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Scientific Notebook # 178

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6/11/96 PJ

Title of Activity - Installation testing for GENII-S
Dose Assessment Code for TOP-018

Participants: Patrick LaPlante

Author / Primary Participant: Same

Overall Objective: Verify proper installation and operation of the GENII-S code following the procedure outlined in TOP-018, section 5.6. This procedure involves running test cases and comparing with anticipated results.

Work Plan: The GENII-S code was designed for statistical and deterministic simulations of radiation doses to humans from radionuclides in the environment.

Version 1.4.85 (dated Jan 15, 1991) of GENII-S was obtained from C. Leigh at Sandia National Laboratories in 1993.

Due to changes at DOE, the primary funding source for GENII-S, ~~INTERA~~ now maintains the code and the contact is Bruce Thompson (505 246-1600). A phone conversation with B. Thompson on 4/19/96 indicated the code has not been modified since 1993.

6/11/96

By

Work Plan (cont).

6 sample problems with answers are provided in the appendices of the GENII-S user manual, and the input files for these problems are included with the program disks. These problems will be executed on the code and results will be compared with those in the user manual. Any deviation from the sample problems results obtained (referred to as 'Test' results) and those presented in the manual will be identified and discussed.

The sample problems include the following:

Input Files: Description:

Sample 1D.INP > Deterministic sample problem S1V1 from a report by Pelquin and Napier entitled 'GenII-S Regression Test Plan' (provided in Appendix E of GENII-S User Manual). This is a far field, population dose calculation with a chronic air release. Pathways include - air submersion, groundshine, inhalation, terrestrial food ingestion and animal product ingestion.

Sample 1S.INP > Statistical calculation of S1V1.
Sample 1S.FLG (i.e. stochastic)

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Work Plan (cont)

Input File: Description:

Sample 2D.INP > Deterministic sample problem S3V1 from the GENII-S Regression Test Plan provided in Appendix E of user manual. This is a far field population dose calculation with an acute air release. Pathways include: plume submersion, groundshine, inhalation, terrestrial food ingestion and animal product ingestion.

Sample 2S.INP > Statistical calculation of S3V1
Sample 2S.FLG

Sample 3D.INP > Deterministic sample problem S4V1 from the regression test plan (Appendix E in user manual). This is a near field, narrowly focused, single site scenario for an individual dose from deeply buried contaminated soil. Pathways include: submersion in plume, groundshine, inhalation, terrestrial food ingestion, and animal product ingestion.

Sample 3S.INP > Statistical calculation of S4V1.
Sample 3S.FLG

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Work Plan (cont)

Input File: Description

Sample 44.INP Statistical PA calculation for a
(Internal File) Hypothetical high-level waste repository using
empirical distributions of groundwater concentrations
for 3 nuclides. Empirical distributions are
derived from rain data using GENII-5. Family
form dose calculation is conducted for
far field, chronic release. Contaminated well
water is assumed for drinking, irrigation and
livestock watering.

Sample 50.INP Sludge treatment plant effluent deterministic
Sample 50.FLG dose calculation from NUREG CR-5814.

(Evaluation of exposure pathways to man from
disposal of Radioactive Materials into sanitary
sewer systems, 1992). Effluents are assumed
released into river water which is used for
irrigation downstream. Exposure pathways include
external, recreational (swim/boat), shoreline
exposure, groundshine, inhalation, ingestion
of contaminated food (garden crops/Fish).

Sample 55.FLG Statistical calculation of H5.

Sample 55.INP

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Work Plan (cont)

Input File: Description:

Sample 60.INP Another scenario from NUREG-CR5814
Sample 60.FLG (Kennedy et al, 1992) involving exposure
of a landfill equipment operator, to contaminated
sludge from a sewage treatment plant. Exposure
pathways include external groundshine and
inhalation of resuspended material.

Sample 65.INP Statistical calculation of problem 6.
Sample 65.FLG

The sample problems were run and results tabulated to
compare w/ same in the manual. See tables 1 through 10
on pages 6-10 in this notebook and additional results
presented on pages 11 through 21 (charts). Code input and
output files have been compressed using PKZIP 2.04 with
the following file naming conventions: (unless otherwise noted).

Sample <num><type>.<ext>

where num = problem number

type = 'S' for statistical, 'D' for deterministic

ext = .INP and .FLG for input files

.OUT for deterministic output

.DTA for statistical output

The zipped file is GENQA.ZIP

7/15/96 *Results: Comparison of Installation Test runs with GENII-S Manual*

Table 1: GENII-S Sample Problem 1 (deterministic) Committed Dose Equivalent Results (rem)

	Inhalation EDE	Ingestion EDE	External Dose	Total EDE
Test	5.6E-2	6.1E-2	3.3E-3	1.2E-1
Manual	5.6E-2	6.1E-2	3.3E-3	1.2E-1
Ratio	1.0	1.0	1.0	1.0

Table 2: GENII-S Sample Problem 1 (statistical) Committed Dose Equivalent Results (rem)

	Inhalation EDE	External Dose	Annual EDE
Test AVG	2.57E-02	9.14E-04	6.50E-02
Manual AVG	2.57E-02	9.14E-04	6.50E-02
Ratio	1.0	1.0	1.0
Test MAX	9.65E-02	3.82E-03	1.64E-01
Manual MAX	9.65E-02	3.82E-03	1.64E-01
Ratio	1.0	1.0	1.0
Test MIN	3.31E-03	7.85E-05	2.35E-02
Manual MIN	3.31E-03	7.85E-05	2.35E-02
Ratio	1.0	1.0	1.0

*GENII-S output:
'statcom1.DTA'*

Table 4: GENII-S Sample Problem 2 (deterministic) Results for Winter (rem)

	Inhalation EDE	Ingestion EDE	External Dose	Annual EDE
Test	1.2E+0	4.2E-3	2.1E-1	1.4E+0
Manual	1.2E+0	4.2E-3	2.1E-1	1.4E+0
Ratio	1.0	1.0	1.0	1.0

7/15/96 *Results (cont)*

Table 5: GENII-S Sample Problem 2 (statistical) Results (rem)

	Inhalation EDE	External Dose	GENII-S Out: 'statwin2.DTA'
Test MAX	1.08E+06	1.90E+05	
Manual MAX	1.08E+06	1.91E+05	
Ratio	1.0	1.0	
Test MIN	7.03E+03	1.21E+03	
Manual MIN	7.03E+03	1.21E+03	
Ratio	1.0	1.0	

Table 3: GENII-S Sample Problem 1 (statistical) Nuclide Specific Results (rem)

	SR90	PU239	GENII-S Output: 'statnucl.DTA'
Test AVG	1.08E-04	2.34E-02	
Manual AVG	1.08E-04	2.34E-02	
Ratio	1.0	1.0	
Test MAX	1.66E-04	9.42E-02	
Manual MAX	1.66E-04	9.42E-02	
Ratio	1.0	1.0	
Test MIN	6.19E-05	2.34E-03	
Manual MIN	6.19E-05	2.34E-03	
Ratio	1.0	1.0	

All Excel tables are in 'QAGENII.XLS' file.

7/15/96 *1/8 results... (cont)*

Table 6: GENII-S Sample Problem 3 (statistical) Results (rem)

GENII-S OUTPUT 'SAMPLE3S.DTA'	Inhalation EDE	Ingestion EDE	External Dose
Test AVG	5.02E-08	2.35E+00	1.14E-01
Manual AVG	5.02E-08	2.35E+00	1.14E-01
Ratio	1.0	1.0	1.0
Test MAX	5.07E-07	2.14E+01	1.45E+00
Manual MAX	5.07E-07	2.14E+01	1.45E+00
Ratio	1.0	1.0	1.0
Test MIN	1.07E-08	1.27E-01	3.72E-06
Manual MIN	1.07E-08	1.27E-01	3.72E-06
Ratio	1.0	1.0	1.0

Table 7: GENII-S Sample Problem 5 (deterministic) Results for Co60 (rem)

	Inhalation EDE	Ingestion EDE	External Dose	Total EDE
Test	7.0E-12	1.5E-5	2.7E-6	1.8E-5
Manual	7.0E-12	1.5E-5	2.7E-6	1.8E-5
Ratio	1.0	1.0	1.0	1.0

1/8
7/15/967/15/96 *1/8 results... (cont)*

Table 8: GENII-S Sample Problem 5 (statistical) Results (rem)

	Inhalation EDE	Ingestion EDE	External Dose	Total EDE
Test AVG	2.00E-12	3.90E-06	3.40E-07	4.20E-06
Manual AVG	2.00E-12	3.90E-06	1.40E-06	5.30E-06
Ratio	1.0	1.0	0.2	0.8
Test MAX	1.90E-11	3.50E-05	3.40E-06	3.50E-05
Manual MAX	1.90E-11	3.50E-05	1.40E-05	3.50E-05
Ratio	1.0	1.0	0.2	1.0
Test MIN	1.80E-15	1.20E-07	3.70E-10	1.50E-07
Manual MIN	1.80E-15	1.20E-07	1.10E-09	2.20E-07
Ratio	1.0	1.0	0.3	0.7

Table 9: GENII-S Sample Problem 6 (deterministic) Results (rem)

	Inhalation EDE	External Dose	Total EDE
Test	1.4E-6	6.4E-2	6.4E-2
Manual	1.4E-6	6.4E-2	6.4E-2
Ratio	1.0	1.0	1.0

1/8
7/15/96

7/15/96 Results... (Cont'd)

Table 10: GENII-S Sample Problem 6 (statistical) Results (rem)

	Inhalation EDE	External Dose	Total EDE
Test AVG	1.60E-06	3.50E-02	3.50E-02
Manual AVG	1.60E-06	3.50E-01	3.50E-02
Ratio	1.0	0.1	1.0
Test MAX	1.40E-05	4.60E-01	4.60E-01
Manual MAX	1.30E-05	4.60E-01	4.60E-02
Ratio	1.1	1.0	10.2 7/15/96
Test MIN	1.20E-08	4.00E-04	4.00E-04
Manual MIN	1.20E-08	4.00E-04	4.00E-04
Ratio	1.0	1.0	1.0

Special note on Problem #4: 7/15/96

Input files for problem #4 were not included with the GENII-S program disks and these files were requested from Bruce Thompson (ENTERA). In the meantime, data for the problem in Appx B of the user manual were entered into the code and run. Subsequently, the files from Bruce Thompson arrived, however, they generated output error run errors in GENII-S causing the code to prematurely terminate the calculations. Thus, it was determined that the files contained errors and would not be useful for this testing. As a result the runs from the data entered by hand were used for comparison with the results in the manual. The comparison follows:

* See from
note from
J. Campbell on
page 24.
7/16/96

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.40, 7.42. Albuquerque, NM: Sandia National Laboratories. pp. 7-36, 7-37. 1993.

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.44. Albuquerque, NM: Sandia National Laboratories. pp. 7-38. 1993.

Discussion of Results:

All comparisons indicate identical results between the sample problem runs and the results in the user manual except under 2 circumstances. The first is the external exposure results for the statistical run for problem #5. Here the manual results are based upon external dose factors from an input file (GADF.DOE) which was not provided on the GENII-S system disks. The discrepancy in these external doses, is attributable to the different dose factors used (we used GADF.NPR which was available). Results are in Table 8.

Discussion of Results (cont).

The second circumstance where deviating between test results and Manual exist is due to ~~an~~ errors detected in the user manual, in ~~problem #4~~ ^{7/16/96} and #6. In #4, ^{7/16/96} the empirical distribution reported in the manual for the final binning strategy (Fig 7.44 on pg 12 of this notebook) is the exact same result that is also listed in Fig 7.38 (below) as the result based upon the logarithms of raw data values. Since these figures are screen prints from GENII-S and the run time and date are identical - the two are from the same run, because the 3 nuclide concentration distributions are created for a particular run, and the run date and time also correspond to the

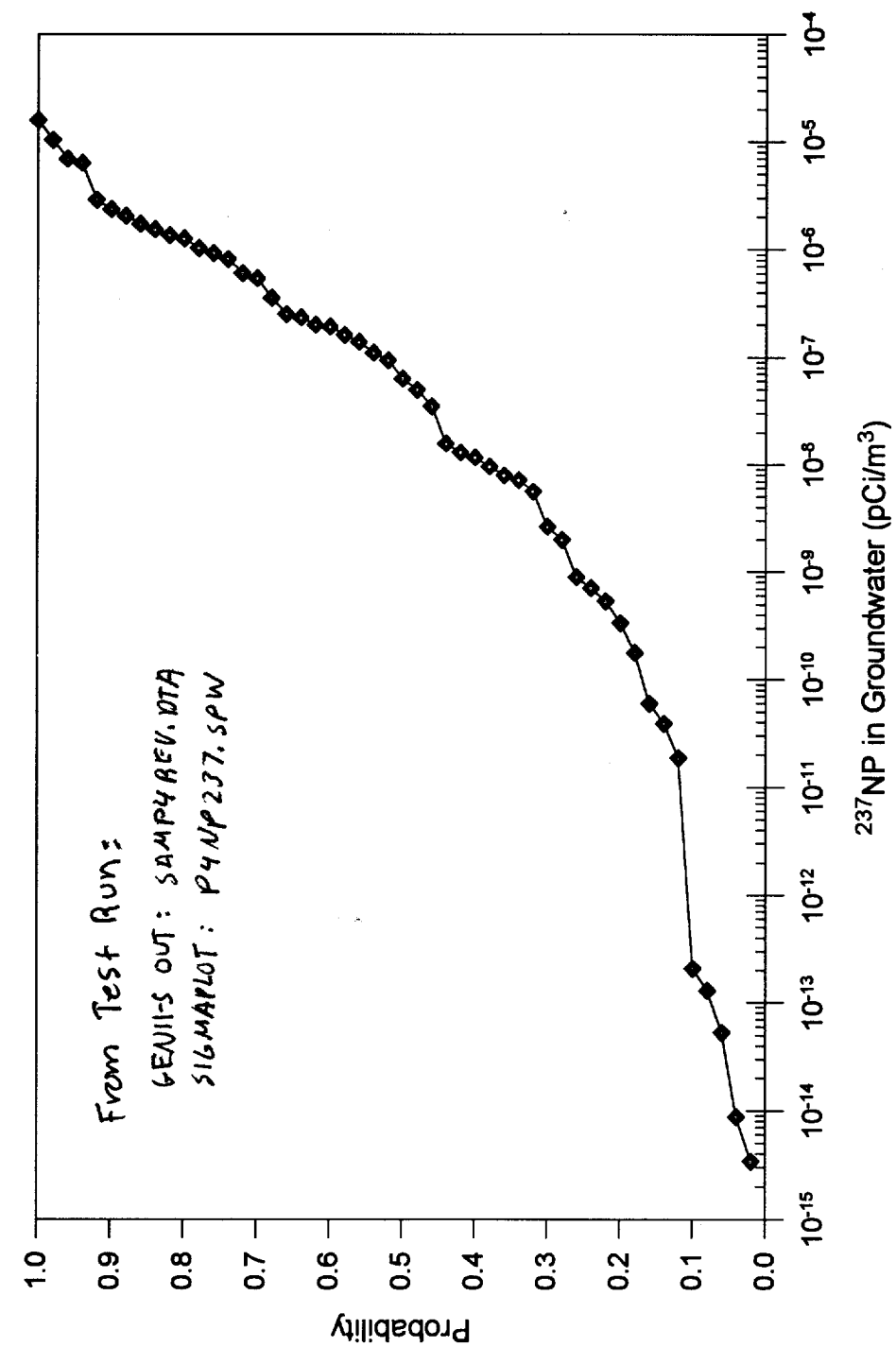
Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.38. Albuquerque, NM: Sandia National Laboratories. pp. 7-34. 1993.

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Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.39. Albuquerque, NM: Sandia National Laboratories. pp. 7-36. 1993.

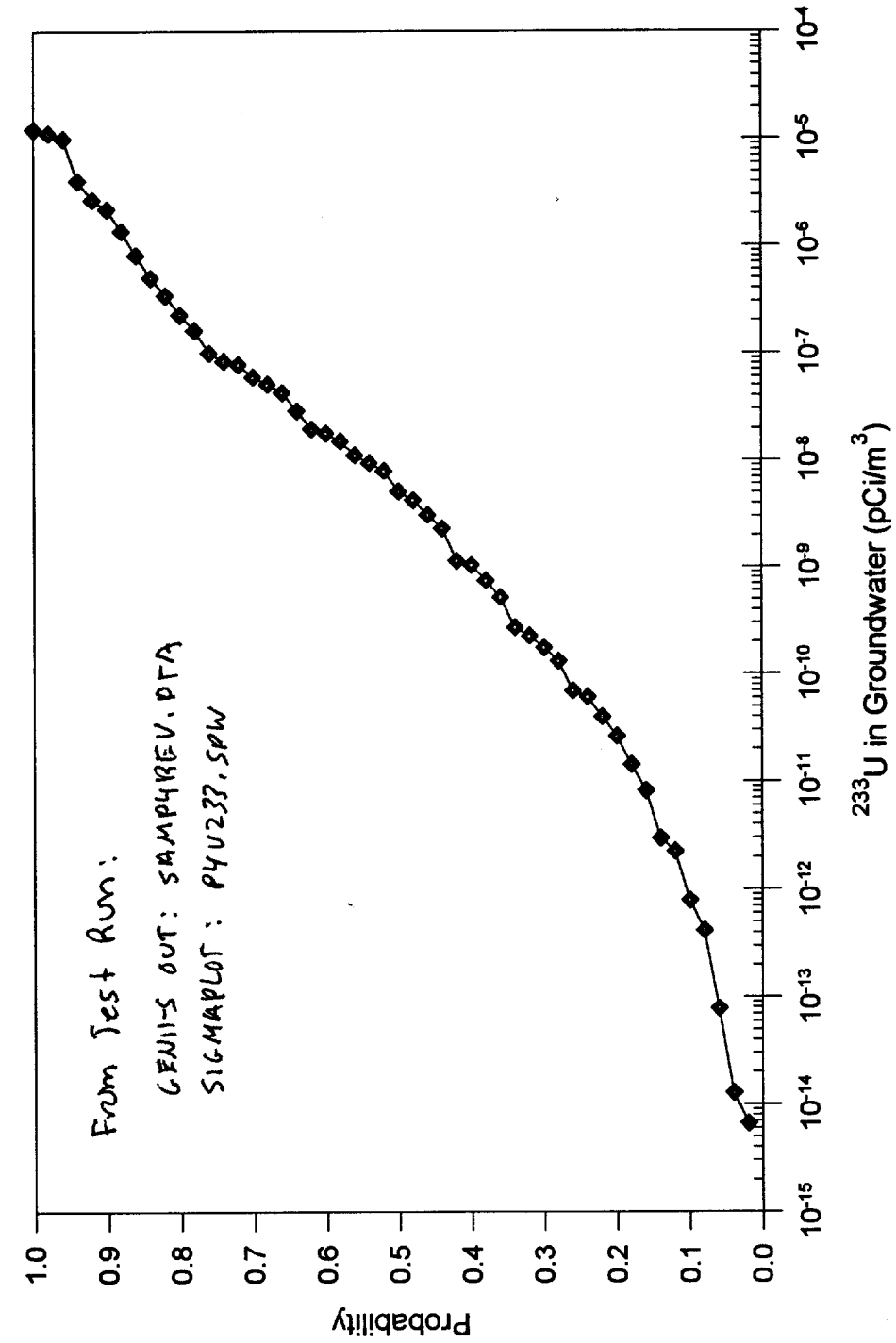
GENII-S Sample Problem 4 Results for ²³⁷Np Empirical Distribution



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Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.41. Albuquerque, NM: Sandia National Laboratories. pp. 7-37. 1993.

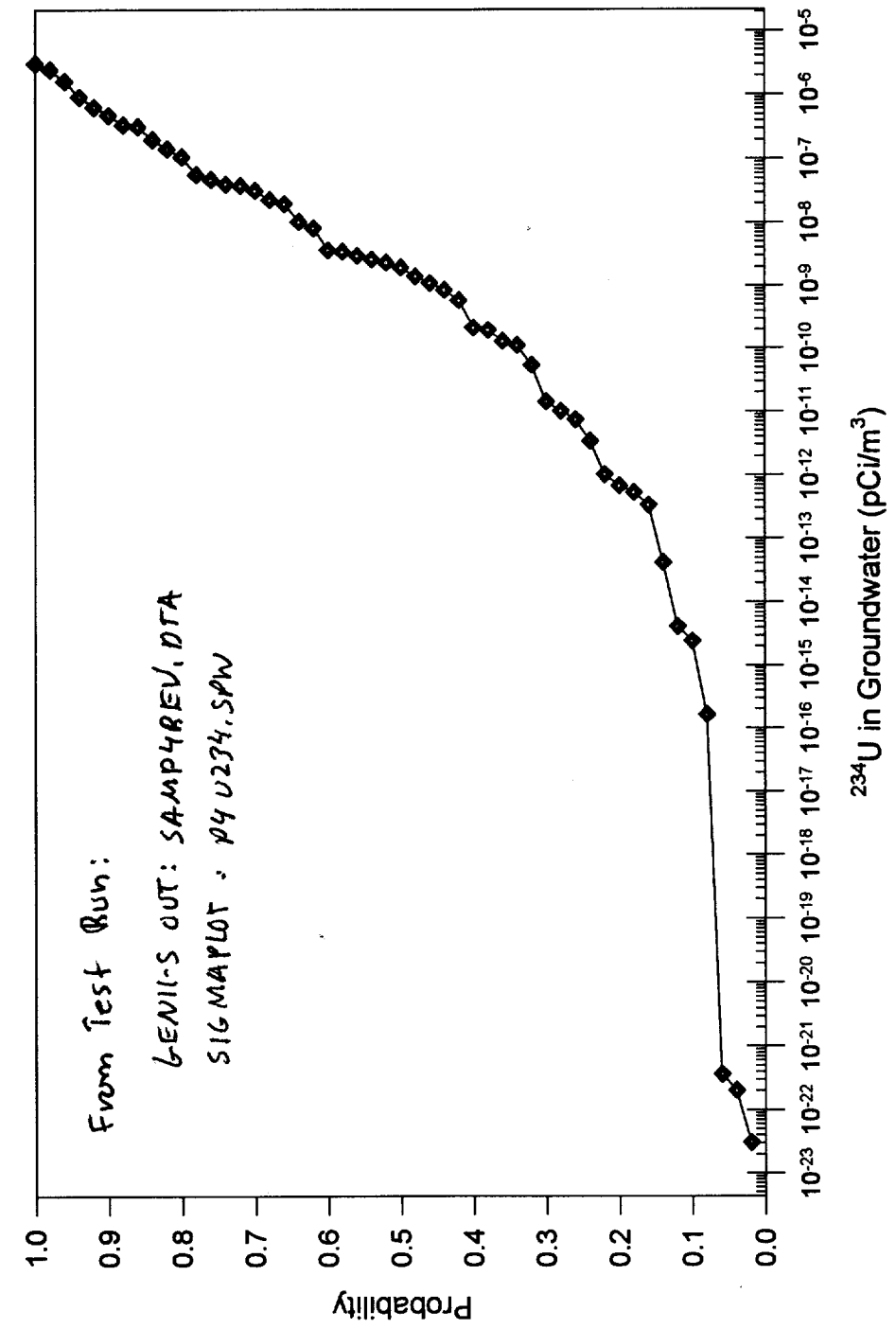
GENII-S Sample Problem 4 Results for ^{233}U Empirical Distribution



Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.43. Albuquerque, NM: Sandia National Laboratories. pp. 7-38. 1993.

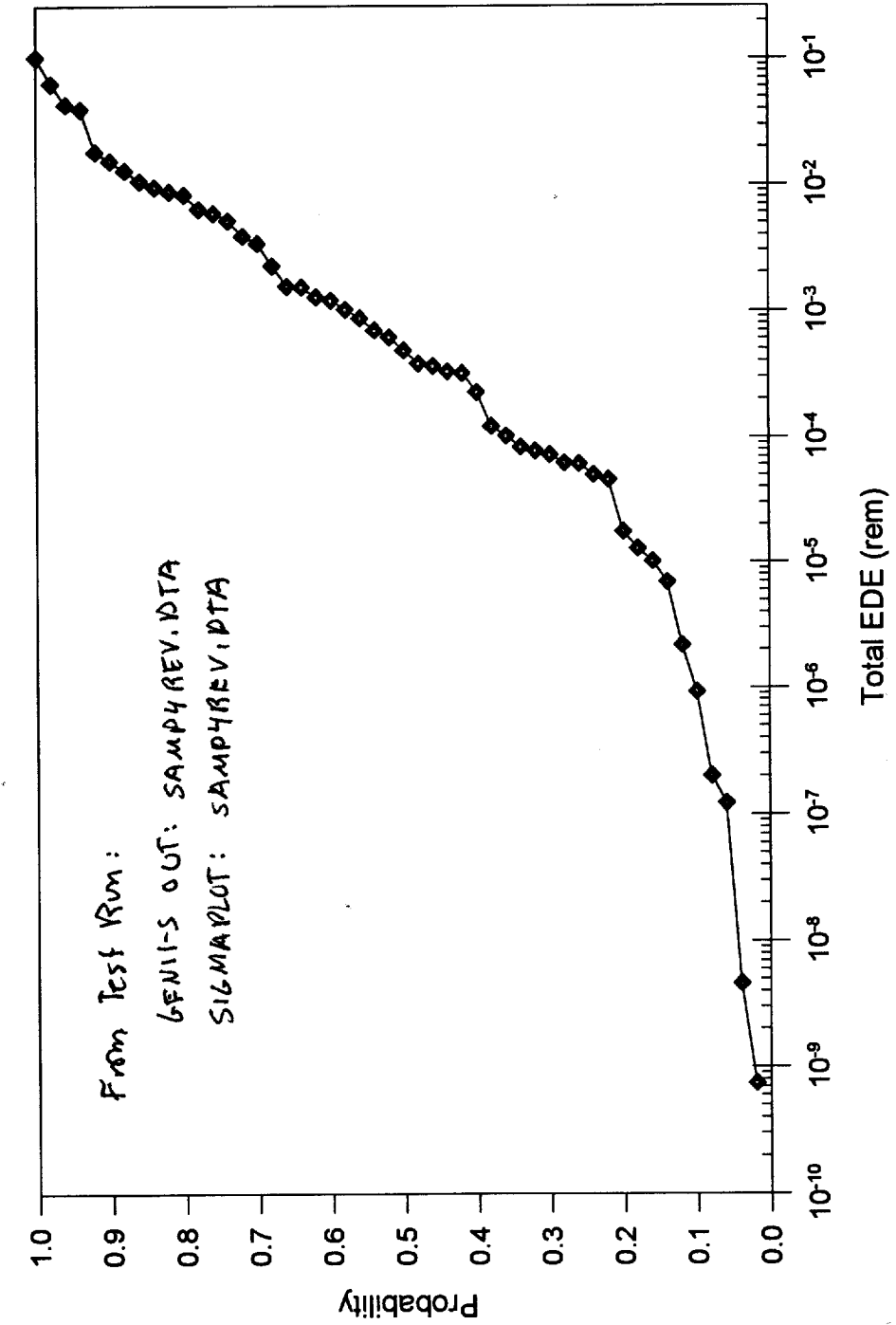
GENII-S Sample Problem 4 Results for ^{234}U Empirical Distribution



Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Leigh, C.D. B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, and B.A. Napier. "User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment." SAND 91-0561. Figures 7.48. Albuquerque, NM: Sandia National Laboratories. pp. 7-40. 1993.

GENII-S Sample Problem 4 Results for Final Binning Strategy



7/15/96 1/6 Results (Discussion cont'd).

other two figures (7.34, 7.36) (not shown) which are based upon logarithms of raw data, AND the run time and date is different than that shown for the final binning strategy results for U237 and Np237 (Fig 7.40, 7.42 on page 11 here), it is reasonable to conclude that table 7.44 (page 12) incorrectly shows the ~~wrong~~ ^{7/15/96} information distribution information for U234 generated by the final binning strategy. Thus there is no way to confirm what the correct result is for U234 concentration distribution, however, since the other 2 nuclides empirical distributions from the test runs match exactly to the information in the GENII-S manual (pg 11 here) there is good reason to believe the code is installed correctly and operating as intended with respect to generation of these empirical distributions. See the plots of these distributions for comparison on pages 14 through 19.

For the final dose comparison for problem #4, there appears to be a slight increase in the test case dose versus the plotted dose from the user manual chart (see pg 20-21 here), however both "test" and "manual" distributions are identical in shape. This could be the result of using the different U234 distribution of concentrations (discussed in previous paragraph), which is slightly reduced from the values generated by the test run. The apparent errors in the GENII-S manual with respect to problem #4 may be the reason why the input files for this problem were not included with the system disks, while the other sample problem input files were. ^{see attached e-mail pg 24} The present GENII-S contacts at INTEGRA (B. Thompson) could not recall any problems when asked about this. This final discrepancy is considered

7/15/96 1/6 Discussion of Results (cont'd).

slight, nevertheless, given the ^{overall} variation in the result. A purely quantitative comparison is not possible since no numeric results for TEDE's from the final binning strategy are reported in the user manual (no mean, no min/max reported) despite similar results reported for the other binning strategies. Finally, the difference noted in Table 10 for the avg ext. dose ^{for problem 4} is due to what appears to be a typo in the User Manual on page 7-48 where column totals are less than the column sum.

Conclusions:

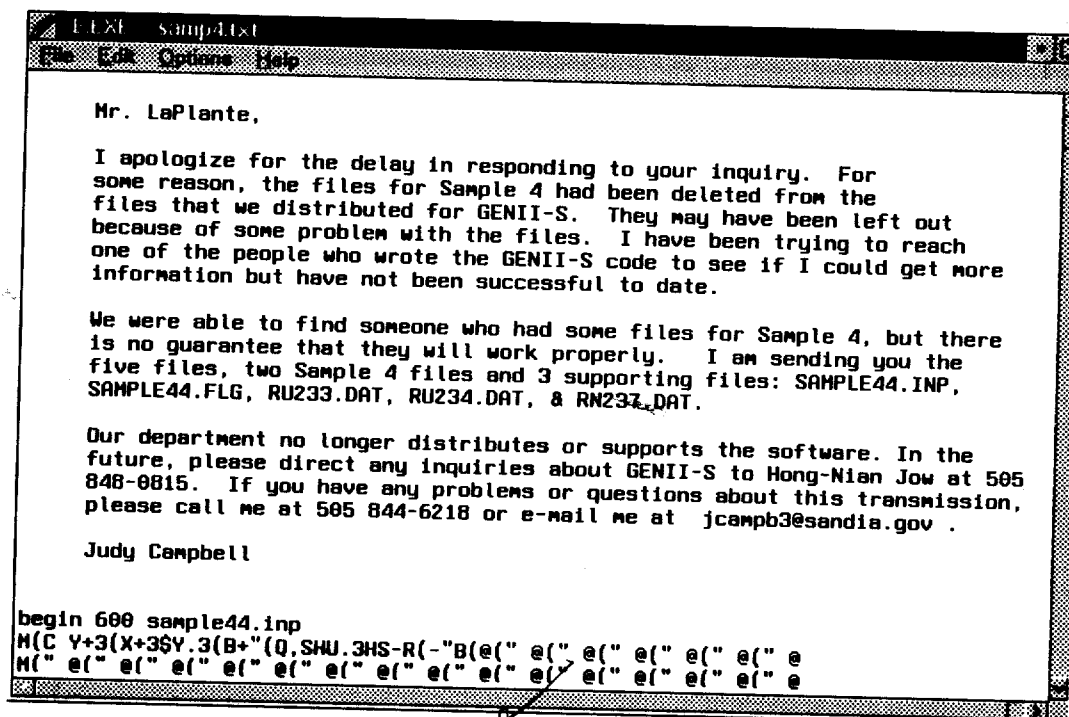
The installation test runs show close agreement with the results for these problems presented in the GENII-S user manual. In most cases, the agreement is exact. ^{7/15/96} The few cases where there is lack of agreement are explained by errors identified in the manual, and the unavailability of ^{unique} ^{7/15/96} external dose factor input data files which ^{was} ^{7/15/96} used for 1 problem in the user manual. These results confirm that the code is installed properly and is operating as intended.

7/15/96

1/6

7/16/96 *by* Attachment:

E-mail note from one of the Authors of the GENII-S (Judy Campbell)



References:

Leigh C.D., B.M. Thompson, J.E. Campbell, D.E. Longsine, B.A. Kennedy, B.A. Napier et. al. 1993. User Guide for GENII-S: A code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment. SAND 91-1436. Albuquerque, NM: Sandia National Laboratories. 0561

I have reviewed this scientific notebook and find that it contains sufficient detail for a person with similar qualifications to reproduce the results. I find that, in general, the scientific notebook complies with QAR-001.

PG/Bara 3/19/97

5/27/97 *My* Installation Testing for "STEPWISE" Software

Participants: P. LaPlante

Author/Primary Participant: P. LaPlante

Overall Objective: Verify proper installation and operation of the STEPWISE ("Stepwise Regression with PAESS and Rank Regression") software following the procedure outlined in TOP-018, Section 5.6. This procedure involves running test^{problems} and comparing results with those published in the user manual.

Work Plan: The STEPWISE software was originally developed at Kansas State University and was subsequently provided to Savannah National Laboratories who added additional features to the code as described in the user guide (Iman et. al, 1980). The STEPWISE program is designed to perform single and multiple regression statistics on data with up to 129 independent variables. The code performs regression on raw or rank transformed data and allows ^{either} a stepwise or backward selection technique to be used. The code outputs summary statistics as well as tables of correlation coefficients (correlation matrices) and plots of residuals and PAESS (predicted regression error sum of squares) plots. The user manual provides 2 examples problems which involve stepwise, backward selection and on raw and ranked data. These examples will be ~~run~~ copied directly from the user manual

5/27/97

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(i.e., the STEPWISE input decks) and run with the installed version of STEPWISE. Output of results will be compared with the output printouts provided in the user manual to check for deviations. Any discrepancies will be documented. Primary statistics to check in the output will include: summary statistics, results for each model including the sum of squares (SS), the mean square (MS), F statistic, F test significance, R^2 , variables selected for model, regression coefficients, standardized regression coefficients, partial sum of squares, and t test values, PAESS value and the summary plot of PAESS values for each model. A visual inspection of plots will also be done to check for differences.

If no differences are detected in the output, these results will indicate the code has been installed correctly and is functioning as intended.

6/9/97

My

Results:

The input deck was prepared in an ascii file to match the input deck provided for the examples in the STEPWISE manual. The manual's input deck is shown on page 30, and the deck that was used for the testing is shown on page 31. Subsequent pages show the code output from the manual on the even numbered pages and the testing output on the odd numbered pages - for easy comparison. On the testing output, check

6/6/97

Setup information for STEPWISE INPUT DECK (cards not used so far
our purpose cards = lines)

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 22. January 1980.

6/9/97

Results (cont)

works indicate those results that were compared with the manual output. The manual copy is difficult to read, however all compared values could be deciphered from the available copy.

Discussion of results:

All information that was checked from the testing output file compared exactly with that presented in the manual except in 2 instances where deviations were considered to be of no significance to current anticipated use of the code. These 2 instances include the addition of confidence interval output (noted on page 55) which was not found in the stepwise manual. This indicates that this feature was added after the manual was published. The determination of confidence intervals for regression estimates is a simple calculation and if such output is used, it will be possible to confirm correctness w/ hand calculations. The 2nd instance where a deviation was noted is a difference in the 'alpha hat' numbers determined for rank regression as shown on page 61. The deviation from the manual example is by .0005 and since the alpha level used to determine ^{6/9/97} in significance (t-tests) tests is .05 (in) and .1 (out) this difference is thought to be insignificant and should not affect results. Furthermore, the current intended use will not involve rank regression - so this part of the code is not being exercised.

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Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarie "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 23-24. January 1980.

6/6/97

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```

LEXE exemplin
File Edit Options Help
TITLE, EXAMPLE OF STEPWISE OPTION (DATA FROM DRAPER AND SMITH, PG 365-402)
DATA, 5, 0, 1.
LABEL (1)=X1, X2, X3, X4, Y
MODEL, 5=1+2+3+4
STEPWISE, SIGIN=.05, SIGOUT=.10
PRESS
OUTPUT, ALL
PLOT RESIDUALS
END OF PARAMETERS
(5F6.0)
  7. 26.  6.  60.  78.5
  1. 29. 15.  52.  74.3
 11. 56.  8.  20. 104.3
 11. 31.  8.  47.  87.6
  7. 52.  5.  33.  95.9
 11. 55.  9.  22. 109.2
  3. 71. 17.  6. 102.7
  1. 31. 22. 44.  72.5
  2. 54. 18.  2.  93.1
 21. 47.  4.  26. 115.9
  1. 40. 23. 34.  83.8
 11. 66.  9.  12. 113.3
 10. 68.  8.  12. 109.4
END OF DATA
TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DRAPER AND SMITH, P 364-402)
DATA, 5, 0, 2.
MODEL, 5=1+2+3+4.
BACKWARD, SIG=0.05
OUTPUT, CORR, STEPS, RESIDUALS
PRESS
END OF PARAMETERS
TITLE, EXAMPLE OF RANK REGRESSION WITH STEPWISE OPTION (DATA FROM DRAPER/SMITH)
DATA, 5, 0, 2.
LABEL (1)=RANK(X1), RANK(X2), RANK(X3), RANK(X4), RANK(Y)
MODEL, 5=1+2+3+4.
STEPWISE, SIGIN=.05, SIGOUT=.10
PRESS
RANK REGRESSION
OUTPUT, CORR, STEPS, RESIDUALS
END OF PARAMETERS

```


Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 31. January 1980.

Testing output

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      TITLE, EXAMPLE OF STEPWISE OPTION (DATA FROM DRAPER AND SMITH, PG 365-402)
SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY
ANALYSIS OF REGRESSION FOR VARIABLE 5---Y
(RUNNING)
      ROV TABLE
      (TABLE 1)
      SOURCE          D.F.          SS          MS          F          SIGNIFICANCE
REGRESSION           1 ✓         1831.8952 ✓        1831.8962 ✓       22.798520 ✓       0.0006
RESIDUAL             11 ✓          883.86692 ✓
TOTAL                12 ✓         2715.7631 ✓
R**2 IS 0.67454 ✓
INTERCEPT IS 117.56793 ✓
STANDARD ERROR OF INTERCEPT IS 5.26221 ✓
      VARIABLE    VARIABLE    STANDARDIZED    PARTIAL    T-TEST    R**2
NUMBER          NAME          COEFFICIENTS   SSQ        VALUES   DELETES
4              X4          -0.73616181 ✓ -0.821305 ✓ 1031.8962 ✓ -4.7748 ✓     0.0006
UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 101
PRESS IS 1194.2 ✓
      TITLE, EXAMPLE OF STEPWISE OPTION (DATA FROM DRAPER AND SMITH, PG 365-402)
SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY
INVERSE OF CORR MATRIX
X1      1 1.064E+00
X4      4 2.612E-01 1.064E+00
NO.      1      4
NAME      X1      X4
      TITLE, EXAMPLE OF STEPWISE OPTION (DATA FROM DRAPER AND SMITH, PG 365-402)
SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY
ANALYSIS OF REGRESSION FOR VARIABLE 5---Y
(RUNNING)
      ROV TABLE
      (TABLE 1)

```

616697
15

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 32. January 1980.

416197

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      TITLE, EXAMPLE OF STEPWISE OPTION (DATA FROM DRAPER AND SMITH, PG 365-402)
      SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

      ANALYSIS OF REGRESSION FOR VARIABLE 5---Y
      (TABLE 1)

      SOURCE          D.F.    SS        MS            F            SIGNIFICANCE

      REGRESSION       2 ✓     2641.0010 ✓   1320.5005 ✓   176.62696 ✓   0.0000
      RESIDUAL         16 ✓     74.762112 ✓   7.4762112 ✓
      TOTAL           12 ✓     2715.7631 ✓

      R**2 IS 0.97247 ✓
      INTERCEPT IS 103.09738 ✓
      STANDARD ERROR OF INTERCEPT IS 2.12398 ✓

      VARIABLE NAME    REGRESSION COEFFICIENTS    STANDARDIZED REGRESSION COEFFICIENTS    PARTIAL SSO    T-TEST VALUES    R**2 DELETES    ALPHA HATS

      1 X1             1.4399503 ✓    0.563052 ✓    809.1048 ✓    10.4031 ✓    0.6745 ✓    0.0000
      4 X4             - .61395363 ✓  -0.603107 ✓   1190.9246 ✓   -12.6212 ✓    0.5339 ✓    0.0000

      UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 102

      PRESS IS      121.22 ✓

      *
      SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

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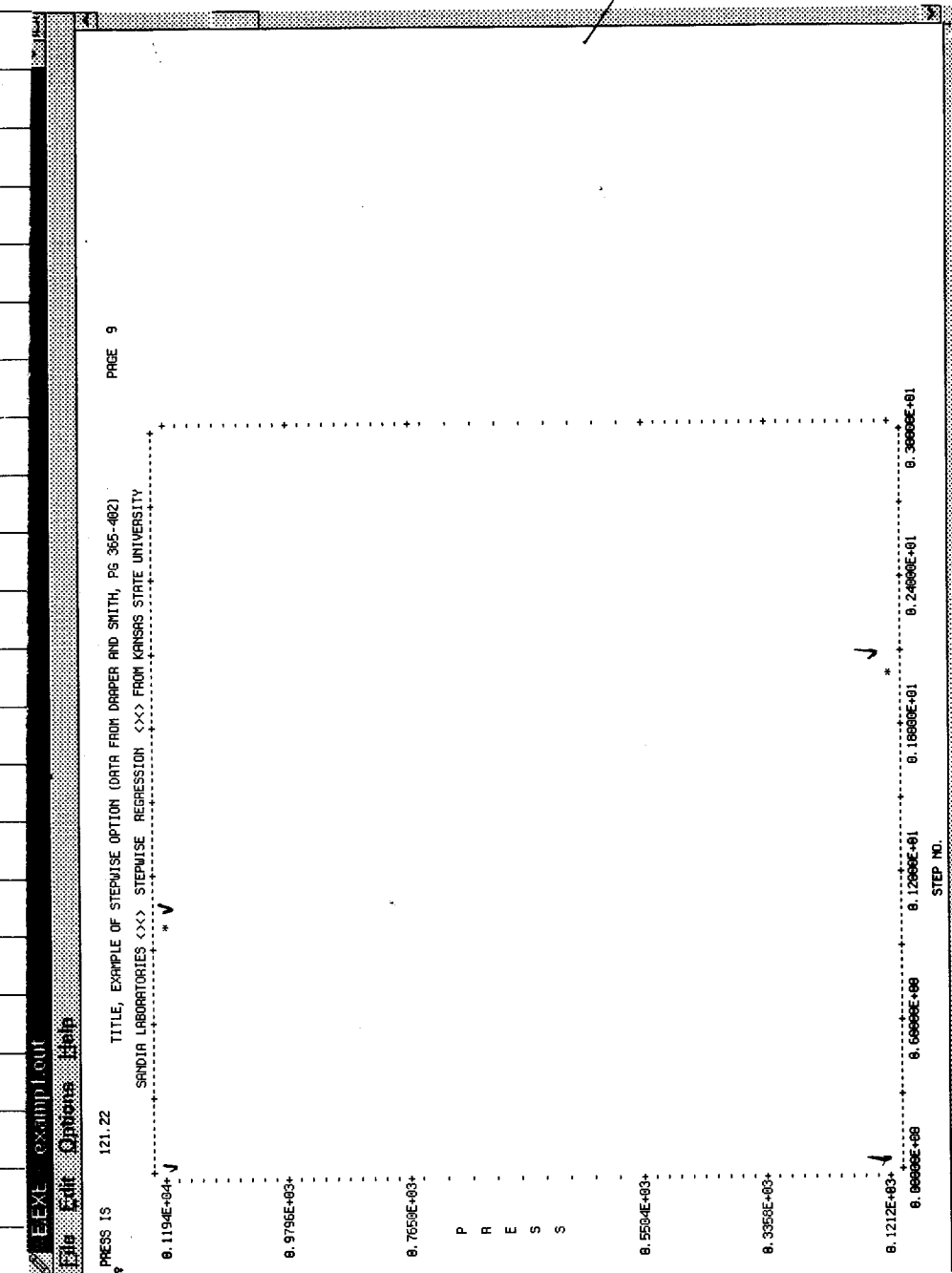
Stepwise manual example output

6/9/97 *hy*

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier
"Stepwise Regression with PRESS and Rank Regression
(Program User's Guide)." SAND79-1472. Albuquerque, New
Mexico: Sandia National Laboratories. p. 33.
January 1980.

6/9/97 *hy* Testing Output



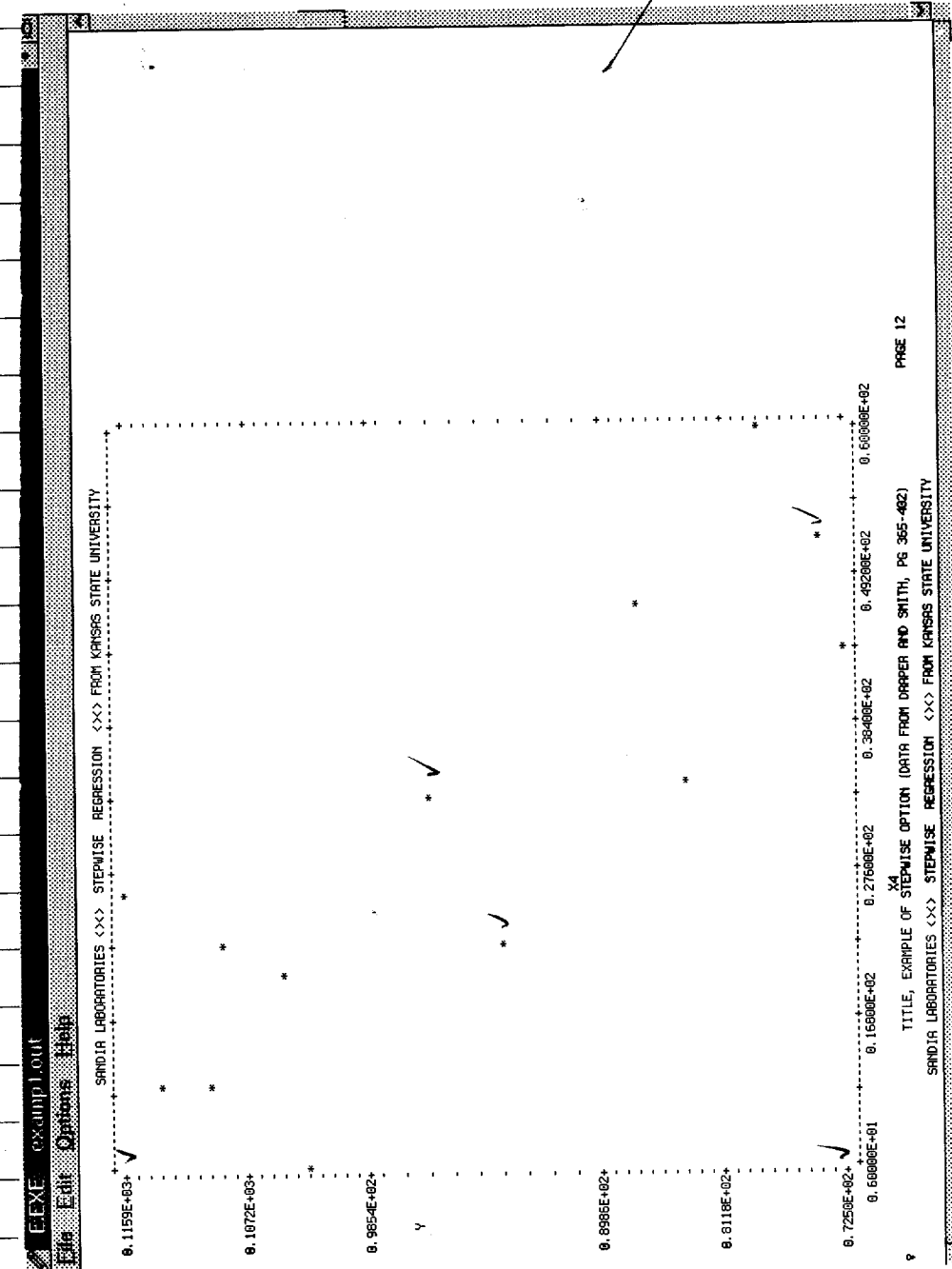
6/9/97
Mg

Stepwise Manual Sample Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarrie
"Stepwise Regression with PRESS and Rank Regression
(Program User's Guide)." SAND79-1472. Albuquerque, New
Mexico: Sandia National Laboratories. p. 35.
January 1980.

Testing Output

6/9/97
Mg

6/9/97

Nj

Stepwise Manual example output

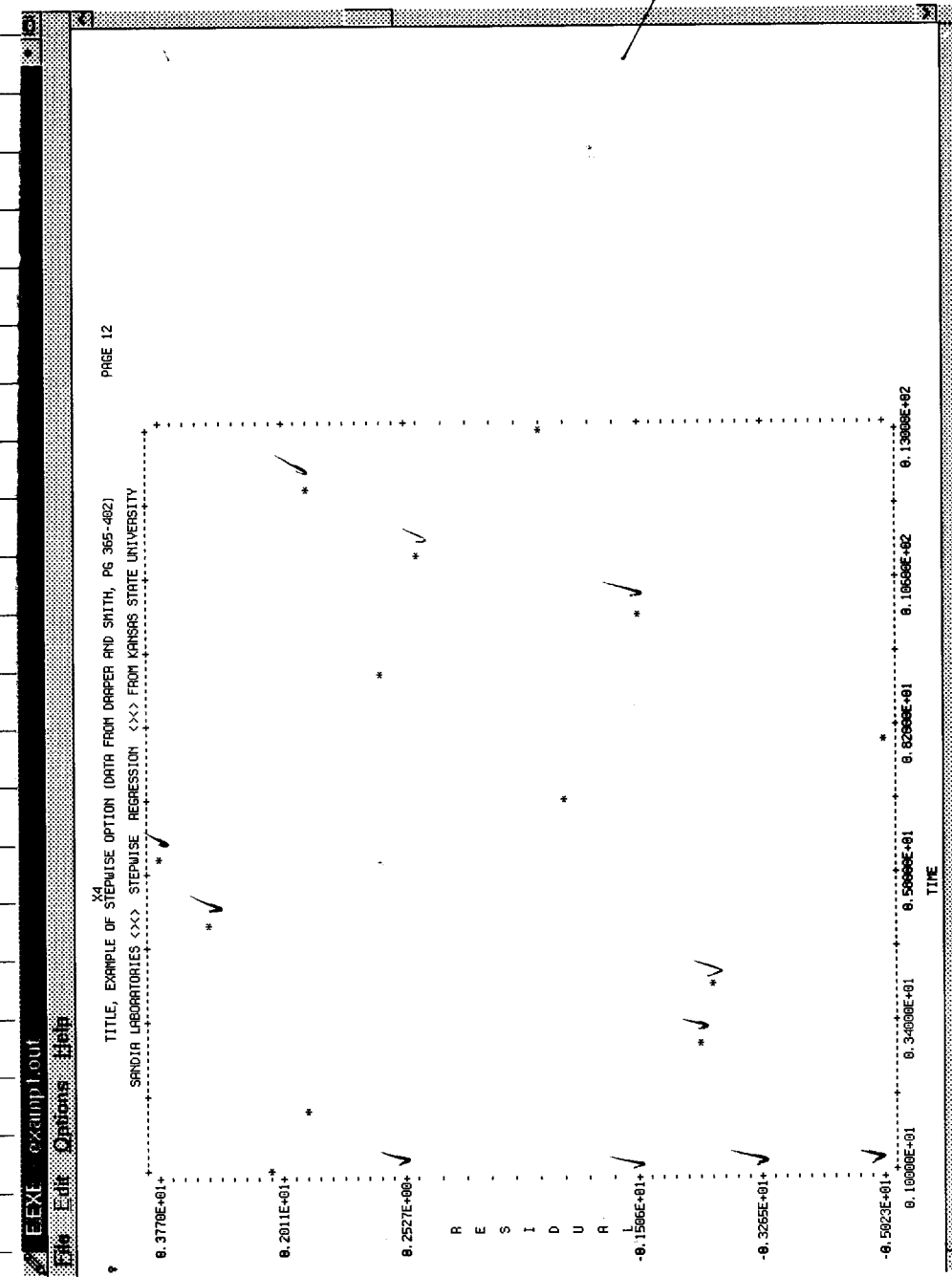
Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 36. January 1980.

6/9/97

Nj

Testing output



6/9/97 *Stepwise Manual Example Output*

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 41. January 1980.

Testing Output

6/9/97
48

E:XT - exemplout									
File Edit Options Help									
TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DAPPER AND SMITH, P 364-482)									
SANDIA LABORATORIES <X> STEPWISE REGRESSION <X> FROM KANSAS STATE UNIVERSITY									
VARIABLE NAME	VARIABLE NUMBER	MEAN	VARIANCE	STD. DEV.	STD. ERR.	C.V.			
X1	1	7.46154	34.6925	5.88239	1.53148	78.84	✓		
X2	2	48.1538	242.141	15.5569	4.31581	32.31	✓		
X3	3	11.7652	41.6255	6.4513	1.77546	54.42	✓		
X4	4	98.0000	299.167	17.1357	4.17238	15.77	✓		
Y	5	95.4231	220.314	14.8437	4.17238	15.77	✓		
TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DAPPER AND SMITH, P 364-482)									
SANDIA LABORATORIES <X> STEPWISE REGRESSION <X> FROM KANSAS STATE UNIVERSITY									
CORRELATION MATRIX									
NO.	1	2	3	4	5				
X1	1.0000								
X2	0.9208	1.0000							
X3	-0.8241	-0.1392	1.0000						
X4	-0.2254	-0.9736	0.8095	1.0000					
Y	0.7367	0.8163	-0.5347	-0.8213	1.0000				
NAME	X1	X2	X3	X4	Y				
ROUNDING ERROR IN ROW	3	3	3	4	5				

6/4/97
df

Stepwise Manual Example Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier
"Stepwise Regression with PRESS and Rank Regression
(Program User's Guide)." SAND79-1472. Albuquerque, New
Mexico: Sandia National Laboratories. p. 42.
January 1980.

6/1/97

Testing output

PAGE 4

TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DRAPER AND SMITH, P 364-402)
SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

ANALYSIS OF REGRESSION FOR VARIABLE 5---Y
(TABLE 1)

SOURCE	D.F.	SS	MS	F	SIGNIFICANCE
REGRESSION	4	2657.8944	664.4736	111.47917	0.0000
RESIDUAL	8	47.86353	5.982941		
TOTAL	12	2715.7631			

STANDARDIZED	REGRESSION	PARTIAL	T-TEST	R-SQ	DELETES	ALPHA
COEFFICIENTS	COEFFICIENTS	SS	VALUES	VALUES	VALUES	VALUES
1	1.511926	25.9599	2.0827	0.9728	0.0708	0.0708
2	0.1511926	0.69512	0.7949	0.9813	0.5009	0.5009
3	0.1819938	0.1065	0.7949	0.9813	0.5009	0.5009
4	-1.4486183	0.643398	-0.2332	0.9823	0.8441	0.8441

UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 103
PRESS IS 110.35

PAGE 5

TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DRAPER AND SMITH, P 364-402)
SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

ANALYSIS OF REGRESSION FOR VARIABLE 5---Y
(TABLE 1)

SOURCE	D.F.	SS	MS	F	SIGNIFICANCE
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6/9/97 y

Stepwise Manual. example output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 43. January 1980.

6/9/97 y Testin output

TEXT example1.out

File Edit Options Help

SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

ANALYSIS OF REGRESSION FOR VARIABLE 5---Y

SOURCE	D.F.	SS	MS	F	SIGNIFICANCE
REGRESSION	3	2667.7903	889.26345	155.83168	0.0000
RESIDUAL	9	47.972729	5.3303833		
TOTAL	12	2715.7631			

R² IS 0.98234
INTERCEPT IS 71.648307
STANDARD ERROR OF INTERCEPT IS 14.1424

VARIABLE NUMBER	NAME	REGRESSION COEFFICIENTS	STANDARDIZED REGRESSION COEFFICIENTS	PARTIAL SSQ	T-TEST VALUES	R ² DELETES
1	X1	1.4519380	0.567737	829.9874	12.4180	0.6891
2	X2	0.4110976	0.430414	26.7854	2.2418	0.9725
4	X4	-2.2554622	-0.263183	9.3318	-1.3650	0.9767

UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 104

PRESS IS 85.351

TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DRAPER AND SMITH, P 364-482)

SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

ANALYSIS OF REGRESSION FOR VARIABLE 5---Y

SOURCE	D.F.	SS	MS	F	SIGNIFICANCE
REGRESSION	2	2657.8586	1328.9293	229.50370	0.0000
RESIDUAL	10	57.904483	5.7904483		
TOTAL	12	2715.7631			

R² IS 0.97868
INTERCEPT IS 52.577349
STANDARD ERROR OF INTERCEPT IS 2.28617

VARIABLE NUMBER	NAME	REGRESSION COEFFICIENTS	STANDARDIZED REGRESSION COEFFICIENTS	PARTIAL SSQ	T-TEST VALUES	R ² DELETES
1	X1	1.4683957	0.574317	848.4319	12.1847	0.6563
2	X2	0.66225949	0.662917	1287.7823	14.4424	0.5339

UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 105

PRESS IS 93.883

TITLE, EXAMPLE OF BACKWARD OPTION (DATA FROM DRAPER AND SMITH, P 364-482)

SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

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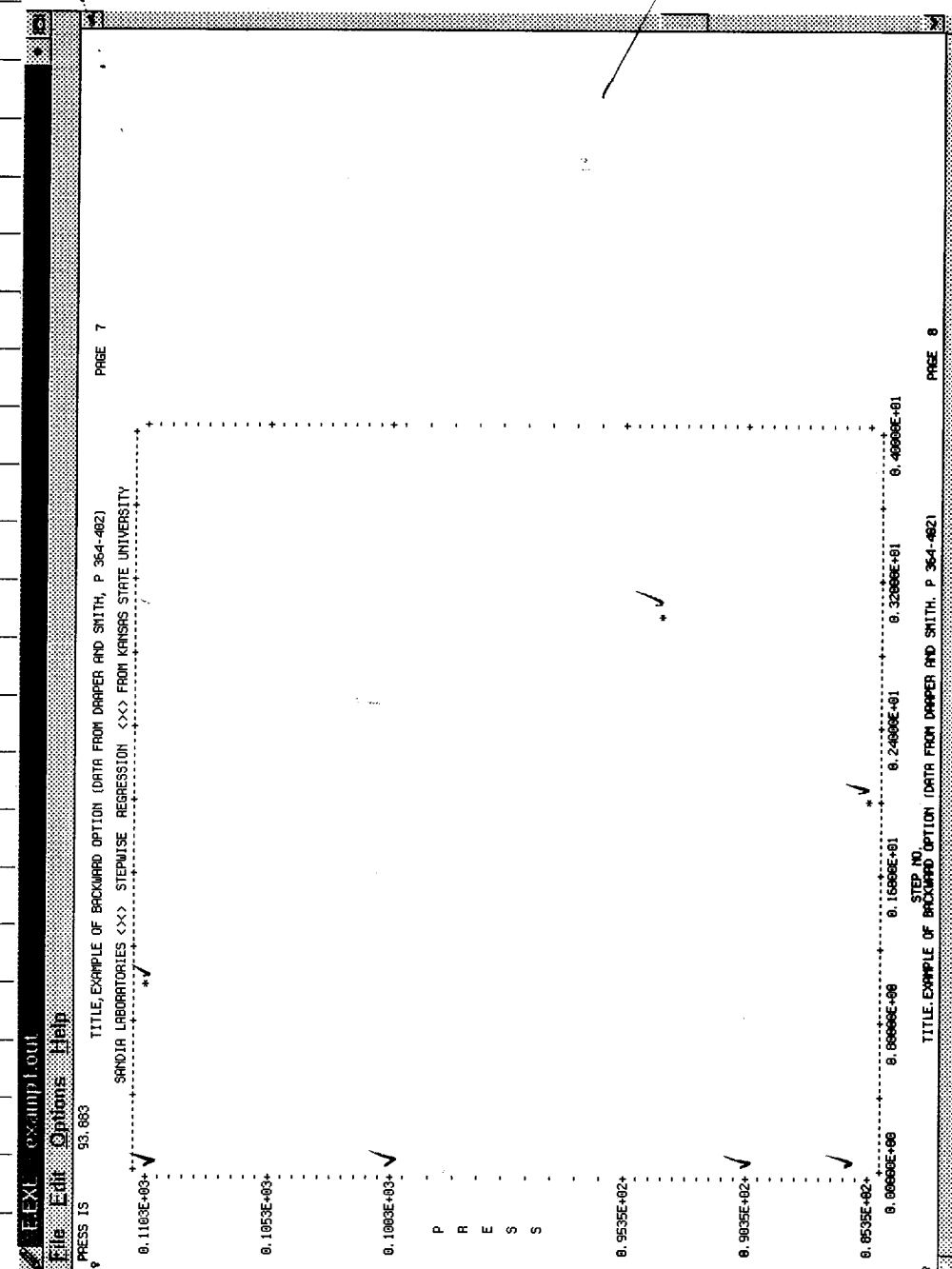
Stepwise Manual Example Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 44. January 1980.

6/9/97
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Testing Output



6/9/97/8 Stepwise Manual Example Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 45. January 1980.

6/9/97/8

testin output

FILE Edit Options Help

SANDIA LABORATORIES <>> STEPWISE REGRESSION <>> FROM KANSAS STATE UNIVERSITY

TABLE OF RESIDUALS FOR VARIABLES 5---Y

TIME	OBSERVED VALUE	PREDICTED VALUE	RESIDUAL
1	1300	1300	0
2	1400	1400	0
3	1500	1500	0
4	1600	1600	0
5	1700	1700	0
6	1800	1800	0
7	1900	1900	0
8	2000	2000	0
9	2100	2100	0
10	2200	2200	0
11	2300	2300	0
12	2400	2400	0
13	2500	2500	0
14	2600	2600	0
15	2700	2700	0
16	2800	2800	0
17	2900	2900	0
18	3000	3000	0
19	3100	3100	0
20	3200	3200	0
21	3300	3300	0
22	3400	3400	0
23	3500	3500	0
24	3600	3600	0
25	3700	3700	0
26	3800	3800	0
27	3900	3900	0
28	4000	4000	0
29	4100	4100	0
30	4200	4200	0
31	4300	4300	0
32	4400	4400	0
33	4500	4500	0
34	4600	4600	0
35	4700	4700	0
36	4800	4800	0
37	4900	4900	0
38	5000	5000	0
39	5100	5100	0
40	5200	5200	0
41	5300	5300	0
42	5400	5400	0
43	5500	5500	0
44	5600	5600	0
45	5700	5700	0
46	5800	5800	0
47	5900	5900	0
48	6000	6000	0
49	6100	6100	0
50	6200	6200	0
51	6300	6300	0
52	6400	6400	0
53	6500	6500	0
54	6600	6600	0
55	6700	6700	0
56	6800	6800	0
57	6900	6900	0
58	7000	7000	0
59	7100	7100	0
60	7200	7200	0
61	7300	7300	0
62	7400	7400	0
63	7500	7500	0
64	7600	7600	0
65	7700	7700	0
66	7800	7800	0
67	7900	7900	0
68	8000	8000	0
69	8100	8100	0
70	8200	8200	0
71	8300	8300	0
72	8400	8400	0
73	8500	8500	0
74	8600	8600	0
75	8700	8700	0
76	8800	8800	0
77	8900	8900	0
78	9000	9000	0
79	9100	9100	0
80	9200	9200	0
81	9300	9300	0
82	9400	9400	0
83	9500	9500	0
84	9600	9600	0
85	9700	9700	0
86	9800	9800	0
87	9900	9900	0
88	10000	10000	0
89	10100	10100	0
90	10200	10200	0
91	10300	10300	0
92	10400	10400	0
93	10500	10500	0
94	10600	10600	0
95	10700	10700	0
96	10800	10800	0
97	10900	10900	0
98	11000	11000	0
99	11100	11100	0
100	11200	11200	0
101	11300	11300	0
102	11400	11400	0
103	11500	11500	0
104	11600	11600	0
105	11700	11700	0
106	11800	11800	0
107	11900	11900	0
108	12000	12000	0
109	12100	12100	0
110	12200	12200	0
111	12300	12300	0
112	12400	12400	0
113	12500	12500	0
114	12600	12600	0
115	12700	12700	0
116	12800	12800	0
117	12900	12900	0
118	13000	13000	0
119	13100	13100	0
120	13200	13200	0
121	13300	13300	0
122	13400	13400	0
123	13500	13500	0
124	13600	13600	0
125	13700	13700	0
126	13800	13800	0
127	13900	13900	0
128	14000	14000	0
129	14100	14100	0
130	14200	14200	0
131	14300	14300	0
132	14400	14400	0
133	14500	14500	0
134	14600	14600	0
135	14700	14700	0
136	14800	14800	0
137	14900	14900	0
138	15000	15000	0
139	15100	15100	0
140	15200	15200	0
141	15300	15300	0
142	15400	15400	0
143	15500	15500	0
144	15600	15600	0
145	15700	15700	0
146	15800	15800	0
147	15900	15900	0
148	16000	16000	0
149	16100	16100	0
150	16200	16200	0
151	16300	16300	0
152	16400	16400	0
153	16500	16500	0
154	16600	16600	0
155	16700	16700	0
156	16800	16800	0
157	16900	16900	0
158	17000	17000	0
159	17100	17100	0
160	17200	17200	0
161	17300	17300	0
162	17400	17400	0
163	17500	17500	0
164	17600	17600	0
165	17700	17700	0
166	17800	17800	0
167	17900	17900	0
168	18000	18000	0
169	18100	18100	0
170	18200	18200	0
171	18300	18300	0
172	18400	18400	0
173	18500	18500	0
174	18600	18600	0
175	18700	18700	0
176	18800	18800	0
177	18900	18900	0
178	19000	19000	0
179	19100	19100	0
180	19200	19200	0
181	19300	19300	0
182	19400	19400	0
183	19500	19500	0
184	19600	19600	0
185	19700	19700	0
186	19800	19800	0
187	19900	19900	0
188	20000	20000	0
189	20100	20100	0
190	20200	20200	0
191	20300	20300	0
192	20400	20400	0
193	20500	20500	0
194	20600	20600	0
195	20700	20700	0
196	20800	20800	0
197	20900	20900	0
198	21000	21000	0
199	21100	21100	0
200	21200	21200	0
201	21300	21300	0
202	21400	21400	0
203	21500	21500	0
204	21600	21600	0
205	21700	21700	0
206	21800	21800	0
207	21900	21900	0
208	22000	22000	0
209	22100	22100	0
210	22200	22200	0
211	22300	22300	0
212	22400	22400	0
213	22500	22500	0
214	22600	22600	0
215	22700	22700	0
216	22800	22800	0
217	22900	22900	0
218	23000	23000	0
219	23100	23100	0
220	23200	23200	0
221	23300	23300	0
222	23400	23400	0
223	23500	23500	0
224	23600	23600	0
225	23700	23700	0
226	23800	23800	0
227	23900	23900	0
228	24000	24000	0
229	24100	24100	0
230	24200	24200	0
231	24300	24300	0
232	24400	24400	0
233	24500	24500	0
234	24600	24600	0
235	24700	24700	0
236	24800	24800	0
237	24900	24900	0
238	25000	25000	0
239	25100	25100	0
240	25200	25200	0
241	25300	25300	0
242	25400	25400	0
243	25500	25500	0
244	25600	25600	0
245	25700	25700	0
246	25800	25800	0
247	25900	25900	0
248	26000	26000	0
249	26100	26100	0
250	26200	26200	0
251	26300	26300	0
252	26400	26400	0
253	26500	26500	0
254	26600	26600	0
255	26700	26700	0
256	26800	26800	0
257	26900	26900	0
258	27000	27000	0
259	27100	27100	0
260	27200	27200	0
261	27300	27300	0
262	27400	27400	0
263	27500	27500	0
264	27600	27600	0
265	27700	27700	0
266	27800	27800	0
267	27900	27900	0
268	28000	28000	0
269	28100	28100	0
270	28200	28200	0
271	28300	28300	0
272	28400	28400	0
273	28500	28500	0
274	28600	28600	0
275	28700	28700	0
276	28800	28800	0
277	28900	28900	0
278	29000	29000	0
279	29100	29100	0
280	29200	29200	0
281	29300	29300	0
282	29400	29400	0
283	29500	29500	0
284	29600	29600	0
285	29700	29700	0
286	29800	29800	0
287	29900	29900	0
288	30000	30000	0
289	30100	30100	0
290	30200	30200	0
291	30300	30300	0
292	30400	30400	0
293	30500	30500	0
294	30600	30600	0
295	30700	30700	0
296	30800	30800	0
297	30900	30900	0
298	31000	31000	0
299	31100	31100	0
300	31200	31200	0
301	31300	31300	0
302	31400	31400	0
303	31500	31500	0
304	31600	31600	0
305	31700	31700	0
306	31800	31800	0
307	31900	31900	0
308	32000	32000	0
309	32100	32100	0
310	32200	32200	0
311	32300	32300	0
312	32400	32400	0
313	32500	32500	0
314	32600	32600	0
315	32700	32700	0
316	32800	32800	0
317	32900	32900	0
318	33000	33000	0
319	33100	33100	0
320	33200	33200	0
321	333		

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 46. January 1980.

[illegible]

6/9/97
MB

Stepwise Mixed Example Output

Information potentially subject to copyright protection was redacted from this location. The redacted material is from the following reference:

Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 47. January 1980.

6/9/97
MB

Testing output

F:\XL example1.out

File Edit Options Help

NO.	1	2	3	4	5
-----	---	---	---	---	---

9 NONE RANK(X1) RANK(X2) RANK(X3) RANK(X4) RANK(Y)

TITLE, EXAMPLE OF RANK REGRESSION WITH STEPWISE OPTION (DATA FROM DRAPER/SMITH)

SANDIA LABORATORIES <<>> STEPWISE REGRESSION <<>> FROM KANSAS STATE UNIVERSITY

ANALYSIS OF REGRESSION FOR VARIABLE 5:--RANK(Y)

ANOVA TABLE (TABLE 1)

SOURCE	D.F.	SS	MS	F	SIGNIFICANCE
REGRESSION	1	113.93123	113.93123	18.411433	0.0013
RESIDUAL	11	68.068768	6.1880698		
TOTAL	12	182.00000			

R-squared IS 0.62589

INTERCEPT IS 1.3438395

STANDARD ERROR OF INTERCEPT IS 1.48783

VARIABLE NUMBER	NAME	REGRESSION COEFFICIENTS	STANDARDIZED REGRESSION COEFFICIENTS	PARTIAL SSQ	T-TEST VALUES	R-squared DELETES
-----------------	------	-------------------------	--------------------------------------	-------------	---------------	-------------------

1	RANK(X1)	0.8082232	0.791195	113.9312	4.2909	0.0000
---	----------	-----------	----------	----------	--------	--------

UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 106

RANK FIT GIVES A RAW DATA NORMALIZED R-squared = 0.64252846

COEFFICIENT OF INTERPOLATION = 0.6848359E-01

PRESS IS 98.347

PAGE 4

input rank data
R-squared = 0.62589
12/19/91

ALPHA
HAITS
0.0013

unexplained data
at 0.001

6/9/97
M

Stepwise Manual Sample Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 48. January 1980.

6/9/97
M

Testing Output

TITLE, EXAMPLE OF RANK REGRESSION WITH STEPWISE OPTION (DATA FROM DAPPER/SMITH)									
SANDIA LABORATORIES <X> STEPWISE REGRESSION <X> FROM KANSAS STATE UNIVERSITY									
ANALYSIS OF REGRESSION FOR VARIABLE 5---RANK(Y)									
ADJ. TABLE									
SOURCE	D.F.	SS	MS	F	SIGNIFICANCE				
REGRESSION	2	152.92283	81.461413	42.700984	0.0000				
RESIDUAL	10	19.077175	1.9077175						
TOTAL	12	182.00000							
R=2 IS 0.89518									
INTERCEPT IS 6.5999988									
STANDARD ERROR OF INTERCEPT IS 1.31214									
VARIABLE NUMBER	NAME	REGRESSION COEFFICIENTS	STANDARDIZED REGRESSION COEFFICIENTS	PARTIAL SS	T-TEST VALUES	R=2 DELETES	ALPHA VALUES		
1	RANK(X)10	62154180	0.998891	59.9822	5.6073	0.5556	0.0002		
4	RANK(X)15	55154182	-0.950824	48.9516	-5.0676	0.6259	0.0005		
UNIQUE SEQUENCE NUMBER FOR THIS ANOVA = 187									
RANK FIT GIVES A RAW DATA NORMALIZED R=2 = 0.92844814									
COEFFICIENT OF INTERPOLATION = 0.14538800E-01									
PRESS IS 35.860									
TITLE, EXAMPLE OF RANK REGRESSION WITH STEPWISE OPTION (DATA FROM DAPPER/SMITH)									
SANDIA LABORATORIES <X> STEPWISE REGRESSION <X> FROM KANSAS STATE UNIVERSITY									

used manual diff
at ~ .0005
6/9/97
M

6/9/97
M

Stepwise Manual Example Output

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Iman, R.L., J.M. Davenport, E.L. Frost, and M.J. Shortencarier. "Stepwise Regression with PRESS and Rank Regression (Program User's Guide)." SAND79-1472. Albuquerque, New Mexico: Sandia National Laboratories. p. 50. January 1980.

19/97
M

Testing output

11x1 example out
File Edit Options Help

TIME	RANK OF Y	PREDICTED RANK OF Y	RANK RESIDUAL	RANK Y	RAW VARIAT	RAW RESIDUAL
1	2.00	1.00	1.00	76.5000	80.51393	-2.01393
2	9.00	13.00	4.00	74.3000	72.7422	-1.5578
3	5.00	6.00	1.00	104.300	104.3000	0.0000
4	5.00	6.00	1.00	97.5000	97.5000	0.0000
5	10.00	10.00	0.00	97.4000	93.4000	-4.0000
6	10.00	10.00	0.00	109.200	109.2001	0.0001
7	10.00	10.00	0.00	102.700	104.624	2.924
8	10.00	10.00	0.00	92.1000	92.1000	0.0000
9	10.00	10.00	0.00	115.900	115.9000	0.0000
10	10.00	10.00	0.00	83.8000	83.8000	0.0000
11	12.00	12.00	0.00	113.300	113.3000	0.0000
12	12.00	12.00	0.00	109.200	109.2001	0.0001
13	11.00	11.00	0.00	109.200	109.2001	0.0001

TABLE OF RESIDUALS FOR VARIABLES 5----RANK(Y)

RESIDUAL SUM OF SQUARES ON RAW DATA = 289.052

(STAT CONTROL CARD)

THE ABOVE CARD IS AN UNDEFINED PARAMETER CARD AND IS TAKEN AS A COMMENT
TERMINATION ON END OF FILE - UNIT 5

6/9/97

Conclusions:

The results of the installation testing indicate that the code is producing the same output as shown in the user manual when example problems are run. 2 minor deviations were noted and considered to not impact results. These tests confirm that the code has been installed correctly (and is running as intended by the authors) per the procedures in TOP-018.

6/8/98

Title of Activity - Installation testing for RESRAD 5.82

Dose Assessment Code to satisfy TOP-018 requirements

Participants: Patrick LaPlante

Author/Primary Participant: Same

Overall Objective: Verify proper installation and operation of RESRAD 5.82 following the procedure outlined in TOP-018 section 5.6.3. This involves running a test problem relevant to the intended code use and comparing output with results provided by the code developer.

Work Plan - RESRAD software is developed and maintained by Argonne National Laboratories. Contact is Charlie Yu (630)-252-5589. He is the primary code developer. Other information on RESRAD is available on the website (www.ead.anl.gov).

RESRAD software comes with a RESRAD.QA File which contains the necessary parameter inputs to test the code for a contaminated soil source pathway - dose calculation similar to our intended use (Uranium source, unsaturated and saturated zone transport, farming receptor). The summary.QA File contains the output (provided by ANL) which will be used to compare with output results from the test contained in 'summary.AEP File.

The summary.AEP File will be read into RESRAD 5.82 and run. Results will then be compared with summary.QA.

Installation testing - - - RESRAD 5.82 (cont)

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```
RESRAD, Version 5.80      Tk Limit = 0.5 year      03/10/98      Summary.qa
Summary : RESRAD QA File                                     14:18      Page 1
                                                           File: TEST.RAD

Table of Contents
XXXXXXXXXXXXXXXXXXXX
Part I: Mixture Sums and Single Radionuclide Guidelines
XXXXXXXXXXXXXXXXXXXX
Dose Conversion Factor (and Related) Parameter Summary ... 2
Site-Specific Parameter Summary ... 3
Summary of Pathway Selections ... 7
Contaminated Zone and Total Dose Summary ... 8
Total Dose Components
Time = 0.000E+00 ..... 9
Time = 1.000E+00 ..... 10
Time = 3.000E+00 ..... 11
Time = 1.000E+01 ..... 12
Time = 3.000E+01 ..... 13
Time = 1.000E+02 ..... 14
Time = 3.000E+02 ..... 15
Time = 1.000E+03 ..... 16
Dose/Source Ratios Summed Over All Pathways ..... 17
Single Radionuclide Soil Guidelines ..... 17
Dose Per Nuclide Summed Over All Pathways ..... 18
Soil Concentration Per Nuclide ..... 18
RESRAD, Version 5.80      Tk Limit = 0.5 year      03/10/98      Page 2
Summary : RESRAD QA File                                     14:18      File: TEST.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu :
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
B-1 : Dose conversion factors for inhalation, mrem/pCi:
B-1 : Pb-210+D ..... 2.320E-02 ..... DCF2( 1)
B-1 : Ra-226+D ..... 8.600E-03 ..... DCF2( 2)
B-1 : Ra-226+D ..... 3.260E-01 ..... DCF2( 3)
B-1 : Th-230 ..... 1.320E-01 ..... DCF2( 4)
B-1 : U-234 ..... 1.180E-01 ..... DCF2( 5)
B-1 : U-238+D .....
D-1 : Dose conversion factors for ingestion, mrem/pCi:
D-1 : Pb-210+D ..... 7.270E-03 ..... DCF3( 1)
D-1 : Ra-226+D ..... 1.330E-03 ..... DCF3( 2)
D-1 : Th-230 ..... 5.480E-04 ..... DCF3( 3)
D-1 : U-234 ..... 2.830E-04 ..... DCF3( 4)
D-1 : U-238+D ..... 2.690E-04 ..... DCF3( 5)
D-34 : Food transfer factors:
D-34 : Pb-210+D, plant/soil concentration ratio, dimensionless ..... 1.000E-02 ..... RTF( 1,1)
D-34 : Pb-210+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ..... 8.000E-04 ..... RTF( 1,2)
D-34 : Pb-210+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d) ..... 3.000E-04 ..... RTF( 1,3)
D-34 : Ra-226+D, plant/soil concentration ratio, dimensionless ..... 4.000E-02 ..... RTF( 2,1)
D-34 : Ra-226+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ..... 1.000E-03 ..... RTF( 2,2)
D-34 : Ra-226+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d) ..... 1.000E-03 ..... RTF( 2,3)
D-34 : Th-230, plant/soil concentration ratio, dimensionless ..... 1.000E-03 ..... RTF( 3,1)
D-34 : Th-230, plant/soil concentration ratio, dimensionless ..... 1.000E-03 ..... RTF( 3,1)
Page 1
```

ANL
File

Installation testing of RESRAD 5.82 (cont)

6/8/98
15

Results:

```
RESRAD, Version 5.82      Tk Limit = 0.5 year      06/06/98      Summary.rep
Summary : RESRAD QA File                                     22:41      Page 1
                                                           File: RESRAD.QA

Table of Contents
XXXXXXXXXXXXXXXXXXXX
Part I: Mixture Sums and Single Radionuclide Guidelines
XXXXXXXXXXXXXXXXXXXX
Dose Conversion Factor (and Related) Parameter Summary ... 2
Site-Specific Parameter Summary ... 3
Summary of Pathway Selections ... 7
Contaminated Zone and Total Dose Summary ... 8
Total Dose Components
Time = 0.000E+00 ..... 9
Time = 1.000E+00 ..... 10
Time = 3.000E+00 ..... 11
Time = 1.000E+01 ..... 12
Time = 3.000E+01 ..... 13
Time = 1.000E+02 ..... 14
Time = 3.000E+02 ..... 15
Time = 1.000E+03 ..... 16
Dose/Source Ratios Summed Over All Pathways ..... 17
Single Radionuclide Soil Guidelines ..... 17
Dose Per Nuclide Summed Over All Pathways ..... 18
Soil Concentration Per Nuclide ..... 18
RESRAD, Version 5.82      Tk Limit = 0.5 year      06/06/98      Page 2
Summary : RESRAD QA File                                     22:41      File: RESRAD.QA

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu :
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
B-1 : Dose conversion factors for inhalation, mrem/pCi:
B-1 : Pb-210+D ..... 2.320E-02 ..... DCF2( 1)
B-1 : Ra-226+D ..... 8.600E-03 ..... DCF2( 2)
B-1 : Ra-226+D ..... 3.260E-01 ..... DCF2( 3)
B-1 : Th-230 ..... 1.320E-01 ..... DCF2( 4)
B-1 : U-234 ..... 1.180E-01 ..... DCF2( 5)
B-1 : U-238+D .....
D-1 : Dose conversion factors for ingestion, mrem/pCi:
D-1 : Pb-210+D ..... 7.270E-03 ..... DCF3( 1)
D-1 : Ra-226+D ..... 1.330E-03 ..... DCF3( 2)
D-1 : Th-230 ..... 5.480E-04 ..... DCF3( 3)
D-1 : U-234 ..... 2.830E-04 ..... DCF3( 4)
D-1 : U-238+D ..... 2.690E-04 ..... DCF3( 5)
D-34 : Food transfer factors:
D-34 : Pb-210+D, plant/soil concentration ratio, dimensionless ..... 1.000E-02 ..... RTF( 1,1)
D-34 : Pb-210+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ..... 8.000E-04 ..... RTF( 1,2)
D-34 : Pb-210+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d) ..... 3.000E-04 ..... RTF( 1,3)
D-34 : Ra-226+D, plant/soil concentration ratio, dimensionless ..... 4.000E-02 ..... RTF( 2,1)
D-34 : Ra-226+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ..... 1.000E-03 ..... RTF( 2,2)
D-34 : Ra-226+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d) ..... 1.000E-03 ..... RTF( 2,3)
D-34 : Th-230, plant/soil concentration ratio, dimensionless ..... 1.000E-03 ..... RTF( 3,1)
Page 1
```

Test
Results
File

✓ = compared ok
w/ ANL File

Menu	Parameter	User Input	Default	(if different from user input)	Name
R001	Area of contaminated zone (m**2)	1.000E+00	1.000E+00		AREA
R001	Area of contaminated zone (m)	2.000E+00	2.000E+00		THICRO
R001	Thickness of contaminated zone (m)	1.000E+02	1.000E+02		LCZPCO
R001	length parallel to aquifer flow (m)	3.000E+01	3.000E+01		BRDL
R001	Basic radiation dose limit (mrem/yr)	0.000E+00	0.000E+00		TI
R001	Time since placement of material (yr)	1.000E+00	1.000E+00		T (2)
R001	Times for calculations (yr)	3.000E+00	3.000E+00		T (3)
R001	Times for calculations (yr)	1.000E+01	1.000E+01		T (4)
R001	Times for calculations (yr)	3.000E+01	3.000E+01		T (5)
R001	Times for calculations (yr)	1.000E+02	1.000E+02		T (6)
R001	Times for calculations (yr)	3.000E+02	3.000E+02		T (7)
R001	Times for calculations (yr)	1.000E+03	1.000E+03		T (8)
R001	Times for calculations (yr)	not used	0.000E+00		T (9)
R001	Times for calculations (yr)	not used	0.000E+00		T (10)
R001	Times for calculations (yr)	not used	0.000E+00		SI (4)
R002	Initial principal radionuclide (PCI/g)	1.000E+00	0.000E+00		SI (5)
R002	Initial principal radionuclide (PCI/g)	1.000E+00	0.000E+00		MI (4)
R002	Initial principal radionuclide (PCI/L)	not used	0.000E+00		MI (5)
R002	Concentration in groundwater (PCI/L)	not used	0.000E+00		COVERO
R003	Cover depth (m)	0.000E+00	0.000E+00		DENSCV
R003	Density of cover material (g/cm**3)	not used	1.500E+00		VCV
R003	Cover depth erosion rate (m/yr)	not used	1.000E-03		

Page 2

		Summary.rep					
D-34	Th-230	beef/livestock-intake ratio, (pci/kg)/(pci/d)	1.000E-04	1.000E-04	RTF (3, 2)		
D-34	Th-230	milk/livestock-intake ratio, (pci/lb)/(pci/d)	5.000E-06	5.000E-06	RTF (3, 3)		
D-34	U-234	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF (4, 1)		
D-34	U-234	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF (4, 2)		
D-34	U-234	milk/livestock-intake ratio, (pci/lb)/(pci/d)	6.000E-04	6.000E-04	RTF (4, 3)		
D-34	U-238+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF (5, 1)		
D-34	U-238+D	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF (5, 2)		
D-34	U-238+D	milk/livestock-intake ratio, (pci/lb)/(pci/d)	6.000E-04	6.000E-04	RTF (5, 3)		
D-5		Bioaccumulation factors, fresh water, L/kg:					
D-5	EP-210+D	fish	3.000E+02	3.000E+02	BIOFAC (1, 1)		
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC (1, 2)		
D-5							
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC (2, 1)		
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC (2, 2)		
D-5							
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC (3, 1)		
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC (3, 2)		
D-5							
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC (4, 1)		
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (4, 2)		
D-5							
D-5	U-238+D	fish	1.000E+01	1.000E+01	BIOFAC (5, 1)		
D-5	U-238+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (5, 2)		
1RRSRD							
Summary :	RESRAD QA file						

File

6/8/98 Installation testing --- RESRAD 5.02 (cont.)
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Menu	Parameter	Use	Input	Default	(If different from user input)	Used by RESRAD	Parameter Name
AAAAA	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	---	---	AREA	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	---	THICKO	THICKO
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	---	LCZPAQ	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+01	3.000E+01	---	---	BRDL	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	---	TT	TT
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	---	T (2)	T (2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	---	T (3)	T (3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	---	T (4)	T (4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	---	T (5)	T (5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	---	T (6)	T (6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	---	T (7)	T (7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	---	T (8)	T (8)
R011	Times for calculations (yr)	not used	0.000E+00	---	---	T (9)	T (9)
R011	Times for calculations (yr)	not used	0.000E+00	---	---	T (10)	T (10)
R012	Initial principal radionuclide (pci/g):	1.000E+00	0.000E+00	---	---	SI (4)	SI (4)
R012	Initial principal radionuclide (pci/g):	1.000E+00	0.000E+00	---	---	SI (5)	SI (5)
R012	Concentration in groundwater (pci/L):	not used	0.000E+00	---	---	MI (4)	MI (4)
R012	Concentration in groundwater (pci/L):	not used	0.000E+00	---	---	MI (5)	MI (5)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	---	COVERO	COVERO
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	---	DENSCV	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	---	VCV	VCV

Page 2

Summary									
D-34	Th-230	beef/livestock-intake ratio, (pci/kg)/(pci/d)	1.000E-04	1.000E-04	RTF (3,2)				
D-34	Th-230	mlk/livestock-intake ratio, (pci/L)/(pci/d)	5.000E-06	5.000E-06	RTF (3,3)				
D-34	U-234	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF (4,1)				
D-34	U-234	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF (4,2)				
D-34	U-234	mlk/livestock-intake ratio, (pci/L)/(pci/d)	6.000E-04	6.000E-04	RTF (4,3)				
D-34	U-238+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF (5,1)				
D-34	U-238+D	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF (5,2)				
D-34	U-238+D	mlk/livestock-intake ratio, (pci/L)/(pci/d)	6.000E-04	6.000E-04	RTF (5,3)				
D-5	Bioaccumulation factors, fresh water, L/kg:								
D-5	Pb-210+D	fish	3.000E+02	3.000E+02	BIOFAC (1,1)				
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC (1,2)				
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC (2,1)				
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC (2,2)				
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC (3,1)				
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC (3,2)				
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC (4,1)				
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (4,2)				
D-5	U-238+D	fish	1.000E+01	1.000E+01	BIOFAC (5,1)				
D-5	U-238+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (5,2)				

IRRSRAD, Version 5.80 Tk Limit = 0.5 year 03/10/98 14:18 Page 3

Summary : RESRAD QA File File: TEST.RAD

BNL
File

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R016  Contaminated zone (cm**3/g)          Summary rep      DCNUCC ( 1 )
R016  Unsaturated zone 1 (cm**3/g)         1.000E+02        DCNUCC ( 1,1 )
R016  Saturated zone (cm**3/g)            1.000E+02        DCNUCC ( 1 )
R016  Leach rate (/yr)                    0.000E+00        ALEACH ( 1 )
R016  Solubility constant                  0.000E+00        SOLDBK ( 1 )
R016  Distribution coefficients for daughter Ra-226
R016  Contaminated zone (cm**3/g)          7.000E+01        DCNUCC ( 2 )
R016  Unsaturated zone 1 (cm**3/g)         7.000E+01        DCNUCC ( 2,1 )
R016  Saturated zone (cm**3/g)            7.000E+01        DCNUCC ( 2 )
R016  Leach rate (/yr)                    0.000E+00        ALEACH ( 2 )
R016  Solubility constant                  0.000E+00        SOLDBK ( 2 )
R016  Distribution coefficients for daughter Th-230
R016  Contaminated zone (cm**3/g)          6.000E+04        DCNUCC ( 3 )
R016  Unsaturated zone 1 (cm**3/g)         6.000E+04        DCNUCC ( 3,1 )
R016  Saturated zone (cm**3/g)            6.000E+04        DCNUCC ( 3 )
R016  Leach rate (/yr)                    0.000E+00        ALEACH ( 3 )
R016  Solubility constant                  0.000E+00        SOLDBK ( 3 )
R017  Inhalation rate (m**3/yr)           8.400E+03        INHAIR
R017  Mass loading for inhalation (g/m**3) 2.000E-04        MLINH
R017  Exposure duration                   3.000E+01        ED
R017  Shielding factor, inhalation       4.000E-01        SHF3
R017  Shielding factor, external gamma   7.000E-01        SHF1
R017  Fraction of time spent indoors     5.000E-01        SFIND
R017  Shape factor flag, external gamma  2.500E-01        FORD
1RSRAD, Version 5.82 T* Limit = 0.5 year 1.000E+00    >0 shows circular AREA.
Summary : RESRAD QA file                      File: RESRAD_QA Page 5
Site-Specific Parameter Summary (continued)
Menu  Parameter                                Used by RESRAD
-----
R017  RadII of shape factor array (used if FS = -1): Input (If different from user input)
R017  Outer annular radius (m), ring 1: not used 5.000E+01 RAD SHAPE ( 1 )
R017  Outer annular radius (m), ring 2: not used 7.071E+01 RAD SHAPE ( 2 )
R017  Outer annular radius (m), ring 3: not used 0.000E+00 RAD SHAPE ( 3 )
R017  Outer annular radius (m), ring 4: not used 0.000E+00 RAD SHAPE ( 4 )
R017  Outer annular radius (m), ring 5: not used 0.000E+00 RAD SHAPE ( 5 )
R017  Outer annular radius (m), ring 6: not used 0.000E+00 RAD SHAPE ( 6 )
R017  Outer annular radius (m), ring 7: not used 0.000E+00 RAD SHAPE ( 7 )
R017  Outer annular radius (m), ring 8: not used 0.000E+00 RAD SHAPE ( 8 )
R017  Outer annular radius (m), ring 9: not used 0.000E+00 RAD SHAPE ( 9 )
R017  Outer annular radius (m), ring 10: not used 0.000E+00 RAD SHAPE (10)
R017  Outer annular radius (m), ring 11: not used 0.000E+00 RAD SHAPE (11)
R017  Outer annular radius (m), ring 12: not used 0.000E+00 RAD SHAPE (12)
R017  Fractions of annular areas within AREA:
R017  Ring 1: not used 1.000E+00 FRACA ( 1 )
R017  Ring 2: not used 2.732E-01 FRACA ( 2 )
R017  Ring 3: not used 0.000E+00 FRACA ( 3 )
R017  Ring 4: not used 0.000E+00 FRACA ( 4 )
R017  Ring 5: not used 0.000E+00 FRACA ( 5 )
R017  Ring 6: not used 0.000E+00 FRACA ( 6 )
R017  Ring 7: not used 0.000E+00 FRACA ( 7 )

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test
results
file

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R016  Contaminated zone (cm**3/g)          1.000E+02      1.000E+02      ---      DCNUCC (1)
R016  Unsaturated zone 1 (cm**3/g)        1.000E+02      1.000E+02      ---      DCNUCC (1,1)
R016  Saturated zone (cm**3/g)            0.000E+00      0.000E+00      ---      DCNUCC (3)
R016  Leach rate (/yr)                    0.000E+00      0.000E+00      1.663E-03     ALEACH (1)
R016  Solubility constant                  0.000E+00      0.000E+00      not used       ALEACH (1)
R016  Distribution coefficients for daughter Ra-226
R016  Contaminated zone (cm**3/g)         7.000E+01      7.000E+01      ---      DCNUCC (2)
R016  Unsaturated zone 1 (cm**3/g)        7.000E+01      7.000E+01      ---      DCNUCC (2,1)
R016  Saturated zone (cm**3/g)            0.000E+00      0.000E+00      ---      DCNUCC (3)
R016  Leach rate (/yr)                    0.000E+00      0.000E+00      2.374E-03     ALEACH (2)
R016  Solubility constant                  0.000E+00      0.000E+00      not used       ALEACH (2)
R016  Distribution coefficients for daughter Th-230
R016  Contaminated zone (cm**3/g)         6.000E+04      6.000E+04      ---      DCNUCC (3)
R016  Unsaturated zone 1 (cm**3/g)        6.000E+04      6.000E+04      ---      DCNUCC (3,1)
R016  Saturated zone (cm**3/g)            0.000E+00      0.000E+00      ---      DCNUCC (3)
R016  Leach rate (/yr)                    0.000E+00      0.000E+00      2.778E-06     ALEACH (3)
R016  Solubility constant                  0.000E+00      0.000E+00      not used       ALEACH (3)
R017  Inhalation rate (m**3/yr)           8.400E+03      8.400E+03      ---      INHLNR
R017  Mass loading for inhalation (g/m**3) 2.000E-04      1.000E-04      ---      ED
R017  Exposure duration                   3.000E+01      3.000E+01      ---      SHF3
R017  Shielding factor, inhalation         4.000E-01      4.000E-01      ---      SHF1
R017  Shielding factor, external gamma     7.000E-01      7.000E-01      ---      SHF1
R017  Fraction of time spent indoors       5.000E-01      5.000E-01      ---      FIND
R017  Fraction of time spent outdoors (on site) 2.500E-01      2.500E-01      ---      FOTD
R017  Shape factor flag, external gamma    1.000E+00      1.000E+00      >0 shows circular AREA.
RESRAD, Version 5.80                      File: TEST.RAD Page 5
Summary : RESRAD CA file

Site-Specific Parameter Summary (continued)

Menu : Parameter Input Default (if different from user input) Parameter
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
R017  RadII of shape factor array (used if FS = -1):
R017  Outer annular radius (m), ring 1:   not used      5.000E+01      ---      RAD_SHAPE (1)
R017  Outer annular radius (m), ring 2:   not used      7.071E+01      ---      RAD_SHAPE (2)
R017  Outer annular radius (m), ring 3:   not used      0.000E+00      ---      RAD_SHAPE (3)
R017  Outer annular radius (m), ring 4:   not used      0.000E+00      ---      RAD_SHAPE (4)
R017  Outer annular radius (m), ring 5:   not used      0.000E+00      ---      RAD_SHAPE (5)
R017  Outer annular radius (m), ring 6:   not used      0.000E+00      ---      RAD_SHAPE (6)
R017  Outer annular radius (m), ring 7:   not used      0.000E+00      ---      RAD_SHAPE (7)
R017  Outer annular radius (m), ring 8:   not used      0.000E+00      ---      RAD_SHAPE (8)
R017  Outer annular radius (m), ring 9:   not used      0.000E+00      ---      RAD_SHAPE (9)
R017  Outer annular radius (m), ring 10:  not used      0.000E+00      ---      RAD_SHAPE (10)
R017  Outer annular radius (m), ring 11:  not used      0.000E+00      ---      RAD_SHAPE (11)
R017  Outer annular radius (m), ring 12:  not used      0.000E+00      ---      RAD_SHAPE (12)
R017  Fractions of annular areas within AREA:
R017  Ring 1                             not used      1.000E+00      ---      FRACA (1)
R017  Ring 2                             not used      2.732E-01      ---      FRACA (2)
R017  Ring 3                             not used      0.000E+00      ---      FRACA (3)
R017  Ring 4                             not used      0.000E+00      ---      FRACA (4)
R017  Ring 5                             not used      0.000E+00      ---      FRACA (5)
R017  Ring 6                             not used      0.000E+00      ---      FRACA (6)
R017  Ring 7                             not used      0.000E+00      ---      FRACA (7)

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Contaminated Zone Dimensions
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Area: 10000.00 square meters
Thickness: 2.00 meters

```

Total Dose TDose(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) Fraction of Basic Dose Limit Received at Time (t)
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
t (years) 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 1.000E+02 3.000E+02 1.000E+03 ✓
TDose(t): 2.587E-01 2.578E-01 2.561E-01 2.503E-01 2.503E-01 1.688E-01 1.028E-01 1.966E+00
M(t): 8.622E-03 8.594E-03 8.557E-03 8.342E-03 7.810E-03 6.227E-03 3.426E-03 6.553E-02
Maximum TDose(t): 1.966E+00 mrem/yr at t = 1.000E+03 years
IRSRAD, Version 5.80 T* Limit = 0.5 year 03/10/98 14:18 Page 9
Summary : IRSRAD QA File File: TEST.RAD

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)												
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years												
	Ground			Inhalation			Radon			Plant		
	Water Independent Pathways (Inhalation excludes radon)											
	mrem/yr	frac.		mrem/yr	frac.		mrem/yr	frac.		mrem/yr	frac.	
Radio-	AAAAAAAAAAAAAAAA			AAAAAAAAAAAAAAAA			AAAAAAAAAAAAAAAA			AAAAAAAAAAAAAAAA		
Nuclide												
U-234	2.338E-04	0.0009		1.689E-02	0.0653		0.000E+00	0.0000		6.159E-02	0.2361	
U-238	7.752E-02	0.2997		1.510E-02	0.0584		0.000E+00	0.0000		5.854E-02	0.2263	
TTTTTT	TTTTTTTT	TTTTTT		TTTTTTTT	TTTTTT		TTTTTTTT	TTTTTT		TTTTTTTT	TTTTTT	
Total	7.775E-02	0.3006		3.200E-02	0.1237		0.000E+00	0.0000		1.201E-01	0.4644	
Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)												
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years												

[illegible]

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Summary: rep
2 -- inhalation (%o radon) ; active
3 -- plant ingestion ; active
4 -- meat ingestion ; active
5 -- milk ingestion ; active
6 -- aquatic foods ; active
7 -- drinking water ; active
8 -- soil ingestion ; active
9 -- radon ; active
Find peak pathway doses ; suppressed
+++++ suppressed +++++
1RESRAD, Version 5.82 Tk Limit = 0.5 year 06/06/98 22:41 Page 8
Summary: RESRAD QA File
File: RESRAD.QA
Contaminated zone Dimensions
AAAAAAAAAAAAAAAAAAAAAAAAAAAA Initial Soil Concentrations, pci/g
Area: 10000.00 square meters U-234 1.000E+00
Thickness: 2.00 meters U-238 1.000E+00
Cover Depth: 0.00 meters
0

```

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Total Dose TDOSF(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
t (years) 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 1.000E+02 3.000E+02
TDOSF(t): 2.587E-01 2.578E-01 2.557E-01 2.503E-01 2.343E-01 1.868E-01 1.028E-01
M(t): 8.622E-03 8.594E-03 8.557E-03 8.342E-03 7.810E-03 6.227E-03 3.426E-03
Omaximum TDOSF(t): 1.966E+00 mrem/yr at t = 1.000E+03 years 1.966E+00
1RRSRAD, Version 3,82 T* Limit = 0.5 year 06/06/98 22:41 Page 9
Summary: RRSRAD QA File File: RRSRAD.QA

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Total Dose Contributions TDose (i, p, t) for Individual Radionuclides (i) and Pathways (p)											
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years											
Water Independent Pathways (Inhalation excludes radon)											
0	Ground	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX
0	Radionuclide	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.
U-234	XXXXXXXXXX	2.338E-04	0.0009	1.689E-02	0.0653	0.000E+00	0.0000	6.158E-02	0.2381	2.032E-03	0.0079
U-238	XXXXXXXXXX	7.752E-02	0.2997	1.510E-02	0.0584	0.000E+00	0.0000	5.854E-02	0.2263	1.931E-03	0.0075
↓	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX
0	Total	7.775E-02	0.3006	3.200E-02	0.1237	0.000E+00	0.0000	1.201E-01	0.4664	3.963E-03	0.0153
Total Dose Contributions TDose (i, p, t) for Individual Radionuclides (i) and Pathways (p)											
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years											
Water Dependent Pathways											
0	Water	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX
0	Radionuclide	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.
U-234	XXXXXXXXXX	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	XXXXXXXXXX	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
↓	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXXX
0	Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sum of all water independent and dependent pathways.											
1985RAD, Version 3.82 T _{1/2} Limit = 0.5 year 06/06/98 Page 10											
Summary: RESRAD QA file											

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6/5/45 ~~1/2~~ Installation Festivity --- RESRAD 5.82 (cont)

6/8/98 *Installation Testing* - RESRAD 5.82 (Cont)

Summary: 9a
Total Dose Contributions TDose(I,P,t) for Individual Radionuclides (I) and Pathways (P)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil	All Pathways*
Radio-0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Nuclide	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of all water independent and dependent pathways:	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RESRAD, Version 5.80	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Summary: RESRAD QA file	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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File: TEST.RAD

Summary: 9b
Total Dose Contributions TDose(I,P,t) for Individual Radionuclides (I) and Pathways (P)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil	All Pathways*
Radio-0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Nuclide	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of all water independent and dependent pathways:	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RESRAD, Version 5.80	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Summary: RESRAD QA file	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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File: TEST.RAD

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test resd file

6/8/98 *Installation Testing* - RESRAD 5.82 (Cont)

Summary: 9c
Total Dose Contributions TDose(I,P,t) for Individual Radionuclides (I) and Pathways (P)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil	All Pathways*
Radio-0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Nuclide	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of all water independent and dependent pathways:	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RESRAD, Version 5.82	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Summary: RESRAD QA file	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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File: RESRAD.QA

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File: RESRAD.QA

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Dependent Pathways

Total Dose Contributions $\text{TDose}(i,p,t)$ for Individual Radionuclides (i) and Pathways (p) as mrem/yr and Fraction of Total Dose At $t = 3.000E+01$ years

Total Dose Contributions TDOSE(I,P,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p) as mgm/yr and Fraction of Total Dose at t = 1.000E+02 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

File: RESRAD.QA

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mem/yr and Fraction of Total Dose At t = 3.000E+01 years

File: RESRAD_QA

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways

test results
file

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File: R11

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Installation testing -- RESRAD -- 15.02. (cont)

[illegible]

Summary: Version 5.80
 File: RESRAD QA File
 Date: 03/10/98
 Page: 17
 File: TEST.RAD

Parent and Property Principal Radionuclide Contributions Indicated

Parent	Product	Branch	Fraction	t = 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238	Th-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-229	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-225	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-228	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-225	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-225	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Th-225	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Pa-224	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	Ac-224	1.000E+00	0.000E+00	0.000E							

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test

RESRAD, Version 5.80		T ₀ Limit = 0.5 year		03/10/98		14:18		Page 18																																																																																																																																																																																																																																																						
Summary :		RESRAD QA File				File: TEST.RAD																																																																																																																																																																																																																																																								
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Nuclide	Parent	BRF(1)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	3.000E+03	1.000E+04	3.000E+04	1.000E+05	3.000E+05	1.000E+06	3.000E+06	1.000E+07	3.000E+07	1.000E+08	3.000E+08	1.000E+09	3.000E+09	1.000E+10	3.000E+10	1.000E+11	3.000E+11	1.000E+12	3.000E+12	1.000E+13	3.000E+13	1.000E+14	3.000E+14	1.000E+15	3.000E+15	1.000E+16	3.000E+16	1.000E+17	3.000E+17	1.000E+18	3.000E+18	1.000E+19	3.000E+19	1.000E+20	3.000E+20	1.000E+21	3.000E+21	1.000E+22	3.000E+22	1.000E+23	3.000E+23	1.000E+24	3.000E+24	1.000E+25	3.000E+25	1.000E+26	3.000E+26	1.000E+27	3.000E+27	1.000E+28	3.000E+28	1.000E+29	3.000E+29	1.000E+30	3.000E+30	1.000E+31	3.000E+31	1.000E+32	3.000E+32	1.000E+33	3.000E+33	1.000E+34	3.000E+34	1.000E+35	3.000E+35	1.000E+36	3.000E+36	1.000E+37	3.000E+37	1.000E+38	3.000E+38	1.000E+39	3.000E+39	1.000E+40	3.000E+40	1.000E+41	3.000E+41	1.000E+42	3.000E+42	1.000E+43	3.000E+43	1.000E+44	3.000E+44	1.000E+45	3.000E+45	1.000E+46	3.000E+46	1.000E+47	3.000E+47	1.000E+48	3.000E+48	1.000E+49	3.000E+49	1.000E+50	3.000E+50	1.000E+51	3.000E+51	1.000E+52	3.000E+52	1.000E+53	3.000E+53	1.000E+54	3.000E+54	1.000E+55	3.000E+55	1.000E+56	3.000E+56	1.000E+57	3.000E+57	1.000E+58	3.000E+58	1.000E+59	3.000E+59	1.000E+60	3.000E+60	1.000E+61	3.000E+61	1.000E+62	3.000E+62	1.000E+63	3.000E+63	1.000E+64	3.000E+64	1.000E+65	3.000E+65	1.000E+66	3.000E+66	1.000E+67	3.000E+67	1.000E+68	3.000E+68	1.000E+69	3.000E+69	1.000E+70	3.000E+70	1.000E+71	3.000E+71	1.000E+72	3.000E+72	1.000E+73	3.000E+73	1.000E+74	3.000E+74	1.000E+75	3.000E+75	1.000E+76	3.000E+76	1.000E+77	3.000E+77	1.000E+78	3.000E+78	1.000E+79	3.000E+79	1.000E+80	3.000E+80	1.000E+81	3.000E+81	1.000E+82	3.000E+82	1.000E+83	3.000E+83	1.000E+84	3.000E+84	1.000E+85	3.000E+85	1.000E+86	3.000E+86	1.000E+87	3.000E+87	1.000E+88	3.000E+88	1.000E+89	3.000E+89	1.000E+90	3.000E+90	1.000E+91	3.000E+91	1.000E+92	3.000E+92	1.000E+93	3.000E+93	1.000E+94	3.000E+94	1.000E+95	3.000E+95	1.000E+96	3.000E+96	1.000E+97	3.000E+97	1.000E+98	3.000E+98	1.000E+99	3.000E+99	1.000E+100	3.000E+100	1.000E+101	3.000E+101	1.000E+102	3.000E+102	1.000E+103	3.000E+103	1.000E+104	3.000E+104	1.000E+105	3.000E+105	1.000E+106	3.000E+106	1.000E+107	3.000E+107	1.000E+108	3.000E+108	1.000E+109	3.000E+109	1.000E+110	3.000E+110	1.000E+111	3.000E+111	1.000E+112	3.000E+112	1.000E+113	3.000E+113	1.000E+114	3.000E+114	1.000E+115	3.000E+115	1.000E+116	3.000E+116	1.000E+117	3.000E+117	1.000E+118	3.000E+118	1.000E+119	3.000E+119	1.000E+120	3.000E+120	1.000E+121	3.000E+121	1.000E+122	3.000E+122	1.000E+123	3.000E+123	1.000E+124	3.000E+124

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Discussion of results and conclusions.

The comparison of the ANL results in summary QA file and the installation test run results in summary rep agree 100%. This confirms that the code as installed is operating as expected.

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Title of Activity: Installation testing of MEPAS 3.2g (Multimedia Environmental Pollutant Assessment System) pathway /dose assessment code.

Participants: P. LaPlante

Author/primary participant: Same

Overall Objective: Verify proper installation and operation of MEPAS 3.2g following the procedure outlined in TOP-018, section 5.6.3. This involves running a test problem relevant to the intended code use and comparing output with results provided by the code developer.

Work Plan: MEPAS software is developed and maintained by Pacific Northwest ^{National} ~~laboratory~~ (PNL). Contact is John W. Buck (lead developer) who can be reached by calling Garrison Gelston (509) 376-6104. Module/discipline-specific contacts can be found at the website at mepas.pnl.gov: 20804/.

MEPAS was modified specifically for the Nuclear Regulatory Commission in version 3.2g. The report which documents this latest revision is NUREG CR-0566 (Buck et al., 1997). This report contains results of case examples (test runs) including CASE1A which is a uranium ~~and~~ soil contamination, groundwater transport, and farm receptor scenario for 1000 yr time period. This scenario is similar to the intended use of the code for

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6/19/98
Filename: WCFCOMP2.XLS
Location: QAZ folder on attached floppy 8/12/98
Results: MEPAS 3.2g ... testing for groundwater (cont)

Comparison of CNWRA and PNL MEPAS 3.2g Results: CASE1A.WCF Groundwater Concentration Output						
RADCON VERSION 05/01/1997						
WATERBORNE COMPONENT of the Multimedia Environmental Pollutant Assessment System (MEPAS): Models the movement of chemicals and radionuclides through vadose zone, saturated zone, surface water, and wetlands media.						
Pacific Northwest National Laboratory Operated for the U.S Department of Energy by Battelle Memorial Institute P.O. Box 999 Richland, Washington 99352						
Run Name: CASE1A						
Run Performed: 6/ 9/1998 g/mL or pCi/mL						
PAL	PNL	Ratio	PAL	PNL	Ratio	
Time (yr)	Time (yr)	PAL/PNL	Well Conc. U238	Well Conc. U238	#DIV/0!	
1.60E+02	1.60E+02	1.00	0.00E+00	0.00E+00		
4.11E+02	4.11E+02	1.00	1.72E-03	1.72E-03	1.00	
6.61E+02	6.61E+02	1.00	8.57E-03	8.57E-03	1.00	
9.11E+02	9.11E+02	1.00	1.27E-02	1.27E-02	1.00	
1.16E+03	1.16E+03	1.00	1.33E-02	1.33E-02	1.00	
1.41E+03	1.41E+03	1.00	1.32E-02	1.32E-02	1.00	
1.66E+03	1.66E+03	1.00	1.29E-02	1.29E-02	1.00	
1.91E+03	1.91E+03	1.00	1.27E-02	1.27E-02	1.00	
2.16E+03	2.16E+03	1.00	1.25E-02	1.25E-02	1.00	
2.41E+03	2.41E+03	1.00	1.23E-02	1.23E-02	1.00	
2.66E+03	2.66E+03	1.00	1.21E-02	1.21E-02	1.00	
2.91E+03	2.91E+03	1.00	1.19E-02	1.19E-02	1.00	
3.16E+03	3.16E+03	1.00	1.17E-02	1.17E-02	1.00	
3.41E+03	3.41E+03	1.00	1.15E-02	1.15E-02	1.00	
3.66E+03	3.66E+03	1.00	1.13E-02	1.13E-02	1.00	
3.91E+03	3.91E+03	1.00	1.11E-02	1.11E-02	1.00	
4.16E+03	4.16E+03	1.00	1.09E-02	1.09E-02	1.00	
4.41E+03	4.41E+03	1.00	1.07E-02	1.07E-02	1.00	
4.66E+03	4.66E+03	1.00	1.05E-02	1.05E-02	1.00	
4.91E+03	4.91E+03	1.00	1.03E-02	1.03E-02	1.00	
5.16E+03	5.16E+03	1.00	1.02E-02	1.02E-02	1.00	
5.41E+03	5.41E+03	1.00	9.99E-03	9.99E-03	1.00	
5.66E+03	5.66E+03	1.00	9.82E-03	9.82E-03	1.00	
5.91E+03	5.91E+03	1.00	9.65E-03	9.65E-03	1.00	
6.16E+03	6.16E+03	1.00	9.49E-03	9.49E-03	1.00	
6.41E+03	6.41E+03	1.00	9.32E-03	9.32E-03	1.00	
6.66E+03	6.66E+03	1.00	9.16E-03	9.16E-03	1.00	
6.91E+03	6.91E+03	1.00	9.01E-03	9.01E-03	1.00	
7.16E+03	7.16E+03	1.00	8.85E-03	8.85E-03	1.00	
7.41E+03	7.41E+03	1.00	8.70E-03	8.70E-03	1.00	
7.66E+03	7.66E+03	1.00	8.55E-03	8.55E-03	1.00	
7.91E+03	7.91E+03	1.00	8.41E-03	8.41E-03	1.00	
8.16E+03	8.16E+03	1.00	8.26E-03	8.26E-03	1.00	
8.41E+03	8.41E+03	1.00	8.12E-03	8.12E-03	1.00	

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Results: MEPAS 3.2g ... testing for groundwater (cont)

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8.88E+03	8.88E+03	1.00	7.98E-03	7.98E-03	1.00		
8.91E+03	8.91E+03	1.00	7.85E-03	7.85E-03	1.00		
9.16E+03	9.16E+03	1.00	7.71E-03	7.71E-03	1.00		
9.41E+03	9.41E+03	1.00	7.58E-03	7.58E-03	1.00		
9.66E+03	9.66E+03	1.00	7.45E-03	7.45E-03	1.00		
9.91E+03	9.91E+03	1.00	7.33E-03	7.33E-03	1.00		
1.02E+04	1.02E+04	1.00	7.15E-03	7.15E-03	1.00		
TH234	TH234	#VALUE!	TH234	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.44E-04	6.44E-04	1.00		
5.08E+02	5.08E+02	1.00	4.39E-03	4.39E-03	1.00		
7.62E+02	7.62E+02	1.00	1.03E-02	1.03E-02	1.00		
1.02E+03	1.02E+03	1.00	1.30E-02	1.30E-02	1.00		
1.27E+03	1.27E+03	1.00	1.33E-02	1.33E-02	1.00		
1.52E+03	1.52E+03	1.00	1.31E-02	1.31E-02	1.00		
1.78E+03	1.78E+03	1.00	1.28E-02	1.28E-02	1.00		
2.03E+03	2.03E+03	1.00	1.26E-02	1.26E-02	1.00		
2.29E+03	2.29E+03	1.00	1.24E-02	1.24E-02	1.00		
2.54E+03	2.54E+03	1.00	1.22E-02	1.22E-02	1.00		
2.79E+03	2.79E+03	1.00	1.20E-02	1.20E-02	1.00		
3.05E+03	3.05E+03	1.00	1.18E-02	1.18E-02	1.00		
3.30E+03	3.30E+03	1.00	1.15E-02	1.15E-02	1.00		
3.56E+03	3.56E+03	1.00	1.13E-02	1.13E-02	1.00		
3.81E+03	3.81E+03	1.00	1.12E-02	1.12E-02	1.00		
4.06E+03	4.06E+03	1.00	1.10E-02	1.10E-02	1.00		
4.32E+03	4.32E+03	1.00	1.08E-02	1.08E-02	1.00		
4.57E+03	4.57E+03	1.00	1.06E-02	1.06E-02	1.00		
4.83E+03	4.83E+03	1.00	1.04E-02	1.04E-02	1.00		
5.08E+03	5.08E+03	1.00	1.02E-02	1.02E-02	1.00		
5.33E+03	5.33E+03	1.00	1.00E-02	1.00E-02	1.00		
5.59E+03	5.59E+03	1.00	9.87E-03	9.87E-03	1.00		
5.84E+03	5.84E+03	1.00	9.70E-03	9.70E-03	1.00		
6.10E+03	6.10E+03	1.00	9.53E-03	9.53E-03	1.00		
6.35E+03	6.35E+03	1.00	9.36E-03	9.36E-03	1.00		
6.60E+03	6.60E+03	1.00	9.20E-03	9.20E-03	1.00		
6.86E+03	6.86E+03	1.00	9.04E-03	9.04E-03	1.00		
7.11E+03	7.11E+03	1.00	8.88E-03	8.88E-03	1.00		
7.37E+03	7.37E+03	1.00	8.73E-03	8.73E-03	1.00		
7.62E+03	7.62E+03	1.00	8.57E-03	8.57E-03	1.00		
7.88E+03	7.88E+03	1.00	8.43E-03	8.43E-03	1.00		
8.13E+03	8.13E+03	1.00	8.28E-03	8.28E-03	1.00		
8.38E+03	8.38E+03	1.00	8.14E-03	8.14E-03	1.00		
8.64E+03	8.64E+03	1.00	8.00E-03	8.00E-03	1.00		
8.89E+03	8.89E+03	1.00	7.86E-03	7.86E-03	1.00		
9.15E+03	9.15E+03	1.00	7.72E-03	7.72E-03	1.00		
9.40E+03	9.40E+03	1.00	7.59E-03	7.59E-03	1.00		
9.65E+03	9.65E+03	1.00	7.46E-03	7.46E-03	1.00		
9.91E+03	9.91E+03	1.00	7.33E-03	7.33E-03	1.00		
1.02E+04	1.02E+04	1.00	7.15E-03	7.15E-03	1.00		
U234	U234	#VALUE!	U234	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.51E-07	7.51E-07	1.00		
5.08E+02	5.08E+02	1.00	7.50E-06	7.50E-06	1.00		
7.62E+02	7.62E+02	1.00	2.05E-05	2.05E-05	1.00		
1.02E+03	1.02E+03	1.00	2.75E-05	2.75E-05	1.00		
1.27E+03	1.27E+03	1.00	2.81E-05	2.81E-05	1.00		

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Results: MEPAS 3.2g ... testing for groundwater (cont)

1.52E+03	1.52E+03	1.00	2.77E-05	2.77E-05	1.00		
1.78E+03	1.78E+03	1.00	2.72E-05	2.72E-05	1.00		
2.03E+03	2.03E+03	1.00	2.68E-05	2.68E-05	1.00		
2.29E+03	2.29E+03	1.00	2.64E-05	2.64E-05	1.00		
2.54E+03	2.54E+03	1.00	2.59E-05	2.59E-05	1.00		
2.79E+03	2.79E+03	1.00	2.55E-05	2.55E-05	1.00		
3.05E+03	3.05E+03	1.00	2.51E-05	2.51E-05	1.00		
3.30E+03	3.30E+03	1.00	2.47E-05	2.47E-05	1.00		
3.56E+03	3.56E+03	1.00	2.43E-05	2.43E-05	1.00		
3.81E+03	3.81E+03	1.00	2.39E-05	2.39E-05	1.00		
4.06E+03	4.06E+03	1.00	2.35E-05	2.35E-05	1.00		
4.32E+03	4.32E+03	1.00	2.31E-05	2.31E-05	1.00		
4.57E+03	4.57E+03	1.00	2.27E-05	2.27E-05	1.00		
4.83E+03	4.83E+03	1.00	2.23E-05	2.23E-05	1.00		
5.08E+03	5.08E+03	1.00	2.20E-05	2.20E-05	1.00		
5.33E+03	5.33E+03	1.00	2.16E-05	2.16E-05	1.00		
5.59E+03	5.59E+03	1.00	2.13E-05	2.13E-05	1.00		
5.84E+03	5.84E+03	1.00	2.09E-05	2.09E-05	1.00		
6.10E+03	6.10E+03	1.00	2.06E-05	2.06E-05	1.00		
6.35E+03	6.35E+03	1.00	2.02E-05	2.02E-05	1.00		
6.60E+03	6.60E+03	1.00	1.99E-05	1.99E-05	1.00		
6.86E+03	6.86E+03	1.00	1.96E-05	1.96E-05	1.00		
7.11E+03	7.11E+03	1.00	1.92E-05	1.92E-05	1.00		
7.37E+03	7.37E+03	1.00	1.89E-05	1.89E-05	1.00		
7.62E+03	7.62E+03	1.00	1.86E-05	1.86E-05	1.00		
7.88E+03	7.88E+03	1.00	1.83E-05	1.83E-05	1.00		
8.13E+03	8.13E+03	1.00	1.80E-05	1.80E-05	1.00		
8.38E+03	8.38E+03	1.00	1.77E-05	1.77E-05	1.00		
8.64E+03	8.64E+03	1.00	1.74E-05	1.74E-05	1.00		
8.89E+03	8.89E+03	1.00	1.71E-05	1.71E-05	1.00		
9.15E+03	9.15E+03	1.00	1.69E-05	1.69E-05	1.00		
9.40E+03	9.40E+03	1.00	1.66E-05	1.66E-05	1.00		
9.65E+03	9.65E+03	1.00	1.63E-05	1.63E-05	1.00		
9.91E+03	9.91E+03	1.00	1.60E-05	1.60E-05	1.00		
1.02E+04	1.02E+04	1.00	5.36E-07	5.40E-07	0.99		
TH230	TH230	#VALUE!	TH230	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	1.39E-09	1.39E-09	1.00		
5.08E+02	5.08E+02	1.00	2.09E-08	2.09E-08	1.00		
7.62E+02	7.62E+02	1.00	6.52E-08	6.52E-08	1.00		
1.02E+03	1.02E+03	1.00	9.24E-08	9.24E-08	1.00		
1.27E+03	1.27E+03	1.00	9.44E-08	9.44E-08	1.00		
1.52E+03	1.52E+03	1.00	9.31E-08	9.31E-08	1.00		
1.78E+03	1.78E+03	1.00	9.17E-08	9.17E-08	1.00		
2.03E+03	2.03E+03	1.00	9.03E-08	9.03E-08	1.00		
2.29E+03	2.29E+03	1.00	8.89E-08	8.89E-08	1.00		
2.54E+03	2.54E+03	1.00	8.75E-08	8.75E-08	1.00		
2.79E+03	2.79E+03	1.00	8.62E-08	8.62E-08	1.00		
3.05E+03	3.05E+03	1.00	8.48E-08	8.48E-08	1.00		
3.30E+03	3.30E+03	1.00	8.35E-08	8.35E-08	1.00		
3.56E+03	3.56E+03	1.00	8.22E-08	8.22E-08	1.00		
3.81E+03	3.81E+03	1.00	8.09E-08	8.09E-08	1.00		
4.06E+03	4.06E+03	1.00	7.97E-08	7.97E-08	1.00		
4.32E+03	4.32E+03	1.00	7.84E-08	7.84E-08	1.00		
4.57E+03	4.57E+03	1.00	7.72E-08	7.72E-08	1.00		
4.83E+03	4.83E+03	1.00	7.60E-08	7.60E-08	1.00		

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Results: MEPAS 3.2g ... testing for groundwater (cont)

5.08E+03	5.08E+03	1.00	7.49E-08	7.49E-08	1.00		
5.33E+03	5.33E+03	1.00	7.37E-08	7.37E-08	1.00		
5.59E+03	5.59E+03	1.00	7.26E-08	7.26E-08	1.00		
5.84E+03	5.84E+03	1.00	7.14E-08	7.14E-08	1.00		
6.10E+03	6.10E+03	1.00	7.03E-08	7.03E-08	1.00		
6.35E+03	6.35E+03	1.00	6.92E-08	6.92E-08	1.00		
6.60E+03	6.60E+03	1.00	6.81E-08	6.81E-08	1.00		
6.86E+03	6.86E+03	1.00	6.71E-08	6.71E-08	1.00		
7.11E+03	7.11E+03	1.00	6.60E-08	6.60E-08	1.00		
7.37E+03	7.37E+03	1.00	6.50E-08	6.50E-08	1.00		
7.62E+03	7.62E+03	1.00	6.40E-08	6.40E-08	1.00		
7.88E+03	7.88E+03	1.00	6.30E-08	6.30E-08	1.00		
8.13E+03	8.13E+03	1.00	6.20E-08	6.20E-08	1.00		
8.38E+03	8.38E+03	1.00	6.11E-08	6.11E-08	1.00		
8.64E+03	8.64E+03	1.00	6.01E-08	6.01E-08	1.00		
8.89E+03	8.89E+03	1.00	5.92E-08	5.92E-08	1.00		
9.15E+03	9.15E+03	1.00	5.83E-08	5.83E-08	1.00		
9.40E+03	9.40E+03	1.00	5.74E-08	5.74E-08	1.00		
9.65E+03	9.65E+03	1.00	5.65E-08	5.65E-08	1.00		
9.91E+03	9.91E+03	1.00	5.56E-08	5.56E-08	1.00		
1.02E+04	1.02E+04	1.00	3.62E-09	3.65E-09	0.99		
RA226	RA226	#VALUE!	RA226	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.87E-11	7.87E-11	1.00		
5.08E+02	5.08E+02	1.00	1.79E-09	1.79E-09	1.00		
7.62E+02	7.62E+02	1.00	6.19E-09	6.19E-09	1.00		
1.02E+03	1.02E+03	1.00	9.21E-09	9.21E-09	1.00		
1.27E+03	1.27E+03	1.00	9.42E-09	9.42E-09	1.00		
1.52E+03	1.52E+03	1.00	9.30E-09	9.30E-09	1.00		
1.78E+03	1.78E+03	1.00	9.17E-09	9.17E-09	1.00		
2.03E+03	2.03E+03	1.00	9.03E-09	9.03E-09	1.00		
2.29E+03	2.29E+03	1.00	8.90E-09	8.90E-09	1.00		
2.54E+03	2.54E+03	1.00	8.77E-09	8.77E-09	1.00		
2.79E+03	2.79E+03	1.00	8.64E-09	8.64E-09	1.00		
3.05E+03	3.05E+03	1.00	8.51E-09	8.51E-09	1.00		
3.30E+03	3.30E+03	1.00	8.39E-09	8.39E-09	1.00		
3.56E+03	3.56E+03	1.00	8.26E-09	8.26E-09	1.00		
3.81E+03	3.81E+03	1.00	8.14E-09	8.14E-09	1.00		
4.06E+03	4.06E+03	1.00	8.02E-09	8.02E-09	1.00		
4.32E+03	4.32E+03	1.00	7.91E-09	7.91E-09	1.00		
4.57E+03	4.57E+03	1.00	7.79E-09	7.79E-09	1.00		
4.83E+03	4.83E+03	1.00	7.68E-09	7.68E-09	1.00		
5.08E+03	5.08E+03	1.00	7.56E-09	7.56E-09	1.00		
5.33E+03	5.33E+03	1.00	7.45E-09	7.45E-09	1.00		
5.59E+03	5.59E+03	1.00	7.34E-09	7.34E-09	1.00		
5.84E+03	5.84E+03	1.00	7.24E-09	7.24E-09	1.00		
6.10E+03	6.10E+03	1.00	7.13E-09	7.13E-09	1.00		
6.35E+03	6.35E+03	1.00	7.02E-09	7.02E-09	1.00		
6.61E+03	6.61E+03	1.00	6.92E-09	6.92E-09	1.00		
6.86E+03	6.86E+03	1.00	6.82E-09	6.82E-09	1.00		
7.11E+03	7.11E+03	1.00	6.72E-09	6.72E-09	1.00		
7.37E+03	7.37E+03	1.00	6.62E-09	6.62E-09	1.00		
7.62E+03	7.62E+03	1.00	6.52E-09	6.52E-09	1.00		
7.88E+03	7.88E+03	1.00	6.42E-09	6.42E-09	1.00		
8.13E+03	8.13E+03	1.00	6.33E-09	6.33E-09	1.00		
8.38E+03	8.38E+03	1.00	6.24E-09	6.24E-09	1.00		

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Results: MEPAS 3.2g ... testing for groundwater (cont)

8.64E+03	8.64E+03	1.00	6.14E-09	6.14E-09	1.00		
8.89E+03	8.89E+03	1.00	6.05E-09	6.05E-09	1.00		
9.15E+03	9.15E+03	1.00	5.97E-09	5.97E-09	1.00		
9.40E+03	9.40E+03	1.00	5.88E-09	5.88E-09	1.00		
9.65E+03	9.65E+03	1.00	5.79E-09	5.79E-09	1.00		
9.91E+03	9.91E+03	1.00	5.70E-09	5.70E-09	1.00		
1.02E+04	1.02E+04	1.00	9.95E-13	9.95E-13	1.00		
RN222	RN222	#VALUE!	RN222	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.87E-11	7.87E-11	1.00		
5.08E+02	5.08E+02	1.00	1.79E-09	1.79E-09	1.00		
7.62E+02	7.62E+02	1.00	6.19E-09	6.19E-09	1.00		
1.02E+03	1.02E+03	1.00	9.21E-09	9.21E-09	1.00		
1.27E+03	1.27E+03	1.00	9.42E-09	9.42E-09	1.00		
1.52E+03	1.52E+03	1.00	9.30E-09	9.30E-09	1.00		
1.78E+03	1.78E+03	1.00	9.17E-09	9.17E-09	1.00		
2.03E+03	2.03E+03	1.00	9.03E-09	9.03E-09	1.00		
2.29E+03	2.29E+03	1.00	8.90E-09	8.90E-09	1.00		
2.54E+03	2.54E+03	1.00	8.77E-09	8.77E-09	1.00		
2.79E+03	2.79E+03	1.00	8.64E-09	8.64E-09	1.00		
3.05E+03	3.05E+03	1.00	8.51E-09	8.51E-09	1.00		
3.30E+03	3.30E+03	1.00	8.39E-09	8.39E-09	1.00		
3.56E+03	3.56E+03	1.00	8.26E-09	8.26E-09	1.00		
3.81E+03	3.81E+03	1.00	8.14E-09	8.14E-09	1.00		
4.06E+03	4.06E+03	1.00	8.02E-09	8.02E-09	1.00		
4.32E+03	4.32E+03	1.00	7.91E-09	7.91E-09	1.00		
4.57E+03	4.57E+03	1.00	7.79E-09	7.79E-09	1.00		
4.83E+03	4.83E+03	1.00	7.68E-09	7.68E-09	1.00		
5.08E+03	5.08E+03	1.00	7.56E-09	7.56E-09	1.00		
5.33E+03	5.33E+03	1.00	7.45E-09	7.45E-09	1.00		
5.59E+03	5.59E+03	1.00	7.34E-09	7.34E-09	1.00		
5.84E+03	5.84E+03	1.00	7.24E-09	7.24E-09	1.00		
6.10E+03	6.10E+03	1.00	7.13E-09	7.13E-09	1.00		
6.35E+03	6.35E+03	1.00	7.02E-09	7.02E-09	1.00		
6.61E+03	6.61E+03	1.00	6.92E-09	6.92E-09	1.00		
6.86E+03	6.86E+03	1.00	6.82E-09	6.82E-09	1.00		
7.11E+03	7.11E+03	1.00	6.72E-09	6.72E-09	1.00		
7.37E+03	7.37E+03	1.00	6.62E-09	6.62E-09	1.00		
7.62E+03	7.62E+03	1.00	6.52E-09	6.52E-09	1.00		
7.88E+03	7.88E+03	1.00	6.42E-09	6.42E-09	1.00		
8.13E+03	8.13E+03	1.00	6.33E-09	6.33E-09	1.00		
8.38E+03	8.38E+03	1.00	6.24E-09	6.24E-09	1.00		
8.64E+03	8.64E+03	1.00	6.14E-09	6.14E-09	1.00		
8.89E+03	8.89E+03	1.00	6.05E-09	6.05E-09	1.00		
9.15E+03	9.15E+03	1.00	5.96E-09	5.96E-09	1.00		
9.40E+03	9.40E+03	1.00	5.88E-09	5.88E-09	1.00		
9.65E+03	9.65E+03	1.00	5.79E-09	5.79E-09	1.00		
9.91E+03	9.91E+03	1.00	5.70E-09	5.70E-09	1.00		
1.02E+04	1.02E+04	1.00	9.95E-13	9.95E-13	1.00		
PB210	PB210	#VALUE!	PB210	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.30E-11	6.30E-11	1.00		
5.08E+02	5.08E+02	1.00	1.55E-09	1.55E-09	1.00		
7.62E+02	7.62E+02	1.00	5.44E-09	5.44E-09	1.00		
1.02E+03	1.02E+03	1.00	8.14E-09	8.14E-09	1.00		
1.27E+03	1.27E+03	1.00	8.33E-09	8.33E-09	1.00		

Results: MEPAS 3.2g ... testing for groundwater (cont)

1.52E+03	1.52E+03	1.00	8.22E-09	8.22E-09	1.00		
1.78E+03	1.78E+03	1.00	8.11E-09	8.11E-09	1.00		
2.03E+03	2.03E+03	1.00	7.99E-09	7.99E-09	1.00		
2.29E+03	2.29E+03	1.00	7.87E-09	7.87E-09	1.00		
2.54E+03	2.54E+03	1.00	7.76E-09	7.76E-09	1.00		
2.79E+03	2.79E+03	1.00	7.64E-09	7.64E-09	1.00		
3.05E+03	3.05E+03	1.00	7.53E-09	7.53E-09	1.00		
3.30E+03	3.30E+03	1.00	7.42E-09	7.42E-09	1.00		
3.56E+03	3.56E+03	1.00	7.31E-09	7.31E-09	1.00		
3.81E+03	3.81E+03	1.00	7.21E-09	7.21E-09	1.00		
4.06E+03	4.06E+03	1.00	7.10E-09	7.10E-09	1.00		
4.32E+03	4.32E+03	1.00	7.00E-09	7.00E-09	1.00		
4.57E+03	4.57E+03	1.00	6.90E-09	6.90E-09	1.00		
4.83E+03	4.83E+03	1.00	6.80E-09	6.80E-09	1.00		
5.08E+03	5.08E+03	1.00	6.70E-09	6.70E-09	1.00		
5.33E+03	5.33E+03	1.00	6.60E-09	6.60E-09	1.00		
5.59E+03	5.59E+03	1.00	6.51E-09	6.51E-09	1.00		
5.84E+03	5.84E+03	1.00	6.41E-09	6.41E-09	1.00		
6.10E+03	6.10E+03	1.00	6.32E-09	6.32E-09	1.00		
6.35E+03	6.35E+03	1.00	6.22E-09	6.22E-09	1.00		
6.61E+03	6.61E+03	1.00	6.13E-09	6.13E-09	1.00		
6.86E+03	6.86E+03	1.00	6.04E-09	6.04E-09	1.00		
7.11E+03	7.11E+03	1.00	5.95E-09	5.95E-09	1.00		
7.37E+03	7.37E+03	1.00	5.87E-09	5.87E-09	1.00		
7.62E+03	7.62E+03	1.00	5.78E-09	5.78E-09	1.00		
7.88E+03	7.88E+03	1.00	5.70E-09	5.70E-09	1.00		
8.13E+03	8.13E+03	1.00	5.61E-09	5.61E-09	1.00		
8.38E+03	8.38E+03	1.00	5.53E-09	5.53E-09	1.00		
8.64E+03	8.64E+03	1.00	5.45E-09	5.45E-09	1.00		
8.89E+03	8.89E+03	1.00	5.37E-09	5.37E-09	1.00		
9.15E+03	9.15E+03	1.00	5.29E-09	5.29E-09	1.00		
9.40E+03	9.40E+03	1.00	5.21E-09	5.21E-09	1.00		
9.65E+03	9.65E+03	1.00	5.14E-09	5.14E-09	1.00		
9.91E+03	9.91E+03	1.00	5.06E-09	5.06E-09	1.00		
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00		
BI210	BI210	#VALUE!	BI210	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.30E-11	6.30E-11	1.00		
5.08E+02	5.08E+02	1.00	1.55E-09	1.55E-09	1.00		
7.62E+02	7.62E+02	1.00	5.44E-09	5.44E-09	1.00		
1.02E+03	1.02E+03	1.00	8.14E-09	8.14E-09	1.00		
1.27E+03	1.27E+03	1.00	8.33E-09	8.33E-09	1.00		
1.52E+03	1.52E+03	1.00	8.22E-09	8.22E-09	1.00		
1.78E+03	1.78E+03	1.00	8.10E-09	8.10E-09	1.00		
2.03E+03	2.03E+03	1.00	7.99E-09	7.99E-09	1.00		
2.29E+03	2.29E+03	1.00	7.87E-09	7.87E-09	1.00		
2.54E+03	2.54E+03	1.00	7.76E-09	7.76E-09	1.00		
2.79E+03	2.79E+03	1.00	7.64E-09	7.64E-09	1.00		
3.05E+03	3.05E+03	1.00	7.53E-09	7.53E-09	1.00		
3.30E+03	3.30E+03	1.00	7.42E-09	7.42E-09	1.00		
3.56E+03	3.56E+03	1.00	7.31E-09	7.31E-09	1.00		
3.81E+03	3.81E+03	1.00	7.21E-09	7.21E-09	1.00		
4.06E+03	4.06E+03	1.00	7.10E-09	7.10E-09	1.00		
4.32E+03	4.32E+03	1.00	7.00E-09	7.00E-09	1.00		
4.57E+03	4.57E+03	1.00	6.90E-09	6.90E-09	1.00		
4.83E+03	4.83E+03	1.00	6.80E-09	6.80E-09	1.00		

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Results: MEPAS 3.2g --- testing for groundwater (cont)

5.08E+03	5.08E+03	1.00	6.70E-09	6.70E-09	1.00			
5.33E+03	5.33E+03	1.00	6.80E-09	6.80E-09	1.00			
5.59E+03	5.59E+03	1.00	6.50E-09	6.50E-09	1.00			
5.84E+03	5.84E+03	1.00	6.41E-09	6.41E-09	1.00			
6.10E+03	6.10E+03	1.00	6.32E-09	6.32E-09	1.00			
6.35E+03	6.35E+03	1.00	6.22E-09	6.22E-09	1.00			
6.61E+03	6.61E+03	1.00	6.13E-09	6.13E-09	1.00			
6.86E+03	6.86E+03	1.00	6.04E-09	6.04E-09	1.00			
7.11E+03	7.11E+03	1.00	5.95E-09	5.95E-09	1.00			
7.37E+03	7.37E+03	1.00	5.87E-09	5.87E-09	1.00			
7.62E+03	7.62E+03	1.00	5.78E-09	5.78E-09	1.00			
7.88E+03	7.88E+03	1.00	5.70E-09	5.70E-09	1.00			
8.13E+03	8.13E+03	1.00	5.61E-09	5.61E-09	1.00			
8.38E+03	8.38E+03	1.00	5.53E-09	5.53E-09	1.00			
8.64E+03	8.64E+03	1.00	5.45E-09	5.45E-09	1.00			
8.89E+03	8.89E+03	1.00	5.37E-09	5.37E-09	1.00			
9.15E+03	9.15E+03	1.00	5.29E-09	5.29E-09	1.00			
9.40E+03	9.40E+03	1.00	5.21E-09	5.21E-09	1.00			
9.65E+03	9.65E+03	1.00	5.14E-09	5.14E-09	1.00			
9.91E+03	9.91E+03	1.00	5.06E-09	5.06E-09	1.00			
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00			
PO210	PO210	#VALUE!	PO210	#VALUE!	#VALUE!	41 URANIUM-	U238	
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!			
2.54E+02	2.54E+02	1.00	6.28E-11	6.28E-11	1.00			
5.08E+02	5.08E+02	1.00	1.54E-09	1.54E-09	1.00			
7.62E+02	7.62E+02	1.00	5.43E-09	5.43E-09	1.00			
1.02E+03	1.02E+03	1.00	8.13E-09	8.13E-09	1.00			
1.27E+03	1.27E+03	1.00	8.31E-09	8.31E-09	1.00			
1.52E+03	1.52E+03	1.00	8.20E-09	8.20E-09	1.00			
1.78E+03	1.78E+03	1.00	8.09E-09	8.09E-09	1.00			
2.03E+03	2.03E+03	1.00	7.97E-09	7.97E-09	1.00			
2.29E+03	2.29E+03	1.00	7.85E-09	7.85E-09	1.00			
2.54E+03	2.54E+03	1.00	7.74E-09	7.74E-09	1.00			
2.79E+03	2.79E+03	1.00	7.63E-09	7.63E-09	1.00			
3.05E+03	3.05E+03	1.00	7.52E-09	7.52E-09	1.00			
3.30E+03	3.30E+03	1.00	7.41E-09	7.41E-09	1.00			
3.56E+03	3.56E+03	1.00	7.30E-09	7.30E-09	1.00			
3.81E+03	3.81E+03	1.00	7.19E-09	7.19E-09	1.00			
4.06E+03	4.06E+03	1.00	7.09E-09	7.09E-09	1.00			
4.32E+03	4.32E+03	1.00	6.98E-09	6.98E-09	1.00			
4.57E+03	4.57E+03	1.00	6.88E-09	6.88E-09	1.00			
4.83E+03	4.83E+03	1.00	6.78E-09	6.78E-09	1.00			
5.08E+03	5.08E+03	1.00	6.68E-09	6.68E-09	1.00			
5.33E+03	5.33E+03	1.00	6.59E-09	6.59E-09	1.00			
5.59E+03	5.59E+03	1.00	6.49E-09	6.49E-09	1.00			
5.84E+03	5.84E+03	1.00	6.40E-09	6.40E-09	1.00			
6.10E+03	6.10E+03	1.00	6.30E-09	6.30E-09	1.00			
6.35E+03	6.35E+03	1.00	6.21E-09	6.21E-09	1.00			
6.61E+03	6.61E+03	1.00	6.12E-09	6.12E-09	1.00			
6.86E+03	6.86E+03	1.00	6.03E-09	6.03E-09	1.00			
7.11E+03	7.11E+03	1.00	5.94E-09	5.94E-09	1.00			
7.37E+03	7.37E+03	1.00	5.85E-09	5.85E-09	1.00			
7.62E+03	7.62E+03	1.00	5.77E-09	5.77E-09	1.00			
7.88E+03	7.88E+03	1.00	5.68E-09	5.68E-09	1.00			
8.13E+03	8.13E+03	1.00	5.60E-09	5.60E-09	1.00			
8.38E+03	8.38E+03	1.00	5.52E-09	5.52E-09	1.00			

Results: MEPAS 3.2g --- testing for groundwater (cont)

8.64E+03	8.64E+03	1.00	5.44E-09	5.44E-09	1.00			
8.89E+03	8.89E+03	1.00	5.36E-09	5.36E-09	1.00			
9.15E+03	9.15E+03	1.00	5.28E-09	5.28E-09	1.00			
9.40E+03	9.40E+03	1.00	5.20E-09	5.20E-09	1.00			
9.65E+03	9.65E+03	1.00	5.13E-09	5.13E-09	1.00			
9.91E+03	9.91E+03	1.00	5.05E-09	5.05E-09	1.00			
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00			

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Results: MEPAS 3.2 s - - testing for groundwater (cont)

Casela.hhi
Multimedia Environmental Pollutant Assessment System (MEPAS)
MEPAS 3.1 Report Generator (REPORT version 10/3/94 KJC)
Run Date and time 07/01/1997 at 11:04:32
Input file name CASE1A.ina

PNL
Results

Health Impact Detailed Result for: URANIUM-238 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	980	1.5E-18	1.8E-18	2.4E-15	1.5E-18	1.8E-18	2.4E-15
Leafy Vegetables	991	4.2E-20	4.8E-20	6.6E-17	4.2E-20	4.8E-20	6.6E-17
Other Vegetables	996	7.5E-20	8.7E-20	1.2E-16	7.5E-20	8.7E-20	1.2E-16
Meat	996	2.4E-21	2.8E-21	3.8E-18	2.4E-21	2.8E-21	3.8E-18
Milk	997	2.9E-20	3.3E-20	4.5E-17	2.9E-20	3.3E-20	4.5E-17
Subtotal		1.7E-18	1.9E-18	2.6E-15	1.7E-18	1.9E-18	2.6E-15
Total		1.7E-18	1.9E-18	2.6E-15	1.7E-18	1.9E-18	2.6E-15

Health Impact Detailed Result for: THORIUM-234 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	983	2.3E-21	2.7E-21	3.7E-18	2.3E-21	2.7E-21	3.7E-18
Leafy Vegetables	993	7.1E-22	8.2E-22	1.1E-18	7.1E-22	8.2E-22	1.1E-18
Other Vegetables	995	8.2E-22	9.5E-22	1.3E-18	8.2E-22	9.5E-22	1.3E-18
Meat	996	8.0E-25	9.3E-25	1.3E-21	8.0E-25	9.3E-25	1.3E-21
Milk	994	3.0E-24	3.4E-24	4.7E-21	3.0E-24	3.4E-24	4.7E-21
Subtotal		3.8E-21	4.5E-21	6.1E-18	3.8E-21	4.5E-21	6.1E-18
Total		3.8E-21	4.5E-21	6.1E-18	3.8E-21	4.5E-21	6.1E-18

Filename: Casela.hhi

Location: QA2 folder on attached floppy
(applies to pg 104, 106, and 108 as well)6/19/98
MS

Results: MEPAS 3.2 s - - testing for groundwater (cont)

Casela.hhi
Multimedia Environmental Pollutant Assessment System (MEPAS)
MEPAS 3.1 Report Generator (REPORT version 10/3/94 KJC)
Run Date and time 06/09/1998 at 21:04:19
Input file name CASE1A.ina

Health Impact Detailed Result for: URANIUM-238 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

CNWAA
Results

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	980	1.5E-06	1.8E-06	2.4E-03	1.5E-06	1.8E-06	2.4E-03
Leafy Vegetables	1000	4.2E-08	4.8E-08	6.6E-05	4.2E-08	4.8E-08	6.6E-05
Other Vegetables	1000	7.5E-08	8.7E-08	1.2E-04	7.5E-08	8.7E-08	1.2E-04
Meat	1000	2.4E-09	2.8E-09	3.8E-06	2.4E-09	2.8E-09	3.8E-06
Milk	1000	2.9E-08	3.3E-08	4.5E-05	2.9E-08	3.3E-08	4.5E-05
Subtotal		1.7E-06	1.9E-06	2.6E-03	1.7E-06	1.9E-06	2.6E-03
Total		1.7E-06	1.9E-06	2.6E-03	1.7E-06	1.9E-06	2.6E-03

Health Impact Detailed Result for: THORIUM-234 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	990	2.3E-09	2.7E-09	3.7E-06	2.3E-09	2.7E-09	3.7E-06
Leafy Vegetables	1000	7.1E-10	8.2E-10	1.1E-06	7.1E-10	8.2E-10	1.1E-06
Other Vegetables	1000	8.2E-10	9.5E-10	1.3E-06	8.2E-10	9.5E-10	1.3E-06
Meat	1000	8.0E-13	9.3E-13	1.3E-09	8.0E-13	9.3E-13	1.3E-09
Milk	1000	3.0E-12	3.5E-12	4.7E-09	3.0E-12	3.5E-12	4.7E-09
Subtotal		3.9E-09	4.5E-09	6.1E-06	3.9E-09	4.5E-09	6.1E-06
Total		3.9E-09	4.5E-09	6.1E-06	3.9E-09	4.5E-09	6.1E-06

Filename: Casela.hhi

Location: QA folder on attached floppy
(applies to pg 105, 107, and 109 as well)

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Health Impact Detailed Result for: URANIUM-234 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	984	1.9E-28	2.2E-28	3.0E-25	1.9E-28	2.2E-28	3.0E-25
Leafy Vegetables	996	2.7E-25	3.1E-25	4.3E-22	2.7E-25	3.1E-25	4.3E-22
Other Vegetables	999	3.1E-24	3.5E-24	4.8E-21	3.1E-24	3.5E-24	4.8E-21
Meat	999	5.1E-26	5.9E-26	8.1E-23	5.1E-26	5.9E-26	8.1E-23
Milk	997	2.1E-25	2.4E-25	3.3E-22	2.1E-25	2.4E-25	3.3E-22
Subtotal		3.6E-24	4.2E-24	5.7E-21	3.6E-24	4.2E-24	5.7E-21
Total		3.6E-24	4.2E-24	5.7E-21	3.6E-24	4.2E-24	5.7E-21

Health Impact Detailed Result for: THORIUM-230 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

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Casela.hhi

PNL Results

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	888	9.6E-34	1.1E-33	1.5E-30	9.6E-34	1.1E-33	1.5E-30
Leafy Vegetables	999	2.2E-30	2.5E-30	3.4E-27	2.2E-30	2.5E-30	3.4E-27
Other Vegetables	996	2.5E-29	2.8E-29	3.9E-26	2.5E-29	2.8E-29	3.9E-26
Meat	993	9.8E-31	1.1E-30	1.5E-27	9.8E-31	1.1E-30	1.5E-27
Milk	994	1.2E-30	1.4E-30	1.9E-27	1.2E-30	1.4E-30	1.9E-27
Subtotal		2.9E-29	3.4E-29	4.6E-26	2.9E-29	3.4E-29	4.6E-26
Total		2.9E-29	3.4E-29	4.6E-26	2.9E-29	3.4E-29	4.6E-26

Health Impact Detailed Result for: RADIUM-226 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	893	1.4E-33	1.6E-33	2.2E-30	1.4E-33	1.6E-33	2.2E-30
Leafy Vegetables	998	1.7E-30	1.9E-30	2.7E-27	1.7E-30	1.9E-30	2.7E-27
Other Vegetables	998	1.9E-29	2.2E-29	3.1E-26	1.9E-29	2.2E-29	3.1E-26
Meat	999	1.3E-30	1.5E-30	2.1E-27	1.3E-30	1.5E-30	2.1E-27
Milk	995	3.4E-30	3.9E-30	5.4E-27	3.4E-30	3.9E-30	5.4E-27
Subtotal		2.6E-29	3.0E-29	4.1E-26	2.6E-29	3.0E-29	4.1E-26
Total		2.6E-29	3.0E-29	4.1E-26	2.6E-29	3.0E-29	4.1E-26

Health Impact Detailed Result for: URANIUM-234 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	990	1.9E-16	2.2E-16	3.0E-13	1.9E-16	2.2E-16	3.0E-13
Leafy Vegetables	1000	2.7E-13	3.1E-13	4.3E-10	2.7E-13	3.1E-13	4.3E-10
Other Vegetables	1000	3.1E-12	3.5E-12	4.8E-09	3.1E-12	3.5E-12	4.8E-09
Meat	1000	5.1E-14	5.9E-14	8.1E-11	5.1E-14	5.9E-14	8.1E-11
Milk	1000	2.1E-13	2.4E-13	3.3E-10	2.1E-13	2.4E-13	3.3E-10
Subtotal		3.6E-12	4.2E-12	5.7E-09	3.6E-12	4.2E-12	5.7E-09
Total		3.6E-12	4.2E-12	5.7E-09	3.6E-12	4.2E-12	5.7E-09

Health Impact Detailed Result for: THORIUM-230 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Page 1

Casela.hhi

CNWRA Results

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	990	5.5E-22	6.4E-22	8.7E-19	5.5E-22	6.4E-22	8.7E-19
Leafy Vegetables	1000	2.2E-18	2.5E-18	3.4E-15	2.2E-18	2.5E-18	3.4E-15
Other Vegetables	1000	2.5E-17	2.9E-17	3.9E-14	2.5E-17	2.9E-17	3.9E-14
Meat	1000	9.8E-19	1.1E-18	1.5E-15	9.8E-19	1.1E-18	1.5E-15
Milk	1000	1.2E-18	1.4E-18	1.9E-15	1.2E-18	1.4E-18	1.9E-15
Subtotal		2.9E-17	3.4E-17	4.6E-14	2.9E-17	3.4E-17	4.6E-14
Total		2.9E-17	3.4E-17	4.6E-14	2.9E-17	3.4E-17	4.6E-14

Health Impact Detailed Result for: RADIUM-226 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Drinking Water	900	1.4E-21	1.6E-21	2.2E-18	1.4E-21	1.6E-21	2.2E-18
Leafy Vegetables	1000	1.7E-18	1.9E-18	2.7E-15	1.7E-18	1.9E-18	2.7E-15
Other Vegetables	1000	1.9E-17	2.2E-17	3.1E-14	1.9E-17	2.2E-17	3.1E-14
Meat	1000	1.3E-18	1.5E-18	2.1E-15	1.3E-18	1.5E-18	2.1E-15
Milk	1000	3.4E-18	3.9E-18	5.4E-15	3.4E-18	3.9E-18	5.4E-15
Subtotal		2.6E-17	3.0E-17	4.1E-14	2.6E-17	3.0E-17	4.1E-14
Total		2.6E-17	3.0E-17	4.1E-14	2.6E-17	3.0E-17	4.1E-14

Results: MEANS 3.2g ... testing for groundwater (cont)

Results: MEANS 3.2g ... testing for groundwater (cont)

Health Impact Detailed Result for: RADON-222 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	975	1.0E-36	1.2E-36	1.7E-33	1.0E-36	1.2E-36	1.7E-33
Leafy Vegetables	999	3.0E-39	3.5E-39	4.7E-36	3.0E-39	3.5E-39	4.7E-36
Other Vegetables	991	3.4E-39	3.9E-39	5.4E-36	3.4E-39	3.9E-39	5.4E-36
Meat	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Milk	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subtotal		1.1E-36	1.2E-36	1.7E-33	1.1E-36	1.2E-36	1.7E-33
Total		1.1E-36	1.2E-36	1.7E-33	1.1E-36	1.2E-36	1.7E-33

Health Impact Detailed Result for: LEAD-210 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	945	5.6E-33	6.5E-33	8.9E-30	5.6E-33	6.5E-33	8.9E-30
Leafy Vegetables	999	5.0E-30	5.8E-30	7.9E-27	5.0E-30	5.8E-30	7.9E-27
Other Vegetables	999	5.7E-29	6.6E-29	9.0E-26	5.7E-29	6.6E-29	9.0E-26
Meat	999	4.7E-30	5.4E-30	7.4E-27	4.7E-30	5.4E-30	7.4E-27
Milk	998	5.6E-30	6.4E-30	8.8E-27	5.6E-30	6.4E-30	8.8E-27
Subtotal		7.2E-29	8.4E-29	1.1E-25	7.2E-29	8.4E-29	1.1E-25
Total		7.2E-29	8.4E-29	1.1E-25	7.2E-29	8.4E-29	1.1E-25

Health Impact Detailed Result for: BISMUTH-210 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	948	6.7E-36	7.8E-36	1.1E-32	6.7E-36	7.8E-36	1.1E-32
Leafy Vegetables	999	5.9E-33	6.9E-33	9.4E-30	5.9E-33	6.9E-33	9.4E-30
Other Vegetables	999	5.8E-32	7.8E-32	1.1E-28	6.8E-32	7.8E-32	1.1E-28
Meat	999	7.4E-33	8.6E-33	1.2E-29	7.4E-33	8.6E-33	1.2E-29
Milk	996	1.3E-32	1.5E-32	2.1E-29	1.3E-32	1.5E-32	2.1E-29
Subtotal		9.4E-32	1.1E-31	1.5E-28	9.4E-32	1.1E-31	1.5E-28
Total		9.4E-32	1.1E-31	1.5E-28	9.4E-32	1.1E-31	1.5E-28

Health Impact Detailed Result for: RADON-222 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	860	9.1E-25	1.1E-24	1.5E-21	9.1E-25	1.1E-24	1.5E-21
Leafy Vegetables	1000	3.0E-27	3.5E-27	4.7E-24	3.0E-27	3.5E-27	4.7E-24
Other Vegetables	1000	3.4E-27	3.9E-27	5.4E-24	3.4E-27	3.9E-27	5.4E-24
Meat	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Milk	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subtotal		9.2E-25	1.1E-24	1.5E-21	9.2E-25	1.1E-24	1.5E-21
Total		9.2E-25	1.1E-24	1.5E-21	9.2E-25	1.1E-24	1.5E-21

Health Impact Detailed Result for: LEAD-210 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	890	5.4E-21	6.2E-21	8.5E-18	5.4E-21	6.2E-21	8.5E-18
Leafy Vegetables	1000	5.0E-18	5.8E-18	7.9E-15	5.0E-18	5.8E-18	7.9E-15
Other Vegetables	1000	5.7E-17	6.6E-17	9.0E-14	5.7E-17	6.6E-17	9.0E-14
Meat	1000	4.7E-18	5.4E-18	7.4E-15	4.7E-18	5.4E-18	7.4E-15
Milk	1000	5.6E-18	6.4E-18	8.8E-15	5.6E-18	6.4E-18	8.8E-15
Subtotal		7.2E-17	8.4E-17	1.1E-13	7.2E-17	8.4E-17	1.1E-13
Total		7.2E-17	8.4E-17	1.1E-13	7.2E-17	8.4E-17	1.1E-13

Health Impact Detailed Result for: BISMUTH-210 from URANIUM-238

Transport Pathway: Ground water

Usage Location: Groundwater Well

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Drinking Water	890	5.8E-24	6.7E-24	9.2E-21	5.8E-24	6.7E-24	9.2E-21
Leafy Vegetables	1000	5.9E-21	6.9E-21	9.4E-18	5.9E-21	6.9E-21	9.4E-18
Other Vegetables	1000	6.8E-20	7.8E-20	1.1E-16	6.8E-20	7.8E-20	1.1E-16
Meat	1000	7.4E-21	8.6E-21	1.2E-17	7.4E-21	8.6E-21	1.2E-17
Milk	1000	1.3E-20	1.5E-20	2.1E-17	1.3E-20	1.5E-20	2.1E-17
Subtotal		9.4E-20	1.1E-19	1.5E-16	9.4E-20	1.1E-19	1.5E-16
Total		9.4E-20	1.1E-19	1.5E-16	9.4E-20	1.1E-19	1.5E-16

Health Impact Detailed Result for: POLONIUM-210 from URANIUM-238						
Transport Pathway: Ground water			Usage Location: Groundwater Well			
PNL Results	Individual Result			Population Results		
	Time Period	Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Person Rem
Exposure Pathway Ingestion:						
Drinking Water	999	2.0E-33	2.3E-33	3.2E-30	2.0E-33	2.3E-33 3.2E-30
Leafy Vegetables	998	4.9E-30	5.6E-30	7.7E-27	4.9E-30	5.6E-30 7.7E-27
Other Vegetables	999	5.6E-29	6.5E-29	8.8E-26	5.6E-29	6.5E-29 8.8E-26
Meat	998	1.9E-30	2.2E-30	3.0E-27	1.9E-30	2.2E-30 3.0E-27
Milk	998	3.1E-30	3.6E-30	4.9E-27	3.1E-30	3.6E-30 4.9E-27
Subtotal		6.6E-29	7.6E-29	1.0E-25	6.6E-29	7.6E-29 1.0E-25
Total		6.6E-29	7.6E-29	1.0E-25	6.6E-29	7.6E-29 1.0E-25

Health Impact Detailed Result for: THORIUM-234 from THORIUM-234						
Transport Pathway: Ground water			Usage Location: Groundwater Well			
Individual Result			Population Results			
Time Period	Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway Ingestion:						
Drinking Water	999	7.9E-20	9.1E-20	1.2E-16	7.9E-20	9.1E-20 1.2E-16
Leafy Vegetables	995	1.3E-21	1.5E-21	2.0E-18	1.3E-21	1.5E-21 2.0E-18
Other Vegetables	999	2.8E-22	3.2E-22	4.4E-19	2.8E-22	3.2E-22 4.4E-19
Meat	993	1.5E-24	1.8E-24	2.5E-21	1.5E-24	1.8E-24 2.5E-21
Milk	999	8.5E-24	9.8E-24	1.3E-20	8.5E-24	9.8E-24 1.3E-20
Subtotal		8.0E-20	9.3E-20	1.3E-16	8.0E-20	9.3E-20 1.3E-16

PNL Results

Health Impact Detailed Result for: POLONIUM-210 from URANIUM-238						
Transport Pathway: Ground water			Usage Location: Groundwater Well			
CNWAA Results	Individual Result			Population Results		
	Time Period	Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Person Rem
Exposure Pathway Ingestion:						
Drinking Water	830	1.8E-21	2.1E-21	2.8E-18	1.8E-21	2.1E-21 2.8E-18
Leafy Vegetables	1000	4.9E-18	5.7E-18	7.7E-15	4.9E-18	5.7E-18 7.7E-15
Other Vegetables	1000	5.6E-17	6.5E-17	8.8E-14	5.6E-17	6.5E-17 8.8E-14
Meat	1000	1.9E-18	2.2E-18	3.0E-15	1.9E-18	2.2E-18 3.0E-15
Milk	1000	3.1E-18	3.6E-18	4.9E-15	3.1E-18	3.6E-18 4.9E-15
Subtotal		6.6E-17	7.6E-17	1.0E-13	6.6E-17	7.6E-17 1.0E-13
Total		6.6E-17	7.6E-17	1.0E-13	6.6E-17	7.6E-17 1.0E-13

Health Impact Detailed Result for: THORIUM-234 from THORIUM-234						
Transport Pathway: Ground water			Usage Location: Groundwater Well			
Individual Result			Population Results			
Time Period	Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway Ingestion:						
Drinking Water	1000	7.9E-08	9.1E-08	1.2E-04	7.9E-08	9.1E-08 1.2E-04
Leafy Vegetables	1000	1.3E-09	1.5E-09	2.0E-06	1.3E-09	1.5E-09 2.0E-06
Other Vegetables	1000	2.8E-10	3.2E-10	4.4E-07	2.8E-10	3.2E-10 4.4E-07
Meat	1000	1.6E-12	1.8E-12	2.5E-09	1.6E-12	1.8E-12 2.5E-09
Milk	1000	8.5E-12	9.8E-12	1.3E-08	8.5E-12	9.8E-12 1.3E-08
Subtotal		8.0E-08	9.3E-08	1.3E-04	8.0E-08	9.3E-08 1.3E-04

CNWAA Results

6/19/98

JG

Discussion of Results:

Comparison of time history of dose output in CASEIA.1NA File:

All Results from PNL are ^{a factor of} 1×10^{-12} too low compared to the CNWRA results. This difference is due to a unit conversion error that PNL identified in the latest version of MEPA5 (3.2g), during some initial interactions that P. LaPlante had with Dennis Strenge (PNL) during an initial phase of conducting the QA testing. D. Strenge identified the source of the error (a missed Ci to pCi conversion) and provided P. LaPlante a software patch that would correct the problem. Because P. Strenge did not have the original CASEIA test files, nor the original 3.2g version of the code, J. Buck (PNL) was contacted and he provided the CASEIA output files associated with the examples in NUREG-CR-6566 (Buck et al. 1997). Because these files were the ones compared w/ CNWRA test run for this installation test, the comparison had to take into account that all the PNL dose results were affected by the conversion error and thus were low by a factor of 1×10^{-12} . When this is taken into account most results compare 1 to 1, however, there were a few exceptions that will be discussed further.

6/19/98

JG

Discussion of Results (cont)

Comparison of time history of dose output in CASEIA.1NA (cont)

The comparison of CASEIA.1NA results is shown on page 93. The results (following adjustment of PNL results by 1×10^{12}) show 1 to 1 agreement for all exposure rates from 300 to 1000 yrs. The small difference noted in the 1000 yr time period can be explained by the fact that the PNL results file could not be read into EXCEL 5.0 spreadsheet due to its large size. The output file was therefore truncated by EXCEL 5.0 at year 998 - so these results were used and assumed to be close enough to 1000 yr. The results only differ slightly, ~~so~~ and are in the direction expected (PNL is slightly lower due to longer time period).

see
page 114
for
info
JG
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The other deviations are in the early years of 100, and 200 yrs. Particularly for other vegetable meat, and milk consumption (from 30% to 5 fold deviation in results). This is expected to have something to do with differences in daughter ingrowth when daughters are first coming in, however, the exact cause of the difference has not been identified. It is important to note that the current intended use of the code will be for decommissioning dose calculations to identify the peak dose over a 100 yr period from a groundwater transport or surface transport scenario. For the groundwater transport scenario, the peak dose occurs well beyond this period of time where the difference in results is noted and therefore the difference is not important.

6/19/98 Results (cont)

Comparison of time history of groundwater well concentrations in CASEIA WCF files:

Pages 94-101 of this notebook contain the comparison of groundwater well time history of concentration results. All time steps match 1 to 1 from PNL to C/NWBA runs. All concentrations match 1 to 1 for all time steps except for 2 where results are differ by 1% which is not considered significant.

Comparison of ^{Peak} dose summary output in CASE1A.HHI files:

Pages 102 through 109 contain the excerpted sections
of CASEIA, HHI Files from PM and CNWBA runs of CASEIA.

After the necessary conversion of PNL results to correct for the error discussed on pg 110 of this notebook (i.e. $\times 18/12$) most results compare 1 to 1. The exceptions include:

see page
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Results... (cont)

(comparison of . . . *.HHF files (cont))

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10

(do not appear to be explained by the difference in precision (i.e., time difference is greater than 10 years) are more difficult to explain. The code developer has been asked and I am awaiting the response. The bottom line, however, is that the time of peak dose is ^{not as} ~~so~~ ^{6/19/88} much important as the magnitude of the peak dose, and while there are some differences noted in the peak doses compared, these are small and not considered significant. This is true particularly because the largest differences occurred for daughters that are at very low concentrations which will not significantly affect the magnitude of the total dose (i.e., Uranium + daughters at peak time). Therefore, the discrepancies discussed in this notebook will not affect the final result that we will use from MEPAS for the JGO-PA.

Conclusion from groundwater pathing/transport testing.

Comparison of PNL and CNWRA results for the same example groundwater transport and farming exposure scenario run indicate that the peak dose for uranium over a 1000 year compliance period are identical, indicating the installed well is operating as intended. Identical agreement for groundwater concentrations output except ^{for} 2 time periods (1% deviation) also indicate the well is running as intended. Some discrepancies for results that are not expected to be used, nor will not affect results to be used were noted and will be described further as more info is available.

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8/07/98
115

Resolution of Detected Discrepancies Between CNUWA
installed software Results and PNL Results.

Results of CNUWA installation testing were submitted to John Buck (PNL) for his consideration. Telephone conversations during the period from 6/19 to 8/07/98 indicated that the *.HHT, *.INA, and *.WCF files that were sent to CNUWA for QA testing were the original archived test runs, however, these tests were conducted prior to a meeting with NRC where comments were made on code and some minor changes were made prior to delivery to NRC (the code CNUWA used for this testing). PNL then compared dates on for my MEPAS program files to confirm I had the correct version. They re-ran the input files with the equivalent version of MEPAS and compared results using my comparison spreadsheets. Results from the *.INA output are shown on page 130 and indicate 1 to 1 agreement - this resolves the errors noted in comparison shown on page 93 of this notebook. The e-mail transmitting the results is provided on pgs 131-132 of this notebook. In a subsequent e-mail on 7/13 J. Buck discussed the discrepancy between peak dose in *.HHT and that identified in *.INA files - noting that the *.INA output is in "cancer incidence" not dose (as was previously indicated by PNL). He noted when compared with the cancer ~~incidence~~ ^{8/1/98} incidence results in HHT the *.INA results agree (see note on pg 132 of this notebook). This response resolves the discrepancies highlighted in ~~and~~ on pages 112 and 113 for groundwater testing.

Results (cont)

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Comparison of Results for surface water scenario.

Results for the comparison of surface water concentrations from CASE2A.WCF files are shown on pages 116 through 123 of this notebook. These results show that all time steps agree and most surface water concentrations agree. Differences in calculated surface water concentrations are circled in red. These differences occur only in daughters that are in very low concentration compared to the parent radionuclide.

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Differences noted above and indicated on pgs 119, 120, 121, 122 did not show up when PNL ran the same case with the correct version of the code (see discussion on pg 114 of this notebook). Results of comparison are in Excel file compswb.xls that was transmitted via e-mail shown on page 131 of this notebook. The excel file is included in a disk attached to this notebook. This resolves the discrepancies found in the WCF file.

6/22/98
MS

Results: MEPAS 3.2g installation testing for surface water

CASE1A

Comparison of CNWRA and PNL MEPAS 3.2g Results: CASE2A.WCF Surface Water Concentration Output					
RADCON VERSION 05/01/1997					
WATERBORNE COMPONENT of the Multimedia Environmental Pollutant Assessment System (MEPAS): Models the movement of chemicals and radionuclides through vadose zone, saturated zone, surface water, and wetlands media.					
Pacific Northwest National Laboratory Operated for the U.S Department of Energy by Battelle Memorial Institute P.O. Box 999 Richland, Washington 99352					
Run Name: CASE2A					
Run Performed: 6/20/1998 g/mL or pCi/mL					
PAL	PNL	Ratio	PAL	PNL	Ratio
Time (yr)	Time (yr)	PAL/PNL	SW Conc. U238	SW Conc. U238	PAL/PNL
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!
2.50E+02	2.50E+02	1.00	1.18E-05	1.18E-05	1.00
5.00E+02	5.00E+02	1.00	1.18E-05	1.18E-05	1.00
7.50E+02	7.50E+02	1.00	1.18E-05	1.18E-05	1.00
1.00E+03	1.00E+03	1.00	1.18E-05	1.18E-05	1.00
1.25E+03	1.25E+03	1.00	1.18E-05	1.18E-05	1.00
1.50E+03	1.50E+03	1.00	1.18E-05	1.18E-05	1.00
1.75E+03	1.75E+03	1.00	1.18E-05	1.18E-05	1.00
2.00E+03	2.00E+03	1.00	1.18E-05	1.18E-05	1.00
2.25E+03	2.25E+03	1.00	1.18E-05	1.18E-05	1.00
2.50E+03	2.50E+03	1.00	1.18E-05	1.18E-05	1.00
2.75E+03	2.75E+03	1.00	1.18E-05	1.18E-05	1.00
3.00E+03	3.00E+03	1.00	1.18E-05	1.18E-05	1.00
3.25E+03	3.25E+03	1.00	1.18E-05	1.18E-05	1.00
3.50E+03	3.50E+03	1.00	1.18E-05	1.18E-05	1.00
3.75E+03	3.75E+03	1.00	1.18E-05	1.18E-05	1.00
4.00E+03	4.00E+03	1.00	1.18E-05	1.18E-05	1.00
4.25E+03	4.25E+03	1.00	1.18E-05	1.18E-05	1.00
4.50E+03	4.50E+03	1.00	1.18E-05	1.18E-05	1.00
4.75E+03	4.75E+03	1.00	1.18E-05	1.18E-05	1.00
5.00E+03	5.00E+03	1.00	1.18E-05	1.18E-05	1.00
5.25E+03	5.25E+03	1.00	1.18E-05	1.18E-05	1.00
5.50E+03	5.50E+03	1.00	1.18E-05	1.18E-05	1.00
5.75E+03	5.75E+03	1.00	1.18E-05	1.18E-05	1.00
6.00E+03	6.00E+03	1.00	1.18E-05	1.18E-05	1.00
6.25E+03	6.25E+03	1.00	1.18E-05	1.18E-05	1.00
6.50E+03	6.50E+03	1.00	1.18E-05	1.18E-05	1.00
6.75E+03	6.75E+03	1.00	1.18E-05	1.18E-05	1.00
7.00E+03	7.00E+03	1.00	1.18E-05	1.18E-05	1.00
7.25E+03	7.25E+03	1.00	1.18E-05	1.18E-05	1.00
7.50E+03	7.50E+03	1.00	1.18E-05	1.18E-05	1.00
7.75E+03	7.75E+03	1.00	1.18E-05	1.18E-05	1.00
8.00E+03	8.00E+03	1.00	1.18E-05	1.18E-05	1.00
8.25E+03	8.25E+03	1.00	1.18E-05	1.18E-05	1.00

Location: QAZ folder on attached floppy

Filename: WCF WCMC2.XLS

6/12/98

6/22/98
MS

Results: MEPAS 3.2g -- testing for surface water (cont)

CASE1A

8.50E+03	8.50E+03	1.00	1.18E-05	1.18E-05	1.00			
8.75E+03	8.75E+03	1.00	1.18E-05	1.18E-05	1.00			
9.00E+03	9.00E+03	1.00	1.18E-05	1.18E-05	1.00			
9.25E+03	9.25E+03	1.00	1.18E-05	1.18E-05	1.00			
9.50E+03	9.50E+03	1.00	1.18E-05	1.18E-05	1.00			
9.75E+03	9.75E+03	1.00	1.18E-05	1.18E-05	1.00			
1.00E+04	1.00E+04	1.00	4.66E-07	4.66E-07	1.00			
TH234	TH234	#VALUE!	TH234	#VALUE!	#VALUE!	41 URANIUM-	U238	
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!			
2.50E+02	2.50E+02	1.00	1.19E-05	1.19E-05	1.00			
5.00E+02	5.00E+02	1.00	1.19E-05	1.19E-05	1.00			
7.50E+02	7.50E+02	1.00	1.19E-05	1.19E-05	1.00			
1.00E+03	1.00E+03	1.00	1.19E-05	1.19E-05	1.00			
1.25E+03	1.25E+03	1.00	1.19E-05	1.19E-05	1.00			
1.50E+03	1.50E+03	1.00	1.19E-05	1.19E-05	1.00			
1.75E+03	1.75E+03	1.00	1.19E-05	1.19E-05	1.00			
2.00E+03	2.00E+03	1.00	1.19E-05	1.19E-05	1.00			
2.25E+03	2.25E+03	1.00	1.19E-05	1.19E-05	1.00			
2.50E+03	2.50E+03	1.00	1.19E-05	1.19E-05	1.00			
2.75E+03	2.75E+03	1.00	1.19E-05	1.19E-05	1.00			
3.00E+03	3.00E+03	1.00	1.19E-05	1.19E-05	1.00			
3.25E+03	3.25E+03	1.00	1.19E-05	1.19E-05	1.00			
3.50E+03	3.50E+03	1.00	1.19E-05	1.19E-05	1.00			
3.75E+03	3.75E+03	1.00	1.19E-05	1.19E-05	1.00			
4.00E+03	4.00E+03	1.00	1.19E-05	1.19E-05	1.00			
4.25E+03	4.25E+03	1.00	1.19E-05	1.19E-05	1.00			
4.50E+03	4.50E+03	1.00	1.19E-05	1.19E-05	1.00			
4.75E+03	4.75E+03	1.00	1.19E-05	1.19E-05	1.00			
5.00E+03	5.00E+03	1.00	1.19E-05	1.19E-05	1.00			
5.25E+03	5.25E+03	1.00	1.19E-05	1.19E-05	1.00			
5.50E+03	5.50E+03	1.00	1.19E-05	1.19E-05	1.00			
5.75E+03	5.75E+03	1.00	1.19E-05	1.19E-05	1.00			
6.00E+03	6.00E+03	1.00	1.19E-05	1.19E-05	1.00			
6.25E+03	6.25E+03	1.00	1.19E-05	1.19E-05	1.00			
6.50E+03	6.50E+03	1.00	1.19E-05	1.19E-05	1.00			
6.75E+03	6.75E+03	1.00	1.19E-05	1.19E-05	1.00			
7.00E+03	7.00E+03	1.00	1.19E-05	1.19E-05	1.00			
7.25E+03	7.25E+03	1.00	1.19E-05	1.19E-05	1.00			
7.50E+03	7.50E+03	1.00	1.19E-05	1.19E-05	1.00			
7.75E+03	7.75E+03	1.00	1.19E-05	1.19E-05	1.00			
8.00E+03	8.00E+03	1.00	1.19E-05	1.19E-05	1.00			
8.25E+03	8.25E+03	1.00	1.19E-05	1.19E-05	1.00			
8.50E+03	8.50E+03	1.00	1.19E-05	1.19E-05	1.00			
8.75E+03	8.75E+03	1.00	1.19E-05	1.19E-05	1.00			
9.00E+03	9.00E+03	1.00	1.19E-05	1.19E-05	1.00			
9.25E+03	9.25E+03	1.00	1.19E-05	1.19E-05	1.00			
9.50E+03	9.50E+03	1.00	1.19E-05	1.19E-05	1.00			
9.75E+03	9.75E+03	1.00	1.19E-05	1.19E-05	1.00			
1.00E+04	1.00E+04	1.00	4.73E-07	4.73E-07	1.00			
U234	U234	#VALUE!	U234	#VALUE!	#VALUE!	41 URANIUM-	U238	
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!			
2.50E+02	2.50E+02	1.00	1.98E-11	1.98E-11	1.00			
5.00E+02	5.00E+02	1.00	4.30E-11	4.30E-11	1.00			
7.50E+02	7.50E+02	1.00	6.62E-11	6.62E-11	1.00			
1.00E+03	1.00E+03	1.00	8.94E-11	8.94E-11	1.00			
1.25E+03	1.25E+03	1.00	1.13E-10	1.13E-10	1.00			

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Results: MEPA 3.2g ... testing for surface water (cont)

CASE1A

1.50E+03	1.50E+03	1.00	1.36E-10	1.36E-10	1.00		
1.75E+03	1.75E+03	1.00	1.59E-10	1.59E-10	1.00		
2.00E+03	2.00E+03	1.00	1.82E-10	1.82E-10	1.00		
2.25E+03	2.25E+03	1.00	2.05E-10	2.05E-10	1.00		
2.50E+03	2.50E+03	1.00	2.29E-10	2.29E-10	1.00		
2.75E+03	2.75E+03	1.00	2.52E-10	2.52E-10	1.00		
3.00E+03	3.00E+03	1.00	2.75E-10	2.75E-10	1.00		
3.25E+03	3.25E+03	1.00	2.98E-10	2.98E-10	1.00		
3.50E+03	3.50E+03	1.00	3.21E-10	3.21E-10	1.00		
3.75E+03	3.75E+03	1.00	3.45E-10	3.45E-10	1.00		
4.00E+03	4.00E+03	1.00	3.68E-10	3.68E-10	1.00		
4.25E+03	4.25E+03	1.00	3.91E-10	3.91E-10	1.00		
4.50E+03	4.50E+03	1.00	4.14E-10	4.14E-10	1.00		
4.75E+03	4.75E+03	1.00	4.37E-10	4.37E-10	1.00		
5.00E+03	5.00E+03	1.00	4.60E-10	4.60E-10	1.00		
5.25E+03	5.25E+03	1.00	4.84E-10	4.84E-10	1.00		
5.50E+03	5.50E+03	1.00	5.07E-10	5.07E-10	1.00		
5.75E+03	5.75E+03	1.00	5.30E-10	5.30E-10	1.00		
6.00E+03	6.00E+03	1.00	5.53E-10	5.53E-10	1.00		
6.25E+03	6.25E+03	1.00	5.76E-10	5.76E-10	1.00		
6.50E+03	6.50E+03	1.00	6.00E-10	6.00E-10	1.00		
6.75E+03	6.75E+03	1.00	6.23E-10	6.23E-10	1.00		
7.00E+03	7.00E+03	1.00	6.46E-10	6.46E-10	1.00		
7.25E+03	7.25E+03	1.00	6.69E-10	6.69E-10	1.00		
7.50E+03	7.50E+03	1.00	6.92E-10	6.92E-10	1.00		
7.75E+03	7.75E+03	1.00	7.16E-10	7.16E-10	1.00		
8.00E+03	8.00E+03	1.00	7.39E-10	7.39E-10	1.00		
8.25E+03	8.25E+03	1.00	7.62E-10	7.62E-10	1.00		
8.50E+03	8.50E+03	1.00	7.85E-10	7.85E-10	1.00		
8.75E+03	8.75E+03	1.00	8.08E-10	8.08E-10	1.00		
9.00E+03	9.00E+03	1.00	8.31E-10	8.31E-10	1.00		
9.25E+03	9.25E+03	1.00	8.54E-10	8.54E-10	1.00		
9.50E+03	9.50E+03	1.00	8.78E-10	8.78E-10	1.00		
9.75E+03	9.75E+03	1.00	9.01E-10	9.01E-10	1.00		
1.00E+04	1.00E+04	1.00	3.58E-11	3.58E-11	1.00		
TH230	TH230	#VALUE!	TH230	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	5.73E-17	5.73E-17	1.00		
5.00E+02	5.00E+02	1.00	2.52E-16	2.52E-16	1.00		
7.50E+02	7.50E+02	1.00	5.97E-16	5.97E-16	1.00		
1.00E+03	1.00E+03	1.00	1.08E-15	1.08E-15	1.00		
1.25E+03	1.25E+03	1.00	1.93E-15	1.93E-15	1.00		
1.50E+03	1.50E+03	1.00	2.79E-15	2.79E-15	1.00		
1.75E+03	1.75E+03	1.00	3.64E-15	3.64E-15	1.00		
2.00E+03	2.00E+03	1.00	4.49E-15	4.49E-15	1.00		
2.25E+03	2.25E+03	1.00	5.92E-15	5.92E-15	1.00		
2.50E+03	2.50E+03	1.00	7.36E-15	7.36E-15	1.00		
2.75E+03	2.75E+03	1.00	8.79E-15	8.79E-15	1.00		
3.00E+03	3.00E+03	1.00	1.02E-14	1.02E-14	1.00		
3.25E+03	3.25E+03	1.00	1.22E-14	1.22E-14	1.00		
3.50E+03	3.50E+03	1.00	1.43E-14	1.43E-14	1.00		
3.75E+03	3.75E+03	1.00	1.63E-14	1.63E-14	1.00		
4.00E+03	4.00E+03	1.00	1.83E-14	1.83E-14	1.00		
4.25E+03	4.25E+03	1.00	2.09E-14	2.09E-14	1.00		
4.50E+03	4.50E+03	1.00	2.35E-14	2.35E-14	1.00		
4.75E+03	4.75E+03	1.00	2.61E-14	2.61E-14	1.00		

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Results: MEPA 3.2g ... testing for surface water (cont)

CASE1A

5.00E+03	5.00E+03	1.00	2.87E-14	2.87E-14	1.00		
5.25E+03	5.25E+03	1.00	3.19E-14	3.19E-14	1.00		
5.50E+03	5.50E+03	1.00	3.50E-14	3.50E-14	1.00		
5.75E+03	5.75E+03	1.00	3.82E-14	3.82E-14	1.00		
6.00E+03	6.00E+03	1.00	4.14E-14	4.14E-14	1.00		
6.25E+03	6.25E+03	1.00	4.52E-14	4.52E-14	1.00		
6.50E+03	6.50E+03	1.00	4.89E-14	4.89E-14	1.00		
6.75E+03	6.75E+03	1.00	5.27E-14	5.27E-14	1.00		
7.00E+03	7.00E+03	1.00	5.65E-14	5.65E-14	1.00		
7.25E+03	7.25E+03	1.00	6.08E-14	6.08E-14	1.00		
7.50E+03	7.50E+03	1.00	6.51E-14	6.51E-14	1.00		
7.75E+03	7.75E+03	1.00	6.95E-14	6.95E-14	1.00		
8.00E+03	8.00E+03	1.00	7.39E-14	7.39E-14	1.00		
8.25E+03	8.25E+03	1.00	7.88E-14	7.88E-14	1.00		
8.50E+03	8.50E+03	1.00	8.37E-14	8.37E-14	1.00		
8.75E+03	8.75E+03	1.00	8.86E-14	8.86E-14	1.00		
9.00E+03	9.00E+03	1.00	9.36E-14	9.36E-14	1.00		
9.25E+03	9.25E+03	1.00	9.91E-14	9.91E-14	1.00		
9.50E+03	9.50E+03	1.00	1.05E-13	1.05E-13	1.00		
9.75E+03	9.75E+03	1.00	1.10E-13	1.10E-13	1.00		
1.00E+04	1.00E+04	1.00	4.37E-15	4.37E-15	1.00		
RA226	RA226	#VALUE!	RA226	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	5.59E-21	1.60E-27	3489082.97		
5.00E+02	5.00E+02	1.00	4.73E-20	3.05E-27	15523465.70		
7.50E+02	7.50E+02	1.00	1.74E-19	4.49E-27	38641425.39		
1.00E+03	1.00E+03	1.00	4.22E-19	4.22E-19	1.00		
1.25E+03	1.25E+03	1.00	1.20E-18	1.20E-18	1.00		
1.50E+03	1.50E+03	1.00	1.98E-18	1.98E-18	1.00		
1.75E+03	1.75E+03	1.00	2.76E-18	2.76E-18	1.00		
2.00E+03	2.00E+03	1.00	3.56E-18	3.56E-18	1.00		
2.25E+03	2.25E+03	1.00	5.71E-18	5.71E-18	1.00		
2.50E+03	2.50E+03	1.00	7.87E-18	7.87E-18	1.00		
2.75E+03	2.75E+03	1.00	1.00E-17	1.00E-17	1.00		
3.00E+03	3.00E+03	1.00	1.22E-17	1.22E-17	1.00		
3.25E+03	3.25E+03	1.00	1.64E-17	1.64E-17	1.00		
3.50E+03	3.50E+03	1.00	2.07E-17	2.07E-17	1.00		
3.75E+03	3.75E+03	1.00	2.49E-17	2.49E-17	1.00		
4.00E+03	4.00E+03	1.00	2.92E-17	2.92E-17	1.00		
4.25E+03	4.25E+03	1.00	3.62E-17	3.62E-17	1.00		
4.50E+03	4.50E+03	1.00	4.32E-17	4.32E-17	1.00		
4.75E+03	4.75E+03	1.00	5.02E-17	5.02E-17	1.00		
5.00E+03	5.00E+03	1.00	5.73E-17	5.73E-17	1.00		
5.25E+03	5.25E+03	1.00	6.77E-17	6.77E-17	1.00		
5.50E+03	5.50E+03	1.00	7.82E-17	7.82E-17	1.00		
5.75E+03	5.75E+03	1.00	8.87E-17	8.87E-17	1.00		
6.00E+03	6.00E+03	1.00	9.93E-17	9.93E-17	1.00		
6.25E+03	6.25E+03	1.00	1.14E-16	1.14E-16	1.00		
6.50E+03	6.50E+03	1.00	1.29E-16	1.29E-16	1.00		
6.75E+03	6.75E+03	1.00	1.43E-16	1.43E-16	1.00		
7.00E+03	7.00E+03	1.00	1.58E-16	1.58E-16	1.00		
7.25E+03	7.25E+03	1.00	1.78E-16	1.78E-16	1.00		
7.50E+03	7.50E+03	1.00	1.97E-16	1.97E-16	1.00		
7.75E+03	7.75E+03	1.00	2.17E-16	2.17E-16	1.00		
8.00E+03	8.00E+03	1.00	2.36E-16	2.36E-16	1.00		
8.25E+03	8.25E+03	1.00	2.61E-16	2.61E-16	1.00		

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Results: MERAS 3.2g ... testing for surface water (cont)

CASE1A

8.50E+03	8.50E+03	1.00	2.86E-16	2.86E-16	1.00		
8.75E+03	8.75E+03	1.00	3.12E-16	3.12E-16	1.00		
9.00E+03	9.00E+03	1.00	3.37E-16	3.37E-16	1.00		
9.25E+03	9.25E+03	1.00	3.68E-16	3.68E-16	1.00		
9.50E+03	9.50E+03	1.00	3.99E-16	3.99E-16	1.00		
9.75E+03	9.75E+03	1.00	4.31E-16	4.31E-16	1.00		
1.00E+04	1.00E+04	1.00	1.71E-17	1.71E-17	1.00		
RN222	RN222	#VALUE!	RN222	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	4.89E-21	6.53E-22	7.48		
5.00E+02	5.00E+02	1.00	4.67E-20	6.53E-22	71.28		
7.50E+02	7.50E+02	1.00	1.72E-19	6.53E-22	263.09		
1.00E+03	1.00E+03	1.00	4.20E-19	6.53E-22	642.39		
1.25E+03	1.25E+03	1.00	1.20E-18	1.20E-18	1.00		
1.50E+03	1.50E+03	1.00	1.99E-18	1.99E-18	1.00		
1.75E+03	1.75E+03	1.00	2.77E-18	2.77E-18	1.00		
2.00E+03	2.00E+03	1.00	3.57E-18	3.57E-18	1.00		
2.25E+03	2.25E+03	1.00	5.73E-18	5.73E-18	1.00		
2.50E+03	2.50E+03	1.00	7.90E-18	7.90E-18	1.00		
2.75E+03	2.75E+03	1.00	1.01E-17	1.01E-17	1.00		
3.00E+03	3.00E+03	1.00	1.23E-17	1.23E-17	1.00		
3.25E+03	3.25E+03	1.00	1.65E-17	1.65E-17	1.00		
3.50E+03	3.50E+03	1.00	2.08E-17	2.08E-17	1.00		
3.75E+03	3.75E+03	1.00	2.51E-17	2.51E-17	1.00		
4.00E+03	4.00E+03	1.00	2.94E-17	2.94E-17	1.00		
4.25E+03	4.25E+03	1.00	3.64E-17	3.64E-17	1.00		
4.50E+03	4.50E+03	1.00	4.35E-17	4.35E-17	1.00		
4.75E+03	4.75E+03	1.00	5.06E-17	5.06E-17	1.00		
5.00E+03	5.00E+03	1.00	5.78E-17	5.78E-17	1.00		
5.25E+03	5.25E+03	1.00	6.83E-17	6.83E-17	1.00		
5.50E+03	5.50E+03	1.00	7.89E-17	7.89E-17	1.00		
5.75E+03	5.75E+03	1.00	8.94E-17	8.94E-17	1.00		
6.00E+03	6.00E+03	1.00	1.00E-16	1.00E-16	1.00		
6.25E+03	6.25E+03	1.00	1.15E-16	1.15E-16	1.00		
6.50E+03	6.50E+03	1.00	1.30E-16	1.30E-16	1.00		
6.75E+03	6.75E+03	1.00	1.45E-16	1.45E-16	1.00		
7.00E+03	7.00E+03	1.00	1.59E-16	1.59E-16	1.00		
7.25E+03	7.25E+03	1.00	1.79E-16	1.79E-16	1.00		
7.50E+03	7.50E+03	1.00	1.99E-16	1.99E-16	1.00		
7.75E+03	7.75E+03	1.00	2.19E-16	2.19E-16	1.00		
8.00E+03	8.00E+03	1.00	2.39E-16	2.39E-16	1.00		
8.25E+03	8.25E+03	1.00	2.64E-16	2.64E-16	1.00		
8.50E+03	8.50E+03	1.00	2.89E-16	2.89E-16	1.00		
8.75E+03	8.75E+03	1.00	3.14E-16	3.14E-16	1.00		
9.00E+03	9.00E+03	1.00	3.40E-16	3.40E-16	1.00		
9.25E+03	9.25E+03	1.00	3.72E-16	3.72E-16	1.00		
9.50E+03	9.50E+03	1.00	4.03E-16	4.03E-16	1.00		
9.75E+03	9.75E+03	1.00	4.35E-16	4.35E-16	1.00		
1.00E+04	1.00E+04	1.00	1.73E-17	1.73E-17	1.00		
PB210	PB210	#VALUE!	PB210	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	2.73E-22	2.61E-22	1.00		
5.00E+02	5.00E+02	1.00	7.14E-22	2.61E-22	2.74		
7.50E+02	7.50E+02	1.00	2.99E-21	2.61E-22	11.49		
1.00E+03	1.00E+03	1.00	9.25E-21	2.61E-22	35.54		
1.25E+03	1.25E+03	1.00	4.50E-20	2.61E-22	172.52		

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RESULTS:
MERAS 3.2g ... testing for surface water (cont)

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CASE1A

1.50E+03	1.50E+03	1.00	8.08E-20	2.61E-22	309.98		
1.75E+03	1.75E+03	1.00	1.17E-19	2.61E-22	447.43		
2.00E+03	2.00E+03	1.00	1.54E-19	2.61E-22	589.03		
2.25E+03	2.25E+03	1.00	3.09E-19	2.61E-22	1187.26		
2.50E+03	2.50E+03	1.00	4.66E-19	4.66E-19	1.00		
2.75E+03	2.75E+03	1.00	6.23E-19	6.23E-19	1.00		
3.00E+03	3.00E+03	1.00	7.84E-19	7.84E-19	1.00		
3.25E+03	3.25E+03	1.00	1.20E-18	1.20E-18	1.00		
3.50E+03	3.50E+03	1.00	1.62E-18	1.62E-18	1.00		
3.75E+03	3.75E+03	1.00	2.04E-18	2.04E-18	1.00		
4.00E+03	4.00E+03	1.00	2.47E-18	2.47E-18	1.00		
4.25E+03	4.25E+03	1.00	3.33E-18	3.33E-18	1.00		
4.50E+03	4.50E+03	1.00	4.21E-18	4.21E-18	1.00		
4.75E+03	4.75E+03	1.00	5.08E-18	5.08E-18	1.00		
5.00E+03	5.00E+03	1.00	5.97E-18	5.97E-18	1.00		
5.25E+03	5.25E+03	1.00	7.53E-18	7.53E-18	1.00		
5.50E+03	5.50E+03	1.00	9.09E-18	9.09E-18	1.00		
5.75E+03	5.75E+03	1.00	1.07E-17	1.07E-17	1.00		
6.00E+03	6.00E+03	1.00	1.23E-17	1.23E-17	1.00		
6.25E+03	6.25E+03	1.00	1.48E-17	1.48E-17	1.00		
6.50E+03	6.50E+03	1.00	1.73E-17	1.73E-17	1.00		
6.75E+03	6.75E+03	1.00	1.98E-17	1.98E-17	1.00		
7.00E+03	7.00E+03	1.00	2.24E-17	2.24E-17	1.00		
7.25E+03	7.25E+03	1.00	2.62E-17	2.62E-17	1.00		
7.50E+03	7.50E+03	1.00	3.00E-17	3.00E-17	1.00		
7.75E+03	7.75E+03	1.00	3.39E-17	3.39E-17	1.00		
8.00E+03	8.00E+03	1.00	3.78E-17	3.78E-17	1.00		
8.25E+03	8.25E+03	1.00	4.32E-17	4.32E-17	1.00		
8.50E+03	8.50E+03	1.00	4.86E-17	4.86E-17	1.00		
8.75E+03	8.75E+03	1.00	5.41E-17	5.41E-17	1.00		
9.00E+03	9.00E+03	1.00	5.97E-17	5.97E-17	1.00		
9.25E+03	9.25E+03	1.00	6.71E-17	6.71E-17	1.00		
9.50E+03	9.50E+03	1.00	7.46E-17	7.46E-17	1.00		
9.75E+03	9.75E+03	1.00	8.21E-17	8.21E-17	1.00		
1.00E+04	1.00E+04	1.00	3.27E-18	3.27E-18	1.00		
BI210	BI210	#VALUE!	BI210	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	1.77E-27	1.77E-27	1.00		
5.00E+02	5.00E+02	1.00	3.63E-27	3.63E-27	1.00		
7.50E+02	7.50E+02	1.00	5.49E-27	5.49E-27	1.00		
1.00E+03	1.00E+03	1.00	8.66E-21	7.35E-27	1178367.35		
1.25E+03	1.25E+03	1.00	4.37E-20	9.21E-27	4745357.80		
1.50E+03	1.50E+03	1.00	7.88E-20	1.11E-26	7121951.22		
1.75E+03	1.75E+03	1.00	1.14E-19	1.29E-26	8816705.34		
2.00E+03	2.00E+03	1.00	1.50E-19	1.48E-26	10155510.48		
2.25E+03	2.25E+03	1.00	3.04E-19	1.67E-26	18252252.25		
2.50E+03	2.50E+03	1.00	4.59E-19	4.59E-19	1.00		
2.75E+03	2.75E+03	1.00	6.13E-19	6.13E-19	1.00		
3.00E+03	3.00E+03	1.00	7.71E-19	7.71E-19	1.00		
3.25E+03	3.25E+03	1.00	1.18E-18	1.18E-18	1.00		
3.50E+03	3.50E+03	1.00	1.60E-18	1.60E-18	1.00		
3.75E+03	3.75E+03	1.00	2.01E-18	2.01E-18	1.00		
4.00E+03	4.00E+03	1.00	2.44E-18	2.44E-18	1.00		
4.25E+03	4.25E+03	1.00	3.30E-18	3.30E-18	1.00		
4.50E+03	4.50E+03	1.00	4.16E-18	4.16E-18	1.00		
4.75E+03	4.75E+03	1.00	5.03E-18	5.03E-18	1.00		

Results: MERAS 3.2g ... testing for surface water (cont)

CASE1A

5.00E+03	5.00E+03	1.00	5.91E-18	5.91E-18	1.00		
5.25E+03	5.25E+03	1.00	7.45E-18	7.45E-18	1.00		
5.50E+03	5.50E+03	1.00	9.00E-18	9.00E-18	1.00		
5.75E+03	5.75E+03	1.00	1.06E-17	1.06E-17	1.00		
6.00E+03	6.00E+03	1.00	1.21E-17	1.21E-17	1.00		
6.25E+03	6.25E+03	1.00	1.46E-17	1.46E-17	1.00		
6.50E+03	6.50E+03	1.00	1.71E-17	1.71E-17	1.00		
6.75E+03	6.75E+03	1.00	1.97E-17	1.97E-17	1.00		
7.00E+03	7.00E+03	1.00	2.22E-17	2.22E-17	1.00		
7.25E+03	7.25E+03	1.00	2.60E-17	2.60E-17	1.00		
7.50E+03	7.50E+03	1.00	2.98E-17	2.98E-17	1.00		
7.75E+03	7.75E+03	1.00	3.36E-17	3.36E-17	1.00		
8.00E+03	8.00E+03	1.00	3.74E-17	3.74E-17	1.00		
8.25E+03	8.25E+03	1.00	4.28E-17	4.28E-17	1.00		
8.50E+03	8.50E+03	1.00	4.82E-17	4.82E-17	1.00		
8.75E+03	8.75E+03	1.00	5.37E-17	5.37E-17	1.00		
9.00E+03	9.00E+03	1.00	5.92E-17	5.92E-17	1.00		
9.25E+03	9.25E+03	1.00	6.66E-17	6.66E-17	1.00		
9.50E+03	9.50E+03	1.00	7.40E-17	7.40E-17	1.00		
9.75E+03	9.75E+03	1.00	8.14E-17	8.14E-17	1.00		
1.00E+04	1.00E+04	1.00	3.24E-18	3.24E-18	1.00		
PO210	PO210	#VALUE!	PO210	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	1.02E-21	1.02E-21	1.00		
5.00E+02	5.00E+02	1.00	1.02E-21	1.02E-21	1.00		
7.50E+02	7.50E+02	1.00	1.02E-21	1.02E-21	1.00		
1.00E+03	1.00E+03	1.00	2.59E-21	1.02E-21	2.55		
1.25E+03	1.25E+03	1.00	1.52E-20	1.02E-21	14.94		
1.50E+03	1.50E+03	1.00	2.78E-20	1.02E-21	27.35		
1.75E+03	1.75E+03	1.00	4.04E-20	1.02E-21	39.76		
2.00E+03	2.00E+03	1.00	5.32E-20	1.02E-21	52.39		
2.25E+03	2.25E+03	1.00	1.15E-19	1.02E-21	113.30		
2.50E+03	2.50E+03	1.00	1.77E-19	1.02E-21	174.8		
2.75E+03	2.75E+03	1.00	2.39E-19	1.02E-21	235.67		
3.00E+03	3.00E+03	1.00	3.02E-19	1.02E-21	297.44		
3.25E+03	3.25E+03	1.00	4.79E-19	4.79E-19	1.00		
3.50E+03	3.50E+03	1.00	6.56E-19	6.56E-19	1.00		
3.75E+03	3.75E+03	1.00	8.33E-19	8.33E-19	1.00		
4.00E+03	4.00E+03	1.00	1.01E-18	1.01E-18	1.00		
4.25E+03	4.25E+03	1.00	1.39E-18	1.39E-18	1.00		
4.50E+03	4.50E+03	1.00	1.78E-18	1.78E-18	1.00		
4.75E+03	4.75E+03	1.00	2.16E-18	2.16E-18	1.00		
5.00E+03	5.00E+03	1.00	2.55E-18	2.55E-18	1.00		
5.25E+03	5.25E+03	1.00	3.25E-18	3.25E-18	1.00		
5.50E+03	5.50E+03	1.00	3.95E-18	3.95E-18	1.00		
5.75E+03	5.75E+03	1.00	4.65E-18	4.65E-18	1.00		
6.00E+03	6.00E+03	1.00	5.36E-18	5.36E-18	1.00		
6.25E+03	6.25E+03	1.00	6.51E-18	6.51E-18	1.00		
6.50E+03	6.50E+03	1.00	7.67E-18	7.67E-18	1.00		
6.75E+03	6.75E+03	1.00	8.83E-18	8.83E-18	1.00		
7.00E+03	7.00E+03	1.00	1.00E-17	1.00E-17	1.00		
7.25E+03	7.25E+03	1.00	1.18E-17	1.18E-17	1.00		
7.50E+03	7.50E+03	1.00	1.35E-17	1.35E-17	1.00		
7.75E+03	7.75E+03	1.00	1.53E-17	1.53E-17	1.00		
8.00E+03	8.00E+03	1.00	1.71E-17	1.71E-17	1.00		
8.25E+03	8.25E+03	1.00	1.96E-17	1.96E-17	1.00		

Results: MERAS 3.2g ... testing for surface water (cont)

CASE1A

8.50E+03	8.50E+03	1.00	2.22E-17	2.22E-17	1.00		
8.75E+03	8.75E+03	1.00	2.47E-17	2.47E-17	1.00		
9.00E+03	9.00E+03	1.00	2.73E-17	2.73E-17	1.00		
9.25E+03	9.25E+03	1.00	3.08E-17	3.08E-17	1.00		
9.50E+03	9.50E+03	1.00	3.43E-17	3.43E-17	1.00		
9.75E+03	9.75E+03	1.00	3.78E-17	3.78E-17	1.00		
1.00E+04	1.00E+04	1.00	6.75E-19	6.75E-19	1.00		

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Results: MEPAS 3.2g ... testing for surface water (cont)

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Case2a.hhi

Multimedia Environmental Pollutant Assessment System (MEPAS)
MEPAS 3.1 Report Generator (REPORT version 10/3/94 KJC)
Run Date and time 05/15/1997 at 09:21:28
Input file name CASE2A.ina

Health Impact Detailed Result for: URANIUM-238 from URANIUM-238

Transport Pathway: Surface water Usage Location: Chapman Run upstream

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Meat	270	1.2E-24	1.4E-24	1.9E-21	1.2E-24	1.4E-24	1.9E-21
Milk	270	6.3E-24	7.3E-24	9.9E-21	6.3E-24	7.3E-24	9.9E-21
Finfish	270	9.3E-22	1.1E-21	1.5E-18	9.4E-22	1.1E-21	1.5E-18
Shellfish	270	1.1E-21	1.3E-21	1.8E-18	1.1E-21	1.3E-21	1.8E-18
Subtotal		2.1E-21	2.4E-21	3.3E-18	2.1E-21	2.4E-21	3.3E-18
Total		2.1E-21	2.4E-21	3.3E-18	2.1E-21	2.4E-21	3.3E-18

Health Impact Detailed Result for: THORIUM-234 from URANIUM-238

Transport Pathway: Surface water Usage Location: Chapman Run upstream

PNL Results

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Meat	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Milk	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Finfish	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Shellfish	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subtotal		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Filename: Case2a.hhi
location: QA2 folder
on attached floppy
applies to pg 110 of this notebook.
126 and 128 also

Note: PNL results on pgs 124-128 have not been corrected to address the factor of 1×10^{12} error. Thus, the results need to be multiplied by 1×10^{12} prior to comparing w/ CNVRA results. The error is discussed on pgs 126 and 128 also.

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Results: MEPAS 3.2g ... testing for surface water (cont)

Case2a.hhi

Multimedia Environmental Pollutant Assessment System (MEPAS)
MEPAS 3.1 Report Generator (REPORT version 10/3/94 KJC)
Run Date and time 06/20/1998 at 19:47:58
Input file name CASE2A.ina

Health Impact Detailed Result for: URANIUM-238 from URANIUM-238

Transport Pathway: Surface water Usage Location: Chapman Run upstream

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Meat	270	1.2E-12	1.4E-12	1.9E-09	1.2E-12	1.4E-12	1.9E-09
Milk	270	6.3E-12	7.3E-12	9.9E-09	6.3E-12	7.3E-12	9.9E-09
Finfish	270	9.3E-10	1.1E-09	1.5E-06	9.4E-10	1.1E-09	1.5E-06
Shellfish	270	1.1E-09	1.3E-09	1.8E-06	1.1E-09	1.3E-09	1.8E-06
Subtotal		2.1E-09	2.4E-09	3.3E-06	2.1E-09	2.4E-09	3.3E-06
Total		2.1E-09	2.4E-09	3.3E-06	2.1E-09	2.4E-09	3.3E-06

Health Impact Detailed Result for: THORIUM-234 from URANIUM-238

Transport Pathway: Surface water Usage Location: Chapman Run upstream

CNVRA Results

	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Exposure Pathway							
Ingestion:							
Meat	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Milk	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Finfish	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Shellfish	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Subtotal		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total		0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Filename: Case2a.hhi

location: QA folder
on attached floppy
applies to pg 127 and 129 also

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Results: MEPAS 3.2g ... testing for surface water (cont)

Health Impact Detailed Result for: THORIUM-234 from THORIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	330	1.1E-27	1.3E-27	1.7E-24	1.1E-27	1.3E-27	1.7E-24
Milk	300	2.5E-27	2.9E-27	4.0E-24	2.5E-27	2.9E-27	4.0E-24
Finfish	450	8.2E-23	9.5E-23	1.3E-19	8.3E-23	9.6E-23	1.3E-19
Shellfish	480	4.1E-22	4.8E-22	6.5E-19	4.1E-22	4.8E-22	6.6E-19
Subtotal		4.9E-22	5.7E-22	7.8E-19	5.0E-22	5.8E-22	7.9E-19
Total		4.9E-22	5.7E-22	7.8E-19	5.0E-22	5.8E-22	7.9E-19

Health Impact Detailed Result for: URANIUM-234 from THORIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Individual Result			Population Results		
Fatal	Total		Fatal	Total	Dose,
					Page 3

Health Impact Detailed Result for: URANIUM-234 from URANIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	1.0E-28	1.2E-28	1.6E-25	1.0E-28	1.2E-28	1.6E-25
Milk	9750	5.3E-28	6.2E-28	8.5E-25	5.3E-28	6.2E-28	8.5E-25
Finfish	9750	7.9E-26	9.2E-26	1.3E-22	8.0E-26	9.3E-26	1.3E-22
Shellfish	9720	9.5E-26	1.1E-25	1.5E-22	9.6E-26	1.1E-25	1.5E-22
Subtotal		1.7E-25	2.0E-25	2.8E-22	1.8E-25	2.0E-25	2.8E-22
Total		1.7E-25	2.0E-25	2.8E-22	1.8E-25	2.0E-25	2.8E-22

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Results: MEPAS 3.2g ... testing for surface water (cont)

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Health Impact Detailed Result for: THORIUM-234 from THORIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	330	1.1E-15	1.3E-15	1.7E-12	1.1E-15	1.3E-15	1.7E-12
Milk	300	2.5E-15	2.9E-15	4.0E-12	2.5E-15	2.9E-15	4.0E-12
Finfish	450	8.2E-11	9.5E-11	1.3E-07	8.3E-11	9.6E-11	1.3E-07
Shellfish	480	4.1E-10	4.8E-10	6.5E-07	4.1E-10	4.8E-10	6.6E-07
Subtotal		4.9E-10	5.7E-10	7.8E-07	5.0E-10	5.8E-10	7.9E-07
Total		4.9E-10	5.7E-10	7.8E-07	5.0E-10	5.8E-10	7.9E-07

Health Impact Detailed Result for: URANIUM-234 from THORIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Individual Result			Population Results		
Fatal	Total		Fatal	Total	Dose,

Health Impact Detailed Result for: URANIUM-234 from URANIUM-234

Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	1.0E-16	1.2E-16	1.6E-13	1.0E-16	1.2E-16	1.6E-13
Milk	9750	5.3E-16	6.2E-16	8.5E-13	5.3E-16	6.2E-16	8.5E-13
Finfish	9750	7.9E-14	9.2E-14	1.3E-10	8.0E-14	9.3E-14	1.3E-10
Shellfish	9720	9.5E-14	1.1E-13	1.5E-10	9.6E-14	1.1E-13	1.5E-10
Subtotal		1.7E-13	2.0E-13	2.8E-10	1.8E-13	2.0E-13	2.8E-10
Total		1.7E-13	2.0E-13	2.8E-10	1.8E-13	2.0E-13	2.8E-10

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Results: MEPA 3.2g --- testing for surface water (cont)

Health Impact Detailed Result for: THORIUM-230 from THORIUM-230
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	7.2E-34	8.4E-34	1.1E-30	7.2E-34	8.4E-34	1.1E-30
Milk	9750	1.1E-33	1.2E-33	1.7E-30	1.1E-33	1.2E-33	1.7E-30
Finfish	9750	3.7E-29	4.3E-29	5.9E-26	3.8E-29	4.4E-29	6.0E-26
Shellfish	9750	1.9E-28	2.2E-28	3.0E-25	1.9E-28	2.2E-28	3.0E-25
Subtotal		2.2E-28	2.6E-28	3.6E-25	2.3E-28	2.6E-28	3.6E-25
Total		2.2E-28	2.6E-28	3.6E-25	2.3E-28	2.6E-28	3.6E-25

Health Impact Detailed Result for: RADIUM-226 from RADIUM-226
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	2.8E-34	3.3E-34	4.5E-31	2.8E-34	3.3E-34	4.5E-31
Milk	9750	8.9E-34	1.0E-33	1.4E-30	8.9E-34	1.0E-33	1.4E-30
Finfish	9750	2.5E-31	2.9E-31	3.9E-28	2.5E-31	2.9E-31	4.0E-28
Shellfish	9750	8.8E-31	1.0E-30	1.4E-27	8.9E-31	1.0E-30	1.4E-27
Subtotal		1.1E-30	1.3E-30	1.8E-27	1.1E-30	1.3E-30	1.8E-27
Total		1.1E-30	1.3E-30	1.8E-27	1.1E-30	1.3E-30	1.8E-27

Health Impact Detailed Result for: LEAD-210 from LEAD-210
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	2.6E-34	3.0E-34	4.2E-31	2.6E-34	3.0E-34	4.2E-31
Milk	9750	3.8E-34	4.4E-34	6.1E-31	3.8E-34	4.4E-34	6.1E-31
Finfish	9750	2.7E-31	3.2E-31	4.3E-28	2.8E-31	3.2E-31	4.4E-28
Shellfish	9750	2.7E-31	3.2E-31	4.3E-28	2.8E-31	3.2E-31	4.4E-28
Subtotal		5.5E-31	6.3E-31	8.7E-28	5.5E-31	6.4E-31	8.8E-28
Total		5.5E-31	6.3E-31	8.7E-28	5.5E-31	6.4E-31	8.8E-28

6/22/88
N6

Results: MEPA 3.2g --- testing for surface water (cont)

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book 1

Health Impact Detailed Result for: THORIUM-230 from THORIUM-230
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	7.2E-22	8.4E-22	1.1E-18	7.2E-22	8.4E-22	1.1E-18
Milk	9750	1.1E-21	1.2E-21	1.7E-18	1.1E-21	1.2E-21	1.7E-18
Finfish	9750	3.7E-17	4.3E-17	5.9E-14	3.8E-17	4.4E-17	6.0E-14
Shellfish	9750	1.9E-16	2.2E-16	3.0E-13	1.9E-16	2.2E-16	3.0E-13
Subtotal		2.2E-16	2.6E-16	3.6E-13	2.3E-16	2.6E-16	3.6E-13
Total		2.2E-16	2.6E-16	3.6E-13	2.3E-16	2.6E-16	3.6E-13

Health Impact Detailed Result for: RADIUM-226 from RADIUM-226
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	2.8E-22	3.3E-22	4.5E-19	2.8E-22	3.3E-22	4.5E-19
Milk	9750	8.9E-22	1.0E-21	1.4E-18	8.9E-22	1.0E-21	1.4E-18
Finfish	9750	2.5E-19	2.9E-19	3.9E-16	2.5E-19	2.9E-19	4.0E-16
Shellfish	9750	8.8E-19	1.0E-18	1.4E-15	8.9E-19	1.0E-18	1.4E-15
Subtotal		1.1E-18	1.3E-18	1.8E-15	1.1E-18	1.3E-18	1.8E-15
Total		1.1E-18	1.3E-18	1.8E-15	1.1E-18	1.3E-18	1.8E-15

Health Impact Detailed Result for: LEAD-210 from LEAD-210
Transport Pathway: Surface water Usage Location: Chapman Run upstream

Exposure Pathway	Time Period	Individual Result			Population Results		
		Fatal Effect Risk	Total Incid. Index	Dose, Rem	Fatal Effect Risk	Total Incid. Index	Dose, Person Rem
Ingestion:							
Meat	9750	2.6E-22	3.0E-22	4.2E-19	2.6E-22	3.0E-22	4.2E-19
Milk	9750	3.8E-22	4.4E-22	6.1E-19	3.8E-22	4.4E-22	6.1E-19
Finfish	9750	2.7E-19	3.2E-19	4.3E-16	2.8E-19	3.2E-19	4.4E-16
Shellfish	9750	2.7E-19	3.2E-19	4.3E-16	2.8E-19	3.2E-19	4.4E-16
Subtotal		5.5E-19	6.3E-19	8.7E-16	5.5E-19	6.4E-19	8.8E-16
Total		5.5E-19	6.3E-19	8.7E-16	5.5E-19	6.4E-19	8.8E-16

Spreadsheet of Final PNL Comparison of A. INA Output For CASE 1A Example
(File submitted in e-mail shown on page 131 of this notebook). ~~File~~ 8/12/98
Filename: R100A
Location: D:\3 folder on file

Comparison of Annual Doses from CASE1A,INA MEPA5 3.2g Output/Summed Parents and Daughters for Each 50 y Interval by Exposure Pathway for Runs by P. LaPlante (PAL) and the Code Developer (PNL)																									
Year	PAL DW	PNL DW	PNNL Revised DW		Ratio PAL/DLS	PNL LEAF		Ratio PAL/DLS	PNNL Revised LEAF	New Ratio PAL/PNNL		PNL OTH	Ratio PAL/DLS	PNNL Revised OTHER	New Ratio PAL/PNNL		PNL MEAT	Ratio PAL/DLS	PNNL Revised MEAT	New Ratio PAL/PNNL		PNL MILK	Ratio PAL/DLS	PNNL Revised MILK	New Ratio PAL/PNNL
			PAL	LEAF		PAL	LEAF			PAL	OTH				PAL	MEAT				PAL	MILK				
50	9.32E-01		9.32E-01	1.00E+00	1.00E-01	1.35E-11		1.55E-11		1.00E+00	4.10E-12		4.10E-12	1.00E+00	4.95E-14		4.95E-14	1.00E+00	5.08E-13		5.08E-13		5.08E-13	1.00E+00	
100	1.86E-09	1.81E-08	1.02	1.86E-09	1.00E+00	3.09E-11	1.04	3.06E-11	1.00E+00	8.98E-12	8.04E-12	1.31	1.31	1.00E+00	4.95E-14	4.95E-14	1.00E+00	5.08E-13	4.95E-14	1.00E+00	5.08E-13		5.08E-13	1.00E+00	
150	2.78E-09		1.00	2.78E-09	1.00E+00	3.09E-11	1.04	3.06E-11	1.00E+00	8.98E-12	8.04E-12	1.31	1.31	1.00E+00	4.95E-14	4.95E-14	1.00E+00	5.08E-13	4.95E-14	1.00E+00	5.08E-13		5.08E-13	1.00E+00	
200	4.13E-08	4.12E-08	1.00	4.13E-08	1.00E+00	4.92E-11	1.01	4.92E-11	1.00E+00	1.29E-11	1.29E-11	1.01	1.01	1.00E+00	1.05E-13	1.05E-13	1.00E+00	1.05E-13	1.05E-13	1.00E+00	1.05E-13		1.05E-13	1.00E+00	
250	8.91E-08		1.00	8.91E-08	1.00E+00	1.07E-09	1.01	1.07E-09	1.00E+00	1.48E-09	1.29E-09	1.13	1.13	1.00E+00	1.48E-09	1.48E-09	1.00E+00	1.48E-09	1.48E-09	1.00E+00	1.48E-09		1.48E-09	1.00E+00	
300	1.41E-07	1.41E-07	1.00	1.41E-07	1.00E+00	3.75E-09	1.00	3.75E-09	1.00E+00	6.04E-09	6.02E-09	1.00	1.00	1.00E+00	6.04E-09	6.04E-09	1.00E+00	6.04E-09	6.04E-09	1.00E+00	6.04E-09		6.04E-09	1.00E+00	
350	1.93E-07		1.00	1.93E-07	1.00E+00	1.51E-09	1.00	1.51E-09	1.00E+00	8.41E-09	8.41E-09	1.00	1.00	1.00E+00	8.41E-09	8.41E-09	1.00E+00	8.41E-09	8.41E-09	1.00E+00	8.41E-09		8.41E-09	1.00E+00	
400	2.48E-07	2.45E-07	1.00	2.48E-07	1.00E+00	6.52E-09	1.00	6.52E-09	1.00E+00	1.08E-08	1.08E-08	1.00	1.00	1.00E+00	1.08E-08	1.08E-08	1.00E+00	1.08E-08	1.08E-08	1.00E+00	1.08E-08		1.08E-08	1.00E+00	
450	4.10E-07		1.00	4.10E-07	1.00E+00	1.09E-08	1.00	1.09E-08	1.00E+00	1.74E-08	1.74E-08	1.00	1.00	1.00E+00	1.74E-08	1.74E-08	1.00E+00	1.74E-08	1.74E-08	1.00E+00	1.74E-08		1.74E-08	1.00E+00	
500	6.01E-07	6.00E-07	1.00	6.01E-07	1.00E+00	1.62E-08	1.00	1.62E-08	1.00E+00	2.65E-08	2.64E-08	1.00	1.00	1.00E+00	2.65E-08	2.65E-08	1.00E+00	2.65E-08	2.65E-08	1.00E+00	2.65E-08		2.65E-08	1.00E+00	
550	7.97E-07		1.00	7.97E-07	1.00E+00	2.14E-08	1.00	2.14E-08	1.00E+00	3.08E-08	3.08E-08	1.00	1.00	1.00E+00	3.08E-08	3.08E-08	1.00E+00	3.08E-08	3.08E-08	1.00E+00	3.08E-08		3.08E-08	1.00E+00	
600	9.92E-07	9.90E-07	1.00	9.92E-07	1.00E+00	2.67E-08	1.00	2.67E-08	1.00E+00	4.52E-08	4.52E-08	1.00	1.00	1.00E+00	4.52E-08	4.52E-08	1.00E+00	4.52E-08	4.52E-08	1.00E+00	4.52E-08		4.52E-08	1.00E+00	
650	1.19E-06		1.00	1.19E-06	1.00E+00	3.21E-08	1.00	3.21E-08	1.00E+00	5.48E-08	5.48E-08	1.00	1.00	1.00E+00	5.48E-08	5.48E-08	1.00E+00	5.48E-08	5.48E-08	1.00E+00	5.48E-08		5.48E-08	1.00E+00	
700	1.33E-06	1.32E-06	1.00	1.33E-06	1.00E+00	3.59E-08	1.00	3.59E-08	1.00E+00	6.18E-08	6.17E-08	1.00	1.00	1.00E+00	6.18E-08	6.18E-08	1.00E+00	6.18E-08	6.18E-08	1.00E+00	6.18E-08		6.18E-08	1.00E+00	
750	1.45E-06		1.00	1.45E-06	1.00E+00	3.92E-08	1.00	3.92E-08	1.00E+00	6.77E-08	6.77E-08	1.00	1.00	1.00E+00	6.77E-08	6.77E-08	1.00E+00	6.77E-08	6.77E-08	1.00E+00	6.77E-08		6.77E-08	1.00E+00	
800	1.56E-06	1.56E-06	1.00	1.56E-06	1.00E+00	4.24E-08	1.00	4.24E-08	1.00E+00	7.35E-08	7.34E-08	1.00	1.00	1.00E+00	7.35E-08	7.35E-08	1.00E+00	7.35E-08	7.35E-08	1.00E+00	7.35E-08		7.35E-08	1.00E+00	
850	1.69E-06		1.00	1.69E-06	1.00E+00	4.56E-08	1.00	4.56E-08	1.00E+00	7.93E-08	7.93E-08	1.00	1.00	1.00E+00	7.93E-08	7.93E-08	1.00E+00	7.93E-08	7.93E-08	1.00E+00	7.93E-08		7.93E-08	1.00E+00	
890	1.84E-06	1.80E-06	1.00	1.84E-06	1.00E+00	4.89E-08	1.00	4.89E-08	1.00E+00	8.50E-08	8.49E-08	1.00	1.00	1.00E+00	8.50E-08	8.50E-08	1.00E+00	8.50E-08	8.50E-08	1.00E+00	8.50E-08		8.50E-08	1.00E+00	
950	1.80E-06		1.00	1.80E-06	1.00E+00	5.01E-08	1.00	5.01E-08	1.00E+00	8.77E-08	8.77E-08	1.00	1.00	1.00E+00	8.77E-08	8.77E-08	1.00E+00	8.77E-08	8.77E-08	1.00E+00	8.77E-08		8.77E-08	1.00E+00	
1000	1.98E-06	1.79E-06	1.05	1.98E-06	1.00E+00	5.05E-08	1.03	5.05E-08	1.00E+00	8.89E-08	8.84E-08	1.01	1.01	1.00E+00	8.89E-08	8.89E-08	1.00E+00	8.89E-08	8.89E-08	1.00E+00	8.89E-08		8.89E-08	1.00E+00	

Date: 7/10/98
Sender: "Buck John W" <john.w.buck@pnl.gov>
To: Patrick LaPlante
cc: "Whelan Gene" <Gene.WheLAN@pnl.gov>, "Gelston Gariann M" <gariann.gelston@pnl.gov>
 "Tom J. Nicholson (E-mail)" <tjn@nrc.gov>
Priority: Normal
Subject: RE: RE: Clarifications Regarding Case Example Results

Attached are the two Excel files you sent us on comparisons of values. I modified them to add in the new information. Bottom line is that your values match exactly with ours (see highlighted columns in spreadsheets). I will be sending NRC an official updated version of MEPAS 3.2 and a letter on the QA/QC process.

I apologize for the problems that this has caused you and I want to thank you for the help in resolving this issue. I hope to see you the week of July 20th for the MEPAS/FRAMES training.

Please let me know if you have any questions.

John

<<compjwb.xls>> <<RIcompjb.xls>>

-----Original Message-----

From: plaplante@swri.edu [SMTP:plaplante@swri.edu]

Sent: Thursday, July 09, 1998 10:05 AM

To: Gelston, Gariann M

Cc: Buck, John W: clp@nrc.gov; tin@nrc.gov; bmabrito@swri.edu;

irussell@swri.edu

Subject: Re:RE: Clarifications Regarding Case Example Results

Gariann.

Thanks for the update. I appreciate it very much.

Pat

Reply Separator

Reply Separator
Subject: RE: Clarifications Regarding Case Example Results

Author: "Gelston Gariann M" <gariann.gelston@pnl.gov>

Date: 7/8/98 5:55 PM

Pat.

We wanted to let you know that we have run the example CASE1A on the MEPAS 3.2 version that matches yours (with the upgraded SPATCH executable) and appear to match your output perfectly. We are currently tied up with preparations for the MEPAS4.0 training later this month and haven't had the chance to completely fill in matching data for your spreadsheet, but the all the numbers we have checked match so far. We should be able to get you additional information by early next week.

Just wanted to keep you updated.

Thanks

Gariann Gelston for John Buck

<< File: RFC822.TXT >>



RFC822.TXT



Rlcompib.xls



compjwb.xls

8/07/98

E-mail Resolving Discrepancies Discussed pg 114 of this book

Date: 7/13/98
 Sender: "Buck John W" <john.w.buck@pnl.gov>
 To: "laplante@swri.edu" <laplante@swri.edu>
 cc: "Gelston Gariann M" <gariann.gelston@pnl.gov> "Castleton Karl J" <karl.castleton@pnl.gov>
 "Hoopes Bonnie L" <bonnie.hoopes@pnl.gov> "Whelan Gene" <Gene.Whelan@pnl.gov>
 "Streng Dennis L" <D.L.Streng@pnl.gov> "McDonald John P" <john.p.mcdonald@pnl.gov>
 bcc: Tom J. Nicholson (E-mail) <tjn@hrc.gov>
 Patrick LaPlante
 Priority: Normal
 Subject: MEPAS 3.2 INA and HHI files
 Pat,

I finally got a chance to look at the HHI and INA files. I had some problems matching up the HHI max impact values with the INA max impact values but Karl Castleton finally straighten me out. The max impact values and time match up between the two files. It just gets a little confusing because of the number of progeny that are involved.

First, INA only contains cancer incidence/hazard index values so you need to look at the "Total Incidence Index" value in the HHI. Second, U234 appears in the INA file in three places - progeny of U238, progeny of Th234, and parent. I messed up here and mapped the wrong U234 progeny value to the HHI file.

So, INA and HHI values match up. If you need more information, please let me know.

Thanks for your patience and interest, John

PS I think this resolves all your issues with MEPAS 3.2? Is that true?



RFC822.TXT

8/07/98

Conclusions for MEPAS 3.2g Installation Testing:

MEPAS 3.2g was tested using test files supplied by the code developer which exercise both surface and groundwater transport calculations, radon transport, and exposure models at the code for uranium and daughters. Problems encountered include a 12 order of magnitude error in the groundwater calculation and sporadic discrepancies in some results that were compared with PNL output files. The 12 order of magnitude error was corrected by PNL (code developer) and a software patch was provided so testing could be completed. The other discrepancies were subsequently identified to be the result of PNL ~~not~~ providing output files that were from a prior version of MEPAS. ~~After PNL ran the test files with the correct version of MEPAS~~ Fast results provided by PNL confirm that the installed MEPAS 3.2g is running as intended.

8/12/98

Key to referenced files:

* CD was sent to B. Mahritz for QA

Files for the installation testing of MEPAS 3.2g are too large to fit on a floppy disk. Therefore other archive media such as CD* or tape will be used. Folders will remain intact for ease of use. The following is a key that describes files contained in folders (directories).

/MEPAS/QA: Contains CNWRA MEPAS 3.2g input/output files from records following installation test runs and excel spreadsheets that compare CNWRA results with PNL results that were initially sent but later determined were not the correct files (not from 3.2g code).
 File is not a zip file.
 See page 29 of notebook 281. 5/9/00

MEPAS 3.2g installation testing (cont)

8/12/98

Key to referenced files: (cont)

1/MEPAS/QA2: This folder contains installation test files for CASE1A and CASE2A that were run by PNL for the original tests done for MEPAS 3.2g (from PNL archive) and excel spreadsheets that compare these results with CNWBA installation test runs for same input files. The PNL files were later found to be incorrect in that there were changes made to that version of 3.2g prior to delivering to NRC, but after the archived test files (tests for a specific milestone) were done.

1/MEPAS/QA3: This folder contains excel spreadsheet files that were sent by PNL. These files (described in e-mail on pg 131 of this notebook) are installation test result comparisons done by PNL using output from the confirmed correct version of the code and output from CNWBA MEPAS 3.2g runs of the same input files.

8/12/98

MEPAS 3.2g installation testing (cont)
E-mail exchange between PNL and CNWBA regarding Code Error and Patch

Spatch.txt

Date: 6/9/98
 Sender: "Streng Dennis L" <D.L.Streng@pnl.gov>
 To: Patrick LaPlante
 Priority: Normal
 Subject: RE: MEPAS Test Case

Pat,

I have asked John Buck to look for the original output files that were used to generate the Figures in NUREG/CR-6566.

However, there is a bigger problem. In the process of modifying the program for another project, and as a result of your testing, we have discovered that there is an error in the transfer of water concentration values

from RADCON (groundwater transport component) to AHAZ (the exposure component). Your version will generate results (in both the WCF and the INA file es) that are low by 12 orders of magnitude. The problem was in an intermediate program (SPATCH.EXE) that failed to convert from Ci to pCi in generation of the WCF file. I have attached an updated SPATCH.EXE file. Be sure to save the one you have (don't just over-write it), as there could be other change s to the new version that are incompatible with the rest of your code the (although I strongly doubt there are any such problems). Also, I have attached the WCF and INA files (prefix CASE1AP) that I just ran using the current 3.2g (slight modifications from your version). My version seems to be giving the same results as yours (after correction by 1E12).

Please take a look at the files to see if they make sense. I will let you know what John Buck tells me.

As you can imagine, it is very embarrassing to have such a simple, but large error to be found in a program that we felt was working correctly. The components were tested quite well in stand-alone mode, but testing of the combined programs under the MEPAS shell was obviously deficient.

Hopefully, the magnitude of the error would be a flag to potential users that something was wrong. I am surprised that no one has found the error before. Perhaps the program has not been used much yet.

Dennis

<<SPATCH.EXE>> <<CASE1AP.INA>> <<CASE1AP.WCF>>

-----Original Message-----
 From: plaplante@swri.edu [SMTP:plaplante@swri.edu]
 Sent: Tuesday, June 09, 1998 9:22 AM
 To: Streng, Dennis L
 Subject: Re:MEPAS Test Case

Dennis,

I summed all the daughters within each year of interest (i.e., 100, 200, 300 etc) and obtained results that were same order of magnitude as the report figure but still appear just a tick or two low on the log scale. I checked the input with the NUREG Appendix and the numbers checked out. Would it be possible for you or someone there to run my CASE1A file (attached) using ver 3.2g and send me back the *.INA and *.WCF files. The attached *.prm file is the same as the last one I sent except the time periods were changed to go every 100yrs to 1000. The code I am using was given to NRC as Version "3.2g". I am run

8/12/98
8

e-mail exchange between PNL and CNWRA regarding code error and patch (cont)

ning

Spatch.txt

up against a deadline and need to complete this QA testing ASAP.

Either way, let me know if this can or cannot be done so I can move ahead.

Thanks
Pat

Reply Separator

Subject: MEPAS Test Case
Author: "Streng Dennis L" <D.L.Streng@pnl.gov>
Date: 6/8/98 1:16 PM

Patrick,

Thanks for sending the PRM file. I ran it and the risk results were about 1E12 higher than those in the report. Could you send me the WCF file that you generated when you ran CASE1A? I'm using in modified version of MEPAS 3.2 that seems to be giving different results than your version. Thanks.

Dennis

<< File: RFC822.TXT >> << File: Casela.prm >>

9/15/98
11

Summary of Additional Problem, resolution, and testing of MEPAS 3.2g.

Subsequently, an additional problem was identified on 8/18/98 while trying to run MEPAS with the site specific input files developed for JPG PA calculations. The groundwater transport module in the code was crashing during execution. This error had been occurring for about a month prior to its identification, but was undetected because the error message was only displayed briefly and the code continued operation despite the error. Contacts with PNL helped identify this problem was the result of running the code in the Windows NT operating environment rather than DOS. During early testing of the code, the MEPAS interface ran with less stability in DOS compared to Windows NT therefore NT was chosen with an understanding that QA testing would identify any problems. None of the QA testing files had problems with the NT environment, but the site specific files were slightly different than the testing files and this difference resulted in the crash of the groundwater transport model.

Initial testing then began on running the site specific JPG files in MEPAS under a DOS environment (to avoid crashing the groundwater model) and an additional problem was identified that suggested the patch provided for the prior 12 order of magnitude error may not have addressed all areas of the code that contained this unit conversion error. On 8/21/98, a note was

sent by CNWRA identifying the potential additional 12 order of magnitude problem. PNL responded indicating the part of the code being run was not supposed to be impacted by the original correction to the 12 order of magnitude error and thus they did not expect a problem with the code. CNWRA then ran tests of MEPAS using the site specific JPG input files to confirm the appearance of the additional 12 order of magnitude problem and informed PNL on 8/25/98. PNL responded shortly thereafter indicating they would have the programmers investigate the potential problem. A week later PNL indicated their programmers had been busy but were beginning to investigate the problem. On 9/3/98, CNWRA received a response from PNL clarifying that a problem was identified with the code input interface where the flux was called for in Ci units instead of pCi resulting in a 12 order of magnitude underestimation in the results. A new executable was provided to CNWRA on 9/4/98. The inability to use MEPAS with confidence during this period affected the CNWRA's ability to complete the draft PA report under the planned schedule (by September 25).

9/15/98

Methods:

On 9/11/98, PNL resent files for shell.exe and MEPPAS.ATR after the ones sent on 9/4 failed to execute properly. PNL indicated they changed only the graphical user interface (GUI) so that the Flux input units were in pCi rather than Ci. To confirm that the changes were made correctly and new errors were not introduced, the prior installation test cases were re-run with this version and results compared with PNL output (as before). An additional test using a site-specific input file for JPO was run to see if similar results would be obtained if the same case was run with a user defined flux input via the same term module and outside source term module.

Results: 10/13/98

10/13/98

Ongoing tests were postponed due to an error in PNL's last patch for MEPPAS resulting in input problems in the GUI. It took a few attempts by PNL to isolate and correct the source of the problem - which was subsequently found to be the result of corruption of the patch files by PNL's e-mail system. More specifically, a hard return character was being inserted into the MEPPAS.ATR file thereby altering the "fixed format" and causing the code to hang on boot. On 10/9/98, the problem was resolved and the QA tests commenced on 10/13/98.

10/13/98

Results:

MEPPAS 3.2.8 installation testing results 10/16/98
Reproduction of ~~grandfather transport case (CASE7A)~~ following code update to fix errors (see page 92 in this notebook for description).

(note the X-10A comparison will not be done because it is time consuming and is not necessary if the results in the data files agree) 10/16/98

10/17/98

10/13/98
Results... (cont)

CASE1A

Final Comparison of CNWRA and PNL MEPAS 3.2g Results: CASE1A.WCF					
Groundwater Concentration Output (PAL 10/13/98)					
RADCON VERSION 05/01/1997					
WATERBORNE COMPONENT of the Multimedia Environmental					
Pollutant Assessment System (MEPAS): Models the					
movement of chemicals and radionuclides through vadose					
zone, saturated zone, surface water, and wetlands media.					
Pacific Northwest National Laboratory					
Operated for the U.S Department of Energy					
by Battelle Memorial Institute					
P.O. Box 999					
Richland, Washington 99352					
Run Name: CASE1A					
Run Performed: 10/7/98 15:55:33 g/mL or pCi/mL					
PAL	PNL	Ratio	PAL	PNL	Ratio
Time (yr)	Time (yr)	PAL/PNL	Well Conc.	Well Conc.	PAL/PNL
1.60E+02	1.60E+02	1.00	0.00E+00	0.00E+00	#DIV/0!
4.11E+02	4.11E+02	1.00	1.72E-03	1.72E-03	1.00
6.61E+02	6.61E+02	1.00	8.57E-03	8.57E-03	1.00
9.11E+02	9.11E+02	1.00	1.27E-02	1.27E-02	1.00
1.16E+03	1.16E+03	1.00	1.33E-02	1.33E-02	1.00
1.41E+03	1.41E+03	1.00	1.32E-02	1.32E-02	1.00
1.66E+03	1.66E+03	1.00	1.29E-02	1.29E-02	1.00
1.91E+03	1.91E+03	1.00	1.27E-02	1.27E-02	1.00
2.16E+03	2.16E+03	1.00	1.25E-02	1.25E-02	1.00
2.41E+03	2.41E+03	1.00	1.23E-02	1.23E-02	1.00
2.66E+03	2.66E+03	1.00	1.21E-02	1.21E-02	1.00
2.91E+03	2.91E+03	1.00	1.19E-02	1.19E-02	1.00
3.16E+03	3.16E+03	1.00	1.17E-02	1.17E-02	1.00
3.41E+03	3.41E+03	1.00	1.15E-02	1.15E-02	1.00
3.66E+03	3.66E+03	1.00	1.13E-02	1.13E-02	1.00
3.91E+03	3.91E+03	1.00	1.11E-02	1.11E-02	1.00
4.16E+03	4.16E+03	1.00	1.09E-02	1.09E-02	1.00
4.41E+03	4.41E+03	1.00	1.07E-02	1.07E-02	1.00
4.66E+03	4.66E+03	1.00	1.05E-02	1.05E-02	1.00
4.91E+03	4.91E+03	1.00	1.03E-02	1.03E-02	1.00
5.16E+03	5.16E+03	1.00	1.02E-02	1.02E-02	1.00
5.41E+03	5.41E+03	1.00	9.99E-03	9.99E-03	1.00
5.66E+03	5.66E+03	1.00	9.82E-03	9.82E-03	1.00
5.91E+03	5.91E+03	1.00	9.65E-03	9.65E-03	1.00
6.16E+03	6.16E+03	1.00	9.49E-03	9.49E-03	1.00
6.41E+03	6.41E+03	1.00	9.32E-03	9.32E-03	1.00
6.66E+03	6.66E+03	1.00	9.16E-03	9.16E-03	1.00
6.91E+03	6.91E+03	1.00	9.01E-03	9.01E-03	1.00
7.16E+03	7.16E+03	1.00	8.85E-03	8.85E-03	1.00
7.41E+03	7.41E+03	1.00	8.70E-03	8.70E-03	1.00
7.66E+03	7.66E+03	1.00	8.55E-03	8.55E-03	1.00
7.91E+03	7.91E+03	1.00	8.41E-03	8.41E-03	1.00
8.16E+03	8.16E+03	1.00	8.26E-03	8.26E-03	1.00
8.41E+03	8.41E+03	1.00	8.12E-03	8.12E-03	1.00

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Results... (cont)

CASE1A

8.66E+03	8.66E+03	1.00	7.98E-03	7.98E-03	1.00		
8.91E+03	8.91E+03	1.00	7.85E-03	7.85E-03	1.00		
9.16E+03	9.16E+03	1.00	7.71E-03	7.71E-03	1.00		
9.41E+03	9.41E+03	1.00	7.58E-03	7.58E-03	1.00		
9.66E+03	9.66E+03	1.00	7.45E-03	7.45E-03	1.00		
9.91E+03	9.91E+03	1.00	7.33E-03	7.33E-03	1.00		
1.02E+04	1.02E+04	1.00	7.15E-03	7.15E-03	1.00		
TH234	TH234	#VALUE!	TH234	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.44E-04	6.44E-04	1.00		
5.08E+02	5.08E+02	1.00	4.39E-03	4.39E-03	1.00		
7.62E+02	7.62E+02	1.00	1.03E-02	1.03E-02	1.00		
1.02E+03	1.02E+03	1.00	1.30E-02	1.30E-02	1.00		
1.27E+03	1.27E+03	1.00	1.33E-02	1.33E-02	1.00		
1.52E+03	1.52E+03	1.00	1.31E-02	1.31E-02	1.00		
1.78E+03	1.78E+03	1.00	1.28E-02	1.28E-02	1.00		
2.03E+03	2.03E+03	1.00	1.26E-02	1.26E-02	1.00		
2.29E+03	2.29E+03	1.00	1.24E-02	1.24E-02	1.00		
2.54E+03	2.54E+03	1.00	1.22E-02	1.22E-02	1.00		
2.79E+03	2.79E+03	1.00	1.20E-02	1.20E-02	1.00		
3.05E+03	3.05E+03	1.00	1.18E-02	1.18E-02	1.00		
3.30E+03	3.30E+03	1.00	1.15E-02	1.15E-02	1.00		
3.56E+03	3.56E+03	1.00	1.13E-02	1.13E-02	1.00		
3.81E+03	3.81E+03	1.00	1.12E-02	1.12E-02	1.00		
4.06E+03	4.06E+03	1.00	1.10E-02	1.10E-02	1.00		
4.32E+03	4.32E+03	1.00	1.08E-02	1.08E-02	1.00		
4.57E+03	4.57E+03	1.00	1.06E-02	1.06E-02	1.00		
4.83E+03	4.83E+03	1.00	1.04E-02	1.04E-02	1.00		
5.08E+03	5.08E+03	1.00	1.02E-02	1.02E-02	1.00		
5.33E+03	5.33E+03	1.00	1.00E-02	1.00E-02	1.00		
5.59E+03	5.59E+03	1.00	9.87E-03	9.87E-03	1.00		
5.84E+03	5.84E+03	1.00	9.70E-03	9.70E-03	1.00		
6.10E+03	6.10E+03	1.00	9.53E-03	9.53E-03	1.00		
6.35E+03	6.35E+03	1.00	9.36E-03	9.36E-03	1.00		
6.60E+03	6.60E+03	1.00	9.20E-03	9.20E-03	1.00		
6.86E+03	6.86E+03	1.00	9.04E-03	9.04E-03	1.00		
7.11E+03	7.11E+03	1.00	8.88E-03	8.88E-03	1.00		
7.37E+03	7.37E+03	1.00	8.73E-03	8.73E-03	1.00		
7.62E+03	7.62E+03	1.00	8.57E-03	8.57E-03	1.00		
7.88E+03	7.88E+03	1.00	8.43E-03	8.43E-03	1.00		
8.13E+03	8.13E+03	1.00	8.28E-03	8.28E-03	1.00		
8.38E+03	8.38E+03	1.00	8.14E-03	8.14E-03	1.00		
8.64E+03	8.64E+03	1.00	8.00E-03	8.00E-03	1.00		
8.89E+03	8.89E+03	1.00	7.86E-03	7.86E-03	1.00		
9.15E+03	9.15E+03	1.00	7.72E-03	7.72E-03	1.00		
9.40E+03	9.40E+03	1.00	7.59E-03	7.59E-03	1.00		
9.65E+03	9.65E+03	1.00	7.46E-03	7.46E-03	1.00		
9.91E+03	9.91E+03	1.00	7.33E-03	7.33E-03	1.00		
1.02E+04	1.02E+04	1.00	7.15E-03	7.15E-03	1.00		
U234	U234	#VALUE!	U234	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.51E-07	7.51E-07	1.00		
5.08E+02	5.08E+02	1.00	7.50E-06	7.50E-06	1.00		
7.62E+02	7.62E+02	1.00	2.05E-05	2.05E-05	1.00		
1.02E+03	1.02E+03	1.00	2.75E-05	2.75E-05	1.00		
1.27E+03	1.27E+03	1.00	2.81E-05	2.81E-05	1.00		

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18 Results... (cont)

CASE1A

1.52E+03	1.52E+03	1.00	2.77E-05	2.77E-05	1.00		
1.78E+03	1.78E+03	1.00	2.72E-05	2.72E-05	1.00		
2.03E+03	2.03E+03	1.00	2.68E-05	2.68E-05	1.00		
2.29E+03	2.29E+03	1.00	2.64E-05	2.64E-05	1.00		
2.54E+03	2.54E+03	1.00	2.59E-05	2.59E-05	1.00		
2.79E+03	2.79E+03	1.00	2.55E-05	2.55E-05	1.00		
3.05E+03	3.05E+03	1.00	2.51E-05	2.51E-05	1.00		
3.30E+03	3.30E+03	1.00	2.47E-05	2.47E-05	1.00		
3.56E+03	3.56E+03	1.00	2.43E-05	2.43E-05	1.00		
3.81E+03	3.81E+03	1.00	2.39E-05	2.39E-05	1.00		
4.06E+03	4.06E+03	1.00	2.35E-05	2.35E-05	1.00		
4.32E+03	4.32E+03	1.00	2.31E-05	2.31E-05	1.00		
4.57E+03	4.57E+03	1.00	2.27E-05	2.27E-05	1.00		
4.83E+03	4.83E+03	1.00	2.23E-05	2.23E-05	1.00		
5.08E+03	5.08E+03	1.00	2.20E-05	2.20E-05	1.00		
5.33E+03	5.33E+03	1.00	2.16E-05	2.16E-05	1.00		
5.59E+03	5.59E+03	1.00	2.13E-05	2.13E-05	1.00		
5.84E+03	5.84E+03	1.00	2.09E-05	2.09E-05	1.00		
6.10E+03	6.10E+03	1.00	2.06E-05	2.06E-05	1.00		
6.35E+03	6.35E+03	1.00	2.02E-05	2.02E-05	1.00		
6.60E+03	6.60E+03	1.00	1.99E-05	1.99E-05	1.00		
6.86E+03	6.86E+03	1.00	1.96E-05	1.96E-05	1.00		
7.11E+03	7.11E+03	1.00	1.92E-05	1.92E-05	1.00		
7.37E+03	7.37E+03	1.00	1.89E-05	1.89E-05	1.00		
7.62E+03	7.62E+03	1.00	1.86E-05	1.86E-05	1.00		
7.88E+03	7.88E+03	1.00	1.83E-05	1.83E-05	1.00		
8.13E+03	8.13E+03	1.00	1.80E-05	1.80E-05	1.00		
8.38E+03	8.38E+03	1.00	1.77E-05	1.77E-05	1.00		
8.64E+03	8.64E+03	1.00	1.74E-05	1.74E-05	1.00		
8.89E+03	8.89E+03	1.00	1.71E-05	1.71E-05	1.00		
9.15E+03	9.15E+03	1.00	1.69E-05	1.69E-05	1.00		
9.40E+03	9.40E+03	1.00	1.66E-05	1.66E-05	1.00		
9.65E+03	9.65E+03	1.00	1.63E-05	1.63E-05	1.00		
9.91E+03	9.91E+03	1.00	1.60E-05	1.60E-05	1.00		
1.02E+04	1.02E+04	1.00	5.36E-07	5.40E-07	0.99		
TH230	TH230	#VALUE!	TH230	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	1.39E-09	1.39E-09	1.00		
5.08E+02	5.08E+02	1.00	2.09E-08	2.09E-08	1.00		
7.62E+02	7.62E+02	1.00	6.52E-08	6.52E-08	1.00		
1.02E+03	1.02E+03	1.00	9.24E-08	9.24E-08	1.00		
1.27E+03	1.27E+03	1.00	9.44E-08	9.44E-08	1.00		
1.52E+03	1.52E+03	1.00	9.31E-08	9.31E-08	1.00		
1.78E+03	1.78E+03	1.00	9.17E-08	9.17E-08	1.00		
2.03E+03	2.03E+03	1.00	9.03E-08	9.03E-08	1.00		
2.29E+03	2.29E+03	1.00	8.89E-08	8.89E-08	1.00		
2.54E+03	2.54E+03	1.00	8.75E-08	8.75E-08	1.00		
2.79E+03	2.79E+03	1.00	8.62E-08	8.62E-08	1.00		
3.05E+03	3.05E+03	1.00	8.48E-08	8.48E-08	1.00		
3.30E+03	3.30E+03	1.00	8.35E-08	8.35E-08	1.00		
3.56E+03	3.56E+03	1.00	8.22E-08	8.22E-08	1.00		
3.81E+03	3.81E+03	1.00	8.09E-08	8.09E-08	1.00		
4.06E+03	4.06E+03	1.00	7.97E-08	7.97E-08	1.00		
4.32E+03	4.32E+03	1.00	7.84E-08	7.84E-08	1.00		
4.57E+03	4.57E+03	1.00	7.72E-08	7.72E-08	1.00		
4.83E+03	4.83E+03	1.00	7.60E-08	7.60E-08	1.00		

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Results... (cont)

CASE1A

5.08E+03	5.08E+03	1.00	7.49E-08	7.49E-08	1.00		
5.33E+03	5.33E+03	1.00	7.37E-08	7.37E-08	1.00		
5.59E+03	5.59E+03	1.00	7.26E-08	7.26E-08	1.00		
5.84E+03	5.84E+03	1.00	7.14E-08	7.14E-08	1.00		
6.10E+03	6.10E+03	1.00	7.03E-08	7.03E-08	1.00		
6.35E+03	6.35E+03	1.00	6.92E-08	6.92E-08	1.00		
6.60E+03	6.60E+03	1.00	6.81E-08	6.81E-08	1.00		
6.86E+03	6.86E+03	1.00	6.71E-08	6.71E-08	1.00		
7.11E+03	7.11E+03	1.00	6.60E-08	6.60E-08	1.00		
7.37E+03	7.37E+03	1.00	6.50E-08	6.50E-08	1.00		
7.62E+03	7.62E+03	1.00	6.40E-08	6.40E-08	1.00		
7.88E+03	7.88E+03	1.00	6.30E-08	6.30E-08	1.00		
8.13E+03	8.13E+03	1.00	6.20E-08	6.20E-08	1.00		
8.38E+03	8.38E+03	1.00	6.11E-08	6.11E-08	1.00		
8.64E+03	8.64E+03	1.00	6.01E-08	6.01E-08	1.00		
8.89E+03	8.89E+03	1.00	5.92E-08	5.92E-08	1.00		
9.15E+03	9.15E+03	1.00	5.83E-08	5.83E-08	1.00		
9.40E+03	9.40E+03	1.00	5.74E-08	5.74E-08	1.00		
9.65E+03	9.65E+03	1.00	5.65E-08	5.65E-08	1.00		
9.91E+03	9.91E+03	1.00	5.56E-08	5.56E-08	1.00		
1.02E+04	1.02E+04	1.00	3.62E-09	3.65E-09	0.99		
RA226	RA226	#VALUE!	RA226	#VALUE!	#VALUE!	41 URANIUM-	U238
9.62E-06	9.62E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.87E-11	7.87E-11	1.00		
5.08E+02	5.08E+02	1.00	1.79E-09	1.79E-09	1.00		
7.62E+02	7.62E+02	1.00	6.19E-09	6.19E-09	1.00		
1.02E+03	1.02E+03	1.00	9.21E-09	9.21E-09	1.00		
1.27E+03	1.27E+03	1.00	9.42E-09	9.42E-09	1.00		
1.52E+03	1.52E+03	1.00	9.30E-09	9.30E-09	1.00		
1.78E+03	1.78E+03	1.00	9.17E-09	9.17E-09	1.00		
2.03E+03	2.03E+03	1.00	9.03E-09	9.03E-09	1.00		
2.29E+03	2.29E+03	1.00	8.90E-09	8.90E-09	1.00		
2.54E+03	2.54E+03	1.00	8.77E-09	8.77E-09	1.00		
2.79E+03	2.79E+03	1.00	8.64E-09	8.64E-09	1.00		
3.05E+03	3.05E+03	1.00	8.51E-09	8.51E-09	1.00		
3.30E+03	3.30E+03	1.00	8.39E-09	8.39E-09	1.00		
3.56E+03	3.56E+03	1.00	8.26E-09	8.26E-09	1.00		
3.81E+03	3.81E+03	1.00	8.14E-09	8.14E-09	1.00		
4.06E+03	4.06E+03	1.00	8.02E-09	8.02E-09	1.00		
4.32E+03	4.32E+03	1.00	7.91E-09	7.91E-09	1.00		
4.57E+03	4.57E+03	1.00	7.79E-09	7.79E-09	1.00		
4.83E+03	4.83E+03	1.00	7.68E-09	7.68E-09	1.00		
5.08E+03	5.08E+03	1.00	7.56E-09	7.56E-09	1.00		
5.33E+03	5.33E+03	1.00	7.45E-09	7.45E-09	1.00		
5.59E+03	5.59E+03	1.00	7.34E-09	7.34E-09	1.00		
5.84E+03	5.84E+03	1.00	7.24E-09	7.24E-09	1.00		
6.10E+03	6.10E+03	1.00	7.13E-09	7.13E-09	1.00		
6.35E+03	6.35E+03	1.00	7.02E-09	7.02E-09	1.00		
6.61E+03	6.61E+03	1.00	6.92E-09	6.92E-09	1.00		
6.86E+03	6.86E+03	1.00	6.82E-09	6.82E-09	1.00		
7.11E+03	7.11E+03	1.00	6.72E-09	6.72E-09	1.00		
7.37E+03	7.37E+03	1.00	6.62E-09	6.62E-09	1.00		
7.62E+03	7.62E+03	1.00	6.52E-09	6.52E-09	1.00		
7.88E+03	7.88E+03	1.00	6.42E-09	6.42E-09	1.00		
8.13E+03	8.13E+03	1.00	6.33E-09	6.33E-09	1.00		
8.38E+03	8.38E+03	1.00	6.24E-09	6.24E-09	1.00		

10/18/98 Rev Mfg: . . . (cont)

CASE1A

8.64E+03	8.64E+03	1.00	6.14E-09	6.14E-09	1.00		
8.89E+03	8.89E+03	1.00	6.05E-09	6.05E-09	1.00		
9.15E+03	9.15E+03	1.00	5.97E-09	5.97E-09	1.00		
9.40E+03	9.40E+03	1.00	5.88E-09	5.88E-09	1.00		
9.65E+03	9.65E+03	1.00	5.79E-09	5.79E-09	1.00		
9.91E+03	9.91E+03	1.00	5.70E-09	5.70E-09	1.00		
1.02E+04	1.02E+04	1.00	9.95E-13	9.95E-13	1.00		
RN222	RN222	#VALUE!	RN222	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	7.87E-11	7.87E-11	1.00		
5.08E+02	5.08E+02	1.00	1.79E-09	1.79E-09	1.00		
7.62E+02	7.62E+02	1.00	6.19E-09	6.19E-09	1.00		
1.02E+03	1.02E+03	1.00	9.21E-09	9.21E-09	1.00		
1.27E+03	1.27E+03	1.00	9.42E-09	9.42E-09	1.00		
1.52E+03	1.52E+03	1.00	9.30E-09	9.30E-09	1.00		
1.78E+03	1.78E+03	1.00	9.17E-09	9.17E-09	1.00		
2.03E+03	2.03E+03	1.00	9.03E-09	9.03E-09	1.00		
2.29E+03	2.29E+03	1.00	8.90E-09	8.90E-09	1.00		
2.54E+03	2.54E+03	1.00	8.77E-09	8.77E-09	1.00		
2.79E+03	2.79E+03	1.00	8.64E-09	8.64E-09	1.00		
3.05E+03	3.05E+03	1.00	8.51E-09	8.51E-09	1.00		
3.30E+03	3.30E+03	1.00	8.39E-09	8.39E-09	1.00		
3.56E+03	3.56E+03	1.00	8.26E-09	8.26E-09	1.00		
3.81E+03	3.81E+03	1.00	8.14E-09	8.14E-09	1.00		
4.06E+03	4.06E+03	1.00	8.02E-09	8.02E-09	1.00		
4.32E+03	4.32E+03	1.00	7.91E-09	7.91E-09	1.00		
4.57E+03	4.57E+03	1.00	7.79E-09	7.79E-09	1.00		
4.83E+03	4.83E+03	1.00	7.68E-09	7.68E-09	1.00		
5.08E+03	5.08E+03	1.00	7.56E-09	7.56E-09	1.00		
5.33E+03	5.33E+03	1.00	7.45E-09	7.45E-09	1.00		
5.59E+03	5.59E+03	1.00	7.34E-09	7.34E-09	1.00		
5.84E+03	5.84E+03	1.00	7.24E-09	7.24E-09	1.00		
6.10E+03	6.10E+03	1.00	7.13E-09	7.13E-09	1.00		
6.35E+03	6.35E+03	1.00	7.02E-09	7.02E-09	1.00		
6.61E+03	6.61E+03	1.00	6.92E-09	6.92E-09	1.00		
6.86E+03	6.86E+03	1.00	6.82E-09	6.82E-09	1.00		
7.11E+03	7.11E+03	1.00	6.72E-09	6.72E-09	1.00		
7.37E+03	7.37E+03	1.00	6.62E-09	6.62E-09	1.00		
7.62E+03	7.62E+03	1.00	6.52E-09	6.52E-09	1.00		
7.88E+03	7.88E+03	1.00	6.42E-09	6.42E-09	1.00		
8.13E+03	8.13E+03	1.00	6.33E-09	6.33E-09	1.00		
8.38E+03	8.38E+03	1.00	6.24E-09	6.24E-09	1.00		
8.64E+03	8.64E+03	1.00	6.14E-09	6.14E-09	1.00		
8.89E+03	8.89E+03	1.00	6.05E-09	6.05E-09	1.00		
9.15E+03	9.15E+03	1.00	5.96E-09	5.96E-09	1.00		
9.40E+03	9.40E+03	1.00	5.88E-09	5.88E-09	1.00		
9.65E+03	9.65E+03	1.00	5.79E-09	5.79E-09	1.00		
9.91E+03	9.91E+03	1.00	5.70E-09	5.70E-09	1.00		
1.02E+04	1.02E+04	1.00	9.95E-13	9.95E-13	1.00		
PB210	PB210	#VALUE!	PB210	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.30E-11	6.30E-11	1.00		
5.08E+02	5.08E+02	1.00	1.55E-09	1.55E-09	1.00		
7.62E+02	7.62E+02	1.00	5.44E-09	5.44E-09	1.00		
1.02E+03	1.02E+03	1.00	8.14E-09	8.14E-09	1.00		
1.27E+03	1.27E+03	1.00	8.33E-09	8.33E-09	1.00		

10/18/98 Rev Mfg: . . . (cont)

CASE1A

1.52E+03	1.52E+03	1.00	8.22E-09	8.22E-09	1.00		
1.78E+03	1.78E+03	1.00	8.11E-09	8.11E-09	1.00		
2.03E+03	2.03E+03	1.00	7.99E-09	7.99E-09	1.00		
2.29E+03	2.29E+03	1.00	7.87E-09	7.87E-09	1.00		
2.54E+03	2.54E+03	1.00	7.76E-09	7.76E-09	1.00		
2.79E+03	2.79E+03	1.00	7.64E-09	7.64E-09	1.00		
3.05E+03	3.05E+03	1.00	7.53E-09	7.53E-09	1.00		
3.30E+03	3.30E+03	1.00	7.42E-09	7.42E-09	1.00		
3.56E+03	3.56E+03	1.00	7.31E-09	7.31E-09	1.00		
3.81E+03	3.81E+03	1.00	7.21E-09	7.21E-09	1.00		
4.06E+03	4.06E+03	1.00	7.10E-09	7.10E-09	1.00		
4.32E+03	4.32E+03	1.00	7.00E-09	7.00E-09	1.00		
4.57E+03	4.57E+03	1.00	6.90E-09	6.90E-09	1.00		
4.83E+03	4.83E+03	1.00	6.80E-09	6.80E-09	1.00		
5.08E+03	5.08E+03	1.00	6.70E-09	6.70E-09	1.00		
5.33E+03	5.33E+03	1.00	6.60E-09	6.60E-09	1.00		
5.59E+03	5.59E+03	1.00	6.51E-09	6.51E-09	1.00		
5.84E+03	5.84E+03	1.00	6.41E-09	6.41E-09	1.00		
6.10E+03	6.10E+03	1.00	6.32E-09	6.32E-09	1.00		
6.35E+03	6.35E+03	1.00	6.22E-09	6.22E-09	1.00		
6.61E+03	6.61E+03	1.00	6.13E-09	6.13E-09	1.00		
6.86E+03	6.86E+03	1.00	6.04E-09	6.04E-09	1.00		
7.11E+03	7.11E+03	1.00	5.95E-09	5.95E-09	1.00		
7.37E+03	7.37E+03	1.00	5.87E-09	5.87E-09	1.00		
7.62E+03	7.62E+03	1.00	5.78E-09	5.78E-09	1.00		
7.88E+03	7.88E+03	1.00	5.70E-09	5.70E-09	1.00		
8.13E+03	8.13E+03	1.00	5.61E-09	5.61E-09	1.00		
8.38E+03	8.38E+03	1.00	5.53E-09	5.53E-09	1.00		
8.64E+03	8.64E+03	1.00	5.45E-09	5.45E-09	1.00		
8.89E+03	8.89E+03	1.00	5.37E-09	5.37E-09	1.00		
9.15E+03	9.15E+03	1.00	5.29E-09	5.29E-09	1.00		
9.40E+03	9.40E+03	1.00	5.21E-09	5.21E-09	1.00		
9.65E+03	9.65E+03	1.00	5.14E-09	5.14E-09	1.00		
9.91E+03	9.91E+03	1.00	5.06E-09	5.06E-09	1.00		
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00		
BI210	BI210	#VALUE!	BI210	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.30E-11	6.30E-11	1.00		
5.08E+02	5.08E+02	1.00	1.55E-09	1.55E-09	1.00		
7.62E+02	7.62E+02	1.00	5.44E-09	5.44E-09	1.00		
1.02E+03	1.02E+03	1.00	8.14E-09	8.14E-09	1.00		
1.27E+03	1.27E+03	1.00	8.33E-09	8.33E-09	1.00		
1.52E+03	1.52E+03	1.00	8.22E-09	8.22E-09	1.00		
1.78E+03	1.78E+03	1.00	8.10E-09	8.10E-09	1.00		
2.03E+03	2.03E+03	1.00	7.99E-09	7.99E-09	1.00		
2.29E+03	2.29E+03	1.00	7.87E-09	7.87E-09	1.00		
2.54E+03	2.54E+03	1.00	7.76E-09	7.76E-09	1.00		
2.79E+03	2.79E+03	1.00	7.64E-09	7.64E-09	1.00		
3.05E+03	3.05E+03	1.00	7.53E-09	7.53E-09	1.00		
3.30E+03	3.30E+03	1.00	7.42E-09	7.42E-09	1.00		
3.56E+03	3.56E+03	1.00	7.31E-09	7.31E-09	1.00		
3.81E+03	3.81E+03	1.00	7.21E-09	7.21E-09	1.00		
4.06E+03	4.06E+03	1.00	7.10E-09	7.10E-09	1.00		
4.32E+03	4.32E+03	1.00	7.00E-09	7.00E-09	1.00		
4.57E+03	4.57E+03	1.00	6.90E-09	6.90E-09	1.00		
4.83E+03	4.83E+03	1.00	6.80E-09	6.80E-09	1.00		

10/13/98 Results: ... (Cont)

CASE1A

5.08E+03	5.08E+03	1.00	6.70E-09	6.70E-09	1.00		
5.33E+03	5.33E+03	1.00	6.60E-09	6.60E-09	1.00		
5.59E+03	5.59E+03	1.00	6.50E-09	6.50E-09	1.00		
5.84E+03	5.84E+03	1.00	6.41E-09	6.41E-09	1.00		
6.10E+03	6.10E+03	1.00	6.32E-09	6.32E-09	1.00		
6.35E+03	6.35E+03	1.00	6.22E-09	6.22E-09	1.00		
6.61E+03	6.61E+03	1.00	6.13E-09	6.13E-09	1.00		
6.86E+03	6.86E+03	1.00	6.04E-09	6.04E-09	1.00		
7.11E+03	7.11E+03	1.00	5.95E-09	5.95E-09	1.00		
7.37E+03	7.37E+03	1.00	5.87E-09	5.87E-09	1.00		
7.62E+03	7.62E+03	1.00	5.78E-09	5.78E-09	1.00		
7.88E+03	7.88E+03	1.00	5.70E-09	5.70E-09	1.00		
8.13E+03	8.13E+03	1.00	5.61E-09	5.61E-09	1.00		
8.38E+03	8.38E+03	1.00	5.53E-09	5.53E-09	1.00		
8.64E+03	8.64E+03	1.00	5.45E-09	5.45E-09	1.00		
8.89E+03	8.89E+03	1.00	5.37E-09	5.37E-09	1.00		
9.15E+03	9.15E+03	1.00	5.29E-09	5.29E-09	1.00		
9.40E+03	9.40E+03	1.00	5.21E-09	5.21E-09	1.00		
9.65E+03	9.65E+03	1.00	5.14E-09	5.14E-09	1.00		
9.91E+03	9.91E+03	1.00	5.06E-09	5.06E-09	1.00		
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00		
PO210	PO210	#VALUE!	PO210	#VALUE!	#VALUE!	41 URANIUM-	U238
9.60E-06	9.60E-06	1.00	0.00E+00	0.00E+00	#DIV/0!		
2.54E+02	2.54E+02	1.00	6.28E-11	6.28E-11	1.00		
5.08E+02	5.08E+02	1.00	1.54E-09	1.54E-09	1.00		
7.62E+02	7.62E+02	1.00	5.43E-09	5.43E-09	1.00		
1.02E+03	1.02E+03	1.00	8.13E-09	8.13E-09	1.00		
1.27E+03	1.27E+03	1.00	8.31E-09	8.31E-09	1.00		
1.52E+03	1.52E+03	1.00	8.20E-09	8.20E-09	1.00		
1.78E+03	1.78E+03	1.00	8.09E-09	8.09E-09	1.00		
2.03E+03	2.03E+03	1.00	7.97E-09	7.97E-09	1.00		
2.29E+03	2.29E+03	1.00	7.85E-09	7.85E-09	1.00		
2.54E+03	2.54E+03	1.00	7.74E-09	7.74E-09	1.00		
2.79E+03	2.79E+03	1.00	7.63E-09	7.63E-09	1.00		
3.05E+03	3.05E+03	1.00	7.52E-09	7.52E-09	1.00		
3.30E+03	3.30E+03	1.00	7.41E-09	7.41E-09	1.00		
3.56E+03	3.56E+03	1.00	7.30E-09	7.30E-09	1.00		
3.81E+03	3.81E+03	1.00	7.19E-09	7.19E-09	1.00		
4.06E+03	4.06E+03	1.00	7.09E-09	7.09E-09	1.00		
4.32E+03	4.32E+03	1.00	6.98E-09	6.98E-09	1.00		
4.57E+03	4.57E+03	1.00	6.88E-09	6.88E-09	1.00		
4.83E+03	4.83E+03	1.00	6.78E-09	6.78E-09	1.00		
5.08E+03	5.08E+03	1.00	6.68E-09	6.68E-09	1.00		
5.33E+03	5.33E+03	1.00	6.59E-09	6.59E-09	1.00		
5.59E+03	5.59E+03	1.00	6.49E-09	6.49E-09	1.00		
5.84E+03	5.84E+03	1.00	6.40E-09	6.40E-09	1.00		
6.10E+03	6.10E+03	1.00	6.30E-09	6.30E-09	1.00		
6.35E+03	6.35E+03	1.00	6.21E-09	6.21E-09	1.00		
6.61E+03	6.61E+03	1.00	6.12E-09	6.12E-09	1.00		
6.86E+03	6.86E+03	1.00	6.03E-09	6.03E-09	1.00		
7.11E+03	7.11E+03	1.00	5.94E-09	5.94E-09	1.00		
7.37E+03	7.37E+03	1.00	5.85E-09	5.85E-09	1.00		
7.62E+03	7.62E+03	1.00	5.77E-09	5.77E-09	1.00		
7.88E+03	7.88E+03	1.00	5.68E-09	5.68E-09	1.00		
8.13E+03	8.13E+03	1.00	5.60E-09	5.60E-09	1.00		
8.38E+03	8.38E+03	1.00	5.52E-09	5.52E-09	1.00		

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Results: ... (Cont)

CASE1A

8.64E+03	8.64E+03	1.00	5.44E-09	5.44E-09	1.00		
8.89E+03	8.89E+03	1.00	5.36E-09	5.36E-09	1.00		
9.15E+03	9.15E+03	1.00	5.28E-09	5.28E-09	1.00		
9.40E+03	9.40E+03	1.00	5.20E-09	5.20E-09	1.00		
9.65E+03	9.65E+03	1.00	5.13E-09	5.13E-09	1.00		
9.91E+03	9.91E+03	1.00	5.05E-09	5.05E-09	1.00		
1.02E+04	1.02E+04	1.00	1.01E-12	1.01E-12	1.00		

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Results: ... (cont)

CASE1A

Final Comparison of CNWRA and PNL MEPAS 3.2g Results: CASE2A.WCF					
=====Surface Water Concentration Output (PAL 10/13/98)					
RADCON VERSION 05/01/1997					
WATERBORNE COMPONENT of the Multimedia Environmental					
Pollutant Assessment System (MEPAS): Models the					
movement of chemicals and radionuclides through vadose					
zone, saturated zone, surface water, and wetlands media.					
Pacific Northwest National Laboratory					
Operated for the U.S Department of Energy					
by Battelle Memorial Institute					
P.O. Box 999					
Richland, Washington 99352					
=====					
Run Name:		CASE2A			
Run Performed:		10/7/98	16:18:01	g/mL or pCi/mL	
=====					
PAL	PNL		PAL	PNL	
		Ratio	SW Conc.	SW Conc.	Ratio
Time (yr)	Time (yr)	PAL/PNL	U238	U238	PAL/PNL
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!
2.50E+02	2.50E+02	1.00	1.18E-05	1.18E-05	1.00
5.00E+02	5.00E+02	1.00	1.18E-05	1.18E-05	1.00
7.50E+02	7.50E+02	1.00	1.18E-05	1.18E-05	1.00
1.00E+03	1.00E+03	1.00	1.18E-05	1.18E-05	1.00
1.25E+03	1.25E+03	1.00	1.18E-05	1.18E-05	1.00
1.50E+03	1.50E+03	1.00	1.18E-05	1.18E-05	1.00
1.75E+03	1.75E+03	1.00	1.18E-05	1.18E-05	1.00
2.00E+03	2.00E+03	1.00	1.18E-05	1.18E-05	1.00
2.25E+03	2.25E+03	1.00	1.18E-05	1.18E-05	1.00
2.50E+03	2.50E+03	1.00	1.18E-05	1.18E-05	1.00
2.75E+03	2.75E+03	1.00	1.18E-05	1.18E-05	1.00
3.00E+03	3.00E+03	1.00	1.18E-05	1.18E-05	1.00
3.25E+03	3.25E+03	1.00	1.18E-05	1.18E-05	1.00
3.50E+03	3.50E+03	1.00	1.18E-05	1.18E-05	1.00
3.75E+03	3.75E+03	1.00	1.18E-05	1.18E-05	1.00
4.00E+03	4.00E+03	1.00	1.18E-05	1.18E-05	1.00
4.25E+03	4.25E+03	1.00	1.18E-05	1.18E-05	1.00
4.50E+03	4.50E+03	1.00	1.18E-05	1.18E-05	1.00
4.75E+03	4.75E+03	1.00	1.18E-05	1.18E-05	1.00
5.00E+03	5.00E+03	1.00	1.18E-05	1.18E-05	1.00
5.25E+03	5.25E+03	1.00	1.18E-05	1.18E-05	1.00
5.50E+03	5.50E+03	1.00	1.18E-05	1.18E-05	1.00
5.75E+03	5.75E+03	1.00	1.18E-05	1.18E-05	1.00
6.00E+03	6.00E+03	1.00	1.18E-05	1.18E-05	1.00
6.25E+03	6.25E+03	1.00	1.18E-05	1.18E-05	1.00
6.50E+03	6.50E+03	1.00	1.18E-05	1.18E-05	1.00
6.75E+03	6.75E+03	1.00	1.18E-05	1.18E-05	1.00
7.00E+03	7.00E+03	1.00	1.18E-05	1.18E-05	1.00
7.25E+03	7.25E+03	1.00	1.18E-05	1.18E-05	1.00
7.50E+03	7.50E+03	1.00	1.18E-05	1.18E-05	1.00
7.75E+03	7.75E+03	1.00	1.18E-05	1.18E-05	1.00
8.00E+03	8.00E+03	1.00	1.18E-05	1.18E-05	1.00
8.25E+03	8.25E+03	1.00	1.18E-05	1.18E-05	1.00

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Results: ... (cont)

CASE1A

8.50E+03	8.50E+03	1.00	1.18E-05	1.18E-05	1.00		
8.75E+03	8.75E+03	1.00	1.18E-05	1.18E-05	1.00		
9.00E+03	9.00E+03	1.00	1.18E-05	1.18E-05	1.00		
9.25E+03	9.25E+03	1.00	1.18E-05	1.18E-05	1.00		
9.50E+03	9.50E+03	1.00	1.18E-05	1.18E-05	1.00		
9.75E+03	9.75E+03	1.00	1.18E-05	1.18E-05	1.00		
1.00E+04	1.00E+04	1.00	4.66E-07	4.66E-07	1.00		
TH234	TH234	#VALUE!	TH234	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	1.19E-05	1.19E-05	1.00		
5.00E+02	5.00E+02	1.00	1.19E-05	1.19E-05	1.00		
7.50E+02	7.50E+02	1.00	1.19E-05	1.19E-05	1.00		
1.00E+03	1.00E+03	1.00	1.19E-05	1.19E-05	1.00		
1.25E+03	1.25E+03	1.00	1.19E-05	1.19E-05	1.00		
1.50E+03	1.50E+03	1.00	1.19E-05	1.19E-05	1.00		
1.75E+03	1.75E+03	1.00	1.19E-05	1.19E-05	1.00		
2.00E+03	2.00E+03	1.00	1.19E-05	1.19E-05	1.00		
2.25E+03	2.25E+03	1.00	1.19E-05	1.19E-05	1.00		
2.50E+03	2.50E+03	1.00	1.19E-05	1.19E-05	1.00		
2.75E+03	2.75E+03	1.00	1.19E-05	1.19E-05	1.00		
3.00E+03	3.00E+03	1.00	1.19E-05	1.19E-05	1.00		
3.25E+03	3.25E+03	1.00	1.19E-05	1.19E-05	1.00		
3.50E+03	3.50E+03	1.00	1.19E-05	1.19E-05	1.00		
3.75E+03	3.75E+03	1.00	1.19E-05	1.19E-05	1.00		
4.00E+03	4.00E+03	1.00	1.19E-05	1.19E-05	1.00		
4.25E+03	4.25E+03	1.00	1.19E-05	1.19E-05	1.00		
4.50E+03	4.50E+03	1.00	1.19E-05	1.19E-05	1.00		
4.75E+03	4.75E+03	1.00	1.19E-05	1.19E-05	1.00		
5.00E+03	5.00E+03	1.00	1.19E-05	1.19E-05	1.00		
5.25E+03	5.25E+03	1.00	1.19E-05	1.19E-05	1.00		
5.50E+03	5.50E+03	1.00	1.19E-05	1.19E-05	1.00		
5.75E+03	5.75E+03	1.00	1.19E-05	1.19E-05	1.00		
6.00E+03	6.00E+03	1.00	1.19E-05	1.19E-05	1.00		
6.25E+03	6.25E+03	1.00	1.19E-05	1.19E-05	1.00		
6.50E+03	6.50E+03	1.00	1.19E-05	1.19E-05	1.00		
6.75E+03	6.75E+03	1.00	1.19E-05	1.19E-05	1.00		
7.00E+03	7.00E+03	1.00	1.19E-05	1.19E-05	1.00		
7.25E+03	7.25E+03	1.00	1.19E-05	1.19E-05	1.00		
7.50E+03	7.50E+03	1.00	1.19E-05	1.19E-05	1.00		
7.75E+03	7.75E+03	1.00	1.19E-05	1.19E-05	1.00		
8.00E+03	8.00E+03	1.00	1.19E-05	1.19E-05	1.00		
8.25E+03	8.25E+03	1.00	1.19E-05	1.19E-05	1.00		
8.50E+03	8.50E+03	1.00	1.19E-05	1.19E-05	1.00		
8.75E+03	8.75E+03	1.00	1.19E-05	1.19E-05	1.00		
9.00E+03	9.00E+03	1.00	1.19E-05	1.19E-05	1.00		
9.25E+03	9.25E+03	1.00	1.19E-05	1.19E-05	1.00		
9.50E+03	9.50E+03	1.00	1.19E-05	1.19E-05	1.00		
9.75E+03	9.75E+03	1.00	1.19E-05	1.19E-05	1.00		
1.00E+04	1.00E+04	1.00	4.73E-07	4.73E-07	1.00		
U234	U234	#VALUE!	U234	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	1.98E-11	1.98E-11	1.00		
5.00E+02	5.00E+02	1.00	4.30E-11	4.30E-11	1.00		
7.50E+02	7.50E+02	1.00	6.62E-11	6.62E-11	1.00		
1.00E+03	1.00E+03	1.00	8.94E-11	8.94E-11	1.00		
1.25E+03	1.25E+03	1.00	1.13E-10	1.13E-10	1.00		

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Results: --- (cont)

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1.50E+03	1.50E+03	1.00	1.36E-10	1.36E-10	1.00		
1.75E+03	1.75E+03	1.00	1.59E-10	1.59E-10	1.00		
2.00E+03	2.00E+03	1.00	1.82E-10	1.82E-10	1.00		
2.25E+03	2.25E+03	1.00	2.05E-10	2.05E-10	1.00		
2.50E+03	2.50E+03	1.00	2.29E-10	2.29E-10	1.00		
2.75E+03	2.75E+03	1.00	2.52E-10	2.52E-10	1.00		
3.00E+03	3.00E+03	1.00	2.75E-10	2.75E-10	1.00		
3.25E+03	3.25E+03	1.00	2.98E-10	2.98E-10	1.00		
3.50E+03	3.50E+03	1.00	3.21E-10	3.21E-10	1.00		
3.75E+03	3.75E+03	1.00	3.45E-10	3.45E-10	1.00		
4.00E+03	4.00E+03	1.00	3.68E-10	3.68E-10	1.00		
4.25E+03	4.25E+03	1.00	3.91E-10	3.91E-10	1.00		
4.50E+03	4.50E+03	1.00	4.14E-10	4.14E-10	1.00		
4.75E+03	4.75E+03	1.00	4.37E-10	4.37E-10	1.00		
5.00E+03	5.00E+03	1.00	4.60E-10	4.60E-10	1.00		
5.25E+03	5.25E+03	1.00	4.84E-10	4.84E-10	1.00		
5.50E+03	5.50E+03	1.00	5.07E-10	5.07E-10	1.00		
5.75E+03	5.75E+03	1.00	5.30E-10	5.30E-10	1.00		
6.00E+03	6.00E+03	1.00	5.53E-10	5.53E-10	1.00		
6.25E+03	6.25E+03	1.00	5.76E-10	5.76E-10	1.00		
6.50E+03	6.50E+03	1.00	6.00E-10	6.00E-10	1.00		
6.75E+03	6.75E+03	1.00	6.23E-10	6.23E-10	1.00		
7.00E+03	7.00E+03	1.00	6.46E-10	6.46E-10	1.00		
7.25E+03	7.25E+03	1.00	6.69E-10	6.69E-10	1.00		
7.50E+03	7.50E+03	1.00	6.92E-10	6.92E-10	1.00		
7.75E+03	7.75E+03	1.00	7.16E-10	7.16E-10	1.00		
8.00E+03	8.00E+03	1.00	7.39E-10	7.39E-10	1.00		
8.25E+03	8.25E+03	1.00	7.62E-10	7.62E-10	1.00		
8.50E+03	8.50E+03	1.00	7.85E-10	7.85E-10	1.00		
8.75E+03	8.75E+03	1.00	8.08E-10	8.08E-10	1.00		
9.00E+03	9.00E+03	1.00	8.31E-10	8.31E-10	1.00		
9.25E+03	9.25E+03	1.00	8.54E-10	8.54E-10	1.00		
9.50E+03	9.50E+03	1.00	8.78E-10	8.78E-10	1.00		
9.75E+03	9.75E+03	1.00	9.01E-10	9.01E-10	1.00		
1.00E+04	1.00E+04	1.00	3.58E-11	3.58E-11	1.00		
TH230	TH230	#VALUE!	TH230	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	5.73E-17	5.73E-17	1.00		
5.00E+02	5.00E+02	1.00	2.52E-16	2.52E-16	1.00		
7.50E+02	7.50E+02	1.00	5.97E-16	5.97E-16	1.00		
1.00E+03	1.00E+03	1.00	1.08E-15	1.08E-15	1.00		
1.25E+03	1.25E+03	1.00	1.93E-15	1.93E-15	1.00		
1.50E+03	1.50E+03	1.00	2.79E-15	2.79E-15	1.00		
1.75E+03	1.75E+03	1.00	3.64E-15	3.64E-15	1.00		
2.00E+03	2.00E+03	1.00	4.49E-15	4.49E-15	1.00		
2.25E+03	2.25E+03	1.00	5.92E-15	5.92E-15	1.00		
2.50E+03	2.50E+03	1.00	7.36E-15	7.36E-15	1.00		
2.75E+03	2.75E+03	1.00	8.79E-15	8.79E-15	1.00		
3.00E+03	3.00E+03	1.00	1.02E-14	1.02E-14	1.00		
3.25E+03	3.25E+03	1.00	1.22E-14	1.22E-14	1.00		
3.50E+03	3.50E+03	1.00	1.43E-14	1.43E-14	1.00		
3.75E+03	3.75E+03	1.00	1.63E-14	1.63E-14	1.00		
4.00E+03	4.00E+03	1.00	1.83E-14	1.83E-14	1.00		
4.25E+03	4.25E+03	1.00	2.09E-14	2.09E-14	1.00		
4.50E+03	4.50E+03	1.00	2.35E-14	2.35E-14	1.00		
4.75E+03	4.75E+03	1.00	2.61E-14	2.61E-14	1.00		

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Results: --- (cont)

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5.00E+03	5.00E+03	1.00	2.87E-14	2.87E-14	1.00		
5.25E+03	5.25E+03	1.00	3.19E-14	3.19E-14	1.00		
5.50E+03	5.50E+03	1.00	3.50E-14	3.50E-14	1.00		
5.75E+03	5.75E+03	1.00	3.82E-14	3.82E-14	1.00		
6.00E+03	6.00E+03	1.00	4.14E-14	4.14E-14	1.00		
6.25E+03	6.25E+03	1.00	4.52E-14	4.52E-14	1.00		
6.50E+03	6.50E+03	1.00	4.89E-14	4.89E-14	1.00		
6.75E+03	6.75E+03	1.00	5.27E-14	5.27E-14	1.00		
7.00E+03	7.00E+03	1.00	5.65E-14	5.65E-14	1.00		
7.25E+03	7.25E+03	1.00	6.08E-14	6.08E-14	1.00		
7.50E+03	7.50E+03	1.00	6.51E-14	6.51E-14	1.00		
7.75E+03	7.75E+03	1.00	6.95E-14	6.95E-14	1.00		
8.00E+03	8.00E+03	1.00	7.39E-14	7.39E-14	1.00		
8.25E+03	8.25E+03	1.00	7.88E-14	7.88E-14	1.00		
8.50E+03	8.50E+03	1.00	8.37E-14	8.37E-14	1.00		
8.75E+03	8.75E+03	1.00	8.86E-14	8.86E-14	1.00		
9.00E+03	9.00E+03	1.00	9.36E-14	9.36E-14	1.00		
9.25E+03	9.25E+03	1.00	9.91E-14	9.91E-14	1.00		
9.50E+03	9.50E+03	1.00	1.05E-13	1.05E-13	1.00		
9.75E+03	9.75E+03	1.00	1.10E-13	1.10E-13	1.00		
1.00E+04	1.00E+04	1.00	4.37E-15	4.37E-15	1.00		
RA226	RA226	#VALUE!	RA226	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	5.59E-21	1.60E-27	3489082.97		
5.00E+02	5.00E+02	1.00	4.73E-20	3.05E-27	15523465.70		
7.50E+02	7.50E+02	1.00	1.74E-19	4.49E-27	38641425.39		
1.00E+03	1.00E+03	1.00	4.22E-19	4.22E-19	1.00		
1.25E+03	1.25E+03	1.00	1.20E-18	1.20E-18	1.00		
1.50E+03	1.50E+03	1.00	1.98E-18	1.98E-18	1.00		
1.75E+03	1.75E+03	1.00	2.76E-18	2.76E-18	1.00		
2.00E+03	2.00E+03	1.00	3.56E-18	3.56E-18	1.00		
2.25E+03	2.25E+03	1.00	5.71E-18	5.71E-18	1.00		
2.50E+03	2.50E+03	1.00	7.87E-18	7.87E-18	1.00		
2.75E+03	2.75E+03	1.00	1.00E-17	1.00E-17	1.00		
3.00E+03	3.00E+03	1.00	1.22E-17	1.22E-17	1.00		
3.25E+03	3.25E+03	1.00	1.64E-17	1.64E-17	1.00		
3.50E+03	3.50E+03	1.00	2.07E-17	2.07E-17	1.00		
3.75E+03	3.75E+03	1.00	2.49E-17	2.49E-17	1.00		
4.00E+03	4.00E+03	1.00	2.92E-17	2.92E-17	1.00		
4.25E+03	4.25E+03	1.00	3.62E-17	3.62E-17	1.00		
4.50E+03	4.50E+03	1.00	4.32E-17	4.32E-17	1.00		
4.75E+03	4.75E+03	1.00	5.02E-17	5.02E-17	1.00		
5.00E+03	5.00E+03	1.00	5.73E-17	5.73E-17	1.00		
5.25E+03	5.25E+03	1.00	6.77E-17	6.77E-17	1.00		
5.50E+03	5.50E+03	1.00	7.82E-17	7.82E-17	1.00		
5.75E+03	5.75E+03	1.00	8.87E-17	8.87E-17	1.00		
6.00E+03	6.00E+03	1.00	9.93E-17	9.93E-17	1.00		
6.25E+03	6.25E+03	1.00	1.14E-16	1.14E-16	1.00		
6.50E+03	6.50E+03	1.00	1.29E-16	1.29E-16	1.00		
6.75E+03	6.75E+03	1.00	1.43E-16	1.43E-16	1.00		
7.00E+03	7.00E+03	1.00	1.58E-16	1.58E-16	1.00		
7.25E+03	7.25E+03	1.00	1.78E-16	1.78E-16	1.00		
7.50E+03	7.50E+03	1.00	1.97E-16	1.97E-16	1.00		
7.75E+03	7.75E+03	1.00	2.17E-16	2.17E-16	1.00		
8.00E+03	8.00E+03	1.00	2.36E-16	2.36E-16	1.00		
8.25E+03	8.25E+03	1.00	2.61E-16	2.61E-16	1.00		

see pg 27
in notebook 281
for explanation
of discrepancies

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8.50E+03	8.50E+03	1.00	2.86E-16	2.86E-16	1.00		
8.75E+03	8.75E+03	1.00	3.12E-16	3.12E-16	1.00		
9.00E+03	9.00E+03	1.00	3.37E-16	3.37E-16	1.00		
9.25E+03	9.25E+03	1.00	3.68E-16	3.68E-16	1.00		
9.50E+03	9.50E+03	1.00	3.99E-16	3.99E-16	1.00		
9.75E+03	9.75E+03	1.00	4.31E-16	4.31E-16	1.00		
1.00E+04	1.00E+04	1.00	1.71E-17	1.71E-17	1.00		
RN222	RN222	#VALUE!	RN222	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	4.89E-21	6.53E-22	7.48		
5.00E+02	5.00E+02	1.00	4.67E-20	6.53E-22	71.46		
7.50E+02	7.50E+02	1.00	1.72E-19	6.53E-22	263.09		
1.00E+03	1.00E+03	1.00	4.20E-19	6.53E-22	642.49		
1.25E+03	1.25E+03	1.00	1.20E-18	1.20E-18	1.00		
1.50E+03	1.50E+03	1.00	1.99E-18	1.99E-18	1.00		
1.75E+03	1.75E+03	1.00	2.77E-18	2.77E-18	1.00		
2.00E+03	2.00E+03	1.00	3.57E-18	3.57E-18	1.00		
2.25E+03	2.25E+03	1.00	5.73E-18	5.73E-18	1.00		
2.50E+03	2.50E+03	1.00	7.90E-18	7.90E-18	1.00		
2.75E+03	2.75E+03	1.00	1.01E-17	1.01E-17	1.00		
3.00E+03	3.00E+03	1.00	1.23E-17	1.23E-17	1.00		
3.25E+03	3.25E+03	1.00	1.65E-17	1.65E-17	1.00		
3.50E+03	3.50E+03	1.00	2.08E-17	2.08E-17	1.00		
3.75E+03	3.75E+03	1.00	2.51E-17	2.51E-17	1.00		
4.00E+03	4.00E+03	1.00	2.94E-17	2.94E-17	1.00		
4.25E+03	4.25E+03	1.00	3.64E-17	3.64E-17	1.00		
4.50E+03	4.50E+03	1.00	4.35E-17	4.35E-17	1.00		
4.75E+03	4.75E+03	1.00	5.06E-17	5.06E-17	1.00		
5.00E+03	5.00E+03	1.00	5.78E-17	5.78E-17	1.00		
5.25E+03	5.25E+03	1.00	6.83E-17	6.83E-17	1.00		
5.50E+03	5.50E+03	1.00	7.89E-17	7.89E-17	1.00		
5.75E+03	5.75E+03	1.00	8.94E-17	8.94E-17	1.00		
6.00E+03	6.00E+03	1.00	1.00E-16	1.00E-16	1.00		
6.25E+03	6.25E+03	1.00	1.15E-16	1.15E-16	1.00		
6.50E+03	6.50E+03	1.00	1.30E-16	1.30E-16	1.00		
6.75E+03	6.75E+03	1.00	1.45E-16	1.45E-16	1.00		
7.00E+03	7.00E+03	1.00	1.59E-16	1.59E-16	1.00		
7.25E+03	7.25E+03	1.00	1.79E-16	1.79E-16	1.00		
7.50E+03	7.50E+03	1.00	1.99E-16	1.99E-16	1.00		
7.75E+03	7.75E+03	1.00	2.19E-16	2.19E-16	1.00		
8.00E+03	8.00E+03	1.00	2.39E-16	2.39E-16	1.00		
8.25E+03	8.25E+03	1.00	2.64E-16	2.64E-16	1.00		
8.50E+03	8.50E+03	1.00	2.89E-16	2.89E-16	1.00		
8.75E+03	8.75E+03	1.00	3.14E-16	3.14E-16	1.00		
9.00E+03	9.00E+03	1.00	3.40E-16	3.40E-16	1.00		
9.25E+03	9.25E+03	1.00	3.72E-16	3.72E-16	1.00		
9.50E+03	9.50E+03	1.00	4.03E-16	4.03E-16	1.00		
9.75E+03	9.75E+03	1.00	4.35E-16	4.35E-16	1.00		
1.00E+04	1.00E+04	1.00	1.73E-17	1.73E-17	1.00		
PB210	PB210	#VALUE!	PB210	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	2.73E-22	2.61E-22	1.05		
5.00E+02	5.00E+02	1.00	7.14E-22	2.61E-22	2.74		
7.50E+02	7.50E+02	1.00	2.99E-21	2.61E-22	11.49		
1.00E+03	1.00E+03	1.00	9.25E-21	2.61E-22	35.51		
1.25E+03	1.25E+03	1.00	4.50E-20	2.61E-22	172.52		

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Results: ... (cont)

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1.50E+03	1.50E+03	1.00	8.08E-20	2.61E-22	309.98		
1.75E+03	1.75E+03	1.00	1.17E-19	2.61E-22	447.43		
2.00E+03	2.00E+03	1.00	1.54E-19	2.61E-22	589.03		
2.25E+03	2.25E+03	1.00	3.09E-19	2.61E-22	1187.26		
2.50E+03	2.50E+03	1.00	4.66E-19	4.66E-19	1.00		
2.75E+03	2.75E+03	1.00	6.23E-19	6.23E-19	1.00		
3.00E+03	3.00E+03	1.00	7.84E-19	7.84E-19	1.00		
3.25E+03	3.25E+03	1.00	1.20E-18	1.20E-18	1.00		
3.50E+03	3.50E+03	1.00	1.62E-18	1.62E-18	1.00		
3.75E+03	3.75E+03	1.00	2.04E-18	2.04E-18	1.00		
4.00E+03	4.00E+03	1.00	2.47E-18	2.47E-18	1.00		
4.25E+03	4.25E+03	1.00	3.33E-18	3.33E-18	1.00		
4.50E+03	4.50E+03	1.00	4.21E-18	4.21E-18	1.00		
4.75E+03	4.75E+03	1.00	5.08E-18	5.08E-18	1.00		
5.00E+03	5.00E+03	1.00	5.97E-18	5.97E-18	1.00		
5.25E+03	5.25E+03	1.00	7.53E-18	7.53E-18	1.00		
5.50E+03	5.50E+03	1.00	9.09E-18	9.09E-18	1.00		
5.75E+03	5.75E+03	1.00	1.07E-17	1.07E-17	1.00		
6.00E+03	6.00E+03	1.00	1.23E-17	1.23E-17	1.00		
6.25E+03	6.25E+03	1.00	1.48E-17	1.48E-17	1.00		
6.50E+03	6.50E+03	1.00	1.73E-17	1.73E-17	1.00		
6.75E+03	6.75E+03	1.00	1.98E-17	1.98E-17	1.00		
7.00E+03	7.00E+03	1.00	2.24E-17	2.24E-17	1.00		
7.25E+03	7.25E+03	1.00	2.62E-17	2.62E-17	1.00		
7.50E+03	7.50E+03	1.00	3.00E-17	3.00E-17	1.00		
7.75E+03	7.75E+03	1.00	3.39E-17	3.39E-17	1.00		
8.00E+03	8.00E+03	1.00	3.78E-17	3.78E-17	1.00		
8.25E+03	8.25E+03	1.00	4.32E-17	4.32E-17	1.00		
8.50E+03	8.50E+03	1.00	4.86E-17	4.86E-17	1.00		
8.75E+03	8.75E+03	1.00	5.41E-17	5.41E-17	1.00		
9.00E+03	9.00E+03	1.00	5.97E-17	5.97E-17	1.00		
9.25E+03	9.25E+03	1.00	6.71E-17	6.71E-17	1.00		
9.50E+03	9.50E+03	1.00	7.46E-17	7.46E-17	1.00		
9.75E+03	9.75E+03	1.00	8.21E-17	8.21E-17	1.00		
1.00E+04	1.00E+04	1.00	3.27E-18	3.27E-18	1.00		
BI210	BI210	#VALUE!	BI210	#VALUE!	#VALUE!	41 URANIUM-	U238
0.00E+00	0.00E+00	#DIV/0!	0.00E+00	0.00E+00	#DIV/0!		
2.50E+02	2.50E+02	1.00	1.77E-27	1.77E-27	1.00		
5.00E+02	5.00E+02	1.00	3.63E-27	3.63E-27	1.00		
7.50E+02	7.50E+02	1.00	5.49E-27	5.49E-27	1.00		
1.00E+03	1.00E+03	1.00	8.66E-21	7.35E-27	1178387.35		
1.25E+03	1.25E+03	1.00	4.37E-20	9.21E-27	4745357.80		
1.50E+03	1.50E+03	1.00	7.88E-20	1.11E-26	7121951.22		
1.75E+03	1.75E+03	1.00	1.14E-19	1.29E-26	8816705.34		
2.00E+03	2.00E+03	1.00	1.50E-19	1.48E-26	10155510.48		
2.25E+03	2.25E+03	1.00	3.04E-19	1.67E-26	18252252.25		
2.50E+03	2.50E+03	1.00	4.59E-19	4.59E-19	1.00		
2.75E+03	2.75E+03	1.00	6.13E-19	6.13E-19	1.00		
3.00E+03	3.00E+03	1.00	7.71E-19	7.71E-19	1.00		
3.25E+03	3.25E+03	1.00	1.18E-18	1.18E-18	1.00		
3.50E+03	3.50E+03	1.00	1.60E-18	1.60E-18	1.00		
3.75E+03	3.75E+03	1.00	2.01E-18	2.01E-18	1.00		
4.00E+03	4.00E+03	1.00	2.44E-18	2.44E-18	1.00		
4.25E+03	4.25E+03	1.00	3.30E-18	3.30E-18	1.00		
4.50E+03	4.50E+03	1.00	4.16E-18	4.16E-18	1.00		
4.75E+03	4.75E+03	1.00	5.03E-18	5.03E-18	1.00		

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Results: ... (cont)

CASE1A

5.00E+03	5.00E+03	1.00	5.91E-18	5.91E-18	1.00			
5.25E+03	5.25E+03	1.00	7.45E-18	7.45E-18	1.00			
5.50E+03	5.50E+03	1.00	9.00E-18	9.00E-18	1.00			
5.75E+03	5.75E+03	1.00	1.06E-17	1.06E-17	1.00			
6.00E+03	6.00E+03	1.00	1.21E-17	1.21E-17	1.00			
6.25E+03	6.25E+03	1.00	1.46E-17	1.46E-17	1.00			
6.50E+03	6.50E+03	1.00	1.71E-17	1.71E-17	1.00			
6.75E+03	6.75E+03	1.00	1.97E-17	1.97E-17	1.00			
7.00E+03	7.00E+03	1.00	2.22E-17	2.22E-17	1.00			
7.25E+03	7.25E+03	1.00	2.60E-17	2.60E-17	1.00			
7.50E+03	7.50E+03	1.00	2.98E-17	2.98E-17	1.00			
7.75E+03	7.75E+03	1.00	3.36E-17	3.36E-17	1.00			
8.00E+03	8.00E+03	1.00	3.74E-17	3.74E-17	1.00			
8.25E+03	8.25E+03	1.00	4.28E-17	4.28E-17	1.00			
8.50E+03	8.50E+03	1.00	4.82E-17	4.82E-17	1.00			
8.75E+03	8.75E+03	1.00	5.37E-17	5.37E-17	1.00			
9.00E+03	9.00E+03	1.00	5.92E-17	5.92E-17	1.00			
9.25E+03	9.25E+03	1.00	6.66E-17	6.66E-17	1.00			
9.50E+03	9.50E+03	1.00	7.40E-17	7.40E-17	1.00			
9.75E+03	9.75E+03	1.00	8.14E-17	8.14E-17	1.00			
1.00E+04	1.00E+04	1.00	3.24E-18	3.24E-18	1.00			
PO210	PO210	#VALUE!	PO210	#VALUE!	#VALUE!	41 URANIUM-	U238	
0.00E+00	0.00E+00		0.00E+00	0.00E+00	#DIV/0!			
2.50E+02	2.50E+02	1.00	1.02E-21	1.02E-21	1.00			
5.00E+02	5.00E+02	1.00	1.02E-21	1.02E-21	1.00			
7.50E+02	7.50E+02	1.00	1.02E-21	1.02E-21	1.00			
1.00E+03	1.00E+03	1.00	2.59E-21	1.02E-21	2.55			
1.25E+03	1.25E+03	1.00	1.52E-20	1.02E-21	14.94			
1.50E+03	1.50E+03	1.00	2.78E-20	1.02E-21	27.35			
1.75E+03	1.75E+03	1.00	4.04E-20	1.02E-21	39.76			
2.00E+03	2.00E+03	1.00	5.32E-20	1.02E-21	52.38			
2.25E+03	2.25E+03	1.00	1.15E-19	1.02E-21	113.39			
2.50E+03	2.50E+03	1.00	1.77E-19	1.02E-21	174.51			
2.75E+03	2.75E+03	1.00	2.39E-19	1.02E-21	235.63			
3.00E+03	3.00E+03	1.00	3.02E-19	1.02E-21	297.44			
3.25E+03	3.25E+03	1.00	4.79E-19	4.79E-19	1.00			
3.50E+03	3.50E+03	1.00	6.56E-19	6.56E-19	1.00			
3.75E+03	3.75E+03	1.00	8.33E-19	8.33E-19	1.00			
4.00E+03	4.00E+03	1.00	1.01E-18	1.01E-18	1.00			
4.25E+03	4.25E+03	1.00	1.39E-18	1.39E-18	1.00			
4.50E+03	4.50E+03	1.00	1.78E-18	1.78E-18	1.00			
4.75E+03	4.75E+03	1.00	2.16E-18	2.16E-18	1.00			
5.00E+03	5.00E+03	1.00	2.55E-18	2.55E-18	1.00			
5.25E+03	5.25E+03	1.00	3.25E-18	3.25E-18	1.00			
5.50E+03	5.50E+03	1.00	3.95E-18	3.95E-18	1.00			
5.75E+03	5.75E+03	1.00	4.65E-18	4.65E-18	1.00			
6.00E+03	6.00E+03	1.00	5.36E-18	5.36E-18	1.00			
6.25E+03	6.25E+03	1.00	6.51E-18	6.51E-18	1.00			
6.50E+03	6.50E+03	1.00	7.67E-18	7.67E-18	1.00			
6.75E+03	6.75E+03	1.00	8.83E-18	8.83E-18	1.00			
7.00E+03	7.00E+03	1.00	1.00E-17	1.00E-17	1.00			
7.25E+03	7.25E+03	1.00	1.18E-17	1.18E-17	1.00			
7.50E+03	7.50E+03	1.00	1.35E-17	1.35E-17	1.00			
7.75E+03	7.75E+03	1.00	1.53E-17	1.53E-17	1.00			
8.00E+03	8.00E+03	1.00	1.71E-17	1.71E-17	1.00			
8.25E+03	8.25E+03	1.00	1.96E-17	1.96E-17	1.00			

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Results: ... (cont)

CASE1A

8.50E+03	8.50E+03	1.00	2.22E-17	2.22E-17	1.00			
8.75E+03	8.75E+03	1.00	2.47E-17	2.47E-17	1.00			
9.00E+03	9.00E+03	1.00	2.73E-17	2.73E-17	1.00			
9.25E+03	9.25E+03	1.00	3.08E-17	3.08E-17	1.00			
9.50E+03	9.50E+03	1.00	3.43E-17	3.43E-17	1.00			
9.75E+03	9.75E+03	1.00	3.78E-17	3.78E-17	1.00			
1.00E+04	1.00E+04	1.00	6.75E-19	6.75E-19	1.00			

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Results: ... (cont)

Additional results are continued in notebook # 281
due to lack of space in this notebook.

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and MELAS software packages, is prepared
in the correct format and contains the
information needed for another qualified
engineer or scientist to replicate the work
herein.

Steven Willmeyer

5/15/2000

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