Sta. 34 22

ENGINEERING DATA TRANSMITTAL

156487

156487

2. To: (Receiving Organization) SN&NE	3. From: (Originating Organization) Consequence Analysis 8M400	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: TWRS FSAR/BIO	6. Cog. Engr.: C.H. Huang	7. Purchase Order No.: N/A
8. Originator Remarks: The attached SD provides the information of dose calculations for radioactive liquid waste tank criticality.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: TWRS
		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
11. Receiver Remarks:		14. Required Response Date: N/A

[illegible]

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHCM-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

(G)	(H)	17.	SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)
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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. Hunag	<i>[Signature]</i>	9/3/96	A3-34						
1		Cog. Mgr. D.S. Leach	<i>[Signature]</i>	9/3/96	A3-34						
		QA									
		Safety									
		Env.									
1		Peer rev. D.A. Hipes	<i>[Signature]</i>	9/3/96	A3-34						

18. C.H. Huang <i>C.H. Huang</i> 9/3/96 Signature of EDT Date Originator	19. R. M. Mennich <i>R. M. Mennich</i> 9/3/96 Authorized Representative Date for Receiving Organization	20. D.S. Leach <i>D.S. Leach</i> 9/3/96 Cognizant Manager Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ [N/A] Approved ☐ Approved w/comments ☐ Disapproved w/comments
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GENII DOSE CALCULATIONS FOR RADIOACTIVE LIQUID WASTE TANK CRITICALITY

C. H. HUANG

Westinghouse Hanford, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

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Key Words: Dose Calculation, Liquid Waste Tank, TWRS FSAR, Criticality, Calculation Note.

Abstract: This document provides the values of dose calculations for radioactive liquid waste tank criticality.

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Chris Stillingland 9-5-96
Release Approval Date

Release Stamp

Approved for Public Release

GENII DOSE CALCULATIONS FOR RADIOACTIVE LIQUID WASTE TANK CRITICALITY

C. H. HUANG
August 22, 1996

INTRODUCTION

The objective for this document is to present the GXQ and GENII calculations for the radioactive liquid waste tank criticality. The release location is at the tank farm in the 200 W Area.

SOURCE TERM

GENII code was used to calculate the dose release with the source term for various isotopes specified by the customer as given in Table 1 (see Hey 1992). The assumptions used for evaluation of a criticality are given in the NRC regulatory guides RG. 3.35, the "Assumptions Used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Plutonium Processing and Fuel Fabrication Plant," (NRC 1979). The Curies content in Table 1 also came from Nuclear Regulatory Commission Regulatory Guide 3.35.

Table 1. Source Term for Various Isotopes.

Isotope	Source Term (Ci)
KR83M	1.1E+02
KR85M	7.1E+01
KR85	8.1E-04
KR87	4.3E+02
KR88	2.3E+02
KR89	1.3E+04
XE131M	1.0E-01
XE133M	2.2E+00
XE133	2.7E+01
XE135M	3.3E+03
XE135	4.1E+02
XE137	4.9E+04
XE138	1.1E+04
I 131	2.8E+00
I 132	3.0E+02
I 133	4.0E+01
I 134	1.1E+03
I 135	1.1E+02

RECEPTOR LOCATIONS

The receptor locations are specified by the customer (see Table 2). The receptor locations at the onsite and the offsite boundary for acute ground level releases at the tank farm area are given in Table 2. The site boundary is near the river bank in the north and east directions.

Table 2. Receptor Locations.

Receptor	Distance
Onsite	100 m E
Offsite	8.76 km N

METHODOLOGIES AND ASSUMPTIONS

The GENII code (Napier et al., 1988) was used to calculate the onsite and offsite doses for inhalation and submersion. The dimension of finite plume was assumed in the GENII calculations. GENII code takes into account the radioactive decay in transit for various isotopes. GXQ code was used to calculate X/Q values for the tank farm project. Since the X/Q values calculated from the GENII code are different from the GXQ code, the doses calculated from the GENII code are adjusted by applying a ratio factor, i.e., the ratio of X/Q value obtained from the GXQ code to that obtained from the GENII code. The heavy metals of Plutonium and Americium are not included in the GENII calculations, which has been reported as a separate issue in another document.

RECEPTOR DESCRIPTIONS

The onsite and offsite receptor locations were provided by the customer.

•Onsite (Facility): The receptor location is at a distance of 100 m. The receptor at the worst direction is at a distance of 100 m East.

•Offsite(Site Boundary): Receptor at the site boundary in the worst direction. Where the site is bounded by the Columbia River, the site boundary is taken to be at the near bank of the river at the north and the east directions. The receptor at the worst direction (8.76 km N) was given by the customer.

CODE DOCUMENTATION

- o GXQ version 4.0 (11/19/94)
- o Joint Frequency Data: 200 Area, 10 m, Pasquill A-G (1983-1991 Average).
- 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)

GXQ output file and GENII input and output files are attached in Appendix A.

RESULTS

X/Q CALCULATIONS

GXQ code (Hey 1994) was used to calculate the X/Q values for the onsite receptor at 100 m E and Offsite receptor at 8.76 km N. The calculated X/Q values are shown in Table 3 (WHC-SD-WM-SARR-016, Rev. 2).

Table 3. X/Q Values for the Onsite and Offsite Receptors.

Receptor	Distance	X/Q (s/m ³) (GXQ code)	X/Q (s/m ³) (GENII code)	Ratio (GXQ/GENII)
Onsite	100 m E	3.41E-02	3.2E-02	1.066
Offsite	8.76 km N	2.83E-05	5.4E-05	0.524

DOSE CALCULATIONS

GENII code was used to calculate the doses with source terms for various isotopes as given in Table 1. These source terms were used to calculate the doses for onsite and offsite receptors. The calculated doses for inhalation and submersion are given in Table 4.

Table 4. Committed Doses.

Dose Pathway	Onsite (100 m E) EDE (rem)	Offsite (8.76 km N) EDE (rem)
Inhalation	7.8E+00	8.9E-03
Submersion	5.1E+00	6.8E-03
Total	1.3E+01	1.6E-02

The doses calculated from the GENII code were adjusted by a ratio factor shown in Table 3, i.e., the adjusted dose is obtained by multiplying the dose in Table 4 by a ratio factor of 1.066 and 0.524 for the onsite and offsite receptors, respectively. The adjusted doses for the onsite and offsite receptors are shown in Table 5.

Table 5. Committed Doses (Adjusted).

Dose Pathway	Onsite (100 m E) EDE (rem)	Offsite (8.76 km N) EDE (rem)
Inhalation	8.3E+00	4.7E-03
Submersion	5.4E+00	3.6E-03
Total	1.4E+01	8.3E-02

REFERENCES

- Hey, B. E., 1994, *GXQ Program Users' Guide*, WHC-SD-GN-SWD-30002, Westinghouse Hanford Company, Richland, Washington.
- Napier, B. A., et al., 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, PNL-6584, Pacific Northwest Laboratory, Richland, Washington.
- U.S. Nuclear Regulatory Commission, November 1982, *Atmospheric Dispersion Models For Potential Accident Consequence Assessments At Nuclear Power Plants*, Regulatory Guide 1.145, Revision 1, Office Of Nuclear Regulatory Research.
- Van Keuren, J. C., 1996: *Tank Waste Compositions and Atmospheric Dispersion Coefficients for Use in Safety Analysis Consequence Assessments*, WHC-SD-WM-SARR-016, Rev. 2, Westinghouse Hanford Company, Richland, Washington.
- NRC, 1979, *Assumptions Used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Plutonium Processing and Fuel Fabrication Plant*, Regulatory Guides 3.35, U.S. Nuclear Regulatory Commission, Washington, D.C.

Appendix A

GXQ OUTPUT FILE AND GENII INPUT AND OUTPUT FILES

GXQ Version 4.0
December 19, 1994

General Purpose Atmospheric Dispersion Code
Produced by Westinghouse Hanford Company

Users Guide documented in WHC-SD-GN-SWD-30002 Rev. 1.
Validation documented in WHC-SD-GN-SWD-30003 Rev. 1.
Code Custodian is: Brit E. Hey
Westinghouse Hanford Company
P.O. Box 1970
Richland, WA 99352
(509) 376-2921

Run Date = 09/02/96
Run Time = 10:15:50.96

INPUT ECHO:
TWR SAR XQS, case 1. Acute Ground Level Releases, no effect
c GXQ Version 4.0 Input File
c mode
1
c
c MODE CHOICE:
c mode = 1 then X/Q based on Hanford site specific meteorology
c mode = 2 then X/Q based on atmospheric stability class and wind speed
c mode = 3 then X/Q plot file is created
c
c LOGICAL CHOICES:
c ifox inorm icdf ichk isite ipop
T F F F F F
c ifox = t then joint frequency used to compute frequency to exceed X/Q
c = f then joint frequency used to compute annual average X/Q
c inorm = t then joint frequency data is normalized (as in GENII)
c = f then joint frequency data is un-normalized
c icdf = t then cumulative distribution file created (CDF.OUT)
c = f then no cumulative distribution file created
c ichk = t then X/Q parameter print option turned on
c = f then no parameter print
c isite = t then X/Q based on joint frequency data for all 16 sectors
c = f then X/Q based on joint frequency data of individual sectors
c ipop = t then X/Q is population weighted
c = f then no population weighting
c
c X/Q AND WIND SPEED ADJUSTMENT MODELS:
c ipuff idep isrc iwind
0 0 0 0
c DIFFUSION COEFFICIENT ADJUSTMENT MODELS:
c iwake ipm iflow ientr
0 0 0 0
c EFFECTIVE RELEASE HEIGHT ADJUSTMENT MODELS:
c (irise igrnd)iwash igrav
0 0 0 0
c ipuff = 1 then X/Q calculated using puff model
c = 0 then X/Q calculated using default continuous plume model
c idep = 1 then plume depletion model turned on (Chamberlain model)
c isrc = 1 then X/Q multiplied by scalar
c = 2 then X/Q adjusted by wind speed function
c iwind = 1 then wind speed corrected for plume height
c iwake = 1 then NRC RG 1.145 building wake model turned on
c = 2 then MACCS virtual distance building wake model turned on
c ipm = 1 then NRC RG 1.145 plume meander model turned on
c = 2 then 5th Power Law plume meander model turned on
c = 3 then sector average model turned on
c iflow = 1 then sigmas adjusted for volume flow rate
c ientr = 1 then method of Pasquill used to account for entrainment
c irise = 1 then MACCS buoyant plume rise model turned on
c = 2 then ISC2 momentum/buoyancy plume rise model turned on
c igrnd = 1 then Mills buoyant plume rise modification for ground effects
c iwash = 1 then stack downwash model turned on
c igrav = 1 then gravitational settling model turned on
c = 0 unless specified otherwise, 0 turns model off
c
c PARAMETER INPUT:
c reference frequency
c release anemometer mixing to

WHC-SD-WM-CN-067, Rev. 0

```

c height          height          height          exceed
c hs(m)           ha(m)           hm(m)           Cx(%)
c
c 0.00000E+00     1.00000E+01     1.00000E+03     5.00000E-01
c
c initial          initial          release          deposition          gravitational
c plume            plume            duration         velocity           settling
c width            Hb(m)            trd(hr)          vd(m/s)            velocity
c Wb(m)            Hb(m)            trd(hr)          vd(m/s)            vg(m/s)
c
c 0.00000E+00     0.00000E+00     1.00000E+00     1.00000E-03     1.00000E-03
c
c ambient          initial          initial          release          convective
c temperature      plume            plume            diameter         heat release
c Tamb(C)          T0(C)            flow rate        d(m)             rate(1)
c                  T0(C)            V0(m3/s)         d(m)             qh(w)
c
c 2.00000E+01     2.00000E+01     1.00000E+00     1.00000E+00     0.00000E+00
c
c (1) If zero then buoyant flux based on plume/ambient temperature difference.
c
c X/Q              Wind
c scaling          Speed
c factor           Exponent
c c(?)            a(?)
c
c 1.00000E+00     7.80000E-01
c
c RECEPTOR DEPENDENT DATA (no line limit)
c FOR MODE make RECEPTOR DEPENDENT DATA
c 1 (site specific) sector distance receptor-height
c 2 (by class & wind speed) class Windspeed distance offset receptor-height
c 3 (create plot file) class Windspeed xmax ymax xmin power
c
c RECEPTOR PARAMETER DESCRIPTION
c sector = 0, 1, 2... (all, S, SSW, etc.)
c distance = receptor distance (m)
c receptor height = height of receptor (m)
c class = 1, 2, 3, 4, 5, 6, 7 (P-G stability class A, B, C, D, E, F, G)
c windspeed = anemometer wind speed (m/s)
c offset = offset from plume centerline (m)
c xmax = maximum distance to plot or calculate to (m)
c imax = distance intervals
c ymax = maximum offset to plot (m)
c jmax = offset intervals
c xqmin = minimum scaled X/Q to calculate
c power = exponent in power function step size

```

MODE:

Site specific X/Q calculated.

LOGICAL CHOICES:

Joint frequency used to calculate X/Q based on frequency of exceedance.

No normalization of joint frequency.

X/Q calculated for single sector.

MODELS SELECTED:

Default Gaussian plume model selected.

WARNING/ERROR MESSAGES:

JOINT FREQUENCY DATA:

200 AREA (HMS) - 10 M - Pasquill A - G (1983 - 1991 Average)

Created 8/26/92 KR

TWRSAR XQs, case 1. Acute Ground level Releases, no effect

SECTOR	DISTANCE (m)	RECEPT HEIGHT (m)	SECT. FREQ. (%)	POPULATION	TOTAL POPULATION SCALED X/Q (s/m3)	AVERAGE INDIVIDUAL SCALED X/Q (s/m3)	ATM. STAB. CLASS	WIND SPEED (m/s)
E	100	0	14.05	1	3.41E-02	3.41E-02	F	0.89
N	8760	0	4.36	1	2.83E-05	2.83E-05	G	2.65

Program GENII Input File ##### 8 Jul 88

Title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

\GENII\TANKFC2.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 Complete
 TRANSPORT OPTIONS===== Section EXPOSURE PATHWAY OPTIONS===== Section
 T Air Transport 1 T Finite plume, external 5
 F Surface Water Transport 2 F 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				
	Release Radio- nuclide	Air /yr	Surface Water /yr	Buried Waste /m3	Air /m3	Surface Soil /unit	Deep Soil /m3	Ground Water /L

KR83M 1.1E+02
 KR85M 7.1E+01
 KR85 8.1E-04
 KR87 4.3E+02
 KR88 2.3E+02
 KR89 1.3E+04
 XE131M 1.0E-01
 XE133M 2.2E+00
 XE133 2.7E+01
 XE135M 3.3E+03
 XE135 4.1E+02
 XE137 4.9E+04
 XE138 1.1E+04
 I 131 2.8E+00
 I 132 3.0E+02
 I 133 4.0E+01
 I 134 1.1E+03
 I 135 1.1E+02

Use when	-----Derived Concentrations----- measured values are known			
	Release Radio- Plant	Terres. Animal Product	Drink Water	Aquatic Food

nuclide	/kg	/kg	/L	/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-Calculates PM	0	Release type (0-3)
3	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)
0	Chi/Q or PM value	0	Stack radius (m)
13	MI sector index (1=S)	0	Effluent temp. (C)
100.	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

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=====
Atmospheric production definition (select option):
0   0-Use food-weighted chi/Q,(food-sec/m3), enter value on this line
0   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	Consumption(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=====

```

WMC-SD-WM-CN-067, Rev. 0

USE ?	FOOD T/F TYPE	---HUMAN---		TOTAL	DRINK	DIET FRAC- TION	GROW TIME da	-----STORED FEED-----				STOR- AGE da
		CONSUMPTION RATE kg/yr	HOLDUP da	PROD- UCTION kg/yr	WATER CONTAM FRACT.			-IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m3		
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
									-----FRESH FORAGE-----			
	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

#####

Program GENII Input File ##### 8 Jul 88 ###
 Title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.
 \GENII\TANKFFC2.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 T Finite plume, external 5
 F Surface Water Transport 2 F 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

	---Release Terms---			---Basic Concentrations---				
Use when	transport selected			near-field scenario, optionally				
Release		Surface	Buried		Surface	Deep	Ground	Surface
Radio-	Air	Water	Waste	Air	Soil	Soil	Water	Water
nuclide	/yr	/yr	/m3	/m3	/unit	/m3	/L	/L
KR83M	1.1E+02							
KR85M	7.1E+01							
KR85	8.1E-04							
KR87	4.3E+02							
KR88	2.3E+02							
KR89	1.3E+04							
XE131M	1.0E-01							
XE133M	2.2E+00							
XE133	2.7E+01							
XE135M	3.3E+03							
XE135	4.1E+02							
XE137	4.9E+04							
XE138	1.1E+04							
I 131	2.8E+00							
I 132	3.0E+02							
I 133	4.0E+01							
I 134	1.1E+03							
I 135	1.1E+02							

-----Derived Concentrations-----			
Use when	measured values are known		
Release	Terres.	Animal	Drink
Radio-	Plant	Product	Water
			Aquatic
			Food

nuclide	/kg	/kg	/L	/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 0-Calculate PM 0 Release type (0-3)
 3 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)
 0 Chi/Q or PM value 0 Stack radius (m)
 9 MI sector index (1=S) 0 Effluent temp. (C)
 8760. 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 ?	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	Consumption(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---		TOTAL PROD- UCTION kg/yr	DRINK WATER CONTAM FRACT.	DIET FRAC- TION	GROW TIME da	--STORED FEED--				STOR- AGE da
		CONSUMPTION RATE kg/yr	HOLDUP da					-IRRIGATION-- S RATE * in/yr	TIME mo/yr	YIELD kg/m3		
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

#####

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

Case title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

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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:
 Finite 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\TANKFC2.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)

EXTGAM - Gamma Energies by Group for Finite Plume (13-May-90 RAP)

200 AREA (HMS) - 10 M - Pasquill A - G (1983 - 1991 Average)

=====

-----Release Terms-----			
Release	Surface Buried		
Radio-	Air	Water	Source
nuclide	Ci/yr	Ci/yr	Ci/m3
KR83M	1.1E+02	0.0E+00	0.0E+00
KR85M	7.1E+01	0.0E+00	0.0E+00
KR85	8.1E-04	0.0E+00	0.0E+00
KR87	4.3E+02	0.0E+00	0.0E+00
KR88	2.3E+02	0.0E+00	0.0E+00

KR89	1.3E+04	0.0E+00	0.0E+00
XE131M	1.0E-01	0.0E+00	0.0E+00
XE133M	2.2E+00	0.0E+00	0.0E+00
XE133	2.7E+01	0.0E+00	0.0E+00
XE135M	3.3E+03	0.0E+00	0.0E+00
XE135	4.1E+02	0.0E+00	0.0E+00
XE137	4.9E+04	0.0E+00	0.0E+00
XE138	1.1E+04	0.0E+00	0.0E+00
I 131	2.8E+00	0.0E+00	0.0E+00
I 132	3.0E+02	0.0E+00	0.0E+00
I 133	4.0E+01	0.0E+00	0.0E+00
I 134	1.1E+03	0.0E+00	0.0E+00
I 135	1.1E+02	0.0E+00	0.0E+00

===== AIR TRANSPORT

=====

Joint frequency data input.

1.0E+02 Maximum individual distance from release point (m)

1.3E+01 Maximum individual sector index (Wind Toward E)

Ground level release.

===== 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
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Sector Index: 13
Probability: 5.0E-02

Distance (m)	Travel Time (sec)	Energy 0.15 (MeV)	Energy 0.4 (MeV)	Energy 0.75 (MeV)	Energy 1.25 (MeV)	Energy 1.75 (MeV)	Energy 2.25 (MeV)
100.	38.	1.6E-04	1.7E-04	1.7E-04	1.6E-04	1.4E-04	1.2E-04

GENII Dose Calculation Program
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3.2E-02 Individual E/Q

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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	4.6E-01	2.5E-01	1.2E-01
Breast	6.5E-01	1.5E-01	9.7E-02
R Marrow	6.2E-01	1.2E-01	7.5E-02
Lung	1.5E+01	1.2E-01	1.8E+00
Thyroid	1.7E+02	3.0E-02	5.2E+00
Bone Sur	5.3E-01	3.0E-02	1.6E-02
Stomach	6.0E+00	6.0E-02	3.6E-01
UL Int.	5.9E-01	6.0E-02	3.5E-02
S Int.	5.8E-01	6.0E-02	3.5E-02
LL Int.	5.2E-01	6.0E-02	3.1E-02
Internal Effective Dose Equivalent			7.8E+00
External Dose			5.1E+00
Annual Effective Dose Equivalent			1.3E+01

Controlling Organ:	Thyroid
Controlling Pathway:	Inh
Controlling Radionuclide:	I 133
Total Inhalation EDE:	7.8E+00
Total Ingestion EDE:	0.0E+00

 GENII Dose Calculation Program
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Case title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

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2

 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	:	7.8E+00	+ 3.7E-05	+ 3.8E-06	+ ... = 7.8E+00	Dose
						Equivalent	
Internal						Cumulative	
Annual			7.8E+00	+ 3.7E-05	+ 3.8E-06	+ ... = 7.8E+00	Internal
Dose						Dose	
			+	+	+	+	
External							
Annual			5.1E+00	0.0E+00	0.0E+00	... 5.1E+00	
Dose							

Annual					Cumulative
Dose	1.3E+01	+ 3.7E-05	+ 3.8E-06	+ ... = 1.3E+01	Dose
					Maximum
				1.3E+01	Annual
					Dose Occurred
					In Year 1

 GENII Dose Calculation Program
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Case title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

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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	1.5E+01	6.0E+00	5.8E-01	5.9E-01	5.2E-01	5.3E-01	6.2E-01
4.4E-01							
-----	-----	-----	-----	-----	-----	-----	-----
Total	1.5E+01	6.0E+00	5.8E-01	5.9E-01	5.2E-01	5.3E-01	6.2E-01
4.4E-01							

Pathway	Ovaries	Muscle	Thyroid
-----	-----	-----	-----
Inhale	4.6E-01	6.5E-01	1.7E+02
-----	-----	-----	-----
Total	4.6E-01	6.5E-01	1.7E+02

External Dose by Exposure Pathway

Pathway	
-----	-----
Plume	5.1E+00
-----	-----
Total	5.1E+00

GENII Dose Calculation Program
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Case title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

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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 Testes	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro
-----	-----	-----	-----	-----	-----	-----	-----
KR 83M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
KR 85M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+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							
KR 87	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 87	3.3E-16	2.2E-16	2.1E-16	2.1E-16	2.1E-16	7.4E-16	4.2E-16
2.1E-16							
KR 88	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 88	3.3E-02	1.4E-02	3.1E-04	3.3E-04	3.1E-04	3.7E-04	3.9E-04
2.8E-04							
KR 89	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 89	9.5E-01	4.1E-01	2.1E-02	2.3E-02	2.0E-02	3.6E-02	2.9E-02
1.7E-02							
SR 89	7.7E-05	1.3E-05	1.6E-05	4.9E-05	1.4E-04	3.4E-04	2.2E-04
8.5E-06							
I 131	7.2E-02	8.2E-03	3.0E-03	2.9E-03	2.8E-03	1.2E-02	6.5E-03
2.4E-03							
XE 131M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
I 132	3.3E+00	1.2E+00	1.5E-01	1.5E-01	1.4E-01	1.3E-01	1.5E-01
1.2E-01							
I 133	1.3E+00	1.8E-01	3.5E-02	3.5E-02	3.3E-02	3.5E-02	4.1E-02
3.2E-02							
XE 133M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
XE 133	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
I 134	6.7E+00	3.3E+00	2.6E-01	2.7E-01	2.2E-01	2.1E-01	2.7E-01
1.9E-01							

WHC-SD-WM-CN-067, Rev. 0

I 135	2.0E+00	4.4E-01	8.9E-02	8.4E-02	8.0E-02	7.5E-02	9.3E-02
7.1E-02							
XE 135M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
XE 135	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 135	8.4E-12	7.2E-12	7.2E-12	7.2E-12	7.2E-12	8.5E-12	8.9E-12
7.2E-12							
XE 137	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 137	4.6E-04	4.5E-04	4.7E-04	4.6E-04	4.7E-04	4.2E-04	4.4E-04
4.6E-04							
XE 138	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 138	8.9E-01	4.4E-01	2.2E-02	2.3E-02	2.0E-02	2.9E-02	3.2E-02
1.7E-02							
-----	-----	-----	-----	-----	-----	-----	-----
Total	1.5E+01	6.0E+00	5.8E-01	5.9E-01	5.2E-01	5.3E-01	6.2E-01
4.4E-01							

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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	Ovaries	Muscle	Thyroid
-----	-----	-----	-----
KR 83M	0.0E+00	0.0E+00	0.0E+00
KR 85M	0.0E+00	0.0E+00	0.0E+00
KR 85	0.0E+00	0.0E+00	0.0E+00
KR 87	0.0E+00	0.0E+00	0.0E+00
RB 87	2.1E-16	2.1E-16	2.1E-16
KR 88	0.0E+00	0.0E+00	0.0E+00
RB 88	3.1E-04	3.3E-04	3.1E-04
KR 89	0.0E+00	0.0E+00	0.0E+00
RB 89	1.9E-02	2.4E-02	2.3E-02
SR 89	8.5E-06	8.5E-06	8.5E-06
I 131	2.7E-03	8.3E-03	3.0E+01
XE 131M	0.0E+00	0.0E+00	0.0E+00
I 132	1.2E-01	1.7E-01	1.9E+01
I 133	3.2E-02	4.8E-02	7.6E+01
XE 133M	0.0E+00	0.0E+00	0.0E+00
XE 133	0.0E+00	0.0E+00	0.0E+00
I 134	2.0E-01	2.8E-01	1.2E+01
I 135	7.5E-02	1.0E-01	3.6E+01
XE 135M	0.0E+00	0.0E+00	0.0E+00
XE 135	0.0E+00	0.0E+00	0.0E+00
CS 135	7.2E-12	7.2E-12	7.2E-12
XE 137	0.0E+00	0.0E+00	0.0E+00
CS 137	4.2E-04	4.1E-04	4.1E-04
XE 138	0.0E+00	0.0E+00	0.0E+00
CS 138	1.9E-02	2.4E-02	2.1E-02
-----	-----	-----	-----
Total	4.6E-01	6.5E-01	1.7E+02

GENII Dose Calculation Program
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Case title: WASTE TANK CRITICALITY - ONSITE, Inhalation & Submersion.

Executed on: 08/13/96 at 15:02:03

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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
KR 83M	0.0E+00	0.0E+00	3.0E-05	0.0E+00	3.0E-05
KR 85M	0.0E+00	0.0E+00	1.2E-03	0.0E+00	1.2E-03
KR 85	0.0E+00	0.0E+00	2.1E-10	0.0E+00	2.1E-10
KR 87	0.0E+00	0.0E+00	3.5E-02	0.0E+00	3.5E-02
RB 87	2.5E-16	0.0E+00	0.0E+00	2.5E-16	2.5E-16
KR 88	0.0E+00	0.0E+00	4.4E-02	0.0E+00	4.4E-02
RB 88	5.0E-03	0.0E+00	3.7E-04	5.0E-03	5.4E-03
KR 89	0.0E+00	0.0E+00	2.2E+00	0.0E+00	2.2E+00
RB 89	1.6E-01	0.0E+00	7.4E-02	1.6E-01	2.3E-01
SR 89	6.2E-05	0.0E+00	1.7E-11	6.2E-05	6.2E-05
I 131	9.1E-01	0.0E+00	1.2E-04	9.1E-01	9.1E-01
XE 131M	0.0E+00	0.0E+00	2.2E-07	0.0E+00	2.2E-07
I 132	1.1E+00	0.0E+00	7.8E-02	1.1E+00	1.2E+00
I 133	2.5E+00	0.0E+00	2.8E-03	2.5E+00	2.5E+00
XE 133M	0.0E+00	0.0E+00	9.8E-06	0.0E+00	9.8E-06
XE 133	0.0E+00	0.0E+00	1.3E-04	0.0E+00	1.3E-04
I 134	1.5E+00	0.0E+00	3.2E-01	1.5E+00	1.9E+00
I 135	1.4E+00	0.0E+00	1.9E-02	1.4E+00	1.4E+00
XE 135M	0.0E+00	0.0E+00	1.6E-01	0.0E+00	1.6E-01
XE 135	0.0E+00	0.0E+00	1.1E-02	0.0E+00	1.1E-02
CS 135	7.2E-12	0.0E+00	0.0E+00	7.2E-12	7.2E-12
XE 137	0.0E+00	0.0E+00	9.1E-01	0.0E+00	9.1E-01
CS 137	4.2E-04	0.0E+00	8.2E-08	4.2E-04	4.2E-04
XE 138	0.0E+00	0.0E+00	1.2E+00	0.0E+00	1.2E+00
CS 138	1.5E-01	0.0E+00	3.7E-02	1.5E-01	1.9E-01

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

Executed on: 08/13/96 at 15:06:32

Page A.

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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:
 Finite 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\TANKffc2.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)

EXTGAM - Gamma Energies by Group for Finite Plume (13-May-90 RAP)

200 AREA (HMS) - 10 M - Pasquill A - G (1983 - 1991 Average)

=====

Release Radio- nuclide	----Release Terms-----		
	Air Ci/yr	Surface Water Ci/yr	Buried Source Ci/m3
KR83M	1.1E+02	0.0E+00	0.0E+00
KR85M	7.1E+01	0.0E+00	0.0E+00
KR85	8.1E-04	0.0E+00	0.0E+00
KR87	4.3E+02	0.0E+00	0.0E+00
KR88	2.3E+02	0.0E+00	0.0E+00
KR89	1.3E+04	0.0E+00	0.0E+00

XE131M	1.0E-01	0.0E+00	0.0E+00
XE133M	2.2E+00	0.0E+00	0.0E+00
XE133	2.7E+01	0.0E+00	0.0E+00
XE135M	3.3E+03	0.0E+00	0.0E+00
XE135	4.1E+02	0.0E+00	0.0E+00
XE137	4.9E+04	0.0E+00	0.0E+00
XE138	1.1E+04	0.0E+00	0.0E+00
I 131	2.8E+00	0.0E+00	0.0E+00
I 132	3.0E+02	0.0E+00	0.0E+00
I 133	4.0E+01	0.0E+00	0.0E+00
I 134	1.1E+03	0.0E+00	0.0E+00
I 135	1.1E+02	0.0E+00	0.0E+00

===== AIR TRANSPORT

=====

Joint frequency data input.

8.8E+03 Maximum individual distance from release point (m)

9.0E+00 Maximum individual sector index (Wind Toward N)

Ground level release.

===== 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: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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Page A.

Sector Index: 9
Probability: 5.0E-02

Distance (m)	Travel Time (sec)	Energy 0.15 (MeV)	Energy 0.4 (MeV)	Energy 0.75 (MeV)	Energy 1.25 (MeV)	Energy 1.75 (MeV)	Energy 2.25 (MeV)
8760.	9843.	6.4E-06	6.0E-06	5.3E-06	5.0E-06	4.7E-06	4.1E-06

GENII Dose Calculation Program
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Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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5.4E-05 Individual E/Q

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

Executed on: 08/13/96 at 15:06:43

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	3.5E-04	2.5E-01	8.8E-05
Breast	4.8E-04	1.5E-01	7.2E-05
R Marrow	6.6E-04	1.2E-01	8.0E-05
Lung	1.2E-02	1.2E-01	1.5E-03
Thyroid	2.3E-01	3.0E-02	6.8E-03
Bone Sur	7.2E-04	3.0E-02	2.1E-05
Stomach	4.2E-03	6.0E-02	2.5E-04
LL Int.	5.0E-04	6.0E-02	3.0E-05
UL Int.	4.6E-04	6.0E-02	2.7E-05
S Int.	4.3E-04	6.0E-02	2.6E-05
Internal Effective Dose Equivalent			8.9E-03
External Dose			6.8E-03
Annual Effective Dose Equivalent			1.6E-02

 Controlling Organ: Thyroid
 Controlling Pathway: Inh
 Controlling Radionuclide: I 133

 Total Inhalation EDE: 8.9E-03
 Total Ingestion EDE: 0.0E+00

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

Executed on: 08/13/96 at 15:06:43

Page C.

2

 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 | 8.8E-03 + 1.0E-06 + 5.7E-08 + ... = 8.9E-03

Internal

Effective

Dose

Equivalent

|| || ||

Internal

Cumulative

Annual 8.8E-03 + 1.0E-06 + 5.7E-08 + ... = 8.9E-03

Internal

Dose

Dose

+ + + +

External

Annual 6.8E-03 0.0E+00 0.0E+00 ... 6.8E-03

Dose

Annual					Cumulative
Dose	1.6E-02 + 1.0E-06 + 5.7E-08 + ... = 1.6E-02				Dose
					Maximum
				1.6E-02	Annual
					Dose Occurred
					In Year 1

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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3

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

Committed Dose Equivalent by Exposure Pathway

Pathway Testes	Lung	Stomach	S Int.	UL Int.	LL Int.	Bone Su	R Marro
-----	-----	-----	-----	-----	-----	-----	-----
Inhale 3.4E-04	1.2E-02	4.2E-03	4.3E-04	4.6E-04	5.0E-04	7.2E-04	6.6E-04
-----	-----	-----	-----	-----	-----	-----	-----
Total 3.4E-04	1.2E-02	4.2E-03	4.3E-04	4.6E-04	5.0E-04	7.2E-04	6.6E-04

Pathway	Ovaries	Muscle	Thyroid
-----	-----	-----	-----
Inhale	3.5E-04	4.8E-04	2.3E-01
-----	-----	-----	-----
Total	3.5E-04	4.8E-04	2.3E-01

External Dose by Exposure Pathway

Pathway	
-----	-----
Plume	6.8E-03
-----	-----
Total	6.8E-03

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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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							
-----	-----	-----	-----	-----	-----	-----	-----
KR 83M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
KR 85M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+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							
KR 87	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 87	7.3E-17	4.9E-17	4.8E-17	4.8E-17	4.8E-17	1.7E-16	9.4E-17
4.8E-17							
KR 88	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 88	1.3E-03	5.4E-04	1.2E-05	1.3E-05	1.2E-05	1.4E-05	1.5E-05
1.1E-05							
KR 89	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
RB 89	1.0E-05	4.4E-06	2.2E-07	2.4E-07	2.1E-07	3.8E-07	3.1E-07
1.8E-07							
SR 89	7.0E-05	1.1E-05	1.4E-05	4.4E-05	1.3E-04	3.1E-04	2.0E-04
7.8E-06							
I 131	1.2E-04	1.3E-05	4.9E-06	4.7E-06	4.5E-06	2.0E-05	1.1E-05
4.0E-06							
XE 131M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
I 132	2.4E-03	8.5E-04	1.1E-04	1.1E-04	1.0E-04	9.4E-05	1.1E-04
8.5E-05							
I 133	2.0E-03	2.6E-04	5.3E-05	5.3E-05	5.1E-05	5.3E-05	6.3E-05
4.8E-05							
XE 133M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
XE 133	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
I 134	1.3E-03	6.3E-04	4.9E-05	5.1E-05	4.3E-05	4.0E-05	5.1E-05
3.6E-05							

WHC-SD-WM-CN-067, Rev. 0

I 135	2.6E-03	5.6E-04	1.1E-04	1.1E-04	1.0E-04	9.4E-05	1.2E-04
8.9E-05							
XE 135M	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
XE 135	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 135	4.0E-12	3.4E-12	3.4E-12	3.4E-12	3.4E-12	4.1E-12	4.2E-12
3.4E-12							
XE 137	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 137	6.9E-06	6.8E-06	7.1E-06	7.0E-06	7.1E-06	6.3E-06	6.5E-06
6.9E-06							
XE 138	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
0.0E+00							
CS 138	2.6E-03	1.3E-03	6.3E-05	6.7E-05	5.9E-05	8.5E-05	9.3E-05
4.9E-05							
-----	-----	-----	-----	-----	-----	-----	-----
Total	1.2E-02	4.2E-03	4.3E-04	4.6E-04	5.0E-04	7.2E-04	6.6E-04
3.4E-04							

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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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	Ovaries	Muscle	Thyroid
KR 83M	0.0E+00	0.0E+00	0.0E+00
KR 85M	0.0E+00	0.0E+00	0.0E+00
KR 85	0.0E+00	0.0E+00	0.0E+00
KR 87	0.0E+00	0.0E+00	0.0E+00
RB 87	4.8E-17	4.8E-17	4.8E-17
KR 88	0.0E+00	0.0E+00	0.0E+00
RB 88	1.2E-05	1.3E-05	1.2E-05
KR 89	0.0E+00	0.0E+00	0.0E+00
RB 89	2.0E-07	2.5E-07	2.4E-07
SR 89	7.8E-06	7.8E-06	7.8E-06
I 131	4.4E-06	1.4E-05	4.9E-02
XE 131M	0.0E+00	0.0E+00	0.0E+00
I 132	8.5E-05	1.2E-04	1.4E-02
I 133	4.8E-05	7.2E-05	1.2E-01
XE 133M	0.0E+00	0.0E+00	0.0E+00
XE 133	0.0E+00	0.0E+00	0.0E+00
I 134	3.7E-05	5.3E-05	2.4E-03
I 135	9.4E-05	1.3E-04	4.6E-02
XE 135M	0.0E+00	0.0E+00	0.0E+00
XE 135	0.0E+00	0.0E+00	0.0E+00
CS 135	3.4E-12	3.4E-12	3.4E-12
XE 137	0.0E+00	0.0E+00	0.0E+00
CS 137	6.4E-06	6.2E-06	6.2E-06
XE 138	0.0E+00	0.0E+00	0.0E+00
CS 138	5.7E-05	7.0E-05	6.2E-05
Total			
	3.5E-04	4.8E-04	2.3E-01

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

Case title: WASTE TANK CRITICALITY - OFFSITE, Inhalation & Submersion.

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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
KR 83M	0.0E+00	0.0E+00	4.3E-07	0.0E+00	4.3E-07
KR 85M	0.0E+00	0.0E+00	3.1E-05	0.0E+00	3.1E-05
KR 85	0.0E+00	0.0E+00	6.4E-12	0.0E+00	6.4E-12
KR 87	0.0E+00	0.0E+00	2.7E-04	0.0E+00	2.7E-04
RB 87	5.7E-17	0.0E+00	0.0E+00	5.7E-17	5.7E-17
KR 88	0.0E+00	0.0E+00	7.7E-04	0.0E+00	7.7E-04
RB 88	2.0E-04	0.0E+00	2.9E-04	2.0E-04	4.9E-04
KR 89	0.0E+00	0.0E+00	2.2E-17	0.0E+00	2.2E-17
RB 89	1.6E-06	0.0E+00	1.5E-05	1.6E-06	1.7E-05
SR 89	5.6E-05	0.0E+00	2.8E-10	5.6E-05	5.6E-05
I 131	1.5E-03	0.0E+00	4.1E-06	1.5E-03	1.5E-03
XE 131M	0.0E+00	0.0E+00	8.6E-09	0.0E+00	8.6E-09
I 132	8.2E-04	0.0E+00	1.1E-03	8.2E-04	1.9E-03
I 133	3.8E-03	0.0E+00	7.9E-05	3.8E-03	3.8E-03
XE 133M	0.0E+00	0.0E+00	3.8E-07	0.0E+00	3.8E-07
XE 133	0.0E+00	0.0E+00	5.3E-06	0.0E+00	5.3E-06
I 134	3.0E-04	0.0E+00	1.2E-03	3.0E-04	1.5E-03
I 135	1.8E-03	0.0E+00	4.6E-04	1.8E-03	2.2E-03
XE 135M	0.0E+00	0.0E+00	2.5E-05	0.0E+00	2.5E-05
XE 135	0.0E+00	0.0E+00	4.5E-04	0.0E+00	4.5E-04
CS 135	3.4E-12	0.0E+00	0.0E+00	3.4E-12	3.4E-12
XE 137	0.0E+00	0.0E+00	4.6E-15	0.0E+00	4.6E-15
CS 137	6.3E-06	0.0E+00	2.4E-08	6.3E-06	6.3E-06
XE 138	0.0E+00	0.0E+00	1.4E-05	0.0E+00	1.4E-05
CS 138	4.4E-04	0.0E+00	2.1E-03	4.4E-04	2.5E-03

CHECKLIST FOR PEER REVIEW

Document Reviewed: C. H. Huang, "GENII DOSE CALCULATIONS FOR RADIOACTIVE LIQUID WASTE TANK CRITICALITY," August 22, 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)

7/5/96
Date

HEDOP REVIEW CHECKLIST
for
Radiological and Nonradiological Release Calculations

Document Reviewed: C. H. Huang, "GENII DOSE CALCULATIONS FOR RADIOACTIVE LIQUID WASTE TANK CRITICALITY," August 22, 1996.

Submitted by: C. H. HUANG
Date Submitted: August 22, 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. Hines [Signature] 9/3/96
HEDOP-Approved Reviewer (Printed Name and Signature) Date

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

DISTRIBUTION SHEET

To R. M. Marusich	From C.H. Huang	Page 1 of 1
		Date 8/23/96
Project Title/Work Order TWRS BIO/WHC-SD-WM-CN-067, Rev. 0, GENII DOSE CALCULATIONS FOR RADIOACTIVE LIQUID WASTE TANK CRITICALITY		EDT No. 156487
		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
R.M. Marusich	A3-34	X			
C.H. Huang	A3-34	X			
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