

# SCIENTIFIC NOTEBOOK

by

Ron Janetzke

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R. Janetzke

SCIENTIFIC NOTEBOOK No. 453e

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by

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## **INITIAL ENTRIES**

Scientific Notebook: #453e

Issued to: R. Janetzke

Issue Date: March 21, 2001

Account Number: 20-1402-672

Title: PCSA Tool

Participants: Ron Janetzke

Objective:

The work described here will convert the LHS program from the TPA environment to the PCSA Tool environment. The TPA environment is a standalone command line environment, and the PCSA Tool environment is a Windows/GUI interactive environment. The flat text input for the LHS program will be derived from the PCSA Tool dialog box fields. The output of the LHS code will be a flat text file that will be read by the PCSA Tool.

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March 22, 2001 - RSAC Sample parameters

The following table was received from R. Benke showing the RSAC sampled parameters.

**Distributions for RSAC Input Parameters**

Parameter	RSAC Input Location	Distribution	Distribution Values	Supporting Information
Average wind velocity (m/s)	line 5001, entry 1	exponential	l = 2 s/m	(should be replaced by actual site data) Wind speed of 1 m/s recommended by Regulatory Guide 1.98; same distribution for wind speed as in TPA 4.1, arbitrary selection of recurrence rate
Mixing Layer Height (m)	line 5001, entry 3	logtriangular	100, 400, 3300	(should be replaced by actual site data) Based on seasonal and annual mixing depths for the desert at Idaho National Engineering Laboratory (Clawson et. al., 1989) presented in Table A-1 (p.A-6) of the RSAC 5.2 User's Manual (Wenzel, 1994); logtriangular appeared to fit the data better
Weather Class	line 5410, entry 6	iconstant	equally sampled from {1,2,3,4,5,6}	(should be replaced by actual site data) data not yet obtained
Deposition Velocity (m/s) for solids	line 5002, entry 1	uniform	0.000026, 0.02	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Deposition Velocity (m/s) for halogens	line 5002, entry 2	logtriangular	0.0002, 0.01, 0.26	range for iodine gas from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984); mode assigned the typically accepted value of 0.01 equal to RSAC-5.2 default value (Wenzel, 1994); logtriangular was selected because the accepted value did not bound the range

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Deposition Velocity (m/s) for noble gases	line 5002, entry 3	constant	0	assigned to the RSAC-5.2 default value (Wenzel, 1994)
Deposition Velocity (m/s) for cesium	line 5002, entry 4	uniform	0.0004, 0.006	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Deposition Velocity (m/s) for ruthenium	line 5002, entry 5	uniform	0.0002, 0.023	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Release Fraction (unitless) for noble gases {Ar, Kr, Rn}	line 2000, multiplicative inventory factor	triangular	0.05, 0.40, 0.40	minimum assigned to free-fall spill value in Table A1 (American Nuclear Society, 1998); mode assigned to Table 3.3 value of NUREG/CR-6451 (U.S. Nuclear Regulatory Commission, 1997b); maximum assigned to free-fall spill value in Table 11.4 of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a)
Release Fraction (unitless) for H	line 2000, multiplicative inventory factor	uniform	0.01, 0.3	minimum assigned to the high-energy crush/impact value (free-fall spill value was not provided for H) in Table A1 (American Nuclear Society, 1998); maximum assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a)
Release Fraction (unitless) for I	line 2000, multiplicative inventory factor	triangular	1.5e-5, 2.3e-3, 0.3	minimum assigned to value from Table 3.3 of NUREG/CR-6451 (U.S. Nuclear Regulatory Commission, 1997b); mode assigned to free-fall spill value for I <sub>2</sub> in Table A1* (American Nuclear Society, 1998); maximum assigned to Table 4-1 value of NUREG-1617 (U.S. Nuclear Regulatory Commission, 2000)

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Release Fraction (unitless) for Cs & Sr	line 2000, multiplicative inventory factor	triangular	2e-6, 2.3e-5, 2.5e-4	minimum assigned to impact rupture value in Table 11.4 and mode assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value for Cs vapor in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for Ru	line 2000, multiplicative inventory factor	triangular	2e-6, 1.5e-5, 2.4e-4	minimum assigned to impact rupture value in Table 11.4 and mode assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for fuel fines	line 2000, multiplicative inventory factor	triangular	2e-6, 2e-6, 2.4e-4	minimum and mode assigned to impact rupture values in Table 11.4 of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for Co crud	line 2000, multiplicative inventory factor	uniform	0.001, 1.0	minimum assigned to shock/vibration value from Table A1 <sup>†</sup> (American Nuclear Society, 1998); maximum assigned to Table 4-1 value of NUREG-1617 (U.S. Nuclear Regulatory Commission, 2000)

\*Table A1 cites Mishima (1995) as a reference.

<sup>†</sup> For loose surface contamination, Table A1 cites subsection 4.4.3.3.1 of the DOE Handbook (U.S. Department of Energy, 1994).

### References

American Nuclear Society, *Airborne Release Fractions at Non-Reactor Nuclear Facilities*, American National Standard, ANSI/ANS-5.10-1998, La Grange Park, Illinois, 1998.

K.L. Clawson, G.E. Start, N.R. Ricks, *Climatology of the Idaho National Engineering Laboratory*, 2<sup>nd</sup> Edition, DOE/ID-12118, U.S. Department of Commerce: Idaho Falls, Idaho, 1989.

J. Mishima, "LANL TA-55 Particles Generated by Impact of Bare Fuel Pellets," letter report to Bob Jackson, Richland, Washington, March 1995.

National Council on Radiation Protection and Measurements (NCRP), *Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment*, NCRP Report 76,

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Bethesda, Maryland, 1984.

U.S. Department of Energy, *DOE Handbook – Airborne Release Fractions/Rates and Respirable Fractions for Nonnuclear Facilities*, DOE-HDBK-3010-94, Washington, D.C., 1994.

U.S. Nuclear Regulatory Commission, *Standard Review Plan for Dry Cask Storage Systems*, NUREG-1536, Washington, DC, 1997a.

U.S. Nuclear Regulatory Commission, *A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants*, NUREG/CR-6451, Washington, DC, 1997b.

U.S. Nuclear Regulatory Commission, *Standard Review Plan for Transportation Packages for Spent Nuclear Fuel*, NUREG-1617, Washington, DC, 2000.

D.R. Wenzel, *The Radiological Safety Analysis Computer Program (RSAC-5) User's Manual*, WINCO-1123, Revision 1. Westinghouse Idaho Nuclear Company, Inc. Idaho National Engineering Laboratory: Idaho Falls, Idaho.1994.

March 27, 2001    SNLLHS.F

Removed global data input file tpa\_lhs.lgd as means of entering file names and number of realizations. Input file is returned to that as described in the User Guide and is assigned to unit 5 instead of unit 12 in order to allow redirection of input files. The sampled output remains on unit 1 and the screen output remains on unit 6.

March 27, 2001    Test input file

This is the lhs.inp test input file used to see if the new executable produces the same results.

```
TITLE - Created for tpa execution
RANDOM SEED        -246813579
NOBS              10
NREPS     1
EXPONENTIAL            Lambda for average wind velocity [s/m].
2.0
LOGTRIANGULAR        Mixing layer height [m].
100.0, 400.0, 3300.0
USER DISTRIBUTION    Weather class.
6
```

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```

1.
2.
3.
4.
5.
6.
IUNIFORM
0, 10
CONSTANT
-1.
UNIFORM
10., 20.
LOGUNIFORM
100., 200.
NORMAL
20., 30.
LOGNORMAL
200., 300.
CORR
      2           1           2      0.6310
           3           2      -0.6230

```

March 28, 2001    User Discrete Empirical Distribution

The User Discrete Empirical Distribution was added as a permanent feature of the SNLLHS code. In previous version of the code the user was required to supply the necessary modules and recompile the code to use this feature. This distribution is identified in the lhs.inp file as USER DISCRETE EMPIRICAL and accepts both the discrete sample values and the frequency of occurrence for each value. This distribution type is number 16 in the SNLLHS set. Due to the long name for this distribution, the size of the character string variable for distribution types (DIST) was lengthened to 23 characters. The new module is named UsrDisEmp and follows the example of the empirical distribution given in the LHS Users Guide.

March 30, 2001    SNLLHS Include files.

Several parameter, common, and local function statements were organized into 7 include files (lhs1.i, . . . , lhs7.i). These modifications were saved in SCCS as version 2.1d.



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April 13, 2001    SNLLHS code cleanup.

The snllhs.f file underwent modification for the following:

- removed dead code in comments that were the result of adding the include file references
- labels for the user distribution and finite exponential were increased to handle the fully spelled distribution string
- the USER DISTRIBUTION was changed to USER DISCRETE EMPIRICAL
- the keyword for supplying a correlation matrix was changed from CORR to CORRELATION MATRIX
- subroutine WRTCRD was not handling the exponential distribution correctly since it is the only distribution that has only one control parameter
- the size of the user distribution tables was increased to 20 entries
- a new distribution called USER SUPPLIED DISCRETE was added to the code
- explanatory text was added to the PAUSE statement in RAN()

APRIL 18, 2001    Snllhs.f

Completed new version of snllhs.f. The following are the SCCS deltas entered during the development.

SCCS/s.snllhs.f:

D 1.8 01/04/18 15:45:11 janetzke 8 7      00133/00025/06349

MRs:

COMMENTS:

V2.1g Added lhs8.i usage, move the binary buffer for the user distributions from unit 7 to unit 8, added new routines chkusrdis and chkusrsup, added new comma separated value output file lhs.csv that contains the same information as lhs.out.

D 1.7 01/04/17 20:05:58 janetzke 7 6      00145/00087/06229

MRs:

COMMENTS:

V2.1f Corrected entries of 3-28-01 to use USER DISCRETE EMPIRICAL where USER DISTRIBUTION was used before and call the new distribution USER SUPPLIED DISCRETE, changed handling of constants to treat them as regular sampled variables, added CHKCONS subroutine, open lhs.out as STATUS UNKNOWN, modified IUNIFORM algorithm to permit sampling of point A, modified WRTPAR to handle logbeta and logtriangular correctly.

D 1.6 01/04/13 17:29:03 janetzke 6 5      00570/01095/05746

MRs:

COMMENTS:

V2.1e Code cleanup, including resizing labels, changing input keyword CORR to

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CORRELATION MATRIX, added USER DISCRETE EMPIRICAL distribution, and extended the number of entries for both USER ... distributions to 20.

D 1.5 01/03/30 19:12:43 janetzke 5 4      00512/00399/06329

MRs:

COMMENTS:

V2.1d Converted some parameter, common, and local function statements to reside in INCLUDE files.

D 1.4 01/03/28 18:42:55 janetzke 4 3      00245/00194/06483

MRs:

COMMENTS:

V2.1c Added Header and Disclaimer to beginning of code. Removed TAB characters from code.

D 1.3 01/03/28 17:50:47 janetzke 3 2      00194/00041/06483

MRs:

COMMENTS:

V2.1b Added module UsrDisEmp to handle the USER DISCRETE EMPIRICAL distribution as a permanent module.

D 1.2 01/03/27 11:27:07 janetzke 2 1      00056/00046/06468

MRs:

COMMENTS:

V2.1a Changed input data from unit 12 to unit 5, and removed usage of the tpa\_lhs.lgd file in favor of standard input.

D 1.1 01/03/27 09:35:31 janetzke 1 0      06514/00000/00000

MRs:

COMMENTS:

Original test from TPA 4.1f.

June 27, 2001 pcsatool

A new version of the PCSATool was loaded on Alby that can produce all the interface files to pcsarsac.f.

June 27, 2001 RSAC sampled variables.

A new parameter table was received from R. Benke.

**Distributions for RSAC Input Parameters**

Parameter	RSAC Input Location	Distributi on	Distribution Values	Supporting Information
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Average wind velocity (m/s)	line 5001, entry 1	logtriangular	0.978, 2.13, 13.2	Based on minimized chi-squared fit to 1997 Desert Rock wind speed data [ <i>Windsprd40-m_LogT_ABSfit.xls</i> ]
Mixing Layer Height (m)	line 5001, entry 3	logtriangular	100, 400, 3300	(should be replaced by actual site data) Based on seasonal and annual mixing depths for the desert at Idaho National Engineering Laboratory (Clawson et al., 1989) presented in Table A-1 (p.A-6) of the RSAC 5.2 User's Manual (Wenzel, 1994); logtriangular appeared to fit the data better
Weather Class	line 5410, entry 2	user defined discrete	sampled from {1,2,3,4,5,6} with the respective probabilities of {0.04101, 0.00631, 0.02524, 0.13249, 0.39432, 0.40063}	Weather classes were selected from the 1997 Desert Rock temperature data at different heights based on Table 2 of Regulatory Guide 1.23 (U.S. Nuclear Regulatory Commission) [ <i>97_dT-dx.xls</i> ]
Deposition Velocity (m/s) for solids	line 5002, entry 1	uniform	0.000026, 0.02	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Deposition Velocity (m/s) for halogens	line 5002, entry 2	logtriangular	0.0002, 0.01, 0.26	range for iodine gas from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984); mode assigned the typically accepted value of 0.01 equal to RSAC-5.2 default value (Wenzel, 1994); logtriangular was selected because the accepted value did not bound the range
Deposition Velocity (m/s) for noble gases	line 5002, entry 3	constant	0	assigned to the RSAC-5.2 default value (Wenzel, 1994)
Deposition Velocity (m/s) for cesium	line 5002, entry 4	uniform	0.0004, 0.006	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Deposition Velocity (m/s) for ruthenium	line 5002, entry 5	uniform	0.0002, 0.023	range from Table 2.8 (p. 49) of NCRP Report 76 (National Council on Radiation Protection and Measurements, 1984)
Release Fraction (unitless) for noble gases {Ar, Kr, Rn}	line 2000, multiplicative inventory factor	triangular	0.05, 0.40, 0.40	minimum assigned to free-fall spill value in Table A1 (American Nuclear Society, 1998); mode assigned to Table 3.3 value of NUREG/CR-6451 (U.S. Nuclear Regulatory Commission, 1997b); maximum assigned to free-fall spill value in Table 11.4 of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a)

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Release Fraction (unitless) for H	line 2000, multiplicative inventory factor	uniform	0.01, 0.3	minimum assigned to the high-energy crush/impact value (free-fall spill value was not provided for H) in Table A1 (American Nuclear Society, 1998); maximum assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a)
Release Fraction (unitless) for I	line 2000, multiplicative inventory factor	triangular	1.5e-5, 2.3e-3, 0.3	minimum assigned to value from Table 3.3 of NUREG/CR-6451 (U.S. Nuclear Regulatory Commission, 1997b); mode assigned to free-fall spill value for I <sub>2</sub> in Table A1* (American Nuclear Society, 1998); maximum assigned to Table 4-1 value of NUREG-1617 (U.S. Nuclear Regulatory Commission, 2000)
Release Fraction (unitless) for Cs & Sr	line 2000, multiplicative inventory factor	triangular	2e-6, 2.3e-5, 2.5e-4	minimum assigned to impact rupture value in Table 11.4 and mode assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value for Cs vapor in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for Ru	line 2000, multiplicative inventory factor	triangular	2e-6, 1.5e-5, 2.4e-4	minimum assigned to impact rupture value in Table 11.4 and mode assigned to Table 7.1 value of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for fuel fines	line 2000, multiplicative inventory factor	triangular	2e-6, 2e-6, 2.4e-4	minimum and mode assigned to impact rupture values in Table 11.4 of NUREG-1536 (U.S. Nuclear Regulatory Commission, 1997a); maximum assigned to free-fall spill value in Table A1* (American Nuclear Society, 1998)
Release Fraction (unitless) for Co crud	line 2000, multiplicative inventory factor	uniform	0.001, 1.0	minimum assigned to shock/vibration value from Table A1† (American Nuclear Society, 1998); maximum assigned to Table 4-1 value of NUREG-1617 (U.S. Nuclear Regulatory Commission, 2000)

\*Table A1 cites Mishima (1995) as a reference.

† For loose surface contamination, Table A1 cites subsection 4.4.3.3.1 of the DOE Handbook (U.S. Department of Energy, 1994).

## References

American Nuclear Society, *Airborne Release Fractions at Non-Reactor Nuclear Facilities*, American National Standard, ANSI/ANS-5.10-1998, La Grange Park, Illinois, 1998.

K.L. Clawson, G.E. Start, N.R. Ricks, *Climatology of the Idaho National Engineering Laboratory*, 2<sup>nd</sup> Edition, DOE/ID-12118, U.S. Department of Commerce: Idaho Falls, Idaho, 1989.

J. Mishima, "LANL TA-55 Particles Generated by Impact of Bare Fuel Pellets," letter report to Bob Jackson, Richland,

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Washington, March 1995.

National Council on Radiation Protection and Measurements (NCRP), *Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment*, NCRP Report 76, Bethesda, Maryland, 1984.

U.S. Department of Energy, *DOE Handbook – Airborne Release Fractions/Rates and Respirable Fractions for Nonnuclear Facilities*, DOE-HDBK-3010-94, Washington, D.C., 1994.

U.S. Nuclear Regulatory Commission, *Onsite Meteorological Programs* (Safety Guide 23), Regulatory Guide 1.23, Washington, DC, 1972.

U.S. Nuclear Regulatory Commission, *Standard Review Plan for Dry Cask Storage Systems*, NUREG-1536, Washington, DC, 1997a.

U.S. Nuclear Regulatory Commission, *A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants*, NUREG/CR-6451, Washington, DC, 1997b.

U.S. Nuclear Regulatory Commission, *Standard Review Plan for Transportation Packages for Spent Nuclear Fuel*, NUREG-1617, Washington, DC, 2000.

D.R. Wenzel, *The Radiological Safety Analysis Computer Program (RSAC-5) User's Manual*, WINCO-1123, Revision 1. Westinghouse Idaho Nuclear Company, Inc. Idaho National Engineering Laboratory: Idaho Falls, Idaho. 1994.

July 5, 2001    LF90

Manual use of the AUTOMAKE utility is a two step process.

- 1) automake fig=myfile.fig to=makemyfile.bat
- 2) makemyfile.bat

July 5, 2001    LF90 I/O

I/O statement list elements cannot invoke another I/O action. Example: Calling a function that does I/O;

```
print *, function_does_IO(arg1,arg2)
```

July 18, 2001    Make file

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### A rudimentary make file:

```
@echo off
REM      LHS01 2.1
REM
REM It uses Lahey's AUTOMAKE utility (lf9045/bin)
REM and thus needs the input file automake.fig
REM
REM
rem Check if lf90 is in current PATH. If not, quit.
lf90 > NUL
ECHO.
IF ERRORLEVEL 1000 ECHO lf90 compiler not found. Check your PATH with 'PATH'
IF ERRORLEVEL 1000 ECHO Your current path is:
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 PATH
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO "Standard lf90 path is: C:\LF9045\BIN"
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO Attempting to compile by adding to your PATH:"
IF ERRORLEVEL 1000 SET PATH=%PATH%;C:\LF9045\BIN
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 PATH
IF ERRORLEVEL 1000 ECHO.
lf90 > NUL
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO lf90 compiler still not found.
IF ERRORLEVEL 1000 ECHO Fix your path to include the Lahey compiler bin
IF ERRORLEVEL 1000 ECHO directory and run this 'make' batch file again.
IF ERRORLEVEL 1000 GOTO QUIT
REM
ECHO.
REM
REM
echo Compile the main executable...
automake fig=automake.fig to=makemainlhs.bat
call makemainlhs.bat
@IF ERRORLEVEL 1 GOTO QUIT
REM
automake fig=pcsarsac.fig to=makepcsarsac.bat
call makepcsarsac.bat
@IF ERRORLEVEL 1 GOTO QUIT
REM
GOTO NORMAL
:QUIT
REM
echo ...
echo ERROR DETECTED...QUITTING
GOTO END
:NORMAL
echo Normal Termination...
:END
REM END of LHS build
```

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### Using automake.fig:

```
# Lahey Fortran 90 v 4.0 AUTOMAKE Configuration
#
# For compilation of the LHS01 code
# See Lahey Fortran User's Guide, chapter 6 for information
# on the structure and syntax of this file and the Automake
# utility.
#
# Begin compilation of main module, in current directory
#
DEP=snullhs.dep
COMPILE=@lf90 -o3 -dbl -fix -vax -swm 528,562 -maxfatals 5 -nwrap -nbind
-nchk -nstchk -npca -nco -c %FI
FILES=snullhs.f
AND
FILES=zportpc.f
TARGET=snullhs.EXE
LINK=@LF90 %OB -nvm -winconsole -nbind -NOMap -FULLWARN -nco -exe %EX
#
# COMPILATION DONE
# END-OF-FILE
```

### And pcsarsac.fig:

```
# Lahey Fortran 90 v 4.0 AUTOMAKE Configuration
#
# For compilation of the PCSARSAC code
# See Lahey Fortran User's Guide, chapter 6 for information
# on the structure and syntax of this file and the Automake
# utility.
#
# Begin compilation of main module, in current directory
#
DEP=pcsarsac.dep
COMPILE=@lf90 -g -dbl -fix -vax -swm 528,562 -maxfatals 5 -nwrap -nbind -nchk -nstchk
-npca -nco -c %FI
FILES=zportpc.f
AND
FILES=pcsarsac.f
TARGET=pcsarsac.EXE
LINK=@LF90 %OB -g -nvm -winconsole -nbind -NOMap -FULLWARN -nco -exe %EX
#
# COMPILATION DONE
# END-OF-FILE
```

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July 19, 2001    Makefile

The following batch file invokes the LAHEY automake utility.

```

@echo off
REM NAME:   Make.bat - Makefile for pcsa modules.
REM
REM PURPOSE:
REM         This batch file functions as a LF90 make file for the Windows/DOS
REM         platform, just as the makefile does for the UNIX platform.
REM         It uses Lahey's AUTOMAKE utility (lf9045/bin) and thus needs the
REM         input files snllhs.fig and pcsarsac.fig.
REM
REM METHOD:
REM         The method differs from the UNIX style in that a preprocessor for
REM         the make files is used.  The preprocessor is called automake.
REM         It requires an *.fig file to specify the switches and files to be
REM         used in compile and link steps.  Automake creates the low level
REM         make files that are called immediately in this batch file.  Before
REM         automake is invoked a check is made to see if the LF90 compiler
REM         can be accessed from within the make process.
REM
REM HISTORY:
REM         07-19-01 Ron Janetzke
REM         Original text modeled after the TPA Make.bat file.
REM
REM ***
REM * Check if lf90 is in current PATH.  If not, add it to PATH.
REM ***
REM
    echo.
    lf90 > NUL
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO lf90 compiler not found. Check your PATH with 'PATH'
IF ERRORLEVEL 1000 ECHO Your current path is:
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 PATH
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO "Standard lf90 path is: C:\LF9045\BIN"
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO Attempting to continue by adding standard path to your PATH:"
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 SET PATH=%PATH%;C:\LF9045\BIN
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 PATH
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO OFF
REM
REM ***
REM * Check again to see if lf90 has been successfully added to the current
REM * PATH.  If not, quit.
REM ***
REM

```



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```

1f90 > NUL
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 ECHO 1f90 compiler still not found.
IF ERRORLEVEL 1000 ECHO Fix your path to include the Lahey compiler bin
IF ERRORLEVEL 1000 ECHO directory and run this 'make' batch file again.
IF ERRORLEVEL 1000 ECHO.
IF ERRORLEVEL 1000 GOTO QUIT
REM
    echo ***
    echo ***   WRITELHSINP
    echo ***
    echo Using writelhsinp.fig to create makewritelhsinp.bat
    automake fig=writelhsinp.fig to=makewritelhsinp.bat
    @echo off
    IF ERRORLEVEL 1 ECHO automake failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
    call makewritelhsinp.bat
    IF ERRORLEVEL 1 ECHO make file execution failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
    echo ***
    echo ***   SNLLHS
    echo ***
    echo Using snllhs.fig to create makesnllhs.bat
    automake fig=snllhs.fig to=makesnllhs.bat
    @echo off
    IF ERRORLEVEL 1 ECHO automake failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
    call makesnllhs.bat
    IF ERRORLEVEL 1 ECHO make file execution failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
    echo ***
    echo ***   PCSARSAC
    echo ***
    echo Using pcsarsac.fig to create makepcsarsac.bat
    automake fig=pcsarsac.fig to=makepcsarsac.bat
    IF ERRORLEVEL 1 ECHO automake failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
    call makepcsarsac.bat
    IF ERRORLEVEL 1 ECHO make file execution failed.
    IF ERRORLEVEL 1 GOTO QUIT
REM
REM ***
REM *   NORMAL EXIT
REM ***
REM
    echo Normal termination of %0
    goto END
REM
REM ***
REM *   ERROR EXIT
REM ***

```

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```
REM
:QUIT
    echo ...
    echo ERROR DETECTED...QUITTING %0
:END
```

July 20, 2001    Tool modules

A sample manual invocation of the PCSA modules is:

```
>writelhsinp.exe
>snllhs.exe <lhs.inp
>pcsarsac.exe
```

A sample invocation of the RSAC5 module is:

```
>rsac5.exe <rsac5.inp
```

July 20, 2001    Automake

The following is a sample automake configuration file:

```
# NAME: writelhsinp.fig - writelhsinp automake configuration file
#
# PURPOSE:
#     This configuration file contains the compile and link switch
#     specifications for the LF90 compiler required in order to produce
#     the writelhsinp.exe executable file. This file is intended to be
#     used by Lahey's AUTOMAKE utility Version 6.06Dc.
#
# METHOD:
#     The switches used are modeled after those used for the TPA code.
#     Note that although not specified in the AUTOMAKE documentation
#     the COMPILE line must appear before the FILES line, if the AND
#     construct is used for FILES.
#
# HISTORY:
#     07-19-01 Ron Janetzke
#             Original text modeled after the TPA configuration file.
#
# DOCUMENTATION:
#     See Lahey LF 90 User's Guide, 1997, Chapter 6 for information on
#     the structure and syntax of this file and the AUTOMAKE utility.
#
# ***
```

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```
# * COMPILE
# ***
#
DEP=writelhsinp.dep
COMPILE=@lf90 -o3 -dbl -fix -vax -swm 528,562 -maxfatals 5 -nwrap -nbind -nchk -nstchk
-npca -nco -c %FI
FILES=writelhsinp.f
AND
FILES=zportpc.f
#
# ***
# * LINK
# ***
#
TARGET=writelhsinp.EXE
LINK=@LF90 %OB -nvm -winconsole -nbind -NOMap -FULLWARN -nco -exe %EX
#
# ***
# * END
# ***
```

July 25, 2001    RSAC5 batch file

Here is a suitable batch file for rsac5 execution from the *pcsa* directory:

```
copy rsac5.in rsac5
cd rsac5
rsac5.exe
copy rsac5.out ..
cd ..
rsacrd.exe
```

July 26, 2001    rsacrd.exe

A. Lozano requested via telecon that the filename for *rsac5summary.out* be changed to *rsac5res.out*.

July 27, 2001    bring and put

Here is the latest bring2pc.bat file:

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```

u2d H:\janetzke\pcsa\make.bat make.bat
u2d H:\janetzke\pcsa\CLEANALL.bat CLEANALL.bat
u2d H:\janetzke\pcsa\CLEANUP.bat CLEANUP.bat
u2d H:\janetzke\pcsa\bring2pc.bat bring2pc.bat
u2d H:\janetzke\pcsa\ieeepart2.i ieeepart2.i
u2d H:\janetzke\pcsa\lhs1.i lhs1.i
u2d H:\janetzke\pcsa\lhs2.i lhs2.i
u2d H:\janetzke\pcsa\lhs3.i lhs3.i
u2d H:\janetzke\pcsa\lhs4.i lhs4.i
u2d H:\janetzke\pcsa\lhs5.i lhs5.i
u2d H:\janetzke\pcsa\lhs6.i lhs6.i
u2d H:\janetzke\pcsa\lhs7.i lhs7.i
u2d H:\janetzke\pcsa\lhs8.i lhs8.i
u2d H:\janetzke\pcsa\snllhs.f snllhs.f
u2d H:\janetzke\pcsa\writelhsinp.f writelhsinp.f
u2d H:\janetzke\pcsa\pcsarsac1.i pcsarsac1.i
u2d H:\janetzke\pcsa\pcsarsac2.i pcsarsac2.i
u2d H:\janetzke\pcsa\pcsarsac3.i pcsarsac3.i
u2d H:\janetzke\pcsa\tccdf.i tccdf.i
u2d H:\janetzke\pcsa\pcsarsac.f pcsarsac.f
u2d H:\janetzke\pcsa\rsacrd.i rsacrd.i
u2d H:\janetzke\pcsa\rsacrd.f rsacrd.f
u2d H:\janetzke\pcsa\zportpc.f zportpc.f
u2d H:\janetzke\pcsa\zportunx.f zportunx.F

```

Here is the latest put.bat:

```

copy bring2pc.bat H:\janetzke\pcsa\pcdos\bring2pc.bat
copy CLEANALL.BAT H:\janetzke\pcsa\pcdos\cleanall.BAT
copy CLEANUP.BAT H:\janetzke\pcsa\pcdos\cleanup.BAT
copy groupdef.dat H:\janetzke\pcsa\pcdos\groupdef.dat
copy ieeepart2.i H:\janetzke\pcsa\pcdos\ieeepart2.i
copy lhs.inp H:\janetzke\pcsa\pcdos\lhs.inp
copy lhs.out H:\janetzke\pcsa\pcdos\lhs.out
copy lhs1.i H:\janetzke\pcsa\pcdos\lhs1.i
copy lhs2.i H:\janetzke\pcsa\pcdos\lhs2.i
copy lhs3.i H:\janetzke\pcsa\pcdos\lhs3.i
copy lhs4.i H:\janetzke\pcsa\pcdos\lhs4.i

```

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```

copy lhs5.i H:\janetzke\pcsa\pcdos\lhs5.i
copy lhs6.i H:\janetzke\pcsa\pcdos\lhs6.i
copy lhs7.i H:\janetzke\pcsa\pcdos\lhs7.i
copy lhs8.i H:\janetzke\pcsa\pcdos\lhs8.i
copy lhsinp.dat H:\janetzke\pcsa\pcdos\lhsinp.dat
copy make.bat H:\janetzke\pcsa\pcdos\make.bat
copy pcsarsac.f H:\janetzke\pcsa\pcdos\pcsarsac.f
copy pcsarsac.fig H:\janetzke\pcsa\pcdos\pcsarsac.fig
copy pcsarsac1.i H:\janetzke\pcsa\pcdos\pcsarsac1.i
copy pcsarsac2.i H:\janetzke\pcsa\pcdos\pcsarsac2.i
copy pcsarsac3.i H:\janetzke\pcsa\pcdos\pcsarsac3.i
copy RSAC5.BAT H:\janetzke\pcsa\pcdos\rsac5.BAT
copy rsac5.def H:\janetzke\pcsa\pcdos\rsac5.def
copy rsac5.in H:\janetzke\pcsa\pcdos\rsac5.in
copy RSAC5.OUT H:\janetzke\pcsa\pcdos\rsac5.OUT
copy rsac5res.out H:\janetzke\pcsa\pcdos\rsac5res.out
copy rsacrd.f H:\janetzke\pcsa\pcdos\rsacrd.f
copy rsacrd.fig H:\janetzke\pcsa\pcdos\rsacrd.fig
copy rsacrd.i H:\janetzke\pcsa\pcdos\rsacrd.i
copy snllhs.f H:\janetzke\pcsa\pcdos\snllhs.f
copy snllhs.fig H:\janetzke\pcsa\pcdos\snllhs.fig
copy tccdf.i H:\janetzke\pcsa\pcdos\tccdf.i
copy varnames.dat H:\janetzke\pcsa\pcdos\varnames.dat
copy writelhsinp.f H:\janetzke\pcsa\pcdos\writelhsinp.f
copy writelhsinp.fig H:\janetzke\pcsa\pcdos\writelhsinp.fig
copy zportpc.f H:\janetzke\pcsa\pcdos\zportpc.f

```

Aug. 16, 2001    comban.f

Here is an initial cut at a throw away combination analysis code comban.f.

```

PROGRAM comban

dimension rfreq(50000)
dimension rdose(50000)
dimension icombos(6,50000)
character*16 combos(100)
character*16 cinevnt
dimension ncombevnt(50000)

cc
cc    Open output file.

```

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```

cc      open (12,file='comban.out', status='UNKNOWN')
cc
cc      Position input file.
cc
cc      open (unit=11, file='comban.dat', status='OLD')
cc      read (11,*)
cc      read (11,*) rcutoff
cc      if (rcutoff .lt.0 .or. rcutoff .gt. 1.) then
cc          write(12,*) '****'
cc          write(12,*) '*** ERROR: rcutoff < 0 OR rcutoff > 1'
cc          write(12,*) '*** rcutoff = ', rcutoff
cc          write(12,*) '****'
cc          stop
cc      end if
cc      read (11,*)
cc
cc      Initialize variables.
cc
cc      i=0
cc      level = 1
cc
cc      Read input data set.
cc
cc      100 continue
cc      read(11,*,end=200) cinevnt, rinfreq, rindose
cc
cc      Error checks.
cc
cc      if (rinfreq .lt. 0.) then
cc          write(12,*) '****'
cc          write(12,*) '*** ERROR: frequency < 0 '
cc          write(12,*) '*** rinfreq = ', rinfreq
cc          write(12,*) '****'
cc          stop
cc      end if
cc      if (rindose .lt. 0.) then
cc          write(12,*) '****'
cc          write(12,*) '*** ERROR: dose < 0 '
cc          write(12,*) '*** rindose = ', rindose
cc          write(12,*) '****'
cc          stop
cc      end if
cc
cc      Filter input against threshold cutoff.
cc      Input file is sorted from high to low, so values remaining
cc      at the first failed IF test are not read and not used.
cc
cc      if (rinfreq .ge. rcutoff) then
cc          i = i+1
cc          if (i .gt. 100) then
cc              write(12,*) '****'
cc              write(12,*) '*** ERROR: Number of input event records'
cc              write(12,*) '*** ERROR: exceeds maximum.'
cc              write(12,*) '*** ERROR: i > 100 '
cc              write(12,*) '*** i = ', i

```

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```

        write(12,*) '***'
        stop
    end if
cc
cc    The input set is the level 1 single event set.
ccc
        combos(i) = cinevnt
        ncombevnt(i) = level
        icombos(level,i) = i
        rfreq(i) = rinfreq
        rdose(i) = rindose
        go to 100
    end if
cc
cc    Check for sufficient number of filtered entries.
cc
    200 continue
        close (11)
        if (i .lt. 1) then
            write(12,*) '***'
            write(12,*) '*** No events found.'
            write(12,*) '***'
            stop
        end if
cc
cc    Initialize pointers.
cc
        istartbase = 1
        istopbase = i
        jstop = 0
cc
cc    Combination level loop.
cc
    300 continue
        ibasemax = 0
        jstart = jstop+1
        jstop = i
        level = level + 1
        if (level .gt. 6) then
            write(12,*) '***'
            write(12,*) '*** ERROR: levels > 6 '
            write(12,*) '*** level = ', level
            write(12,*) '***'
            stop
        end if
cc
cc    Loop over previous level combinations using the single event set.
cc
        do j=jstart, jstop
cc
cc            Single event set.
cc
                do k=istartbase,istopbase
cc
cc                    CULL:
cc                    Current event number must be less then or equal to the

```

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```

cc      first event number in the combination set.
cc
cc      if (icombos(1,k) .le. icombos(1,j)) then
cc
cc      FILTER:
cc
cc      if (rfreq(j)*rfreq(k) .ge. rcutoff) then
cc          i = i+1
cc          if (i .gt. 50000) then
cc              write(12,*) '***'
cc              write(12,*) '*** ERROR: Number of accepted combinations'
cc              write(12,*) '*** ERROR: exceeds maximum.'
cc              write(12,*) '*** ERROR: i > 50000 '
cc              write(12,*) '*** i = ', i
cc              write(12,*) '*** at level', level
cc              write(12,*) '***'
cc              stop
cc          end if
cc          ncombevnt(i) = level
cc          do lvl=1,level-1
cc              icombos(lvl,i) = icombos(lvl,j)
cc          end do
cc          icombos(level,i) = icombos(1,k)
cc          rfreq(i) = rfreq(j)*rfreq(k)
cc          rdose(i) = rdose(j)+rdose(k)
cc          ibasemax = max(ibasemax, k)
cc      end if
cc      end if
cc      end do
cc      end do
cc
cc      Stop when combination set is exhausted.
cc      I.E. Neither ibasemax nor i are incremented.
cc
cc      istopbase =ibasemax
cc      if (i .gt. jstop) go to 300
cc
cc      Output loop.
cc
800 continue
      level = 0
      do j=1,i
          if (ncombevnt(j) .gt. level) then
              level = ncombevnt(j)
              write (12,996)
&          'PCSA tool event listing for combinations of', level
              write (12,997)
&          'that is greater than ', rcutoff
              write (12,998)
&          ' Frequency      Dose      ',
&          ('Event-name      ',lvl=1,ncombevnt(j))
              write (12,999)
&          ' (1/yr)      (rem) '
          end if
              write (12,'(1pe10.2,e10.2,3x,6a16)')
&          rfreq(j), rdose(j),

```



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```

&      (combos (icombos (lvl, j)), lvl=1, ncombevnt (j))
end do
cc
cc  END
cc
900 continue
    close (12)
    stop
996 FORMAT (/a,i3,
& ' events that have a composite frequency')
997 FORMAT (a,f5.3/)
998 FORMAT (a,9a16)
999 FORMAT (a)
end

```

Sept. 7, 2001    Version control

Modules changed on the PC can be transferred to *scratchy1* with the *put.bat* file. They arrive in *.../pcsa/pcdos*. Conversion to unix format is done with *putunix* which puts the converted files in *.../pcsa/pcunix*. These files can be compared to the SCCS files with *dff*.

Sept. 19, 2001    Organ names

This is a list of organ names used for the composite of all pathways:

```

=====
BLOCK DATA p3i
=====

include 'pcsarsac3.i'

data callorgan /
& 'LUNGS',
& 'STOMACH',
& 'SMALL IN',
& 'UPPER LI',
& 'LOWER LI',
& 'GONADS',
& 'BREAST',
& 'BONE SUR',
& 'RED MARR',
& 'THYROID',
& 'KIDNEYS',

```

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```

&      'LIVER',
&      'SPLEEN',
&      'PANCREAS',
&      'SOFT TIS',
&      'SKIN',
&      'BRAIN',
&      'THYMUS',
&      'BLADDER',
&      'MARROW',
&      'HEART',
&      'OVARIES',
&      'UTERUS',
&      'ADRENALS',
&      'OTHER',
&      'TOTAL',
&      ', ',
&      ', ',
&      ', ',
&      ' ' /

```

end

Sept. 25, 2001    PCSA Tool V1.0beta

The names of the codes in the utility suite were changed according to the following table:

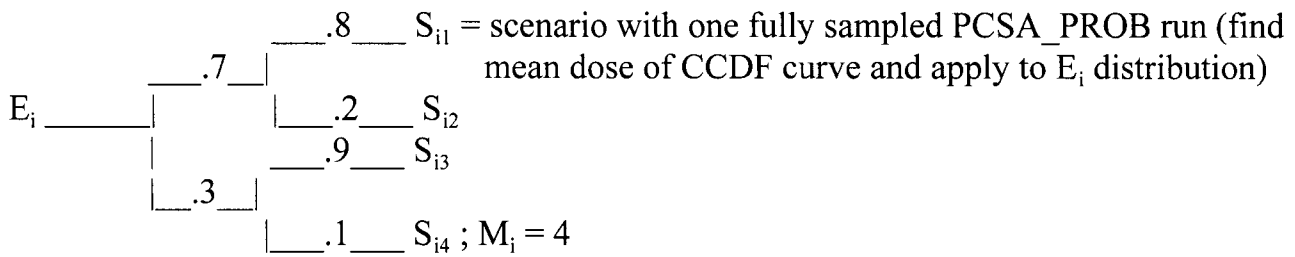
<b>From</b>	<b>To</b>
writelhsinp.f	pcsa_lhsinp.f
snllhs.f	pcsa_lhs.f
pcsarsac.f	pcsa_prob.f
rsacrd.f	pcsa_rsacrd.f
comban.f	pcsa_comban.f

The *Makefile*, *dff*, and *putunx* files on the Unix side were edited to reflect the new names.

The *bring2pc.bat*, *put.bat*, *make.bat*, *pcsa\_\*.fig* and *pcsa\_\*.f* files were changed on the PC side.

Oct. 9, 2001    Total CCDF

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The following is a restatement of a handout from B. Sagar.

Initiating events

$$E_i, i = 1, 2, \dots, N$$

Event sequences from

$$E_1 \Rightarrow S_{11}, S_{12}, S_{13}, \dots, S_{1j}$$

$$E_2 \Rightarrow S_{21}, S_{22}, S_{23}, \dots, S_{2j}$$

$S_{ij}$  =  $j$ th event sequence from the  $i$ th initiating event.

$$j = 1, 2, \dots, M_i$$

$$P\{E_i\} = \text{Prob}\{1 \text{ or more } i\text{th events occur in any one year}\}$$

$$0 \leq P\{E_i\} \leq 1$$

If the rate of  $E_i$  is  $\lambda$  per year, then

$$P\{E_i\} = 1 - e^{-\lambda} \quad (\text{Poisson Process}) \text{ e. g.}$$

Use mean frequencies for lambda

$$C_{ij} = \text{consequence (annual dose) from an event sequence } S_{ij}$$

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$P\{C_{ij} \geq x \mid S_{ij}\}$  is calculated by Monte Carlo simulations.

$x =$  dose limit

$P\{C_i \geq x \mid E_i\} = \sum_{j=1}^{M_i} P\{C_{ij} \geq x \mid S_{ij}\} \cdot P\{S_{ij}\}$  Probability that consequence will exceed  $x$  given that initiating event  $E_i$  occurs.

$M_i =$  number of event sequences associated with  $i$ th initiating event

Note that  $\sum_{j=1}^M P\{S_{ij}\} = P\{E_i\}$

Assume that  $E_i$  are statistically independent.

An event  $E_i$  either occurs one or more times or it doesn't.

$E_i^+$  means it occurs  $\Rightarrow P\{E_i^+\}$

$E_i^-$  means it doesn't occur  $\Rightarrow P\{E_i^-\} = 1 - P\{E_i^+\}$

Then

$P\{E_1^+ E_2^- E_3^- \dots E_N^-\} = P\{E_1^+\} \cdot \prod_{k=2}^N P\{E_k^-\} \Rightarrow$  only  $E_1$  occurs and no other

$P\{E_1^- E_2^+ E_3^- \dots E_N^-\} = P\{E_2^+\} \cdot \prod_{\substack{k=1 \\ k \neq 2}}^N P\{E_k^-\} \Rightarrow$  only  $E_2$  occurs and no other

$\vdots$

$P\{E_l^+\} \cdot \prod_{\substack{k=1 \\ k \neq l}}^N P\{E_k^-\} \Rightarrow$  events occur one at a time

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$$P\{E_1^+ E_2^+ E_3^- \dots E_N^-\} = P\{E_1^+\} P\{E_2^+\} \cdot \prod_{k=3}^N P\{E_k^-\} \Rightarrow E_1 \text{ and } E_2 \text{ occur and no other}$$

⋮

events occur two at a time

⋮

events occur three at a time

⋮

$P\{E^+ \dots\}$     all N events occur

$P\{E^- \dots\}$     all N events do not occur

$$\sum = 1.0$$

Dec. 11, 2001    Comments

Comments were added to pcsa\_prob.f up to line 333.

Dec. 27, 2001    Time

High resolution time can be found in QueryPerformanceCounter boolean function calls.

The following must appear in a module and not code for a form:

```
Public Declare Function QueryPerformanceCounter Lib "kernel32" _
    (lpPerformanceCount As LARGE_INTEGER) As Long
Public Type LARGE_INTEGER
    lowpart As Long
    highpart As Long
End Type
```

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```
Public lpPerformanceCount As LARGE_INTEGER

Public Declare Function QueryPerformanceFrequency Lib "kernel32" _
    (lpFrequency As LARGE_INTEGER) As Long

Public lpFrequency As LARGE_INTEGER
```

Low part handler can be implemented with:

```
lstat = QueryPerformanceCounter(lpPerformanceCount)
time2 = lpPerformanceCount.lowpart / lpFrequency.lowpart
```

Correct handling of time will require handling upper part also.

A timer with interval setting of 1 tries to perform a return event every .01 seconds, although an error oscillation is noticed within the range of +/- 255 ticks of the lpPerformanceCount.lowpart. The lpFrequency.lowpart for ALBY is 1193182 ticks per second, which is about 838 nanoseconds per tick. So the number of ticks between timer return events could be anywhere between 11676 and 12186 on an unloaded system.

January 2, 2002    rsacrd.exe

A. Lozano requested that the filename for rsac5res.out be changed to rsac5res.txt to enable use with Notepad.

Jan. 25, 2002

The latest version of the tool does not print "END OF FILE" at the end of the *lhsinp.dat* file. Also, the *rsac5res.out* file name has been changed to *rsac5res.txt*.

Jan. 26, 2002    Batch files in *pcsatool\tools*

The following batch files reference \*.exe files whose names have changed.

*Comban.bat*

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*rsaclhs.bat*

Changes to the Tool to handle the new \*.exes are complete on Alby.

Feb. 20, 2002   Pcsa\_comban.f

The composite frequency cutoff value was changed to scientific notation for the output file *comban.out*. The Makefile was also updated to include *pcsa\_comban.f* and *pcsa\_comban.e*.

Apr. 1, 2002   Pcsa\_rsacrd.exe

The entry for Jan. 25, 2002 should be titled *pcsa\_rsacrd.exe*.

May 6, 2002   pcsa\_prob.f

File name *pcsastat.out* was changed to *pcsastat.txt*.

The organ name arrays and dose arrays in subroutine *rsacrd()* were initialized to 'xxxxxxx' and 0.0 respectively. This will produce printable text in the *pcsastat.txt* file for all organ name fields when *rsac5* is run for the pool data set.

May 16, 2002   Combining CCDFs

Bis requested the following features when combining the CCDFs.

1) Allow deterministic runs to be used in place of probabilistic ones when combining the CCDFs of a given initiating event ( $E_i$ ). This can be handled by creating CCDF files with a single entry in them.

2) The results from a deterministic run could be used directly or the user could input a value via dialog box or the user could request that the mean of a probabilistic run be used instead.

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- 3) Allow CCDF sets with disparate number of realizations to be combined.
- 4) Accept a probability cutoff limit from the PCSA Tool below which further combinations of events will not be considered.

Also notation should be made available to the user regarding the maximum number of event sequences permitted.

June 21, 2002 Risk CCDF

Data transfer from the tool to the Fortran utility could either be deterministic data or probabilistic data. Deterministic runs will contain one file name, probabilistic runs will contain a list of directory path names.

The output from *ieprob.f* should list the event combinations in text format of values for Notepad.

Output from the probabilistic risk cdf runs should show the distribution of total risk and percentiles (5,50,95, mean).

Aug. 6, 2002 Congruent RSAC5 deterministic and probabilistic run types

A. Lozano suggests that the control file (*runtype.txt*) be used to control the *pcsa\_prob.e* program, by placing a digit 0 in the first record to indicate a **deterministic** run and a 1 digit to indicate a **probabilistic** run. The PCSA Tool will then provide an RSAC5 input file called *rsac5.inp* that the deterministic run can use directly or an RSAC5 default file that can be parsed for the probabilistic runs.

Aug. 6, 2002 *pcsa\_prob.f*

Module *pcsa\_prob.f* was modified to handle both probabilistic and deterministic runs. This involves the use of the *runtype.txt* file, which uses 0 for deterministic and 1 for probabilistic.



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Aug. 18, 2002    NT Inquire for directories.

NT does not permit the use of relative paths for directories when using an INQUIRE statement. To test the existence of a directory, the directory must be fully specified including the drive letter. The path must be followed by '\nul'.

A demo program for inquiring with relative paths follows:

```

logical lexist
character*132 cdir
character*80 cpath
cpath = 'xxx'
istatus = zportsh('cd >pcsa.tmp')
open (unit=10, file='pcsa.tmp', status='OLD', err=900)
read (10, *) cdir
close (unit=10, status='DELETE')
cdir = charnb(cdir) // '\ ' // cpath
call inquire_dir(cdir, lexist)
print *, lexist
stop
900 continue
stop 'error opening pcsa.tmp'
end
subroutine inquire_dir(cdir, lexist)
character*(*) cdir
logical lexist
lexist = .false.
inquire(file = charnb(cdir)//'\nul', exist=lexist)
print *, charnb(cdir)
return
end

```

Aug, 27, 2002    ZPORT

Zport routines in *zportpc.f* and *zportunx.f* named *zportcheckdir*, *zportmakefname*, and *zporttrimlen* were created to support the directory queries in *pcsa\_ietccdf* and *pcsa\_totrisk*. The PC version requires the specification of the 'nul' file while checking for the existence of a directory (i.e. ...*\path\nul*).

Aug. 27, 2002 *pcsa\_ietccdf* and *pcsa\_totrisk*

The Lahey compiler for the PC has a limit on the format specification multiplier of 127. To format 256 blanks in a Fortran format requires something similar to (64x, 64x, 64x, 64x).

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Aug. 27, 2002    ZPORT

The input command string to *zportsh* and the *NEWCMD* variable inside *zportpc.f* were increased to 256 characters.

Sep.19, 2002 Risk analysis

Risk analysis is performed by *pcsa\_totrisk.f*. Only total risk files (*allccdf.dat*) are handled.

The outcome files have the event combination index, outcome index from the combination set, probability, and a list of event states for all of the combinations that pass the probability threshold that is specified in the input file *totrisk.inp*. The combination set starts at one and goes to  $2^e$ , where *e* is the number of events considered.

Consequence files are *allccdf\_xxxx.dat*, where *xxxx* is the index to the combination set. The consequence files have the consequence for a given combination.

Risk files are *rallccdf\_xxxx.dat*, where *xxxx* is the index to the combination set. The risk files have the risk for a given combination.

Oct. 20, 2002    Realizations

A. Lozano agrees to use file *pcsastat.txt* for both *pcsa\_prob.exe* and *pcsa\_ietccdf.exe*. This file contains the number of realizations in the 4<sup>th</sup> column. This datum is needed for the *pcsa\_totrisk.exe* code.

May 9, 2003    QA updates.

New versions of all of the *pcsa\_\*.f* files were made with comments updated with QA information.

May 9, 2003    SCR 362

R. Janetzke      SCIENTIFIC NOTEBOOK No. 453e

Unused arguments were removed from the *pcsa\_totrisk.f* module.

June 9, 2004    Merge Utility

The following e-mail was received from Mark Sillman:

-----Original Message-----  
From: Mark Silliman [mailto:msilliman@cnwra.swri.edu]  
Sent: Tuesday, June 08, 2004 4:28 PM  
To: gadams@cnwra.swri.edu  
Cc: rjenetzke@cnwra.swri.edu  
Subject: MCUTIL Beta A

George and Ron,

Short:

MCUTIL Beta A can be found at:

S:\GAdams\Mark Updates\MCUTIL

George: If Ron's email (see above) is incorrect please forward this email.

-----  
Mark

Details:

An executable (which will run on most computers running vb6) is available. I have not developed an installation program yet.

A manual is also available. Feel free to critique the manual. This is basically a first draft.

The actual working code will not be changed from this point on till the first series of testing is complete. Comments are still being added / altered but will be done by the end of this week (at which point I will release the source code).

R. Janetzke

SCIENTIFIC NOTEBOOK No. 453e

My suggestion regarding how testing should be executed:

It is not important regarding if part A or part B is tested first. I do recommend though that the order is followed inside of each part (because the lower tests are dependent on the higher tests being valid).

PART A

Merge - forms

Merge - rule creation (develop actual rule file for version 3)

Merge - logic (very complex, it is hard to tell how complicated different combinations of rules could become)

Merge - PCSA extensions

Merge - error handling, (i.e. invalid rules, invalid databases etc)

PART B

Analysis - forms

Analysis - logic

Analysis - base rule file creation

Analysis - error handling

Conversion - forms

Conversion - rule creation (develop actual rule file for version 2 to version 3)

Conversion - logic

Conversion - error handling

R. Janetzke      SCIENTIFIC NOTEBOOK No. 453e

Entries into Scientific Notebook #453E for pages   1   -  37  have been made by Ron Janetzke 6/2/06.

No original text entered into this Scientific Notebook has been removed.

    Ron Janetzke          6/2/06.

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

    AR Witzel            6-6-06