01
5.000000e+00	1.066246e+01
1.000000e+01	8.287573e+00
1.500000e+01	7.410825e+00
2.000000e+01	7.675146e+00
2.500000e+01	6.531137e+00
3.000000e+01	7.418075e+00
4.000000e+01	5.419006e+00
5.000000e+01	4.621820e+00
5.019998e+01	2.581685e+01
5.100001e+01	2.291550e+00
5.199999e+01	1.947705e-01
5.300000e+01	1.007060e-01
5.500000e+01	1.802051e-01
6.000000e+01	6.087540e-01
6.500000e+01	4.810384e-01
7.000000e+01	3.076712e-01
8.000000e+01	**1.181771e-01**
1.000000e+02	-1.207723e-01
1.200000e+02	5.636609e-02
1.400000e+02	9.238326e-02
1.600000e+02	6.481591e-01
1.800000e+02	6.350973e+00
2.000000e+02	6.510713e+00
2.200000e+02	3.102216e+00
2.400000e+02	4.336287e+00
2.600000e+02	4.840991e+00
2.800000e+02	5.055544e+00
3.000000e+02	5.420091e+00
3.199999e+02	4.890033e+00
3.399998e+02	4.442515e+00
3.600002e+02	4.611407e+00
3.800001e+02	4.102844e+00
4.000000e+02	4.020400e+00
4.199999e+02	3.775738e+00
4.399998e+02	3.602395e+00

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4.600002e+02   3.276427e+00
4.800001e+02   3.261940e+00
5.000000e+02   2.960695e+00
5.199999e+02   2.939206e+00
5.399999e+02   2.651485e+00
5.600001e+02   2.452721e+00
5.800001e+02   2.555550e+00
6.000000e+02   2.254055e+00
6.199999e+02   2.071326e+00
6.399999e+02   2.067488e+00
6.600001e+02   1.956617e+00
6.800001e+02   1.658352e+00
7.000000e+02   1.559324e+00
7.199999e+02   1.648738e+00
7.399998e+02   1.450016e+00
7.600001e+02   1.344928e+00
7.800001e+02   1.351209e+00
8.000001e+02   1.342321e+00
8.500000e+02   1.194841e+00
9.000000e+02   1.068039e+00
9.500000e+02   9.299233e-01
1.000000e+03   1.086894e+00
1.050000e+03   9.571839e-01
1.100000e+03   9.344550e-01
1.150000e+03   9.547734e-01
1.200000e+03   7.710623e-01
1.300000e+03   7.633808e-01
1.400000e+03   6.666282e-01
1.500000e+03   6.518438e-01
1.600000e+03   5.687510e-01
1.700000e+03   4.695902e-01
1.800000e+03   5.183547e-01
1.900000e+03   4.053510e-01
2.000000e+03   4.624864e-01
2.200000e+03   2.509444e-01
2.400000e+03   2.428521e-01
2.600000e+03   2.601748e-01
2.800000e+03   3.479495e-01
3.000000e+03   2.038064e-01
3.500000e+03   1.816793e-01
4.000000e+03   1.465802e-01
4.500000e+03   1.723837e-01
5.000000e+03   1.593852e-01
6.000000e+03   1.533824e-01
7.000000e+03   1.081557e-01
8.000000e+03   6.983878e-02
9.000000e+03   8.518720e-02
1.000000e+04   2.328085e-01
1.500000e+04   1.894932e-01
2.000000e+04   2.541314e-02
3.000000e+04   4.073712e-02
4.000000e+04   1.529021e-01
5.000000e+04   6.680828e-03
1.000000e+05   3.229685e-03
2.000000e+05   5.481317e-03
3.000000e+05   3.988838e-04
4.000000e+05   5.866883e-04
5.000000e+05   6.917422e-04
6.000000e+05   4.248930e-04
8.000000e+05   3.543924e-04
1.000000e+06   8.800993e-05
## end section ##
...
```

An excerpt of the software routine generated result file (for this particular infiltration rate bin) for TSPA gives the following:

```
Infiltration Bin:
 qinf >  60.0 mm/yr
```

RIP_csnf_d1041700_bin-60_mean

Time (yr), Waste Pack Temp.(C), Drip shield temp. (C), Drift wall temp.(C), Invert temp. (C), Waste pack RH, Drip shield RH, Drift wall RH, Backfill RH, Invert RH, Liquid Satr. @ Drip Shield, Liquid Satr.@Invert, Air mass Frac, Water Vapor flux at Dwall (kg/yr/m of drift), Air flux at Dwall(kg/yr/m of drift), A Drip Shield Evapo. rate (m3/yr), Backfill Evapo. Rate (m3/yr), Invert Evapo. Rate (m3/yr), Percolation Flux at 5 m (mm/yr), Vol ume flow at top dripshield (m3/yr), volume flow at invert (m3/yr), Top of the dripshield Temp (C)

...

The number of Rows = 99
The fraction of this history=0.000976
Coordinate Location:
The easting coordinate = 170228.75 m
The northing coordinate = 234315.60 m
Infiltration rate:
qinf = 60.79350 mm/yr

```
     0.00   0.222890E+02  -0.999900E+03   0.222870E+02   0.223130E+02   0.999137E+00  -
0.999900E+03   0.999952E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.152617E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
     1.00   0.749606E+02  -0.999900E+03   0.611100E+02   0.659458E+02   0.434889E+00  -
0.999900E+03   0.999955E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.181515E-01  -
0.999900E+03   0.205752E+02   0.102612E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143302E+02  -0.999900E+03  -0.181283E-16  -0.999900E+03
     2.00   0.817234E+02  -0.999900E+03   0.688697E+02   0.734716E+02   0.483429E+00  -
0.999900E+03   0.999956E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.170663E-01  -
0.999900E+03   0.254962E+02   0.108931E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143640E+02  -0.999900E+03  -0.262740E-02  -0.999900E+03
     5.00   0.886183E+02  -0.999900E+03   0.773099E+02   0.814204E+02   0.548045E+00  -
0.999900E+03   0.998090E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.669952E-02  -
0.999900E+03   0.301927E+02   0.106625E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.144179E+02  -0.999900E+03  -0.626846E-11  -0.999900E+03
    10.00   0.895588E+02  -0.999900E+03   0.798369E+02   0.832322E+02   0.599050E+00  -
0.999900E+03   0.996682E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.129361E-09  -
0.999900E+03   0.230702E+02   0.828757E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.145038E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    15.00   0.870769E+02  -0.999900E+03   0.783998E+02   0.813227E+02   0.627600E+00  -
0.999900E+03   0.996112E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.250820E-11  -
0.999900E+03   0.213039E+02   0.741082E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.144983E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    20.00   0.840259E+02  -0.999900E+03   0.761661E+02   0.787182E+02   0.650719E+00  -
0.999900E+03   0.996166E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.520448E-11  -
0.999900E+03   0.224224E+02   0.767515E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.144622E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    25.00   0.806236E+02  -0.999900E+03   0.734554E+02   0.757081E+02   0.670574E+00  -
0.999900E+03   0.996386E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.182220E-10  -
0.999900E+03   0.185521E+02   0.653114E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.144020E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    30.00   0.774529E+02  -0.999900E+03   0.708857E+02   0.728696E+02   0.687624E+00  -
0.999900E+03   0.996662E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.352615E-10  -
0.999900E+03   0.167109E+02   0.741807E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143384E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    40.00   0.714819E+02  -0.999900E+03   0.659720E+02   0.674629E+02   0.722063E+00  -
0.999900E+03   0.997286E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.134012E-02  -
0.999900E+03   0.143239E+02   0.541901E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.142248E+02  -0.999900E+03  -0.686552E-28  -0.999900E+03
    50.00   0.650067E+02  -0.999900E+03   0.605039E+02   0.614447E+02   0.755552E+00  -
0.999900E+03   0.997965E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.103812E-01  -
0.999900E+03   0.113415E+02   0.462182E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.141372E+02  -0.999900E+03  -0.159075E-09  -0.999900E+03
    50.20   0.137107E+03   0.122403E+03   0.104055E+03   0.123767E+03   0.398000E+00
0.618293E+00   0.991637E+00  -0.999900E+03   0.644807E+00  -0.999900E+03   0.000000E+00
0.240463E+00   0.492416E+02   0.258168E+02  -0.158258E-03  -0.999900E+00   0.374719E-01
0.143097E+02   0.000000E+00   0.000000E+00   0.121676E+03
    51.00   0.145673E+03   0.132601E+03   0.113234E+03   0.133333E+03   0.326877E+00
0.474126E+00   0.749048E+00  -0.999900E+03   0.479450E+00  -0.999900E+03   0.000000E+00
```

0.702815E-01	0.268254E+02	0.229155E+01	0.370621E-06	-0.999900E+00	0.826202E-07
0.147793E+02	0.000000E+00	0.000000E+00	0.131957E+03		
52.00	0.154267E+03	0.142040E+03	0.122727E+03	0.142579E+03	0.292664E+00
0.407546E+00	0.626587E+00	-0.999900E+03	0.413006E+00	-0.999900E+03	0.000000E+00
0.160268E-02	0.621522E+02	0.194771E+00	-0.162386E-04	-0.999900E+00	-0.307964E-06
0.156095E+02	0.000000E+00	0.000000E+00	0.141436E+03		
53.00	0.160592E+03	0.148906E+03	0.130211E+03	0.149317E+03	0.289439E+00
0.392959E+00	0.584017E+00	-0.999900E+03	0.396705E+00	-0.999900E+03	0.000000E+00
0.501705E-03	0.483144E+02	0.100706E+00	0.419530E-04	-0.999900E+00	0.934721E-05
0.176655E+02	0.000000E+00	0.000000E+00	0.148330E+03		
55.00	0.161194E+03	0.150202E+03	0.132740E+03	0.150514E+03	0.234625E+00
0.312261E+00	0.447622E+00	-0.999900E+03	0.317261E+00	-0.999900E+03	0.000000E+00
0.262368E-02	0.363604E+00	0.180205E+00	0.861491E-05	-0.999900E+00	0.425984E-06
0.287278E+02	0.000000E+00	0.000000E+00	0.149660E+03		
60.00	0.149832E+03	0.139823E+03	0.125218E+03	0.140054E+03	0.208070E+00
0.274193E+00	0.369774E+00	-0.999900E+03	0.277592E+00	-0.999900E+03	0.000000E+00
0.181425E-01	-0.519778E+00	0.608754E+00	-0.250208E-04	-0.999900E+00	-0.742356E-06
0.370441E+02	0.000000E+00	0.000000E+00	0.139328E+03		
65.00	0.134568E+03	0.125201E+03	0.113054E+03	0.125427E+03	0.194173E+00
0.257070E+00	0.329724E+00	-0.999900E+03	0.259876E+00	-0.999900E+03	0.000000E+00
0.424538E-01	-0.475511E+00	0.481038E+00	-0.324886E-05	-0.999900E+00	-0.259133E-07
0.621968E+02	0.000000E+00	0.000000E+00	0.124737E+03		
70.00	0.108569E+03	0.997014E+02	0.911819E+02	0.999328E+02	0.204738E+00
0.278749E+00	0.325519E+00	-0.999900E+03	0.281141E+00	-0.999900E+03	0.000000E+00
0.552208E-01	-0.334761E+00	0.307671E+00	-0.209277E-04	-0.999900E+00	-0.249010E-07
0.693251E+02	0.000000E+00	0.000000E+00	0.992619E+02		
80.00	0.981665E+02	0.900759E+02	0.832284E+02	0.903401E+02	0.235337E+00
0.317514E+00	0.353059E+00	-0.999900E+03	0.319142E+00	-0.999900E+03	0.000000E+00
0.847833E-01	**-0.166319E+00**	**0.118177E+00**	-0.343488E-04	-0.999900E+00	-0.362070E-06
0.575351E+02	0.000000E+00	0.000000E+00	0.896749E+02		
100.00	0.906014E+02	0.836183E+02	0.778577E+02	0.839407E+02	0.318886E+00
0.417749E+00	0.450973E+00	-0.999900E+03	0.417360E+00	-0.999900E+03	0.000000E+00
0.155185E+00	0.737888E-01	-0.120772E+00	-0.517391E-04	-0.999900E+00	-0.274043E-05
0.263266E+02	0.000000E+00	0.000000E+00	0.832741E+02		
120.00	0.887763E+02	0.824419E+02	0.769569E+02	0.827486E+02	0.402259E+00
0.515061E+00	0.554194E+00	-0.999900E+03	0.511991E+00	-0.999900E+03	0.000000E+00
0.188836E+00	-0.116882E+00	0.563661E-01	-0.279067E-06	-0.999900E+00	-0.117781E-07
0.183899E+02	0.000000E+00	0.000000E+00	0.821318E+02		
140.00	0.808646E+02	0.751653E+02	0.705948E+02	0.754923E+02	0.524106E+00
0.662146E+00	0.693785E+00	-0.999900E+03	0.652999E+00	-0.999900E+03	0.000000E+00
0.231014E+00	-0.157029E+00	0.923833E-01	0.940472E-07	-0.999900E+00	0.264515E-06
0.156044E+02	0.000000E+00	0.000000E+00	0.748879E+02		
160.00	0.773671E+02	0.721466E+02	0.679682E+02	0.724834E+02	0.661281E+00
0.822777E+00	0.854474E+00	-0.999900E+03	0.806034E+00	-0.999900E+03	0.000000E+00
0.273672E+00	-0.377786E-01	0.648159E+00	-0.913778E-06	-0.999900E+00	0.820699E-07
0.145801E+02	0.000000E+00	0.000000E+00	0.718939E+02		
180.00	0.755691E+02	0.706665E+02	0.667116E+02	0.709965E+02	0.759365E+00
0.934852E+00	0.968561E+00	-0.999900E+03	0.920601E+00	-0.999900E+03	0.000000E+00
0.301397E+00	0.705607E+01	0.635097E+01	-0.599482E-06	-0.999900E+00	0.801379E-02
0.142458E+02	0.000000E+00	0.000000E+00	0.704301E+02		
200.00	0.738602E+02	0.692767E+02	0.655128E+02	0.696034E+02	0.785004E+00
0.955520E+00	0.988309E+00	-0.999900E+03	0.939969E+00	-0.999900E+03	0.000000E+00
0.383101E+00	0.238122E+01	0.651071E+01	-0.680799E-05	-0.999900E+00	0.810960E-02
0.140538E+02	0.000000E+00	0.000000E+00	0.690565E+02		
220.00	0.728709E+02	0.684770E+02	0.648623E+02	0.687952E+02	0.793520E+00
0.958395E+00	0.990993E+00	-0.999900E+03	0.945693E+00	-0.999900E+03	0.000000E+00
0.451804E+00	0.316120E+01	0.310222E+01	-0.120508E-03	-0.999900E+00	0.463766E-02
0.139731E+02	0.000000E+00	0.000000E+00	0.682662E+02		
240.00	0.719317E+02	0.677286E+02	0.642588E+02	0.680371E+02	0.801999E+00
0.962121E+00	0.993058E+00	-0.999900E+03	0.962436E+00	-0.999900E+03	0.000000E+00
0.505235E+00	0.999985E+01	0.433629E+01	-0.662658E-04	-0.999900E+00	0.509498E-02
0.139280E+02	0.000000E+00	0.000000E+00	0.675270E+02		
260.00	0.711430E+02	0.671069E+02	0.637580E+02	0.674042E+02	0.808255E+00
0.963467E+00	0.994550E+00	-0.999900E+03	0.967908E+00	-0.999900E+03	0.138081E-02
0.550857E+00	0.125392E+02	0.484099E+01	-0.144067E-03	-0.999900E+00	0.552304E-02
0.138767E+02	0.000000E+00	0.000000E+00	0.669135E+02		
280.00	0.705103E+02	0.666176E+02	0.633641E+02	0.669019E+02	0.813866E+00
0.964761E+00	0.995912E+00	-0.999900E+03	0.972203E+00	-0.999900E+03	0.124898E-01
0.584923E+00	0.133059E+02	0.505554E+01	-0.419318E-03	-0.999900E+00	0.758357E-02
0.138547E+02	0.000000E+00	0.000000E+00	0.664314E+02		
300.00	0.698792E+02	0.661294E+02	0.629706E+02	0.664013E+02	0.819626E+00
0.966035E+00	0.997199E+00	-0.999900E+03	0.973554E+00	-0.999900E+03	0.148874E-01
0.616184E+00	0.116048E+02	0.542009E+01	-0.185076E-02	-0.999900E+00	0.517238E-02
0.138275E+02	0.000000E+00	0.000000E+00	0.659504E+02		

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    320.00   0.693803E+02   0.657477E+02   0.626597E+02   0.660082E+02   0.825522E+00
0.968209E+00   0.998472E+00  -0.999900E+03   0.975963E+00  -0.999900E+03   0.165237E-01
0.640219E+00   0.117269E+02   0.489003E+01  -0.104395E-02  -0.999900E+00   0.566941E-02
0.138190E+02   0.000000E+00   0.000000E+00   0.655745E+02
    340.00   0.688738E+02   0.653580E+02   0.623349E+02   0.656075E+02   0.830387E+00
0.969356E+00   0.998905E+00  -0.999900E+03   0.977381E+00  -0.999900E+03   0.171653E-01
0.662249E+00   0.114693E+02   0.444252E+01  -0.102306E-02  -0.999900E+00   0.546776E-02
0.138168E+02   0.000000E+00   0.000000E+00   0.651907E+02
    360.00   0.684023E+02   0.649930E+02   0.620302E+02   0.652318E+02   0.832881E+00
0.969063E+00   0.998914E+00  -0.999900E+03   0.977002E+00  -0.999900E+03   0.179386E-01
0.681441E+00   0.103825E+02   0.461141E+01  -0.900905E-03  -0.999900E+00   0.466272E-02
0.138051E+02   0.000000E+00   0.000000E+00   0.648312E+02
    380.00   0.679743E+02   0.646613E+02   0.617541E+02   0.648894E+02   0.836107E+00
0.968737E+00   0.998896E+00  -0.999900E+03   0.977899E+00  -0.999900E+03   0.248050E-01
0.697982E+00   0.105718E+02   0.410284E+01  -0.139158E-04  -0.999900E+00   0.534548E-02
0.138041E+02   0.000000E+00   0.000000E+00   0.645043E+02
    400.00   0.675346E+02   0.643174E+02   0.614663E+02   0.645352E+02   0.839620E+00
0.968602E+00   0.999096E+00  -0.999900E+03   0.980942E+00  -0.999900E+03   0.349782E-01
0.712850E+00   0.103201E+02   0.402040E+01  -0.236252E-05  -0.999900E+00   0.888421E-02
0.138020E+02   0.000000E+00   0.000000E+00   0.641654E+02
    420.00   0.671496E+02   0.640135E+02   0.612167E+02   0.642245E+02   0.842497E+00
0.968247E+00   0.999151E+00  -0.999900E+03   0.982151E+00  -0.999900E+03   0.350006E-01
0.726170E+00   0.931138E+01   0.377574E+01  -0.394217E-03  -0.999900E+00   0.599604E-02
0.138011E+02   0.000000E+00   0.000000E+00   0.638654E+02
    440.00   0.667606E+02   0.637052E+02   0.609628E+02   0.639097E+02   0.844752E+00
0.967836E+00   0.999056E+00  -0.999900E+03   0.982394E+00  -0.999900E+03   0.353704E-01
0.738774E+00   0.878555E+01   0.360240E+01  -0.440372E-03  -0.999900E+00   0.639419E-02
0.138010E+02   0.000000E+00   0.000000E+00   0.635610E+02
    460.00   0.663850E+02   0.634065E+02   0.607133E+02   0.636052E+02   0.847157E+00
0.968121E+00   0.998841E+00  -0.999900E+03   0.984254E+00  -0.999900E+03   0.356890E-01
0.750079E+00   0.810894E+01   0.327643E+01  -0.298337E-03  -0.999900E+00   0.594821E-02
0.137986E+02   0.000000E+00   0.000000E+00   0.632662E+02
    480.00   0.660286E+02   0.631235E+02   0.604738E+02   0.633168E+02   0.849636E+00
0.968525E+00   0.998707E+00  -0.999900E+03   0.985826E+00  -0.999900E+03   0.362211E-01
0.760110E+00   0.763470E+01   0.326194E+01  -0.345455E-03  -0.999900E+00   0.662934E-02
0.138020E+02   0.000000E+00   0.000000E+00   0.629867E+02
    500.00   0.656636E+02   0.628314E+02   0.602254E+02   0.630196E+02   0.852434E+00
0.968671E+00   0.998629E+00  -0.999900E+03   0.987801E+00  -0.999900E+03   0.366726E-01
0.769576E+00   0.718882E+01   0.296069E+01  -0.246305E-03  -0.999900E+00   0.648049E-02
0.138063E+02   0.000000E+00   0.000000E+00   0.626981E+02
    520.00   0.653291E+02   0.625580E+02   0.600001E+02   0.627437E+02   0.854649E+00
0.968181E+00   0.998563E+00  -0.999900E+03   0.988420E+00  -0.999900E+03   0.370612E-01
0.777874E+00   0.687344E+01   0.293921E+01  -0.224644E-03  -0.999900E+00   0.689553E-02
0.138022E+02   0.000000E+00   0.000000E+00   0.624276E+02
    540.00   0.649923E+02   0.622820E+02   0.597720E+02   0.624652E+02   0.856894E+00
0.967669E+00   0.998498E+00  -0.999900E+03   0.989221E+00  -0.999900E+03   0.377201E-01
0.785888E+00   0.647317E+01   0.265149E+01  -0.174356E-03  -0.999900E+00   0.693996E-02
0.138041E+02   0.000000E+00   0.000000E+00   0.621543E+02
    560.00   0.646770E+02   0.620243E+02   0.595573E+02   0.622053E+02   0.858167E+00
0.967172E+00   0.998457E+00  -0.999900E+03   0.989922E+00  -0.999900E+03   0.381526E-01
0.793100E+00   0.608932E+01   0.245272E+01  -0.157054E-03  -0.999900E+00   0.670248E-02
0.138063E+02   0.000000E+00   0.000000E+00   0.618992E+02
    580.00   0.643777E+02   0.617794E+02   0.593515E+02   0.619583E+02   0.859438E+00
0.966728E+00   0.998424E+00  -0.999900E+03   0.989461E+00  -0.999900E+03   0.385001E-01
0.799689E+00   0.582717E+01   0.255555E+01  -0.174397E-03  -0.999900E+00   0.716869E-02
0.138064E+02   0.000000E+00   0.000000E+00   0.616568E+02
    600.00   0.640744E+02   0.615304E+02   0.591415E+02   0.617071E+02   0.860737E+00
0.966284E+00   0.998407E+00  -0.999900E+03   0.988948E+00  -0.999900E+03   0.392112E-01
0.806128E+00   0.544551E+01   0.225406E+01  -0.120725E-03  -0.999900E+00   0.656741E-02
0.138055E+02   0.000000E+00   0.000000E+00   0.614103E+02
    620.00   0.637874E+02   0.612963E+02   0.589379E+02   0.614700E+02   0.862390E+00
0.966221E+00   0.998408E+00  -0.999900E+03   0.988150E+00  -0.999900E+03   0.397001E-01
0.811922E+00   0.519515E+01   0.207133E+01  -0.269213E-05  -0.999900E+00   0.624166E-02
0.162022E+02   0.000000E+00   0.000000E+00   0.611787E+02
    640.00   0.634979E+02   0.610598E+02   0.587318E+02   0.612304E+02   0.864608E+00
0.966739E+00   0.998480E+00  -0.999900E+03   0.988077E+00  -0.999900E+03   0.402665E-01
0.817441E+00   0.487452E+01   0.206749E+01  -0.129615E-03  -0.999900E+00   0.603622E-02
0.211025E+02   0.000000E+00   0.000000E+00   0.609447E+02
    660.00   0.632118E+02   0.608240E+02   0.585268E+02   0.609919E+02   0.867335E+00
0.967277E+00   0.998576E+00  -0.999900E+03   0.988828E+00  -0.999900E+03   0.411579E-01
0.822711E+00   0.463309E+01   0.195662E+01  -0.842090E-04  -0.999900E+00   0.608679E-02
0.272324E+02   0.000000E+00   0.000000E+00   0.607112E+02
    680.00   0.629352E+02   0.605950E+02   0.583281E+02   0.607605E+02   0.869977E+00
0.967789E+00   0.998703E+00  -0.999900E+03   0.988793E+00  -0.999900E+03   0.420148E-01
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0.827718E+00   0.441035E+01   0.165835E+01  -0.797769E-04  -0.999900E+00   0.589892E-02
0.319203E+02   0.000000E+00   0.000000E+00   0.604844E+02
    700.00   0.626586E+02   0.603660E+02   0.581288E+02   0.605292E+02   0.871433E+00
0.967651E+00   0.998850E+00  -0.999900E+03   0.988242E+00  -0.999900E+03   0.426986E-01
0.832534E+00   0.427590E+01   0.155932E+01  -0.895587E-04  -0.999900E+00   0.575317E-02
0.348733E+02   0.000000E+00   0.000000E+00   0.602576E+02
    720.00   0.624083E+02   0.601524E+02   0.579498E+02   0.603148E+02   0.872340E+00
0.967316E+00   0.998981E+00  -0.999900E+03   0.987975E+00  -0.999900E+03   0.433177E-01
0.836828E+00   0.409418E+01   0.164874E+01  -0.753086E-04  -0.999900E+00   0.609588E-02
0.365817E+02   0.000000E+00   0.000000E+00   0.600455E+02
    740.00   0.621578E+02   0.599387E+02   0.577708E+02   0.601004E+02   0.873278E+00
0.966984E+00   0.999125E+00  -0.999900E+03   0.987500E+00  -0.999900E+03   0.438193E-01
0.840624E+00   0.392482E+01   0.145002E+01  -0.608088E-04  -0.999900E+00   0.587267E-02
0.375389E+02   0.000000E+00   0.000000E+00   0.598333E+02
    760.00   0.619052E+02   0.597250E+02   0.575867E+02   0.598852E+02   0.874423E+00
0.966756E+00   0.999286E+00  -0.999900E+03   0.986670E+00  -0.999900E+03   0.439771E-01
0.839429E+00   0.380151E+01   0.134493E+01  -0.339443E-05  -0.999900E+00   0.574188E-02
0.380821E+02   0.000000E+00   0.000000E+00   0.596213E+02
    780.00   0.616500E+02   0.595109E+02   0.573968E+02   0.596689E+02   0.875790E+00
0.966641E+00   0.999474E+00  -0.999900E+03   0.986271E+00  -0.999900E+03   0.440963E-01
0.838509E+00   0.369703E+01   0.135121E+01  -0.734989E-04  -0.999900E+00   0.574744E-02
0.384031E+02   0.000000E+00   0.000000E+00   0.594091E+02
    800.00   0.613897E+02   0.592916E+02   0.572018E+02   0.594474E+02   0.877154E+00
0.966491E+00   0.999635E+00  -0.999900E+03   0.986052E+00  -0.999900E+03   0.442574E-01
0.837832E+00   0.349032E+01   0.134232E+01  -0.546377E-04  -0.999900E+00   0.574117E-02
0.386082E+02   0.000000E+00   0.000000E+00   0.591917E+02
    850.00   0.607739E+02   0.587616E+02   0.567416E+02   0.589149E+02   0.880718E+00
0.966805E+00   0.999961E+00  -0.999900E+03   0.985498E+00  -0.999900E+03   0.507601E-01
0.836469E+00   0.354176E+01   0.119484E+01  -0.238139E-04  -0.999900E+00   0.725680E-02
0.389023E+02   0.000000E+00   0.000000E+00   0.586653E+02
    900.00   0.601684E+02   0.582375E+02   0.562787E+02   0.583879E+02   0.884518E+00
0.967691E+00   0.999958E+00  -0.999900E+03   0.985906E+00  -0.999900E+03   0.512635E-01
0.836834E+00   0.302180E+01   0.106804E+01  -0.456762E-04  -0.999900E+00   0.585221E-02
0.390714E+02   0.000000E+00   0.000000E+00   0.581447E+02
    950.00   0.595872E+02   0.577328E+02   0.558246E+02   0.578796E+02   0.886912E+00
0.967059E+00   0.999929E+00  -0.999900E+03   0.984344E+00  -0.999900E+03   0.514452E-01
0.837796E+00   0.300853E+01   0.929923E+00  -0.230584E-03  -0.999900E+00   0.524882E-02
0.391811E+02   0.000000E+00   0.000000E+00   0.576435E+02
   1000.00   0.591022E+02   0.573041E+02   0.554500E+02   0.574501E+02   0.888285E+00
0.966077E+00   0.999895E+00  -0.999900E+03   0.983442E+00  -0.999900E+03   0.515959E-01
0.838389E+00   0.305285E+01   0.108689E+01  -0.190271E-03  -0.999900E+00   0.551507E-02
0.392687E+02   0.000000E+00   0.000000E+00   0.572169E+02
   1050.00   0.587264E+02   0.569756E+02   0.551530E+02   0.571195E+02   0.888930E+00
0.965505E+00   0.999864E+00  -0.999900E+03   0.982153E+00  -0.999900E+03   0.516695E-01
0.839074E+00   0.308534E+01   0.957184E+00  -0.104908E-03  -0.999900E+00   0.542379E-02
0.393410E+02   0.000000E+00   0.000000E+00   0.568904E+02
   1100.00   0.583711E+02   0.566679E+02   0.548762E+02   0.568097E+02   0.890758E+00
0.965397E+00   0.999832E+00  -0.999900E+03   0.981993E+00  -0.999900E+03   0.517418E-01
0.839735E+00   0.313209E+01   0.934455E+00  -0.101378E-03  -0.999900E+00   0.541646E-02
0.393978E+02   0.000000E+00   0.000000E+00   0.565847E+02
   1150.00   0.580154E+02   0.563598E+02   0.545990E+02   0.564994E+02   0.893198E+00
0.965886E+00   0.999799E+00  -0.999900E+03   0.982204E+00  -0.999900E+03   0.518665E-01
0.840566E+00   0.299952E+01   0.954773E+00  -0.988111E-04  -0.999900E+00   0.533027E-02
0.394469E+02   0.000000E+00   0.000000E+00   0.562786E+02
   1200.00   0.576489E+02   0.560410E+02   0.543113E+02   0.561785E+02   0.895750E+00
0.966416E+00   0.999773E+00  -0.999900E+03   0.982117E+00  -0.999900E+03   0.519134E-01
0.841762E+00   0.303541E+01   0.771062E+00  -0.467492E-04  -0.999900E+00   0.532158E-02
0.394865E+02   0.000000E+00   0.000000E+00   0.559617E+02
   1300.00   0.568432E+02   0.553298E+02   0.536635E+02   0.554633E+02   0.898623E+00
0.965415E+00   0.999761E+00  -0.999900E+03   0.980488E+00  -0.999900E+03   0.522980E-01
0.845265E+00   0.276765E+01   0.763381E+00  -0.675666E-04  -0.999900E+00   0.491340E-02
0.395518E+02   0.000000E+00  -0.121384E-09   0.552545E+02
   1400.00   0.559455E+02   0.545265E+02   0.529247E+02   0.546559E+02   0.900914E+00
0.964441E+00   0.999802E+00  -0.999900E+03   0.978695E+00  -0.999900E+03   0.525754E-01
0.850159E+00   0.250205E+01   0.666628E+00  -0.331917E-03  -0.999900E+00   0.437303E-02
0.396086E+02   0.000000E+00  -0.264084E-12   0.544552E+02
   1500.00   0.549837E+02   0.536596E+02   0.521205E+02   0.537846E+02   0.906739E+00
0.965589E+00   0.999883E+00  -0.999900E+03   0.978770E+00  -0.999900E+03   0.527963E-01
0.855764E+00   0.195908E+01   0.651844E+00  -0.498229E-03  -0.999900E+00   0.328926E-02
0.396557E+02   0.000000E+00  -0.912829E-08   0.535923E+02
   1600.00   0.543491E+02   0.530655E+02   0.515589E+02   0.531897E+02   0.906004E+00
0.964715E+00   0.999922E+00  -0.999900E+03   0.977802E+00  -0.999900E+03   0.562120E-01
0.859777E+00   0.202181E+01   0.568751E+00  -0.137106E-03  -0.999900E+00   0.349808E-02
0.397205E+02   0.000000E+00  -0.823084E-09   0.529998E+02
```

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   1700.00   0.537568E+02   0.525147E+02   0.510402E+02   0.526381E+02   0.907235E+00
0.963817E+00   0.999944E+00  -0.999900E+03   0.980324E+00  -0.999900E+03   0.573775E-01
0.863432E+00   0.199011E+01   0.469590E+00  -0.156305E-03  -0.999900E+00   0.378257E-02
0.398095E+02   0.000000E+00  -0.882821E-08   0.524505E+02
   1800.00   0.531684E+02   0.519683E+02   0.505262E+02   0.520908E+02   0.910656E+00
0.964820E+00   0.999957E+00  -0.999900E+03   0.980655E+00  -0.999900E+03   0.659601E-01
0.867235E+00   0.175873E+01   0.518355E+00  -0.119938E-03  -0.999900E+00   0.321857E-02
0.398916E+02   0.000000E+00  -0.111974E-03   0.519058E+02
   1900.00   0.525879E+02   0.514305E+02   0.500213E+02   0.515512E+02   0.911956E+00
0.965042E+00   0.999961E+00  -0.999900E+03   0.982019E+00  -0.999900E+03   0.726055E-01
0.870842E+00   0.173902E+01   0.405351E+00  -0.308218E-04  -0.999900E+00   0.319985E-02
0.399548E+02   0.000000E+00  -0.721534E-03   0.513696E+02
   2000.00   0.519799E+02   0.508655E+02   0.494898E+02   0.509844E+02   0.912096E+00
0.964168E+00   0.999961E+00  -0.999900E+03   0.980972E+00  -0.999900E+03   0.854537E-01
0.874748E+00   0.148197E+01   0.462486E+00  -0.127606E-03  -0.999900E+00   0.323282E-02
0.400045E+02   0.000000E+00  -0.161674E-02   0.508064E+02
   2200.00   0.511011E+02   0.500243E+02   0.486834E+02   0.501432E+02   0.915107E+00
0.964310E+00   0.999961E+00  -0.999900E+03   0.980673E+00  -0.999900E+03   0.936928E-01
0.880648E+00   0.147265E+01   0.250944E+00  -0.479226E-05  -0.999900E+00   0.346486E-02
0.586898E+02   0.000000E+00  -0.454381E-03   0.499666E+02
   2400.00   0.502728E+02   0.492355E+02   0.479283E+02   0.493541E+02   0.915941E+00
0.964906E+00   0.999961E+00  -0.999900E+03   0.980161E+00  -0.999900E+03   0.933217E-01
0.886304E+00   0.129877E+01   0.242852E+00  -0.241575E-05  -0.999900E+00   0.328924E-02
0.593520E+02   0.000000E+00  -0.333362E-03   0.491794E+02
   2600.00   0.495160E+02   0.485072E+02   0.472309E+02   0.486262E+02   0.916407E+00
0.963820E+00   0.999961E+00  -0.999900E+03   0.979092E+00  -0.999900E+03   0.926476E-01
0.891464E+00   0.118832E+01   0.260175E+00  -0.684631E-04  -0.999900E+00   0.300467E-02
0.596341E+02   0.000000E+00  -0.513734E-04   0.484521E+02
   2800.00   0.488407E+02   0.478489E+02   0.466010E+02   0.479694E+02   0.918315E+00
0.964467E+00   0.999961E+00  -0.999900E+03   0.978855E+00  -0.999900E+03   0.920213E-01
0.896073E+00   0.937833E+00   0.347950E+00  -0.381194E-03  -0.999900E+00   0.275111E-02
0.598277E+02   0.000000E+00  -0.207697E-03   0.477944E+02
   3000.00   0.481995E+02   0.472259E+02   0.460066E+02   0.473474E+02   0.918116E+00
0.964888E+00   0.999961E+00  -0.999900E+03   0.979534E+00  -0.999900E+03   0.909681E-01
0.900287E+00   0.998571E+00   0.203806E+00  -0.459851E-04  -0.999900E+00   0.244751E-02
0.599600E+02   0.000000E+00  -0.503667E-04   0.471721E+02
   3500.00   0.468870E+02   0.459437E+02   0.447551E+02   0.460657E+02   0.920067E+00
0.964467E+00   0.999961E+00  -0.999900E+03   0.979179E+00  -0.999900E+03   0.922382E-01
0.908785E+00   0.888146E+00   0.181679E+00  -0.209593E-04  -0.999900E+00   0.240198E-02
0.601159E+02   0.000000E+00  -0.700506E-05   0.458912E+02
   4000.00   0.457904E+02   0.448614E+02   0.437016E+02   0.449849E+02   0.919516E+00
0.965165E+00   0.999961E+00  -0.999900E+03   0.979830E+00  -0.999900E+03   0.104448E+00
0.915527E+00   0.780903E+00   0.146580E+00  -0.870408E-05  -0.999900E+00   0.241174E-02
0.601770E+02   0.000000E+00   0.295745E-02   0.448097E+02
   4500.00   0.448244E+02   0.439113E+02   0.427834E+02   0.440362E+02   0.921397E+00
0.965129E+00   0.999961E+00  -0.999900E+03   0.980095E+00  -0.999900E+03   0.105571E+00
0.921180E+00   0.708949E+00   0.172384E+00  -0.506498E-04  -0.999900E+00   0.219543E-02
0.602072E+02   0.000000E+00  -0.907875E-04   0.438605E+02
   5000.00   0.439526E+02   0.430535E+02   0.419515E+02   0.431790E+02   0.921354E+00
0.966424E+00   0.999961E+00  -0.999900E+03   0.980784E+00  -0.999900E+03   0.106269E+00
0.925916E+00   0.622424E+00   0.159385E+00  -0.997143E-04  -0.999900E+00   0.202891E-02
0.602478E+02   0.000000E+00  -0.237083E-04   0.430034E+02
   6000.00   0.423985E+02   0.415280E+02   0.404698E+02   0.416529E+02   0.924244E+00
0.967555E+00   0.999961E+00  -0.999900E+03   0.981078E+00  -0.999900E+03   0.107310E+00
0.933529E+00   0.537907E+00   0.153382E+00  -0.207698E-06  -0.999900E+00   0.174197E-02
0.603045E+02   0.000000E+00   0.102269E-02   0.414795E+02
   7000.00   0.409787E+02   0.401417E+02   0.391311E+02   0.402652E+02   0.925749E+00
0.966711E+00   0.999960E+00  -0.999900E+03   0.979943E+00  -0.999900E+03   0.107555E+00
0.939666E+00   0.443618E+00   0.108156E+00  -0.346777E-04  -0.999900E+00   0.147893E-02
0.603386E+02   0.000000E+00   0.288891E-03   0.400948E+02
   8000.00   0.397377E+02   0.389310E+02   0.379620E+02   0.390523E+02   0.926867E+00
0.968759E+00   0.999960E+00  -0.999900E+03   0.981237E+00  -0.999900E+03   0.108047E+00
0.944472E+00   0.349230E+00   0.698388E-01  -0.136749E-03  -0.999900E+00   0.145341E-02
0.603673E+02   0.000000E+00   0.428507E-03   0.388856E+02
   9000.00   0.385972E+02   0.378252E+02   0.368916E+02   0.379432E+02   0.929505E+00
0.968654E+00   0.999960E+00  -0.999900E+03   0.980639E+00  -0.999900E+03   0.108479E+00
0.948480E+00   0.365487E+00   0.851872E-01  -0.384784E-04  -0.999900E+00   0.114965E-02
0.604112E+02   0.000000E+00   0.523249E-03   0.377815E+02
  10000.00   0.375382E+02   0.368016E+02   0.359021E+02   0.369156E+02   0.931879E+00
0.970542E+00   0.999960E+00  -0.999900E+03   0.982281E+00  -0.999900E+03   0.108774E+00
0.951851E+00   0.147984E+00   0.232809E+00  -0.183346E-03  -0.999900E+00   0.112938E-02
0.604202E+02   0.000000E+00   0.594197E-03   0.367596E+02
  15000.00   0.332184E+02   0.326275E+02   0.319086E+02   0.327241E+02   0.943428E+00
0.974989E+00   0.999959E+00  -0.999900E+03   0.984673E+00  -0.999900E+03   0.109570E+00
```

```
0.963131E+00   0.420799E-01   0.189493E+00  -0.156277E-03  -0.999900E+00   0.727189E-03
0.605087E+02   0.000000E+00   0.907325E-03   0.325922E+02
  20000.00   0.301284E+02   0.296468E+02   0.290518E+02   0.297292E+02   0.951094E+00
0.977899E+00   0.999958E+00  -0.999900E+03   0.985926E+00  -0.999900E+03   0.110850E+00
0.969399E+00   0.131563E+00   0.254131E-01  -0.984958E-05  -0.999900E+00   0.401309E-03
0.605948E+02   0.000000E+00   0.115705E-02   0.296163E+02
  30000.00   0.260855E+02   0.257547E+02   0.253356E+02   0.258167E+02   0.965305E+00
0.984454E+00   0.999955E+00  -0.999900E+03   0.990339E+00  -0.999900E+03   0.111564E+00
0.975982E+00   0.302499E-01   0.407371E-01  -0.665478E-04  -0.999900E+00   0.304248E-03
0.606534E+02   0.000000E+00   0.132666E-02   0.257306E+02
  40000.00   0.237700E+02   0.235240E+02   0.232172E+02   0.235752E+02   0.973600E+00
0.988392E+00   0.999953E+00  -0.999900E+03   0.992884E+00  -0.999900E+03   0.111907E+00
0.979124E+00   0.513801E-02   0.152902E+00  -0.138650E-03  -0.999900E+00   0.225261E-03
0.606638E+02   0.000000E+00   0.140694E-02   0.235034E+02
  50000.00   0.223131E+02   0.221235E+02   0.218890E+02   0.221675E+02   0.980278E+00
0.991514E+00   0.999952E+00  -0.999900E+03   0.995019E+00  -0.999900E+03   0.112100E+00
0.980897E+00   0.284508E-01   0.668083E-02  -0.337977E-05  -0.999900E+00   0.100581E-03
0.607370E+02   0.000000E+00   0.145595E-02   0.221052E+02
 100000.00   0.196525E+02   0.195750E+02   0.194943E+02   0.196054E+02   0.991940E+00
0.996822E+00   0.999951E+00  -0.999900E+03   0.998275E+00  -0.999900E+03   0.112735E+00
0.983800E+00   0.885215E-02   0.322968E-02  -0.867036E-05  -0.999900E+00   0.281235E-04
0.607759E+02   0.000000E+00   0.148868E-02   0.195610E+02
 200000.00   0.190166E+02   0.189663E+02   0.189227E+02   0.189936E+02   0.995252E+00
0.998325E+00   0.999951E+00  -0.999900E+03   0.999203E+00  -0.999900E+03   0.114499E+00
0.984441E+00   0.889945E-03   0.548132E-02  -0.953263E-06  -0.999900E+00   0.167736E-04
0.607893E+02   0.000000E+00   0.143742E-02   0.189533E+02
 300000.00   0.189475E+02   0.189015E+02   0.188612E+02   0.189282E+02   0.995774E+00
0.998495E+00   0.999951E+00  -0.999900E+03   0.999322E+00  -0.999900E+03   0.114515E+00
0.984505E+00   0.417401E-02   0.398884E-03  -0.117363E-07  -0.999900E+00   0.121306E-04
0.607907E+02   0.000000E+00   0.143522E-02   0.188887E+02
 400000.00   0.189121E+02   0.188666E+02   0.188299E+02   0.188933E+02   0.995824E+00
0.998526E+00   0.999951E+00  -0.999900E+03   0.999321E+00  -0.999900E+03   0.114524E+00
0.984538E+00   0.392677E-02   0.586688E-03  -0.247100E-07  -0.999900E+00   0.112244E-04
0.607912E+02   0.000000E+00   0.143486E-02   0.188537E+02
 500000.00   0.188525E+02   0.188112E+02   0.187772E+02   0.188374E+02   0.996234E+00
0.998692E+00   0.999952E+00  -0.999900E+03   0.999431E+00  -0.999900E+03   0.114539E+00
0.984593E+00   0.351975E-02   0.691742E-03  -0.642496E-07  -0.999900E+00   0.972434E-05
0.607920E+02   0.000000E+00   0.142870E-02   0.187985E+02
 600000.00   0.188181E+02   0.187772E+02   0.187467E+02   0.188035E+02   0.996287E+00
0.998726E+00   0.999952E+00  -0.999900E+03   0.999430E+00  -0.999900E+03   0.114547E+00
0.984625E+00   0.326050E-02   0.424893E-03  -0.430393E-08  -0.999900E+00   0.878533E-05
0.607925E+02   0.000000E+00   0.142881E-02   0.187645E+02
 800000.00   0.187395E+02   0.187031E+02   0.186770E+02   0.187288E+02   0.996743E+00
0.998924E+00   0.999952E+00  -0.999900E+03   0.999551E+00  -0.999900E+03   0.114566E+00
0.984698E+00   0.272159E-02   0.354392E-03  -0.928830E-08  -0.999900E+00   0.679576E-05
0.607936E+02   0.000000E+00   0.141635E-02   0.186906E+02
1000000.00   0.187191E+02   0.186873E+02   0.186626E+02   0.187125E+02   0.997050E+00
0.998962E+00   0.999953E+00  -0.999900E+03   0.999506E+00  -0.999900E+03   0.114576E+00
0.984716E+00   0.215444E-02   0.880099E-04  -0.223992E-08  -0.999900E+00   0.467054E-05
0.607935E+02   0.000000E+00   0.151318E-02   0.186749E+02

...
```

These randomly checked values for the water vapor and air mass flow indicate that TH abstraction routine performs as intended.

Although not used by TSPA, the averages of a few selected variables are checked to ensure proper implementation in the software routine. Randomly selected pillar temperatures are considered for software routine testing. Excerpts from the raw location dependent data files are the following:

file: csnf_x1_y20_data

```
data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000
```

Type:
average WP type: bwr1

Location:
easting (NV central): 170208.78
northing (NV central): 234316.72

Area:
fraction of repository area
represented by cell 1,20 = **0.000586**

Infiltration:
cell 1,20 infiltration: 61.004459 (mm/yr)

TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m

...

```
time    T_pillar_x=2.99m      T_pillar_x=3.69m      T_pillar_x=4.89m      T_pillar_x=6.89m
        T_pillar_x=10.14m     T_pillar_x=10.39m     T_pillar_x=15.14m     T_pillar_x=16.64m
        T_pillar_x=22.64m     T_pillar_x=24.14m     T_pillar_x=27.68m
0.000000e+00   2.226750e+01   2.226750e+01   2.226750e+01   2.226750e+01   2.226750e+01
        2.226750e+01   2.226750e+01   2.226750e+01   2.226750e+01   2.226750e+01   2.226750e+01
1.000000e+00   6.756573e+01   6.073705e+01   5.178516e+01   4.160742e+01   3.203805e+01
        3.171573e+01   2.559178e+01   2.507459e+01   2.300584e+01   2.275158e+01   2.259914e+01
2.000000e+00   7.456641e+01   6.804649e+01   5.938113e+01   4.920999e+01   3.885263e+01
        3.842866e+01   3.037332e+01   2.933084e+01   2.516089e+01   2.455486e+01   2.395844e+01
5.000000e+00   8.122845e+01   7.538284e+01   6.751856e+01   5.804145e+01   4.776632e+01
        4.728075e+01   3.805499e+01   3.647095e+01   3.013474e+01   2.907687e+01   2.765614e+01
1.000000e+01   8.169707e+01   7.666357e+01   6.986584e+01   6.159898e+01   5.243784e+01
        5.198219e+01   4.332496e+01   4.166524e+01   3.502635e+01   3.382952e+01   3.194512e+01
1.500000e+01   7.987056e+01   7.538991e+01   6.933537e+01   6.195218e+01   5.371185e+01
        5.329500e+01   4.537495e+01   4.379950e+01   3.749767e+01   3.632933e+01   3.437918e+01
2.000000e+01   7.731870e+01   7.331188e+01   6.789713e+01   6.128621e+01   5.388190e+01
        5.350410e+01   4.632605e+01   4.487063e+01   3.904897e+01   3.795381e+01   3.606606e+01
2.500000e+01   7.469608e+01   7.108213e+01   6.619776e+01   6.023059e+01   5.353538e+01
        5.319221e+01   4.667199e+01   4.533608e+01   3.999244e+01   3.897937e+01   3.719875e+01
3.000000e+01   7.197214e+01   6.872006e+01   6.432410e+01   5.895118e+01   5.291560e+01
        5.260529e+01   4.670931e+01   4.549246e+01   4.062503e+01   3.969720e+01   3.804269e+01
4.000000e+01   6.680760e+01   6.416387e+01   6.058987e+01   5.622079e+01   5.130938e+01
        5.105621e+01   4.624620e+01   4.524589e+01   4.124467e+01   4.047775e+01   3.908241e+01
5.000000e+01   6.130308e+01   5.921815e+01   5.639741e+01   5.294845e+01   4.907207e+01
        4.887223e+01   4.507525e+01   4.428371e+01   4.111752e+01   4.050965e+01   3.938934e+01
5.019998e+01   1.090920e+02   9.928757e+01   8.746704e+01   7.312807e+01   5.917451e+01
        5.864112e+01   4.850676e+01   4.705157e+01   4.123081e+01   4.011420e+01   3.848650e+01
5.100001e+01   1.204809e+02   1.081244e+02   9.618694e+01   8.693816e+01   7.073215e+01
        6.998764e+01   5.584216e+01   5.353166e+01   4.428965e+01   4.257577e+01   4.042282e+01
5.199999e+01   1.320215e+02   1.191142e+02   1.038677e+02   9.276361e+01   7.758340e+01
        7.681277e+01   6.217104e+01   5.949825e+01   4.880708e+01   4.675069e+01   4.394466e+01
5.300000e+01   1.371508e+02   1.247221e+02   1.085413e+02   9.480405e+01   8.125908e+01
        8.049399e+01   6.595733e+01   6.318670e+01   5.210418e+01   4.992696e+01   4.676949e+01
5.500000e+01   1.381957e+02   1.265553e+02   1.111064e+02   9.556810e+01   8.441035e+01
        8.367900e+01   6.978333e+01   6.705697e+01   5.615149e+01   5.396729e+01   5.058639e+01
```

```
6.000000e+01  1.284488e+02   1.192540e+02   1.070799e+02   9.443495e+01   8.438648e+01
      8.379230e+01  7.250266e+01  7.022507e+01   6.111471e+01   5.926271e+01   5.620727e+01
6.500000e+01   1.171960e+02   1.098333e+02   1.002500e+02   9.103469e+01   8.224245e+01
      8.176257e+01   7.264503e+01   7.078925e+01   6.336620e+01   6.185315e+01   5.929710e+01
7.000000e+01   9.364296e+01   8.981226e+01   8.523154e+01   8.025027e+01   7.438319e+01
      7.408407e+01   6.840086e+01   6.723656e+01   6.257932e+01   6.162888e+01   6.000687e+01
8.000000e+01   8.370042e+01   8.136224e+01   7.824806e+01   7.438940e+01   7.006881e+01
      6.984905e+01   6.567377e+01   6.482018e+01   6.140578e+01   6.070966e+01   5.952840e+01
1.000000e+02   7.819093e+01   7.633981e+01   7.383157e+01   7.077301e+01   6.736069e+01
      6.718738e+01   6.389442e+01   6.322234e+01   6.053400e+01   5.998611e+01   5.906013e+01
1.200000e+02   7.339576e+01   7.191030e+01   6.990858e+01   6.747523e+01   6.476725e+01
      6.462997e+01   6.202154e+01   6.149044e+01   5.936598e+01   5.893345e+01   5.820490e+01
...
```

file: csnf_x2_y20_data

```
data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):          170228.75
northing (NV central):         234315.67

Area:
fraction of repository area
represented by cell  2,20 =          0.000976

Infiltration:
cell  2,20 infiltration:            60.793499   (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m
...

time    T_pillar_x=2.99m       T_pillar_x=3.69m       T_pillar_x=4.89m       T_pillar_x=6.89m
        T_pillar_x=10.14m      T_pillar_x=10.39m      T_pillar_x=15.14m      T_pillar_x=16.64m
        T_pillar_x=22.64m      T_pillar_x=24.14m      T_pillar_x=27.68m
0.000000e+00   2.227358e+01   2.227358e+01   2.227358e+01   2.227358e+01   2.227358e+01
      2.227358e+01   2.227358e+01   2.227358e+01   2.227358e+01   2.227358e+01   2.227358e+01
1.000000e+00   6.331949e+01   5.641513e+01   4.748584e+01   3.765292e+01   2.910222e+01
      2.885761e+01   2.421008e+01   2.388831e+01   2.260124e+01   2.252549e+01   2.243087e+01
2.000000e+00   7.121970e+01   6.454301e+01   5.572411e+01   4.551880e+01   3.548570e+01
      3.510781e+01   2.792801e+01   2.712907e+01   2.393334e+01   2.366366e+01   2.322841e+01
5.000000e+00   7.965583e+01   7.359481e+01   6.546355e+01   5.571882e+01   4.528889e+01
      4.481033e+01   3.571767e+01   3.424248e+01   2.834172e+01   2.764457e+01   2.632628e+01
1.000000e+01   8.198248e+01   7.672892e+01   6.963754e+01   6.102464e+01   5.150950e+01
      5.103964e+01   4.211228e+01   4.042493e+01   3.367549e+01   3.271357e+01   3.075462e+01
```

```
1.500000e+01   8.034809e+01   7.571177e+01   6.944876e+01   6.181736e+01   5.331589e+01
       5.288766e+01   4.475138e+01   4.314631e+01   3.672604e+01   3.575318e+01   3.372227e+01
2.000000e+01   7.795884e+01   7.383701e+01   6.826803e+01   6.147220e+01   5.386980e+01
       5.348300e+01   4.613377e+01   4.465243e+01   3.872702e+01   3.780122e+01   3.584362e+01
2.500000e+01   7.511674e+01   7.144884e+01   6.649281e+01   6.044148e+01   5.366061e+01
       5.331413e+01   4.673085e+01   4.539101e+01   4.003160e+01   3.918248e+01   3.737440e+01
3.000000e+01   7.242705e+01   6.914409e+01   6.470786e+01   5.928956e+01   5.321290e+01
       5.290165e+01   4.698810e+01   4.577769e+01   4.093605e+01   4.016248e+01   3.850742e+01
4.000000e+01   6.733561e+01   6.469400e+01   6.112455e+01   5.676564e+01   5.187791e+01
       5.162746e+01   4.686874e+01   4.589178e+01   4.198389e+01   4.135604e+01   4.000498e+01
5.000000e+01   6.169816e+01   5.966827e+01   5.692319e+01   5.357145e+01   4.981747e+01
       4.962551e+01   4.597829e+01   4.523129e+01   4.224327e+01   4.176408e+01   4.072944e+01
5.019998e+01   1.092629e+02   9.943607e+01   8.764405e+01   7.332359e+01   5.940439e+01
       5.887436e+01   4.880372e+01   4.736229e+01   4.159657e+01   4.066239e+01   3.904551e+01
5.100001e+01   1.193158e+02   1.079849e+02   9.610724e+01   8.549966e+01   6.936559e+01
       6.864070e+01   5.486764e+01   5.268511e+01   4.395498e+01   4.262832e+01   4.053845e+01
5.199999e+01   1.289737e+02   1.158683e+02   1.015176e+02   9.163169e+01   7.616625e+01
       7.539838e+01   6.080880e+01   5.821786e+01   4.785411e+01   4.619659e+01   4.347766e+01
5.300000e+01   1.365835e+02   1.239312e+02   1.075792e+02   9.461102e+01   8.036250e+01
       7.959174e+01   6.494775e+01   6.218903e+01   5.115416e+01   4.931151e+01   4.615960e+01
5.500000e+01   1.388287e+02   1.269304e+02   1.111729e+02   9.560432e+01   8.424184e+01
       8.349930e+01   6.939104e+01   6.664793e+01   5.567542e+01   5.377198e+01   5.035677e+01
6.000000e+01   1.306620e+02   1.212540e+02   1.087810e+02   9.539078e+01   8.561810e+01
       8.501492e+01   7.355482e+01   7.126345e+01   6.209793e+01   6.046172e+01   5.739347e+01
6.500000e+01   1.178638e+02   1.106800e+02   1.013218e+02   9.216995e+01   8.390808e+01
       8.344540e+01   7.465453e+01   7.288312e+01   6.579743e+01   6.452834e+01   6.211203e+01
7.000000e+01   9.528941e+01   9.159129e+01   8.756448e+01   8.293869e+01   7.755600e+01
       7.728339e+01   7.210390e+01   7.105771e+01   6.687292e+01   6.612459e+01   6.469596e+01
8.000000e+01   8.688345e+01   8.487366e+01   8.205872e+01   7.860165e+01   7.473611e+01
       7.454045e+01   7.082315e+01   7.007315e+01   6.707313e+01   6.653732e+01   6.551885e+01
1.000000e+02   8.123489e+01   7.967780e+01   7.757834e+01   7.502315e+01   7.218174e+01
       7.203836e+01   6.931413e+01   6.876596e+01   6.657323e+01   6.618224e+01   6.544100e+01
1.200000e+02   8.017628e+01   7.870042e+01   7.671167e+01   7.429447e+01   7.160845e+01
       7.147297e+01   6.889883e+01   6.838120e+01   6.631060e+01   6.594152e+01   6.524219e+01
...
```

file: csnf_x3_y20_data

```
data file creation date:            Mon Apr 10 23:47:19 2000
MSTHM version:          MSTHM_rev_6.2
base EXTfile creation date:         Mon Apr 10 23:33:16 2000

Type:
average WP type:        bwr1

Location:
easting (NV central):          170256.20
northing (NV central):         234314.20

Area:
fraction of repository area
represented by cell  3,20 =          0.001171

Infiltration:
cell  3,20 infiltration:            60.375038   (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
```

```
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m
...
```

time	T_pillar_x=2.99m	T_pillar_x=3.69m	T_pillar_x=4.89m	T_pillar_x=6.89m	T_pillar_x=10.14m	T_pillar_x=10.39m	T_pillar_x=15.14m	T_pillar_x=16.64m	T_pillar_x=22.64m	T_pillar_x=24.14m	T_pillar_x=27.68m
0.000000e+00	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228628e+01	2.228629e+01	2.228628e+01
1.000000e+00	6.131370e+01	5.437297e+01	4.545411e+01	3.578517e+01	2.771969e+01	2.751219e+01	2.356973e+01	2.334441e+01	2.244314e+01	2.242001e+01	2.236555e+01
2.000000e+00	6.934348e+01	6.257654e+01	5.366860e+01	4.344172e+01	3.359130e+01	3.323977e+01	2.656065e+01	2.590387e+01	2.327676e+01	2.314780e+01	2.284409e+01
5.000000e+00	7.833198e+01	7.207835e+01	6.370847e+01	5.372511e+01	4.315984e+01	4.268805e+01	3.372390e+01	3.235241e+01	2.686647e+01	2.638212e+01	2.524146e+01
1.000000e+01	8.178065e+01	7.624845e+01	6.879211e+01	5.976449e+01	4.986429e+01	4.938362e+01	4.025081e+01	3.858398e+01	3.191667e+01	3.112761e+01	2.926939e+01
1.500000e+01	8.132906e+01	7.636757e+01	6.966895e+01	6.152058e+01	5.248130e+01	5.203048e+01	4.346496e+01	4.181041e+01	3.519218e+01	3.432448e+01	3.228107e+01
2.000000e+01	7.966013e+01	7.519781e+01	6.917027e+01	6.182244e+01	5.362531e+01	5.321106e+01	4.534025e+01	4.377710e+01	3.752448e+01	3.666216e+01	3.463140e+01
2.500000e+01	7.742431e+01	7.340541e+01	6.797659e+01	6.135281e+01	**5.394407e+01**	5.356724e+01	4.640772e+01	4.496607e+01	3.919948e+01	3.838348e+01	3.646180e+01
3.000000e+01	7.495100e+01	7.133064e+01	6.643993e+01	6.047049e+01	5.378629e+01	5.344534e+01	4.696731e+01	4.565434e+01	4.040248e+01	3.964986e+01	3.787743e+01
4.000000e+01	6.772602e+01	6.508572e+01	6.151913e+01	5.716677e+01	5.229429e+01	5.204559e+01	4.732010e+01	4.635860e+01	4.251260e+01	4.195539e+01	4.064318e+01
5.000000e+01	6.578531e+01	6.337215e+01	6.011148e+01	5.613281e+01	5.168125e+01	5.145426e+01	4.714142e+01	4.626514e+01	4.275996e+01	4.225285e+01	4.105860e+01
5.019998e+01	1.075217e+02	9.762507e+01	8.595886e+01	7.175674e+01	5.832521e+01	5.783123e+01	4.844569e+01	4.709928e+01	4.171361e+01	4.092998e+01	3.935258e+01
5.100001e+01	1.171949e+02	1.074106e+02	9.595573e+01	8.313331e+01	6.707662e+01	6.638042e+01	5.315259e+01	5.116087e+01	4.319394e+01	4.217838e+01	4.026327e+01
5.199999e+01	1.242075e+02	1.108084e+02	9.769971e+01	8.985504e+01	7.381969e+01	7.305563e+01	5.853857e+01	5.606302e+01	4.616084e+01	4.484376e+01	4.234077e+01
5.300000e+01	1.319990e+02	1.190192e+02	1.038173e+02	9.286822e+01	7.780520e+01	7.703558e+01	6.241283e+01	5.976143e+01	4.915581e+01	4.765091e+01	4.471454e+01
5.500000e+01	1.383419e+02	1.259584e+02	1.097408e+02	9.525064e+01	8.250721e+01	8.174459e+01	6.725465e+01	6.448799e+01	5.342134e+01	5.174732e+01	4.838721e+01
6.000000e+01	1.368950e+02	1.261615e+02	1.119037e+02	9.646214e+01	8.629464e+01	8.561606e+01	**7.272300e+01**	7.017738e+01	5.999489e+01	5.837048e+01	5.501652e+01
6.500000e+01	1.277220e+02	1.191072e+02	1.076825e+02	9.521718e+01	8.614814e+01	8.559555e+01	7.509648e+01	7.300105e+01	6.461934e+01	6.326363e+01	6.042984e+01
7.000000e+01	1.161160e+02	1.094517e+02	1.008160e+02	9.251932e+01	8.476179e+01	**8.433500e+01**	7.622599e+01	7.460049e+01	6.809852e+01	6.704797e+01	6.484388e+01
8.000000e+01	9.513366e+01	9.203046e+01	8.883006e+01	8.463943e+01	7.988145e+01	7.964164e+01	7.508498e+01	7.417445e+01	7.053237e+01	6.994831e+01	6.872488e+01
1.000000e+02	8.887415e+01	8.704153e+01	8.454788e+01	8.150333e+01	7.810835e+01	7.793732e+01	7.468771e+01	**7.403865e+01**	7.144243e+01	7.102657e+01	7.015723e+01
1.200000e+02	8.488196e+01	8.341145e+01	8.143117e+01	7.902507e+01	7.635408e+01	7.621983e+01	7.366927e+01	7.316090e+01	7.112746e+01	7.080225e+01	7.012309e+01

...

The pillar temperature is calculated using the equations previously described above. The pillar temperatures selected for routine results testing and verification are marked in bold above. For j = 25 years, the average pillar temperature (at pillar location 10.14 m) is computed from the equations as:

T_10.14(*j*=25 years) = (0.000586/0.002733)* **5.353538e+01**+ (0.000976/0.002733)* **5.366061e+01**

+ (0.001171/0.002733)* **5.394407e+01**= **53.7553°C**.

An excerpt of the resultant output file obtained from the TH abstraction routine gives the following average pillar temperature at this location. The routine generated values are marked in bold.

```
The average Pillar Temperatures
 Time (yr), Tx=2.99m (C), Tx=3.69m (C), Tx=4.89m (C), Tx=6.89 m (C), Tx=10.14
(C), Tx=10.39m (C), Tx=15.14m,        Tx=16.64m (C), Tx=22.65 (C), Tx=24.14m
(C), Tx=27.68 (C)
      0.00      0.222777E+02      0.222777E+02      0.222777E+02      0.222777E+02
0.222777E+02      0.222777E+02      0.222777E+02      0.222777E+02      0.222777E+02
0.222777E+02      0.222777E+02
      1.00      0.633705E+02      0.564668E+02      0.475372E+02      0.377006E+02
0.291393E+02      0.288940E+02      0.242320E+02      0.239096E+02      0.226203E+02
0.225288E+02      0.224390E+02
      2.00      0.711334E+02      0.644516E+02      0.556275E+02      0.454203E+02
0.353959E+02      0.350195E+02      0.278665E+02      0.270762E+02      0.239152E+02
0.236337E+02      0.232203E+02
      5.00      0.794258E+02      0.733284E+02      0.651522E+02      0.553626E+02
0.449079E+02      0.444307E+02      0.353646E+02      0.339105E+02      0.280941E+02
0.274108E+02      0.261466E+02
     10.00      0.818348E+02      0.765090E+02      0.693243E+02      0.606079E+02
0.510036E+02      0.505322E+02      0.415747E+02      0.399021E+02      0.332115E+02
0.322733E+02      0.303735E+02
     15.00      0.806660E+02      0.759237E+02      0.695188E+02      0.617191E+02
0.530432E+02      0.526077E+02      0.443339E+02      0.427140E+02      0.362343E+02
0.352646E+02      0.332456E+02
     20.00      0.785505E+02      0.743075E+02      0.685751E+02      0.615824E+02
0.537676E+02      0.533710E+02      0.458350E+02      0.443242E+02      0.382808E+02
0.373459E+02      0.353719E+02
     25.00      0.760153E+02      0.722085E+02      0.670653E+02      0.607867E+02
0.537552E+02      0.533964E+02      0.465798E+02      0.451972E+02      0.396667E+02
0.387966E+02      0.369457E+02
     30.00      0.734109E+02      0.699900E+02      0.653677E+02      0.597230E+02
0.533948E+02      0.530711E+02      0.469194E+02      0.456637E+02      0.406407E+02
0.398431E+02      0.381378E+02
     40.00      0.673897E+02      0.647482E+02      0.611790E+02      0.568207E+02
0.519344E+02      0.516841E+02      0.469287E+02      0.459533E+02      0.420519E+02
0.414245E+02      0.400806E+02
     50.00      0.633647E+02      0.611587E+02      0.581765E+02      0.545353E+02
0.504562E+02      0.502476E+02      0.462830E+02      0.454711E+02      0.422233E+02
0.417045E+02      0.405831E+02
     50.20      0.108480E+03      0.986283E+02      0.868840E+02      0.726103E+02
0.588927E+02      0.583774E+02      0.485866E+02      0.471830E+02      0.415683E+02
0.406595E+02      0.390572E+02
     51.00      0.118657E+03      0.107769E+03      0.960594E+02      0.847942E+02
0.686779E+02      0.679611E+02      0.543418E+02      0.522135E+02      0.437007E+02
0.424243E+02      0.403958E+02
     52.00      0.127585E+03      0.114396E+03      0.100386E+03      0.911132E+02
0.754647E+02      0.746979E+02      0.601282E+02      0.575691E+02      0.473329E+02
0.457358E+02      0.430907E+02
     53.00      0.134741E+03      0.121996E+03      0.106174E+03      0.939057E+02
0.794590E+02      0.786900E+02      0.640781E+02      0.613628E+02      0.505016E+02
0.487320E+02      0.456712E+02
     55.00      0.138484E+03      0.126434E+03      0.110545E+03      0.954450E+02
0.835347E+02      0.827860E+02      0.685598E+02      0.658102E+02      0.548117E+02
0.529464E+02      0.495621E+02
     60.00      0.132858E+03      0.122928E+03      0.109754E+03      0.956449E+02
0.856439E+02      0.850103E+02      0.729728E+02      0.705755E+02      0.609860E+02
0.593086E+02      0.561207E+02
     65.00      0.121945E+03      0.114109E+03      0.103817E+03      0.932322E+02
0.845107E+02      0.840058E+02      0.744130E+02      0.724847E+02      0.647714E+02
0.634128E+02      0.607877E+02
     70.00      0.103860E+03      0.988624E+02      0.927421E+02      0.864672E+02
0.799631E+02      0.796188E+02      0.730761E+02      0.717564E+02      0.664774E+02
0.655563E+02      0.637539E+02
```

```
     80.00        0.897359E+02        0.871872E+02        0.841429E+02        0.802855E+02
0.759400E+02        0.757202E+02        0.715451E+02        0.707041E+02        0.673401E+02
0.667493E+02        0.656081E+02
    100.00        0.838554E+02        0.821172E+02        0.797612E+02        0.768884E+02
0.736874E+02        0.735257E+02        0.704545E+02        0.698365E+02        0.673646E+02
0.669293E+02        0.660936E+02
    120.00        0.807387E+02        0.792630E+02        0.772751E+02        0.748592E+02
0.721749E+02        0.720396E+02        0.694682E+02        0.689517E+02        0.668854E+02
0.665215E+02        0.658246E+02
...
```

As shown, the implementation of the TH abstraction routine is correct. Consider location (10.39 m).

The pillar temperature is calculated using the equations previously described above. The pillar temperatures selected for routine results testing and verification are marked in bold above. For j = 70 years, the average pillar temperature (at pillar location 10.39 m) is computed from the equations as:

T_10.39(*j*=70 years) = (0.000586/0.002733)* **7.408407e+01**+ (0.000976/0.002733)* **7.728339e+01**+ (0.001171/0.002733)* **8.433500e+01**= **79.61878°C**.

As shown, the implementation of the TH abstraction routine is correct. Consider location (15.14 m).

The pillar temperature is calculated using the equations previously described above. The pillar temperatures selected for routine results testing and verification are marked in bold above. For j = 60 years, the average pillar temperature (at pillar location 15.14 m) is computed from the equations as:

T_15.14(*j*=60 years) = (0.000586/0.002733)* **7.250266e+01**+ (0.000976/0.002733)* **7.355482e+01**+ (0.001171/0.002733)* **7.272300e+01**= **72.9728°C**.

As shown, the implementation of the TH abstraction routine is correct. Consider location (16.64 m).

The pillar temperature is calculated using the equations previously described above. The pillar temperatures selected for routine results testing and verification are marked in bold above. For j = 100 years, the average pillar temperature (at pillar location 15.14 m) is computed from the equations as:

T_16.54(*j*=100 years) = (0.000586/0.002733)* **6.322234e+01**+ (0.000976/0.002733)* **6.876596e+01**+ (0.001171/0.002733)* **7.403865e+01**= **69.8365°C**.

As shown, the implementation of the TH abstraction routine is correct. This concludes the spot checking testing and data verification. The routine produces the intended results for the TSPA abstraction. All resulting routine generated (abstraction) data files each contain 99 different time entries ranging from 0 to $1x10^6$ years. For the large files, each data block contains 99 entries ranging from 0 to $1x10^6$ years. Some final spot checks are performed in the large files used as the raw inputs to TSPA (e.g., non-averaged process-level model results for each of the location dependent result files). These include, among others, the volume flow rate in the invert and the evaporation rate in the invert. An excerpt of the raw data file is the following:

```
file:        csnf_x3_y20_data

data file creation date:              Mon Apr 10 23:47:19 2000
MSTHM version:            MSTHM_rev_6.2
base EXTfile creation date:           Mon Apr 10 23:33:16 2000

Type:
average WP type:          bwr1

Location:
easting (NV central):           170256.20
northing (NV central):          234314.20

Area:
fraction of repository area
represented by cell  3,20 =           0.001171

Infiltration:
cell  3,20 infiltration:              60.375038    (mm/yr)


TSPA_SR00nbf_mean
--TSPA-SR Multiscale TH results (E0120)
--Medium Infiltration Case using the Drift-Scale Property set.
  DTN=LB990861233129.001
--Climate states: 0 to 600 years present day, 600 to 2000 years monsoonal,
  and 2000 to 10^6 years glacial
--Active fracture model concept using an implicit DKM
--50 year ventilation period with 70% heat removal efficiency.
--AML=56.5 MTU/acre, line-loaded (10 cm waste package spacing),
  81 meter driftspacing
--dripshield emplacement at repository closure--50 years
--No waste aging
--Initial LPL=1.45 kW/m
...
time  q.liq_5m    q.liq_3m    q.liq_dwTop q.liq_dwBot q.liq_dsTop
      q.liq_dsTop_avg   q.liq_dsSide       q.liq_invert
0.000000e+00   1.515894e+01   1.515894e+01   0.0     0.0     -9.999000e+02  -9.999000e+02  -
9.999000e+02   0.000000e+00
1.000000e+00   1.423241e+01   1.432650e+01   -4.607912e-05  7.541708e-01   -9.999000e+02  -
9.999000e+02   -9.999000e+02  -1.957402e-14
2.000000e+00   1.426084e+01   1.436840e+01   -6.389301e-07  9.313450e-01   -9.999000e+02  -
9.999000e+02   -9.999000e+02  -2.546308e+00
5.000000e+00   1.434117e+01   1.456118e+01   0.000000e+00   1.285984e+00   -9.999000e+02  -
9.999000e+02   -9.999000e+02  -1.551410e-08
1.000000e+01   1.440325e+01   1.469647e+01   0.000000e+00   1.124639e+00   -9.999000e+02  -
9.999000e+02   -9.999000e+02  0.000000e+00
1.500000e+01   1.439766e+01   1.470719e+01   0.000000e+00   1.047790e+00   -9.999000e+02  -
9.999000e+02   -9.999000e+02  0.000000e+00
```

```
2.000000e+01   1.436136e+01   1.463422e+01   0.000000e+00   2.140658e+01   -9.999000e+02  -
9.999000e+02   -9.999000e+02  0.000000e+00
2.500000e+01   1.430123e+01   1.452275e+01   0.000000e+00   2.352432e+00   -9.999000e+02  -
9.999000e+02   -9.999000e+02  0.000000e+00
...

4.000000e+04   6.023867e+01   6.021982e+01   -2.182924e-03  -1.854876e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.546954e+00
5.000000e+04   6.031652e+01   6.030095e+01   -7.652644e-05  -2.224257e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.601654e+00
1.000000e+05   6.035665e+01   6.034126e+01   -7.340022e-07  -2.696869e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.646154e+00
2.000000e+05   6.037077e+01   6.035539e+01   -4.481075e-07  -2.792460e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.600556e+00
3.000000e+05   6.037230e+01   6.035718e+01   -3.726235e-07  -2.812601e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.600119e+00
4.000000e+05   6.037280e+01   6.035769e+01   -3.622701e-07  -2.818238e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.600905e+00
5.000000e+05   6.037365e+01   6.035854e+01   -3.387448e-07  -2.827881e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.595840e+00
6.000000e+05   6.037418e+01   6.035909e+01   -3.278080e-07  -2.833912e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.597209e+00
8.000000e+05   6.037534e+01   6.036024e+01   -2.883127e-07  -2.847035e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.586522e+00
1.000000e+06   6.037504e+01   6.035995e+01   -3.573989e-07  -2.859482e-02  0.000000e+00
       0.000000e+00   0.000000e+00   1.725531e+00
## end section ##
...
time   Qevap_dsTop   Qevap_dsPerim  Qevap_BFpeak   Qevap_invert   Qevap_dwTop   Qevap_dwBot
0.000000e+00   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
1.000000e+00   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
2.000000e+00   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
5.000000e+00   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
1.000000e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
1.500000e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
2.000000e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
2.500000e+01   -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -9.999000e+02  -
9.999000e+02
...
3.000000e+04   -6.970151e-02  -1.543546e-01  -9.999000e+02  3.080377e-01   -3.013526e-03
       1.686930e-02
4.000000e+04   -1.453577e-01  -4.143320e-01  -9.999000e+02  2.284086e-01   -1.802738e-03
       2.875184e-02
5.000000e+04   -2.700021e-03  5.024902e-02   -9.999000e+02  1.003705e-01   -3.601959e-03  -
2.814899e-03
1.000000e+05   -9.243238e-03  -8.688550e-03  -9.999000e+02  2.804682e-02   -1.193151e-03
       3.350223e-03
2.000000e+05   -1.057117e-03  4.947145e-04   -9.999000e+02  1.706992e-02   2.427185e-03
       5.961862e-03
3.000000e+05   -1.192103e-05  6.000626e-03   -9.999000e+02  1.209632e-02   -6.029503e-04
       4.957580e-03
4.000000e+05   -2.770227e-05  5.378925e-03   -9.999000e+02  1.118801e-02   -5.745098e-04
       5.068144e-03
5.000000e+05   -7.352898e-05  4.393931e-03   -9.999000e+02  9.684507e-03   -5.238274e-04
       5.249908e-03
6.000000e+05   -5.315595e-06  4.006718e-03   -9.999000e+02  8.744178e-03   -4.932951e-04
       5.365018e-03
8.000000e+05   -1.067178e-05  2.783135e-03   -9.999000e+02  6.750525e-03   -4.230366e-04
       5.604308e-03
1.000000e+06   -1.511116e-06  1.512564e-03   -9.999000e+02  4.601364e-03   -3.512390e-04
       5.903592e-03
## end section ##
```

The software routine excerpt (from the large file that contains location dependent entries for this

infiltration rate bin 60+ mm/yr) is the following:

```
Infiltration Bin:
 qinf >  60.0 mm/yr

 RIP_csnf_d1041700_bin-60_mean

 Time (yr), Waste Pack Temp.(C), Drip shield temp. (C), Drift wall temp.(C),
Invert temp. (C), Waste pack RH, Drip   shield RH, Drift wall RH, Backfill RH,
Invert RH, Liquid Satr. @  Drip Shield, Liquid Satr.@Invert, Air mass Frac,
Water Vapor flux at Dwall (kg/yr/m of drift), Air flux at Dwall(kg/yr/m of
drift), A Drip Shield Evapo. rate (m3/yr), Backfill Evapo. Rate (m3/yr),
Invert Evapo. Rate (m3/yr), Percolation Flux at 5 m (mm/yr), Vol ume flow at
top dripshield (m3/yr), volume flow at invert (m3/yr), Top of the dripshield
Temp (C)
...
The number of Rows =  99
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 170256.20 m
The northing coordinate = 234314.20 m
 Infiltration rate:
qinf =  60.37504 mm/yr
     0.00   0.223017E+02  -0.999900E+03   0.222997E+02   0.223257E+02   0.999138E+00  -
0.999900E+03   0.999952E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.151589E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
     1.00   0.732417E+02  -0.999900E+03   0.591335E+02   0.642270E+02   0.425705E+00  -
0.999900E+03   0.999951E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.180501E-01  -
0.999900E+03   0.209648E+02   0.101200E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.142324E+02  -0.999900E+03  -0.180081E-16  -0.999900E+03
     2.00   0.801258E+02  -0.999900E+03   0.669960E+02   0.718739E+02   0.474028E+00  -
0.999900E+03   0.999950E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.169406E-01  -
0.999900E+03   0.252568E+02   0.111242E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.142608E+02  -0.999900E+03  -0.234260E-02  -0.999900E+03
     5.00   0.876680E+02  -0.999900E+03   0.759607E+02   0.804701E+02   0.536906E+00  -
0.999900E+03   0.997572E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.665452E-02  -
0.999900E+03   0.298404E+02   0.106481E+02  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143412E+02  -0.999900E+03  -0.142730E-10  -0.999900E+03
    10.00   0.897963E+02  -0.999900E+03   0.795828E+02   0.834697E+02   0.586944E+00  -
0.999900E+03   0.995661E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.288800E-09  -
0.999900E+03   0.228986E+02   0.823012E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.144032E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    15.00   0.884954E+02  -0.999900E+03   0.793081E+02   0.827411E+02   0.616501E+00  -
0.999900E+03   0.994915E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.571104E-11  -
0.999900E+03   0.211283E+02   0.735051E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143977E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    20.00   0.861606E+02  -0.999900E+03   0.777874E+02   0.808529E+02   0.640200E+00  -
0.999900E+03   0.994985E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.118503E-10  -
0.999900E+03   0.222356E+02   0.761085E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143614E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
    25.00   0.833630E+02  -0.999900E+03   0.756784E+02   0.784475E+02   0.659971E+00  -
0.999900E+03   0.995274E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.414905E-10  -
0.999900E+03   0.183917E+02   0.647455E+01  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.143012E+02  -0.999900E+03   0.000000E+00  -0.999900E+03
...
40000.00   0.239910E+02   0.237449E+02   0.234502E+02   0.237962E+02   0.974680E+00
0.989289E+00   0.999952E+00  -0.999900E+03   0.993766E+00  -0.999900E+03   0.111230E+00
0.978839E+00   0.478401E-02   0.161880E+00  -0.145358E-03  -0.999900E+00   0.228409E-03
0.602387E+02   0.000000E+00   0.142320E-02   0.237244E+02
  50000.00   0.224869E+02   0.222973E+02   0.220717E+02   0.223414E+02   0.981008E+00
0.992136E+00   0.999951E+00  -0.999900E+03   0.995621E+00  -0.999900E+03   0.111407E+00
0.980686E+00   0.286304E-01   0.650953E-02  -0.270002E-05  -0.999900E+00   0.100370E-03
0.603165E+02   0.000000E+00   0.147352E-02   0.222790E+02
 100000.00   0.197548E+02   0.196773E+02   0.195994E+02   0.197077E+02   0.992167E+00
0.997019E+00   0.999948E+00  -0.999900E+03   0.998472E+00  -0.999900E+03   0.112112E+00
```

```
0.983688E+00   0.892470E-02   0.353826E-02  -0.924324E-05  -0.999900E+00   0.280468E-04
0.603567E+02   0.000000E+00   0.151446E-02   0.196633E+02
 200000.00   0.190995E+02   0.190493E+02   0.190068E+02   0.190765E+02   0.994939E+00
0.998223E+00   0.999949E+00  -0.999900E+03   0.999099E+00  -0.999900E+03   0.114373E+00
0.984353E+00   0.367515E-03   0.630468E-02  -0.105712E-05  -0.999900E+00   0.170699E-04
0.603708E+02   0.000000E+00   0.147251E-02   0.190362E+02
 300000.00   0.190283E+02   0.189824E+02   0.189432E+02   0.190091E+02   0.995667E+00
0.998566E+00   0.999949E+00  -0.999900E+03   0.999391E+00  -0.999900E+03   0.114391E+00
0.984420E+00   0.418325E-02   0.512761E-03  -0.119210E-07  -0.999900E+00   0.120963E-04
0.603723E+02   0.000000E+00   0.147211E-02   0.189696E+02
 400000.00   0.189919E+02   0.189463E+02   0.189107E+02   0.189731E+02   0.995903E+00
0.998592E+00   0.999949E+00  -0.999900E+03   0.999386E+00  -0.999900E+03   0.114401E+00
0.984454E+00   0.393394E-02   0.641593E-03  -0.277023E-07  -0.999900E+00   0.111880E-04
0.603728E+02   0.000000E+00   0.147283E-02   0.189335E+02
 500000.00   0.189302E+02   0.188889E+02   0.188558E+02   0.189151E+02   0.996303E+00
0.998750E+00   0.999950E+00  -0.999900E+03   0.999488E+00  -0.999900E+03   0.114417E+00
0.984511E+00   0.352746E-02   0.841205E-03  -0.735290E-07  -0.999900E+00   0.968451E-05
0.603736E+02   0.000000E+00   0.146817E-02   0.188762E+02
 600000.00   0.188946E+02   0.188537E+02   0.188240E+02   0.188799E+02   0.996351E+00
0.998779E+00   0.999950E+00  -0.999900E+03   0.999482E+00  -0.999900E+03   0.114426E+00
0.984544E+00   0.326605E-02   0.483554E-03  -0.531560E-08  -0.999900E+00   0.874418E-05
0.603742E+02   0.000000E+00   0.146943E-02   0.188410E+02
 800000.00   0.188132E+02   0.187769E+02   0.187514E+02   0.188026E+02   0.996795E+00
0.998966E+00   0.999951E+00  -0.999900E+03   0.999591E+00  -0.999900E+03   0.114447E+00
0.984620E+00   0.272524E-02   0.398867E-03  -0.106718E-07  -0.999900E+00   0.675053E-05
0.603753E+02   0.000000E+00   0.145960E-02   0.187643E+02
1000000.00   0.188053E+02   0.187734E+02   0.187488E+02   0.187986E+02   0.997066E+00
0.998968E+00   0.999951E+00  -0.999900E+03   0.999510E+00  -0.999900E+03   0.114456E+00
0.984626E+00   0.215295E-02   0.143884E-03  -0.151112E-08  -0.999900E+00   0.460136E-05
0.603750E+02   0.000000E+00   0.158749E-02   0.187611E+02
```

The liquid volume flow rates at the top of the drip shield and in the invert are checked in the abstraction files for TSPA. Consider first early time (at 2 years). The values tested above are marked in bold. The top of the drip shield is not in place at this early time (drip shield emplacement at repository closure at 50 years); therefore, the dummy variable is identified in the raw data file used as input to the abstraction. The abstraction routine captures this fact and reproduces the dummy variable. The invert volume flow rate is computed as the following:

Volume flow invert = **-2.546308e+00** * 0.92/1000 = **$\underline{-2.3426\text{x}10^{-3}}$** ($m^3$/yr)

The routine operates as intended. The evaporation rate is also checked at 2 years. The raw data reports dummy variables for both the top drip shield and the invert during the preclosure period. The routine reproduces this correctly as well. Consider a later time as well.

For the same variables, consider 50,000 years as late time check. The top drip shield volume flow rate is zero in the raw data files. This is reproduced by the abstraction routine as well (which computes: raw value *x* 0.57/1000 to convert from mm/yr to m^3/yr). The invert volume flow rate is computed as the following:

Volume flow invert = **1.601654e+00*** 0.92/1000 = **$\underline{1.4735\text{x}10^{-3}}$** ($m^3$/yr)

The routine operates as intended. The evaporation rate is checked as well. The top drip shield evaporation rate is computed as the following (converting kg/yr to m^3/yr):

Evap = **-2.700021e-03** / 1000 = **$\underline{-2.7\text{x}10^{-6}}$** ($m^3$/yr)

The invert evaporation rate is computed as the following (converting kg/yr to m^3/yr):

Evap = **1.003705e-01**/ 1000 = **$\underline{1.0037 \times 10^{-4}}$** ($m^3$/yr)

This is the correct value as reported in the abstraction routine output (see bold above).

This concludes the testing and verification of the TH abstraction routine (version 2). It performs its abstraction tasks as intended (both for the raw data reformatted and the infiltration bin averages). The TH abstraction software routine is listed in detail in the next section.

Source Code for Version 2 of the TH Abstraction Routine (TH-msmabs_ver_2)

```
c23456789012345678901234567890123456789012345678901234567890123456789012

c....This computes averages directly from the multiscale model results
c
c    for TSPA-SR.  This will place resultant files into appropriate
c
c    infiltration bins as specified by the TCT.
c
c    raw values given by LLNL
c
c    ndf 4/3/98-original file for TSPA-VA, LADS
c
c....ndf 10/12/99-modified for TSPA-SR
c....ndf 10/99-12/99 various changes for RIP including time stepping
c     control based on rates of changes on T and q.liquid 5m
c    change top dripshield and invert q.liquid to volume flow rate
c    version 2 used for no backfill design
c    ndf  03/07/00- TSPA-SR, Rev00
c
c
c
c
c
c
c     Input the number of time points in the LLNL file so that
c
c     the correct number of data points within the file can be
c
c     processed.
c
C
c
C.....The required input is a value for $npts$.  This value must be
c
C     input before compilation of the source code
c
C
c
c.....The required input is a value for $ninf$.  This value specifies
c     the number of infiltration bins and it must be input before
c     complilation of the source code.  An example: is for ninf =2.
```

```
c     in this case the bins may look like 0 - 25 mm/yr for the bin 1
c     and > 25 mm/yr for bin 2
c
c
      parameter(npts=99, ninf=5, nbinm=650)
C
□
      implicit double precision (a-h,l,o-z)
      character*4 name
      character*10 label
      character*80 infile1
      character*80 infile2
      character*80 infile3
      character*80 infile4
      character*80 outfile(ninf)
      character*80 resultsbinfile(ninf)
      character*80 resultsbinfile2(ninf)
      character*80 resultsbinfile2p(ninf)
      character*80 resultsbinfile3(ninf)
      character*80 resultsbinfile3a(ninf)
      character*80 resultsbinfile3b(ninf)
      character*80 resultsbinfile4(ninf)
      character*80 resultsbinfile5(ninf)
      character*80 resultsbinfile6(ninf)
      character*80 resultsbinfile7(ninf)
      character*80 resultsbinfile8(ninf)
      character*80 resultsbinfile9(ninf)
      character*80 resultsbinfile10(ninf)
      character*80 resultsbinfile11(ninf)
      character*80 resultsbinfile12(ninf)
      character*80 resultsbinfile13(ninf)
      character*12 nmeinf
      character*80 xinfillabel
      character*80 ch
c
c.....infile1 opens the large file containing waste packages of the same type
c     infile2 file names contained within an infiltration bin for bin averages
c     infile3 file names contained within the large file
c     infile4 file names contained within an infiltration bin for bin area
weight
c     outfile file names sorted into appropriate infiltration bins
c     resultsbinfile name of the resulting file for average quantities
c     resultsbinfile2 name of the resulting file for raw values for RIP
c     resultsbinfile3 name of the resulting file for average values for RIP
c
c
□
c
□
c.....The format of value X(i,j) is the following:
□
c     i = the number of entries in an infiltration bin
□
c     j = the number of time entries within an input file inside the
c          the infiltration bin
□
c
□
c23456789012345678901234567890123456789012345678901234567890123456789012
      dimension timeyr(npts), PAwpT(nbinm,npts), PAwpRH(nbinm,npts),
     @ PAdsT(nbinm,npts), PAdsRH(nbinm,npts),PAwpT1a(npts),
```

```
     @ PAwpRH2a(npts),
     @ PAdsT3a(npts), PAdsRH4a(npts), T_wp(nbinm,npts),
     @ T_5m(nbinm,npts),
     @ T_bfpk(nbinm,npts), T_ds(nbinm,npts), T_dw(nbinm,npts),
     @ T_inv(nbinm,npts), RH_dw(nbinm,npts),
     @ RH_bfp(nbinm,npts), RH_ds(nbinm,npts), RH_wp(nbinm,npts),
     @ RH_inv(nbinm,npts), Sl_dw(nbinm,npts), Sl_ds(nbinm,npts),
     @ Sl_inv(nbinm,npts), ql_5m(nbinm,npts), ql_3m(nbinm,npts),
     @ ql_dwtop(nbinm,npts), ql_dsT(nbinm,npts), ql_dsS(nbinm,npts),
     @ ql_inv(nbinm,npts), xa_ds(nbinm,npts), P_ds(nbinm,npts),
     @ Pc_ds(nbinm,npts), Pc_inv(nbinm,npts), PcM_dw(nbinm,npts),
     @ PcF_dw(nbinm,npts), qw_dw(nbinm,npts), qa_dw(nbinm,npts),
     @ qvpdsT(nbinm,npts), qvpdsP(nbinm,npts), qvpbfp(nbinm,npts),
     @ qvpinv(nbinm,npts), T_wp1a(npts), T_5m2a(npts), T_bfpk3a(npts),
     @ T_ds4a(npts), T_dw5a(npts), T_inv6a(npts),
     @ RH_dw1a(npts), RH_bfp2a(npts), RH_ds3a(npts), RH_wp4a(npts),
     @ RH_inv5a(npts), Sl_dw1a(npts), Sl_ds2a(npts), Sl_inv3a(npts),
     @ ql_5m1a(npts), ql_3m2a(npts), ql_dwtop3a(npts), ql_dsT4a(npts),
     @ ql_dsS5a(npts), ql_inv6a(npts), xa_ds1a(npts), P_ds1a(npts),
     @ Pc_ds1a(npts), Pc_inv2a(npts), PcM_dw3a(npts), PcF_dw4a(npts),
     @ qw_dw1a(npts), qa_dw2a(npts),qvpdsT1a(npts), qvpdsP2a(npts),
     @ qvpbfp3a(npts), qvpinv4a(npts), qinf0(ninf), facttb(ninf),
     @ factbin(ninf,nbinm), PAwpTf(nbinm,npts), PAwpRHf(nbinm,npts),
     @ PAdsTf(nbinm,npts), PAdsRHf(nbinm,npts), T_wpf(nbinm,npts),
     @ T_5mf(nbinm,npts),
     @ T_bfpkf(nbinm,npts), T_dsf(nbinm,npts), T_dwf(nbinm,npts),
     @ T_invf(nbinm,npts),  RH_dwf(nbinm,npts),
     @ RH_bfpf(nbinm,npts), RH_dsf(nbinm,npts), RH_wpf(nbinm,npts),
     @ RH_invf(nbinm,npts), Sl_dwf(nbinm,npts), Sl_dsf(nbinm,npts),
     @ Sl_invf(nbinm,npts), ql_5mf(nbinm,npts), ql_3mf(nbinm,npts),
c23456789012345678901234567890123456789012345678901234567890123456789012
     @ ql_dwtopf(nbinm,npts), ql_dsTf(nbinm,npts), ql_dsSf(nbinm,npts),
     @ ql_invf(nbinm,npts), xa_dsf(nbinm,npts), P_dsf(nbinm,npts),
     @ Pc_dsf(nbinm,npts), Pc_invf(nbinm,npts), PcM_dwf(nbinm,npts),
     @ PcF_dwf(nbinm,npts), qw_dwf(nbinm,npts), qa_dwf(nbinm,npts),
     @ qvpdsTf(nbinm,npts), qvpdsPf(nbinm,npts), qvpbfpf(nbinm,npts),
     @ qvpinvf(nbinm,npts), TavgRIP(ninf,npts), S_lavgRIP(ninf,npts),
     @ ql_5mavgRIP(ninf,npts), noent(ninf), Tdstop(nbinm,npts),
     @ Tdstopf(nbinm,npts), Tdstop8a(npts), ql_dsTagf(nbinm,npts),
     @ ql_dsTag(nbinm,npts), ql_dsTag7a(npts),Tp1299f(nbinm,npts),
     @ Tp1299(nbinm,npts), Tp1369f(nbinm,npts), Tp1369(nbinm,npts),
     @ Tp1489f(nbinm,npts), Tp1489(nbinm,npts),
     @ Tp1689f(nbinm,npts), Tp1689(nbinm,npts), Tp1039f(nbinm,npts),
     @ Tp1039(nbinm,npts), Tp1664f(nbinm,npts), Tp1664(nbinm,npts),
     @ Tp2768f(nbinm,npts), Tp2768(nbinm,npts),
     @  Tp12991a(npts), Tp13692a(npts),
     @ Tp14893a(npts), Tp16894a(npts), Tp10395a(npts), Tp16646a(npts),
     @ Tp27687a(npts),  coord1(ninf,nbinm),
     @ coord2(ninf,nbinm), Tmaxrip(ninf,npts), RHavgRIPin(ninf,npts),
     @ TavgRIPinv(ninf,npts), qvpavgRIPinv(ninf,npts), Tmax_min(nbinm),
     @ Tminrip(ninf,npts), TavgRIPdstop(ninf,npts),
     @  ql_invavgRIP(ninf,npts),ql_invavgabs(ninf,npts),
c23456789012345678901234567890123456789012345678901234567890123456789012
     @ TavgRIPdw(ninf,npts), RHavgRIPdw(ninf,npts),
     @ ql_dwbotf(nbinm,npts),
     @ ql_dwbot(nbinm,npts), qvpdwTp(nbinm,npts), qvpdwBt(nbinm,npts),
     @ qvpdwTpf(nbinm,npts), qvpdwBtf(nbinm,npts),ql_dwbot8a(npts),
     @ qvpdwTp5a(npts),qvpdwBt6a(npts), Tp10148a(npts), Tp15149a(npts),
     @ Tp226410a(npts), Tp241411a(npts), Tp1014(nbinm,npts),
     @ Tp1514(nbinm,npts), Tp2264(nbinm,npts), Tp2414(nbinm,npts),
     @ Tp1514f(nbinm,npts), Tp2264f(nbinm,npts), Tp2414f(nbinm,npts),
```

```
      @ Tp1014f(nbinm,npts)



        integer iinf(ninf)
        real *8 xinf, finf(ninf,nbinm)
c.....density of water
c     drip shield top flow area
c     invert flow area

        rho=1000.
        a_dsT=0.57
        a_inv=0.92

c.....This counter will specify the number of entries in each
c     of the infiltration bins--note: for k=ninf is the high infiltration
c     bin while for k=1 iinf is the low infiltration bin
c
      do k = 1,ninf
      iinf(k)=0
      end do

      write(*,*)
      write(*,*) '*********************************************'
      write(*,*) '***The TH abstraction routine for TSPA-SR***'
      write(*,*) '*****Performance Assessments Operations*****'
      write(*,*) '*********************************************'
      write(*,*)
      write(*,*)
      write(*,*) '*****************************************************'
      write(*,*) 'This version of the code will require an input deck'
      write(*,*) 'for the names of the i/o files.'
      write(*,*) 'Input Deck Filename is required: THabstraction.fil'
      write(*,*)
      write(*,*) 'The total required file names is a function of ninf'
      write(*,*) '** ninf is the number of infiltration bins **'
      write(*,*)
      write(*,*) '*****************************************************'
      write(*,*) '*****************************************************'
      write(*,*)
      write(*,*)
      write(*,*) 'The input deck is a name list in a single column:'
      write(*,*)
      write(*,*) 'bin1'
      write(*,*) 'bin2'
      write(*,*) '...'
      write(*,*) 'ninf'
      write(*,*) 'File name containing WP type file names from LLNL'
      write(*,*) 'bin1 results-average file'
      write(*,*) 'bin1 results-RIP raw values file'
      write(*,*) 'bin1 results-RIP Qperc-only values file'
      write(*,*) 'bin2 results-average file'
      write(*,*) 'bin2 results-RIP raw values file'
      write(*,*) 'bin2 results-RIP Qperc-only values file'
      write(*,*) '...'
      write(*,*) 'ninf results-average file'
      write(*,*) 'ninf results-RIP raw values file'
      write(*,*) 'ninf results-RIP Qperc-only values file'
      write(*,*) 'bin1RIP-Tavg file'
      write(*,*) 'bin1RIP-S_L avg file'
```

```
      write(*,*) 'bin1RIP-Q_perc avg file'
      write(*,*) 'bin1RIP-Tmax file'
      write(*,*) 'bin1RIP-Tmin file'
      write(*,*) 'bin1RIP-Tinvavg file'
      write(*,*) 'bin1RIP-RHinvavg file'
      write(*,*) 'bin1RIP-Qevap_invavg file'
      write(*,*) 'bin1RIP-Top DS file'
      write(*,*) 'bin1RIP-qperc_invavg file'
      write(*,*) 'bin1RIP-TDWavg file'
      write(*,*) 'bin1RIP-RHDWavg file'
      write(*,*) '...'
      write(*,*) 'ninfRIP-Tavg file'
      write(*,*) 'ninfRIP-S_L avg file'
      write(*,*) 'ninfRIP-Q_perc avg file'
      write(*,*) 'ninfRIP-Tmax file'
      write(*,*) 'ninfRIP-Tmin file'
      write(*,*) 'ninfRIP-Tinvavg file'
      write(*,*) 'ninfRIP-RHinvavg file'
      write(*,*) 'ninfRIP-Qevap_invavg file'
      write(*,*) 'ninfRIP-Top DS file'
      write(*,*) 'ninfRIP-qperc_invavg file'
      write(*,*) 'ninfRIP-TDWavg file'
      write(*,*) 'ninfRIP-RHDWavg file'
      write(*,*) 'bin1 ABS qprec inv avg'
      write(*,*) '...'
      write(*,*) 'ninf ABS qprec inv avg'

      write(*,*)
      write(*,*) 'So, as an example for ninf = '
      write(*,*) ninf
       ifiles = ninf+1+3*ninf+13*ninf
      write(*,*) 'There are a total of file names required:'
      write(*,*) ifiles
      write(*,*)

      write(*,*)
      write(*,*) 'Enter the rate of change factor'
      read(*,*) prntfac
      write(*,*)


      open(3,file='THabstraction.fil', status='old')

c.....Begin to read in the ranges of infiltration bins
        do k = 1, ninf
        write(*,*) 'Enter bin ranges starting from lowest mm/yr'
        read(*,*) qinf0(k)
        end do
      do k = 1,ninf
            read(3,'(a)') outfile(k)
      end do
c.....open the resulting infiltration bin files for later processing
c     write the appropriate file names that belong in the bin
c
      do k = 1,ninf
      open (106-k, file=outfile(k),status='new')
           if (k .eq. ninf) then
          write(106-k,1) qinf0(k)
 1          format('qinf >', 1x,f5.1,1x, 'mm/yr  ')
         else
```

```
          write(106-k,11) qinf0(k+1), qinf0(k)
 11         format(f5.1, 1x,'> qinf >', 1x,f5.1, 1x,'mm/yr   ')
         end if
        end do

c
c     Read in the large files (2 total) that contain all of the results for
c
c     a single run.  An example is each waste package location
c
c     for a specific type (e.g., csnf) from the mean infiltration
c
c     case multiscale model run
c
c.....Note: The input file must contain a label as the first line
c
c     an example may be csnf, hlw and the last line should be end
c
c
c      write(*,*)'What is the name of the large input file?'
c
      read(3,'(a)') infile1
c
      open(51,file=infile1,status='old')
c
      read(51,'(a)') label
c
      write(*,*)
c
      write(*,*) '****************************************'
c
      write(*,*) 'now reading input file for LLNL files:'
c
      write(*,*) label
c
      write(*,*) '****************************************'
c
      write(*,*)
c
      write(*,*)
c

c
 55     read(51,'(a)') infile3
c
         if (infile3 .eq. 'end') goto 44
        open(999,file=infile3,status='old')
c
4           read (999,45) nmeinf
c
45              format(a12)
c
        if (nmeinf .ne. 'Infiltration') goto 4
        read (999, '(a)') ch
c
        read (ch(26:),*) xinf
c
        close(999)

c
```

```
c.....check each infiltration rate in each file to determine the
c     appropriate infiltration rate bin placement
c

      do k = 1,ninf
      j=ninf+1-k
      if (xinf .ge. qinf0(j) ) goto 33
      end do

c.....write each file name to the appropriate infiltration bin
c     file name for later processing on an infiltration rate bin
c     basis
c

 33      open (106-j, file=outfile(j),status='old')

       write (106-j,31) infile3
 31    format(a70)

       iinf(j) = iinf(j)+1

       goto 55


c.....keep track of the number of entries in each infiltration
c     bin for later processing
c

 44   open (555, file='binmembers.dat', status='new')
        write(555,*) 'The entries in infiltration bin:from lo to hi'
      do k =1,ninf
       write(555,*) iinf(k)
      end do
      close(555)

      do k = 1,ninf
      close(106-k)
      enddo

      close(51)

c.....end the portion of the rountine that builds the infiltration bins
c.....The infiltration bins have now been assembled.  The remainder of
c     rountine will build the average quantities and reformat the data
c
c
c.....This section will build the average quantities for each infiltration
c     bin as specified by the above portion of this routine
c
c     Each sub-section in the multiscale model results will
c     be handled as an averaging process----
c
c
c.....Nomenclature for this processor
c     timeyr--time in years as taken from the multiscale results
c     T_wp--the waste package temperature
c       T_5m--the temperature at 5 meters into host rock
```

```
c        T_bfpk--the temperature at the backfill spoil peak
c        T_ds--the temperature at the dripshield
c        T_dw--the temperature at the drift wall
c        T_inv--the invert temperature
c        T_dwlow--the drift wall lower temperature
c        RH_dw--the relative humidity of the drift wall
c        RH_bfp--the relative humidity of the backfill spoil peak
c        RH_ds--the relative humidity of the dripshield
c        RH_wp--the relative humidity of the waste package
c        RH_inv--the relative humidity of the invert
c        Sl_dw--the liquid saturation of the drift wall
c        Sl_ds--the liquid saturation of the dripshield
c        Sl_inv--the liquid saturation of the invert
c        ql_5m--the liquid flow in fracture 5m into host rock
c        ql_3m--the liquid flow in fracture 3m into host rock
c        ql_dw--the liquid flow in fracture at drift wall
c        ql_dsT--the liquid flow at the top of the dripshield
c        ql_dsS--the liquid flow at the side of the dripshield
c        ql_inv--the liquid flow in the invert
c        xa_ds--the air mass fraction at the dripshield
c        P_ds--gas pressure at the dripshield
c        Pc_ds--the capillary pressure at dripshield
c        Pc_inv--the capillary pressure at invert
c        PcM_dw--matrix capillary pressure at drift wall
c        PcF_dw--fracture capillary pressure at drift wall
c      qw_dw--the water flux in the gas phase at the drift wall
c        qa_dw--the air flux in the gas phase at the drift wall
c      qvpdsT--the evaporation rate at the top of the drip shield
c      qvpdsP--the evaporation rate at the perimeter of the drip shield
c      qvpbfp--the evaporation rate at backfill spoil peak
c        qvpinv--the evaporation rate at the invert
c        PAwpT--waste package temperature
c        PAwpRH--waste package relative humidity
c        PAdsT--dripshield temperature
c        PAdsRH--driphield relative humidity
c
c
c
c

          do k1=1,ninf
           facttb(k1) = 0.
          enddo

          do ii=1,ninf
            noent(ii)=0
          enddo

c
c
c
c.....open the results files for the average values within a bin
c      this information will require the number of infiltration bins
c

      do k = 1,ninf
```

```
      Tmaxo = 0.

c.....compute the infiltration rate bin factor so that a bin
c     averaged value can be computed
c
       open(106-k,file=outfile(k),status='old')
       read(106-k,'(a)') xinfillabel

         do m = 1,iinf(k)
       read(106-k,'(a)') infile4
         open(666,file=infile4,status='old')
 21      read(666,6) name
 6    format(a4)
      if(name .ne. 'frac') goto 21
      read(666,10) factbin(k,m)
 10   format(29x,f8.6)
      facttb(k) = factbin(k,m)+facttb(k)
         end do
       close (106-k)

c......re-open the files to obtain the coordinate locations
c
       open(106-k,file=outfile(k),status='old')
       read(106-k,'(a)') xinfillabel


         do m = 1,iinf(k)
       read(106-k,'(a)') infile4
         open(667,file=infile4,status='old')
 81      read(667,6) name
      if(name .ne. 'Loca') goto 81
      read(667,41) coord1(k,m)
      read(667,41) coord2(k,m)
 41   format(23x,f9.2)
         end do
       close (106-k)

       open(106-k,file=outfile(k),status='old')
       read(106-k,'(a)') xinfillabel


         do m = 1,iinf(k)
       read(106-k,'(a)') infile4
         open(668,file=infile4,status='old')
 82      read(668,6) name
      if(name .ne. 'Infi') goto 82
        read (668, '(a)') ch
□
        read (ch(26:),*) finf(k,m)
□
         end do
       close (106-k)


c
c
c......Name and open the output files
c
c
```

```
        write (*,*) 'Computing all averages for E0130'
c       write (*,*) k
        read(3,'(a)') resultsbinfile(k)
      open(206-k,file=resultsbinfile(k),status='new')
      open(106-k,file=outfile(k),status='old')
        read(106-k,'(a)') xinfillabel
        write(206-k,*) 'Infiltration Bin:'
        write(206-k,*) xinfillabel
        write(206-k,*) resultsbinfile(k)
          if(iinf(k) .eq. 0) then
          write(206-k,*) 'No Entries in this Bin'
          end if

        write (*,*) 'Computing the RIP raw values'
c     @ --this is the raw value file for RIP'
c       write (*,*) k
        read(3,'(a)') resultsbinfile2(k)
      open(306-k,file=resultsbinfile2(k),status='new')
      write(306-k, *) 'Infiltration Bin:'
      write(306-k,*) xinfillabel

      write(306-k,*) resultsbinfile2(k)
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(306-k,*)'Time (yr), Waste Pack Temp.(C), Drip shield temp.
     @ (C), Drift wall temp.(C), Invert temp. (C), Waste pack RH, Drip
     @ shield RH, Drift wall RH, Backfill RH, Invert RH, Liquid Satr. @
     @ Drip Shield, Liquid Satr.@Invert, Air mass Frac, Water Vapor flux
     @ at Dwall (kg/yr/m of drift), Air flux at Dwall(kg/yr/m of drift),
     @ A Drip Shield Evapo. rate (m3/yr), Backfill Evapo. Rate (m3/yr),
     @ Invert Evapo. Rate (m3/yr), Percolation Flux at 5 m (mm/yr), Vol
     @ume flow at top dripshield (m3/yr), volume flow at invert (m3/yr),
     @ Top of the dripshield Temp (C)'

          if(iinf(k) .eq. 0) then
          write(306-k,*) 'No Entries in this Bin'
          end if


        write (*,*) 'Computing the RIP raw Qperc-only values'
c     @ --this is the raw value file for RIP'
c
       write (*,*) k
       read(3,'(a)') resultsbinfile2p(k)
      open(306+k,file=resultsbinfile2p(k),status='new')
      write(306+k, *) 'Infiltration Bin:'
      write(306+k,*) xinfillabel
      write(306+k,*) resultsbinfile2p(k)
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(306+k,*) ' Time (yr),  Percolation Flux at 5 m (mm/yr),
     @Percolation Flux at 3 m (mm/yr)'

          if(iinf(k) .eq. 0) then
          write(306+k,*) 'No Entries in this Bin'
          end if



c
c.....read each entry within an infiltration bin (e.g., ninf=1)
```

```
c     which may be the low infiltration bin as the following
c     (0-5 mm/yr)
c

        do i=1,iinf(k)

        Tmxmno = 0.

      read(106-k,'(a)') infile2
        open(777,file=infile2,status='old')
      write(206-k,*) infile2



 2      read(777,6) name
      if(name .ne. 'frac') goto 2
      read(777,10) fact
      fact=fact/facttb(k)
c
 801     read(777,6) name
      if(name .ne. 'time') goto 801

c
c.....This will read the first block of data in the raw files
c     resulting from the multiscale model--TSPA data
c
           do j = 1,npts
      read(777,*) timeyr(j), PAwpT(i,j), PAwpRH(i,j),
     @   PAdsT(i,j),PAdsRH(i,j)

      PAwpTf(i,j) = PAwpT(i,j)*fact
      PAwpRHf(i,j) = PAwpRH(i,j)*fact
      PAdsTf(i,j) = PAdsT(i,j)*fact
      PAdsRHf(i,j) = PAdsRH(i,j)*fact
           end do


c
c......continue reading the raw file for other variables
c       read the second block--temperature data
c

 802      read(777,6) name
      if(name .ne. 'time') goto 802


           do j = 1,npts
      read(777,*) timeyr(j), T_dw(i,j), T_5m(i,j), T_bfpk(i,j),
     @   T_ds(i,j), Tdstop(i,j), T_wp(i,j), T_inv(i,j)

      T_wpf(i,j) = T_wp(i,j)*fact
      T_5mf(i,j) = T_5m(i,j)*fact
      T_bfpkf(i,j) = T_bfpk(i,j)*fact
      T_dsf(i,j) = T_ds(i,j)*fact
      T_dwf(i,j) = T_dw(i,j)*fact
      T_invf(i,j) = T_inv(i,j)*fact
c     T_dwlowf(i,j) = T_dwlow(i,j)*fact
      Tdstopf(i,j) = Tdstop(i,j)*fact
c     T_dwtopf(i,j) = T_dwtop(i,j)*fact

      Tmaxn = DMAX1(T_wp(i,j), Tmaxo)
```

```
            if (Tmaxn .gt. Tmaxo) then
             mark=i
             Tmaxo=Tmaxn
            endif
      Tmax_min(i) = DMAX1(T_wp(i,j), Tmxmno)
            Tmxmno = Tmax_min(i)

             end do



c
c......continue reading the raw file for other variables
c       read the third block--Relative Humidity data
c

 803      read(777,6) name
      if(name .ne. 'time') goto 803


          do j = 1,npts
      read(777,*) timeyr(j), RH_dw(i,j), RH_bfp(i,j),
     @   RH_ds(i,j), RH_wp(i,j), RH_inv(i,j)

      RH_dwf(i,j) = RH_dw(i,j)*fact
      RH_bfpf(i,j) = RH_bfp(i,j)*fact
      RH_dsf(i,j) = RH_ds(i,j)*fact
      RH_wpf(i,j) = RH_wp(i,j)*fact
      RH_invf(i,j) = RH_inv(i,j)*fact
          end do

c
c......continue reading the raw file for other variables
c       read the fourth block--Liquid Saturation data
c

 804      read(777,6) name
      if(name .ne. 'time') goto 804


          do j = 1,npts
      read(777,*) timeyr(j), Sl_dw(i,j), Sl_ds(i,j), Sl_inv(i,j)

      Sl_dwf(i,j) = Sl_dw(i,j)*fact
      Sl_dsf(i,j) = Sl_ds(i,j)*fact
      Sl_invf(i,j) = Sl_inv(i,j)*fact
          end do

c
c......continue reading the raw file for other variables
c       read the fifth block--liquid flux data
c

 805      read(777,6) name
      if(name .ne. 'time') goto 805


          do j = 1,npts
      read(777,*) timeyr(j), ql_5m(i,j), ql_3m(i,j),
     @   ql_dwtop(i,j), ql_dwbot(i,j), ql_dsT(i,j), ql_dsTag(i,j),
     @   ql_dsS(i,j),
```

```
     @   ql_inv(i,j)

      ql_5mf(i,j) = ql_5m(i,j)*fact
      ql_3mf(i,j) = ql_3m(i,j)*fact
      ql_dwtopf(i,j) = ql_dwtop(i,j)*fact
      ql_dwbotf(i,j) = ql_dwbot(i,j)*fact
      ql_dsTf(i,j) = ql_dsT(i,j)*fact
      ql_dsSf(i,j) = ql_dsS(i,j)*fact
      ql_invf(i,j) = ql_inv(i,j)*fact
      ql_dsTagf(i,j) = ql_dsTag(i,j)*fact
             end do

c
c......continue reading the raw file for other variables
c       read the sixth block--air mass fraction data
c

 806      read(777,6) name
      if(name .ne. 'time') goto 806


          do j = 1,npts
      read(777,*) timeyr(j), xa_ds(i,j)

      xa_dsf(i,j) = xa_ds(i,j)*fact
          end do

c
c......continue reading the raw file for other variables
c       read the seventh block--Gas-phase pressure data
c      (see next block.ndf)
c
c 807      read(777,6) name
c     if(name .ne. 'time') goto 807
c
c
c         do j = 1,npts
c     read(777,*) timeyr(j), P_ds(i,j)
c
c     P_dsf(i,j) = P_ds(i,j)*fact
c         end do
c
c
c
c......continue reading the raw file for other variables
c       read the eighth block--gas phase & Capillary pressure data
c

 808      read(777,6) name
      if(name .ne. 'time') goto 808


          do j = 1,npts
      read(777,*) timeyr(j), P_ds(i,j), Pc_ds(i,j), Pc_inv(i,j),
     @   PcM_dw(i,j), PcF_dw(i,j)

        P_dsf(i,j) = P_ds(i,j)*fact
      Pc_dsf(i,j) = Pc_ds(i,j)*fact
      Pc_invf(i,j) = Pc_inv(i,j)*fact
      PcM_dwf(i,j) = PcM_dw(i,j)*fact
      PcF_dwf(i,j) = PcF_dw(i,j)*fact
```

```
          end do
c
c......continue reading the raw file for other variables
c       read the ninth block--gas flux data
c

 809      read(777,6) name
     if(name .ne. 'time') goto 809


          do j = 1,npts
     read(777,*) timeyr(j), qw_dw(i,j)

     qw_dwf(i,j) = qw_dw(i,j)*fact
          end do


 812      read(777,6) name
     if(name .ne. 'time') goto 812


          do j = 1,npts
     read(777,*) timeyr(j), qa_dw(i,j)

     qa_dwf(i,j) = qa_dw(i,j)*fact
          end do


c
c......continue reading the raw file for other variables
c       read the tenth block--evaporation rate data
c

 810      read(777,6) name
     if(name .ne. 'time') goto 810


          do j = 1,npts
     read(777,*) timeyr(j), qvpdsT(i,j), qvpdsP(i,j),
    @   qvpbfp(i,j), qvpinv(i,j), qvpdwTp(i,j), qvpdwBt(i,j)

     qvpdsTf(i,j) = qvpdsT(i,j)*fact
     qvpdsPf(i,j) = qvpdsP(i,j)*fact
     qvpbfpf(i,j) = qvpbfp(i,j)*fact
     qvpinvf(i,j) = qvpinv(i,j)*fact
     qvpdwTpf(i,j) = qvpdwTp(i,j)*fact
     qvpdwBtf(i,j) = qvpdwBt(i,j)*fact
          end do

c
c......continue reading the raw file for other variables
c       read the eleventh block--pillar temperature data
c


 811      read(777,6) name
     if(name .ne. 'time') goto 811


          do j = 1,npts
```

```
      read(777,*) timeyr(j), Tp1299(i,j), Tp1369(i,j),
     @   Tp1489(i,j), Tp1689(i,j), Tp1014(i,j), Tp1039(i,j),
     @   Tp1514(i,j), Tp1664(i,j), Tp2264(i,j), Tp2414(i,j),
     @   Tp2768(i,j)

      Tp1299f(i,j) = Tp1299(i,j)*fact
      Tp1369f(i,j) = Tp1369(i,j)*fact
      Tp1489f(i,j) = Tp1489(i,j)*fact
      Tp1689f(i,j) = Tp1689(i,j)*fact
      Tp1039f(i,j) = Tp1039(i,j)*fact
      Tp1664f(i,j) = Tp1664(i,j)*fact
      Tp2768f(i,j) = Tp2768(i,j)*fact

      Tp1014f(i,j) = Tp1014(i,j)*fact
      Tp1514f(i,j) = Tp1514(i,j)*fact
      Tp2264f(i,j) = Tp2264(i,j)*fact
      Tp2414f(i,j) = Tp2414(i,j)*fact

           end do


c......the raw data has been processed for an infiltration bin
c      **close the i loop**
c


        end do



c......Now-Assemble the max & min WP temperature data for the bin
c

       if(iinf(k) .ne. 0) then
         do j = 1, npts
          Tmaxrip(k,j) = T_wp(mark,j)
         enddo

          Tmino = 1.E+10
         do i = 1,iinf(k)
           Tminn= DMIN1(Tmax_min(i), Tmino)
           if(Tminn .lt. Tmino) then
            imin = i
            Tmino=Tminn
           endif
         enddo

         do j = 1, npts
          Tminrip(k,j) = T_wp(imin,j)
         enddo
       endif

c......Indicate that the bin has no entries
c


      if(iinf(k) .eq. 0) then
      noent(k)=1
      goto 998
      end if
```

```
c
c......compute the infiltration bin averages of the PA variables
c       for WP T, RH and  DS T, RH
c       This is for a particular infiltration bin
c


      do j = 1,npts

      s1PAwpT = 0.
      s2PAwpRH = 0.
      s3PAdsT = 0.
      s4PAdsRH = 0.

       do i = 1,iinf(k)
        s1PAwpT= s1PAwpT + PAwpTf(i,j)
        s2PAwpRH=s2PAwpRH + PAwpRHf(i,j)
        s3PAdsT=s3PAdsT + PAdsTf(i,j)
        s4PAdsRH = s4PAdsRH + PAdsRHf(i,j)
       end do

        PAwpT1a(j) = s1PAwpT
        PAwpRH2a(j) = s2PAwpRH
        PAdsT3a(j)= s3PAdsT
        PAdsRH4a(j) = s4PAdsRH
      end do


c
c
c......compute the averages of the temperature data
c
      do j = 1,npts

      s1T_wp = 0.
      s2T_5m = 0.
      s3T_bfpk = 0.
      s4T_ds = 0.
      s5T_dw = 0.
      s6T_inv = 0.
c     s7T_dwlow = 0.
      s8Tdstop = 0.
c     s9T_dwtop = 0.

       do i = 1,iinf(k)
        s1T_wp = s1T_wp + T_wpf(i,j)
        s2T_5m = s2T_5m + T_5mf(i,j)
        s3T_bfpk = s3T_bfpk + T_bfpkf(i,j)
        s4T_ds = s4T_ds + T_dsf(i,j)
        s5T_dw=s5T_dw+T_dwf(i,j)
        s6T_inv=s6T_inv+T_invf(i,j)
c       s7T_dwlow=s7T_dwlow+T_dwlowf(i,j)
        s8Tdstop= s8Tdstop+Tdstopf(i,j)
c       s9T_dwtop = s9T_dwtop + T_dwtopf(i,j)
       end do

        T_wp1a(j) = s1T_wp
        TavgRIP(k,j)=s1T_wp
        T_5m2a(j) = s2T_5m
```

```
          T_bfpk3a(j)= s3T_bfpk
          T_ds4a(j) = s4T_ds
          T_dw5a(j) = s5T_dw
          T_inv6a(j) = s6T_inv
          TavgRIPinv(k,j)=s6T_inv
c         T_dwlow7a(j) = s7T_dwlow
          Tdstop8a(j) = s8Tdstop
c         T_dwtop9a(j) = s9T_dwtop
          TavgRIPdstop(k,j) = s8Tdstop
          TavgRIPdw(k,j)=s5T_dw
        end do


c
c
c......compute the averages of the relative humidity data
c
        do j = 1,npts

        s1RH_dw = 0.
        s2RH_bfp = 0.
        s3RH_ds = 0.
        s4RH_wp = 0.
        s5RH_inv = 0.

         do i = 1,iinf(k)
          s1RH_dw = s1RH_dw + RH_dwf(i,j)
          s2RH_bfp = s2RH_bfp + RH_bfpf(i,j)
          s3RH_ds = s3RH_ds + RH_dsf(i,j)
          s4RH_wp = s4RH_wp + RH_wpf(i,j)
          s5RH_inv=s5RH_inv + RH_invf(i,j)
         end do

          RH_dw1a(j) = s1RH_dw
          RH_bfp2a(j) = s2RH_bfp
          RH_ds3a(j)= s3RH_ds
          RH_wp4a(j) = s4RH_wp
          RH_inv5a(j) = s5RH_inv
          RHavgRIPin(k,j)=s5RH_inv
          RHavgRIPdw(k,j)=s1RH_dw
        end do


c
c
c......compute the averages of the liquid saturation data
c
        do j = 1,npts

        s1Sl_dw = 0.
        s2Sl_ds = 0.
        s3Sl_inv = 0.

         do i = 1,iinf(k)
          s1Sl_dw = s1Sl_dw + Sl_dwf(i,j)
          s2Sl_ds = s2Sl_ds + Sl_dsf(i,j)
          s3Sl_inv = s3Sl_inv + Sl_invf(i,j)
         end do

            S_lavgRIP(k,j) = s3Sl_inv
          Sl_dw1a(j) = s1Sl_dw
```

```
        Sl_ds2a(j) = s2Sl_ds
        Sl_inv3a(j)= s3Sl_inv
      end do

c
c
c......compute the averages of the liquid flux data
c
      do j = 1,npts

      s1ql_5m = 0.
      s2ql_3m = 0.
      s3ql_dwtop = 0.
      s8ql_dwbot = 0.
      s4ql_dsT = 0.
      s5ql_dsS = 0.
      s6ql_inv = 0.
      s7ql_dsTag = 0.
      s66ql_inv = 0.

       do i = 1,iinf(k)
        s1ql_5m = s1ql_5m + ql_5mf(i,j)
        s2ql_3m = s2ql_3m + ql_3mf(i,j)
        s3ql_dwtop = s3ql_dwtop + ql_dwtopf(i,j)
        s8ql_dwbot = s8ql_dwbot + ql_dwbotf(i,j)
        s4ql_dsT = s4ql_dsT + ql_dsTf(i,j)
        s5ql_dsS = s5ql_dsS+ql_dsSf(i,j)
        s6ql_inv=s6ql_inv+ql_invf(i,j)
        s7ql_dsTag = s7ql_dsTag + ql_dsTagf(i,j)
        s66ql_inv = s66ql_inv + abs( ql_invf(i,j) )
       end do

        ql_5m1a(j) = s1ql_5m
        ql_5mavgRIP(k, j)=s1ql_5m
        ql_3m2a(j) = s2ql_3m
        ql_dwtop3a(j)= s3ql_dwtop
        ql_dwbot8a(j)= s8ql_dwbot
        ql_dsT4a(j) = s4ql_dsT
        ql_dsS5a(j) = s5ql_dsS
        ql_inv6a(j) = s6ql_inv
        ql_invavgRIP(k,j)=s6ql_inv
        ql_invavgabs(k,j)=s66ql_inv
        ql_dsTag7a(j) = s7ql_dsTag
      end do


c
c
c......compute the averages of the air mass fraction data
c
      do j = 1,npts

      s1xa_ds = 0.

       do i = 1,iinf(k)
        s1xa_ds = s1xa_ds + xa_dsf(i,j)
       end do

        xa_ds1a(j) = s1xa_ds
      end do
```

```
c
c
c......compute the averages of the gas pressure data
c
      do j = 1,npts

      s1P_ds = 0.

       do i = 1,iinf(k)
        s1P_ds = s1P_ds + P_dsf(i,j)
       end do

        P_ds1a(j) = s1P_ds
      end do

c
c
c......compute the averages of the capillary pressure data
c
      do j = 1,npts

      s1Pc_ds = 0.
      s2Pc_inv = 0.
      s3PcM_dw = 0.
      s4PcF_dw = 0.

       do i = 1,iinf(k)
        s1Pc_ds = s1Pc_ds + Pc_dsf(i,j)
        s2Pc_inv = s2Pc_inv + Pc_invf(i,j)
        s3PcM_dw = s3PcM_dw + PcM_dwf(i,j)
        s4PcF_dw = s4PcF_dw + PcF_dwf(i,j)
       end do

        Pc_ds1a(j) = s1Pc_ds
        Pc_inv2a(j) = s2Pc_inv
        PcM_dw3a(j)= s3PcM_dw
        PcF_dw4a(j) = s4PcF_dw
      end do


c
c
c......compute the averages of the gas flux data
c
      do j = 1,npts

      s1qw_dw = 0.
      s2qa_dw = 0.

       do i = 1,iinf(k)
        s1qw_dw = s1qw_dw + qw_dwf(i,j)
        s2qa_dw = s2qa_dw + qa_dwf(i,j)
       end do

        qw_dw1a(j) = s1qw_dw
        qa_dw2a(j) = s2qa_dw
      end do


c
c
```

```
c......compute the averages of the evaporation rate data
c
      do j = 1,npts

      s1qvpdsT = 0.
      s2qvpdsP = 0.
      s3qvpbfp = 0.
      s4qvpinv = 0.
      s5qvpdwTp = 0.
      s6qvpdwBt = 0.


       do i = 1,iinf(k)
        s1qvpdsT = s1qvpdsT + qvpdsTf(i,j)
        s2qvpdsP = s2qvpdsP + qvpdsPf(i,j)
        s3qvpbfp = s3qvpbfp + qvpbfpf(i,j)
        s4qvpinv = s4qvpinv + qvpinvf(i,j)
        s5qvpdwTp = s5qvpdwTp + qvpdwTpf(i,j)
        s6qvpdwBt = s6qvpdwBt + qvpdwBtf(i,j)
       end do

        qvpdsT1a(j) = s1qvpdsT
        qvpdsP2a(j) = s2qvpdsP
        qvpbfp3a(j)= s3qvpbfp
        qvpinv4a(j) = s4qvpinv
        qvpavgRIPinv(k,j)=s4qvpinv
        qvpdwTp5a(j) = s5qvpdwTp
        qvpdwBt6a(j) = s6qvpdwBt
      end do


c
c
c....compute the average pillar temperatures
c

      do j = 1,npts

      s1Tpl299 = 0.
      s2Tpl369 = 0.
      s3Tpl489 = 0.
      s4Tpl689 = 0.
      s5Tp1039 = 0.
      s6Tp1664 = 0.
      s7Tp2768 = 0.
      s8Tp1014 = 0.
      s9Tp1514 = 0.
      s10Tp2264 = 0.
      s11Tp2414 = 0.


       do i = 1,iinf(k)
        s1Tpl299 = s1Tpl299 + Tpl299f(i,j)
        s2Tpl369 = s2Tpl369 + Tpl369f(i,j)
        s3Tpl489 = s3Tpl489 + Tpl489f(i,j)
        s4Tpl689 = s4Tpl689 + Tpl689f(i,j)
        s5Tp1039 = s5Tp1039 + Tp1039f(i,j)
        s6Tp1664 = s6Tp1664 + Tp1664f(i,j)
        s7Tp2768 = s7Tp2768 + Tp2768f(i,j)
        s8Tp1014 = s8Tp1014 + Tp1014f(i,j)
        s9Tp1514 = s9Tp1514 + Tp1514f(i,j)
```

```
        s10Tp2264 = s10Tp2264 + Tp2264f(i,j)
        s11Tp2414 = s11Tp2414 + Tp2414f(i,j)


       end do

        Tp12991a(j) = s1Tp1299
        Tp13692a(j) =s2Tp1369
        Tp14893a(j) = s3Tp1489
        Tp16894a(j)= s4Tp1689
        Tp10395a(j) = s5Tp1039
        Tp16646a(j) = s6Tp1664
        Tp27687a(j) = s7Tp2768

        Tp10148a(j) = s8Tp1014
        Tp15149a(j) = s9Tp1514
        Tp226410a(j) = s10Tp2264
        Tp241411a(j) = s11Tp2414

      end do



c
c.....write the infiltration bin raw information for RIP
c.....control the number of time prints
c

      do i=1,iinf(k)
       jcount=0
       do j = 1,npts

       if (j .eq. 1) then

        jcount = jcount + 1
        jtag = j
       else if (j .eq. npts) then

        jcount = jcount + 1
       else

           if (ql_5m(i,j) .eq. 0.) then
            jcount = jcount + 1
            imark0 = j
           else

            ch1 =  ql_5m(i,jtag)
              if(ch1 .eq. 0.) then
               jcount = jcount + 1
               jtag = j
               go to 89
              endif

         crate = (( ql_5m(i,j) - ql_5m(i,jtag) )/ ql_5m(i,jtag) )*100.
         crate1 = (( T_wp(i,j) - T_wp(i,jtag) )/ T_wp(i,jtag) )*100.

            if (abs(crate) .ge. prntfac .or. j-1 .eq. imark0 .or.
     @              abs(crate1) .ge. prntfac) then
             jcount = jcount+1
```

```
            jtag = j
           end if
 89         endif

      endif


        end do



       write(306-k,925) jcount
 925   format('The number of Rows = ', i3)
       write(306-k,926) factbin (k,i)
 926   format('The fraction of this history=',f8.6)
       write(306-k,*) 'Coordinate Location:'
       write(306-k,128) coord1(k,i)
 128  format('The easting coordinate = ', f9.2, ' m')
       write(306-k,129) coord2(k,i)
 129  format('The northing coordinate = ', f9.2, ' m')
       write(306-k,*) 'Infiltration rate:'
       write(306-k,130) finf(k,i)
 130  format('qinf = ', f9.5, ' mm/yr')
 927  format(f10.2, 21(2x, E13.6))
c23456789012345678901234567890123456789012345678901234567890123456789012


□
      do j = 1,npts

      if (j .eq. 1) then


           if (qvpdsT(i,j) .eq. -999.9 ) then

              if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
               RH_inv(i,j) = -999.9
              end if

      write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @  T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @  RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @  qa_dw(i,j), qvpdsT(i,j), qvpbfp(i,j),
     @  qvpinv(i,j),  ql_5m(i,j), ql_dsT(i,j), ql_inv(i,j)*
     @ (a_inv/1000.),Tdstop(i,j)
         jtag = j

             else


              if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
               RH_inv(i,j) = -999.9
              end if


        write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @  T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @  RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @  qa_dw(i,j), qvpdsT(i,j)/rho, qvpbfp(i,j)/rho,
     @  qvpinv(i,j)/rho,  ql_5m(i,j), ql_dsT(i,j)*(a_dsT/1000.)
     @  ,ql_inv(i,j)*(a_inv/1000.), Tdstop(i,j)
```

```
      jtag = j

           end if


  else if (j .eq. npts) then


           if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
            RH_inv(i,j) = -999.9
           end if


  write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
@   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
@   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
@   qa_dw(i,j), qvpdsT(i,j)/rho, qvpbfp(i,j)/rho,
@   qvpinv(i,j)/rho,  ql_5m(i,j), ql_dsT(i,j)*(a_dsT/1000.),
@  ql_inv(i,j)*(a_inv/1000.), Tdstop(i,j)

  else


     if(ql_5m(i,j) .eq. 0.) then

       if (qvpdsT(i,j) .eq. -999.9 ) then

         if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
          RH_inv(i,j) = -999.9
         end if



  write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
@   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
@   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
@   qa_dw(i,j), qvpdsT(i,j), qvpbfp(i,j),
@   qvpinv(i,j),  ql_5m(i,j), ql_dsT(i,j),ql_inv(i,j)
@  *(a_inv/1000.), Tdstop(i,j)
         imark0 = j


           else

           if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
            RH_inv(i,j) = -999.9
           end if


    write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
@   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
@   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
@   qa_dw(i,j), qvpdsT(i,j)/rho, qvpbfp(i,j)/rho,
@   qvpinv(i,j)/rho,  ql_5m(i,j), ql_dsT(i,j)*(a_dsT/1000.),
@   ql_inv(i,j)*(a_inv/1000.), Tdstop(i,j)
         imark0 = j
        end if

       else
```

```
            ch1 = ql_5m(i,jtag)
            if(ch1 .eq. 0.) then

              if (qvpdsT(i,j) .eq. -999.9 ) then

             if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
              RH_inv(i,j) = -999.9
             end if


c23456789012345678901234567890123456789012345678901234567890123456789012

          write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @   qa_dw(i,j), qvpdsT(i,j), qvpbfp(i,j),
     @   qvpinv(i,j), ql_5m(i,j), ql_dsT(i,j),ql_inv(i,j)*(a_inv/1000.)
     @ , Tdstop(i,j)
              jtag=j
              goto 71


              else

             if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
              RH_inv(i,j) = -999.9
             end if


c23456789012345678901234567890123456789012345678901234567890123456789012

          write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @   qa_dw(i,j), qvpdsT(i,j)/rho, qvpbfp(i,j)/rho,
     @   qvpinv(i,j)/rho,  ql_5m(i,j), ql_dsT(i,j)*(a_dsT/1000.),
     @   ql_inv(i,j)*(a_invT/1000.), Tdstop(i,j)
              jtag=j
              goto 71

            end if


            endif


c23456789012345678901234567890123456789012345678901234567890123456789012


        crate = (( ql_5m(i,j) - ql_5m(i,jtag) )/ ql_5m(i,jtag) )*100.
        crate1 = (( T_wp(i,j) - T_wp(i,jtag) )/ T_wp(i,jtag) )*100.

          if (abs(crate) .ge. prntfac .or. j-1 .eq. imark0 .or.
     @          abs(crate1) .ge. prntfac) then


            if (qvpdsT(i,j) .eq. -999.9 ) then

             if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
              RH_inv(i,j) = -999.9
```

```
              end if

             write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @   qa_dw(i,j), qvpdsT(i,j), qvpbfp(i,j),
     @   qvpinv(i,j), ql_5m(i,j), ql_dsT(i,j),ql_inv(i,j)*(a_inv/1000.)
     @ , Tdstop(i,j)
          jtag = j


             else

              if ( RH_inv(i,j) .eq. 0. .and. timeyr(j) .le. 50.) then
               RH_inv(i,j) = -999.9
              end if


             write(306-k,927) timeyr(j), T_wp(i,j), T_ds(i,j), T_dw(i,j),
     @   T_inv(i,j), RH_wp(i,j), RH_ds(i,j), RH_dw(i,j), RH_bfp(i,j),
     @   RH_inv(i,j), Sl_ds(i,j), Sl_inv(i,j), xa_ds(i,j), qw_dw(i,j),
     @   qa_dw(i,j), qvpdsT(i,j)/rho, qvpbfp(i,j)/rho,
     @   qvpinv(i,j)/rho,  ql_5m(i,j), ql_dsT(i,j)*(a_dsT/1000.),
     @   ql_inv(i,j)*(a_inv/1000.), Tdstop(i,j)
          jtag = j

             endif


          end if
 71          endif


       endif


         end do

c......write the percolation flux specific files.  This does not use
c      a predetermined set of time prints for use in the seepage
c      model--prints eacg point to extreme variability in q.liquid
c



        write(306+k,925) npts
        write(306+k,926) factbin (k,i)

        write(306+k,*) 'Coordinate Location:'

        write(306+k,128) coord1(k,i)

        write(306+k,129) coord2(k,i)

        write(306+k,*) 'Infiltration rate:'
        write(306+k,130) finf(k,i)
 939   format(f10.2, 2x, E13.6, 2x, E13.6)
c23456789012345678901234567890123456789012345678901234567890123456789012
```

```
      do j = 1, npts
              write(306+k,939) timeyr(j), ql_5m(i,j),ql_3m(i,j)
      enddo

c.....close the i loop for writing RIP raw values
c


        end do

c
c
c
c.....write the infiltration bin **averages** for each quantity
c     including time
c


      write(206-k,*) 'infiltration bin file:'
      write(206-k,*) outfile(k)
      write(206-k,*) 'average value outputs:'
      write(206-k,*) resultsbinfile(k)
      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average TSPA Variables'
      write(206-k,*)'Time (yr), WP-T (C), WP-RH, DS-T(C), DS-RH'

      do j = 1,npts
      write(206-k,901) timeyr(j),PAwpT1a(j), PAwpRH2a(j),
     @    PAdsT3a(j), PAdsRH4a(j)

 901    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6)
      enddo

      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average Temperature Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*)'Time (yr), WP temp (C), temp at 5m (C), temp at
     @ backfill peak(C), dripshield temp(C), drift wall temp (C), invert
     @ temp(C), dripshield top temp (C)'


      do j = 1,npts
      write(206-k,902) timeyr(j), T_wp1a(j), T_5m2a(j),
     @   T_bfpk3a(j), T_ds4a(j), T_dw5a(j), T_inv6a(j),
     @   Tdstop8a(j)

 902    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6,
     @    5x, E13.6, 5x, E13.6, 5x, E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average Relative Humidity Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*)'Time (yr), drift wall RH, backfill RH, dripshield
     @ RH, waste package RH, invert RH'
```

```
      do j = 1,npts
      write(206-k,903) timeyr(j), RH_dw1a(j), RH_bfp2a(j),
     @   RH_ds3a(j), RH_wp4a(j), RH_inv5a(j)

 903    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6,
     @    5x, E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average Liquid Saturation Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*)'Time (yr), drift wall liq sat, dripshield liq sat
     @, invert liq sat'


      do j = 1,npts
      write(206-k,904) timeyr(j), Sl_dw1a(j), Sl_ds2a(j),
     @   Sl_inv3a(j)

 904    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average liquid flux Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*)'Time (yr), liquid flux 5m (mm/yr), liquid flux 3m
     @ (mm/yr), liquid flux top driftW (mm/yr),  liquid flux top Dshield
     @ (mm/yr), liquid flux side Dshield (mm/yr),  liquid flux invert
     @(mm/yr), liquid flux top DS average (mm/yr), liquid flux bot drift
     @W (mm/yr)'


      do j = 1,npts
      write(206-k,905) timeyr(j), ql_5m1a(j), ql_3m2a(j),
     @   ql_dwtop3a(j), ql_dsT4a(j), ql_dsS5a(j), ql_inv6a(j),
     @   ql_dsTag7a(j), ql_dwbot8a(j)

 905    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6,
     @    5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, e13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average air mass fraction Variables'
      write(206-k,*) 'Time (yr), air mass fraction Dshield'


      do j = 1,npts
      write(206-k,906) timeyr(j), xa_ds1a(j)

 906    format(f10.2,5x,E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
```

```
      write(206-k,*) 'The average gas-phase pressure Variables'
      write(206-k,*) 'Time (yr), gas pressure (Pa)'


      do j = 1,npts
      write(206-k,907) timeyr(j), P_ds1a(j)

 907    format(f10.2,5x,E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average capillary pressure Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*) 'Time (yr), Cap pressure Dshield (Pa),  Cap press
     @ure @ invert (Pa), Cap pressure Dwall-Matrix (Pa),   Cap pressure
     @Dwall-fracture (Pa)'


      do j = 1,npts
      write(206-k,908) timeyr(j), Pc_ds1a(j), Pc_inv2a(j),
     @  PcM_dw3a(j), PcF_dw4a(j)

 908    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6)
      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average gas flux Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*) 'Time (yr), water vapor flux(kg/yr/m of drift),
     @air flux (kg/yr/m of drift)'


      do j = 1,npts
      write(206-k,909) timeyr(j), qw_dw1a(j), qa_dw2a(j)


 909    format(f10.2,5x,E13.6,5x,E13.6)
      enddo



      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average evaporation rate Variables'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*) 'Time (yr), Evaporation rate Dshield top (m3/yr),
     @Evaporation rate Dshield top perimeter (m3/yr), Evaporation rate
     @backfill pk (m3/yr), Evaporation rate invert (m3/yr), Evaporation
     @rate top DW (m3/yr), Evaporation rate bot DW (m3/yr)'

 910    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6, 5x, e13.6,
     @ 5x, e13.6)

      do j = 1,npts


        write(206-k,910) timeyr(j), qvpdsT1a(j)/rho,
```

```
     @  qvpdsP2a(j)/rho, qvpbfp3a(j)/rho,
     @  qvpinv4a(j)/rho, qvpdwTp5a(j)/rho, qvpdwBt6a(j)/rho

      enddo


      write(206-k,*)
      write(206-k,*)
      write(206-k,*) 'The average Pillar Temperatures'
c23456789012345678901234567890123456789012345678901234567890123456789012
      write(206-k,*) 'Time (yr), Tx=2.99m (C), Tx=3.69m (C), Tx=4.89m
     @(C), Tx=6.89 m (C), Tx=10.14 (C), Tx=10.39m (C), Tx=15.14m,
     @Tx=16.64m (C), Tx=22.65 (C), Tx=24.14m (C), Tx=27.68 (C)'


      do j = 1,npts
      write(206-k,911) timeyr(j),Tpl2991a(j), Tpl3692a(j),
     @  Tpl4893a(j), Tpl6894a(j), Tp10148a(j), Tp10395a(j),
     @  Tp15149a(j), Tp16646a(j), Tp226410a(j), Tp241411a(j),
     @  Tp27687a(j)


 911    format(f10.2,5x,E13.6,5x,E13.6,5x,E13.6,5x,E13.6,
     @    5x, E13.6, 5x, E13.6, 5x, E13.6, 5x, e13.6,
     @ 5x, e13.6, 5x, e13.6, 5x, e13.6)
      enddo




 998  close(206-k)
      close(306-k)

c
c.....read the next infiltration bin and start process over--
c.....The portion of the routine from this point on up to the beginning
c     of the routine is completely general for any number of infiltration
c     bins specified in the parameter statement listed near the top of the
c     routine
c     **end the k loop**

      end do


c......Now--write the average results to individual files for RIP
c
c
c
c23456789012345678901234567890123456789012345678901234567890123456789012
 7    format(';', a70)
 8    format(';', 'The Average Waste Package Surface Temp (C)')
 9    format(';', 'The Average Invert Liquid Saturation')
 12   format(';', 'The Average Liquid Flux at 5 m (mm/yr)')
 27   format(';', 'The Maximum Waste Package Surface Temp (C)')
 74   format(';', 'The Minimum Waste Package Surface Temp (C)')
 75   format(';', 'The Average Invert Temp (C)')
 76   format(';', 'The Average Invert Rel. Humidity')
 77   format(';', 'The Average Invert Evaporation rate (m3/yr)')
 13   format(';', 'Time(yr)',',', ' Bin Weight= ', E13.6)
 14   format(';', a80)
```

```
 80    format(';', 'The Average Top Dripshield Temp (C)')
 91    format(';', 'The Average Invert Percolation Flux (m3/yr)')
 92    format(';', 'The Absolute Average Invert Percolation Flux
     @   (m3/yr)')
 93    format(';', 'The Average Drift Wall Temp (C)')
 94    format(';', 'The Average Drift Wall RH')
 928     format(f10.2, ',', E13.6)


c.....Begin building the RIP column files for averages, maximum, minimum Ts
c     invert, etc

      do  k = 1, ninf

c
c.....Average Temperature

      write (*,*) 'Writing T average value file for RIP'
      read(3,'(a)') resultsbinfile3(k)
      open(406-k,file=resultsbinfile3(k),status='new')
      write(406-k,8)
      write(406-k,7) resultsbinfile3(k)
      write(406-k,13) facttb(k)
      write(406-k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(406-k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(406-k,928) timeyr(j), TavgRIP(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(406-k,928) timeyr(j), TavgRIP(k,j)
       else
        crate= ( (TavgRIP(k,j)-TavgRIP(k,jtag))/TavgRIP(k,jtag) )
     @  *100.


            if(abs(crate) .ge. prntfac) then
                 write(406-k,928) timeyr(j), TavgRIP(k,j)
                 jtag = j
                end if

       end if

          end do
         end if

      close(406-k)


c.....Average Liquid Saturation

        write (*,*) 'Writing S_L average value file for RIP'
        read(3,'(a)') resultsbinfile3a(k)
        open(406+k,file=resultsbinfile3a(k),status='new')
        write(406+k,9)
      write(406+k,7) resultsbinfile3a(k)
```

```
      write(406+k,13) facttb(k)
      write(406+k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(406+k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(406+k,928) timeyr(j), S_lavgRIP(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(406+k,928) timeyr(j), S_lavgRIP(k,j)
       else


          if (S_lavgRIP(k,j) .eq. 0.) then
            write(406+k,928) timeyr(j), S_lavgRIP(k,j)
            imark0=j
          else

             ch1 = S_lavgRIP(k,jtag)
              if(ch1 .eq. 0.) then
               write(406+k,928) timeyr(j), S_lavgRIP(k,j)
               jtag=j
               goto 88
              endif
      crate= ( (S_lavgRIP(k,j)-S_lavgRIP(k,jtag))/S_lavgRIP(k,jtag)
     @     ) *100.


            if(abs(crate) .ge. prntfac .or.
     @              j-1 .eq. imark0) then
                 write(406+k,928) timeyr(j), S_lavgRIP(k,j)
                 jtag = j
                end if
88          endif
       end if

          end do
         end if
      close(406+k)

c23456789012345678901234567890123456789012345678901234567890123456789012
□

c.....Average liquid flux at 5 m


        write (*,*) 'Writing Q_perc average value file for RIP'

       read(3,'(a)') resultsbinfile3b(k)

      open(506-k,file=resultsbinfile3b(k),status='new')


      write(506-k,12)
      write(506-k,7) resultsbinfile3b(k)
      write(506-k,13) facttb(k)
      write(506-k,14) outfile(k)
```

```
      if (noent(k) .ne. 0) then
           write(506-k,*) 'No Entries for this Bin'
      else

       do j = 1,npts
      if ( j .eq. 1 ) then
       write(506-k,928) timeyr(j), ql_5mavgRIP(k,j)
       jtag = j
      else if (j .eq. npts) then
       write(506-k,928) timeyr(j), ql_5mavgRIP(k,j)
      else

         if (ql_5mavgRIP(k,j) .eq. 0.) then
            write(506-k,928) timeyr(j), ql_5mavgRIP(k,j)
            imark0 = j
         else

            ch1 = ql_5mavgRIP(k,jtag)
             if(ch1 .eq. 0.) then
              write(506-k,928) timeyr(j), ql_5mavgRIP(k,j)
              jtag=j
              goto 87
             endif


       crate= ( (ql_5mavgRIP(k,j)-ql_5mavgRIP(k,jtag))
     @        /ql_5mavgRIP(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac .or. j-1 .eq.
     @              imark0) then
                write(506-k,928) timeyr(j), ql_5mavgRIP(k,j)
                jtag = j
               end if
87        endif
       end if

          end do
         end if

      close(506-k)

c.....Maximum Temperature


        write (*,*) 'Writing Tmax value file for RIP'

       read(3,'(a)') resultsbinfile4(k)

      open(506+k,file=resultsbinfile4(k),status='new')

      write(506+k,27)
      write(506+k,7) resultsbinfile4(k)
      write(506+k,13) facttb(k)
      write(506+k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(506+k,*) 'No Entries for this Bin'
```

```
      else

       do j = 1,npts
      if ( j .eq. 1 ) then
       write(506+k,928) timeyr(j), Tmaxrip(k,j)
       jtag = j
      else if (j .eq. npts) then
       write(506+k,928) timeyr(j), Tmaxrip(k,j)
      else
       crate= ( (Tmaxrip(k,j)-Tmaxrip(k,jtag))
     @        /Tmaxrip(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac) then
                write(506+k,928) timeyr(j), Tmaxrip(k,j)
                jtag = j
               end if

      end if

         end do
        end if
     close(506+k)

c.....Minimum Temperature


       write (*,*) 'Writing Tmin value file for RIP'
      read(3,'(a)') resultsbinfile5(k)
     open(606-k,file=resultsbinfile5(k),status='new')

     write(606-k,74)
     write(606-k,7) resultsbinfile5(k)
     write(606-k,13) facttb(k)
     write(606-k,14) outfile(k)



      if (noent(k) .ne. 0) then
           write(606-k,*) 'No Entries for this Bin'
      else

       do j = 1,npts
      if ( j .eq. 1 ) then
       write(606-k,928) timeyr(j), Tminrip(k,j)
       jtag = j
      else if (j .eq. npts) then
       write(606-k,928) timeyr(j), Tminrip(k,j)
      else
       crate= ( (Tminrip(k,j)-Tminrip(k,jtag))
     @        /Tminrip(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac) then
                write(606-k,928) timeyr(j), Tminrip(k,j)
                jtag = j
               end if

      end if

         end do
```

```
         end if
      close(606-k)


c.....Average Invert T

        write (*,*) 'Writing Tinvert value file for RIP'

       read(3,'(a)') resultsbinfile6(k)

      open(606+k,file=resultsbinfile6(k),status='new')

      write(606+k,75)
      write(606+k,7) resultsbinfile6(k)
      write(606+k,13) facttb(k)
      write(606+k,14) outfile(k)



       if (noent(k) .ne. 0) then
            write(606+k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(606+k,928) timeyr(j), TavgRIPinv(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(606+k,928) timeyr(j), TavgRIPinv(k,j)
       else
        crate= ( (TavgRIPinv(k,j)-TavgRIPinv(k,jtag))
     @         /TavgRIPinv(k,jtag) ) *100.


            if(abs(crate) .ge. prntfac) then
                 write(606+k,928) timeyr(j), TavgRIPinv(k,j)
                 jtag = j
                end if

       end if

          end do
         end if
      close(606+k)

c.....Average Invert RH


        write (*,*) 'Writing RHinvert value file for RIP'

       read(3,'(a)') resultsbinfile7(k)

      open(706-k,file=resultsbinfile7(k),status='new')

      write(706-k,76)
      write(706-k,7) resultsbinfile7(k)
      write(706-k,13) facttb(k)
      write(706-k,14) outfile(k)
```

```
      if (noent(k) .ne. 0) then
           write(706-k,*) 'No Entries for this Bin'
      else

       do j = 1,npts
      if ( j .eq. 1 ) then

           if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
            RHavgRIPin(k,j) = -999.9
           end if

       write(706-k,928) timeyr(j), RHavgRIPin(k,j)
       jtag = j
      else if (j .eq. npts) then

           if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
            RHavgRIPin(k,j) = -999.9
           end if

       write(706-k,928) timeyr(j), RHavgRIPin(k,j)
      else

           if ( RHavgRIPin(k,j) .eq. 0. .and. timeyr(j) .le. 50.) then
            RHavgRIPin(k,j) = -999.9
           end if


       crate= ( (RHavgRIPin(k,j)-RHavgRIPin(k,jtag))
     @         /RHavgRIPin(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac) then
                write(706-k,928) timeyr(j), RHavgRIPin(k,j)
                jtag = j
               end if

      end if

         end do
        end if
     close(706-k)


c.....Average Invert evaporation rate

       write (*,*) 'Writing Q_evapinvert value file for RIP'

      read(3,'(a)') resultsbinfile8(k)

     open(706+k,file=resultsbinfile8(k),status='new')

     write(706+k,77)
     write(706+k,7) resultsbinfile8(k)
     write(706+k,13) facttb(k)
     write(706+k,14) outfile(k)


      if (noent(k) .ne. 0) then
           write(706+k,*) 'No Entries for this Bin'
```

```
else

 do j = 1,npts
if ( j .eq. 1 ) then

   qvpavgRIPinv(k,j)=-999.9

 write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)
 jtag = j


else if (j .eq. npts) then
 write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)/rho
else

   if (qvpavgRIPinv(k,j)/rho .eq. 0.) then

      if ( qvpavgRIPinv(k,j)  .eq. -999.9) then

     write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)
     imark0 = j

        else


     write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)/rho
     imark0 = j

        endif


   else

     ch1 = (qvpavgRIPinv(k,jtag)/rho)
       if(ch1 .eq. 0.) then

         if ( qvpavgRIPinv(k,j)  .ge. -1001.
@             .and. qvpavgRIPinv(k,j) .le. -999.  ) then

             qvpavgRIPinv(k,j)=-999.9

        write(706+k,928) timeyr(j),qvpavgRIPinv(k,j)
        jtag=j
        goto 83

         else

        write(706+k,928) timeyr(j),qvpavgRIPinv(k,j)/rho
        jtag=j
        goto 83

         endif

       endif


  crate= ( (qvpavgRIPinv(k,j)/rho-qvpavgRIPinv(k,jtag)/rho)
@       /(qvpavgRIPinv(k,jtag)/rho) ) *100.

     if(abs(crate) .ge. prntfac .or. j-1 .eq.
```

```
     @              imark0) then

                 if ( qvpavgRIPinv(k,j)  .ge. -1001.
     @               .and. qvpavgRIPinv(k,j) .le. -999.  ) then

                     qvpavgRIPinv(k,j)=-999.9


                  write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)
                  jtag = j

                   else

                  write(706+k,928) timeyr(j), qvpavgRIPinv(k,j)/rho
                  jtag = j

                   endif

                 end if
 83         endif
       end if

          end do
         end if

      close(706+k)



c
c.....Average DS Temperature

      write (*,*) 'Writing T DS average value file for RIP'
      read(3,'(a)') resultsbinfile9(k)
      open(750-k,file=resultsbinfile9(k),status='new')
      write(750-k,80)
      write(750-k,7) resultsbinfile9(k)
      write(750-k,13) facttb(k)
      write(750-k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(750-k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(750-k,928) timeyr(j), TavgRIPdstop(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(750-k,928) timeyr(j), TavgRIPdstop(k,j)
       else
        crate= ( (TavgRIPdstop(k,j)-TavgRIPdstop(k,jtag))
     @ /TavgRIPdstop(k,jtag) )*100.


            if(abs(crate) .ge. prntfac) then
                 write(750-k,928) timeyr(j), TavgRIPdstop(k,j)
                 jtag = j
                end if
```

```
       end if

          end do
         end if

      close(750-k)

c23456789012345678901234567890123456789012345678901234567890123456789012

c.....Average Qperc.liq in the invert

        write (*,*) 'Writing Qperc_inv average value file for RIP'
        read(3,'(a)') resultsbinfile10(k)
        open(750+k,file=resultsbinfile10(k),status='new')
        write(750+k,91)
      write(750+k,7) resultsbinfile10(k)
      write(750+k,13) facttb(k)
      write(750+k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(750+k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(750+k,928) timeyr(j), ql_invavgRIP(k,j)*(a_inv/1000.)
        jtag = j
       else if (j .eq. npts) then
        write(750+k,928) timeyr(j), ql_invavgRIP(k,j)*(a_inv/1000.)
       else


          if (ql_invavgRIP(k,j) .eq. 0.) then
            write(750+k,928) timeyr(j), ql_invavgRIP(k,j)
     @        *(a_inv/1000.)
            imark0=j
          else

             ch1 = ql_invavgRIP(k,jtag)
             if(ch1 .eq. 0.) then
               write(750+k,928) timeyr(j), ql_invavgRIP(k,j)
     @        *(a_inv/1000.)
               jtag=j
               goto 66
              endif
c23456789012345678901234567890123456789012345678901234567890123456789012
      crate= ( (ql_invavgRIP(k,j)-ql_invavgRIP(k,jtag))/
     @ ql_invavgRIP(k,jtag) ) *100.


            if(abs(crate) .ge. prntfac .or.
     @              j-1 .eq. imark0) then
                 write(750+k,928) timeyr(j), ql_invavgRIP(k,j)
     @        *(a_inv/1000.)
                 jtag = j
                end if
66          endif
       end if

          end do
```

```
         end if
      close(750+k)


c.....Average drift wall T

        write (*,*) 'Writing T_DW value file for RIP'

       read(3,'(a)') resultsbinfile12(k)

      open(850+k,file=resultsbinfile12(k),status='new')

      write(850+k,93)
      write(850+k,7) resultsbinfile12(k)
      write(850+k,13) facttb(k)
      write(850+k,14) outfile(k)



       if (noent(k) .ne. 0) then
            write(850+k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
       if ( j .eq. 1 ) then
        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
        jtag = j
       else if (j .eq. npts) then
        write(850+k,928) timeyr(j), TavgRIPdw(k,j)
       else
        crate= ( (TavgRIPdw(k,j)-TavgRIPdw(k,jtag))
     @        /TavgRIPdw(k,jtag) ) *100.


            if(abs(crate) .ge. prntfac) then
                 write(850+k,928) timeyr(j), TavgRIPdw(k,j)
                 jtag = j
                end if

       end if

          end do
         end if
      close(850+k)

c.....Average Drift Wall RH


        write (*,*) 'Writing RH_DW value file for RIP'

       read(3,'(a)') resultsbinfile13(k)

      open(950-k,file=resultsbinfile13(k),status='new')

      write(950-k,94)
      write(950-k,7) resultsbinfile13(k)
      write(950-k,13) facttb(k)
      write(950-k,14) outfile(k)
```

```
      if (noent(k) .ne. 0) then
           write(950-k,*) 'No Entries for this Bin'
      else

       do j = 1,npts
      if ( j .eq. 1 ) then
       write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
       jtag = j
      else if (j .eq. npts) then
       write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
      else
       crate= ( (RHavgRIPdw(k,j)-RHavgRIPdw(k,jtag))
     @        /RHavgRIPdw(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac) then
               write(950-k,928) timeyr(j), RHavgRIPdw(k,j)
               jtag = j
              end if

      end if

         end do
        end if
     close(950-k)


     end do
c
c
c
c....All averages have been computed for RIP
c
c
c    This is an averaged value that disregardes the directionality
c    given in the raw data for the invert flux.  It has been requested
c    by the THC TSPA model
c


      do  k = 1, ninf

c23456789012345678901234567890123456789012345678901234567890123456789012

c.....Average ABS(Qperc.liq) in the invert

        write (*,*) 'Writing ABS(Qperc_inv) average value file for RIP'
        read(3,'(a)') resultsbinfile11(k)
        open(850-k,file=resultsbinfile11(k),status='new')
        write(850-k,92)
      write(850-k,7) resultsbinfile11(k)
      write(850-k,13) facttb(k)
      write(850-k,14) outfile(k)


       if (noent(k) .ne. 0) then
            write(850-k,*) 'No Entries for this Bin'
       else

        do j = 1,npts
```

```
      if ( j .eq. 1 ) then
       write(850-k,928) timeyr(j), ql_invavgabs(k,j)*(a_inv/1000.)
       jtag = j
      else if (j .eq. npts) then
       write(850-k,928) timeyr(j), ql_invavgabs(k,j)*(a_inv/1000.)
      else


         if (ql_invavgabs(k,j) .eq. 0.) then
           write(850-k,928) timeyr(j), ql_invavgabs(k,j)
     @       *(a_inv/1000.)
           imark0=j
         else

            ch1 = ql_invavgabs(k,jtag)
             if(ch1 .eq. 0.) then
              write(850-k,928) timeyr(j), ql_invavgabs(k,j)
     @       *(a_inv/1000.)
              jtag=j
              goto 67
             endif
c23456789012345678901234567890123456789012345678901234567890123456789012
      crate= ( (ql_invavgabs(k,j)-ql_invavgabs(k,jtag))/
     @ ql_invavgabs(k,jtag) ) *100.


           if(abs(crate) .ge. prntfac .or.
     @              j-1 .eq. imark0) then
                write(850-k,928) timeyr(j), ql_invavgabs(k,j)
     @       *(a_inv/1000.)
                jtag = j
               end if
 67        endif
      end if

         end do
        end if
      close(850-k)

      enddo


      close(3)



      stop
      end
```

Attachment V

Testing and Verification of the Drip Shield Evaporation Rate Abstraction (No Backfill Repository Design)

The Excel 97 spreadsheet used to compute the evaporation rate for a drip shield adjacent to an average commercial spent nuclear fuel (CSNF) waste package and defense high-level (HLW) waste package is tested and verified in order to ensure that it is operating as intended. The spreadsheet calculation computes the evaporation rate (in m^3/yr) by energy balance between the waste package heat output and the amount of incoming water that can be completely vaporized by this heat. The spreadsheet routine named, **evapds_wobackfill** (version 1.0), is tested by hand calculation and visual inspection to ensure correct implementation. As will be shown in the following analysis, the spreadsheet **evapds_wobackfill** and its component worksheets are correctly implemented. This analysis/calculation applies only to the no backfill repository design.

Input to the performance assessment (PA) abstracted evaporation rate at the drip shield requires a knowledge of the average waste package heat output, liquid water density, and the latent heat of vaporization. The average waste package heat output is computed by the spreadsheet using the repository heat loading information for TSPA-SR (CRWMS M&O 2000c) and SN9907T0872799.001 as input. The fluid properties are obtainable from any standard steam table for water.

The average heat output for each fuel type, CSNF and HLW, is computed from each of the individual waste package heat outputs. Consider first the CSNF waste package. Using SN9907T0872799.001 as input for the individual CSNF waste package heat outputs, the average CSNF heat output is computed by hand for the initial time (note that the heat output given at an initial time of 0.01 years is often rounded down in time as the heat output at an initial time of 0.0 years):

$$q_{wp} = \frac{539.7x21x4279 + 112.9x21x87 + 795.02x12x158 + 162.15x44x2889 + 20.46x24x6}{7419} = 9546.48W$$

including ventilation at 70% removal gives:

$$q_{wp} = (1-0.7)x9546.48W = 2863.94W$$

The hand calculations above include the heat output per assembly, the number of assemblies per waste package, and the total number of waste packages of each type all divided by the total number of waste packages. An excerpt of the data in the worksheet entitled "wpheats_csnf" (that employs this formula directly) is the following (the result given in Watts):

0.01	539.7	112.9	795.02	162.15	20.46	**9546.479871**	**2863.943961**
0.02	539.52	112.88	794.78	162.1	20.46	9543.376757	2863.013027
0.03	539.35	112.86	794.54	162.04	20.46	9540.223425	2862.067027
0.04	539.18	112.84	794.3	161.99	20.45	9537.241237	2861.172371
0.05	539	112.81	794.06	161.94	20.45	9534.135661	2860.240698
0.06	538.83	112.79	793.83	161.88	20.45	9530.984885	2859.295465

This averaging process is computed correctly by the worksheet as indicated above. An entry after ventilation heat removal is also considered (at 70 years):

$$q_{wp} = \frac{179.45x21x4279 + 45.14x21x87 + 258.59x12x158 + 51.42x44x2889 + 6.4x24x6}{7419} = 3131.85W$$

An excerpt of the averaged data from the worksheet entitled "wpheats_csnf" (that employs this formula) is the following (the result given in Watts):

50	228.15	55.47	331.6	66.65	8.47	4003.893951	4003.893951
55	213.91	52.45	310.64	62.2	7.87	3749.061431	3749.061431
60	201.09	49.73	291.88	58.23	7.31	3520.289098	3520.289098
65	189.41	47.29	274.17	54.65	6.82	3312.345305	3312.345305
70	179.45	45.14	258.59	51.42	6.4	**3131.848132**	**3131.848132**
75	169.78	43.19	245.68	48.56	6.02	2961.935338	2961.935338
80	161.5	41.42	232.57	45.97	5.67	2813.478172	2813.478172

The averaging process is computed correctly by the worksheet as indicated in the comparison analysis shown above. Based on these sample handcalcs, the averaging formula in the spreadsheet is correctly implemented and is shown to give the correct results required in the determination of an average CSNF waste package heat output as a function of time. Since PA is primarily concerned with post-closure performance, the focus of the calculation analysis is from 50 years on.

Now that the average heat output of the CSNF waste package is established by the worksheet (wpheats_csnf), the evaporation rate at the drip shield surface adjacent to an average CSNF waste package can be computed once the fluid properties of the incoming water are determined. The fluid properties are required in the abstraction as described by equation 5 in the AMR. Two methods are considered for the evaluation of the fluid properties:

(1) constant fluid properties evaluated at 60°C
(2) variable fluid properties based on an average drip shield temperature

Equation 5 can be applied to both methods (1) and (2) listed above with only the denominator differing between methods. Consider first method (1). Equation 5 is applied with the liquid water density and the latent heat of vaporization both evaluated at a single constant temperature of 60°C.

The resultant hand calculation gives the following (at 0.01 or 0.0 year):

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x2863.94}{983.19x2357600} x3600x24x365 = 19.48\frac{m^3}{yr}$$

An excerpt of the evaporation rate data (in m^3/yr) obtained from the component worksheet entitled "evap_csnf" is the following:

0.01	**19.482**
0.02	19.476
0.03	19.469
0.04	19.463
0.05	19.457
0.06	19.450

The energy balance formula is computed correctly by the worksheet as indicated above. An entry after ventilation heat removal is also considered (at 70 years and 1000 years, respectively):

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x3131.85}{983.19x2357600} x3600x24x365 = 21.30\frac{m^3}{yr}$$

and,

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x484.86}{983.19x2357600} x3600x24x365 = 3.3\frac{m^3}{yr}$$

An excerpt of the evaporation rate data (in m^3/yr) obtained from the worksheet entitled "evap_csnf" is the following:

65	22.532
70	**21.304**
75	20.149
80	19.139
85	18.201
90	17.380
95	16.598
100	15.923
150	11.620
200	9.643
250	8.460
300	7.639
350	6.999
400	6.473

450	6.018
500	5.626
550	5.273
600	4.968
650	4.691
700	4.433
750	4.205
800	3.989
850	3.788
900	3.605
950	3.440
1000	**3.298**

The CSNF evaporation rate (computed using the constant fluid properties method) is calculated correctly by the worksheet as indicated by the comparison analysis shown above. Based on these sample handcalcs, the evaporation rate formula in the spreadsheet is implemented correctly and is shown to give the correct results required in the determination of a drip shield evaporation rate for an average CSNF waste package as a function of time. The range of validity for this calculation is set by the time dependent results of the waste package heat output. The range of validity is from 0 to $1x10^6$ years.

The second method for computing the drip shield evaporation rate is also considered. This method computes the liquid water density and latent heat of vaporization in Equation 5 as a function of the average top drip shield surface temperature obtained from the mean infiltration flux TH abstraction. Therefore, the evaporation rate of the incoming water is dependent on the (varying) temperature of the drip shield. The average top drip shield temperature used to determine the fluid properties in Equation 5 is the infiltration rate bin averaged drip shield temperature encompassing the entire repository. This temperature is effectively a single average drip shield temperature over the entire repository as computed from the weighted infiltration rate bins used in the TSPA abstraction. The infiltration bin averaged drip shield temperature is computed in the worksheet entitled "DSavg-mean." This temperature is used to evaluate the incoming water properties. The temperature, and hence the fluid properties, varies with time. The spreadsheet calculation (at 60 years) of the average drip shield temperature used in the determination of the evaporation rate at the drip shield is checked by hand as the following. (The individual infiltration bin component temperatures are given in the worksheets "*mean" where * represents the infiltration rate bin range. The infiltration bin results used in this average are from the abstracted mean infiltration flux case for the no backfill repository design):

$$T_{ds} = 145.05x(2.733x10^{-3}) + 147.613x(0.139089) + 145.367x(0.533827) + 143.133x(0.321208) + 151.33x(3.124x10^{-3}) = 144.977°C$$

The averaging handcalc shown above applies each (5 total) of the infiltration bin drip shield temperatures and bin weights at a particular time. An excerpt from the worksheet entitled "DSavg-mean" (that implements the contents of this formula) is the following (results in degrees C):

53	130.924
55	137.879
60	**144.977**
65	144.806
70	141.388
80	134.157
100	123.103

It is noted that the averaging formula is correctly implemented in the worksheet. An additional point in time is also hand checked (100,000 years):

$T_{ds} = 19.6077x(2.733x10^{-3}) + 24.8554x(0.139089) + 22.3083x(0.533827) + 23.9499x(0.321208) + 26.241x(3.124x10^{-3}) = 23.194°C$

An excerpt from the worksheet entitled "DSavg-mean" (that implements the contents of this formula) is the following (results in degrees C):

30000	32.499
40000	29.077
50000	26.987
100000	**23.194**
200000	22.360
300000	22.282
400000	22.244
500000	22.182

The repository-wide drip shield temperature at this time point is also calculated correctly by the worksheet as indicated by the comparison analysis shown above. Based on these sample handcalcs, the averaging formula for the drip shield temperature is implemented correctly in the spreadsheet and is shown to give the correct results for a repository-wide average drip shield temperature. Now that the average temperature at the top of the drip shield is know at a number of time points (from 50 to $1x10^6$ years with the note that 50.2 years is rounded down to 50 years), this temperature is used as the guide at which the liquid water density and latent heat of vaporization are to be determined.

In order to match time points (between the average drip shield temperature curve just calculated and the average heat output curve previously calculated), a linear interpolation between neighboring points is used. The interpolation to the time points represented in the average heat output curve is shown in the worksheet entitled "DSavg-mean." The interpolation necessary to have consistent (with the average heat output curve for the CSNF) time points is spot checked to be correct. A sample hand check is the following (at 75 years):

$$T = 141.388 + (75 - 70)\frac{134.157 - 141.388}{80 - 70} = 137.773\,°C$$

Using the newly interpolated drip shield temperatures, the fluid properties are now evaluated as a function of the top drip shield temperature.

The repository-wide drip shield temperature is used to interpolate for the liquid water density and the latent heat of vaporization. The valid temperature range for the interpolation of these quantities is $T \geq 100°C$ (assigned the 100°C value) and $100°C \geq T \geq 20°C$. The interpolations are hand checked for a variety of drip shield temperatures as shown. The liquid density and latent heat values at a number of different temperatures are obtainable from any standard steam table.

Using T = 92.750°C; $\rho_l = 965.344 + (92.750-90)x(961.908-965.344)/(95-90) = 963.454$ kg/m^3
$h_{fg} = 2282.7 + (92.750-90)x(2269.8-2282.7)/(95-90) = 2275.605$ kJ/kg = 2,275,605 J/kg

Using T = 75.461°C; $\rho_l = 974.849 + (75.461-75)x(971.817-974.849)/(80-75) = 974.569$ kg/m^3
$h_{fg} = 2320.7 + (75.461-75)x(2308.1-2320.7)/(80-75) = 2319.538$ kJ/kg = 2,319,538 J/kg

Using T = 50.567°C; $\rho_l = 987.947 + (50.567-50)x(985.61-987.947)/(55-50) = 987.682$ kg/m^3
$h_{fg} = 2381.9 + (50.567-50)x(2369.8-2381.9)/(55-50) = 2380.527$ kJ/kg = 2,380,527.86 J/kg

Others are also checked (and found to be correct) in the valid ranges indicated above. An excerpt from the worksheet entitled "DSavg-mean" is the following:

93.722	962.786	2273096.2	5.959
92.750	**963.454**	**2275605.1**	5.575
91.828	964.088	2277983.4	5.243
90.888	964.734	2280409.4	4.943
90.063	965.301	2282537.8	4.664
89.292	965.808	2284513.1	4.418
88.510	966.319	2286513.8	4.184
87.754	966.814	2288449.8	3.969
87.009	967.302	2290356.4	3.771
86.294	967.770	2292187.8	3.594
85.657	968.187	2293818.2	3.442
80.152	971.720	2307716.2	2.348
75.461	**974.569**	**2319538.3**	1.830
71.752	976.706	2328754.9	1.576
68.697	978.433	2336305.8	1.420
66.285	979.774	2342239.8	1.330
64.346	980.841	2346995.2	1.268
62.623	981.771	2351200.5	1.209
61.102	982.592	2354910.3	1.161
59.792	983.288	2358107.0	1.110
58.482	983.923	2361303.6	1.080

57.342	984.475	2364085.7	1.036
56.202	985.028	2366867.9	0.998
55.187	985.520	2369344.6	0.970
54.172	985.997	2371804.8	0.932
53.238	986.434	2374063.7	0.903
52.305	986.870	2376322.7	0.873
51.436	987.276	2378425.7	0.845
50.567	**987.682**	**2380528.6**	0.817
43.660	990.724	2397115.9	0.605

It is noted that the required interpolations for the temperature dependent fluid properties (density and latent heat) applied in Equation 5 are correctly implemented in the spreadsheet as indicated in the comparison analysis above. The final step is to compute an evaporation rate based on these temperature dependent fluid properties.

Equation 5 is applied using the temperature dependent properties obtained at various times after waste emplacement. The hand calculations are shown for a number of different times.

At 50 years,

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x4003.894}{958.405x2256700} x3600x24x365 = 29.19\frac{m^3}{yr}$$

At 70 years,

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x3131.848}{958.405x2256700} x3600x24x365 = 22.833\frac{m^3}{yr}$$

At 1000 years,

$$\frac{\left(\frac{1}{2}\right)q_{wp}}{\rho_l h_{fg}} = \frac{0.5x484.86}{968.187x2293818} x3600x24x365 = 3.4\frac{m^3}{yr}$$

An excerpt form the worksheet "DSavg-mean" is the following:

50	100.701	958.405	2256700.0	**29.190**
55	137.879	958.405	2256700.0	27.332
60	144.977	958.405	2256700.0	25.664
65	144.806	958.405	2256700.0	24.148
70	141.388	958.405	2256700.0	**22.833**
75	137.773	958.405	2256700.0	21.594
80	134.157	958.405	2256700.0	20.511

85	131.394	958.405	2256700.0	19.506
90	128.630	958.405	2256700.0	18.626
95	125.866	958.405	2256700.0	17.789
100	123.103	958.405	2256700.0	17.065
150	109.848	958.405	2256700.0	12.454
200	103.915	958.405	2256700.0	10.335
250	100.694	958.405	2256700.0	9.066
300	98.737	959.290	2260009.8	8.168
350	97.227	960.348	2263966.1	7.462
400	95.948	961.244	2267316.4	6.884
450	94.791	962.052	2270339.7	6.387
500	93.722	962.786	2273096.2	5.959
550	92.750	963.454	2275605.1	5.575
600	91.828	964.088	2277983.4	5.243
650	90.888	964.734	2280409.4	4.943
700	90.063	965.301	2282537.8	4.664
750	89.292	965.808	2284513.1	4.418
800	88.510	966.319	2286513.8	4.184
850	87.754	966.814	2288449.8	3.969
900	87.009	967.302	2290356.4	3.771
950	86.294	967.770	2292187.8	3.594
1000	85.657	968.187	2293818.2	**3.442**
1500	80.152	971.720	2307716.2	2.348
2000	75.461	974.569	2319538.3	1.830

The CSNF evaporation rate (computed using the temperature dependent fluid properties method) is calculated correctly by the worksheet as indicated by the comparison analysis shown above. Based on these sample handcalcs, the evaporation rate formula in the spreadsheet is implemented correctly and is shown to give the correct results required in the determination of a drip shield evaporation rate for an average CSNF waste package as a function of time. The range of validity for this calculation is set by the time dependent results of the waste package heat output. The range of validity is from 0 to 1×10^6 years. Since the drip shield evaporation rates are nearly identical (refer to Section 6.3.10 in this AMR) for the different methods used to evaluate fluid properties in Equation 5, the less complex constant fluid property method is used in the abstraction for both waste package types.

An analogous spot checking procedure is followed for the average HLW drip shield evaporation rate time-history curve used in the TSPA abstraction. Both the average heat output and drip shield evaporation rate formulas are implemented in the spreadsheet correctly. The details of the abstraction for the HLW result is given in the following worksheets entitled:

- wpheats_hlw (gives the computation for the average HLW heat output)
- evap_hlw (gives the computation for the evaporation rate at a drip shield adjacent to an average HLW)

The drip shield evaporation rate data (in m^3/yr) for the average CSNF and HLW waste packages

were required by the TSPA model to be at the same time points represented in the overall TH abstraction data (e.g., waste package temperature, drip shield temperature, ...). Consequently, the evaporation rate data (as derived is representative of the time points in the heat output curve) is linearly interpolated to the time points represented in the TH abstraction time-history curves. The results of the interpolation for each waste package type are shown in Figures V-1 and V-2. The curve denoted (Constant FP) represents the constant fluid property solution described in the preceding text and in Section 6.3.10 of the AMR. The individual points represent the interpolated data points for the evaporation rates required as input to the TSPA model. From the figures, it is noted that the interpolation is computed correctly.

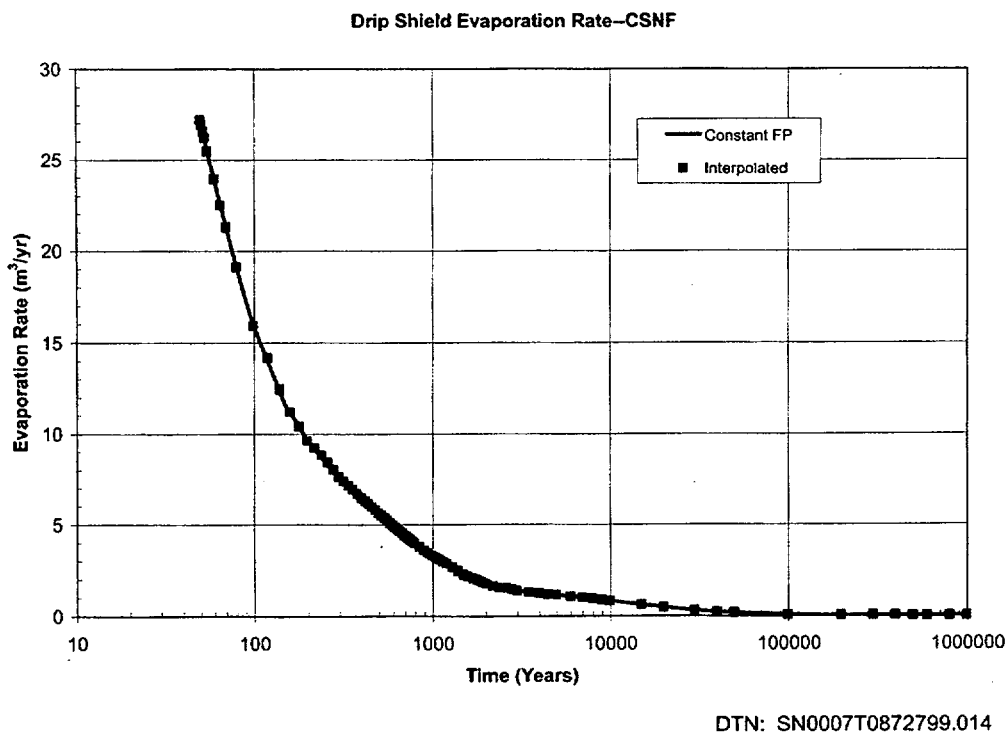

Figure V-1. Testing the Interpolation Performed for the Average CSNF Evaporation Rate

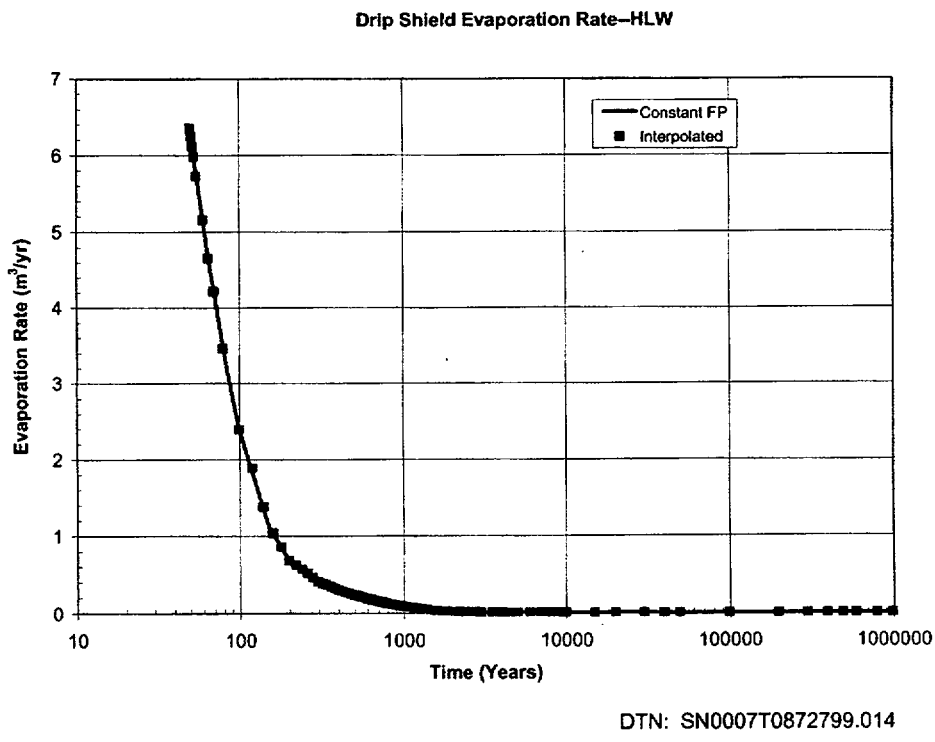

Figure V-2. Testing the Interpolation Performed for the Average HLW Evaporation Rate

Attachment VI
TH Abstraction Routine

(extinf)

This attachment contains documentation of the hand-check to demonstrate that the Subroutine **extinf** works correctly. This routine was written in Fortran 77 and reads in the TH data files and searches for and prints out the glacial infiltration rates for each TH data set. Once the subroutine has looped through all of the files, then the waste package name, location, and infiltration rate are printed out. The name of the raw output file is "output."

There are six versions of the routine **extinf** used in this AMR. A version of this subroutine was created for each of the three infiltration flux cases and for the backfill and no backfill design options; version 1.00 for the mean case with backfill, version 1.01 for the high case with backfill, version 1.02 for the low case with backfill, version 1.03 for the mean case without backfill, version 1.04 for the high case without backfill, and version 1.05 for the low case without backfill. The only difference between versions of the routine is the name of the input files and output files. All six subroutines are documented in this attachment.

A copy of all six routines can be found in DTN: SN0007T0872799.014 in the Zip file called extinfil.ZIP. The input files for the six routines can be found in the same DTN. The output files for the six routines can be found in the same DTN in the files called: Infil.dat.bf.mean, Infil.dat.bf.high, Infil.dat.bf.low, Infil.dat.nbf.mean, Infil.dat.nbf.high, and Infil.dat.nbf.low.

Routine extinf Version 1.00.

This routine was written to extract the mean glacial infiltration rates from each of the 623 the waste package locations for the backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five data files:

RIP_csnf_d0010500_bin0-3_mean
RIP_csnf_d0010500_bin3-10_mean
RIP_csnf_d0010500_bin10-20_mean
RIP_csnf_d0010500_bin20-60_mean
RIP_csnf_d0010500_bin-60_mean

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that appear on the next four lines of the input data set.

```
C extinf.f
C_____________________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates (mm/yr)
C
C Software Routine extinf Version 1.00 (for mean infiltration flux
C                                       case map)
C                                       MTI 12/8/99
C_____________________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5,FILE='RIP_csnf_d0010500_bin0-3_mean', STATUS='OLD')
      OPEN (UNIT=6,FILE='RIP_csnf_d0010500_bin3-10_mean', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d0010500_bin10-20_mean', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d0010500_bin20-60_mean', STATUS='OLD')
      OPEN (UNIT=9,FILE='RIP_csnf_d0010500_bin-60_mean', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
```

```
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.00 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first two lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
170095.39   232179.91       1.642
171292.39   234918.50       2.706
```

Sample Input extracted from the first input file "RIP_csnf_d0010500_bin0-3_mean".

```
 Coordinate Location:
The easting coordinate = 170095.39 m
The northing coordinate = 232179.90 m
 Infiltration rate:
qinf =   1.64195 mm/yr

 Coordinate Location:
The easting coordinate = 171292.39 m
The northing coordinate = 234918.50 m
 Infiltration rate:
qinf =   2.70601 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first two waste package locations. There were 623 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that version 1.00 of the routine was working correctly.

Routine extinf Version 1.01.

This routine is a variation of extinf Version 1.00 and was modified to extract the glacial low infiltration rate from each of the 623 waste package locations for the backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five data files:

RIP_csnf_d0010500_bin0-3_low
RIP_csnf_d0010500_bin3-10_low
RIP_csnf_d0010500_bin10-20_low
RIP_csnf_d0010500_bin20-60_low
RIP_csnf_d0010500_bin-60_low

```
C extinf.f
C_____________________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates ind infiltration rates (mm/yr)
C
C   Software Routine extinf Version 1.01 (for low infiltration flux
C                                         case map)
C                                         MTI 12/8/99
C_____________________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5, FILE='RIP_csnf_d0010500_bin0-3_low', STATUS='OLD')
      OPEN (UNIT=6, FILE='RIP_csnf_d0010500_bin3-10_low', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d0010500_bin10-20_low', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d0010500_bin20-60_low', STATUS='OLD')
      OPEN (UNIT=9, FILE='RIP_csnf_d0010500_bin-60_low', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
```

```
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.01 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first two lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
170435.17   233645.30       2.744
170443.89   233809.70       2.650
```

Sample Input from the first input file "RIP_csnf_d0010500_bin0-3_low".

```
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =   2.74355 mm/yr

 Coordinate Location:
The easting coordinate = 170443.89 m
The northing coordinate = 233809.70 m
 Infiltration rate:
qinf =   2.65049 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first two waste package locations. There were 623 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that version 1.01 of the routine was working correctly.

Routine extinf Version 1.02.

This routine is a variation of extinf Version 1.00 and was modified to extract the glacial high infiltration rates from the 623 waste package locationsfor the backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five data files:

RIP_csnf_d0010500_bin0-3_high
RIP_csnf_d0010500_bin3-10_high
RIP_csnf_d0010500_bin10-20_high
RIP_csnf_d0010500_bin20-60_high
RIP_csnf_d0010500_bin-60_high

```
C extinf.f
c_____________________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates ind infiltration rates (mm/yr)
C
C Software Routine extinf Version 1.02 (for high infiltration flux
C                                       case map)
C                                       MTI 12/8/99
c_____________________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5, FILE='RIP_csnf_d0010500_bin0-3_high', STATUS='OLD')
      OPEN (UNIT=6, FILE='RIP_csnf_d0010500_bin3-10_high', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d0010500_bin10-20_high', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d0010500_bin20-60_high', STATUS='OLD')
      OPEN (UNIT=9, FILE='RIP_csnf_d0010500_bin-60_high', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
```

```
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.02 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first two lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
171234.97   234921.50       9.696
171243.69   235085.91       9.921
```

Sample Input from the first filled input file "RIP_csnf_d0010500_bin3-10_high".

```
 Coordinate Location:
The easting coordinate = 171234.97 m
The northing coordinate = 234921.50 m
 Infiltration rate:
qinf =   9.69646 mm/yr

 Coordinate Location:
The easting coordinate = 171243.69 m
The northing coordinate = 235085.90 m
 Infiltration rate:
qinf =   9.92098 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first two waste package locations. There were 623 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that the routine was working correctly.

Routine extinf Version 1.03.

This routine was written to extract the glacial mean infiltration rates at each of the 610 waste package locations for the no backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five data files:

RIP_csnf_d1050100_bin0-3_mean
RIP_csnf_d1050100_bin3-10_mean
RIP_csnf_d1050100_bin10-20_mean
RIP_csnf_d1050100_bin20-60_mean
RIP_csnf_d1050100_bin-60_mean

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next four lines.

```
C extinf.f
C_____________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates (mm/yr)
C
C Software Routine extinf Version 1.00 (for mean infiltration flux
C                                       case maps)
C                                       MTI 5/17/00
C_____________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5,FILE='RIP_csnf_d1050100_bin0-3_mean', STATUS='OLD')
      OPEN (UNIT=6,FILE='RIP_csnf_d1050100_bin3-10_mean', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_mean', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_mean', STATUS='OLD')
      OPEN (UNIT=9,FILE='RIP_csnf_d1050100_bin-60_mean', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
```

```
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.03 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
171292.39   234918.50      2.705
171301.11   235082.91      2.860
171312.36   234917.41      2.282
```

Sample Input from the input file "RIP_csnf_d1050100_bin0-3_mean".

```
The fraction of this history=0.000976
 Coordinate Location:
The easting coordinate = 171292.39 m
The northing coordinate = 234918.50 m
 Infiltration rate:
qinf =   2.70452 mm/yr

The fraction of this history=0.000976
 Coordinate Location:
The easting coordinate = 171301.11 m
The northing coordinate = 235082.90 m
 Infiltration rate:
qinf =   2.85992 mm/yr

The fraction of this history=0.000586
 Coordinate Location:
The easting coordinate = 171312.36 m
The northing coordinate = 234917.40 m
 Infiltration rate:
qinf =   2.28189 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first three waste package locations checked. There were 610 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that the routine was working correctly.

Routine extinf Version 1.04.

This routine is a variation of extinf Version 1.03 and was modified to extract the glacial low infiltration rates from the 610 waste package locations for the no backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five data files:

RIP_csnf_d1050100_bin0-3_low
RIP_csnf_d1050100_bin3-10_low
RIP_csnf_d1050100_bin10-20_low
RIP_csnf_d1050100_bin20-60_low
RIP_csnf_d1050100_bin-60_low

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next four lines.

```
C extinf.f
C_____________________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates (mm/yr)
C
C Software Routine extinf Version 1.01 (for low infiltration flux
C                                       case map)
C                                       MTI 5/17/00
C_____________________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5,FILE='RIP_csnf_d1050100_bin0-3_low', STATUS='OLD')
      OPEN (UNIT=6,FILE='RIP_csnf_d1050100_bin3-10_low', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_low', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_low', STATUS='OLD')
      OPEN (UNIT=9,FILE='RIP_csnf_d1050100_bin-60_low', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
```

```
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.04 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
170435.17   233645.30      2.744
170443.89   233809.70      2.651
170452.61   233974.09      2.677
```

Sample Input from the input file "RIP_csnf_d1050100_bin0-3_low".

```
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =   2.74419 mm/yr

The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170443.89 m
The northing coordinate = 233809.70 m
 Infiltration rate:
qinf =   2.65114 mm/yr

The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170452.61 m
The northing coordinate = 233974.10 m
 Infiltration rate:
qinf =   2.67709 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first three waste package locations. There were 610 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that the routine was working correctly.

Routine extinf Version 1.05.

This routine is a variation of extinf Version 1.03 and was modified to extract the glacial high infiltration rates from the 610 waste package locationsfor the no backfill case. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The data can be found in the five input data files:

RIP_csnf_d1050100_bin0-3_high
RIP_csnf_d1050100_bin3-10_high
RIP_csnf_d1050100_bin10-20_high
RIP_csnf_d1050100_bin20-60_high
RIP_csnf_d1050100_bin-60_high

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next four lines.

```
C extinf.f
C_____________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates (mm/yr)
C
C Software Routine extinf Version 1.02 (for high infiltration flux
C                                       case map)
C                                       MTI 5/17/00
C_____________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5, FILE='RIP_csnf_d1050100_bin0-3_high', STATUS='OLD')
      OPEN (UNIT=6, FILE='RIP_csnf_d1050100_bin3-10_high', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_high', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_high', STATUS='OLD')
      OPEN (UNIT=9, FILE='RIP_csnf_d1050100_bin-60_high', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (7X,F9.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.3)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
```

```
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf** v 1.05 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. The following are the first three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year).

```
171234.97   234921.50      9.696
171243.69   235085.91      9.920
171264.92   234920.00      7.715
```

Sample Input from the input file "RIP_csnf_d1050100_bin3-10_high".

```
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171234.97 m
The northing coordinate = 234921.50 m
 Infiltration rate:
qinf =   9.69590 mm/yr

The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171243.69 m
The northing coordinate = 235085.90 m
 Infiltration rate:
qinf =   9.92042 mm/yr

The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171264.92 m
The northing coordinate = 234920.00 m
 Infiltration rate:
qinf =   7.71452 mm/yr
```

The locations and infiltration rates in the input and output files were the same for the first three waste package locations. There were 610 entries in the output file; this number matched the expected number of entries that should have been in the output file. This hand check verified that the routine was working correctly.

Attachment VII
TH Abstraction Routine
(extinf2)

This attachment contains documentation of the hand-check to demonstrate that the subroutine **extinf2** works correctly. This routine was written in Fortran 77 and reads in the TH data files, searches for, and prints out the present day mean/high/low infiltration rates at each TH waste package location. Since the abstraction data does not explicitly give the present day infiltration rate, the total liquid flux five meters above the drift at the start of the simulation (t = 0 years) is taken to be the thermally un-perturbed present day infiltration rate. Once the subroutine has looped through all of the files, then the waste package name, location, and infiltration rate are printed out. The name of the raw output file is "output."

There are three versions of the routine **extinf2** used in this AMR. A version of this subroutine was created for each of the three infiltration flux cases for the TSPA-SR no backfill design ; version 1.00 for the mean case , version 1.01 for the high case , version 1.02 for the low case. The only difference between versions of the routine is the name of the input files and output files. All three subroutines are documented in this attachment.

A copy of all three routines can be found in DTN: SN0007T0872799.014 in the Zip file called extinfil.ZIP. The input files for the six routines can be found in the same DTN. The output files for the routines can be found in the same DTN in the three files called: Infil.dat.nbf.mean.init, Infil.dat.nbf.high.init, and Infil.dat.nbf.low.init.

Routine extinf2 Version 1.00.

This routine was written to extract the present day mean infiltration rates from the 610 waste package locations. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five input data files:

RIP_csnf_d1050100_bin0-3_mean
RIP_csnf_d1050100_bin3-10_mean
RIP_csnf_d1050100_bin10-20_mean
RIP_csnf_d1050100_bin20-60_mean
RIP_csnf_d1050100_bin-60_mean

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next five lines. The present day infiltration rate is located in the 19th of the 22 numerical entries in the input data set. This value corresponds to the liquid flux in mm/year five meters above the crown of the drift at ambient (i.e. initial) conditions.

```
C extinf2.f
C_____________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates at t=0sec (mm/yr)
C
C Software routine extinf2 Version 1.00 (for mean infiltration case
C                                        flux maps)
C                                        MTI 5/17/00
C_____________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5,FILE='RIP_csnf_d1050100_bin0-3_mean', STATUS='OLD')
      OPEN (UNIT=6,FILE='RIP_csnf_d1050100_bin3-10_mean', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_mean', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_mean', STATUS='OLD')
      OPEN (UNIT=9,FILE='RIP_csnf_d1050100_bin-60_mean', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (268X,F13.7)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.5)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
```

```
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
        READ(7,*)
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf2** v 1.00 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. First three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year)

```
171292.39   234918.50     0.54115
171301.11   235082.91     0.53673
171312.36   234917.41     0.51863
```

Sample input from the input file "RIP_csnf_d1050100_bin0-3_mean." The numbers highlighted in bold correspond to the easting, northing, and initial infiltration rates (in column 19) listed that are supposed to be extracted by the routine. All of the numbers match the entries in the output file and the output file had entries for each of the 610 waste package locations. This hand check verified that the routine was working correctly.

```
The fraction of this history=0.000976
 Coordinate Location:
The easting coordinate = 171292.39 m
The northing coordinate = 234918.50 m
 Infiltration rate:
qinf =   2.70452 mm/yr
      0.00   0.297201E+02  -0.999900E+03   0.280629E+02   0.297442E+02   0.908029E+00  -
0.999900E+03   0.999305E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.541149E+00  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.000976
 Coordinate Location:
The easting coordinate = 171301.11 m
The northing coordinate = 235082.90 m
 Infiltration rate:
```

```
qinf =   2.85992 mm/yr
      0.00   0.298300E+02  -0.999900E+03   0.281448E+02   0.298540E+02   0.906540E+00  -
0.999900E+03   0.999306E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.536728E+00  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.000586
 Coordinate Location:
The easting coordinate = 171312.36 m
The northing coordinate = 234917.40 m
 Infiltration rate:
qinf =   2.28189 mm/yr
      0.00   0.314358E+02  -0.999900E+03   0.293277E+02   0.314598E+02   0.885570E+00  -
0.999900E+03   0.999291E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.518634E+00  -0.999900E+03   0.000000E+00  -0.999900E+03
```

Routine extinf2 Version 1.01.

This routine is a modification of extinf2.f Version 1.00 to extract the present day low (instead of mean) infiltration rates from the 610 waste package locations. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five input data files:

RIP_csnf_d1050100_bin0-3_low
RIP_csnf_d1050100_bin3-10_low
RIP_csnf_d1050100_bin10-20_low
RIP_csnf_d1050100_bin20-60_low
RIP_csnf_d1050100_bin-60_low

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next five lines. The present day infiltration rates is located in the 19th of the 22 numerical values in the input data set. This value corresponds to the liquid flux in mm/year five meters above the crown of the drift at ambient (i.e. initial) conditions.

```
C extinf.f
C_____________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates at initial time(mm/yr)
C
C  Software Routine extinf2 Version 1.01 (for low infiltration flux
C                                          case map)
C                                        MTI 5/17/00
C_____________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5,FILE='RIP_csnf_d1050100_bin0-3_low', STATUS='OLD')
      OPEN (UNIT=6,FILE='RIP_csnf_d1050100_bin3-10_low', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_low', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_low', STATUS='OLD')
      OPEN (UNIT=9,FILE='RIP_csnf_d1050100_bin-60_low', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (268X,F12.5)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.5)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
```

```
      GOTO 20
30    CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
        READ(7,*)
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
40    CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
50    CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf2** v 1.01 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. First three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year)

```
170435.17   233645.30     0.32220
170443.89   233809.70     0.28323
170452.61   233974.09     0.27513
```

Sample input from the first input file "RIP_csnf_d1050100_bin0-3_low." The numbers highlighted in bold correspond to the easting, northing, and initial infiltration rates listed that are supposed to be extracted by the routine. All of the numbers match the entries in the output file and the output file had entries for each of the 610 waste package locations. This hand check verified that the routine was working correctly.

```
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =   2.74419 mm/yr
      0.00   0.246136E+02  -0.999900E+03   0.245997E+02   0.246377E+02   0.994416E+00  -
0.999900E+03   0.995220E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.322202E+00  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170443.89 m
The northing coordinate = 233809.70 m
 Infiltration rate:
```

```
qinf =   2.65114 mm/yr
      0.00   0.246333E+02  -0.999900E+03   0.246193E+02   0.246573E+02   0.994497E+00  -
0.999900E+03   0.995301E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.283231E+00  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170452.61 m
The northing coordinate = 233974.10 m
 Infiltration rate:
qinf =   2.67709 mm/yr
      0.00   0.246259E+02  -0.999900E+03   0.246120E+02   0.246499E+02   0.994370E+00  -
0.999900E+03   0.995172E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.275134E+00  -0.999900E+03   0.000000E+00  -0.999900E+03
```

Routine extinf2 Version 1.02.

This routine is a modification of extinf2.f Version 1.00 to extract the present day high (instead of mean) infiltration rates from the 610 waste package locations. This routine was written in Fortran 77 and compiled and run on an UltraSparc Sun (Sandia property Number S819978) running SunOS 5.7. The input data can be found in the five input data files:

RIP_csnf_d1050100_bin0-3_low
RIP_csnf_d1050100_bin3-10_low
RIP_csnf_d1050100_bin10-20_low
RIP_csnf_d1050100_bin20-60_low
RIP_csnf_d1050100_bin-60_low

The routine scans the file for the word segment "Coor" that starts in the second column. After finding this word segment, the routine will read in the easting, northing, and infiltration rates that are on the next five lines. The present day infiltration rates is located in the 19th of the 22 numerical values in the input data set. This value corresponds to the liquid flux in mm/year five meters above the crown of the drift at ambient (i.e. initial) conditions.

```
C extinf2.f
C_____________________________________________________________
C This program extracts the infiltration rates from the combined
C   RIP files.   It reads in the five bin files and prints out the
C   easting/northing coordinates and infiltration rates at init time (mm/yr)
C
C Software Routine extinf2 Version 1.02 (for high infiltration flux
C                                        case map)
C                                       MTI 5/17/00
C_____________________________________________________________
C---+----1----+----2----+----3----+----4----+----5----+----6----+----7--
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      REAL  NORTHING, EASTING, INFIL
      CHARACTER *4 TEXT
      OPEN (UNIT=10, FILE='Infil.dat', STATUS='NEW')
      OPEN (UNIT=5, FILE='RIP_csnf_d1050100_bin0-3_high', STATUS='OLD')
      OPEN (UNIT=6, FILE='RIP_csnf_d1050100_bin3-10_high', STATUS='OLD')
      OPEN (UNIT=7,FILE='RIP_csnf_d1050100_bin10-20_high', STATUS='OLD')
      OPEN (UNIT=8,FILE='RIP_csnf_d1050100_bin20-60_high', STATUS='OLD')
      OPEN (UNIT=9, FILE='RIP_csnf_d1050100_bin-60_high', STATUS='OLD')
 10   CONTINUE
        READ(5,11,ERR=20) TEXT
 11     FORMAT (X,A4)
        IF (TEXT .ne. "Coor") goto 10
        READ(5,12) EASTING
 12     FORMAT (25X,F9.2)
        READ(5,13) NORTHING
 13     FORMAT (26X,F9.2)
        READ(5,*)
        READ(5,*)
        READ(5,14) INFIL
 14     FORMAT (268X,F12.2)
        WRITE(10,15) EASTING, NORTHING, INFIL
 15     FORMAT (2X,F10.2,2X,F10.2,2X,F10.5)
      GOTO 10
 20   CONTINUE
        READ(6,11,ERR=30) TEXT
        IF (TEXT .ne. "Coor") goto 20
        READ(6,12) EASTING
        READ(6,13) NORTHING
        READ(6,*)
        READ(6,*)
        READ(6,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
```

```
      GOTO 20
 30   CONTINUE
        READ(7,11,ERR=40) TEXT
        IF (TEXT .ne. "Coor") goto 30
        READ(7,12) EASTING
        READ(7,13) NORTHING
        READ(7,*)
        READ(7,*)
        READ(7,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 30
 40   CONTINUE
        READ(8,11,ERR=50) TEXT
        IF (TEXT .ne. "Coor") goto 40
        READ(8,12) EASTING
        READ(8,13) NORTHING
        READ(8,*)
        READ(8,*)
        READ(8,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 40
 50   CONTINUE
        READ(9,11,ERR=100) TEXT
        IF (TEXT .ne. "Coor") goto 50
        READ(9,12) EASTING
        READ(9,13) NORTHING
        READ(9,*)
        READ(9,*)
        READ(9,14) INFIL
        WRITE(10,15) EASTING, NORTHING, INFIL
      GOTO 50
100   CONTINUE
      STOP
      END
```

To verify that the **extinf2** v 1.02 was working properly, glacial infiltration rate in input files were checked against the content in the output file. Due to the large size of the output files, only a few lines out of a one output file will be presented here. First three lines from the output file: Easting (m), Northing (m), and Infiltration Rate (mm/year)

```
171234.97   234921.50     2.56766
171243.69   235085.91     2.60853
171264.92   234920.00     2.18711
```

Sample input from the first filled input file "RIP_csnf_d1050100_bin3-10_high." The numbers highlighted in bold correspond to the easting, northing, and initial infiltration rates listed that are supposed to be extracted by the routine. All of the numbers match the entries in the output file and the output file had entries for each of the 610 waste package locations. This hand check verified that the routine was working correctly.

```
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171234.97 m
The northing coordinate = 234921.50 m
 Infiltration rate:
qinf =    9.69590 mm/yr
      0.00   0.284205E+02  -0.999900E+03   0.270594E+02   0.284446E+02   0.922638E+00  -
0.999900E+03   0.999957E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.256766E+01  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171243.69 m
The northing coordinate = 235085.90 m
 Infiltration rate:
```

```
qinf =   9.92042 mm/yr
      0.00   0.286874E+02  -0.999900E+03   0.272550E+02   0.287115E+02   0.919800E+00  -
0.999900E+03   0.999957E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.260853E+01  -0.999900E+03   0.000000E+00  -0.999900E+03

...

The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171264.92 m
The northing coordinate = 234920.00 m
 Infiltration rate:
qinf =   7.71452 mm/yr
      0.00   0.288584E+02  -0.999900E+03   0.273943E+02   0.288824E+02   0.918804E+00  -
0.999900E+03   0.999957E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03   0.000000E+00  -
0.999900E+03   0.000000E+00   0.000000E+00  -0.999900E+03  -0.999900E+03  -0.999900E+03
0.218711E+01  -0.999900E+03   0.000000E+00  -0.999900E+03
```

Attachment VIII
TH Abstraction Routine
Post-10k-Year Climates for TSPA

The software routines map percolation flux time-history curves contained in four bins from the high infiltration flux case into two bins associated with the low infiltration flux case. The final destination (or bin placement) of the percolation flux curves from the high flux case (to the low) depend on the coordinate locations (e.g., repository location) that make up each bin in the low infiltration flux case. The overall steps performed by the routine are the following:

a) Determine which repository locations fall within the current bins (2 total) in the low infiltration flux case. Search and complete one bin at a time, first bin 1 then bin 2.
b) Search (for the location found in step a)) all high infiltration flux case bins for the percolation flux curves and map these locations/results to the correct bins in the low infiltration flux case. Match coordinate locations.
c) Write the two new output files for the mapped (to the low infiltration flux bins) percolation flux curves.
d) Check the number of curves processed.

Software routine names: future_cs-csnf (version 1.0) and future_cs-hlw (version 1.0). They are both compiled and executed on a SUN OS 5.7 with UNIX and the FORTRAN 77 compiler.

The software routine testing steps are the following:

(1.) Check the results of the *components.dat* (created by the software routine during runtime) file that indicates how many percolation flux locations from the high infiltration flux case were actually mapped into the two low infiltration flux bins. This file is created by the routine explicitly for error checking.

(2.) Check the total number of data lines in each of the two new bin files to ensure that the expected number of entries actually reside in the output files created by the routines.

(3.) Spot check specific coordinate locations to ensure that the high infiltration rate percolation flux locations were mapped correctly into the appropriate bins in the low infiltration flux case bins.

Each of the steps (1) through (3) listed above are considered in turn. The results of the *csnf* case (routine: future_cs-csnf (version 1.0)) are considered in this testing procedure. The resultant output files generated for the *hlw* case (future_cs-hlw (version 1.0)) are derived from the same software routine with only the file naming scheme (both for inputs and outputs) altered so as to be consistent with the correct input data for the case.

(1.) The results of the file *components.dat* are the following:

361
249

The first number (361) in the file represents the total number of entries (e.g., percolation flux curves) from the high infiltration flux case mapped into the first infiltration bin (0-3 mm/yr) in the low infiltration flux case. The second number corresponds to the second bin (3-10 mm/yr) in the low infiltration flux case. The entry counts were generated by the routine during runtime and represent how many percolation flux locations were mapped into respective low infiltration bins. Note that the total number of percolation flux curves mapped over to the low case was 361 + 249 = 610 curves. This is the correct number of curves to be mapped. Reference to Table 5 in this AMR indicates that 361 entries in bin 1 and 249 entries in bin 2 are indeed the correct number of entries for both bins for this infiltration flux case. This indicates that the first test for the routine is correctly verified.

(2.) Check the total line count in the output files that contain the mapped information (e.g., mapped from the high infiltration flux case to the low infiltration flux case).

The routine re-writes the information directly from the high infiltration flux files (e.g., RIP_csnf_qperc_d1050100_bin3-10_high) into the appropriate bin file (either 1 or 2) for the low infiltration flux case. (The correct bin is based on the location of the entries that already reside in the low infiltration flux bin. This will be tested in number 3 above.) The location dependent information (610 total locations) as written contains 99 time points and 7 header lines that provide information associated with the percolation flux location. Additionally, there are four header lines (e.g., infiltration rate range information, etc.) at the very top of the file. Knowing this, the total number of data lines in the output file generated for the first bin,

- RIP_csnf_qperc_d1050100_bin0-3_low-EIS

should be the following:

total lines = (7 + 99)*361 + 4 = 38, 270.

The routine generated file itself is physically checked by line count (by the SUN UNIX OS Text Editor V3.6.1) to contain 38, 270 lines of data. The second bin file is checked in a similar manner.

- RIP_csnf_qperc_d1050100_bin3-10_low-EIS

should contain the following:

total lines = (7 + 99)*249 + 4 = 26,398.

The file itself is physically checked by line count (by the UNIX OS Text Editor V3.6.1) to contain 26,398 lines of data. This step verifies that the correct number of data points reside in each of the files generated by this software routine. This is checked and verified to be correct for the *hlw* case as well. Now, all that remains is a global spot check to ensure that the data are mapped (from the four high infiltration flux bins into the two low infiltration flux bins) consistently and correctly based on the location information contained within the low infiltration flux bins 1 (0-3 mm/yr) and 2 (3-10 mm/yr).

(3.) Check that the specific percolation flux curves from the high infiltration flux case were mapped into the appropriate bins (two total) for the low infiltration flux.

This requires that the percolation flux locations currently residing within the two infiltration rate bins (0-3 and 3-10 mm/yr) in the low infiltration flux case are determined and correctly linked to the newly abstracted files. That is, the repository coordinate locations in the low infiltration bins are always constant. Therefore, two of the input files required by the routine establish the coordinate locations that belong to bin 1 and bin 2. These two required input files provide the repository coordinate locations to be matched:

RIP_csnf_qperc_d1050100_bin0-3_low
RIP_csnf_qperc_d1050100_bin3-10_low

Since the software routine reads the percolation flux locations (from the two files listed above) in order, the resultant mapping should be in the same exact order. This will be verified. In order to ensure that the high infiltration flux case percolation flux curves (from four bins total; 3-10, 10-20, 20-60, >60 mm/yr) are consistently mapped over to the low flux case bins, comparisons are made directly to the data contained in the files being mapped (note: the first bin in the high infiltration flux case contains no entries). The names of the files that contain the percolation data from the high flux case being mapped into the two bins from the low flux case are the following (these four input files required by the routine provide the percolation flux curves being mapped into the two bins):

RIP_csnf_qperc_d1050100_bin3-10_high
RIP_csnf_qperc_d1050100_bin10-20_high
RIP_csnf_qperc_d1050100_bin20-60_high
RIP_csnf_qperc_d1050100_bin-60_high

In addition to the six data files (shown above for the *csnf* case) required as input for this software routine, two additional driver files are required by the routine to read in the names of the data files listed above. They are called: EIS.fil and inpEIS.fil. The former contains the four filenames of data being mapped (e.g., RIP_csnf_qperc_d1050100_bin3-10_high, etc.) while the latter contains two filenames of data that provide locations (RIP_csnf_qperc_d1050100_bin0-3_low, etc.). The routine source code and the driver files for both the csnf and hlw cases are included in the data submittal to the TDMS. The input data files are contained in the TDMS under the DTN: SN0007T0872799.014. It is noted that each of the six data input files must contain the word "end" at the end of the file for

the routine to operate correctly. An excerpt of the end of one of the files is shown below to illustrate the correct placement of the word "end."

```
...
 100000.00    0.422257E+02    0.422224E+02
 200000.00    0.422287E+02    0.422255E+02
 300000.00    0.422285E+02    0.422253E+02
 400000.00    0.422284E+02    0.422252E+02
 500000.00    0.422283E+02    0.422251E+02
 600000.00    0.422282E+02    0.422250E+02
 800000.00    0.422280E+02    0.422248E+02
1000000.00    0.422278E+02    0.422246E+02
end
```

The routine generated results contain the percolation flux time-history curves from the high infiltration flux case mapped into the appropriate (defined by equivalent repository location) bins for the low infiltration flux case. The routine output file names (for the csnf case) are the following:

RIP_csnf_qperc_d1050100_bin0-3_low-EIS
RIP_csnf_qperc_d1050100_bin3-10_low-EIS

Consider the first bin (0-3 mm/yr) for the low flux case. It is necessary (for the routine) to determine which (repository) locations reside in this particular bin. An excerpt from the first block of header information from the input file RIP_csnf_qperc_d1050100_bin0-3_low is the following:

```
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =   2.74419 mm/yr
...
```

The important data obtained from the header information (marked in bold) are the easting and northing coordinate locations (e.g., repository location). This is what the routine finds for comparison to the high flux bin files. This coordinate location indicates a repository footprint location that is to be included in this first bin for the low infiltration flux case. Therefore, each of the four files (from the high infiltration flux case) are searched by the routine to find this location (e.g., the same easting and northing coordinate) in order to map the percolation flux curves into the first bin. An excerpt from the routine output file RIP_csnf_qperc_d1050100_bin0-3_low-EIS is shown below:

```
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =  65.89330 mm/yr
      0.00    0.203946E+02    0.203946E+02
      1.00    0.201656E+02    0.203385E+02
      2.00    0.202901E+02    0.205890E+02
      5.00    0.206314E+02    0.212492E+02
     10.00    0.209999E+02    0.218924E+02
     15.00    0.211329E+02    0.220604E+02
```

20.00	0.211274E+02	0.219860E+02
25.00	0.210526E+02	0.217838E+02
30.00	0.207536E+02	0.212733E+02
40.00	0.205261E+02	0.208693E+02
50.00	0.203444E+02	0.205584E+02
50.20	0.207407E+02	0.216850E+02
51.00	0.218676E+02	0.249725E+02
52.00	0.235488E+02	0.325553E+02
53.00	0.252567E+02	0.603819E+02
55.00	0.323400E+02	0.184896E+03
60.00	0.850135E+02	0.175168E+03
65.00	0.114872E+03	0.110349E+03
70.00	0.120934E+03	0.726318E+02
80.00	0.109131E+03	0.454335E+02
100.00	0.808611E+02	0.550686E+02
120.00	0.563322E+02	0.692625E+02
140.00	0.388588E+02	0.610469E+02
160.00	0.323595E+02	0.571939E+02
180.00	0.294125E+02	0.527405E+02
200.00	0.274415E+02	0.449731E+02
220.00	0.262201E+02	0.396048E+02
240.00	0.254092E+02	0.357881E+02
260.00	0.247625E+02	0.329176E+02
280.00	0.243090E+02	0.309595E+02
300.00	0.248077E+02	0.300364E+02
320.00	0.247047E+02	0.291919E+02
340.00	0.245342E+02	0.285665E+02
360.00	0.242366E+02	0.279465E+02
380.00	0.238029E+02	0.271687E+02
400.00	0.235963E+02	0.267708E+02
420.00	0.233169E+02	0.262677E+02
440.00	0.230830E+02	0.258785E+02
460.00	0.226256E+02	0.250499E+02
480.00	0.219705E+02	0.237139E+02
500.00	0.216859E+02	0.231284E+02
520.00	0.215458E+02	0.228830E+02
540.00	0.215678E+02	0.229735E+02
560.00	0.213152E+02	0.224221E+02
580.00	0.212151E+02	0.222458E+02
600.00	0.211115E+02	0.220588E+02
620.00	0.255330E+02	0.264659E+02
640.00	0.310161E+02	0.318868E+02
660.00	0.346287E+02	0.355053E+02
680.00	0.366105E+02	0.374480E+02
700.00	0.375748E+02	0.383810E+02
720.00	0.380149E+02	0.387818E+02
740.00	0.382127E+02	0.389337E+02
760.00	0.382756E+02	0.389302E+02
780.00	0.382735E+02	0.388445E+02
800.00	0.382377E+02	0.387195E+02
850.00	0.381350E+02	0.384878E+02
900.00	0.380551E+02	0.383390E+02
950.00	0.379823E+02	0.382201E+02
1000.00	0.379226E+02	0.381270E+02
1050.00	0.378804E+02	0.380601E+02
1100.00	0.378346E+02	0.379937E+02
1150.00	0.377922E+02	0.379327E+02
1200.00	0.377530E+02	0.378726E+02
1300.00	0.376808E+02	0.377683E+02
1400.00	0.376364E+02	0.376992E+02
1500.00	0.375621E+02	0.376016E+02
1600.00	0.375372E+02	0.375663E+02
1700.00	0.375315E+02	0.375601E+02
1800.00	0.375235E+02	0.375324E+02
1900.00	0.375232E+02	0.375363E+02
2000.00	0.375290E+02	0.375300E+02
2200.00	0.643370E+02	0.643317E+02
2400.00	0.648994E+02	0.648953E+02
2600.00	0.650068E+02	0.649998E+02
2800.00	0.650706E+02	0.650613E+02
3000.00	0.651160E+02	0.651069E+02
3500.00	0.652113E+02	0.651994E+02
4000.00	0.652968E+02	0.652861E+02
4500.00	0.653527E+02	0.653405E+02
5000.00	0.654082E+02	0.653970E+02

```
   6000.00   0.654787E+02   0.654676E+02
   7000.00   0.655198E+02   0.655080E+02
   8000.00   0.655560E+02   0.655461E+02
   9000.00   0.655865E+02   0.655763E+02
  10000.00   0.656128E+02   0.656032E+02
  15000.00   0.656921E+02   0.656832E+02
  20000.00   0.657463E+02   0.657390E+02
  30000.00   0.658088E+02   0.658030E+02
  40000.00   0.658362E+02   0.658310E+02
  50000.00   0.658534E+02   0.658484E+02
 100000.00   0.658856E+02   0.658812E+02
 200000.00   0.658929E+02   0.658887E+02
 300000.00   0.658936E+02   0.658894E+02
 400000.00   0.658940E+02   0.658898E+02
 500000.00   0.658938E+02   0.658896E+02
 600000.00   0.658937E+02   0.658895E+02
 800000.00   0.658935E+02   0.658893E+02
1000000.00   0.658933E+02   0.658891E+02
...
```

It is noted that the coordinate locations indeed match so that this time-history curve belongs in this first bin (as placed by the routine). Now, it must be verified that this block of data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally resided). Referring to the header information (obtained from the output file above) it is noted that the infiltration rate for this location (qinf = 65.89330 mm/yr) places it in the highest infiltration rate bin in the high flux case. This corresponds (to being located in) the file RIP_csnf_qperc_d1050100_bin-60_high, as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
...
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170435.17 m
The northing coordinate = 233645.30 m
 Infiltration rate:
qinf =  65.89330 mm/yr
      0.00   0.203946E+02   0.203946E+02
      1.00   0.201656E+02   0.203385E+02
      2.00   0.202901E+02   0.205890E+02
      5.00   0.206314E+02   0.212492E+02
     10.00   0.209999E+02   0.218924E+02
     15.00   0.211329E+02   0.220604E+02
     20.00   0.211274E+02   0.219860E+02
     25.00   0.210526E+02   0.217838E+02
     30.00   0.207536E+02   0.212733E+02
     40.00   0.205261E+02   0.208693E+02
     50.00   0.203444E+02   0.205584E+02
     50.20   0.207407E+02   0.216850E+02
     51.00   0.218676E+02   0.249725E+02
     52.00   0.235488E+02   0.325553E+02
     53.00   0.252567E+02   0.603819E+02
     55.00   0.323400E+02   0.184896E+03
     60.00   0.850135E+02   0.175168E+03
     65.00   0.114872E+03   0.110349E+03
     70.00   0.120934E+03   0.726318E+02
     80.00   0.109131E+03   0.454335E+02
    100.00   0.808611E+02   0.550686E+02
    120.00   0.563322E+02   0.692625E+02
    140.00   0.388588E+02   0.610469E+02
    160.00   0.323595E+02   0.571939E+02
    180.00   0.294125E+02   0.527405E+02
    200.00   0.274415E+02   0.449731E+02
    220.00   0.262201E+02   0.396048E+02
    240.00   0.254092E+02   0.357881E+02
    260.00   0.247625E+02   0.329176E+02
```

280.00	0.243090E+02	0.309595E+02
300.00	0.248077E+02	0.300364E+02
320.00	0.247047E+02	0.291919E+02
340.00	0.245342E+02	0.285665E+02
360.00	0.242366E+02	0.279465E+02
380.00	0.238029E+02	0.271687E+02
400.00	0.235963E+02	0.267708E+02
420.00	0.233169E+02	0.262677E+02
440.00	0.230830E+02	0.258785E+02
460.00	0.226256E+02	0.250499E+02
480.00	0.219705E+02	0.237139E+02
500.00	0.216859E+02	0.231284E+02
520.00	0.215458E+02	0.228830E+02
540.00	0.215678E+02	0.229735E+02
560.00	0.213152E+02	0.224221E+02
580.00	0.212151E+02	0.222458E+02
600.00	0.211115E+02	0.220588E+02
620.00	0.255330E+02	0.264659E+02
640.00	0.310161E+02	0.318868E+02
660.00	0.346287E+02	0.355053E+02
680.00	0.366105E+02	0.374480E+02
700.00	0.375748E+02	0.383810E+02
720.00	0.380149E+02	0.387818E+02
740.00	0.382127E+02	0.389337E+02
760.00	0.382756E+02	0.389302E+02
780.00	0.382735E+02	0.388445E+02
800.00	0.382377E+02	0.387195E+02
850.00	0.381350E+02	0.384878E+02
900.00	0.380551E+02	0.383390E+02
950.00	0.379823E+02	0.382201E+02
1000.00	0.379226E+02	0.381270E+02
1050.00	0.378804E+02	0.380601E+02
1100.00	0.378346E+02	0.379937E+02
1150.00	0.377922E+02	0.379327E+02
1200.00	0.377530E+02	0.378726E+02
1300.00	0.376808E+02	0.377683E+02
1400.00	0.376364E+02	0.376992E+02
1500.00	0.375621E+02	0.376016E+02
1600.00	0.375372E+02	0.375663E+02
1700.00	0.375315E+02	0.375601E+02
1800.00	0.375235E+02	0.375324E+02
1900.00	0.375232E+02	0.375363E+02
2000.00	0.375290E+02	0.375300E+02
2200.00	0.643370E+02	0.643317E+02
2400.00	0.648994E+02	0.648953E+02
2600.00	0.650068E+02	0.649998E+02
2800.00	0.650706E+02	0.650613E+02
3000.00	0.651160E+02	0.651069E+02
3500.00	0.652113E+02	0.651994E+02
4000.00	0.652968E+02	0.652861E+02
4500.00	0.653527E+02	0.653405E+02
5000.00	0.654082E+02	0.653970E+02
6000.00	0.654787E+02	0.654676E+02
7000.00	0.655198E+02	0.655080E+02
8000.00	0.655560E+02	0.655461E+02
9000.00	0.655865E+02	0.655763E+02
10000.00	0.656128E+02	0.656032E+02
15000.00	0.656921E+02	0.656832E+02
20000.00	0.657463E+02	0.657390E+02
30000.00	0.658088E+02	0.658030E+02
40000.00	0.658362E+02	0.658310E+02
50000.00	0.658534E+02	0.658484E+02
100000.00	0.658856E+02	0.658812E+02
200000.00	0.658929E+02	0.658887E+02
300000.00	0.658936E+02	0.658894E+02
400000.00	0.658940E+02	0.658898E+02
500000.00	0.658938E+02	0.658896E+02
600000.00	0.658937E+02	0.658895E+02
800000.00	0.658935E+02	0.658893E+02
1000000.00	0.658933E+02	0.658891E+02

...

Comparison of these excerpts (both the output file from the routine and the routine input file)

indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (> 60 mm/yr) bin to the low infiltration flux 0-3 mm/yr bin corresponding to that location residing within that bin in the low flux case.

A randomly chosen location is also checked (still within the first bin). An excerpt of the header information from the input file RIP_csnf_qperc_d1050100_bin0-3_low is the following:

```
...
The number of Rows =  99
The fraction of this history=0.000748
 Coordinate Location:
The easting coordinate = 170796.02 m
The northing coordinate = 235727.80 m
 Infiltration rate:
qinf =   1.34090 mm/yr
...
```

An excerpt from the output file RIP_csnf_qperc_d1050100_bin0-3_low-EIS is shown below:

```
...
The number of Rows =  99
The fraction of this history=0.000748
 Coordinate Location:
The easting coordinate = 170796.02 m
The northing coordinate = 235727.80 m
 Infiltration rate:
qinf =  44.17319 mm/yr
      0.00   0.133321E+02   0.133321E+02
      1.00   0.130842E+02   0.132508E+02
      2.00   0.132050E+02   0.134991E+02
      5.00   0.134821E+02   0.140658E+02
     10.00   0.137749E+02   0.145918E+02
     15.00   0.138385E+02   0.146817E+02
     20.00   0.138168E+02   0.146032E+02
     25.00   0.137485E+02   0.144162E+02
     30.00   0.136500E+02   0.142080E+02
     40.00   0.134502E+02   0.138232E+02
     50.00   0.132846E+02   0.135270E+02
     50.20   0.136156E+02   0.146930E+02
     51.00   0.148407E+02   0.192443E+02
     52.00   0.169357E+02   0.537267E+02
     53.00   0.213938E+02   0.159928E+03
     55.00   0.592744E+02   0.177948E+03
     60.00   0.137433E+03   0.554506E+02
     65.00   0.123457E+03   0.488051E+02
     70.00   0.111339E+03   0.585600E+02
     80.00   0.926064E+02   0.483139E+02
    100.00   0.474277E+02   0.790419E+02
    120.00   0.289882E+02   0.596663E+02
    140.00   0.208970E+02   0.327266E+02
    160.00   0.174035E+02   0.225830E+02
    180.00   0.160238E+02   0.189655E+02
    200.00   0.169580E+02   0.212973E+02
    220.00   0.165651E+02   0.206345E+02
    240.00   0.163201E+02   0.201584E+02
    260.00   0.161069E+02   0.198339E+02
    280.00   0.159700E+02   0.196504E+02
    300.00   0.157250E+02   0.191977E+02
    320.00   0.155696E+02   0.189907E+02
    340.00   0.153992E+02   0.185132E+02
    360.00   0.152264E+02   0.179631E+02
    380.00   0.150739E+02   0.175355E+02
    400.00   0.149112E+02   0.170882E+02
    420.00   0.147827E+02   0.167298E+02
    440.00   0.146591E+02   0.163874E+02
    460.00   0.145368E+02   0.160772E+02
```

480.00	0.144304E+02	0.158239E+02
500.00	0.143258E+02	0.155843E+02
520.00	0.142357E+02	0.153832E+02
540.00	0.141448E+02	0.151869E+02
560.00	0.140614E+02	0.150139E+02
580.00	0.139841E+02	0.148775E+02
600.00	0.139214E+02	0.147248E+02
620.00	0.140508E+02	0.147903E+02
640.00	0.148665E+02	0.155450E+02
660.00	0.163886E+02	0.170158E+02
680.00	0.182150E+02	0.187884E+02
700.00	0.199678E+02	0.204910E+02
720.00	0.214296E+02	0.219109E+02
740.00	0.225365E+02	0.229817E+02
760.00	0.233267E+02	0.237456E+02
780.00	0.238684E+02	0.242519E+02
800.00	0.242227E+02	0.245750E+02
850.00	0.246149E+02	0.249020E+02
900.00	0.247139E+02	0.249555E+02
950.00	0.247158E+02	0.249234E+02
1000.00	0.246816E+02	0.248570E+02
1050.00	0.246377E+02	0.247903E+02
1100.00	0.245914E+02	0.247266E+02
1150.00	0.245431E+02	0.246658E+02
1200.00	0.244958E+02	0.246035E+02
1300.00	0.244066E+02	0.244830E+02
1400.00	0.243262E+02	0.243825E+02
1500.00	0.242581E+02	0.242947E+02
1600.00	0.242146E+02	0.242432E+02
1700.00	0.241853E+02	0.242065E+02
1800.00	0.241679E+02	0.241808E+02
1900.00	0.241549E+02	0.241666E+02
2000.00	0.241448E+02	0.241486E+02
2200.00	0.407524E+02	0.407536E+02
2400.00	0.426875E+02	0.426871E+02
2600.00	0.430446E+02	0.430411E+02
2800.00	0.432554E+02	0.432506E+02
3000.00	0.433809E+02	0.433729E+02
3500.00	0.435283E+02	0.435203E+02
4000.00	0.436021E+02	0.435933E+02
4500.00	0.436521E+02	0.436430E+02
5000.00	0.436921E+02	0.436833E+02
6000.00	0.437471E+02	0.437386E+02
7000.00	0.437878E+02	0.437789E+02
8000.00	0.438191E+02	0.438105E+02
9000.00	0.438485E+02	0.438404E+02
10000.00	0.438721E+02	0.438644E+02
15000.00	0.439569E+02	0.439498E+02
20000.00	0.440099E+02	0.440036E+02
30000.00	0.440720E+02	0.440667E+02
40000.00	0.441021E+02	0.440973E+02
50000.00	0.441109E+02	0.441061E+02
100000.00	0.441556E+02	0.441516E+02
200000.00	0.441675E+02	0.441637E+02
300000.00	0.441686E+02	0.441649E+02
400000.00	0.441692E+02	0.441655E+02
500000.00	0.441701E+02	0.441664E+02
600000.00	0.441708E+02	0.441671E+02
800000.00	0.441720E+02	0.441683E+02
1000000.00	0.441732E+02	0.441695E+02

...

It is noted that the coordinate locations indeed match so that this time-history curve also belongs in this first bin (as placed by the routine). Now, it must be verified that the data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally resided). Referring to the header information (obtained from the output file) it is noted that the infiltration rate for this location (qinf = 44.17319 mm/yr) places it in the second highest infiltration rate bin in the high flux case. This corresponds to the file

RIP_csnf_qperc_d1050100_bin20-60_high as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
...
The number of Rows =  99
The fraction of this history=0.000748
 Coordinate Location:
The easting coordinate = 170796.02 m
The northing coordinate = 235727.80 m
 Infiltration rate:
qinf =  44.17319 mm/yr
      0.00   0.133321E+02   0.133321E+02
      1.00   0.130842E+02   0.132508E+02
      2.00   0.132050E+02   0.134991E+02
      5.00   0.134821E+02   0.140658E+02
     10.00   0.137749E+02   0.145918E+02
     15.00   0.138385E+02   0.146817E+02
     20.00   0.138168E+02   0.146032E+02
     25.00   0.137485E+02   0.144162E+02
     30.00   0.136500E+02   0.142080E+02
     40.00   0.134502E+02   0.138232E+02
     50.00   0.132846E+02   0.135270E+02
     50.20   0.136156E+02   0.146930E+02
     51.00   0.148407E+02   0.192443E+02
     52.00   0.169357E+02   0.537267E+02
     53.00   0.213938E+02   0.159928E+03
     55.00   0.592744E+02   0.177948E+03
     60.00   0.137433E+03   0.554506E+02
     65.00   0.123457E+03   0.488051E+02
     70.00   0.111339E+03   0.585600E+02
     80.00   0.926064E+02   0.483139E+02
    100.00   0.474277E+02   0.790419E+02
    120.00   0.289882E+02   0.596663E+02
    140.00   0.208970E+02   0.327266E+02
    160.00   0.174035E+02   0.225830E+02
    180.00   0.160238E+02   0.189655E+02
    200.00   0.169580E+02   0.212973E+02
    220.00   0.165651E+02   0.206345E+02
    240.00   0.163201E+02   0.201584E+02
    260.00   0.161069E+02   0.198339E+02
    280.00   0.159700E+02   0.196504E+02
    300.00   0.157250E+02   0.191977E+02
    320.00   0.155696E+02   0.189907E+02
    340.00   0.153992E+02   0.185132E+02
    360.00   0.152264E+02   0.179631E+02
    380.00   0.150739E+02   0.175355E+02
    400.00   0.149112E+02   0.170882E+02
    420.00   0.147827E+02   0.167298E+02
    440.00   0.146591E+02   0.163874E+02
    460.00   0.145368E+02   0.160772E+02
    480.00   0.144304E+02   0.158239E+02
    500.00   0.143258E+02   0.155843E+02
    520.00   0.142357E+02   0.153832E+02
    540.00   0.141448E+02   0.151869E+02
    560.00   0.140614E+02   0.150139E+02
    580.00   0.139841E+02   0.148775E+02
    600.00   0.139214E+02   0.147248E+02
    620.00   0.140508E+02   0.147903E+02
    640.00   0.148665E+02   0.155450E+02
    660.00   0.163886E+02   0.170158E+02
    680.00   0.182150E+02   0.187884E+02
    700.00   0.199678E+02   0.204910E+02
    720.00   0.214296E+02   0.219109E+02
    740.00   0.225365E+02   0.229817E+02
    760.00   0.233267E+02   0.237456E+02
    780.00   0.238684E+02   0.242519E+02
    800.00   0.242227E+02   0.245750E+02
    850.00   0.246149E+02   0.249020E+02
    900.00   0.247139E+02   0.249555E+02
    950.00   0.247158E+02   0.249234E+02
   1000.00   0.246816E+02   0.248570E+02
   1050.00   0.246377E+02   0.247903E+02
   1100.00   0.245914E+02   0.247266E+02
```

```
   1150.00   0.245431E+02   0.246658E+02
   1200.00   0.244958E+02   0.246035E+02
   1300.00   0.244066E+02   0.244830E+02
   1400.00   0.243262E+02   0.243825E+02
   1500.00   0.242581E+02   0.242947E+02
   1600.00   0.242146E+02   0.242432E+02
   1700.00   0.241853E+02   0.242065E+02
   1800.00   0.241679E+02   0.241808E+02
   1900.00   0.241549E+02   0.241666E+02
   2000.00   0.241448E+02   0.241486E+02
   2200.00   0.407524E+02   0.407536E+02
   2400.00   0.426875E+02   0.426871E+02
   2600.00   0.430446E+02   0.430411E+02
   2800.00   0.432554E+02   0.432506E+02
   3000.00   0.433809E+02   0.433729E+02
   3500.00   0.435283E+02   0.435203E+02
   4000.00   0.436021E+02   0.435933E+02
   4500.00   0.436521E+02   0.436430E+02
   5000.00   0.436921E+02   0.436833E+02
   6000.00   0.437471E+02   0.437386E+02
   7000.00   0.437878E+02   0.437789E+02
   8000.00   0.438191E+02   0.438105E+02
   9000.00   0.438485E+02   0.438404E+02
  10000.00   0.438721E+02   0.438644E+02
  15000.00   0.439569E+02   0.439498E+02
  20000.00   0.440099E+02   0.440036E+02
  30000.00   0.440720E+02   0.440667E+02
  40000.00   0.441021E+02   0.440973E+02
  50000.00   0.441109E+02   0.441061E+02
 100000.00   0.441556E+02   0.441516E+02
 200000.00   0.441675E+02   0.441637E+02
 300000.00   0.441686E+02   0.441649E+02
 400000.00   0.441692E+02   0.441655E+02
 500000.00   0.441701E+02   0.441664E+02
 600000.00   0.441708E+02   0.441671E+02
 800000.00   0.441720E+02   0.441683E+02
1000000.00   0.441732E+02   0.441695E+02
...
```

Comparison of these excerpts (both the output file from the routine and the routine input file) indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (20-60 mm/yr) bin to the low infiltration flux 0-3 mm/yr bin corresponding to that location residing within that bin.

Finally, the last entry (still in the first bin) is checked. An excerpt of the header information from the input file RIP_csnf_qperc_d1050100_bin0-3_low is the following:

```
...
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170306.73 m
The northing coordinate = 232168.70 m
 Infiltration rate:
qinf =  0.47948 mm/yr
...
```

An excerpt from the output file RIP_csnf_qperc_d1050100_bin0-3_low-EIS is shown below:

```
...
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170306.73 m
```

The northing coordinate = 232168.70 m

Infiltration rate:

qinf = 14.89704 mm/yr

0.00	0.512648E+01	0.512648E+01
1.00	0.486207E+01	0.503207E+01
2.00	0.498794E+01	0.529030E+01
5.00	0.529536E+01	0.590587E+01
10.00	0.559040E+01	0.643841E+01
15.00	0.566926E+01	0.654636E+01
20.00	0.563382E+01	0.644042E+01
25.00	0.556082E+01	0.625610E+01
30.00	0.545432E+01	0.603706E+01
40.00	0.523728E+01	0.562081E+01
50.00	0.505656E+01	0.532051E+01
50.20	0.536599E+01	0.645818E+01
51.00	0.671317E+01	0.117159E+02
52.00	0.877609E+01	0.579721E+02
53.00	0.145130E+02	0.172484E+03
55.00	0.616800E+02	0.147708E+03
60.00	0.133393E+03	0.278422E+02
65.00	0.118422E+03	0.881121E+00
70.00	0.102609E+03	0.698918E+00
80.00	0.898321E+02	0.294421E+01
100.00	0.459361E+02	0.343376E+02
120.00	0.235681E+02	0.486619E+02
140.00	0.136002E+02	0.303113E+02
160.00	0.141723E+02	0.146306E+02
180.00	0.140915E+02	0.136414E+02
200.00	0.132794E+02	0.159735E+02
220.00	0.121839E+02	0.182395E+02
240.00	0.112383E+02	0.197565E+02
260.00	0.104046E+02	0.207772E+02
280.00	0.980266E+01	0.195837E+02
300.00	0.932623E+01	0.176847E+02
320.00	0.890605E+01	0.161046E+02
340.00	0.851631E+01	0.147502E+02
360.00	0.815765E+01	0.135055E+02
380.00	0.789703E+01	0.126193E+02
400.00	0.761124E+01	0.117151E+02
420.00	0.737491E+01	0.110049E+02
440.00	0.714856E+01	0.103608E+02
460.00	0.694592E+01	0.976052E+01
480.00	0.676356E+01	0.926197E+01
500.00	0.658723E+01	0.881928E+01
520.00	0.643050E+01	0.844599E+01
540.00	0.628082E+01	0.809828E+01
560.00	0.614203E+01	0.779294E+01
580.00	0.602622E+01	0.752148E+01
600.00	0.589616E+01	0.722545E+01
620.00	0.643003E+01	0.761968E+01
640.00	0.696183E+01	0.803417E+01
660.00	0.727937E+01	0.825901E+01
680.00	0.742325E+01	0.831273E+01
700.00	0.748881E+01	0.832558E+01
720.00	0.750880E+01	0.828306E+01
740.00	0.749144E+01	0.821061E+01
760.00	0.745584E+01	0.812269E+01
780.00	0.741614E+01	0.803578E+01
800.00	0.736627E+01	0.793943E+01
850.00	0.723078E+01	0.770426E+01
900.00	0.709157E+01	0.749815E+01
950.00	0.698596E+01	0.732303E+01
1000.00	0.689216E+01	0.717952E+01
1050.00	0.682422E+01	0.707739E+01
1100.00	0.675866E+01	0.698071E+01
1150.00	0.669787E+01	0.690397E+01
1200.00	0.664248E+01	0.682966E+01
1300.00	0.655293E+01	0.668617E+01
1400.00	0.646060E+01	0.656184E+01
1500.00	0.639146E+01	0.646101E+01
1600.00	0.636366E+01	0.641882E+01
1700.00	0.633657E+01	0.638488E+01
1800.00	0.631971E+01	0.636106E+01
1900.00	0.631502E+01	0.633369E+01
2000.00	0.630249E+01	0.632618E+01

```
   2200.00   0.136757E+02   0.136819E+02
   2400.00   0.139803E+02   0.139914E+02
   2600.00   0.140282E+02   0.140303E+02
   2800.00   0.140709E+02   0.140690E+02
   3000.00   0.140812E+02   0.140812E+02
   3500.00   0.141459E+02   0.141414E+02
   4000.00   0.141964E+02   0.141932E+02
   4500.00   0.142439E+02   0.142370E+02
   5000.00   0.142812E+02   0.142763E+02
   6000.00   0.143437E+02   0.143367E+02
   7000.00   0.143961E+02   0.143876E+02
   8000.00   0.144360E+02   0.144282E+02
   9000.00   0.144730E+02   0.144654E+02
  10000.00   0.145065E+02   0.144991E+02
  15000.00   0.146228E+02   0.146163E+02
  20000.00   0.146964E+02   0.146908E+02
  30000.00   0.147705E+02   0.147656E+02
  40000.00   0.148218E+02   0.148177E+02
  50000.00   0.148443E+02   0.148403E+02
 100000.00   0.148898E+02   0.148865E+02
 200000.00   0.148980E+02   0.148947E+02
 300000.00   0.148978E+02   0.148946E+02
 400000.00   0.148977E+02   0.148945E+02
 500000.00   0.148975E+02   0.148943E+02
 600000.00   0.148974E+02   0.148942E+02
 800000.00   0.148972E+02   0.148940E+02
1000000.00   0.148970E+02   0.148938E+02
```

It is noted that the coordinate locations indeed match so this time-history curve also belongs in this first bin (as placed by the routine). Now, it must be verified that the data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally resided). Referring to the header information (obtained from the output file) it is noted that the infiltration rate for this location (qinf = 14.89704 mm/yr) places it in the middle infiltration rate bin in the high flux case. This corresponds to the file RIP_csnf_qperc_d1050100_bin10-20_high as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170306.73 m
The northing coordinate = 232168.70 m
 Infiltration rate:
qinf =  14.89704 mm/yr
      0.00   0.512648E+01   0.512648E+01
      1.00   0.486207E+01   0.503207E+01
      2.00   0.498794E+01   0.529030E+01
      5.00   0.529536E+01   0.590587E+01
     10.00   0.559040E+01   0.643841E+01
     15.00   0.566926E+01   0.654636E+01
     20.00   0.563382E+01   0.644042E+01
     25.00   0.556082E+01   0.625610E+01
     30.00   0.545432E+01   0.603706E+01
     40.00   0.523728E+01   0.562081E+01
     50.00   0.505656E+01   0.532051E+01
     50.20   0.536599E+01   0.645818E+01
     51.00   0.671317E+01   0.117159E+02
     52.00   0.877609E+01   0.579721E+02
     53.00   0.145130E+02   0.172484E+03
     55.00   0.616800E+02   0.147708E+03
     60.00   0.133393E+03   0.278422E+02
     65.00   0.118422E+03   0.881121E+00
     70.00   0.102609E+03   0.698918E+00
     80.00   0.898321E+02   0.294421E+01
    100.00   0.459361E+02   0.343376E+02
    120.00   0.235681E+02   0.486619E+02
    140.00   0.136002E+02   0.303113E+02
    160.00   0.141723E+02   0.146306E+02
    180.00   0.140915E+02   0.136414E+02
```

200.00	0.132794E+02	0.159735E+02
220.00	0.121839E+02	0.182395E+02
240.00	0.112383E+02	0.197565E+02
260.00	0.104046E+02	0.207772E+02
280.00	0.980266E+01	0.195837E+02
300.00	0.932623E+01	0.176847E+02
320.00	0.890605E+01	0.161046E+02
340.00	0.851631E+01	0.147502E+02
360.00	0.815765E+01	0.135055E+02
380.00	0.789703E+01	0.126193E+02
400.00	0.761124E+01	0.117151E+02
420.00	0.737491E+01	0.110049E+02
440.00	0.714856E+01	0.103608E+02
460.00	0.694592E+01	0.976052E+01
480.00	0.676356E+01	0.926197E+01
500.00	0.658723E+01	0.881928E+01
520.00	0.643050E+01	0.844599E+01
540.00	0.628082E+01	0.809828E+01
560.00	0.614203E+01	0.779294E+01
580.00	0.602622E+01	0.752148E+01
600.00	0.589616E+01	0.722545E+01
620.00	0.643003E+01	0.761968E+01
640.00	0.696183E+01	0.803417E+01
660.00	0.727937E+01	0.825901E+01
680.00	0.742325E+01	0.831273E+01
700.00	0.748881E+01	0.832558E+01
720.00	0.750880E+01	0.828306E+01
740.00	0.749144E+01	0.821061E+01
760.00	0.745584E+01	0.812269E+01
780.00	0.741614E+01	0.803578E+01
800.00	0.736627E+01	0.793943E+01
850.00	0.723078E+01	0.770426E+01
900.00	0.709157E+01	0.749815E+01
950.00	0.698596E+01	0.732303E+01
1000.00	0.689216E+01	0.717952E+01
1050.00	0.682422E+01	0.707739E+01
1100.00	0.675866E+01	0.698071E+01
1150.00	0.669787E+01	0.690397E+01
1200.00	0.664248E+01	0.682966E+01
1300.00	0.655293E+01	0.668617E+01
1400.00	0.646060E+01	0.656184E+01
1500.00	0.639146E+01	0.646101E+01
1600.00	0.636366E+01	0.641882E+01
1700.00	0.633657E+01	0.638488E+01
1800.00	0.631971E+01	0.636106E+01
1900.00	0.631502E+01	0.633369E+01
2000.00	0.630249E+01	0.632618E+01
2200.00	0.136757E+02	0.136819E+02
2400.00	0.139803E+02	0.139914E+02
2600.00	0.140282E+02	0.140303E+02
2800.00	0.140709E+02	0.140690E+02
3000.00	0.140812E+02	0.140812E+02
3500.00	0.141459E+02	0.141414E+02
4000.00	0.141964E+02	0.141932E+02
4500.00	0.142439E+02	0.142370E+02
5000.00	0.142812E+02	0.142763E+02
6000.00	0.143437E+02	0.143367E+02
7000.00	0.143961E+02	0.143876E+02
8000.00	0.144360E+02	0.144282E+02
9000.00	0.144730E+02	0.144654E+02
10000.00	0.145065E+02	0.144991E+02
15000.00	0.146228E+02	0.146163E+02
20000.00	0.146964E+02	0.146908E+02
30000.00	0.147705E+02	0.147656E+02
40000.00	0.148218E+02	0.148177E+02
50000.00	0.148443E+02	0.148403E+02
100000.00	0.148898E+02	0.148865E+02
200000.00	0.148980E+02	0.148947E+02
300000.00	0.148978E+02	0.148946E+02
400000.00	0.148977E+02	0.148945E+02
500000.00	0.148975E+02	0.148943E+02
600000.00	0.148974E+02	0.148942E+02
800000.00	0.148972E+02	0.148940E+02
1000000.00	0.148970E+02	0.148938E+02

Comparison of these excerpts (both the output file from the routine and the routine input file) indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (10-20 mm/yr) bin to the low infiltration flux 0-3 mm/yr bin corresponding to that location residing within that bin.

Now consider the second bin (3-10 mm/yr) in the low infiltration flux case. It is necessary (for the routine) to determine which specific locations reside in this particular bin as well. An excerpt from the first block of header information from the input file RIP_csnf_qperc_d1050100_bin3-10_low is the following:

```
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170382.84 m
The northing coordinate = 232659.10 m
 Infiltration rate:
qinf =   4.86150 mm/yr
...
```

An excerpt from the output file RIP_csnf_qperc_d1050100_bin3-10_low-EIS is shown below:

```
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170382.84 m
The northing coordinate = 232659.10 m
 Infiltration rate:
qinf =  70.92735 mm/yr
      0.00   0.222957E+02   0.222957E+02
      1.00   0.220187E+02   0.221747E+02
      2.00   0.221329E+02   0.223979E+02
      5.00   0.225034E+02   0.230523E+02
     10.00   0.228894E+02   0.236919E+02
     15.00   0.230012E+02   0.238401E+02
     20.00   0.229706E+02   0.237386E+02
     25.00   0.228721E+02   0.235249E+02
     30.00   0.225329E+02   0.230081E+02
     40.00   0.223394E+02   0.226531E+02
     50.00   0.221831E+02   0.223858E+02
     50.20   0.225481E+02   0.234252E+02
     51.00   0.235660E+02   0.262890E+02
     52.00   0.250610E+02   0.324337E+02
     53.00   0.266435E+02   0.549297E+02
     55.00   0.327907E+02   0.177069E+03
     60.00   0.801650E+02   0.181270E+03
     65.00   0.110311E+03   0.122192E+03
     70.00   0.119645E+03   0.839841E+02
     80.00   0.112198E+03   0.510017E+02
    100.00   0.839883E+02   0.618965E+02
    120.00   0.619175E+02   0.759538E+02
    140.00   0.415280E+02   0.684887E+02
    160.00   0.338182E+02   0.642662E+02
    180.00   0.309437E+02   0.563051E+02
    200.00   0.289793E+02   0.472828E+02
    220.00   0.278273E+02   0.416344E+02
    240.00   0.270216E+02   0.373839E+02
    260.00   0.263984E+02   0.344252E+02
    280.00   0.262560E+02   0.326611E+02
    300.00   0.268689E+02   0.319941E+02
    320.00   0.267517E+02   0.312606E+02
    340.00   0.265492E+02   0.307169E+02
    360.00   0.262209E+02   0.301020E+02
    380.00   0.258456E+02   0.294005E+02
    400.00   0.257002E+02   0.291075E+02
```

420.00	0.253524E+02	0.285152E+02
440.00	0.251380E+02	0.282043E+02
460.00	0.245723E+02	0.271890E+02
480.00	0.237719E+02	0.256137E+02
500.00	0.234922E+02	0.250603E+02
520.00	0.232486E+02	0.245617E+02
540.00	0.231427E+02	0.243589E+02
560.00	0.230113E+02	0.241174E+02
580.00	0.229264E+02	0.239525E+02
600.00	0.228243E+02	0.237764E+02
620.00	0.307675E+02	0.316350E+02
640.00	0.366145E+02	0.374192E+02
660.00	0.388422E+02	0.396491E+02
680.00	0.395891E+02	0.403702E+02
700.00	0.397981E+02	0.405432E+02
720.00	0.398310E+02	0.405374E+02
740.00	0.398008E+02	0.404844E+02
760.00	0.397441E+02	0.403622E+02
780.00	0.396729E+02	0.402218E+02
800.00	0.395976E+02	0.400736E+02
850.00	0.394528E+02	0.398072E+02
900.00	0.393348E+02	0.396260E+02
950.00	0.392454E+02	0.394871E+02
1000.00	0.391595E+02	0.393697E+02
1050.00	0.391067E+02	0.392905E+02
1100.00	0.390549E+02	0.392133E+02
1150.00	0.390064E+02	0.391452E+02
1200.00	0.389588E+02	0.390856E+02
1300.00	0.388867E+02	0.389769E+02
1400.00	0.388216E+02	0.388898E+02
1500.00	0.387737E+02	0.388174E+02
1600.00	0.387568E+02	0.387946E+02
1700.00	0.387600E+02	0.387858E+02
1800.00	0.387629E+02	0.387801E+02
1900.00	0.387680E+02	0.387760E+02
2000.00	0.387774E+02	0.387964E+02
2200.00	0.696728E+02	0.696720E+02
2400.00	0.698747E+02	0.698719E+02
2600.00	0.699465E+02	0.699474E+02
2800.00	0.700220E+02	0.700134E+02
3000.00	0.700872E+02	0.700769E+02
3500.00	0.702248E+02	0.702154E+02
4000.00	0.703329E+02	0.703233E+02
4500.00	0.704073E+02	0.703984E+02
5000.00	0.704657E+02	0.704571E+02
6000.00	0.705253E+02	0.705174E+02
7000.00	0.705812E+02	0.705728E+02
8000.00	0.706249E+02	0.706158E+02
9000.00	0.706568E+02	0.706489E+02
10000.00	0.706806E+02	0.706733E+02
15000.00	0.707528E+02	0.707457E+02
20000.00	0.707985E+02	0.707925E+02
30000.00	0.708586E+02	0.708542E+02
40000.00	0.708804E+02	0.708764E+02
50000.00	0.708885E+02	0.708840E+02
100000.00	0.709254E+02	0.709220E+02
200000.00	0.709282E+02	0.709249E+02
300000.00	0.709281E+02	0.709248E+02
400000.00	0.709280E+02	0.709247E+02
500000.00	0.709279E+02	0.709245E+02
600000.00	0.709278E+02	0.709244E+02
800000.00	0.709276E+02	0.709243E+02
1000000.00	0.709274E+02	0.709240E+02

...

It is noted that the coordinate locations indeed match so this time-history curve belongs in the second bin (as placed by the routine). Now, it must be verified that the data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally resided). Referring to the header information (obtained from the output file) it is noted that the infiltration rate for this location (qinf = 70.92735 mm/yr) places it in the highest infiltration rate

bin in the high flux case. This corresponds to the file RIP_csnf_qperc_d1050100_bin-60_high as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
The number of Rows =  99
The fraction of this history=0.002409
 Coordinate Location:
The easting coordinate = 170382.84 m
The northing coordinate = 232659.10 m
 Infiltration rate:
qinf =  70.92735 mm/yr
      0.00   0.222957E+02   0.222957E+02
      1.00   0.220187E+02   0.221747E+02
      2.00   0.221329E+02   0.223979E+02
      5.00   0.225034E+02   0.230523E+02
     10.00   0.228894E+02   0.236919E+02
     15.00   0.230012E+02   0.238401E+02
     20.00   0.229706E+02   0.237386E+02
     25.00   0.228721E+02   0.235249E+02
     30.00   0.225329E+02   0.230081E+02
     40.00   0.223394E+02   0.226531E+02
     50.00   0.221831E+02   0.223858E+02
     50.20   0.225481E+02   0.234252E+02
     51.00   0.235660E+02   0.262890E+02
     52.00   0.250610E+02   0.324337E+02
     53.00   0.266435E+02   0.549297E+02
     55.00   0.327907E+02   0.177069E+03
     60.00   0.801650E+02   0.181270E+03
     65.00   0.110311E+03   0.122192E+03
     70.00   0.119645E+03   0.839841E+02
     80.00   0.112198E+03   0.510017E+02
    100.00   0.839883E+02   0.618965E+02
    120.00   0.619175E+02   0.759538E+02
    140.00   0.415280E+02   0.684887E+02
    160.00   0.338182E+02   0.642662E+02
    180.00   0.309437E+02   0.563051E+02
    200.00   0.289793E+02   0.472828E+02
    220.00   0.278273E+02   0.416344E+02
    240.00   0.270216E+02   0.373839E+02
    260.00   0.263984E+02   0.344252E+02
    280.00   0.262560E+02   0.326611E+02
    300.00   0.268689E+02   0.319941E+02
    320.00   0.267517E+02   0.312606E+02
    340.00   0.265492E+02   0.307169E+02
    360.00   0.262209E+02   0.301020E+02
    380.00   0.258456E+02   0.294005E+02
    400.00   0.257002E+02   0.291075E+02
    420.00   0.253524E+02   0.285152E+02
    440.00   0.251380E+02   0.282043E+02
    460.00   0.245723E+02   0.271890E+02
    480.00   0.237719E+02   0.256137E+02
    500.00   0.234922E+02   0.250603E+02
    520.00   0.232486E+02   0.245617E+02
    540.00   0.231427E+02   0.243589E+02
    560.00   0.230113E+02   0.241174E+02
    580.00   0.229264E+02   0.239525E+02
    600.00   0.228243E+02   0.237764E+02
    620.00   0.307675E+02   0.316350E+02
    640.00   0.366145E+02   0.374192E+02
    660.00   0.388422E+02   0.396491E+02
    680.00   0.395891E+02   0.403702E+02
    700.00   0.397981E+02   0.405432E+02
    720.00   0.398310E+02   0.405374E+02
    740.00   0.398008E+02   0.404844E+02
    760.00   0.397441E+02   0.403622E+02
    780.00   0.396729E+02   0.402218E+02
    800.00   0.395976E+02   0.400736E+02
    850.00   0.394528E+02   0.398072E+02
    900.00   0.393348E+02   0.396260E+02
    950.00   0.392454E+02   0.394871E+02
   1000.00   0.391595E+02   0.393697E+02
   1050.00   0.391067E+02   0.392905E+02
   1100.00   0.390549E+02   0.392133E+02
```

```
   1150.00   0.390064E+02   0.391452E+02
   1200.00   0.389588E+02   0.390856E+02
   1300.00   0.388867E+02   0.389769E+02
   1400.00   0.388216E+02   0.388898E+02
   1500.00   0.387737E+02   0.388174E+02
   1600.00   0.387568E+02   0.387946E+02
   1700.00   0.387600E+02   0.387858E+02
   1800.00   0.387629E+02   0.387801E+02
   1900.00   0.387680E+02   0.387760E+02
   2000.00   0.387774E+02   0.387964E+02
   2200.00   0.696728E+02   0.696720E+02
   2400.00   0.698747E+02   0.698719E+02
   2600.00   0.699465E+02   0.699474E+02
   2800.00   0.700220E+02   0.700134E+02
   3000.00   0.700872E+02   0.700769E+02
   3500.00   0.702248E+02   0.702154E+02
   4000.00   0.703329E+02   0.703233E+02
   4500.00   0.704073E+02   0.703984E+02
   5000.00   0.704657E+02   0.704571E+02
   6000.00   0.705253E+02   0.705174E+02
   7000.00   0.705812E+02   0.705728E+02
   8000.00   0.706249E+02   0.706158E+02
   9000.00   0.706568E+02   0.706489E+02
  10000.00   0.706806E+02   0.706733E+02
  15000.00   0.707528E+02   0.707457E+02
  20000.00   0.707985E+02   0.707925E+02
  30000.00   0.708586E+02   0.708542E+02
  40000.00   0.708804E+02   0.708764E+02
  50000.00   0.708885E+02   0.708840E+02
 100000.00   0.709254E+02   0.709220E+02
 200000.00   0.709282E+02   0.709249E+02
 300000.00   0.709281E+02   0.709248E+02
 400000.00   0.709280E+02   0.709247E+02
 500000.00   0.709279E+02   0.709245E+02
 600000.00   0.709278E+02   0.709244E+02
 800000.00   0.709276E+02   0.709243E+02
1000000.00   0.709274E+02   0.709240E+02
...
```

Comparison of these excerpts (both the output file from the routine and the routine input file) indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (> 60 mm/yr) bin to the low infiltration flux 3-10 mm/yr bin corresponding to that location residing within that bin.

A randomly chosen location is also checked (still within the second bin). An excerpt of the header information from the input file RIP_csnf_qperc_d1050100_bin3-10_low is the following:

```
...
The number of Rows =  99
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171165.19 m
The northing coordinate = 233606.60 m
 Infiltration rate:
qinf =   3.06300 mm/yr
...
```

An excerpt from the output file RIP_csnf_qperc_d1050100_bin3-10_low-EIS is shown below:

```
...
The number of Rows =  99
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171165.19 m
The northing coordinate = 233606.60 m
```

Infiltration rate:

qinf = 37.84495 mm/yr

0.00	0.119456E+02	0.119456E+02
1.00	0.126604E+02	0.134892E+02
2.00	0.126418E+02	0.132115E+02
5.00	0.126773E+02	0.130002E+02
10.00	0.124497E+02	0.126675E+02
15.00	0.123079E+02	0.124725E+02
20.00	0.122035E+02	0.123347E+02
25.00	0.121258E+02	0.122359E+02
30.00	0.120722E+02	0.121650E+02
40.00	0.119901E+02	0.120520E+02
50.00	0.119140E+02	0.119491E+02
50.20	0.125106E+02	0.139445E+02
51.00	0.146220E+02	0.165964E+02
52.00	0.146895E+02	0.175121E+02
53.00	0.146698E+02	0.215306E+02
55.00	0.150599E+02	0.490433E+02
60.00	0.174173E+02	0.656349E+02
65.00	0.228676E+02	0.513640E+02
70.00	0.301092E+02	0.295892E+02
80.00	0.314525E+02	0.273121E+02
100.00	0.162767E+02	0.516853E+02
120.00	0.142002E+02	0.220160E+02
140.00	0.134148E+02	0.152986E+02
160.00	0.129073E+02	0.137978E+02
180.00	0.126534E+02	0.132135E+02
200.00	0.124670E+02	0.128229E+02
220.00	0.125298E+02	0.135087E+02
240.00	0.125935E+02	0.138621E+02
260.00	0.126118E+02	0.138417E+02
280.00	0.126395E+02	0.137804E+02
300.00	0.126265E+02	0.136184E+02
320.00	0.126148E+02	0.134802E+02
340.00	0.125879E+02	0.133590E+02
360.00	0.125557E+02	0.132409E+02
380.00	0.125208E+02	0.131353E+02
400.00	0.124783E+02	0.130233E+02
420.00	0.124343E+02	0.129201E+02
440.00	0.123909E+02	0.128203E+02
460.00	0.123412E+02	0.127156E+02
480.00	0.122988E+02	0.126303E+02
500.00	0.123094E+02	0.126134E+02
520.00	0.122890E+02	0.125650E+02
540.00	0.122531E+02	0.125035E+02
560.00	0.122193E+02	0.124462E+02
580.00	0.121802E+02	0.123879E+02
600.00	0.121401E+02	0.123293E+02
620.00	0.133223E+02	0.134907E+02
640.00	0.152814E+02	0.154314E+02
660.00	0.171822E+02	0.173168E+02
680.00	0.185760E+02	0.186986E+02
700.00	0.194692E+02	0.195830E+02
720.00	0.199946E+02	0.201028E+02
740.00	0.202710E+02	0.203735E+02
760.00	0.204112E+02	0.205042E+02
780.00	0.204773E+02	0.205625E+02
800.00	0.205085E+02	0.205872E+02
850.00	0.205009E+02	0.205621E+02
900.00	0.204635E+02	0.205154E+02
950.00	0.204286E+02	0.204767E+02
1000.00	0.204018E+02	0.204393E+02
1050.00	0.203775E+02	0.204075E+02
1100.00	0.203532E+02	0.203784E+02
1150.00	0.203326E+02	0.203585E+02
1200.00	0.203152E+02	0.203389E+02
1300.00	0.202894E+02	0.203030E+02
1400.00	0.202661E+02	0.202796E+02
1500.00	0.202537E+02	0.202594E+02
1600.00	0.202489E+02	0.202561E+02
1700.00	0.202496E+02	0.202529E+02
1800.00	0.202511E+02	0.202548E+02
1900.00	0.202564E+02	0.202586E+02
2000.00	0.202607E+02	0.202627E+02
2200.00	0.371064E+02	0.371067E+02

```
   2400.00   0.374528E+02   0.374524E+02
   2600.00   0.375090E+02   0.375085E+02
   2800.00   0.375422E+02   0.375390E+02
   3000.00   0.375678E+02   0.375652E+02
   3500.00   0.376108E+02   0.376105E+02
   4000.00   0.376379E+02   0.376353E+02
   4500.00   0.376588E+02   0.376570E+02
   5000.00   0.376733E+02   0.376723E+02
   6000.00   0.376865E+02   0.376874E+02
   7000.00   0.377046E+02   0.377030E+02
   8000.00   0.377098E+02   0.377090E+02
   9000.00   0.377230E+02   0.377219E+02
  10000.00   0.377311E+02   0.377302E+02
  15000.00   0.377618E+02   0.377610E+02
  20000.00   0.377800E+02   0.377792E+02
  30000.00   0.377996E+02   0.377987E+02
  40000.00   0.378193E+02   0.378184E+02
  50000.00   0.378169E+02   0.378155E+02
 100000.00   0.378438E+02   0.378427E+02
 200000.00   0.378460E+02   0.378448E+02
 300000.00   0.378459E+02   0.378447E+02
 400000.00   0.378458E+02   0.378446E+02
 500000.00   0.378457E+02   0.378445E+02
 600000.00   0.378456E+02   0.378444E+02
 800000.00   0.378455E+02   0.378442E+02
1000000.00   0.378449E+02   0.378437E+02
...
```

It is noted that the coordinate locations indeed match so this time-history curve belongs in the second bin (as placed by the routine). Now, it must be verified that the data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally resided). Referring to the header information (obtained from the output file) it is noted that the infiltration rate for this location (qinf = 37.84495 mm/yr) places it in the second highest infiltration rate bin in the high flux case. This corresponds to the file RIP_csnf_qperc_d1050100_bin20-60_high as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
...
The number of Rows =  99
The fraction of this history=0.001171
 Coordinate Location:
The easting coordinate = 171165.19 m
The northing coordinate = 233606.60 m
 Infiltration rate:
qinf =  37.84495 mm/yr
      0.00   0.119456E+02   0.119456E+02
      1.00   0.126604E+02   0.134892E+02
      2.00   0.126418E+02   0.132115E+02
      5.00   0.126773E+02   0.130002E+02
     10.00   0.124497E+02   0.126675E+02
     15.00   0.123079E+02   0.124725E+02
     20.00   0.122035E+02   0.123347E+02
     25.00   0.121258E+02   0.122359E+02
     30.00   0.120722E+02   0.121650E+02
     40.00   0.119901E+02   0.120520E+02
     50.00   0.119140E+02   0.119491E+02
     50.20   0.125106E+02   0.139445E+02
     51.00   0.146220E+02   0.165964E+02
     52.00   0.146895E+02   0.175121E+02
     53.00   0.146698E+02   0.215306E+02
     55.00   0.150599E+02   0.490433E+02
     60.00   0.174173E+02   0.656349E+02
     65.00   0.228676E+02   0.513640E+02
     70.00   0.301092E+02   0.295892E+02
     80.00   0.314525E+02   0.273121E+02
    100.00   0.162767E+02   0.516853E+02
```

120.00	0.142002E+02	0.220160E+02
140.00	0.134148E+02	0.152986E+02
160.00	0.129073E+02	0.137978E+02
180.00	0.126534E+02	0.132135E+02
200.00	0.124670E+02	0.128229E+02
220.00	0.125298E+02	0.135087E+02
240.00	0.125935E+02	0.138621E+02
260.00	0.126118E+02	0.138417E+02
280.00	0.126395E+02	0.137804E+02
300.00	0.126265E+02	0.136184E+02
320.00	0.126148E+02	0.134802E+02
340.00	0.125879E+02	0.133590E+02
360.00	0.125557E+02	0.132409E+02
380.00	0.125208E+02	0.131353E+02
400.00	0.124783E+02	0.130233E+02
420.00	0.124343E+02	0.129201E+02
440.00	0.123909E+02	0.128203E+02
460.00	0.123412E+02	0.127156E+02
480.00	0.122988E+02	0.126303E+02
500.00	0.123094E+02	0.126134E+02
520.00	0.122890E+02	0.125650E+02
540.00	0.122531E+02	0.125035E+02
560.00	0.122193E+02	0.124462E+02
580.00	0.121802E+02	0.123879E+02
600.00	0.121401E+02	0.123293E+02
620.00	0.133223E+02	0.134907E+02
640.00	0.152814E+02	0.154314E+02
660.00	0.171822E+02	0.173168E+02
680.00	0.185760E+02	0.186986E+02
700.00	0.194692E+02	0.195830E+02
720.00	0.199946E+02	0.201028E+02
740.00	0.202710E+02	0.203735E+02
760.00	0.204112E+02	0.205042E+02
780.00	0.204773E+02	0.205625E+02
800.00	0.205085E+02	0.205872E+02
850.00	0.205009E+02	0.205621E+02
900.00	0.204635E+02	0.205154E+02
950.00	0.204286E+02	0.204767E+02
1000.00	0.204018E+02	0.204393E+02
1050.00	0.203775E+02	0.204075E+02
1100.00	0.203532E+02	0.203784E+02
1150.00	0.203326E+02	0.203585E+02
1200.00	0.203152E+02	0.203389E+02
1300.00	0.202894E+02	0.203030E+02
1400.00	0.202661E+02	0.202796E+02
1500.00	0.202537E+02	0.202594E+02
1600.00	0.202489E+02	0.202561E+02
1700.00	0.202496E+02	0.202529E+02
1800.00	0.202511E+02	0.202548E+02
1900.00	0.202564E+02	0.202586E+02
2000.00	0.202607E+02	0.202627E+02
2200.00	0.371064E+02	0.371067E+02
2400.00	0.374528E+02	0.374524E+02
2600.00	0.375090E+02	0.375085E+02
2800.00	0.375422E+02	0.375390E+02
3000.00	0.375678E+02	0.375652E+02
3500.00	0.376108E+02	0.376105E+02
4000.00	0.376379E+02	0.376353E+02
4500.00	0.376588E+02	0.376570E+02
5000.00	0.376733E+02	0.376723E+02
6000.00	0.376865E+02	0.376874E+02
7000.00	0.377046E+02	0.377030E+02
8000.00	0.377098E+02	0.377090E+02
9000.00	0.377230E+02	0.377219E+02
10000.00	0.377311E+02	0.377302E+02
15000.00	0.377618E+02	0.377610E+02
20000.00	0.377800E+02	0.377792E+02
30000.00	0.377996E+02	0.377987E+02
40000.00	0.378193E+02	0.378184E+02
50000.00	0.378169E+02	0.378155E+02
100000.00	0.378438E+02	0.378427E+02
200000.00	0.378460E+02	0.378448E+02
300000.00	0.378459E+02	0.378447E+02
400000.00	0.378458E+02	0.378446E+02
500000.00	0.378457E+02	0.378445E+02

```
 600000.00    0.378456E+02    0.378444E+02
 800000.00    0.378455E+02    0.378442E+02
1000000.00    0.378449E+02    0.378437E+02
...
```

Comparison of these excerpts (both the output file from the routine and the routine input file) indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (20-60 mm/yr) bin to the low infiltration flux 3-10 mm/yr bin corresponding to that location residing within that bin.

Finally, the last entry (still in the second bin) is checked. An excerpt of the header information from the input file RIP_csnf_qperc_d1050100_bin3-10_low is the following:

```
...
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170324.19 m
The northing coordinate = 232497.40 m
 Infiltration rate:
qinf =   5.78627 mm/yr
...
```

An excerpt from the output file RIP_csnf_qperc_d1050100_bin3-10_low-EIS is shown below:

```
...
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170324.19 m
The northing coordinate = 232497.40 m
 Infiltration rate:
qinf =  68.23377 mm/yr
      0.00    0.219253E+02    0.219253E+02
      1.00    0.216273E+02    0.217828E+02
      2.00    0.217391E+02    0.220037E+02
      5.00    0.220914E+02    0.226357E+02
     10.00    0.223054E+02    0.230356E+02
     15.00    0.224334E+02    0.231955E+02
     20.00    0.223931E+02    0.230912E+02
     25.00    0.223027E+02    0.228946E+02
     30.00    0.221957E+02    0.226880E+02
     40.00    0.219848E+02    0.223132E+02
     50.00    0.218233E+02    0.220406E+02
     50.20    0.221370E+02    0.230035E+02
     51.00    0.230633E+02    0.260333E+02
     52.00    0.247814E+02    0.403121E+02
     53.00    0.278134E+02    0.132656E+03
     55.00    0.456833E+02    0.207814E+03
     60.00    0.118367E+03    0.118861E+03
     65.00    0.144112E+03    0.513752E+02
     70.00    0.134108E+03    0.284736E+02
     80.00    0.117352E+03    0.222641E+02
    100.00    0.875175E+02    0.471940E+02
    120.00    0.420299E+02    0.755135E+02
    140.00    0.353739E+02    0.546797E+02
    160.00    0.322929E+02    0.585222E+02
    180.00    0.300720E+02    0.531674E+02
    200.00    0.284315E+02    0.462158E+02
    220.00    0.273723E+02    0.411999E+02
    240.00    0.266117E+02    0.371940E+02
    260.00    0.259872E+02    0.342370E+02
    280.00    0.255417E+02    0.322070E+02
    300.00    0.251473E+02    0.304827E+02
```

320.00	0.248871E+02	0.293677E+02
340.00	0.248132E+02	0.287201E+02
360.00	0.245369E+02	0.279672E+02
380.00	0.241770E+02	0.271183E+02
400.00	0.237995E+02	0.262531E+02
420.00	0.235965E+02	0.257327E+02
440.00	0.233949E+02	0.252900E+02
460.00	0.232603E+02	0.249948E+02
480.00	0.231028E+02	0.246756E+02
500.00	0.229556E+02	0.243845E+02
520.00	0.228397E+02	0.241551E+02
540.00	0.227149E+02	0.239156E+02
560.00	0.225877E+02	0.236784E+02
580.00	0.224991E+02	0.235045E+02
600.00	0.223967E+02	0.233278E+02
620.00	0.295681E+02	0.304124E+02
640.00	0.348799E+02	0.356451E+02
660.00	0.369115E+02	0.376225E+02
680.00	0.376063E+02	0.382615E+02
700.00	0.378071E+02	0.384102E+02
720.00	0.378391E+02	0.383954E+02
740.00	0.378114E+02	0.383468E+02
760.00	0.377669E+02	0.382453E+02
780.00	0.377145E+02	0.381567E+02
800.00	0.376593E+02	0.380684E+02
850.00	0.375405E+02	0.378783E+02
900.00	0.374274E+02	0.377053E+02
950.00	0.373421E+02	0.375735E+02
1000.00	0.372589E+02	0.374585E+02
1050.00	0.372078E+02	0.373819E+02
1100.00	0.371581E+02	0.373087E+02
1150.00	0.371115E+02	0.372445E+02
1200.00	0.370665E+02	0.371878E+02
1300.00	0.369989E+02	0.370839E+02
1400.00	0.369403E+02	0.370046E+02
1500.00	0.369062E+02	0.369456E+02
1600.00	0.368944E+02	0.369278E+02
1700.00	0.368976E+02	0.369213E+02
1800.00	0.369015E+02	0.369166E+02
1900.00	0.369075E+02	0.369154E+02
2000.00	0.369163E+02	0.369359E+02
2200.00	0.670087E+02	0.670086E+02
2400.00	0.672340E+02	0.672317E+02
2600.00	0.673033E+02	0.673016E+02
2800.00	0.673738E+02	0.673660E+02
3000.00	0.674332E+02	0.674240E+02
3500.00	0.675578E+02	0.675492E+02
4000.00	0.676573E+02	0.676487E+02
4500.00	0.677277E+02	0.677197E+02
5000.00	0.677826E+02	0.677749E+02
6000.00	0.678426E+02	0.678353E+02
7000.00	0.678967E+02	0.678889E+02
8000.00	0.679380E+02	0.679291E+02
9000.00	0.679721E+02	0.679652E+02
10000.00	0.679942E+02	0.679874E+02
15000.00	0.680589E+02	0.680513E+02
20000.00	0.681047E+02	0.680980E+02
30000.00	0.681688E+02	0.681646E+02
40000.00	0.681876E+02	0.681837E+02
50000.00	0.682009E+02	0.681968E+02
100000.00	0.682341E+02	0.682309E+02
200000.00	0.682346E+02	0.682315E+02
300000.00	0.682345E+02	0.682313E+02
400000.00	0.682344E+02	0.682313E+02
500000.00	0.682342E+02	0.682311E+02
600000.00	0.682342E+02	0.682310E+02
800000.00	0.682340E+02	0.682309E+02
1000000.00	0.682338E+02	0.682306E+02

It is noted that the coordinate locations indeed match so this time-history curve belongs in the second bin (as placed by the routine). Now, it must be verified that the data reported for this bin has indeed been mapped correctly from the high infiltration flux case (where it originally

resided). Referring to the header information (obtained from the output file) it is noted that the infiltration rate for this location (qinf = 68.23377 mm/yr) places it in the highest infiltration rate bin in the high flux case. This corresponds to the file RIP_csnf_qperc_d1050100_bin-60_high as indicated above for input files from the high flux case. An excerpt from this input file is the following:

```
...
The number of Rows =  99
The fraction of this history=0.001496
 Coordinate Location:
The easting coordinate = 170324.19 m
The northing coordinate = 232497.40 m
 Infiltration rate:
qinf =  68.23377 mm/yr
      0.00   0.219253E+02   0.219253E+02
      1.00   0.216273E+02   0.217828E+02
      2.00   0.217391E+02   0.220037E+02
      5.00   0.220914E+02   0.226357E+02
     10.00   0.223054E+02   0.230356E+02
     15.00   0.224334E+02   0.231955E+02
     20.00   0.223931E+02   0.230912E+02
     25.00   0.223027E+02   0.228946E+02
     30.00   0.221957E+02   0.226880E+02
     40.00   0.219848E+02   0.223132E+02
     50.00   0.218233E+02   0.220406E+02
     50.20   0.221370E+02   0.230035E+02
     51.00   0.230633E+02   0.260333E+02
     52.00   0.247814E+02   0.403121E+02
     53.00   0.278134E+02   0.132656E+03
     55.00   0.456833E+02   0.207814E+03
     60.00   0.118367E+03   0.118861E+03
     65.00   0.144112E+03   0.513752E+02
     70.00   0.134108E+03   0.284736E+02
     80.00   0.117352E+03   0.222641E+02
    100.00   0.875175E+02   0.471940E+02
    120.00   0.420299E+02   0.755135E+02
    140.00   0.353739E+02   0.546797E+02
    160.00   0.322929E+02   0.585222E+02
    180.00   0.300720E+02   0.531674E+02
    200.00   0.284315E+02   0.462158E+02
    220.00   0.273723E+02   0.411999E+02
    240.00   0.266117E+02   0.371940E+02
    260.00   0.259872E+02   0.342370E+02
    280.00   0.255417E+02   0.322070E+02
    300.00   0.251473E+02   0.304827E+02
    320.00   0.248871E+02   0.293677E+02
    340.00   0.248132E+02   0.287201E+02
    360.00   0.245369E+02   0.279672E+02
    380.00   0.241770E+02   0.271183E+02
    400.00   0.237995E+02   0.262531E+02
    420.00   0.235965E+02   0.257327E+02
    440.00   0.233949E+02   0.252900E+02
    460.00   0.232603E+02   0.249948E+02
    480.00   0.231028E+02   0.246756E+02
    500.00   0.229556E+02   0.243845E+02
    520.00   0.228397E+02   0.241551E+02
    540.00   0.227149E+02   0.239156E+02
    560.00   0.225877E+02   0.236784E+02
    580.00   0.224991E+02   0.235045E+02
    600.00   0.223967E+02   0.233278E+02
    620.00   0.295681E+02   0.304124E+02
    640.00   0.348799E+02   0.356451E+02
    660.00   0.369115E+02   0.376225E+02
    680.00   0.376063E+02   0.382615E+02
    700.00   0.378071E+02   0.384102E+02
    720.00   0.378391E+02   0.383954E+02
    740.00   0.378114E+02   0.383468E+02
    760.00   0.377669E+02   0.382453E+02
    780.00   0.377145E+02   0.381567E+02
    800.00   0.376593E+02   0.380684E+02
    850.00   0.375405E+02   0.378783E+02
```

900.00	0.374274E+02	0.377053E+02
950.00	0.373421E+02	0.375735E+02
1000.00	0.372589E+02	0.374585E+02
1050.00	0.372078E+02	0.373819E+02
1100.00	0.371581E+02	0.373087E+02
1150.00	0.371115E+02	0.372445E+02
1200.00	0.370665E+02	0.371878E+02
1300.00	0.369989E+02	0.370839E+02
1400.00	0.369403E+02	0.370046E+02
1500.00	0.369062E+02	0.369456E+02
1600.00	0.368944E+02	0.369278E+02
1700.00	0.368976E+02	0.369213E+02
1800.00	0.369015E+02	0.369166E+02
1900.00	0.369075E+02	0.369154E+02
2000.00	0.369163E+02	0.369359E+02
2200.00	0.670087E+02	0.670086E+02
2400.00	0.672340E+02	0.672317E+02
2600.00	0.673033E+02	0.673016E+02
2800.00	0.673738E+02	0.673660E+02
3000.00	0.674332E+02	0.674240E+02
3500.00	0.675578E+02	0.675492E+02
4000.00	0.676573E+02	0.676487E+02
4500.00	0.677277E+02	0.677197E+02
5000.00	0.677826E+02	0.677749E+02
6000.00	0.678426E+02	0.678353E+02
7000.00	0.678967E+02	0.678889E+02
8000.00	0.679380E+02	0.679291E+02
9000.00	0.679721E+02	0.679652E+02
10000.00	0.679942E+02	0.679874E+02
15000.00	0.680589E+02	0.680513E+02
20000.00	0.681047E+02	0.680980E+02
30000.00	0.681688E+02	0.681646E+02
40000.00	0.681876E+02	0.681837E+02
50000.00	0.682009E+02	0.681968E+02
100000.00	0.682341E+02	0.682309E+02
200000.00	0.682346E+02	0.682315E+02
300000.00	0.682345E+02	0.682313E+02
400000.00	0.682344E+02	0.682313E+02
500000.00	0.682342E+02	0.682311E+02
600000.00	0.682342E+02	0.682310E+02
800000.00	0.682340E+02	0.682309E+02
1000000.00	0.682338E+02	0.682306E+02

Comparison of these excerpts (both the output file from the routine and the routine input file) indicates that they are identical. Therefore, this location has been correctly mapped (by the routine) from the high infiltration flux (>60 mm/yr) bin to the low infiltration flux 3-10 mm/yr bin corresponding to that location residing within that bin.

This concludes the testing and verification exercise for the csnf case (future_cs-csnf). Based on the results of steps (1) through (3), the software routines are implemented correctly and are performing as intended.

The hlw case (software routine name: future_cs-hlw) is only different in the routine implemented file naming scheme for both input and input files. All other aspects of the routine remain unchanged when compared to the case just tested. If the file naming scheme was incorrectly implemented, the input files would not be processed (*components.dat* would be empty) or the output files would be empty. This was not the case. Therefore, the hlw case is also correctly processed based on the steps described above for the csnf case.

Range of validity

The range of validity is identical for both routines. The routine parameter statement specifies the number of input files used to determine coordinate locations (=2), the number of input files used to map from the high infiltration flux case (=4), and the number of time points (at each location) in the files (=99). The routine is specified to write only two output files. If the number of input files changes or the number of time points changes in the data files, this statement can be altered and recompiled. The driver files need to reflect any changes in the numbers of files processed. It is noted that the number of routine generated output files should always match the number of input files used to determine the locations (in this case, two).

Source code for future_cs-csnf

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c
c....Routine is adapted for the future climate state analysis of the
c....TSPA sensitivity study and the EIS runs for future climate states
c....ndf 09/19/2000
c
c....This software routine maps the repository percolation flux
c....locations from the high infiltration
c....flux case into the two bins of the low infiltration flux case.
c....This is to be used for the csnf abstraction of percolation data

      parameter(inp=2,nent=4,jcount=99)
c.....inp = 2 is the number of pop. bins from the low infiltration flux case
c.....(will read from a total of 2 input files)
c.....nent = 4 is the number of pop. bins in the high infiltration flux case
c.....(will map from a total of 4 files)
c.....jcount = 99 is the number of time points in the abstraction data
c.....(they range from 0 to 10^6 years)

c.....The number of time points in the abstraction files is 99.
c.....This will need to be modified for the with backfill case if it
c.....is needed for the future climate state analysis
c

      implicit double precision (a-h,l,o-z)

      character*4 name
      character*80 label1
      character*80 label2
      character*10 label3
      character*80 block
      character*21 hinge1
      character*21 hinge
      character*25 infilinfo
      character*80 outfile(nent)
      character*80 infile(inp)

        integer icomp(inp)


c.....open the new files that will contain the high infiltration
c.....flux percolation flux values mapped into the low infiltration
c.....flux case bins (4 total mapped into 2 bins total, numbers 1 and 2)

        open(104,file='RIP_csnf_qperc_d1050100_bin0-3_low-EIS',
     @  status='new')
        open(105,file='RIP_csnf_qperc_d1050100_bin3-10_low-EIS',
     @  status='new')

c.....Consider the lowest (bin=1) in the low flux case first.
c.....Open the bin 1 low infiltration flux file to determine
c.....which repository locations fall in bin 1 from the low
c.....infiltration flux case. Then open bin=2 next.

c.....open the file that houses the names of the files from the low
c.....infiltration flux case (2 total in this case)
```

```
c

c.....Open the existing low infiltration rate files to determine locations
c.....NOTE: the existing files must have the word:  end   :placed at the
c.....very end of the file

        j=1
        open(2, file='inpEIS.fil', status='old')
 166   if(j .gt. inp) goto 777
       write(*,*) 'Opened the file: low bin='
       write(*,*) j
       read(2, '(a)') infile(j)
        ichk=0

        open(3+j,file=infile(j), status='old')
        read(3+j, 25) label1
        read(3+j, 25) label2
        write(103+j, 25) label1
        write(103+j, 25) label2
         if(j .eq. 1) then
          write(103+j,*) 'RIP_csnf_qperc_d1050100_bin0-3_low-EIS'
         else
          write(103+j,*) 'RIP_csnf_qperc_d1050100_bin3-10_low-EIS'
         endif
c234567890123456789012345678901234567890123456789012345678901234567890123456789012
       write(103+j,*) ' Time (yr),  Percolation Flux at 5 m (mm/yr),
     @Percolation Flux at 3 m (mm/yr)'
 25     format(a80)
c.....open a file that contains the percolation flux values
c.....from the low infiltration flux case bins.  This will
c.....provide the coordinate locations for each perc location that
c.....is contained in that bin.
 66      read(3+j, 30) hinge1
 30     format(a21)
            if (hinge1(1:3) .eq. 'end') then
               icomp(j) = ichk
               j=j+1
               close(150)
                do l=1,nent
                close(13+l)
                enddo
               goto 166
            endif
          if (hinge1 .ne. ' Coordinate Location:') goto 66
        read (3+j, 35) cordeast
 35     format(25x, f9.2)
        read (3+j, 40) cordnorth
 40     format (26x, f9.2)
c.....Open the file that houses the the names of the files
c.....(from the high infiltration flux case) that will be
c.....mapped over to the low
c.....Search through all high files until the location is found.
         i=1
        open(150, file='EIS.fil', status='old')
 167      read(150,'(a)') outfile(i)
c234567890123456789012345678901234567890123456789012345678901234567890123456789012
c.....Open the existing high infiltration rate files to be mapped
c.....NOTE: the existing files must have the word:  end   :placed at the
c.....very end of the file
        open(13+i, file=outfile(i), status='old')
 67      read(13+i, 45) label3
 45     format(a10)
            if (label3(1:3) .eq. 'end') then
               close(13+i)
               i=i+1
               goto 167
            endif
          if (label3 .ne. 'The number') goto 67
          read(13+i, 50)  factbin
 50     format(29x, f8.6)
 68       read(13+i, 30) hinge
          if (hinge .ne. ' Coordinate Location:') goto 68

        read(13+i, 35) cordeasthi
        read(13+i, 40) cordnorthhi
```

```
c......When the if statement is executed, the location is found
c......if the if statement is not executed it will continue to look
c......for a match

        if (cordeasthi .eq. cordeast .and. cordnorthhi .eq. cordnorth)
     @   then
         k=1
         ichk=ichk+1
 69       read(13+i,55) name
 55       format(a4)
          if (name .ne. ' Inf') go to 69
          read(13+i, 60) infilinfo
 60       format(a25)
         write(103+j,925) jcount
 925     format('The number of Rows = ', i3)
         write(103+j,926) factbin
 926     format('The fraction of this history=',f8.6)
         write(103+j,*) 'Coordinate Location:'
         write(103+j,128) cordeasthi
 128    format('The easting coordinate = ', f9.2, ' m')
         write(103+j,129) cordnorthhi
 129    format('The northing coordinate = ', f9.2, ' m')
         write(103+j,*) 'Infiltration rate:'
         write(103+j, 60) infilinfo
 71        read(13+i,65) block
 65       format(a80)
          write(103+j,65) block
          k=k+1
          if(k .ne. jcount+1) goto 71
           close(150)
           goto 66
         endif

        goto 67

c.....used to ensure that all locations have been found

 777    open(200, file='components.dat', status='new')
        do l=1,inp
        write(200,*) icomp(l)
        enddo
        stop
        end
```

Source code for future_cs-hlw

```
c23456789012345678901234567890123456789012345678901234567890123456789012
c
c
c....Routine is adapted for the future climate state analysis of the
c....TSPA sensitivity study and the EIS runs for future climate states
c....ndf 09/20/2000
c
c....This software routine maps the repository percolation flux
c....locations from the high infiltration
c....flux case into the two bins of the low infiltration flux case.
c....This is to be used for the hlw abstraction of percolation data

      parameter(inp=2,nent=4,jcount=99)
c.....inp = 2 is the number of pop. bins from the low infiltration flux case
c.....(will read from a total of 2 input files)
c.....nent = 4 is the number of pop. bins in the high infiltration flux case
c.....(will map from a total of 4 files)
c.....jcount = 99 is the number of time points in the abstraction data
c.....(they range from 0 to 10^6 years)

c.....The number of time points in the abstraction files is 99.
c.....This will need to be modified for the with backfill case if it
c.....is needed for the future climate state analysis
c

      implicit double precision (a-h,l,o-z)
```

```
      character*4 name
      character*80 label1
      character*80 label2
      character*10 label3
      character*80 block
      character*21 hinge1
      character*21 hinge
      character*25 infilinfo
      character*80 outfile(nent)
      character*80 infile(inp)

        integer icomp(inp)


c.....open the new files that will contain the high infiltration
c.....flux percolation flux values mapped into the low infiltration
c.....flux case bins (4 total mapped into 2 bins total, numbers 1 and 2)

        open(104,file='RIP_hlw_qperc_d1050100_bin0-3_low-EIS',
     @  status='new')
        open(105,file='RIP_hlw_qperc_d1050100_bin3-10_low-EIS',
     @  status='new')

c.....Consider the lowest (bin=1) in the low flux case first.
c.....Open the bin 1 low infiltration flux file to determine
c.....which repository locations fall in bin 1 from the low
c.....infiltration flux case. Then open bin=2 next.

c.....open the file that houses the names of the files from the low
c.....infiltration flux case (2 total in this case)
c

c.....Open the existing low infiltration rate files to determine locations
c.....NOTE: the existing files must have the word:  end   :placed at the
c.....very end of the file

        j=1
        open(2, file='inpEIS.fil', status='old')
 166   if(j .gt. inp) goto 777
       write(*,*) 'Opened the file: low bin='
       write(*,*) j
       read(2, '(a)') infile(j)
        ichk=0

        open(3+j,file=infile(j), status='old')
        read(3+j, 25) label1
        read(3+j, 25) label2
        write(103+j, 25) label1
        write(103+j, 25) label2
         if(j .eq. 1) then
          write(103+j,*) 'RIP_hlw_qperc_d1050100_bin0-3_low-EIS'
         else
          write(103+j,*) 'RIP_hlw_qperc_d1050100_bin3-10_low-EIS'
         endif
c23456789012345678901234567890123456789012345678901234567890123456789012
        write(103+j,*) ' Time (yr),  Percolation Flux at 5 m (mm/yr),
     @Percolation Flux at 3 m (mm/yr)'
 25      format(a80)
c.....open a file that contains the percolation flux values
c.....from the low infiltration flux case bins.  This will
c.....provide the coordinate locations for each perc location that
c.....is contained in that bin.
 66      read(3+j, 30) hinge1
 30     format(a21)
            if (hinge1(1:3) .eq. 'end') then
               icomp(j) = ichk
               j=j+1
               close(150)
                do l=1,nent
                close(13+l)
                enddo
               goto 166
            endif
          if (hinge1 .ne. ' Coordinate Location:') goto 66
         read (3+j, 35) cordeast
```

```
 35      format(25x, f9.2)
         read (3+j, 40) cordnorth
 40      format (26x, f9.2)
c.....Open the file that houses the the names of the files
c.....(from the high infiltration flux case) that will be
c.....mapped over to the low
c.....Search through all high files until the location is found.
          i=1
         open(150, file='EIS.fil', status='old')
 167      read(150,'(a)') outfile(i)
c234567890123456789012345678901234567890123456789012345678901234567890123456789012
c.....Open the existing high infiltration rate files to be mapped
c.....NOTE: the existing files must have the word:  end   :placed at the
c.....very end of the file
         open(13+i, file=outfile(i), status='old')
 67       read(13+i, 45) label3
 45      format(a10)
             if (label3(1:3) .eq. 'end') then
                close(13+i)
                i=i+1
                goto 167
             endif
           if (label3 .ne. 'The number') goto 67
           read(13+i, 50)  factbin
 50      format(29x, f8.6)
 68        read(13+i, 30) hinge
           if (hinge .ne. ' Coordinate Location:') goto 68

         read(13+i, 35) cordeasthi
         read(13+i, 40) cordnorthhi
c......When the if statement is executed, the location is found
c......if the if statement is not executed it will continue to look
c......for a match

         if (cordeasthi .eq. cordeast .and. cordnorthhi .eq. cordnorth)
     @    then
          k=1
          ichk=ichk+1
 69        read(13+i,55) name
 55        format(a4)
           if (name .ne. ' Inf') go to 69
           read(13+i, 60) infilinfo
 60        format(a25)
          write(103+j,925) jcount
 925      format('The number of Rows = ', i3)
          write(103+j,926) factbin
 926      format('The fraction of this history=',f8.6)
          write(103+j,*) 'Coordinate Location:'
          write(103+j,128) cordeasthi
 128     format('The easting coordinate = ', f9.2, ' m')
          write(103+j,129) cordnorthhi
 129     format('The northing coordinate = ', f9.2, ' m')
          write(103+j,*) 'Infiltration rate:'
          write(103+j, 60) infilinfo
 71         read(13+i,65) block
 65        format(a80)
           write(103+j,65) block
           k=k+1
           if(k .ne. jcount+1) goto 71
            close(150)
            goto 66
          endif

         goto 67

 c.....used to ensure that all locations have been found

  777    open(200, file='components.dat', status='new')
         do l=1,inp
         write(200,*) icomp(l)
         enddo
         stop
         end
```