15 Stat # 19
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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 603231

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
DISTRIBUTION	Standards & Requirements /8M710	
5. Proj./Prog./Dept./Div.:	**6. Cog. Engr.:**	**7. Purchase Order No.:**
SNFP	C. L. Bennett	N/A
8. Originator Remarks:		**9. Equip./Component No.:**
Approval/Release of Software Package KE-PU		N/A
		10. System/Bldg./Facility:
		105-KE Basins/100K
11. Receiver Remarks:		**12. Major Assm. Dwg. No.:**
N/A		N/A
		13. Permit/Permit Application No.:
		N/A
		14. Required Response Date:

15. DATA TRANSMITTED

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1	WHC-SD-SNF-CSWD-002	N/A	0	VALIDATION AND CONFIGURATION MANAGEMENT PLAN FOR THE KE-BASINS KE-PU SPREADSHEET CODE	SQ	1,1	1	

18. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 4. Review 2. Release 5. Post-Review 3. Information 6. Dist. (Receipt Acknow. Required)	1. Approved 4. Reviewed no/comment 2. Approved w/comment 5. Reviewed w/comment 3. Disapproved w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
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(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. C. L. Bennett	C L Bennett	3/7/96	X3-79						
1	1	Cog. Mgr. C DeFigh-Price	C DeFigh-Price	3/6/96	X3-79						
1	1	QA G. W. Davis	G W Davis	3/11/96	X3-80						
1	1	Safety D. O. Hess	D O Hess	3/8/96	X3-80						
		Env.									
1	1	R. A. Harris	R A Harris	3/6/96	H0-40						

18.	19.	20.	21. DOE APPROVAL (if required) Ctrl. No.
C. L. Bennett C L Bennett 3/11/96 Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	C DeFigh-Price C DeFigh-Price 3/6/96 Cognizant Manager Date	[ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

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VALIDATION AND CONFIGURATION MANAGEMENT PLAN FOR THE KE-BASINS KE-PU SPREADSHEET CODE

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U.S. Department of Energy Contract DE-AC06-87RL10930

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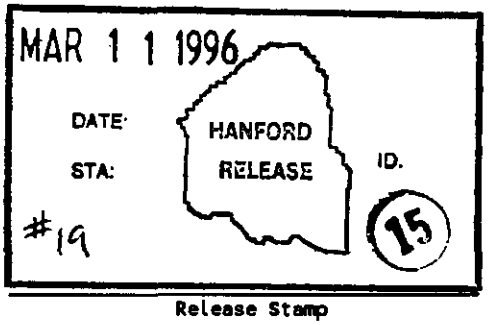
Key Words: K Basins, Operations Safety Requirement, Process Standard, Spent Nuclear Fuel Project, spreadsheet, and Quattro.

Abstract: This report provides documentation of the spreadsheet KE-PU software that is used to verify compliance with the Operational Safety Requirement and Process Standard limit on the amount of plutonium in the KE-Basin sandfilter backwash pit. Included are:

a summary of the verification of the method and technique used in KE-PU that were documented elsewhere,
the requirements, plans, and results of validation tests that confirm the proper functioning of the software,
the procedures and approvals required to make changes to the software, and
and the method used to maintain configuration control over the software.



Release Approval — Date: 3/11/96

Release Stamp

Approved for Public Release

VALIDATION AND CONFIGURATION MANAGEMENT PLAN FOR THE KE-BASINS KE-PU SPREADSHEET CODE

R. A. Harris
Westinghouse Hanford Company

March 6, 1996

CONTENTS

VALIDATION AND CONFIGURATION MANAGEMENT PLAN FOR THE KE-BASINS KE-PU SPREADSHEET CODE

1.0 INTRODUCTION

During each backwash of the 105KE-Basin sandfilter, samples of the backwash flow liquid are collected. These samples are analyzed to determine how much plutonium was added to the sandfilter backwash pit (SFBWP) during each backwash. The total amount of plutonium added is then used to verify compliance with the Operational Safety Requirements (OSR)(WHC-SD-WM-OSR-006 1996) and Process Standard (PS)(304 1996) limits on the plutonium content of the SFBWP. The analysis of the data and the evaluation of the uncertainties in the parameters used in that verification are quite complicated (Harris 1995). For this reason most of the calculations are performed with Quattro® Pro 5.0 spreadsheets.

The subject spreadsheets are used primarily to provide predictions of the amounts of plutonium that will be added in subsequent backwashes (See Harris, 1995.) These predictions must, of course, recognize the measured plutonium additions from previous backwashes. Therefore, it is convenient to maintain these measurements and perform any required analyses in the prediction spreadsheets. Most of the sections (pages) of the spreadsheets support the predictions and have nothing to do with OSR and PS verifications. Only the analyses on spreadsheet page "Limit" and the macro executables "\0" and "\I", on page "macros" are used in these verifications. These three items are given the collective software name "KE-PU" Note that this name does not include any of the other information in the spreadsheets..

During actual use the subject spreadsheets will have names of the form KE-PU??.WB1 where ?? varies depending on the number of backwashes, the time in a backwash cycle, etc.. These name changes are described in operating procedure for that governs routine use and maintenance of the spreadsheet (CP-07-006E 1996).

The following sections provide the plans, information, and results deemed appropriate for this small application that was developed in-house. WHC-CM-4-2, REV 1, "Quality Assurance Manual," Section QR 19.0, "Software Quality Assurance Requirements," and WHC-CM-3-10, REV 0, "Software Practices," Section SP-3.4, "Small Job Development", were the bases used to select the contents of this document.

2.0 FUNCTIONS

The equations that must be solved to determine the total amount plutonium in the SFBWP at the 95% confidence level are described in Sections 3.1 and 3.3.1 of Harris, 1995. Basically, the nominal plutonium addition is increased by a margin that reflects the uncertainty in the measurements. This margin is obtained from the Student's T-Distribution and the effective degrees of freedom and variance of the nominal total amount of plutonium in the SFBWP.

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The sequence of steps and the calculations that the spreadsheet must perform are described in Section 3.4 of Harris, 1995.

3.0 VERIFICATION AND VALIDATION

3.1 VERIFICATION

The document describing the method of analysis and the actual equations employed for verifying compliance with the OSR and PS limits (Harris 1995) was reviewed (verified) by independent reviewers. This review is documented on page ii of Harris, 1995. A second independent review covering only the statistical content of the document was also obtained. The document was also reviewed and approved by Safety and Quality Assurance. These latter approvals are documented on the Engineering Data Transmittal form (EDT 610172, June 5, 1995) that distributed the document. It is not necessary to verify the commercial spreadsheet software package, Quattro Pro.

3.2 VALIDATION

The operation of the spreadsheet and the calculations it performs were validated with a test case consisting of a special set of test data and several spreadsheet operation checks. This test data is also used routinely to validate the spreadsheet during normal operation as shown in Section 4.4. The data are contained in the instructions for the macro "\0". A simple modifications to this macro is required for the validation check. That modification stops the macro so that the test case results can be observed. Under normal use, the macro will complete and reload any real data before returning control to the user. Familiarity with the Quattro Pro spreadsheet program, beyond that needed by the normal user, is required for the validation check. The activities required to perform each step of the validation test, the function that is being tested, and the correct spreadsheet response are listed below.

- Load the record copy of the spreadsheet (KE-PU0-0.WB1 for version 0.0.)
  (File|Open|file address and name|ok)

  ✓Verify that the macro "\0" was performed satisfactorily (No indication of errors.)

- Save the spreadsheet with a different name to ensure that any changes made for this test are not saved in the record copy of the software. (File|Save As|test.wb1|ok)
- Change to page "Limit." ("Limit" tab)
- Remove cell protection on page "Limit." (Property|Active Page|Protection|Disable|ok)
- Add the quantify 1e-08 to the formula under "% Unct" in row one of the data table.
  (Cursor on cell, F2|+1e-08|return)
- Manually run the "\0" macro. (Tools|Macro|Execute|scroll to "\0"|ok)

  ✓Verify that the spreadsheet detects an error, and saves the file to "C:\FAILURE.WB1."
  ✓Verify that there are cells containing "ERR" on page "Limit."
  ✓Verify that the change made in row one is now in the formulas in all rows.

- Close the FAILURE.WB1 file. (File|Close|No)
- Load the test copy of the spreadsheet. (File|Open|directory test.wb1|ok)

- Change to page "Limit." ("Limit" tab)
- Select volume methods a and b.

  ✓Verify that the volume uncertainty (green) reflects the method chosen.

- Attempt to change cells that are not shaded gray.

  ✓Verify that only gray-shaded cells can be changed.

- Place the cursor on the first column of the green "Insert New Rows For New Data" and select the "I" macro from the toolbar.

  ✓Verify that a new row for data is created and that it contains the correct formulas in the last 5 columns. Confirm that the non-gray cells are still protected.

- Remove cell protection on page "Limit." (Property|Active Page|Protection|Disable|ok)
- Delete the formulas (last five columns) in all but the first row in the data table.
- Manually run the "\0" macro. (Tools|Macro|Execute|scroll to "\0"|ok)
- Return to page "Limit". ("Limit" tab)

  ✓Verify that the formulas in all rows are the same as those in row one.

- Modify macro "\0" by 1) selecting the "macros" page. ("macros" tab),
  2) removing cell protection.
  (Property|Active Page|Protection|Disable|ok),
  3) inserting a blank row before the statement "{Calc}{IF @..." in macro "\0". (Cursor on "{Calc}", Block|Insert|Rows|ok).
- Manually run the "\0" macro. (Tools|Macro|Execute|scroll to "\0"|ok)
- Enable automatic recalculation. (Property|Active Notebook|Automatic|ok)

  ✓Verify that the volume uncertainty in row one is that shown above for method c.
  ✓Verify that the volume uncertainty in row two is that shown at the top of the spreadsheet page for method a.
  ✓Verify that the volume uncertainty in row two is that shown at the top of the spreadsheet page for method a.
  ✓Verify that the volume uncertainty in row three is that shown at the top of the spreadsheet page for method b.
  ✓Verify that the "New additions" in row one are the values shown in "Grams of Pu added..."

- Confirm the correctness of the calculated parameters listed below. The computer display produced by the modified macro "\0" is reproduced in Appendix A. The values of the "input" variables used in the calculations are shown in Appendix A in bold type, surrounded by heavy outlines. The calculated parameters are also shown in Appendix A but are surrounded by double lines. The equation number or section number of Harris, 1995 used in the calculation, the input values, and the calculated values are listed below for each parameter.

✓Volume calculated from water level heights (method c)
Method: Equation in Section 3.3.2.c, Harris, 1995.
Input: 13'-1", 11'-3"
Output: 4653.07 "Volume"

✓Uncertainty in volume calculated from method c
Method: Equation in Section 3.3.2.c, Harris, 1995.
Input: 2538.04 * 0.5 / 12 * √2 * 100 / 4653.073
Output: 3.21412 "Unct"

✓Grams of plutonium added (from each sample)
Method: Equation in Section 3.4, Harris, 1995.
Input: 23.2; 27.1; and 4653.07
Output: "Grams of Pu added to SFBWP" 1.31701; 1.5384

✓The degrees of freedom for each backwash (should reflect missing data point)
Method: Last paragraph, Section 3.1, Harris, 1995.
Input: 1.317,1.5384; 4.3,4.2,4.0; 1.1,1.2,1.465; 1e-10,1e-10
Output: "Degrees of Freedom" 1; 2; 2; 1

✓The uncertainty in the laboratory data. (Quadratically combined with volume uncertainty in column "sigma")
Method: SQRT(Variance of the mean (Section 3.1 Harris, 1995) plus (volume unct)^2)
Input: Grams listed above and volume uncertainties;
3.2141; 2; 8.8; 0.0
Output: "sigma" 0.11983; 0.12134; 0.1551; 0

✓The variance of the total amount of plutonium.
Method: Equation (3), Harris, 1995.
Input: Above uncertainties (squared) plus the uncertainty of the original database, 18.6225
Output: 346.8506 "=Sum of sig sqrd"

✓The total effective degrees of freedom.
Method: Equation (4), Harris, 1995.
Input: 9; 1; 2; 2; 1 degrees of freedom, uncertainties used above
Output: "Effective Degrees..." 9.002758

✓The Student's T-Distribution parameter.
Method: Table lookup.
Input: 9 degrees of freedom, 0.10, Student's T-Test table
Output: "95% confidence factor" 1.83311

✓The total plutonium mass.
Method: Average for each backwash; Equation (2), Harris, 1995.
Input: Masses listed above plus mass of original database, 97.5 g
Output: "Total Pu Mass" 104.349

✓The total plutonium uncertainty margin.
Method: Equations (1) and (2), Harris, 1995.
Input: Uncertainty squared, 346.8506; T-table value, 1.83311
Output: "MARGIN (95%..." 34.14

- Confirm the sensitivity of the test case by arbitrarily adding the amounts indicated to the following parameters. (Cursor on value|F2|+1.e-0?|return)
The sensitivity is verified when one or several cells on the page show "ERR" after each modification is made. The tests that produce the "ERR" indications are given in Section 4.4. It should be noted that these sensitivities are many orders of magnitude higher than is required for OSR and PS compliance verification (Section 3.3 of Harris, 1995.)
The previous modifications should be removed before a new parameter is tested. (Cursor on value|F2|backspace, backspace, etc.|return)

Parameter	Amount	
Volume calculation of method c		
✓Volume = (L)	1E-03	L
✓Vol. Unct. (%)	1E-05	%
✓inches	1E-05	in
✓Uncertainty of method a	1E-06	%
✓Uncertainty of method b	1E-08	%
✓Sample Specific Activity	1E-06	uCi/L
✓Grams of Pu added to...	1E-07	g
✓Mean ... Average ...	1E-07	g
✓Total unct... sigma	1E-08	g
✓Original Database Mass	1E-07	g
✓Original Database Uncert.	1E-07	%
✓Added Mass sum=	1E-07	g

Find and delete the TEST.WB1 and C:\FAILURE.WB1 files using any file management tool.

A record of an independent confirmation of the spreadsheet operation and results is given in Appendix B.

4.0 CONFIGURATION MANAGEMENT

4.1 LISTINGS AND RECORD SPREADSHEETS

The manager of Standards and Requirements (S&R) is responsible for the development, control, and maintenance of this software. The manager S&R will designate a custodian who will maintain electronic record copies of the software on a file server or personal computer that is separate from that being used to contain the files generated during normal operation. It should be noted that the record copies will be spreadsheets that contain a large amount of other information that is unrelated to the KE-PU software. The spreadsheet will have the name "KE-PU0-0.WB1" for revision 0.0. The names of the record copies of new revisions (See Section 4.3) will reflect the revision number. The version of the software in use will also be shown on the top of the page "Limit."

The software listings of the formulas on page "Limit" and the macros "\0" and "\I" are given in Appendix C. The custodian will maintain copies of these listings as well as the record copy of this document.

Either the listings in Appendix C or the record spreadsheet constitute a backup of the current version of the software. Either can be used to reconstruct the software in spreadsheets that are being used (Section 4.2.)

Currently the software custodian designated by the manager of S&R is:

R. A. Harris
Spent Nuclear Fuels Evaluation
Payroll number 90998

The record or backup copy of the software is located on the custodian's personal computer hard disk under d:\sym\kbasins\trend\cswd002.

4.2 SOFTWARE RECOVERY

An error in the copy of this software that is being used with real data will be flagged by the test macro "\0" (Section 4.4.) Recovery can only be accomplished by the software custodian. Below are suggested steps to locate and correct the error. The custodian can use alternate procedures if desired, however, he must verify the correctness of macro "\0" since it is used to verify any changes that are made by the custodian.

- Load the "FAILURE.WB1" spreadsheet generated when macro "\0" flagged the error.
- Locate the cells that show "ERR."
- Determine which part of the calculations are causing the error (e.g. averages, uncertainties.) If the possible error(s) can not be narrowed down, all cells must be examined below.
- Compare the formulas of the suspect cells on page "Limit" to the correct values taken either from the listing in Appendix C or the record spreadsheet (KE-PUa-b.WB1.)
  Note: The custodian must be sufficiently familiar with the spreadsheet to recognize that some changes from the record copy or listing are acceptable. During normal use new data will be entered on the page "Limit." This will cause some cells to be moved downward as new data rows are added. The cell locations for some of the parameters will therefore not be exactly the same as on the record copies of the software. Also, some formulas, such as summations, will be changed. This is acceptable. Note that the test macro "\0" discussed in Section 4.4 accommodates these changes.
- Select a spreadsheet to be "recovered." Normally the spreadsheet that was in use just before the error was flagged should be chosen. It should be current except for the last data entered.
- Unprotect page "Limit." (Property|Active Page|Protection|Disable|ok)
- Correct the formulas that were found to be incorrect.
- Protect page "Limit." (Property|Active Page|Protection|Enable|ok)
- Unprotect page "macros." (Property|Active Page|Protection|Disable|ok)
- Verify that macros "\0" and "\I" on page "macros" are correct.
  Note: This can be accomplished by manually comparing the contents of each cell with the listing in Appendix C and making any corrections needed. A more positive way is to use the Windows Copy routine to copy the correct cell

contents from the record spreadsheet into the Windows Clipboard. This information can then be transferred to the "recovery" spreadsheet using the Windows Paste routine.

- Protect page "macros." (Property|Active Page|Protection|Enable|ok)
- Save the spreadsheet. (File|Save)
- Manually run the "\0" macro to confirm that the changes were correct. (Tools|Macro|Execute|scroll to "\0"|ok)

4.3 CHANGE CONTROL

The custodian, designated by the manager S&R, will receive and incorporate user requests for changes into subsequent revisions to the software. The revised electronic record spreadsheets will have names of the form KE-PUa-b.WB1 where a represents a major revision to the software and b represents minor ones. This numbering system was chosen to be consistent with both national and local practice. It is expected that all changes to this software will be classified as major, however, and the numbers will be of the form a.0.

Once a new revision has been generated it must be verified and validated in the manner described in Section 3.0. Verification (Section 3.1) is not required if the basic methods for analyzing the measurement data are not changed. If they are, the basic document (Harris 1995) must be revised and approved by Quality Assurance and Safety. The manager S&R will determine when such changes are necessary.

Validation checks using the steps of Section 3.2 will be made. If the parameters in macro "\0" are not changed it will not be necessary to repeat the verification of the calculated parameters. A signed record of the witnessing of the validation checks by an independent reviewer will be obtained. That record and listings of the "Limit" page formulas and macros "\0" and "\I" will be added to this document as an appendix. The Engineering Change Notice (ECN) promulgating the change must be reviewed and approved by the custodian, manager S&R, Quality Assurance, and Safety.

An electronic record spreadsheet will then be generated by the custodian that has the appropriate name. The current revision number of the software and this document will be included on the top of the page "Limit." The custodian will then modify the spreadsheet currently being used for OSR and PS compliance verification. A manual run of the "\0" macro should be performed to verify that the changes were made correctly.

The custodian will add the record copy of the revised spreadsheet to the personal computer hard disk directory listed in Section 4.1. At least the last three revisions will be maintained in that directory.

4.4 VALIDATION IN USE

The spreadsheets that contain the OSR and PS compliance verification calculations will be loaded onto the user's personal computer. With the variety of software being run on such computers and the sophistication of the average user it is possible that important formulas and cells could be modified so that the calculated parameters produced are incorrect. The possibility of accidental changes is severely limited by using the cell protection feature of the spreadsheet. As shown in Section 3.2, under normal operation only the data entry cells can be changed. Nevertheless it was considered prudent to provide a means of validating the calculations being performed. The means chosen was the macro "\0" discussed earlier.

All Quattro Pro spreadsheet codes default to running any macro labelled "\0" when the spreadsheet is first loaded. As shown in Section 3.2, this macro will detect errors in the formulas of page "Limit" and flag this to the user. The comparisons with prediction are made on the following parameters. Deviations from predictions by the amounts indicated will cause the error indications described in Section 3.2. The 95% confidence factor changes by set amounts, corresponding to integer changes in the effective degrees of freedom.

Parameter	Alarming Deviations
Effective Degrees of Freedom	1E-09
95% confidence factor	Various
Total Pu Mass	1E-07 g
MARGIN (95% Confidence)	1E-07 g
TOTAL MASS and MARGIN	1E-07 g
Minimum uncertainty for predicting new mass.	1E-06 %
Maximum New Mass (g)	1E-07 g

5.0 OPERATION AND MAINTENANCE

The instructions for inputting data and maintaining the spreadsheet are given in operating procedure CP-07-006E, 1996. These instructions address inputting predicted data on page "Limit" prior to the time actual laboratory data is received. There are instructions for correcting errors on most of the pages of the spreadsheet except for "Limit". If there is an error on "Limit" the software custodian must be contacted to assure that corrections meet OSR requirements. An error is generally detected and indicated to the user when the spreadsheet is first loaded.

6.0 REFERENCES

304, 1996, K Basins Process Standards, February 15, 1996, standard 304, Section D.2.e. Westinghouse Hanford Company, Richland, Washington.

CP-07-006E, Rev.1, 1996, KE-Basin Sandfilter Backwash Pu Process Standard Verification and Trend Program, March, 1996, Westinghouse Hanford Company, Richland, Washington.

Harris, Richard A., 1995, Surveillance and Prediction Methods for the Plutonium Limit in the K-East Fuel Storage Basin Sandfilter Backwash Pit, WHC-SD-SNF-TA-007, Rev 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-OSR-006, Rev. 1, 1996, Operational Safety Requirements - 100-KE and 100-KW Fuel Storage Basins, Safety Limits 2.2.1 and 2.2.2, March, 1996, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

TEST CASE DISPLAY

Display generated by the test case run for validation of the spreadsheet code KE-PU 0.0.

CALCULATION OF Pu ADDED TO SFBWP Spreadsheet = KE-PU0-0.WB1 03/05/96

Software Version KE-PU 0.0, WHC-SD-SNF-CSWD-002, REV 0, March, 1996

Sample Specific Activity: 23.2 27.1 uCi/L

Volume of backwash method: c (a, b, or c)

Volume = (L): 4653.1

Vol. Uncr. (%) = 3.21412 %

Insert in following table

Method c: feet inches

Start: 13 1

Finish: 11 3

4653.07 Volume

3.21412 Uncr

a) Change in flow totalizer readings immediately before and after backwash. 2

b) Backwash flowrate for duration of backwash. 9

c) Change in backwash pit volume (in liters) based on distance of water level below the two-foot high curb around the loadout pit):

Grams of Pu added to SFBWP: 1.31701 0 1.5384 Insert in following table

53 = Predicted for last backwash

0.0093 = Revised FACTOR Insert on Page "A"

SFBWP Contents MASS						% Unct. in Vol.	Mean Avg	% Unct	sigma	Degrees of Freedom	
Original Database (g	11/01/93						97.5	19.1	18.6225	9	13363.17
						95 % confidence factor		1.83311			
New additions (g)	01/10/95	1.317		1.5384	3.2141		1.4277	8.39327	0.11983	1	0.000206
		4.3	4.2	4	2		4.1667	2.91204	0.12134	2	0.000108
		1.1	1.2	1.465	8.8		1.255	12.3584	0.1551	2	0.000289
predicted		1E-10	1E-10				1E-10	0	0	1	0

Insert New Rows For New Data

Added Mass sum= 6.8494 346.851 = Sum of sig sqrd

Total Pu Mass	104.349 g	Effective Degrees of Freedom=	9.00276
MARGIN (95% Confidence)	34.14 g	95 % confidence factor	1.83311
TOTAL MASS and MARGIN	138.49 g	Minimum uncertainty for predicting new mass. =	12.3584 %
Total Process Standard Limit	500	Maximum New Mass (g)	316.28 g

Parameters in large, bold type in heavy solid line boxes are the input values for the test case.

Parameters in double line boxes are the calculated quantities that must be validated.

APPENDIX B

RECORD OF VALIDATION CHECK

CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed: WHC-SD-SNF-CSWD-002, REV 0

Author: Richard A. Harris

Yes	No	N/A	
[X]	[ ]	[ ]	Problem completely defined.
[X]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[X]	[ ]	[ ]	Referenced in document WHC-SD-SNF-TA-007 Computer codes and data files documented.
[X]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]	[ ]	[ ]	Variance of mean includes estra term due to uncertainty in volume Models appropriate and used within range of validity or use outside range of established validity justified.
[X]	[ ]	[ ]	Hand calculations checked for errors.
[X]	[ ]	[ ]	Code run streams correct and consistent with analysis documentation.
[X]	[ ]	[ ]	Code output consistent with input and with results reported in analysis documentation.
[X]	[ ]	[ ]	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
[X]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[X]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.
[X]	[ ]	[ ]	Have all reasonable accidents been considered?
[ ]	[ ]	[X]	Has low density water (steam) been evaluated as a moderator?
[ ]	[ ]	[X]	Is the fuel and other hardware composition correct?
[X]	[ ]	[ ]	Are the cases considered conservative? Too conservative?
[ ]	[ ]	[X]	Do the computer models adequately reflect the actual geometry? Have cross sectional cuts of the geometry been made and do they show the desired geometry?
[ ]	[ ]	[X]	Has the analysis been reviewed by Safety? This may not be required in a preliminary design.
[X]	[ ]	[ ]	Has the reviewer completed the Criticality Safety Course for Managers and Engineers?
			Date completed August 1994

Reviewed by: D. Paviago Cruz Pena Date Feb. 28, 1996

NOTE: Any hand calculations, notes, or summaries generated as part of this review should be signed, dated, and attached to this checklist. Materials should be labeled and recorded so that it is intelligible to a technically-qualified third party.

Independent Review and Validation Check

The instructions given in Section 3.2 of document WHC-SD-SNF-CSWD-002, *Software Documentation of the KE-Basins KE-PU Spreadsheet Code*, that validate the operation of the spreadsheet code KE-PU and the calculations it performs were completed without incident. The spreadsheet performed as expected. The calculated parameters and equations employed in the spreadsheet confirmed to the equations given in the document WHC-SD-SNF-TA-007, *Surveillance and Prediction Methods for the Plutonium Limit in the K-East Fuel Storage Basin Sandfilter*.

Reviewed by: D. Santiago Parra Date Feb 28, 1996

S.A. Parra, Senior Engineer

APPENDIX C

LISTING OF LIMIT PAGE FORMULAS AND MACROS \0 AND \I

"Limit" Page Cell Formulas
Software Version KE-PU 0.0, WHC-SD-SNF-CSWD-002, REV 0, March, 1996

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Limit:A1:   'CALCULATION OF Pu ADDED TO SFBWP
Limit:G1:   'Spreadsheet =
Limit:I1:   @CELL("NotebookName",G1)&".WB1"
Limit:M1:    +NOW
Limit:E2:   'Software Version KE-PU 0.0, WHC-SD-SNF-CSWD-002, REV 0, March, 1996
Limit:A3:   'Sample Specific Activity
Limit:E3:   6.8
Limit:F3:   6.4
Limit:G3:   7.04
Limit:H3:   'uCi/L
Limit:A4:   'Volume of backwash method
Limit:E4:   'a
Limit:F4:   '(a, b, or c)
Limit:G4:   "a)
Limit:H4:   'Change in flow totalizer readings immediately
Limit:N4:   2
Limit:B5:   'Volume = (L)
Limit:E5:   6658
Limit:H5:   'before and after backwash.
Limit:B6:   'Vol. Unct. (%) =
Limit:E6:     @IF(E4="a"#OR#E4="A",N4,@IF(E4="b"#OR#E4="B",N6,@IF(E4="c"#OR#E
              4="C",E10,"ERR in method")))
Limit:F6:   '%
Limit:G6:   "b)
Limit:H6:   'Backwash flowrate for duration of backwash.
Limit:N6:   8.8
Limit:E7:   'Insert in following table
Limit:A8:   'Method c
Limit:B8:   "feet
Limit:C8:   "inches
Limit:G8:   "c)
Limit:H8:   'Change in backwash pit volume (in liters)
Limit:A9:   'Start
Limit:C9:   1
Limit:E9:     @IF(B10+C10/12<=9.75,60518.91-2337.82*(B10+C10/12-2),62070.63-2538.04
              *(B10+C10/12-2))-@IF(B9+C9/12<=9.75,60518.91-2337.82*(B9+C9/12-2),
              62070.63 -2538.04*(B9+C9/12-2))
Limit:F9:   'Volume
Limit:H9:   'based on distance of water level below the
Limit:A10:  'Finish
Limit:C10:  1
Limit:E10:  @SQRT(2)*2538.04*100/E9*0.5/12
Limit:F10:  'Unct
Limit:H10:  'two-foot high curb around the loadout pit):
Limit:A12:  'Grams of Pu added to SFBWP
Limit:E12:  @IF(E3<=0,0,+E3*1.22E-05*$E5)
Limit:F12:  @IF(F3<=0,0,+F3*1.22E-05*$E5)
Limit:G12:  @IF(G3<=0,0,+G3*1.22E-05*$E5)
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Limit:H12:  'Insert in following table
Limit:E13:  0.41
Limit:F13:  '= Predicted for last backwash
Limit:E14:    +$FACTOR*@SUM(E12..G12)/(@IF(E12>0,1,0)
              +@IF(F12>0,1,0)+@IF(G12>0,1,0))/E13
Limit:F14:  '= Revised FACTOR
Limit:H14:  'Insert on Page "A"
Limit:A17:  'SFBWP Contents
Limit:H17:  '% Unct.
Limit:I17:  ^Mean
Limit:L17:  ^Degrees of
Limit:A18:  'MASS
Limit:H18:  ^in Vol.
Limit:I18:  ^Avg
Limit:J18:  '% Unct
Limit:K18:  ^sigma
Limit:L18:  ^Freedom
Limit:A19:  ' Original Database (g)
Limit:D19:  11/01/93
Limit:I19:  97.5
Limit:J19:  19.1
Limit:K19:  +J19*P/100
Limit:L19:  9
Limit:M19:  +K19^4/L19
Limit:F20:  95
Limit:G20:  '% confidence factor
Limit:J20:  @TINV((1-F20/100)*2,L19)
Limit:A21:  ' New additions (g)
Limit:D21:  06/16/95
Limit:E21:  9.5974322433388
Limit:F21:  8.965468045817
Limit:G21:  9.9053754655432
Limit:H21:  1.8497979684324
Limit:I21:  @AVG(E21..G21)
Limit:J21:  +K21*100/I21
Limit:K21:  @SQRT(@VARS(E21..G21)/@COUNT(E21..G21)+(H21*I21/100)^2)
Limit:L21:  @COUNT(E21..G21)-1
Limit:M21:  +K21^4/L21
Limit:D22:  08/10/95
Limit:E22:  1.48967293092
Limit:F22:  1.48796164668
Limit:G22:  1.5273211842
Limit:H22:  2.1324059913874
Limit:I22:  @AVG(E22..G22)
Limit:J22:  +K22*100/I22
Limit:K22:  @SQRT(@VARS(E22..G22)/@COUNT(E22..G22)+(H22*I22/100)^2)
Limit:L22:  @COUNT(E22..G22)-1
Limit:M22:  +K22^4/L22
Limit:D23:  09/14/95
Limit:E23:  0.598
Limit:F23:  0.58282
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Limit:G23:  0.6191
Limit:H23:  2.07477
Limit:I23:  @AVG(E23..G23)
Limit:J23:  +K23*100/I23
Limit:K23:  @SQRT(@VARS(E23..G23)/@COUNT(E23..G23)+(H23*I23/100)^2)
Limit:L23:  @COUNT(E23..G23)-1
Limit:M23:   +K23^4/L23
Limit:B24:  'predicted
Limit:D24:  11/21/95
Limit:E24:  0.41
Limit:F24:  0.41
Limit:G24:  0.41
Limit:H24:  2
Limit:I24:  @AVG(E24..G24)
Limit:J24:  +K24*100/I24
Limit:K24:  @SQRT(@VARS(E24..G24)/@COUNT(E24..G24)+(H24*I24/100)^2)
Limit:L24:  @COUNT(E24..G24)-1
Limit:M24:   +K24^4/L24
Limit:E25:  'Insert New Rows For New Data
Limit:F26:  "Added
Limit:G26:  "Mass sum=
Limit:I26:  @SUM(I21..I25)
Limit:K26:  @SUMSQ(K19..K25)
Limit:L26:  '=Sum of sig sqrd
Limit:A28:  '  Total Pu Mass
Limit:E28:  +N_1+P
Limit:F28:  'g
Limit:G28:  'Effective Degrees of Freedom=
Limit:K28:  (@SUMSQ(K19..K25))^2/@SUM(M19..M25)
Limit:A29:  'MARGIN (95% Confidence)
Limit:E29:  @SQRT(SN_1)*FN
Limit:F29:  'g
Limit:G29:  95
Limit:H29:  '% confidence factor
Limit:K29:  @TINV((1-G29/100)*2,K28)
Limit:A30:  'TOTAL MASS and MARGIN
Limit:E30:  +E29+E28
Limit:F30:  'g
Limit:G30:  'Minimum uncertainty for  =
Limit:K30:  @MAX(J21..J25)
Limit:L30:  '%
Limit:G31:  '  predicting new mass.
Limit:K31:  1-(SN/100*FN)^2
Limit:L31:  -2*(LIMIT-P-N_1)
Limit:M31:   (LIMIT-P-N_1)^2-SN_1*FN^2
Limit:A32:  'Total Process Standard Limit
Limit:E32:  500
Limit:F32:  'g
Limit:G32:  'Maximum New Mass (g)
Limit:K32:  (-L31-@SQRT(L31*L31-4*K31*M31))/2/K31
```

Macros "\0" and "\I"

```
macros:A1:   'Macro that saves page A when file is opened, and
macros:H1:   @CELL("NotebookName",F1)&".WB1"
macros:A2:   '  VERIFIES PS COMPLIANCE CALCULATION
macros:A3:   ^\0
macros:B3:   '{Notebook.Recalc_Settings "Manual,Natural,1"}
macros:B4:   '{Goto}a:a1~/ec{End}{Home}~aa:a1~
macros:B5:   '{Goto}Limit:I21~{Page.Protection Disable}
macros:B6:   +"/ec{Right 4}~i21..i"&@STRING(@CELL("row",N_1)-2,0)&"~"
macros:H6:   'Copies down formulas
macros:B7:   '{Goto}Limit:a1~/ec{End}{Home}~QA:a1~
macros:B8:   '{Home}{Down 2}{Right 4}23.2{Right}{Del}{Right}27.1~
macros:B9:   '{Left 2}{Down}c{Down}+{Down 4}~
macros:B10:  '{Down 4}{Left 3}13~{Right}1~{Down}3~{Left}11~
macros:B11:  '{Down 3}{Right 3}53~{Down 8}{Left}/ee{Right 4}~
macros:B12:   +"{Right}.0000000001~/ec~.{Right}~{Left}/ec{Right
              4}~d21..d"&@STRING(@CELL("row",N_1)-2,0)&"~"
macros:B13:  '1/10/95{Right}+e12{Right}{Del}{Right}+g12{Right}+{Up 15}{Left 4}{Right}~
macros:B14:  '{Down}+{Up 18}{Right 6}~{Left}4{Left}4.2{Left}4.3
macros:B15:  '{Down}1.1{Right}1.2{Right}1.465{Right}+{Up 17}{Right 6}~
macros:B16:  '{Right}{End}{Up}{End}{Down 5}
macros:B17:  '{Left 5}@sum({right}.{down 4}{right 7})~
macros:B18:  '{Right 2}{SelectBlock C(0)R(0)..C(0)R(4)}
macros:B19:  '{Setproperty Font,"Arial,16,Yes,No,No,No"}
macros:B20:  '{Setproperty Text_Color,"4"}{Right}{Left}
macros:B21:  '@if(@ABS({Left}-104.3493692)<0.0000001,"",@err)~
macros:B22:  '{Down}@if(@ABS({Left}-34.1397607)<0.0000001,"",@err)~
macros:B23:  '{Down}@if(@ABS({Left}-138.4891299)<0.0000001,"",@err)~
macros:B24:  '{Down}@if(@abs(maxnmass-316.2815364)<0.0000001,"",@err)~
macros:B25:  '{Right 6}{Up 3}{SelectBlock C(0)R(0)..C(0)R(4)}
macros:B26:  '{Setproperty Font,"Arial,16,Yes,No,No,No"}
macros:B27:  '{Setproperty Text_Color,"4"}{Right}{Left}
macros:B28:  '@if(@abs({Left}-9.0027578004)<.0000000001,"",@err)~{Down}
macros:B29:  '@if(@abs({Left}-1.83311293)<.00000001,"",@err)~{Down}
macros:B30:  '@if(@abs({Left}-12.358390276)<.000000001,"",@err)~{Left 8}{Up 2}
macros:B31:  '{Calc}{IF @cellpointer("contents")}{Branch branch3}
macros:B32:  '{Up}'THE NAME OF THIS FILE WILL BE CHANGED TO FAILURE.WB1.
macros:B33:  '  The Limit page for computing PS compliance is corrupted.
macros:B34:  '  See Desk Instruction.  Hit return{?}~
macros:B35:  '{FileSaveAs "C:\FAILURE.WB1"}{Page.Protection Enable}
macros:B36:  '{Notebook.Recalc_Settings "Background,Natural,1"}
macros:B37:  '{SpeedBar.Append "TREND.BAR"}{SpeedBar.Remove "PRODUCTY.BAR"}{Quit}
macros:A38:  "branch3
macros:B38:  '{Goto}qa:a1~{Home}/ec{End}{Home}~Limit:a1~
macros:B39:  '{Home}/edc{Shift+End}{Shift+Home}~
macros:B40:  '{Goto}Limit:a1~{Page.Protection Enable}{Goto}a:a50~{Goto}a15~
macros:B41:  '{Notebook.Recalc_Settings "Background,Natural,1"}
macros:B42:  '{SpeedBar.Append "TREND.BAR"}{SpeedBar.Remove "PRODUCTY.BAR"}
macros:A44:  'Macro that inserts new rows in backwash data table, Sheet Limit.
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macros:A45:  ^\I
macros:B45:  '{Page.Protection Disable}/eir~{End}{Left}{Up}{Right 3}
macros:B46:  '/ec{Right 5}{End}{Right}~{Down}~{Down}
macros:B47:  '{SelectBlock C(0)R(0)..C(3)R(0)}
macros:B48:  '{Setproperty Protection,Unprotect}{Page.Protection Enable}
macros:B49:  '{SelectBlock TABLE}{Page.Protection Disable}
macros:B50:  '{BlockName.MakeTable TABLE}{Page.Protection Enable}
macros:B51:  '{SelectBlock N_1}{Up 2}{Left 5}{Calc}
```