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Title/Desc:

UNIT DOSE CALCULATIONS FOR THE K BASINS SAFETY
REGULATORY ASSESSMENT FEED BASIS

Pages: 30

APR 1 1996
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ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 156463

2. To: (Receiving Organization) SN&NE	3. From: (Originating Organization) Consequence Analysis 8M400	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: Consequence Analysis/SA&NE/8M400	6. Cog. Engr.: C.H. Huang	7. Purchase Order No.: N/A
8. Originator Remarks: The attached SD provides the unit dose calculations for Kasins Safety Regulatory Assessment Feed Basis.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: CWC
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
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15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	WHC-SD-WM-TI-742	N/A	0	Unit Dose Calculations for The K Basins Safety Regulatory Assessment Feed Basis	N/A	1/2		

16. 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	1. Approved	4. Reviewed no/comment
		2. Release	5. Post-Review	2. Approved w/comment	5. Reviewed w/comment
		3. Information	6. Dist. (Receipt Acknow. Required)	3. Disapproved w/comment	6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)								(G)	(H)		
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1		Cog.Eng. C.H. Huang	<i>C.H. Huang</i>	3/7/96	A3-34						
1		Cog. Mgr. D.S. Leach	<i>D.S. Leach</i>	3/20/96							
		QA									
		Safety									
		Env.									
1		Peer rev. D.A. Himer	<i>D.A. Himer</i>	3/7/96	A3-34						

18. C.H. Huang <i>C.H. Huang</i> 3/7/96 Signature of EDT Originator Date	19. M. Kummerer <i>M. Kummerer</i> 3/20/96 Authorized Representative Date for Receiving Organization	20. D.S. Leach <i>D.S. Leach</i> 3/17/96 Cognizant Manager Date	21. DOE APPROVAL (if required) Ctrl. No. [N/A] Approved [] Approved w/comments [] Disapproved w/comments
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UNIT DOSE CALCULATIONS FOR THE K BASINS SAFETY REGULATORY ASSESSMENT FEED BASIS

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Key Words: Dose Calculation, K Basins, Safety Assessment, Calculation Note.

Abstract: This document provides the unit dose calculations for a mixture of isotopes.

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Chris Willingham 4-1-96
Release Approval Date

Approved for Public Release

UNIT DOSE CALCULATIONS FOR THE K BASINS
SAFETY REGULATORY ASSESSMENT FEED BASIS

C. H. HUANG
March 7, 1996

INTRODUCTION

The objective for this document is to present the unit doses for the K Basins safety regulatory assessment feed basis. The release location is at the K Basins in the 100 Area.

METHODOLOGIES AND ASSUMPTIONS

The unit X/Q was used for the dose calculations. The X/Q refers to the concentration of airborne contamination. It is the ratio of contaminant concentration at a specific receptor location to contaminant release rate. The receptor of concern is normally defined as a human having a standard breathing rate and metabolism. The product of X/Q and breathing rate is a unitless number representing the fraction of contaminant inhaled to contaminant released. Inhalation is the most likely pathway to human exposure.

The GENII code was used to calculate the unit doses. The unit X/Q , maximum solubilities, and a typical acute breathing rate were used in the GENII code for the unit dose calculations.

The source terms are specified by the customer (see Table 1 and Appendix A).

CODE DOCUMENTATION

- o GENII version 1.485 (12/3/90)
- o GENII Default Parameter Values (28-Mar-90 RAP)
- o Radionuclide Master Library (7/23/93 PDR)
- o External Dose Factor Library (8-May-90-RAP)
- o Internal Dose Increments, Maximum Solubilities,
(7/23/93 PDR)

GENII code was used in the calculations.

Assumptions used in the unit dose calculations are given below:

- o Unit X/Q

o $3.3\text{E-}04 \text{ m}^3/\text{s}$ for breathing rate.

GENII input and output files are attached in Appendix B.

SOURCE TERM

The source terms for a mixture of isotopes were provided by the customer. The source terms for the mixture (16.72% Pu-240) of isotopes are shown in Table 1. For dose calculations, the source terms in the table are expressed as the specific activity for each isotope in unit of Ci per MTU (Metric Ton of Uranium) of the mixture.

Table 1. The 16.72% Pu-240 Mixture and Activity per MTU of a Mixture.

Isotope	Activity Ci/MTU
H-3	3.57E+01
Kr-85	5.39E+02
Sr-90	7.84E+03
Y-90	7.84E+03
Cs-137	1.08E+04
Pu-238	1.71E+02
Pu-239	1.58E+02
Pu-240	1.28E+02
Pu-241	9.25E+03
Am-241	3.58E+02
Cm-244	5.36E+00

* MTU: Metric Ton of Uranium.

UNIT DOSE CALCULATIONS

The GENII code was used to calculate doses for the mixture of isotopes. The unit X/Q and the source terms as shown in Table 1 were used as input data into the GENII code for dose calculations. The calculated unit doses are shown in Table 2 for the mixture (16.72 % Pu-240). The doses in the table are expressed either in units of rem/MTU and rem/g (gram of Uranium).

Table 2. Doses Per Unit X/Q for the Mixture and Inhalation Effective Dose Equivalent for Each Isotope in Units of rem/MTU and rem/g.

Isotope	Activity Ci/MTU	Inhalation Dose rem/MTU	Inhalation Dose rem/g
H-3	3.57E+01	1.1E+00	1.1E-06
Kr-85	5.39E+02	0.0	0.0
Sr-90	7.84E+03	5.3E+05	5.3E-01
Y-90	7.84E+03	2.3E+04	2.3E-02
Cs-137	1.08E+04	1.1E+05	1.1E-01
Pu-238	1.71E+02	2.2E+07	2.2E+01
Pu-239	1.58E+02	2.3E+07	2.3E+01
Pu-240	1.28E+02	1.9E+07	1.9E+01
Pu-241	9.25E+03	2.5E+07	2.5E+01
Am-241	3.58E+02	5.3E+07	5.3E+01
Cm-244	5.36E+00	4.5E+05	4.5E-01
Total		1.43E+08	1.43E+02

* MTU: Metric Ton of Uranium; g: gram of Uranium.

Note: The application of these unit X/Q doses using an actual X/Q must be HEDOP reviewed.

REFERENCES

Napier, B. A., et al., 1988, GENII - The Hanford Environmental Radiation Dosimetry Software System, PNL-6584, Pacific Northwest Laboratory, Richland, Washington.

APPENDIX A

SOURCE TERMS PROVIDED BY THE CUSTOMER

[72] From: Maryanne Kummerer 1/25/96 4:02PM (116998 bytes: 1 ln, 1 fl)

To: Chin-Hua (Chester) Huang

Subject: Safety/Regulatory Assessment Spreadsheet

----- Forwarded with Changes -----

From: William L Willis at WHC83 1/25/96 8:56AM (115760 bytes: 1 ln, 1 fl)

To: Maryanne Kummerer at BCS78

Subject: Safety/Regulatory Assessment Spreadsheet

----- Message Contents -----

Text item 1: Text_1

Chester -

Here is the file they sent me. It is a Quatro-pro file. Do you have a spreadsheet program that can read it? Ignore the CEDE column he has there. I need you to use the Ci/MTU and calculate rem/gm or rem/MTU or Sv/gm or whatever the standard set of units is. If you can give me the numbers whenever you get the calculation done. Then, when you document them, let me know all the assumptions that are used in the calculation. For example, is the breathing rate included.

The TPCN for doing this is LG021.

Thanks. Ask me any questions you have.

Maryanne

----- Forward Header -----

Subject: Safety/Regulatory Assessment Spreadsheet

Author: William L Willis at WHC83

Date: 1/25/96 8:56 AM

Here is the spreadsheet I used to develop the safety regulatory assessment feed basis in the design basis feed document. The starting point was a RADNUC run for the highest burnup key in the K Basins. The Safeguards Database lists this key as 16.72% Pu-240. If you have any questions or suggestions how I might improve the feed document please let me know.

Maximum Pu-240 content K Basin Fuel

Results decayed to 01/01/1995

Total Mass (MTU)	6.90E+00
Total Activity (Ci)	3.35E+05
Total BTU	3.23E+03
Total Heat Generation (W)	9.46E+02

Isotope	Curies	BTUs	(W)	Activity Ci/MTU	CEDE rem/uCi
H-3	2.46E+02	2.82E-02	8.28E-03	3.57E+01	0.000063
C-14	3.81E+00	3.80E-03	1.11E-03	5.52E-01	0.0021
Fe-55	1.97E+01	2.24E-03	6.56E-04	2.86E+00	0.0026
Co-60	3.27E+01	4.30E+01	1.26E+01	4.74E+00	0.15
Ni-59	2.19E-01	2.96E-05	8.67E-06	3.17E-02	0.0027
Ni-63	2.51E+01	8.65E-03	2.53E-03	3.64E+00	0.0063
Se-79	4.36E-01	4.59E-04	1.34E-04	6.32E-02	0.0089
Kr-85	3.72E+03	1.90E+01	5.57E+00	5.39E+02	0
Sr-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.037
Sr-90	5.41E+04	2.14E+02	6.27E+01	7.84E+03	1.3
Y-90	5.41E+04	1.02E+03	2.99E+02	7.84E+03	0.0082
Y-91	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.044
Zr-93	1.99E+00	7.79E-04	2.28E-04	2.88E-01	0.081
Zr-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.019
Nb-93m	1.08E+00	6.58E-04	1.93E-04	1.56E-01	0.028
Nb-95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0045
Nb-95m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0022
Tc-99	1.46E+01	2.50E-02	7.33E-03	2.12E+00	0.0075
Ru-103	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0078
Ru-106	1.22E+01	2.47E-03	7.24E-04	1.77E+00	0.44
Rh-103m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.6E-06
Rh-106	1.22E+01	3.97E-01	1.16E-01	1.77E+00	0.0002
Pd-107	1.02E-01	1.92E-05	5.63E-06	1.48E-02	0.013
Ag-110	2.62E-06	6.70E-11	1.96E-11	3.80E-07	0.053

Ag-110m	1.97E-04	1.12E-05	3.28E-06	2.86E-05	0.053
Cd-113m	2.42E+01	9.10E-02	2.67E-02	3.51E+00	1.4
Cd-115m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.085
In-113m	8.40E-13	6.63E-15	1.94E-15	1.22E-13	0.000034
Sn-113	8.40E-13	4.76E-16	1.39E-16	1.22E-13	0.0089
Sn-119m	2.64E-04	4.64E-07	1.36E-07	3.82E-05	0.0053
Sn-121m	4.64E-01	1.66E-03	4.87E-04	6.72E-02	0.0089
Sn-123	2.24E-10	2.39E-12	7.00E-13	3.25E-11	0.03
Sn-126	8.46E-01	8.87E-04	2.60E-04	1.23E-01	0.088
Sb-124	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.021
Sb-125	3.66E+02	3.93E+00	1.15E+00	5.31E+01	0.0098
Sb-126	1.18E-01	7.32E-03	2.14E-03	1.71E-02	0.01
Sb-126m	8.46E-01	3.70E-02	1.08E-02	1.23E-01	0.000025
Te-123m	5.18E-15	2.57E-17	7.53E-18	7.51E-16	0.0095
Te-125m	8.94E+01	2.57E-01	7.52E-02	1.30E+01	0.0067
Te-127	2.66E-12	1.23E-14	3.60E-15	3.86E-13	0.000029
Te-127m	2.72E-12	4.60E-15	1.35E-15	3.94E-13	0.02
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000067
Te-129m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.02
I-129	3.41E-02	5.45E-05	1.60E-05	4.94E-03	0.18
Cs-134	3.56E+02	1.24E+01	3.63E+00	5.16E+01	0.047
Cs-135	3.96E-01	4.51E-04	1.32E-04	5.74E-02	0.0045
Cs-137	7.47E+04	2.58E+02	7.56E+01	1.08E+04	0.032
Ba-137m	7.07E+04	9.46E+02	2.77E+02	1.02E+04	0
Ce-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0085
Ce-144	1.36E+00	3.07E-03	9.00E-04	1.97E-01	0.35
Pr-143	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0073
Pr-144	1.35E+00	3.37E-02	9.87E-03	1.96E-01	0.000042
Pr-144m	1.63E-02	1.87E-05	5.48E-06	2.36E-03	0.000042
Pm-147	3.76E+03	4.71E+00	1.38E+00	5.45E+02	0.034
Pm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.01
Pm-148m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.017
Sm-151	6.98E+02	2.79E-01	8.17E-02	1.01E+02	0.029
Eu-152	7.41E+00	1.14E-01	3.34E-02	1.07E+00	0.22

1 MTN = 10^6 g.

Eu-154	1.25E+03	3.84E+01	1.13E+01	1.81E+02	0.28
Eu-155	1.67E+02	4.12E-01	1.21E-01	2.42E+01	0.039
Gd-153	2.30E-06	7.07E-09	2.07E-09	3.33E-07	
Tb-160	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Totals	2.64E+05	2.56E+03	7.50E+02	3.83E+04	
U-234	2.64E+00	2.55E-01	7.47E-02	3.83E-01	130
U-235	8.64E-02	8.00E-03	2.34E-03	1.25E-02	120
U-236	4.97E-01	4.53E-02	1.33E-02	7.20E-02	120
U-238	2.27E+00	1.93E-01	5.65E-02	3.29E-01	120
Np-237	3.91E-01	3.84E-02	1.13E-02	5.67E-02	490
Pu-238	1.18E+03	1.32E+02	3.87E+01	1.71E+02	460
Pu-239	1.09E+03	1.14E+02	3.34E+01	1.58E+02	510
Pu-240	8.83E+02	9.23E+01	2.70E+01	1.28E+02	510
Pu-241	6.38E+04	6.75E+00	1.98E+00	9.25E+03	10
Pu-242	7.24E-01	7.19E-02	2.11E-02	1.05E-01	480
Am-241	2.47E+03	2.77E+02	8.12E+01	3.58E+02	520
Am-242	5.73E+00	1.63E-01	4.78E-02	8.30E-01	0.061
Am-242m	5.76E+00	3.01E-02	8.82E-03	8.35E-01	510
Am-243	8.31E-01	8.97E-02	2.63E-02	1.20E-01	520
Cm-242	4.76E+00	5.88E-01	1.72E-01	6.90E-01	17
Cm-244	3.70E+01	4.35E+01	1.27E+01	5.36E+00	270
Totals	6.95E+04	6.67E+02	1.95E+02	1.01E+04	

APPENDIX B

GENII INPUT AND OUTPUT FILES

Program GENII Input File ##### 8 Jul 88 ####
 Title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE
 \GENII\KBFLT.in

OPTIONS===== Default =====
 F Near-field scenario? (Far-field) NEAR-FIELD: narrowly-focused
 F Population dose? (Individual) release, single site
 T Acute release? (Chronic) FAR-FIELD: wide-scale release,
 Maximum Individual data set used multiple sites
 Complete
 TRANSPORT OPTIONS===== Section EXPOSURE PATHWAY OPTIONS===== Section
 T Air Transport 1 F Finite plume, external 5
 F Surface Water Transport 2 T Infinite plume, external 5
 F Biotic Transport (near-field) 3,4 F Ground, external 5
 F Waste Form Degradation (near) 3,4 F Recreation, external 5
 T Inhalation uptake 5,6
 F Drinking water ingestion 7,8
 F Aquatic foods ingestion 7,8
 F Terrestrial foods ingestion 7,9
 F Animal product ingestion 7,10
 F Inadvertent soil ingestion
 REPORT OPTIONS=====
 T Report AEDE only
 T Report by radionuclide
 T Report by exposure pathway
 F Debug report on screen

INVENTORY #####

- 4 Inventory input activity units: (1-pCi 2-uCi 3-mCi 4-Ci 5-Bq)
 0 Surface soil source units (1- m2 2- m3 3- kg)
 Equilibrium question goes here

Use when	---Release Terms--- transport selected			-----Basic Concentrations----- near-field scenario, optionally				
	Air /yr	Surface Water /yr	Buried Waste /m3	Air /m3	Surface Soil /unit	Deep Soil /m3	Ground Water /L	Surface Water /L
Release Radio- nuclide								
H 3	3.6E+01							
KR85	5.4E+02							
PU238	1.7E+02							
PU239	1.6E+02							
PU240	1.3E+02							
PU241	9.3E+03							
AM241	3.6E+02							
CM244	5.4E+00							
CS137	1.1E+04							
SR90	7.8E+03							
Y 90	7.8E+03							
Use when	---Derived Concentrations--- measured values are known							
	Terres. Plant /kg	Animal Product /kg	Drink Water /L	Aquatic Food /kg				
Release Radio- nuclide								

TIME #####

1 Intake ends after (yr)
 50 Dose calc. ends after (yr)
 0 Release ends after (yr)
 0 No. of years of air deposition prior to the intake period
 0 No. of years of irrigation water deposition prior to the intake period

FAR-FIELD SCENARIOS (IF POPULATION DOSE) #####

0 Definition option: 1-Use population grid in file POP.IN
 0 2-Use total entered on this line

NEAR-FIELD SCENARIOS #####

Prior to the beginning of the intake period: (yr)
 0 When was the inventory disposed? (Package degradation starts)
 0 When was LOIC? (Biotic transport starts)
 0 Fraction of roots in upper soil (top 15 cm)
 0 Fraction of roots in deep soil
 0 Manual redistribution: deep soil/surface soil dilution factor
 0 Source area for external dose modification factor (m2)

TRANSPORT #####

-----AIR TRANSPORT-----SECTION 1-----
 0-Calculate PM 0 Release type (0-3)
 1 Option: 1-Use chi/Q or PM value F Stack release (T/F)
 2-Select MI dist & dir 0 Stack height (m)
 3-Specify MI dist & dir 0 Stack flow (m3/sec)
 1 Chi/Q or PM value 0 Stack radius (m)
 0 MI sector index (1=5) 0 Effluent temp. (C)
 0 MI distance from release point (m) 0 Building x-section (m2)
 T Use jf data, (T/F) else chi/Q grid 0 Building height (m)

-----SURFACE WATER TRANSPORT-----SECTION 2-----
 0 Mixing ratio model: 0-use value, 1-river, 2-lake
 0 Mixing ratio, dimensionless
 0 Average river flow rate for: MIXFLG=0 (m3/s), MIXFLG=1,2 (m/s),
 0 Transit time to irrigation withdrawal location (hr)
 If mixing ratio model > 0:
 0 Rate of effluent discharge to receiving water body (m3/s)
 0 Longshore distance from release point to usage location (m)
 0 Offshore distance to the water intake (m)
 0 Average water depth in surface water body (m)
 0 Average river width (m), MIXFLG=1 only
 0 Depth of effluent discharge point to surface water (m), lake only

-----WASTE FORM AVAILABILITY-----SECTION 3-----
 0 Waste form/package half life, (yr)
 0 Waste thickness, (m)
 0 Depth of soil overburden, m

-----BIOTIC TRANSPORT OF BURIED SOURCE-----SECTION 4-----
 T Consider during inventory decay/buildup period (T/F)?

T Consider during intake period (T/F)? | 1-Arid non agricultural
 0 Pre-Intake site condition..... | 2-Humid non agricultural
 | 3-Agricultural

EXPOSURE #####

====EXTERNAL EXPOSURE=====SECTION 5====
 Exposure time: Residential irrigation:
 0 Plume (hr) T Consider: (T/F)
 0 Soil contamination (hr) 0 Source: 1-ground water
 0 Swimming (hr) 0 2-surface water
 0 Boating (hr) 0 Application rate (in/yr)
 0 Shoreline activities (hr) 0 Duration (mo/yr)
 0 Shoreline type: (1-river, 2-lake, 3-ocean, 4-tidal basin)
 0 Transit time for release to reach aquatic recreation (hr)
 1.0 Average fraction of time submersed in acute cloud (hr/person hr)

====INHALATION=====SECTION 6====
 8766.0 Hours of exposure to contamination per year
 0 0-No resus- 1-Use Mass Loading 2-Use Anspaugh model
 0 pension Mass loading factor (g/m3) Top soil available (cm)

====INGESTION POPULATION=====SECTION 7====
 0 Atmospheric production definition (select option):
 0 0-Use food-weighted chi/Q,(food-sec/m3), enter value on this line
 1-Use population-weighted chi/Q
 2-Use uniform production
 3-Use chi/Q and production grids (PRODUCTION will be overridden)
 0 Population ingesting aquatic foods, 0 defaults to total (person)
 0 Population ingesting drinking water, 0 defaults to total (person)
 F Consider dose from food exported out of region (default=F)

Note below: S* or Source: 0-none, 1-ground water, 2-surface water
 3-Derived concentration entered above

==== AQUATIC FOODS / DRINKING WATER INGESTION=====SECTION 8====
 F Salt water? (default is fresh)

USE ? T/F	FOOD TYPE	TRAN- SIT hr	PROD- UCTION kg/yr	-CONSUMPTION- HOLDUP da	RATE kg/yr	DRINKING WATER
F	FISH	0.00	0.0E+00	0.00	0.0	0 Source(see above)
F	MOLLUS	0.00	0.0E+00	0.00	0.0	T Treatment? T/F
F	CRUSTA	0.00	0.0E+00	0.00	0.0	0 Hldup/transit(da)
F	PLANTS	0.00	0.0E+00	0.00	0.0	0 Consumpton(L/yr)

====TERRESTRIAL FOOD INGESTION=====SECTION 9====

USE ? T/F	FOOD TYPE	GROW TIME da	--IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m2	PROD- UCTION kg/yr	--CONSUMPTION-- HOLDUP da	RATE kg/yr

F	LEAF V	0.00	0	0.0	0.0	0.0	0.0E+00	0.0	0.0
F	ROOT V	0.00	0	0.0	0.0	0.0	0.0E+00	0.0	0.0
F	FRUIT	0.00	0	0.0	0.0	0.0	0.0E+00	0.0	0.0
F	GRAIN	0.00	0	0.0	0.0	0.0	0.0E+00	0.0	0.0

====ANIMAL PRODUCTION CONSUMPTION=====SECTION 10=====

USE ? T/F	FOOD TYPE	---HUMAN--- CONSUMPTION RATE kg/yr	TOTAL HOLDUP da	PROD- DUCTION kg/yr	DRINK WATER CONTAM FRACT.	DIET FRAC- TION	GROW TIME da	STOR- ED FEED -IRRIGATION- S RATE * in/yr	YIELD mo/yr	STOR- AGE kg/m3	da
F	BEEF	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	POULTR	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	MILK	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
F	EGG	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.0
	BEEF					0.00	0.0	0	0.0	0.00	0.0
	MILK					0.00	0.0	0	0.0	0.00	0.0

#####

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

Executed on: 02/05/96 at 09:29:26

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 This is a far-field (wide-scale release, multiple site) scenario.
 Release is acute
 Individual dose

THE FOLLOWING TRANSPORT MODES ARE CONSIDERED
 Air

THE FOLLOWING EXPOSURE PATHS ARE CONSIDERED:
 Infinite plume, external
 Inhalation uptake

THE FOLLOWING TIMES ARE USED:
 Intake ends after (yr): 1.0
 Dose calculations ends after (yr): 50.0

===== FILENAMES AND TITLES OF FILES/LIBRARIES USED
 =====

Input file name: \GENII\KBFLT.in

GENII Default Parameter Values (28-Mar-90 RAP)

Radionuclide Library - Times<100 years (23-July-93 PDR)

External Dose Factors for GENII in person Sv/yr per Bq/n (8-May-90 R

Worst-Case Solubilities, Yearly Dose Increments (23-Jul-93 PDR)

=====

-----Release Terms-----			
Release	Air	Surface	Buried
Radio-		Water	Source
nuclide	Ci/yr	Ci/yr	Ci/m3
H 3	3.6E+01	0.0E+00	0.0E+00

KR85	5.4E+02	0.0E+00	0.0E+00
PU238	1.7E+02	0.0E+00	0.0E+00
PU239	1.6E+02	0.0E+00	0.0E+00
PU240	1.3E+02	0.0E+00	0.0E+00
PU241	9.3E+03	0.0E+00	0.0E+00
AM241	3.6E+02	0.0E+00	0.0E+00
CM244	5.4E+00	0.0E+00	0.0E+00
CS137	1.1E+04	0.0E+00	0.0E+00
SR90	7.8E+03	0.0E+00	0.0E+00
Y 90	7.8E+03	0.0E+00	0.0E+00

===== AIR TRANSPORT

=====

1.0E+00 Input E/Q value (s/m3)

===== EXTERNAL EXPOSURE

=====

1.0E+00 Fraction of time spent in cloud

===== INHALATION

=====

Resuspension not considered

=====

=

Input prepared by: _____ Date: _____

Input checked by: _____ Date: _____

=====

=

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

Executed on: 02/05/96 at 09:29:44

Page C.

1

 Acute release
 Uptake/exposure period: 1.0
 Dose commitment period: 50.0
 Dose units: Rem

Organ	Committed Dose Equivalent	Weighting Factors	Weighted Dose Equivalent
Gonads	3.7E+07	2.5E-01	9.3E+06
Breast	1.1E+05	1.5E-01	1.7E+04
R Marrow	2.1E+08	1.2E-01	2.5E+07
Lung	1.8E+07	1.2E-01	2.2E+06
Thyroid	1.1E+05	3.0E-02	3.3E+03
Bone Sur	2.6E+09	3.0E-02	7.9E+07
Liver	4.6E+08	6.0E-02	2.7E+07
LL Int.	3.1E+05	6.0E-02	1.8E+04
UL Int.	1.9E+05	6.0E-02	1.2E+04
S Int.	1.4E+05	6.0E-02	8.4E+03
Stomach	1.3E+05	6.0E-02	7.6E+03
Internal Effective Dose Equivalent			1.4E+08
External Dose			1.3E+03
Annual Effective Dose Equivalent			1.4E+08

 Controlling Organ: Bone Sur
 Controlling Pathway: Inh
 Controlling Radionuclide: AM241

 Total Inhalation EDE: 1.4E+08

Total Ingestion EDE:	0.0E+00

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

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 Acute release

Uptake/exposure period:

1.0

Dose commitment period:

50.0

Dose units:

Rem

Dose Commitment Year

1 2 3 ...

Internal : |

Intake : |

Year: 3 | 0.0E+00 ...

| +

2 | 0.0E+00 0.0E+00 ...

| + +

1 | 5.6E+06 + 3.8E+06 + 3.7E+06 + ... = 1.4E+08

Internal

Effective

Dose

Equivalent

|| || ||

Internal

Cumulative

Annual 5.6E+06 + 3.8E+06 + 3.7E+06 + ... = 1.4E+08

Internal

Dose

Dose

+ + + +

External

Annual 1.3E+03 0.0E+00 0.0E+00 ... 1.3E+03

Dose

11 11 11 11

Annual

Cumulative

Dose 5.6E+06 + 3.8E+06 + 3.7E+06 + ... = 1.4E+08

Dose

Maximum

5.6E+06

Annual

Dose Occurred

In Year 1

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

Executed on: 02/05/96 at 09:29:44

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 Acute release
 Uptake/exposure period: 1.0
 Dose commitment period: 50.0
 Dose units: Rem

Committed Dose Equivalent by Exposure Pathway

Pathway	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro
Testes	-----	-----	-----	-----	-----	-----	-----
Inhale	1.8E+07	1.3E+05	1.4E+05	1.9E+05	3.1E+05	2.6E+09	2.1E+08
3.7E+07	-----	-----	-----	-----	-----	-----	-----
Total	1.8E+07	1.3E+05	1.4E+05	1.9E+05	3.1E+05	2.6E+09	2.1E+08
3.7E+07	-----	-----	-----	-----	-----	-----	-----

Pathway	Ovaries	Muscle	Thyroid	Liver
Inhale	3.7E+07	1.1E+05	1.1E+05	4.6E+08
Total	3.7E+07	1.1E+05	1.1E+05	4.6E+08

External Dose by Exposure Pathway

Pathway	
Plume	1.3E+03
Total	1.3E+03

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

Executed on: 02/05/96 at 09:29:44

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 Acute release
 Uptake/exposure period: 1.0
 Dose commitment period: 50.0
 Dose units: Rem

Committed Dose Equivalent by Radionuclide

Radionuclide	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro
Testes							
-----	-----	-----	-----	-----	-----	-----	-----
H 3	1.1E+00	1.1E+00	1.1E+00	1.1E+00	1.1E+00	1.4E+00	1.4E+00
1.1E+00							
KR 85	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
SR 90	1.4E+04	3.9E+03	4.2E+03	9.6E+03	3.0E+04	6.3E+06	2.8E+06
3.7E+03							
Y 90	9.3E+04	4.2E+03	1.1E+04	5.1E+04	1.3E+05	1.5E+02	1.5E+02
5.2E+00							
CS 137	1.2E+05	1.2E+05	1.2E+05	1.2E+05	1.2E+05	1.1E+05	1.1E+05
1.2E+05							
CM 244	1.3E+05	1.1E+01	1.9E+01	7.3E+01	2.1E+02	7.8E+06	6.3E+05
1.0E+05							
PU 240	2.7E+06	2.4E+02	3.8E+02	1.5E+03	4.5E+03	3.4E+08	2.7E+07
4.8E+06							
PU 238	3.8E+06	3.3E+02	5.4E+02	2.3E+03	6.2E+03	4.0E+08	3.2E+07
5.5E+06							
PU 241	8.5E+04	4.4E+02	4.9E+02	1.1E+03	1.8E+03	4.8E+08	3.8E+07
7.3E+06							
U 237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
AM 241	8.1E+06	1.6E+03	2.0E+03	5.8E+03	1.4E+04	9.7E+08	7.6E+07
1.4E+07							
PU 239	3.3E+06	2.9E+02	4.7E+02	1.9E+03	5.5E+03	4.3E+08	3.3E+07
5.9E+06							
-----	-----	-----	-----	-----	-----	-----	-----
Total	1.8E+07	1.3E+05	1.4E+05	1.9E+05	3.1E+05	2.6E+09	2.1E+08
3.7E+07							

Radionuclide	Ovaries	Muscle	Thyroid	Liver
H 3	1.1E+00	1.1E+00	1.1E+00	0.0E+00
KR 85	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SR 90	3.7E+03	3.6E+03	3.7E+03	0.0E+00
Y 90	5.1E+00	5.0E+00	5.1E+00	1.5E+02
CS 137	1.1E+05	1.1E+05	1.1E+05	0.0E+00
CM 244	1.0E+05	7.3E+00	6.7E+00	1.6E+06
PU 240	4.7E+06	1.5E+02	1.4E+02	6.0E+07
PU 238	5.4E+06	2.1E+02	2.0E+02	7.3E+07
PU 241	7.2E+06	4.6E+02	2.0E+02	7.5E+07
U 237	0.0E+00	0.0E+00	0.0E+00	0.0E+00
AM 241	1.3E+07	1.3E+03	7.5E+02	1.7E+08
PU 239	5.8E+06	1.8E+02	1.8E+02	7.4E+07
Total	3.7E+07	1.1E+05	1.1E+05	4.6E+08

 GENII Dose Calculation Program
 (Version 1.485 3-Dec-90)

Case title: PROJECT K BASIN FUEL UNIT X/Q DOSES RELEASAE

Executed on: 02/05/96 at 09:29:44

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 Acute release
 Uptake/exposure period: 1.0
 Dose commitment period: 50.0
 Dose units: Rem

Radio-nuclide	Inhalation Effective Dose Equivalent	Ingestion Effective Dose Equivalent	External Dose	Internal Effective Dose Equivalent	Annual Effective Dose Equivalent
H 3	1.1E+00	0.0E+00	7.9E-10	1.1E+00	1.1E+00
KR 85	0.0E+00	0.0E+00	3.0E-01	0.0E+00	3.0E-01
SR 90	5.3E+05	0.0E+00	3.2E-01	5.3E+05	5.3E+05
Y 90	2.3E+04	0.0E+00	1.2E+01	2.3E+04	2.3E+04
CS 137	1.1E+05	0.0E+00	1.3E+03	1.1E+05	1.1E+05
CM 244	4.5E+05	0.0E+00	1.5E-04	4.5E+05	4.5E+05
PU 240	1.9E+07	0.0E+00	4.0E-03	1.9E+07	1.9E+07
PU 238	2.2E+07	0.0E+00	5.4E-03	2.2E+07	2.2E+07
PU 241	2.5E+07	0.0E+00	7.0E-07	2.5E+07	2.5E+07
U 237	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
AM 241	5.3E+07	0.0E+00	7.6E-01	5.3E+07	5.3E+07
PU 239	2.3E+07	0.0E+00	3.4E-03	2.3E+07	2.3E+07

CHECKLIST FOR PEER REVIEW

Document Reviewed: C. H. Huang, "UNIT DOSE CALCULATIONS FOR THE K BASINS SAFETY REGULATORY ASSESSMENT FEED BASIS," March 7, 1996.

Scope of Review: Entire Document

Yes No NA

- ☐ ☐ ☒ * Previous reviews complete and cover analysis, up to scope of this review, with no gaps.
- ☒ ☐ ☐ Problem completely defined.
- ☒ ☐ ☒ Accident scenarios developed in a clear and logical manner.
- ☒ ☐ ☐ Necessary assumptions explicitly stated and supported.
- ☒ ☐ ☐ Computer codes and data files documented.
- ☒ ☐ ☐ Data used in calculations explicitly stated in document.
- ☒ ☐ ☐ Data checked for consistency with original source information as applicable.
- ☐ ☐ ☒ Mathematical derivations checked including dimensional consistency of results.
- ☒ ☐ ☐ Models appropriate and used within range of validity or use outside range of established validity justified.
- ☒ ☐ ☐ Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.
- ☒ ☐ ☐ Software input correct and consistent with document reviewed.
- ☒ ☐ ☐ Software output consistent with input and with results reported in document reviewed.
- ☐ ☐ ☒ Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
- ☐ ☐ ☒ Safety margins consistent with good engineering practices.
- ☒ ☐ ☐ Conclusions consistent with analytical results and applicable limits.
- ☒ ☐ ☐ Results and conclusions address all points required in the problem statement.
- ☐ ☐ ☒ Format consistent with appropriate NRC Regulatory Guide or other standards
- ☐ ☒ * Review calculations, comments, and/or notes are attached.
- ☒ ☐ ☐ Document approved.

DA. Himes
Reviewer (Printed Name and Signature)

3/7/96
Date

HEDOP REVIEW CHECKLIST
for
Radiological and Nonradiological Release Calculations

Document Reviewed: C. H. Huang, " UNIT DOSE CALCULATIONS FOR THE K BASINS
SAFETY REGULATORY ASSESSMENT FEED BASIS," March 7, 1996.

Submitted by: C. H. HUANG
Date Submitted: March 7, 1996

Scope of Review: Entire Document

YES NO* N/A

☒	☐	☐	1. A detailed technical review and approval of the environmental transport and dose calculation portion of the analysis has been performed and documented.
☐	☐	☒	2. Detailed technical review(s) and approval(s) of scenario and release determinations have been performed and documented.
☒	☐	☐	3. HEDOP-approved code(s) were used.
☐	☐	☒	4. Receptor locations were selected according to HEDOP recommendations.
☒	☐	☐	5. All applicable environmental pathways and code options were included and are appropriate for the calculations.
☒	☐	☐	6. Hanford site data were used.
☒	☐	☐	7. Model adjustments external to the computer program were justified and performed correctly.
☒	☐	☒	8. The analysis is consistent with HEDOP recommendations.
☒	☐	☒	9. Supporting notes, calculations, comments, comment resolutions, or other information is attached. (Use the "Page 1 of X" page numbering format and sign and date each added page.)
☒	☐		10. Approval is granted on behalf of the Hanford Environmental Dose Overview Panel.

* All "NO" responses must be explained and use of nonstandard methods justified.

D.A. Himes 3/7/96
HEDOP-Approved Reviewer (Printed Name and Signature) Date

COMMENTS (add additional signed and dated pages if necessary):

If unit KQ doses are modified using an actual KQ , resulting document requires another HEDOP Rev.

DISTRIBUTION SHEET

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M. Kummerer	C.H. Huang	Date 3/1/96
Project Title/Work Order		EDT No. 156463
UNIT DOSE CALCULATIONS FOR THE K BASINS REGULATORY SAFETY ANALYSIS FEED BASIS		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
M. Kummerer	A3-34	X			
J.C. Van Keuren	A3-34	X			

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A3-34(2)