EDC (ENGINEERING DOCUMENT CHANGE) FORM

Document Identification

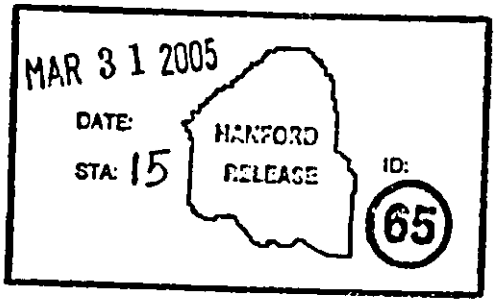
1. Change Title:
Calculational Tool for Skin Contamination Dose Estimate

Key Words:
skin contamination, calculational tool, spreadsheet

2. Project No./Work Package No.:

3. Review Designators:
N/A ☐ D ☐ P ☐ E ☐ N ☐ R ☐ I ☐ F ☐ Q ☒
Additional Reviewers:
___ ☐ ___ ☐ ___ ☐ ___ ☐ ___ ☐ ___ ☐

8. Release: Release CACN 103024



4. Area	5. Building	6. Facility	7. System No.
RCHN	2420 Stvns	Radiation Protection	N/A

9. USQ Required? ☐ USQ ☐ CX ☒ NA No.:

10. Distribution - Name	MSIN	Distribution - Name	MSIN
RL Hill H5-26		LK Adams H8-67	
SR Johnson H5-26		DJ Hanny H8-60	

11. Change Description (description and reason for requested change):
Document revised to cover a revision in the skin contamination dose estimate calculational spreadsheet tool.

Approvals

12. Change Originator	TA/DA	Engineering Management/TA Manager
RL Hill 3/29/05	RL Hill 3/29/05	SR Johnson 3/29/05
Print/Signature/Date	Print/Signature/Date	Print/Signature/Date
Title Quality Assurance	Title	Title
LK Adams 3/29/05		
Print/Signature/Date	Print/Signature/Date	Print/Signature/Date

13. Document Index

Action	Number	Title	Rev (being issued)	Change Page(s)	Config Baseline
DR	HNF-10729	Calculational Tool for Skin Contamination Dose Estimate	1		☐

14. Potentially Affected Documents Not Modified By This EDC:

Document Type	Document Number/Revision	Document Owner (Organization)	Technical Authority Notified	Date Notified
N/A	N/A	N/A	N/A	N/A

HNF-10729
Revision 1

Calculational Tool for Skin Contamination Dose Estimate

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland, Washington

HNF-10729
Revision 1
EDC #: HNF-EDC-05-25460

Calculational Tool for Skin Contamination Dose Estimate

Document Type: TI Program/Project: RADIATION PROTECTION

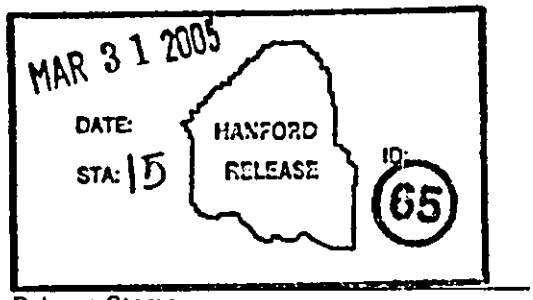
R. L. Hill
Fluor Hanford, Inc.

Date Published
March 2005

Prepared for the U.S. Department of Energy.
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Fluor Hanford
P.O. Box 1000
Richland, Washington



Nancy A. Fouad 3-31-05
Release Approval Date

Release Stamp

Approved for Public Release;
Further Dissemination Unlimited

Total Pages: 36

RECORD OF REVISION	(1) Document Number HNF-10729	Page 1

(2) Title
Calculational Tool for Skin Contamination Dose Estimate
^ ja 3/30

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) DA/TA Date
0	Release, EDT-61609	
1 RS	HNF-EDC-05-25460 Complete revision of document to complement the new revision to the calculaticnal tool.	RL Hill 3/29/05

ABSTRACT

A spreadsheet calculational tool was developed to automate the calculations performed for estimating dose from skin contamination. This document reports on the design and testing of the spreadsheet calculational tool.

KEY WORDS: skin contamination, calculational tool, spreadsheet.

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TABLE OF CONTENTS

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ACRONYMS AND ABBREVIATIONS

cm^2	square centimeters
cpm	counts per minute
dpm	disintegrations per minute
hr	hour
mrem	millirem
PC	personal computer
PHMC	Project Hanford Management Contractor

CALCULATIONAL TOOL FOR SKIN CONTAMINATION DOSE ESTIMATE

1.0 INTRODUCTION

This document provides a description of and testing results for a spreadsheet calculational tool that will automate the calculations associated with estimating the dose from skin contamination. These calculations are based on the information provided in HNF-13536, Section 2.1.4, *Skin Contamination Dose Assessment.*

The calculational process is as follows:

- From the reported dpm, exposure time on skin (hr) and affected skin area, and the contamination-to-dose response factors from Appendix A in HNF-13536, Section 2.1.4, estimate the dose to the skin (mrem) from the contamination.
- This calculation provides an initial estimate of the dose to the skin; it may not necessarily be the dose of record.

The spreadsheet calculational tool developed in-house will be used to do the following:

- Provide an estimate of the skin dose (in mrem) for skin contamination.
- Use the contamination-to-dose response factors from Appendix A in HNF-13536, Section 2.1.4.

The version of the spreadsheet that will be evaluated is SKINDOSE4.XLS.

2.0 CALCULATIONAL TOOL DESIGN AND DESCRIPTION

The skin dose calculational tool is shown in Appendix A.

2.1 System Requirements

This spreadsheet calculational tool will normally be used by personnel who have a need to calculate the dose from contamination on the skin.

2.1.1 Constraints

This spreadsheet calculational tool is a stand-alone product that can be used on any PC system with Microsoft Excel™, version 2000 or higher. This spreadsheet calculational tool is only for use in estimation of dose to the skin when the contamination-to-dose response factors from Appendix A in HNF-13536, Section 2.1.4 are used.

2.1.2 Input and Output Options

The data input is by keyboard. Data output consists of printed pages containing the input and output data. There are no limits applied to input ranges.

2.1.3 Interface Requirements

There are no interface requirements for this spreadsheet calculational tool.

2.1.4 Transferability

There is no limit on the number of computers on which this spreadsheet calculational tool may reside. This spreadsheet calculational tool may be used on any system with Microsoft Excel™, version 2000 or higher.

2.1.5 Installation

Installation to a PC may be accomplished by copying the file to the hard drive. Or, the spreadsheet calculational tool may be accessed from a floppy disk.

2.2 Spreadsheet Calculational Tool Description

Descriptions of each worksheet included in this spreadsheet calculational tool are given below.

2.2.1 Cover Sheet

This worksheet (AppendixA, Page A-2) provides a title and instructions for use of the calculational tool. It also contains the change history associated with this spreadsheet calculational tool. No calculations are performed in this worksheet.

2.2.2 Skin Dose Calculation

This worksheet (Appendix A, Page A-3) provides spaces for data input and reporting of calculational results. In the *Input Data* section, the data input values include date, facility, form number, Radiological Survey Report number, worker name, payroll number or HID, maximum contamination level (dpm), exposure time on skin (h), affected skin area (cm^2), radionuclides involved (Cs-137 or Other), and instrument count efficiency (cpm/dpm).

In the *Supplied Information* section, is the contamination-to-dose response factors from Appendix A in HNF-13536, Section 2.1.4.

In the *Calculated Results* section, the affected skin area and the designation as either a point source or area source are linked to cells in this section. Four calculations are performed in this section (See Appendix B for the formula used):

- Fraction of the skin affected as compared to 100 cm^2 (applies only if the affected skin areas is greater than and equal to 10 cm^2 and less than 100 cm^2.
- Calculated instrument reading (in cpm) using contamination level (dpm) and instrument count efficiency (cpm/dpm).
- Calculated cpm-h
- Estimated skin dose (in mrem) using calculated cpm-hr, response factor, and fraction of skin affected, where appropriate.

The equations used to calculated estimated skin dose are provided in this section of the "Skin Dose Calculation" worksheet. A note is also provided to indicate one of the following conditions that result from the estimated dose:

- If the affected skin area is less than or equal to 10 cm^2, then the note will state that the estimated dose should be recorded in the individual's history file as a special entry only.
- If the affected skin area is greater than or equal to 10 cm^2 and estimated dose is less than 100 mrem, then the note will state that there is no requirement to perform a formal skin dose assessment.
- If the affected skin area is greater than or equal to 10 cm^2 and estimated dose is greater than or equal to 100 mrem, then the note will state to ensure that a formal skin dose assessment is performed.

3.0 SPREADSHEET TESTING

The operation of the spreadsheet calculational tool (SKINDOSE4.XLS) was tested using a test data set. An independent test of the spreadsheet was also obtained.

3.1 Test Information

The testing of the spreadsheet calculational tool was done using the custodian's or reviewer's PC computer. Sample input information is entered in the appropriate cells and the results evaluated. An evaluation form shown in Appendix C is used to document the spreadsheet testing. Each cell containing data is evaluated to

ensure that the data has either been copied correctly or calculated correctly. Calculations are validated using hand calculations (Appendix C).

The spreadsheet custodian is responsible for preparing and administering the testing, and for resolving any test-related issues.

3.2 Test Summary

The evaluation forms and hand calculations are given in Appendix C for both the spreadsheet custodian and the independent reviewer. In all cases, the calculational tool worked appropriately.

4.0 CONFIGURATION CONTROL

4.1 Software Documentation Change Control

The spreadsheet calculational tool will be placed under configuration management. Each version or revision of the spreadsheet will be uniquely identified. The version or revision identifier will be included with the generated output, when feasible. Also, the unique case identifier will be included in the title of the file (e.g., SKINDOSE4 3-28-05.XLS). Software acceptance will be performed, as necessary, for changes.

4.2 Documentation

Configuration control of the calculational tool will include control and documentation to baseline elements. The documentation will contain a description of the change, the rationale for the change, and the identification of affected elements.

4.3 Change Control

The spreadsheet custodian will receive and incorporate user requests for changes into subsequent revisions to the software, as appropriate. The revised spreadsheet calculational tool will have the new version number added to the title of the spreadsheet. The new revision will be tested in the manner described in Section 3.0.

The spreadsheet custodian will maintain a record copy of the spreadsheet calculational tool.

5.0 CONCLUSIONS

A spreadsheet calculational tool (SKINDOSE4.XLS) was developed to assist in calculations for dose to skin from radioactive contamination. The test results indicate that the spreadsheet calculational tool performs as it was designed.

6.0 REFERENCES

HNF-13536, Section 2.1.4. Skin Contamination Dose Assessment. Revision 1. PHMC, Richland, WA.

APPENDIX A

Skin Dose Calculational Tool

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

Revision 4

[Based on the HNF-13536, Section 2.1.4, *"Skin Contamination Dose Assessment"* procedure]

[Software quality assurance on this spreadsheet tool is documented in HNF-10729.

> Go to the 'SKIN DOSE CALC'N" worksheet & enter the data in the white boxes in the INPUT DATA section, and in the SUPPLIED INFORMATION section.

> The resultant dose calculation will be generated in the CALCULATIONAL RESULTS section.

> Click on the "PRINT" button to print a copy of the report.

REVISION HISTORY

Rev 0, 9/16/98	SKINDOSE.XLS	Initial Version
Rev 1, 11/10/98	SKINDOSE2.XLS	- Corrected calculation of (cpm-hr) - Changed input for skin exposure time from (min) to (hr)
Rev 2, 4/18/02	SKINDOSE3.XLS	- Changed name of first worksheet to *Cover Sheet* - Changed to *Radiological Survey Report* number - Under Calculational Results, Affected Skin Area, corrected units to cm^2 - Change to using superscripts, where necessary - Changed shading on cells where data already provided or linked - Changed to all caps on headings
Rev 3, 3/31/05	SKINDOSE4.XLS	- Corrected procedure reference - Added reference to software QA document - Added "STRICTLY PRIVATE" to output document - Added "PRINT" button - Added "Form Number" input box to agree with last row of "Personnel Contamination Data - Skin" (A-6000-957) form - Added input boxes for worker name and payroll number - Changed placement of RSR number row - Changed to "Estimated" from "Calculated" Skin Dose label - Added instructions for input only in white underlined boxes - Added equations used - Added "Selected" to Response Factor To Be Used

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, *"Skin Contamination Dose Assessment"* procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005	FORM #:	SCR-123456
FACILITY:	ABC		
RADIOLOGICAL SURVEY REPORT NUMBER:	QR-100		
WORKER NAME:	J. Smith	PR # or HID:	7Q1234
MAX. CONTAMINATION LEVEL (dpm):	10,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.00		
AFFECTED SKIN AREA (cm^2):	10.0	*This skin area is considered to be a* Point *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Cs-137		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* *Other = Sr-90/Y-90; Cs/Sr/Y; Aged Mixed Fission Products*

SELECTED RESPONSE FACTOR TO BE USED IS: 60

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	10	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	0.1	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	1,000	cpm
CALCULATED cpm-h:	1,000	cpm-h
ESTIMATED SKIN DOSE:	1.7	mrem

Estimated skin dose is less than 100 mrem. Therefore, is no requirement to perform a formal skin dose assessment.

EQUATIONS

$C_h = MCL * E * T_{sk}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is $\leq$ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: _____ Date: _____

APPENDIX B

Calculational Tool Formulae

SKIN DOSE CALCULATION PAGE FORMULAE

	B	C	D	E	E
15	AFFECTED SKIN AREA (cm^2):		This skin area is considered to be a	=IF(C23="Cs-137"," ",IF(C23="Other"," ","Choose either 'Cs-137' or 'Other'"))	source.

	A	B	C	D	E
36	SELECTED RESPONSE FACTOR TO BE USED IS:		=IF(E21="Area",VLOOKUP(C23,B32:D33,2,TRUE),VLOOKUP		
37					
38	AFFECTED SKIN AREA:		=IF(ISBLANK(C21)," ",C21)	cm^2	
39					
40	CONTAMINATION CONSIDERED TO BE A:		=E21	source	
41					
42	FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:		=IF(C21<100,IF(C21>=10,C21/100,"<10"),">100")	[Applies only when >= 10 cm2 and <100 cm2]	
43					
44	CALCULATED MAXIMUM INSTRUMENT READING:		=IF(ISBLANK(C25)," ",C11*C25)	cpm	
45					
46	CALCULATED cpm-hr:		=C48*C19	cpm-hr	
47					
48	CALCULATED SKIN DOSE:		=IF(ISBLANK(C36),"Input RF in Cell C32",(IF(AND(C21>=10,C21<100),(C48/C36)*C44,C48/C36)))	mrem	
53	ESTIMATED SKIN DOSE IS	=IF(C21>=10,IF(C50>=100,"greater than or equal to 100 mrem, so ensure a formal skin dose assessment is performed.","less than 100 mrem. Therefore, is no requirement to perform a formal skin dose assessment."),"recorded in individual's history file as a special entry only.")			

APPENDIX C

Calculational Tool Testing Results

EVALUATION FORM FOR SPREADSHEET SKINDOSE4.XLS				
Evaluator Name: R LITTLE		Date Done: 3/28/05		
	COVER SHEET PAGE			
1.	Does the spreadsheet provide instructions on using the spreadsheet?	☑ YES	☐ NO	☐ N/A
2.	Is the Revision History up-to-date?	☑ YES	☐ NO	☐ N/A
	SKIN DOSE CALCULATION PAGE			
3.	Is the 'Selected Response Factor To Be Used Is:' value in Cell C36 selected accurately using the Radionuclides involved and the information from the table of Contamination-to-Dose Response Factors?	☑ YES	☐ NO	☐ N/A
4.	Are the 'Contamination-to-Dose Response Factors' in Cells C32 through D33 the same as reported in Appendix A in HNF-13536, Section 2.1.4, Revision 1?	☑ YES	☐ NO	☐ N/A
5.	Did the 'Affected Skin Area' in Cell C40 copy accurately from C21?	☑ YES	☐ NO	☐ N/A
6.	Did the 'Contamination Considered to be a:' statement in Cell C42 copy accurately from cell E21?	☑ YES	☐ NO	☐ N/A
7.	Is the 'Fraction of Skin Affected Compared to 100 cm^2' in Cell C44 calculated accurately and under the appropriate conditions?	☑ YES	☐ NO	☐ N/A
8.	Is the 'Calculated Maximum Instrument Reading' in Cell C46 calculated accurately?	☑ YES	☐ NO	☐ N/A
9.	Is the 'Calculated cpm-hr' in Cell C48 calculated accurately?	☑ YES	☐ NO	☐ N/A
10.	Is the 'Calculated Skin Dose' in Cell C50 calculated accurately?	☑ YES	☐ NO	☐ N/A
11.	Is the signature block accurate?	☑ YES	☐ NO	☐ N/A

R LITTLE	[signature]	3/28/05
Evaluator Name (Print)	Signature	Date Completed

EVALUATION OF EXCEL SPREADSHEET CALCULATIONAL TOOL
SKINDOSE4.XLS

TESTS:

TEST CELL	TEST	RESULTS OK
Cell C21:	If enter '8', then Cell E21 is 'Point'	✓ OK
	If enter '101', then Cell E21 is 'Area'	✓ OK
Cell C36:	If Cell C21 = <100, then E21 = 'Point' and C42 = 'Point'	✓ OK
	If Cell C21 = >100, then E21 = 'Area' and C42 = 'Area'	✓ OK
Cell C44:	If Cell C21 = '9', then E21 = 'Point' and C42 = 'Point' and C44 = '<10'	✓ OK
	If Cell C21 = '10', then E21 = 'Point' and C42 = 'Point' and C44 = '0.1'	✓ OK
	If Cell C21 = '75', then E21 = 'Point' and C42 = 'Point' and C44 = '0.75'	✓ OK
	If Cell C21 = '90', then E21 = 'Point' and C42 = 'Point' and C44 = '0.90'	✓ OK
	If Cell C21 = '100', then E21 = 'Area' and C42 = 'Area' and C44 = '>100'	✓ OK
Cell C46:	If Cell C17 = '10,000' and C25 = '0.1', the C46 = '1,000'	✓ OK
Cell C48:	If Cell C46 = '1,000' and C19 = '2', the C46 = '2,000'	✓ OK

EXAMPLE CALCULATIONS:

$C_h = MCL * E * T_{sk}$
$D = (C_h / RF) * F$
where:

- C_h = Calculated cpm-h
- MCL = Max.contamination level (dpm)
- E = Instrument count efficiency (cpm/dpm)
- T_{sk} = Exposure time on skin (h)
- F = Fraction of skin affected compared to 100 cm^2
- RF = Response factor (cpm per mrem/h)
- D = Estimated skin dose (mrem)

Case #1: where C21 = 9 and C23 = Cs-137

$\frac{10{,}000 * 0.1 * 1.5}{60} = 25$ mrem ✓ OK

Case #2: where C21 = 100 and C23 = Cs-137

$\frac{10{,}000 * 0.1 * 1.5}{2{,}200} = 0.7$ mrem ✓ OK

Case #3: where C21 = 50 and C23 = Other

$\left(\frac{150{,}000 * 0.1 * 1.25}{50}\right) * 0.50 = 1875 = 188$ mrem ✓ OK

Evaluation Performed by Custodian: RLHILL / [signature] 3/28/05
Print/Sign Date

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]
[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA *Enter data in the white underlined boxes*

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Calc Case #1	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	10,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.50		
AFFECTED SKIN AREA (cm^2):	9.0	*This skin area is considered to be a* Point *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Cs-137		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

** Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products*

SELECTED RESPONSE FACTOR TO BE USED IS: 60

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	9	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	<10	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	1,000	cpm
CALCULATED cpm-h:	1,500	cpm-h
ESTIMATED SKIN DOSE:	25.0	mrem

Estimated skin dose is recorded in individual's history file as a special entry only.

EQUATIONS:

$C_h = MCL \cdot E \cdot T_{sk}$

$D = (C_h / RF) \cdot F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: [signature] Date: 3/28/05

$\left(\frac{10{,}000 \times 0.1 \times 1.5}{60}\right) = 25$ mrem ✓ [initials] 3/28/05

[..\SKINDOSE4-Rev4.xls.XLS] Revision 4 (03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]
[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA *Enter data in the white underlined boxes*

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Calc Case #2	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	10,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma*	
EXPOSURE TIME ON SKIN (h):	1.50		
AFFECTED SKIN AREA (cm^2):	100.0	*This skin area is considered to be a*	Area source.
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Cs-137		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 2,200

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	100	cm^2
CONTAMINATION CONSIDERED TO BE A:	Area	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	>100	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	1,000	cpm
CALCULATED cpm-h:	1,500	cpm-h
ESTIMATED SKIN DOSE:	0.7	mrem

Estimated skin dose is less than 100 mrem. Therefore, is no requirement to perform a formal skin dose assessment.

EQUATIONS

$C_h = MCL * E * T_{sk}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: MM Date: 3/28/05

$\frac{(10{,}000 * 0.1 * 1.5)}{2200} = 0.7$ mrem. OK MM 3/28/05

[..\SKINDOSE4-Rev4.xls]XLS] Revision 4 (03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]
[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA *Enter data in the white underlined boxes*

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Calc Case #3	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.25		
AFFECTED SKIN AREA (cm^2):	50.0	*This skin area is considered to be a* Point *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Other		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

** Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products*

SELECTED RESPONSE FACTOR TO BE USED IS: 50

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	50	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	0.5	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	18,750	cpm-h
ESTIMATED SKIN DOSE:	187.5	mrem

Estimated skin dose is greater than or equal to 100 mrem, so ensure a formal skin dose assessment is performed.

EQUATIONS

$C_h = MCL \cdot E \cdot T_{sk}$

$D = (C_h / RF) \cdot F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: [signature] Date: 3/28/05

$\left(\frac{150,000 \times 0.1 \times 1.25}{50}\right) \times 0.50 = 188$ mrem ✓ OK
[initials] 3/28/05

[..\SKINDOS~4-Rev4.xls.XLS] Revision 4 (03/31/05)

EVALUATION FORM FOR SPREADSHEET SKINDOSE4.XLS				
Evaluator Name: Jon Haan			Date Done: 3-28-05	
	COVER SHEET PAGE			
1.	Does the spreadsheet provide instructions on using the spreadsheet?	☒ YES	☐ NO	☐ N/A
2.	Is the Revision History up-to-date?	☒ YES	☐ NO	☐ N/A
	SKIN DOSE CALCULATION PAGE			
3.	Is the 'Selected Response Factor To Be Used Is:' value in Cell C36 selected accurately using the Radionuclides involved and the information from the table of Contamination-to-Dose Response Factors?	☒ YES	☐ NO	☐ N/A
4.	Are the 'Contamination-to-Dose Response Factors' in Cells C32 through D33 the same as reported in Appendix A in HNF-13536, Section 2.1.4, Revision 1?	☒ YES	☐ NO	☐ N/A
5.	Did the 'Affected Skin Area' in Cell C40 copy accurately from C21?	☒ YES	☐ NO	☐ N/A
6.	Did the 'Contamination Considered to be a:' statement in Cell C42 copy accurately from cell E21?	☒ YES	☐ NO	☐ N/A
7.	Is the 'Fraction of Skin Affected Compared to 100 cm^2' in Cell C44 calculated accurately and under the appropriate conditions?	☒ YES	☐ NO	☐ N/A
8.	Is the 'Calculated Maximum Instrument Reading' in Cell C46 calculated accurately?	☒ YES	☐ NO	☐ N/A
9.	Is the 'Calculated cpm-hr' in Cell C48 calculated accurately?	☒ YES	☐ NO	☐ N/A
10.	Is the 'Calculated Skin Dose' in Cell C50 calculated accurately?	☒ YES	☐ NO	☐ N/A
11.	Is the signature block accurate?	☒ YES	☐ NO	☐ N/A

J. Haan	J. Haan	3-28-05
Evaluator Name (Print)	Signature	Date Completed

Evaluation of Spreadsheet for "SKINDOSE4.XLS"

Evaluator: J. Haan 3-28-05 Date: 03/28/2005

COVER SHEET PAGE

1. Verified that the instructions are on the cover sheet page.
2. Verified that the revision history is up to date.

SKIN DOSE CALCULATION PAGE

3. Verified the "Contamination-to-Dose-Response Factors" in Cells C32,33 and D32,33 are the same as those in Appendix A of HNF-13536, Section 2.1.4.
4. Verified the "Affected Skin Area" in Cell C40 copied accurately from Cell C21.
5. The "Source Type" in Cell C42 copied accurately from E21. Also Cell E21 shifts from "Point Source" to "Area Source" if the source area is greater than 99 cm^2.
6. Verification of Cell C44 "Fraction of Skin Affected Compared to 100 cm^2":
   - When the affected skin area input was 9 cm^2 or less; Cell C44 value was "< 10".
   - When the affected skin area input was 10 - 99 cm^2 or less; Cell C44 value was equal to the input value divided by 100.
   - When the affected skin area input was greater than or equal to 100 cm^2, Cell C44 value was "> 100".
7. Verified Cell C46 "Calculated Maximum Instrument Reading" value by changing input for "Instrument Efficiency" (C25) and "Max. Contamination Level" (C17). Cell C17*C25 results on the spreadsheet were the same as those determined by calculator.
8. Verified Cell C48 "Calculated cpm-hr" values by changing input for "Calculated Maximum Instrument Reading" (C46) and "Max. Exposure Time on Skin" (C19). Cell C46*C19 results on the spreadsheet were the same as those determined by calculator.
9. Verified "Calculated Skin Dose" in Cell C50 by performing calculator determinations as directed in HNF-13536, Section 2.1.4 using varied values. Calculation summary is attached.

SKINDOSE4.XLS CALCULATION SPREADSHEET VERIFICATION!

Evaluator! Jan Hagan
Date! 3-28-05

$C_h = MCL \cdot E \cdot T_{SK}$

Case 1: $(150{,}000)(.1)(1.5) = 22{,}500$

Case 2: $(150{,}000)(.1)(.75) = 11{,}250$

Case 3: $(75{,}000)(.1)(.75) = 5625$

Case 4: $(150{,}000)(.1)(1.25) = 18{,}750$

Case 5: $(150{,}000)(.1)(1.25) = 18{,}750$

Case 6: $(150{,}000)(.1)(1.5) = 22{,}500$

Case 7: $(150{,}000)(.1)(1.25) = 18{,}750$

$D_{(mrem)} = \left(\frac{C_h}{RF}\right) \cdot F$ Using C_h calculated from above for each case!

Case 1: $\left(\frac{22500}{50}\right)(1) = 450.0$

Case 2: $\left(\frac{11250}{50}\right)(1) = 225.0$

Case 3: $\left(\frac{5625}{50}\right)(1) = 112.5$

Case 4: $\left(\frac{18750}{150}\right)(1) = 375.0$ ~~.5 = 187.5~~ 3-28-05

Case 5: $\left(\frac{18750}{1300}\right)(1) = 14.423$

Case 6: $\left(\frac{22500}{60}\right)(1) = 375.0$

Case 7: $\left(\frac{18750}{2200}\right)(1) = 8.52273$

SKINDOSE4.XLS CALCULATION VERIFICATION

Case #	Max. Contamination Level (dpm)	Exposure Time on Skin (h)	Skin Area (cm^2)	Nuclide(s) Involved	Instrument Efficiency (cpm/dpm)	Hand Calculated Skin Dose (mrem)	Spreadsheet Skin Dose (mrem) (C50)	Difference (mrem)
1	150,000	1.5	5	Other	0.10	450.0	450	0
2	150,000	0.75	5	Other	0.10	225.0	225	0
3	75,000	0.75	5	Other	0.10	112.5	112.5	0
4	150,000	1.25	50	Other	0.10	187.5	187.5	0
5	150,000	1.25	100	Other	0.10	14,423	14.4	0
6	150,000	1.5	5	Cs-137	0.10	375.0	375	0
7	150,000	1.25	100	Cs-137	0.10	8.5227	8.5	0

*Hand Calculation:

$C_h = MCL * E * T_{sk}$

$D = (C_h / RF) * F$

where:

- C_h = Calculated cpm-h
- MCL = Max.contamination level (dpm)
- E = Instrument count efficiency (cpm/dpm)
- T_{sk} = Exposure time on skin (h)
- F = Fraction of skin affected compared to 100 cm^2
- RF = Response factor (cpm per mrem/h)
- D = Estimated skin dose (mrem)

Evaluated by: Jan Hsian / Jan Hsian — Peer Reviewer (Print/Sign) 3-28-05 — Date:

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA *Enter data in the white underlined boxes*

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Case 1	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.50		
AFFECTED SKIN AREA (cm^2):	5.0	*This skin area is considered to be a*	Point source.
RADIONUCLIDES INVOLVED (Cs-137 or Other):	other		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 50

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	5	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	<10	*(Applies only when >= 10 cm^2 and <100 cm^2)*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	22,500	cpm-h
ESTIMATED SKIN DOSE:	450.0	mrem

Estimated skin dose is recorded in individual's history file as a special entry only.

EQUATIONS

$C_h = MCL * E * T_{sk}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Haan Date: 3-28-05

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA *Enter data in the white underlined boxes*

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Case 2	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	0.75		
AFFECTED SKIN AREA (cm^2):	5.0	*This skin area is considered to be a* Point *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	other		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* *Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products*

SELECTED RESPONSE FACTOR TO BE USED IS: 50

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	5	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	<10	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	11,250	cpm-h
ESTIMATED SKIN DOSE:	225.0	mrem

Estimated skin dose is recorded in individual's history file as a special entry only.

EQUATIONS

$C_h = MCL * E * T_{sh}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sh} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: Q. Haan 3-28-05 Date: 3-28-05

[..\SKINDOSE4-Rev4.xls.XLS] Revision 4

(03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005	FORM #:
FACILITY:		
RADIOLOGICAL SURVEY REPORT NUMBER:		
WORKER NAME:	Case 3	PR # or HID:
MAX. CONTAMINATION LEVEL (dpm):	75,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*
EXPOSURE TIME ON SKIN (h):	0.75	
AFFECTED SKIN AREA (cm^2):	5.0	*This skin area is considered to be a* Point *source.*
RADIONUCLIDES INVOLVED (Cs-137 or Other):	other	
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 50

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	5	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	<10	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	7,500	cpm
CALCULATED cpm-h:	5,625	cpm-h
ESTIMATED SKIN DOSE:	112.5	mrem

Estimated skin dose is recorded in individual's history file as a special entry only.

EQUATIONS

$C_h = MCL * E * T_{sk}$

$D = (C_h / RF) * F$

where F = 1 if effected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sk} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Haan Date: 3-28-05

[..\SKINDOSE4-Rev4.xls.XLS] Revision 4

(03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Case 4	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.25		
AFFECTED SKIN AREA (cm^2):	50.0	*This skin area is considered to be a* Point *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	other		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* *Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products*

SELECTED RESPONSE FACTOR TO BE USED IS: 50

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	50	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	0.5	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	18,750	cpm-h
ESTIMATED SKIN DOSE:	187.5	mrem

Estimated skin dose is greater than or equal to 100 mrem, so ensure a formal skin dose assessment is performed.

EQUATIONS

$C_h = MCL * E * T_{ot}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{ot} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Hearn Date: 3-28-05

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Case 5	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.25		
AFFECTED SKIN AREA (cm^2):	100.0	*This skin area is considered to be a*	Area source.
RADIONUCLIDES INVOLVED (Cs-137 or Other):	other		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors (*Appendix A from HNF-13536, Section 2.1.4*)

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 1,300

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	100	cm^2
CONTAMINATION CONSIDERED TO BE A:	Area	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	>100	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	18,750	cpm-h
ESTIMATED SKIN DOSE:	14.4	mrem

Estimated skin dose is less than 100 mrem. Therefore, is no requirement to perform a formal skin dose assessment.

EQUATIONS

$C_h = MCL * E * T_{sh}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sh} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Haan Date: 3-28-05

[..\SKINDOSE4-Rev4.xls.XLS] Revision 4

(03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005
FACILITY:	
RADIOLOGICAL SURVEY REPORT NUMBER:	
WORKER NAME:	Case 6
MAX. CONTAMINATION LEVEL (dpm):	150,000
EXPOSURE TIME ON SKIN (h):	1.50
AFFECTED SKIN AREA (cm^2):	5.0
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Cs-137
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100

FORM #:

PR # or HID:

Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.

This skin area is considered to be a Point *source.*

(i.e., efficiency = 1/CF)

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 60

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	5	cm^2
CONTAMINATION CONSIDERED TO BE A:	Point	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	<10	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	22,500	cpm-h
ESTIMATED SKIN DOSE:	375.0	mrem

Estimated skin dose is recorded in individual's history file as a special entry only.

EQUATIONS

$C_h = MCL * E * T_{sh}$

$D = (C_h / RF) * F$

where F = 1 if affected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{sh} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Haan Date: 3-28-05

[..\SKINDOSE4-Rev4.xls XLS] Revision 4

(03/31/05)

SENSITIVE - STRICTLY PRIVATE

ESTIMATION OF SKIN DOSE FROM SKIN CONTAMINATION

[Based on the HNF-13536, Section 2.1.4, "*Skin Contamination Dose Assessment*" procedure]

[Documentation of software quality control of this tool is found in HNF-10729]

INPUT DATA

Enter data in the white underlined boxes

DATE:	3/28/2005	FORM #:	
FACILITY:			
RADIOLOGICAL SURVEY REPORT NUMBER:			
WORKER NAME:	Case 7	PR # or HID:	
MAX. CONTAMINATION LEVEL (dpm):	150,000	*Dose assessment potentially required if equal to or greater than 5,000 cpm-h or 50,000 dpm-h beta-gamma.*	
EXPOSURE TIME ON SKIN (h):	1.25		
AFFECTED SKIN AREA (cm^2):	100.0	*This skin area is considered to be a* Area *source.*	
RADIONUCLIDES INVOLVED (Cs-137 or Other):	Cs-137		
INSTRUMENT COUNT EFFICIENCY (cpm/dpm):	0.100	*(i.e., efficiency = 1/CF)*	

SUPPLIED INFORMATION

Contamination-to-Dose Response Factors *(Appendix A from HNF-13536, Section 2.1.4)*

Nuclide	Area Source (cpm per mrem/h)	Point Source (cpm per mrem/h)
Cs-137	2,200	60
Other	1,300	50

* Other = Sr-90/Y-90; Cs/Sr/Y;Aged Mixed Fission Products

SELECTED RESPONSE FACTOR TO BE USED IS: 2,200

CALCULATIONAL RESULTS

AFFECTED SKIN AREA:	100	cm^2
CONTAMINATION CONSIDERED TO BE A:	Area	source
FRACTION OF SKIN AFFECTED COMPARED TO 100 cm^2:	>100	*[Applies only when >= 10 cm^2 and <100 cm^2]*
CALCULATED MAXIMUM INSTRUMENT READING:	15,000	cpm
CALCULATED cpm-h:	18,750	cpm-h
ESTIMATED SKIN DOSE:	8.5	mrem

Estimated skin dose is less than 100 mrem. Therefore, is no requirement to perform a formal skin dose assessment.

EQUATIONS

$C_h = MCL * E * T_{ot}$

$D = (C_h / RF) * F$

where F = 1 if effected area of skin is ≤ 10 or >100 cm^2

C_h = Calculated cpm-h
MCL = Max.contamination level (dpm)
E = Instrument count efficiency (cpm/dpm)
T_{ot} = Exposure time on skin (h)
F = Fraction of skin affected compared to 100 cm^2
RF = Response factor (cpm per mrem/h)
D = Estimated skin dose (mrem)

CALCULATION PERFORMED BY: J. Haas Date: 3-28-05