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Title/Desc:

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

Pages: 30

APR 1 1996  
Sta 34 22

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

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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>	3/27/96							
		QA									
		Safety									
		Env.									
1		Peer rev. D.A. Himes	<i>D.A. Himes</i>	3/7/96	A3-34						

18. C.H. Huang <i>C.H. Huang</i> 3/27/96 Signature of EDT Date Originator	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

C. H. HUANG

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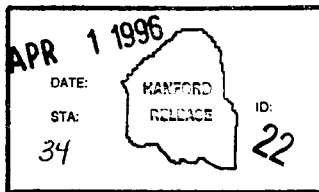
Abstract: This document provides the unit dose calculations for a mixture of isotopes.

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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  $3.3E-04 \text{ m}^3/\text{s}$  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

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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)

Total Activity (Ci)

Total BTU

Total Heat Generation (W)

6.90E+00  
3.35E+05  
3.23E+03  
9.46E+02

Isotope

H-3

C-14

Fe-55

Co-60

Ni-59

Ni-63

Se-79

Kr-85

Sr-89

Sr-90

Y-90

Y-91

Zr-93

Zr-95

Nb-93m

Nb-95

Nb-95m

Tc-99

Ru-103

Ru-106

Rh-103m

Rh-106

Pd-107

Ag-110

Curies	BTUS	(W)	Activity Ci/MTU	CEDE rem/uCi
2.46E+02	2.82E-02	8.28E-03	3.57E+01	0.000063
3.81E+00	3.80E-03	1.11E-03	5.52E-01	0.0021
1.97E+01	2.24E-03	6.56E-04	2.86E+00	0.0026
3.27E+01	4.30E+01	1.26E+01	4.74E+00	0.15
2.19E-01	2.96E-05	8.67E-06	3.17E-02	0.0027
2.51E+01	8.65E-03	2.53E-03	3.64E+00	0.0063
4.36E-01	4.59E-04	1.34E-04	6.32E-02	0.0089
3.72E+03	1.90E+01	5.57E+00	5.39E+02	0
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.037
5.41E+04	2.14E+02	6.27E+01	7.84E+03	1.3
5.41E+04	1.02E+03	2.99E+02	7.84E+03	0.0082
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.044
1.99E+00	7.79E-04	2.28E-04	2.88E-01	0.081
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.019
1.08E+00	6.58E-04	1.93E-04	1.56E-01	0.028
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0045
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0022
1.46E+01	2.50E-02	7.33E-03	2.12E+00	0.0075
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0078
1.22E+01	2.47E-03	7.24E-04	1.77E+00	0.44
0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.6E-06
1.22E+01	3.97E-01	1.16E-01	1.77E+00	0.0002
1.02E-01	1.92E-05	5.63E-06	1.48E-02	0.013
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	0.0000034
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	0.00029
Te-127m	2.72E-12	4.60E-15	1.35E-15	3.94E-13	0.02
Te-129m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000067
I-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.02
CS-134	3.41E-02	5.45E-05	1.60E-05	4.94E-03	0.18
CS-135	3.56E+02	1.24E+01	3.63E+00	5.16E+01	0.047
CS-137	3.96E-01	4.51E-04	1.32E-04	5.74E-02	0.0045
CS-137m	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

I HM = 10<sup>6</sup>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----- Complete 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

REPORT OPTIONS-----  
 T Report AEDE only F Drinking water ingestion 7,8  
 T Report by radionuclide F Aquatic foods ingestion 7,8  
 T Report by exposure pathway F Terrestrial foods ingestion 7,9  
 F Debug report on screen F Animal product ingestion 7,10  
 F Inadvertent soil ingestion

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

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

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

#####

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

=====

=

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

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-----  
 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  
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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	...	Internal
			+	+		Effective
	1		5.6E+06 + 3.8E+06 + 3.7E+06 + ...	=	1.4E+08	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

|| || || ||

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  
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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

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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	
KR 85	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	
Y 90	9.3E+04	4.2E+03	1.1E+04	5.1E+04	1.3E+05	1.5E+02	1.5E+02	
CS 137	1.2E+05	1.2E+05	1.2E+05	1.2E+05	1.2E+05	1.1E+05	1.1E+05	
CM 244	1.3E+05	1.1E+01	1.9E+01	7.3E+01	2.1E+02	7.8E+06	6.3E+05	
PU 240	2.7E+06	2.4E+02	3.8E+02	1.5E+03	4.5E+03	3.4E+08	2.7E+07	
PU 238	3.8E+06	3.3E+02	5.4E+02	2.3E+03	6.2E+03	4.0E+08	3.2E+07	
PU 241	8.5E+04	4.4E+02	4.9E+02	1.1E+03	1.8E+03	4.8E+08	3.8E+07	
U 237	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	
PU 239	3.3E+06	2.9E+02	4.7E+02	1.9E+03	5.5E+03	4.3E+08	3.3E+07	
Total	1.8E+07	1.3E+05	1.4E+05	1.9E+05	3.1E+05	2.6E+09	2.1E+08	

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

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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  3/7/96  
 Reviewer (Printed Name and Signature) Date



### DISTRIBUTION SHEET

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

*Central Files*

*A3-88(2)*