Radioactive Air Emissions Notice of Construction for Construction of the Liquid Effluent Transfer System, Project W-519



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Radioactive Air Emissions Notice of Construction for Construction of the Liquid Effluent Transfer System, Project W-519

Date Published May 2000



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DOE/ORP-2000-18, Rev. 0 05/2000

1 **APPROVAL SIGNATURES** 2 3 4 5 6 5-12-00 7 R. H. Engelmann, Manager, FH Date 9 Project Environmental Documentation 10 11 12 13 5-15-00 14 FOR J. B. PAYNE aiu 15 Date 16 J. B. Payne, Manager, CHG Project W-519, Liquid Effluent Transfer System 17 18 19 \$15/00 20 21 5/5/00 Date 22 1 23 24 W. T. Dixon, Manager, CHG River Protection Project Environmental Services $J_{L-S} = O = \frac{1}{2} \frac{S}{17/100}$ 25 26 J 27 ٢; 28 29 30

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TERMS

-		
2		
3		
4	ALARA	as low as reasonably achievable
5	ALARACT	As low as reasonably achievable control technology
	ALAKACI	As low as reasonably achievable control technology
6	~~~	
7	CFR	Code of Federal Regulations
8	Ci	Curie
9		
10	DOE/ORP	U.S. Department of Energy, Office of River Protection
11	DOE-RL	U.S. Department of Energy, Richland Operations Office
12	dpm	disintegrations per minute
13	-1	
14	EPA	U.S. Environmental Protection Agency
15		O.D. Environmental Protection regency
	IDT	kaaltk whereing tankning
16	HPT	health physics technician
17	HNF	Hanford Nuclear Facility (document identifier)
18		
19	LERF	Liquid Effluent Retention Facility
20	LWTS	liquid waste transfer system
21		
22	MEI	Maximally exposed individual
23	mrem	Millirem
24		
25	NOC	Notice of construction
26	NOC	Notice of construction
	DOM (and the second
27	PCM	periodic confirmatory measurements
28	PTE	Potential-to-emit
29	PVC	polyvinyl chloride
30		
31	RPP	River Protection Project
32	RWP	radiological work permit
33		0 1
34	SEPA	State Environmental Policy Act of 1971
35		
36	TEDE	Total effective dose equivalent
37	TEDF	Treatment Effluent Disposal Facility
38	TWRS	Tank Waste Remediation System
39	_	
40	WAC	Washington Administrative Code
41	WDOH	Washington State Department of Health

1

METRIC CONVERSION CHART

Into metric units

Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get	
	Length		Length			
inches	25.40	millimeters	millimeters	0.0393	inches	
inches	2.54	centimeters	centimeters	0.393	inches	
feet	0.3048	meters	meters	3.2808	feet	
yards	0.914	meters	meters	1.09	yards	
miles	1.609	kilometers	kilometers	0.62	miles	
	Area			Area		
square inches	6.4516	square	square	0.155	square	
		centimeters	centimeters		inches	
square feet	0.092	square meters	square meters	10.7639	square feet	
square yards	0.836	square meters	square meters	1.20	square yards	
square miles	2.59	square	square	0.39	square miles	
-		kilometers	kilometers			
acres	0.404	hectares	hectares	2.471	acres	
	Mass (weight)		Mass (weight)			
ounces	28.35	grams	grams	0.0352	ounces	
pounds	0.453	kilograms	kilograms	2.2046	pounds	
short ton	0.907	metric ton	metric ton	1.10	short ton	
	Volume		Volume			
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces	
quarts	0.95	liters	liters	1.057	quarts	
gallons	3.79	liters	liters	0.26	gallons	
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet	
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards	
	Temperature		Temperature			
Fahrenheit	subtract 32	Celsius	Celsius	multiply by	Fahrenheit	
	then			9/5ths, then		
	multiply by			add 32		
	5/9ths				i	
	Energy		Energy			
kilowatt hour	3,412	British thermal	British thermal	0.000293	kilowatt	
		unit	unit	·	hour	
kilowatt	0.948	British thermal	British thermal	1.055	kilowatt	
unit per second		unit per second				
	Force/Pressure		1	Force/Pressure		
pounds per	6.895	kilopascals	kilopascals	0.14504	pounds per	
square inch					square inch	

Source: Engineering Unit Conversions, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

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RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR CONSTRUCTION OF THE LIQUID EFFLUENT TRANSFER SYSTEM, PROJECT W-519

This document serves as a notice of construction (NOC) pursuant to the requirements of Washington

4 5

6

Administrative Code (WAC) 246-247-060, and as a request for approval to construct pursuant to 40 Code 7 of Federal Regulations (CFR) 61.07, for the construction of a Liquid Effluent Transfer System (LETS). 8 9 The transfer system will provide waste transfer capabilities from the proposed treatment and immobilization facility (Vitrification Plant) to the existing Liquid Effluent Retention Facility (LERF) and 10 to the existing 200 Area Treated Effluent Disposal Facility (TEDF). 11 12 Project W-519, is scoped to provide infrastructure support (pipelines, roads, electrical power, etc.) for the 13 Vitrification Plant, including the installation of three underground pipelines with tie-ins to the LERF and 14 a tie-in to a waste water feed line to the TEDF. Two lines will transport an aqueous waste stream 15 containing trace amounts of radioactive dangerous waste to the LERF and one will transport non-16 radioactive/non-dangerous aqueous waste to the 200 Area TEDF. 17 18 19 This NOC is intended to cover the construction activities associated with installation of the pipelines. 20 Use of the LETS is dependent on operation of the Vitrification Plant and will be addressed in the permitting documentation for that facility. There are no emission points along the transfer piping. Any 21 emissions will be seen at the LERF. 22 23 24 Section 15.0 of this NOC discusses the estimated total effective dose equivalent (TEDE) to the offsite maximally exposed individual (MEI) resulting from the unabated emissions from these construction 25 26 activities. 27 28 Using the currently approved unit dose conversion factors in HNF-3602, the estimated potential TEDE to the MEI resulting from the unabated, fugitive emissions from installation of the LETS is 29 6.37 E-02 millirem per year. This dose was arrived at by conservatively adding together the doses for 30 31 conventional and Guzzler digging. 32

As requested by the EPA and the WDOH, a new MEI evaluation was also performed. Results of the new evaluation show that the nearest public on-site receptor (Energy Northwest) would receive approximately the same doses as those calculated from the HNF-3602 conversion factors. The additive dose from both conventional and Guzzler digging using the new MEI is 5.1 E-02 millirem per year.

37 38

39 1.0 LOCATION

40 The LETS is located along the eastern boundary outside of the 200 East Protected Area fence line within 41 the 200 East Area Perimeter Fence on the Hanford Site. Figure 1 shows the location of the transfer 42 system. The pipelines will be constructed between the proposed site for the new vitrification plant and 43 the LERF Basins. The geodetic coordinates for the LERF are:

- 44
- 45 46° 33" 42' North Latitude
- 46 119° 30" 21' West Longitude
- 47

1 The address for the LETS

23 U.S. Department of Energy, Office of River Protection

4 Hanford Site

5 200 East Area Waste Immobilization Plant

6 Richland, Washington 99352

7 8

9 2.0 RESPONSIBLE MANAGER

10 Mr. R. T. French, Manager

11 U.S. Department of Energy, Office of River Protection

12 P.O. Box 550

13 Richland, Washington 99352

14 (509) 376-6677

15 16

17 3.0 PROPOSED ACTION

18 The proposed action is to install a new liquid effluent transfer system (three underground waste transfer 19 pipelines). As such, a potential new source will be created as a result of the construction activities. The 20 anticipated emissions associated with this activity are insignificant.

21

22 4.0 STATE ENVIRONMENTAL POLICY ACT

23 The proposed activities are categorically exempt from State Environmental Policy Act (SEPA)

requirements in accordance with WAC 197-11-845.

25

2627 5.0 PROCESS DESCRIPTION

Project W-519 will construct and install three underground waste transfer lines. Two lines, one primary and one backup, will transport an aqueous waste stream containing trace amounts of radioactive

30 dangerous waste from the proposed Vitrification Plant to the existing LERF basin risers. Both the

31 primary and backup lines that transport dangerous waste are fiberglass epoxy resin, double pipe

32 containment systems. The primary pipeline consists of a 4-inch pipe within an 8-inch pipe and is

approximately 8,100 feet in length. The back-up line consists of a 3-inch pipe within a 6-inch pipe and is
 approximately 4,000 feet in length.

35

36 The third transfer line will transport non-radioactive/non-dangerous aqueous waste from the proposed

37 Vitrification Plant to a tie-in location on an existing waste line that transports non-dangerous/non-

38 radioactive aqueous waste to the 200 Area TEDF. The non-radioactive/non-dangerous waste line consists

39 of 6-inch PVC approximately 4,000 feet in length.

40

41 All three lines will be buried in a common trench. The trench depth ranges between 3 and 10 feet,

42 however the average depth of most of the trench will be 3 to 5 feet. All three pipelines are low pressure,

43 gravity drained to their destinations and do not contain any in-line vents.

44

45 5.1 TIE-IN CONNECTIONS

The head end, or up-gradient end, of the lines will be blank-flanged until such time the Vitrification Plant is constructed and the final connections made. The down-gradient end of the primary radioactive

184 - 18

1 dangerous waste line will be tied in at the existing LERF basin risers and manifold. There is no forced 2 airflow in the operation of the basins. The risers are at ambient temperature and pressure.

There will be a total of 4 tie-ins made to existing blank flanges at the LERF risers. At each riser the blank

3 4

5 flange will be removed and the area surveyed. If required by the Health Physics Organization, decontamination of the flange surface will take place prior to completing the connection of the new 6 piping. Connection of the new piping will generally take place immediately after the blank flange is 7 removed. If immediate connection is not possible, the opening will be temporarily sealed with a plug. 8 9 tape, or equivalent device, until the connection can be completed. A fifth tie-in will be made to the existing manifold. This is also a flanged connection and the process that will be followed is the same as 10 the process outlined above for each of the riser connections. 11 12 In addition to the five tie-in connections at the LERF basin, two concrete pads will be constructed where 13 14 the primary line transitions from a double piped containment system to a single walled pipe as it leaves the berm. The purpose of the pads is to serve as a catchment for potential future leaks. 15

16

17 The down-gradient end of the backup line will tie into the existing PC5000 waste transfer line that transports waste from the 242-A Evaporator to the LERF basin. There are three basic steps to this tie-in. 18 19 First, the pipe will be cut. Preliminary contamination surveys will be performed through a hole drilled in 20 the pipe in the area to be cut to determine current contamination levels inside the pipe. The Health 21 Physics Organization will then determine the appropriate control measures. The pipe will be cut using .22 appropriate equipment such as a reciprocating saw, a circular saw, a hacksaw, a tri-tool or an abrasive wheel. Each exposed end cut will be temporarily capped. Second, a manway will be constructed. The 23 manway will be designed to provide secondary containment because all connections to the existing 24 PC5000 line will be made using single-wall pipe. Pre-made spool pieces will be used to make these 25 connections and the pipes will be bonded to the inside of the manway. Third, the existing PC5000 line 26 and newly constructed backup line encasements will be bonded to the outside of the manway to complete 27 the connections. Once all the connections have been completed, the manway will be closed. 28 29

If needed or chosen for use during these activities, a Portable/Temporary Radioactive Air Emission Unit,
 or a HEPA Filtered Vacuum Radioactive Air Emission Unit may be used in accordance with the latest
 revisions of their NOCs (DOE/RL-96-75, and DOE/RL-97-50 respectively).

33 34

35 5.2 SOIL EXCAVATION

36 Approximately 30,000 cubic yards of soil will be excavated to install the pipelines. The area to be excavated is managed as a "clean" area and is currently free of surface contamination. There are no 37 38 recorded spills or leaks. However, there are underground radioactive material areas and windblown 39 contamination areas posted in the vicinity of the excavation. A field study (HNF-3210) was performed to collect and test soil samples in areas of known or suspected waste lines or waste sites that could impact 40 placement of the pipe routing. All locations sampled showed no contamination. Therefore, encountering 41 42 contamination is not expected during these soil excavation activities. Because of the possibility of 43 encountering previously undetected subsurface contamination, or future contamination from windblown 44 sources, all work will be performed in accordance with the Project Hanford Radiological Control Manual (PHRCM, HNF-5173) and the RPP As Low As Reasonably Achievable (ALARA) Program requirements. 45 46 These requirements are carried out through the activity work packages and associated radiological work 47 permit (RWP).

48

49 Conventional methods such as the use of backhoes, front-end loaders or manual digging with shovels or 50 the "clean" guzzler will be used. If needed or chosen for use during these activities, the Radiologically Controlled Guzzler may be used in accordance with the NOC (98-EAP-037), as amended. Backfill will
 be made using either the original soil removed or "clean" soil brought in.

3

Excavation activities will be stopped if the stop-work levels described in Section 6.0 are met. Work will not continue until the WDOH has been contacted and the encountered conditions have been mitigated. Excavation activities will not be stopped if hot specks or "specky" contamination are encountered. Hot specks are generally very small volumes of contamination, i.e., a pebble, animal dropping, pieces of tumbleweed, etc. The specks will be removed and containerized for disposal.

9 10

11 6.0 PROPOSED CONTROLS

Emission controls utilized during the construction activities are administrative; based in ALARA principles and consist of ALARA techniques. It is proposed that these controls be approved as low as reasonably achievable control technology (ALARACT) for the installation for the LETS.

15 16

17 6.1 TIE-IN CONNECTIONS

18 A recent radiological survey of the LERF basins shows removable contamination levels below

19 1000 dpm/cm² beta/gamma in the areas of the tie-ins, with the exception of one riser at 3,000 dpm/cm²
 20 beta/gamma.

20 beta/ga 21

22 Health physics technician (HPT) coverage will be provided during all of the tie-in connections. The

23 connections made at the LERF risers will be bolt-on flanged connections, no cutting of pipe will take

24 place. Work will take place in the open air. Prior to starting work on the connections any removable 25 contamination in the flange area will be reduced to ALARA. The reduction goal will be equal to or less

than 1,000 dpm/100 cm² beta gamma and 20 dpm/100 cm² alpha, but may not always be attainable. If

removable contamination levels around the flange area after reduction efforts are greater than

 $10,000 \text{ dpm/}100 \text{ cm}^2$ beta gamma and 200 dpm/100 cm² alpha, the work will be performed in a glove bag.

29

30 The tie-in of the backup line to the existing PC5000 line will involve cutting the PC5000 line, bonding

31 spool pieces into place inside the manway and bonding both the existing PC5000 and backup line

32 encasements to the clean outer surface of the manway. The PC5000 pipe will be exposed and preliminary

33 surveys will be performed to assess internal and external contamination levels. Any removable

34 contamination in the cut and bonding areas will be reduced to ALARA. The goal will be equal to or less

than 1,000 dpm/100 cm² beta gamma and 20 dpm/100 cm² alpha, but may not always be attainable. Work

36 will be performed in open air unless the removable contamination levels around the cut or bonding areas

after reduction efforts are greater than 10,000 dpm/100cm² beta gamma and 200 dpm/100 cm² alpha, then

the work will be performed in a glove bag. Measures such as expandable foam or fixatives may also be

- 39 applied on or around a pipe cut to help fix contamination.
- 40

41 Work in glove bags will not be performed if sustained wind speeds are greater than 30 miles per hour.

42

43 If a Portable/Temporary Radioactive Air Emission Unit or a HEPA Filtered Vacuum Radioactive Air

44 Emission Unit is used during the tie-in activities, controls as described in the latest revision of their NOCs

45 (DOE/RL-96-75, and DOE/RL-97-50) will be followed.

46

1a1 - 45

1 6.2 SOIL EXCAVATION

2 HPT coverage will be provided during the excavation activities. Soil surveys for radioactive
3 contamination will be performed for beta/gamma. If beta/gamma contamination is detected, surveys for
4 alpha contamination will also be performed.

- Appropriate controls such as water, fixatives, covers, or windscreens will be applied, if needed, as
 determined by the Health Physics organization. Spoil piles containing contaminated soil will be
 segregated from the clean soil. Containerizing spoils for disposal may also be performed.
- 9

Excavation activities will be stopped if evenly distributed contamination with detection readings greater than 500,000 dpm/100 cm² beta-gamma.or greater than 200 dpm/100 cm² above background alpha is encountered. Excavation will not continue until a review of the work and encountered conditions has been performed and it has been determined that no threat to worker safety or the environment exists, or until proper controls (i.e., removal and disposal, water, fixatives, covers, etc.) have been put in place to mitigate any further threat; and the WDOH has been contacted and briefed of the situation.

16

If the Radiologically Controlled Guzzler is used to excavate soil, administrative controls as described in
 its NOC for use in the A Tank Farm Complex (98-EAP-037) will be followed.

19

20 After backfilling, the area will be surveyed to verify that radiological contamination levels on the soil

surface are less than 5,000 dpm/100 cm² beta-gamma and less than 100 dpm/100 cm² alpha. If
 contamination is present on the surface above these levels, it will be removed and containerized for

- 23 disposal or covered or fixed to provide containment of the contamination.
- 24 25

26 7.0 DRAWINGS OF CONTROLS

Not applicable because the emission controls to be utilized during these activities are administratively
 defined, based on ALARA principles and consist of ALARA techniques.

- 29
- 30

31 8.0 RADIONUCLIDES OF CONCERN

- 32 The radionuclides of concern are primarily Sr-90 and Am-241. Refer to Table 1.
- 33

34

35 9.0 MONITORING

The potential unabated offsite dose associated with this activity is calculated to be less than 0.1 millirem per year. Therefore in accordance with 40 CFR 61, Subpart H, periodic confirmatory measurements (PCM) will be made to verify the low emissions.

39

40 The proposed PCM will consist of the radiological soil contamination surveys as described in Section 6.

41 This method of PCM is not a direct measurement of effluent emissions. It is intended to demonstrate

42 compliance by showing that being under the contamination levels by which work is controlled, the

43 emissions which are based and calculated from these contamination levels, would inherently be below the

44 estimated emissions. If the Radiologically Controlled Regulated Guzzler, a Portable Temporary

45 Radioactive Air Emission Unit or a HEPA Filtered Vacuum Radioactive Air Emission Unit is used, PCM

- 46 for emissions from those units will be performed as required by their respective NOCs.
- 47

1 **10.0 ANNUAL POSSESSION QUANTITY**

2 The annual possession quantity was determined by assuming 10% of the total volume of soil to be excavated was contaminated at the stop work levels stated in Section 6.0, as monitored by standard 3 4 radiological field instrumentation. The beta-gamma contributing radionuclide was assumed to be Sr-90 5 and the alpha contributing radionuclide was assumed to be Am-241. Refer to Table 1. An additional list of radionuclides representing possible constituents from the PC5000 waste line tie-in is listed below. 6 7 These radionuclides may also contribute to the gross alpha and gross beta-gamma measurements and are conservatively represented by the Sr-90 and Am-241 estimates. 8 9 10 H-3 17 I-129 24 U-234 18 Cs-134 11 C-14 25 Np-237 19 Cs-137 12 Co-60 26 Pu-238 13 Se-79 20 Ce-144 27 Pu-239 21 Eu-154 14 Sr-90 28 Pu-241 15 Nb-94 22 Eu-155 29 Am-241 16 Tc-99 23 Ra-226 30 Cm-244 31 32 33 11.0 PHYSICAL FORM 34 The physical form of each radionuclide in the inventory is particulate solid. 35 36 37 **12.0 RELEASE FORM** 38 The release form of each radionuclide in the inventory is particulate solid. 39 40

41 **13.0 RELEASE RATES**

42 Unabated release rates resulting from these construction activities are expected to be low.

43 Unabated release rates were determined by assuming 10% of the total volume of soil to be excavated was 44 contaminated at the same concentration and the 40 CFR 61 Appendix D release factor for particulates was 45 applied to that volume (see Table 1). This estimate is intended to envelop both the soil excavation and tie-in activities.

- 46
- 47 48

49 **13.1 CONVENTIONAL EXCAVATION**

50 Encountering contamination is not expected during excavation, therefore, to determine a potential to emit 51 if contamination is encountered, the administrative control points set in Section 6.0 for contamination, as monitored by standard radiological field instrumentation, will be used to envelope emissions. The 52 500,000 dpm/100 cm² beta/gamma control point correlates to 50,000 cpm as used in the calculations, and 53 54 200 dpm/100 cm² above background alpha correlates to 29 cpm. To determine the corresponding soil 55 concentration in picocuries per grams of individual radionuclides, conversion factors, as developed in the 56 study Soil Contamination Standards for Protection of Personnel (HNF-2418), were used. The average 57 soil density was assumed to be 98 pounds per cubic feet. The beta-gamma contributing radionuclides were assumed to be represented by Sr-90 and the alpha contributing radionuclides were assumed to be 58 59 represented by Am-241. The potential unabated emissions from the construction activities are shown in Table 1. An additional list of radionuclides, representing possible constituents from the PC5000 waste 60

water line, that may also contribute to the gross alpha and gross beta-gamma measurements are shown in
 Section 10.0.

- 3
- 4 5

13.2 RADIOLOGICALLY CONTROLLED REGULATED GUZZLER EXCAVATION

6 Unabated emissions for soil excavation with the Radiologically Controlled Guzzler are included by
7 reference from 98-EAP-037. The releasable curie values in the referenced NOC were multiplied by 0.86,
8 the ratio between the total volume of soil to be excavated in the Guzzler NOC and the volume of assumed
9 contaminated soil in this NOC. It is not known at this time if, or how much, soil will be excavated by the
10 Radiologically Controlled Guzzler, therefore, the entire volume assumed to be contaminated (3,000 cubic
11 yards) was used to envelope the potential emissions. The potential unabated emissions from
12 Radiologically Controlled Guzzler excavation activities are also shown in Table 1.

13 14

15 14.0 LOCATION OF MAXIMALLY EXPOSED INDIVIDUAL

16 The MEI for this application is located at the Hanford Site boundary, approximately 20.2 kilometers to 17 the east/southeast of the proposed construction (HNF-3602).

18 As requested by the EPA and the WDOH, a new MEI evaluation was performed using the nearest public 19 on-site receptor of Energy Northwest which is 15.99 kilometers east-southeast of the release location.

20 The associated Hanford Map Distances (Version 1.8) run is provided in Appendix A.

21 22

15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY EXPOSED INDIVIDUAL

Using the currently approved unit dose conversion factors in HNF-3602, the estimated potential total effective dose equivalent to the maximally exposed individual resulting from the unabated, fugitive emissions resulting from installation of the LETS is 6.37 E-02 millirem per year (refer to Table 1). This dose was arrived at by conservatively adding together the doses for conventional and Guzzler digging.
As requested by the EPA and the WDOH, a new MEI evaluation was also performed. Results of the new evaluation show that the nearest public on-site receptor (Energy Northwest) would receive approximately

evaluation show that the nearest public on-site receptor (Energy Northwest) would receive approximately the same doses as those calculated from the HNF-3602 conversion factors. The additive dose from both conventional and Guzzler digging using the new MEI is 5.1 E-02 millirem per year. The associated

CAP88PC (Version 2.0) runs for conventional and Guzzler digging have been provided in Appendix B
 and C respectively.

36

The HNF-3602 conversion factors have been retained in this discussion because they result in essentially the same or a more conservative estimated TEDE to the MEI, and they provide an easy method of

- 39 calculating a maximum dose envelope for the project.
- 40

41 The total effective dose equivalent from all 1998 Hanford Site air emissions (point sources, diffuse and

42 fugitive sources, and Radon and Thoron) was 0.038 millirem (DOE/RL-99-41). The emissions resulting

43 from the construction of the LETS, in conjunction with other operations at the Hanford Site, will not

- 44 result in a violation of the National Emission Standard of 10 millirem per year.
- 45

1 16.0 COST FACTORS OF CONTROL TECHNOLOGY COMPONENTS

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Not applicable because the emission controls utilized during the construction activities are
 administratively defined and consist of ALARA techniques.

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6 17.0 DURATION OR LIFETIME

Construction activities to install the LETS are schedule to take place between June 2000 and December
 2001.

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10 11 **18.0 STANDARDS**

12 The activity of installing the LETS has an estimated potential to emit of less than 0.1 millirem/year TEDE 13 to the MEI. None of the standards apply to the emission controls planned for the construction activities 14 undertaken to install the system.

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17 **19.0 REFERENCES**

- 98-EAP-037, J. E. Rasmussen, U. S. Department of Energy, Richland Field Office, to J. Leitch,
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 of Construction (NOC) for Guzzler Excavation and Backfilling Activities in Support of the 200 East
 Area A Farm Complex, January 30, 1998.
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 Radioactive Air Emission Units, September 1999, Department of Energy, Richland Washington.
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 Daniel Northwest, Richland, Washington.
- HNF-3210, TWRS Phase I Infrastructure Project (W-519) Characterization, September 1998,
 R.M. Mitchell, B.M. Markes, D.E. Skoglie, K.J. Young, T.H. Mitchell, Waste Management Federal
 Services, Inc., Northwest Operations, Richland, Washington.
- HNF-3602, Volume 1: Calculating Potential to Emit Releases and Doses for FEMPs and NOCs,
 July, 1999, J.S. Hill, P.D. Rittman, Fluor Daniel Hanford, Inc., Richland, Washington.

41 42

HNF-5173, PHMC Radiological Control Manual, April, 2000, Fluor Hanford, Inc. Richland,
 Washington.

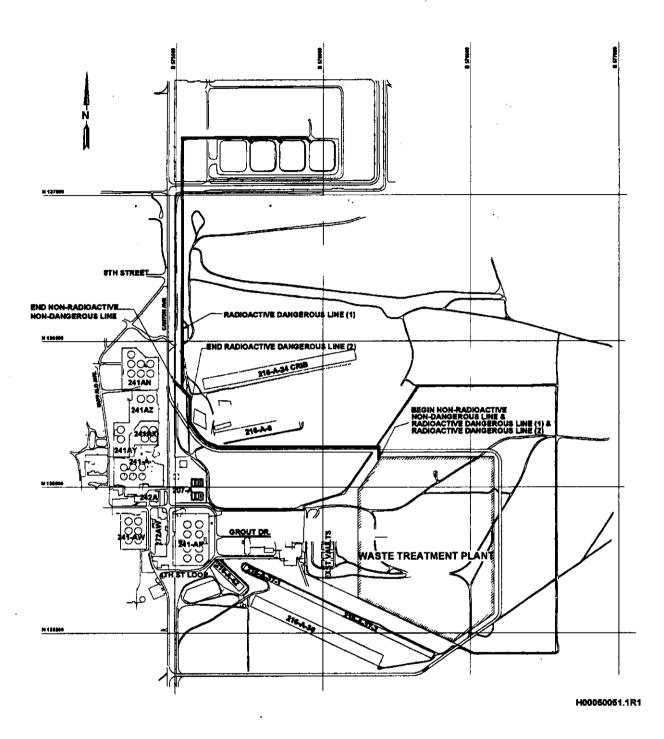


Figure 1. Location of the Liquid Effluent Transfer System.

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Table 1. Estimated Potential Unabated Emissions.

CONVENTIONAL EXCAVATION

MAXIMUM SOIL EXCAVATED	30,000	YARD^3				
CONTAMINATED SOIL EXCAVATED	81,000	FEET*3				
SOIL DENSITY	98	POUNDS/FEET^3		· · · ·		
TOTAL MASS OF SOIL	3.601E+09	GRAMS				
MAXIMUM ALPHA READING	29	CPM	<u> </u>			
MAXIMUM BETA/GAMMA READING	50,000	CPM		,	[····	
RELEASE FACTOR	1.00E-03					
ASSUMED ISOTOPE	CONVERSION FACTOR (a)	TOTAL POSSESSION QUANTITY (b)	UNABATED RELEASE	OFFSITE DOSE FACTOR (c)	UNABATED DOSE	% UNABATED OFFSITE DOSE
	(pCi/gram)/cpm	Ci	Ci	mrem/Ci	mrem	%
Sr-90	0.35	6.301E+01	6.30E-02	1.10E-01	6.93E-03	26.72%
Am-241	14.20	1.462E+00	1.46E-03	1.30E+01	1.90E-02	73.28%
TOTAL					2.59E-02	100.00%
Notes:		·				
(a) FROM TABLE 4 IN HNF-2416						
(b) WEIGHT OF SOIL X FIELD INSTR	UMENT READING	X CONVERSION	ACTOR.			
(c) UNIT DOSE FACTOR FROM HNF-		1			├ ─── -{	

REGULATED GUZZLER EXCAVATION

Curie values are included by reference from 98-EAP-037. The values are multiplied by 0.86, the ratio between the total volume of soil to be excavated in the Guzzler NOC and the total volume of assumed contaminated soil to be excavated in this NOC (81,000 $ft^3/94,500 ft^3 = 0.86$).

(2.23 E-01 curies of Strontium-90) X (0.86) = 1.92 E-01 curies Sr-90(1.49 E-03 curies of Americium-241) X (0.86) = 1.28 E-03 curies Am-241

Offsite Dose: Sr-90 = (1.92 E-01 Ci)(1.10 E-01 mrem/ Ci) = 2.11 E-02 mrem/yr. Am-241 = (1.28 E-03 Ci)(1.30 E+01 mrem/ Ci) = 1.67 E-02 mrem/yr.Total = 3.78 E-02 mrem/yr.

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APPENDIX A

HANFORD MAP DISTANCE REPORT FILE

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Hanford Map Distances Version 1.8 1 2 by Paul D. Rittmann PhD CHP 3 Map Data File (HMD.DAT): Map Coordinate File PDR 5/13/98 4 5 6 Release Location: 46341W 40053N East of Grout Vaults 200-East Area 7 8 Boundary Definition: 9 Highway 240 + the Near Bank of the Columbia River 10 11 Table of Distances from the Release Location to the Boundary Image: Distances, metersTransportDistances, meters14DirectionSectorNRC 1.14515-------DirectionSector16190000 12 _____ 24 _______ Notes: 25 26 (1) NRC Regulatory Guide 1.145 (Rev 1, 1982) requires finding the smallest 27 distance in a 45 degree sector centered on the direction of interest. 28 (2) The last digit is questionable, and is for information only. 29 30 31 32 Release Location: 46341W 40053N East of Grout Vaults 200-East Area 33 34 Special Point Information Transport 35 Number Longitude Latitude Direction Distance 36 124.45627.30115 SE13.19 km (LIGO)220.05428.31714 ESE15.99 km (Energy Northwest) 37 38 39 40 Notes: 41 (1) NRC Regulatory Guide 1.145 (Rev 1, 1982) requires finding the smallest 42 distance in a 45 degree sector centered on the direction of interest. 43 (2) The last digit is questionable, and is for information only. 44

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APPENDIX B

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2 CAP88 PC REPORT FILES FOR CONVENTIONAL DIGGING

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Clean Air Act Assessment Package - 1988

DOSE AND RISK EQUIVALENT SUMMARIES

Non-Radon Individual Assessment May 1, 2000 02:17 pmm

Facility: Project W-519 (East of Grout Vaults 200-East Area)
Address: Hanford Site
City: Richland
State: WA Zip: 99336

Source Category: Source Type: Stack Emission Year: 2000

.

Comments: Project W-519

Dataset Name: Project W-519 Dataset Date: May 1, 2000 02:16 pm Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND

SUMMARY Page 1

1	May	1,	2000	02:17 pmm
2				
3				
4				
5				
6				ORGAN
7				
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9				

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	5.99E-03
BREASŤ	7.28E-04
R MAR	5.15E-02
LUNGS	3.96E-03
THYROID	7.10E-04
ENDOST	4.88E-01
RMNDR	2.06E-02
EFFEC	2.91E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

10	ENDOSI	4.006-01
19	RMNDR	2.06E-02
20		
21	EFFEC	2.91E-02
22		
23		
24		
25		
26	PATHWAY EFFECTIVE DOSE	FOUTVALENT SUN
27		
28		Selected
29		Individual
30	Pathway	(mrem/y)
31	raciiway	(mrem/y)
32		
33	THEFE	2 045 02
	INGESTION	2.94E-03
34	INHALATION	2.62E-02
35	AIR IMMERSION	5.37E-10
36	GROUND SURFACE	2.11E-05
37	INTERNAL	2.91E-02
38	EXTERNAL	2.11E-05
39		
40	TOTAL	2.91E-02
41		
42		
43		
44		
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12	Мау	1,	2000	02:17	pmm					SUMMA Page	
· 3 4										-	
5 6				NU	CLIDE	EFFECTIVE	DOSE	EQUIVALENT	SUMMARY		

Nuclide	Selected Individual (mrem/y)
SR-90 AM-241	2.90E-03 2.62E-02
TOTAL	2.91E-02

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May 1, 2000 02:17 pmm

SUMMARY Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA BONE THYROID BREAST LUNG STOMACH BOWEL LIVER PANCREAS URINARY OTHER	7.19E-08 2.46E-08 1.25E-10 1.02E-09 1.15E-08 6.25E-10 1.35E-09 7.04E-08 5.60E-10 2.95E-10 6.85E-10
TOTAL	1.83E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.36E-08
INHALATION	1.39E-07
AIR IMMERSION	1.12E-14
GROUND SURFACE	4.40E-10
INTERNAL	1.83E-07
EXTERNAL	4.40E-10
TOTAL	1.83E-07

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1 2 3	Мау	1,	2000	02:17 pmm					SUMMAR Page	Y 4
4 5 6 7				NUCLI	DE RISK	SUMMAR	Y			
8 9								ted Individual al Lifetime		
10				Nucl	ide		Fatal	Cancer Risk		
11				<u> </u>						
12 13				CD 0	0			4 005 00		
				SR-9			۰.	4.90E-08		
14				AM-2	41			1.34E-07		
15 16					-					
10				TOTA	.L			1.83E-07		
18										
19										
20										

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	INC	IVIDUAL EF (All	FECTIVE DO Radionucl			(mrem/y)
			Distan	ce (m)		
Directi	on 13190	15990				
N	9.1E-03	7.8E-03	•	,	<u></u>	•.
NNW	1.1E-02	9.4E-03				
NW	1.1E-02	9.1E-03				
WNW	8.8E-03	7.4E-03				
W	7.6E-03	6.5E-03				
WSW	6.4E-03	5.6E-03				
SW	6.6E-03	5.7E-03				
SSW	6.7E-03	5.8E-03				
S	7.4E-03	6.4E-03				
SSE	8.8E-03	7.5E-03				
SE	1.7E-02	1.4E-02				
ESE	2.9E-02	2.4E-02				
E	2.0E-02	1.7E-02				
ENE	1.3E-02	1.1E-02				
NE	9.1E-03	7.7E-03				
NNE	7.7E-03	6.6E-03				

May 1, 2000 02:17 pmm

SUMMARY Page 6

INDIVIDUAL LIFETIME RISK (deaths) (All Radionuclides and Pathways)

			Distand	ce (m)	
Direct:	ion 13190	15990			
	7.7E-08	6.9E-08	•		·
NNW	8.8E-08	7.8E-08			
NW	8.6E-08	7.7E-08			
WNW	7.5E-08	6.7E-08			
W	6.9E-08	6.3E-08			
WSW	6.2E-08	5.8E-08			
SW	6.3E-08	5.8E-08			
SSW	6.4E-08	5.9E-08			
S	6.8E-08	6.2E-08			
SSE	7.5E-08	6.8E-08			
SE	1.2E-07	1.0E-07			
ESE	1.8E-07	1.5E-07			
E	1.4E-07	1.2E-07			
ENE	9.5E-08	8.4E-08			
NE	7.6E-08	6.9E-08			
NNE	6.9E-08	6.3E-08			
		<u> </u>			

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1	C A P 8 8 - P C
2	Version 2.00
·.3 4 5 6 7	Clean Air Act Assessment Package - 1988
8	
9 10	SYNOPSIS REPORT
11	
12	Non-Radon Individual Assessment
13	May 1, 2000 02:17 pmm
14 15	
16	
17	Facility: Project W-519 (East of Grout Vaults 200-East Area)
18	Address: Hanford Site
19 20	City: Richland State: WA Zip: 99336
21	
22	
23	Source Category:
24 25	Source Type: Stack Emission Year: 2000
23 26	Emission lear. 2000
27	
28	Comments: Project W-519
29	
30 31	
32	
33	Effective Dose Equivalent
34	(mrem/year)
35 36	
37	2.91E-02
38	
39	
40	At This Location: 13190 Meters East Southeast
41 42	At This Location: 13190 Meters Last Southeast Dataset Name: Project W-519
42	Dataset Date: May 1, 2000 02:16 pm
44	Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND
45	

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1 2 3 4	Мау	1, 2000 02:17 pmm		SYNOPSIS Page 1
4 5 6 7 8 9		MAXIMALLY EXPOSE	D INDIVIDUAL	
8 9 10 11 12		Location Of The Individual: Lifetime Fatal Cancer Risk:	13190 Meters East Southeas 1.83E-07	st
13 14 15 16		. ORGAN DOSE EQUIV	ALENT SUMMARY	
17 18			Dose Equivalent	
19 20 21		Organ	(mrem/y)	
22 23 24		GONADS BREAST R MAR	5.99E-03 7.28E-04 5.15E-02	
25 26		LUNGS THYROID	3.96E-03 7.10E-04	
27 28 29		ENDOST RMNDR	4.88E-01 2.06E-02	
30 31		EFFEC	2.91E-02	

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1 2 3 4	May 1,	, 2000	02:3	17 pmm						SYNOF Page	SIS 2
5 6 7				RADIONU	CLIDE EMISSION	NS DURING	G THE	YEAR	2000		
8 9 10 11	Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y						
12 13 14 15 16	SR-90 AM-241			6.3E-02 1.5E-03	6.3E-02 1.5E-03	5			ч.		
17 18 19 20 21 22 23				T) Pre	FORMATION emperature: cipitation: ing Height:	12 deg 16 cm, 1000 m	-	с			

1 SYNOPSIS 2 May 1, 2000 02:17 pmm 3 Page 3 4 5 6 7 8 SOURCE INFORMATION <u>9</u> Source Number: 1 10 11 12 Stack Height (m): 1. 13 Diameter (m): 0. ٠. 14 15 Plume Rise C D E 16 F Pasquill Cat: В G Α 17 18 19 0. 0. 0. 0. 0. 0. 0. Fixed (m): 20 (Fixed Rise) 21 22 23 24 AGRICULTURAL DATA 25 26 Vegetable Milk Meat 27 _____ 28 29 0.000 0.000 Fraction Home Produced: 0.000 Fraction From Assessment Area: 1.000 30 1.000 1.000 31 Fraction Imported: 0.000 0.000 0.000 32 33 34 Food Arrays were not generated for this run. 35 Default Values used. 36 37 38 DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT 39 40 41 13190 15990 42

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Clean Air Act Assessment Package - 1988

GENERAL DATA

Non-Radon Individual Assessment May 1, 2000 02:17 pmm

14								`.	
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16									
17	Facility: H	Project	W-519	(East	of	Grout	Vaults	200-East	Areal
18	-	-		(Dubt		OLOUP	TUULUU	200 1400	112 (4)
	Address: H		÷ -						
19	City: H	Richlan	d						
20	State: N	AW				Zip:	99336		
21						-6			
22									
23	Source Categ	gory:							
24	Source 7	Type:	Stack						
25	Emission Y	Year:	2000						
26			2000						
27									
28	Comments: I	Project	W-519						
29									
30									
	- · · · ·	-	-						
31	Dataset N	Name:	Project	W-519	•				
32	Dataset I	Date:	May 1,	2000	02	2:16 pm	n		
33	Wind H	File:	C:\CAP8	8PC2\W	NDF	TLES	HS200E10	D.WND	
34	wind .		5. (On 0	0-02 (N					
J++ C									

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14

1 2 3	Мау	1, 2000 0)2:17 pmm			GENERAL Page 1
4 5 6		VALUES	FOR RADIONUCI	IDE-DEPENDENT	PARAMETERS	
7 8 9 10 11 12		Nuclide	Clearance Class	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
13 14 15 16 17 18		SR-90 . AM-241	D W	1.0 1.0	1.60E-06 1.60E-06	1.80E-03 1.80E-03

VALUE	S FOR RADIONU	CLIDE-DEPENDE	NT PARAMET	ERS	
	DECAY	CONSTANT (PE	R DAY)	TRANSFER CC	DEFFICIENT
Nuclide	Radio- active (1)	Surface	Water	Milk (2)	Meat (3)
SR-90 AM-241	0.00E+00 0.00E+00	5.48E-05 5.48E-05		0 1.50E-03 0 4.00E-07	
FOOTNOTES:		e radioactive ero if less t)	-	stant in plu	me;
	(2) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)				
		of animal's opears in each			le

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VALU	JES FO	R RADIONUCLID	E-DEPENDENT PA	RAMETERS	
			IRATION FACTOR	GI UPTAKE B	FRACTION
Nuclide		Forage (1)	Edible (2)	Inhalation	Ingestion
SR-90 AM-241	•	2.50E+00 5.50E-03	1.07E-01 1.07E-04	3.00E-01 1.00E-03	3.00E-01 1.00E-03
FOOTNOTES:		from soil for	pasture and f	take of nuclide orage Ci/kg dry soil)	
		from soil by (edible parts o	take of nuclide f crops Ci/kg dry soil)	

1 May 1, 2000 02:17 pmm GENERAL 2 Page 4 3 4 5 VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS 6 7 8 9 HUMAN INHALATION RATE 10 Cubic centimeters/hr 9.17E+05 11 12 SOIL PARAMETERS 13 14 Effective surface density (kg/sq m, dry weight) 15 (Assumes 15 cm plow layer) 2.15E+02 16 17 18 BUILDUP TIMES 19 For activity in soil (years) 1.00E+02 20 For radionuclides deposited on ground/water (days) 3.65E+04 21 22 23 DELAY TIMES 24 Ingestion of pasture grass by animals (hr) Ingestion of pasture grass 2, Ingestion of stored feed by animals (hr) Ingestion of leafy vegetables by man (hr) 0.00E+00 25 2.16E+03 3.36E+02 26 27 Ingestion of produce by man (hr) 3.36E+02 Transport time from animal feed-milk-man (day)2.00E+00Time from slaughter to consumption (day)2.00E+01 28 29 30 31 32 WEATHERING 33 Removal rate constant for physical loss (per hr) 2.90E-03 34 35 36 CROP EXPOSURE DURATION 37 Pasture grass (hr) 7.20E+02 38 Crops/leafy vegetables (hr) 1.44E+03 39 40 41 AGRICULTURAL PRODUCTIVITY 42 Grass-cow-milk-man pathway (kg/sq m) 2.80E-01 43 Produce/leafy veg for human consumption (kg/sg m) 7.16E-01 44 45 46 FALLOUT INTERCEPTION FRACTIONS 47 Vegetables 2.00E-01 48 Pasture 5.70E-01 49 50 51 GRAZING PARAMETERS 52 Fraction of year animals graze on pasture 4.00E-01 53 Fraction of daily feed that is pasture grass 54 when animal grazes on pasture 4.30E-01 55 56

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VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS	
ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+0:
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	,1.10E+0:
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg) Fraction of herd slaughtered (per day)	2.00E+0: 3.81E-0:
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-0:
FRACTIONS GROWN IN GARDEN OF INTEREST Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+0
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	0.00E+00 0.00E+00
Meat Milk	0.00E+0
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA	
(Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+0 1.80E+0
Leafy vegetable ingestion (kg/y)	1.00570
SWIMMING PARAMETERS	
Fraction of time spent swimming Dilution factor for water (cm)	0.00E+00 1.00E+00
DITUCION INCLUS WALCE (CM)	T.00710

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Clean Air Act Assessment Package - 1988

WEATHER DATA

Non-Radon Individual Assessment May 1, 2000 02:17 pmm

Facility: Project W-519 (East of Grout Vaults 200-East Area)
Address: Hanford Site
City: Richland
State: WA Zip: 99336

Source Category: Source Type: Stack Emission Year: 2000

Comments: Project W-519

Dataset Name: Project W-519 Dataset Date: May 1, 2000 02:16 pm Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND

	, 2000	02:17 pm						WEATI Page
	HARMON	IC AVERA	GE WIND	SPEEDS (WIND TOW	ARDS)		
		Pasqui	ll Stabi	lity Cla	ss		. <u></u>	
•					·····			Wind
Dir	A	В	С	D	Е	F	G	Freq
N	2.030	1.900	2.080	1.870	1.760	1.660	1,530	0.03
NNW	2.170	2.130	2.090	1.920	1.850	1.730	1.680	0.050
NW	1.950	1.860	1.990	1.740	1.680	1.510	1.480	0.05
WNW	1.800	1.620	1.470	1.460	1.380	1.280	1.160	0.043
W	1.560	1.460	1.390	1.330	1.240	1.150	1.140	0.030
WSW	1.510	1.340	1.290	1.190	1.120	1.120	1.040	0.028
SW	1.780	1.380	1.450	1.300	1.230	1.080	0.960	0.032
SSW	2.090	1.710	1.730	1.510	1.530	1.260	1.000	0.039
S	1.920	1.800	1.660	1.490	1.520	1.270	1.040	0.043
SSE	1.980	1.830	1.720	1.590	1.480	1.380	1.240	0.049
SE	3.190	2.650	2.460	2.470	2.450	2.000	1.830	0.122
ESE	3.290	2.820	2.780	3.150	3.390	2.660	2.690	0.203
E	3.130	2.630	2.530	2.570	2.820	2.390		
ENE	4.120	3.380	3.290	3.100			2.420	0.112
NE	3.140				2.440	1.940	2.170	0.074
NNE	2.270	3.390 2.120	2.640 2.160	2.720 2.000	2.220 1.830	1.540 1.470	1.490	0.04
					·····		1.320	
	ARITHM	ETIC AVE	RAGE WINI					
	ARITHM			D SPEEDS	(WIND TO			
Dir	ARITHMI		RAGE WINI	D SPEEDS	(WIND TO		G	
Dir		Pasqui	RAGE WINN	D SPEEDS lity Clas	(WIND TO	OWARDS)		
	A 3.120 3.010	Pasqui: B	RAGE WINN 11 Stabi: C	D SPEEDS lity Clas D	(WIND TO SS E	OWARDS) F	G	0.029
N	A 3.120	Pasqui B 2.890	RAGE WINI 11 Stabi C 3.220	D SPEEDS lity Clas D 3.120	(WIND TO 55 E 2.870	OWARDS) F 2.530	G 2.240	
N NNW NW	A 3.120 3.010	Pasqui: B 2.890 3.020	RAGE WINI 11 Stabi: C 3.220 3.060	D SPEEDS lity Clas D 3.120 2.960	(WIND TO 55 E 2.870 2.820	DWARDS) F 2.530 2.510 2.140	G 2.240 2.520 2.030	
N NNW NW	A 3.120 3.010 2.650	Pasqui: B 2.890 3.020 2.620	RAGE WINN 11 Stabi C 3.220 3.060 2.650	D SPEEDS Lity Clas D 3.120 2.960 2.540	(WIND TO 55 E 2.870 2.820 2.470	DWARDS) F 2.530 2.510 2.140 1.760	G 2.240 2.520 2.030 1.500	
N NNW NW WNW W	A 3.120 3.010 2.650 2.420	Pasqui B 2.890 3.020 2.620 2.240 2.090	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990	D SPEEDS lity Clas D 3.120 2.960 2.540 2.110 1.920	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750	F 2.530 2.510 2.140 1.760 1.540	G 2.240 2.520 2.030 1.500 1.480	
N NNW NW WNW W WSW	A 3.120 3.010 2.650 2.420 2.150 2.160	Pasqui B 2.890 3.020 2.620 2.240 2.090 1.860	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990 1.780	D SPEEDS lity Clas D 3.120 2.960 2.540 2.110 1.920 1.660	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470	F 2.530 2.510 2.140 1.760 1.540 1.510	G 2.240 2.520 2.030 1.500 1.480 1.280	
N NNW NW WNW WSW SW	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950	Pasqui B 2.890 3.020 2.620 2.240 2.090 1.860 2.180	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990 1.780 2.290	D SPEEDS lity Clas D 3.120 2.960 2.540 2.110 1.920 1.660 2.040	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090	
N NNW NW WNW WSW SW SSW	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170	Pasqui B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610	D SPEEDS lity Clas D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180	
N NNW NW WNW WSW SW SSW SSW	A 3.120 3.010 2.650 2.420 2.150 2.150 2.160 2.950 3.170 2.820	Pasqui B 2.890 3.020 2.620 2.240 2.240 2.090 1.860 2.180 2.790 2.700	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.650 1.990 1.780 2.290 2.610 2.510	D SPEEDS lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280	
N NNW NW WNW WSW SW SSW SSE	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840	Pasqui B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.700 2.640	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.650 1.990 1.780 2.290 2.610 2.510 2.520	D SPEEDS lity Class D 3.120 2.960 2.540 2.540 2.540 1.920 1.660 2.040 2.580 2.380 2.380 2.450	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990 2.000	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.280 1.740	
N NNW NW WNW WSW SSW SSW SSE SSE SE	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840 5.220	Pasqui B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.640 4.430	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610 2.510 2.520 4.100	D SPEEDS Lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380 2.450 4.240	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240 3.960	DWARDS) F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990 2.000 2.790	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.740 2.620	
N NNW NW WNW WSW SSW SSW SSE SSE SE ESE	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840 5.220 5.050	Pasqui: B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.640 4.430 4.600	RAGE WINN 11 Stabi C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610 2.510 2.520 4.100 4.420	D SPEEDS Lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380 2.450 4.240 4.970	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240 3.960 4.850	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990 2.000 2.790 3.450	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.740 2.620 3.490	
N NNW NW WNW WSW SSW SSE SSE SSE ESE ESE E	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840 5.220 5.050 5.000	Pasqui: B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.700 2.640 4.430 4.600 4.530	RAGE WINN 11 Stabi: C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610 2.510 2.520 4.100 4.420 4.090	D SPEEDS lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380 2.450 4.240 4.970 4.430	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240 3.960 4.850 4.010	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990 2.000 2.790 3.450 3.220	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.740 2.620 3.490 3.180	
N NNW NW WNW WSW SSW SSE SSE SSE ESE ESE ENE	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840 5.220 5.050 5.000 6.080	Pasqui: B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.700 2.640 4.430 4.600 4.530 5.470	RAGE WINN 11 Stabi: C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610 2.510 2.520 4.100 4.420 4.090 5.580	D SPEEDS lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380 2.450 4.240 4.970 4.430 5.540	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240 3.960 4.850 4.010 4.150	F 2.530 2.510 2.140 1.760 1.510 1.430 2.130 1.990 2.000 2.790 3.450 3.220 2.820	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.740 2.620 3.490 3.180 3.020	
N NNW NW WNW WSW SSW SSE SSE SSE ESE ESE E	A 3.120 3.010 2.650 2.420 2.150 2.160 2.950 3.170 2.820 2.840 5.220 5.050 5.000	Pasqui: B 2.890 3.020 2.620 2.240 2.090 1.860 2.180 2.790 2.700 2.700 2.640 4.430 4.600 4.530	RAGE WINN 11 Stabi: C 3.220 3.060 2.650 2.060 1.990 1.780 2.290 2.610 2.510 2.520 4.100 4.420 4.090	D SPEEDS lity Class D 3.120 2.960 2.540 2.110 1.920 1.660 2.040 2.580 2.380 2.450 4.240 4.970 4.430	(WIND TO 55 E 2.870 2.820 2.470 1.950 1.750 1.470 2.170 3.030 2.640 2.240 3.960 4.850 4.010	F 2.530 2.510 2.140 1.760 1.540 1.510 1.430 2.130 1.990 2.000 2.790 3.450 3.220	G 2.240 2.520 2.030 1.500 1.480 1.280 1.090 1.180 1.280 1.740 2.620 3.490 3.180	

May 1, 2000 02:17 pmm

WEATHER Page 2

		Pasqui						
Dir	A	В	С	D	E	F	G	
N	0.0977	0.0431	0.0374	0.2126	ò.2672	0.2414	0.1006	
NNW	0.1111	0.0417	0.0377	0.2401	0.2540	0.2103	0.1052	
NW	0.1533	0.0624	0.0606	0.2941	0.2086	0.1515	0.0695	
WNW	0.2014	0.0741	0.0602	0.3056	0.1921	0.1134	0.0532	
W	0.2161	0.0831	0.0637	0.3352		0.0914	0.0416	
WSW	0.2465	0.0845	0.0775	0.3380	0.1408	0.0810	0.0317	
SW	0.2539		0.0743	0.3529	0.1486	0.0619	0.0279	
SSW	0.2690	0.1041	0.0711	0.3376	0.1447	0.0584	0.0152	
S	0.2401	0.0956	0.0746	0.3427	0.1585	0.0676	0.0210	
SSE	0.1967	0.0820	0.0717	0.3361	0.1783	0.1004	0.0348	
SE	0.1404	0.0509	0.0501	0.3120	0.2652	0.1338	0.0476	
ESE	0.0512	0.0222	0.0192	0.2368	0.3732	0.2083	0.0891	
E	0.0661	0.0223	0.0214	0.1716	0.3494	0.2565	0.1126	
ENE	0.1531	0.0434	0.0366	0.2195	0.2859	0.1816	0.0799	
NE	0.1498	0.0506	0.0380	0.2658	0.2743	0.1603	0.0612	
NNE	0.1058	0.0444	0.0307	0.2423	0.2901	0,2082	0.0785	
OTAL	0.1358	0.0505	0.0433	0.2674	0.2677	0.1643	0.0690	
		ADDITIC	NAL WEAT	HER INFC	ORMATION	<u> </u>		
	Aver	age Air	Temperat		2.0 degr .16 K	ees C		
		Pr	ecipitat	ion: 1	.6.0 cm/y .000 mete			
	Surfa	ice Rough	Lid Hei					
)f Wind M			010 mete			
	nergine e		Wind Sp		000 m/s	15		

Ve	ertical	Temp	eratur	e Grad	dien
	STABII	ITI	Е	0.073	k/m
	STABII	ITY	F	0.109	k/m
	STABII	JITY	G	0.146	k/m

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APPENDIX C

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CAP88 PC REPORT FILES FOR GUZZLER DIGGING

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CAP88-PC

Version 2.00

Clean Air Act Assessment Package - 1988

DOSE AND RISK EQUIVALENT SUMMARIES Non-Radon Individual Assessment May 3, 2000 03:28 pmm Facility: Project W-519 (East of Grout Vaults 200-East Area) Address: Hanford Site City: Richland State: WA Zip: 99336 Source Category: Source Type: Stack Emission Year: 2000 Comments: Project W-519 Dataset Name: Project W-519 Dataset Date: May 3, 2000 03:28 pm Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND

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SUMMARY Page 1

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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
	
GONADS BREAST R MAR LUNGS THYROID ENDOST RMNDR	5.51E-03 8.97E-04 7.68E-02 3.75E-03 8.81E-04 4.98E-01 1.90E-02
EFFEC	3.18E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	7.89E-03
INHALATION	2.39E-02
AIR IMMERSION	4.71E-10
GROUND SURFACE	1.85E-05
INTERNAL	3.18E-02
EXTERNAL	1.85E-05
TOTAL	3.18E-02

1 2 3 4	May	3,	2000	03:28 pmm	· ·	SUMMARY Page 2
5 6 7 8				NUCLIDE EFFECTIVE	DOSE EQUIVALENT SUMMARY	
9					Selected Individual	
10 11				Nuclide	(mrem/y)	
12						
13 14				SR-90'	8.85E-03	
15				AM-241	2.30E-02	
16						
17 18				TOTAL	3.18E-02	

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1 2 3 4	May 3, 2000	03:28 pmm		SUMMARY Page 3
4 5 6 7 8 9		CANCER RISK SUM	1ARY	
9 10 11 12 13		Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	
14 15 16 17		 LEUKEMIA BONE THYROID	1.51E-07 3.15E-08 2.24E-10	
18 19 20 21		BREAST LUNG STOMACH BOWEL	1.87E-09 1.15E-08 1.07E-09 3.68E-09	
22 23 24 25		LIVER PANCREAS URINARY OTHER	6.26E-08 1.10E-09 5.70E-10 1.34E-09	
26 27 28 29 30		TOTAL	2.67E-07	
31 32 33 34		PATHWAY RISK SU	MMARY Selected Individual	
35 36 37 38		Pathway	Total Lifetime Fatal Cancer Risk	
39 40 41 42		INGESTION INHALATION AIR IMMERSION GROUND SURFACE	1.28E-07 1.39E-07 9.80E-15 3.86E-10	
43 44 45 46		INTERNAL EXTERNAL TOTAL	2.66E-07 3.86E-10 2.67E-07	
47				

1 2 3 4	May	3,	2000	03:28 pmm			SUMMARY Page 4
5 6 7				NUCLIDE F	ISK SUMMAR	Y	×
8 9 10						Selected Individual Total Lifetime	
11 12 13				Nuclide		Fatal Cancer Risk	
14 15 16			•	SR-90 AM-241	•	1.49E-07 1.18E-07	
17 18				TOTAL		2.67E-07	

7

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y (All Radionuclides and Pathways)								nrem/y)
		(A11	Rad10)		les and	Pathwa	ys)	: :
			Di.	stance	e (m)			
Directio	on 13190	15990	•		1			
N	1.4E-02	1.2E-02						÷
NNW	1.6E-02	1.4E-02						
NW	1.5E-02	1.4E-02						
WNW		1.2E-02						
W		1.1E-02						
WSW		1.0E-02						
SW		1.0E-02						
SSW	1.1E-02	1.1E-02						
S	1.2E-02	1.1E-02						
SSE	1.3E-02	1.2E-02						
SE	2.1E-02	1.8E-02						
ESE	3.2E-02	2.7E-02						
E	2.4E-02	2.0E-02						
ENE	1.7E-02	1.5E-02						
NE	1.4E-02	1.2E-02						
NNE	1.2E-02	1.1E-02						

				ETIME RISE	(deaths) Pathways)	·.	
			Dista	nce (m)			
Directi	on 13190	15990	. •	·.			
N	1.6E-07	1.5E-07		<u> </u>	×		<u> </u>
NNW	1.7E-07	1.6E-07		,			
NW	1.7E-07	1.6E-07					
WNW	1.6E-07	1.5E-07					
W	1.5E-07	1.5E-07					
WSW	1.5E-07	1.4E-07					
SW	1.5E-07	1.4E-07					
SSW	1.5E-07	1.4E-07					
S	1.5E-07	1.5E-07					
SSE	1.6E-07	1.5E-07					
SE	2.0E-07	1.9E-07					
ESE E	2.7E-07 2.2E-07	2.4E-07 2.0E-07					
ENE	2.2E-07 1.8E-07	2.0E-07 1.7E-07					
NE	1.6E-07	1.5E-07					
1915	1.5E-07	1.5E-07					

C A P 8 8 - P C Version 2.00 Clean Air Act Assessment Package - 1988 SYNOPSIS REPORT Non-Radon Individual Assessment May 3, 2000 03:28 pmm Facility: Project W-519 (East of Grout Vaults 200-East Area) Address: Hanford Site City: Richland Zip: 99336 State: WA Source Category: Source Type: Stack Emission Year: 2000 Comments: Project W-519 Effective Dose Equivalent (mrem/year) 3.18E-02 At This Location: 13190 Meters East Southeast Dataset Name: Project W-519 Dataset Date: May 3, 2000 03:28 pm Wind File: C:\CAF88PC2\WNDFILES\HS200E10.WND

1 2 · 3 4	May 3, 2000 03:28 pmm	SYNOPSIS Page 1
4 5 6 7 8 9	MAXIMALLY EXPOS	SED INDIVIDUAL
8 9 10 11 12	Location Of The Individual Lifetime Fatal Cancer Risk	L: 13190 Meters East Southeast C: 2.67E-07
12 13 14 15 16	ORGAN DOSE EQUI	VALENT SUMMARY
17		Dose
18		Equivalent
19	Organ	(mrem/y)
20		
21 .22	GONADS	5.51 E- 03
23	BREAST	8.97E-04
24	R MAR	7.68E-02
25	LUNGS	3.75E-03
26	THYROID	8.81E-04
27	ENDOST	4.98E-01
28	RMNDR	1.90E-02
29 30 31	EFFEC	3.18E-02

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1 2 3 4	May 3,	, 2000	03::	28 pmm					SYNOPSIS Page 2
5 6 7				RADIONU	CLIDE EMISSIC	ONS DURIN	G THE	YEAR 2000)
8 9 10 11	Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y				
12 13 14 15 16	SR-90 AM-241			1.9E-01 1.3E-03		ч.			
17 18 19				SITE IN	FORMATION				
20 21 22 23				Pre	emperature: cipitation: ing Height:	16 cm	grees /y	с	

1 2 3 4 5 6 7 8	May 3, 2000	03:28 g	тт					SYNOPSIS Page 3
5 6 7		sot	IRCE INFO	RMATION			·.	
9 10	Source Num	nber:	1					
11 12 13 14	Stack Height Diameter		1. 0.		•			
14 15 16 17	Plume Rise Pasquill Cat:	A	В	с	D	E	F	G
18 19 20 21	Fixed (m): (Fixed Rise	0.	0.	0.	0.	0.	0.	0.
22 23 24		AGF	ICULTURAI	DATA				
25 26 27 28					Veget	able	Milk	Meat
28 29 30 31 32	Fract	ion From	on Home H Assessme raction]	ent Area:	1.	000 000 000	0.000 1.000 0.000	0.000 1.000 0.000
33 34 35 36		Food	Arrays v De	vere not efault Va			his run.	
37 38 39	DISTANCES (M	I) USED F	OR MAXIMU	INDIVI	DUAL ASS	SESSMENT		
40 41 42 43	13190 159	90						

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C A P 8 8 - P C
Version 2.00
Clean Air Act Assessment Package - 1988
GENERAL DATA
Non-Radon Individual Assessment May 3, 2000 03:28 pmm
Facility: Project W-519 (East of Grout Vaults 200-East Area) Address: Hanford Site City: Richland State: WA Zip: 99336
Source Category: Source Type: Stack Emission Year: 2000
Comments: Project W-519
Dataset Name: Project W-519 Dataset Date: May 3, 2000 03:28 pm Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND

1 May 3, 2000 03:28 pmm 2

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GENERAL Page 1

Nuclide	Clearance Class	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
SR-90	D	· 1.0	1.60E-06	1.80E-0
AM-241	Ŵ	1.0	1.60E-06	1.80E-0

VALUI	ES FOR RADIONU	CLIDE-DEPENDE	NT PARAMET	ERS	
	DECAY	CONSTANT (PE	R DAY)	TRANSFER CC	DEFFICIENT
Nuclíde	Radio- active (1)	Surface	Water	Milk (2)	Meat (3
SR-90 AM-241	0.00E+00 0.00E+00	5.48E-05 5.48E-05	• • • • • •	0 1.50E-03 0 4.00E-07	3.00E-04 3.50E-04
FOOTNOTES:		e radioactive ero if less t	-	-	ıme;
		of animal's opears in each			le
		of animal's o bears in each			le

1 2 3 GENERAL Page 3

			CONCENTRATION UPTAKE FACTOR		FRACTION
Nuclide		Forage (1)	Edible (2)	Inhalation	Ingestio
SR-90 AM-241	•	2.50E+00 5.50E-03	1.07E-01 1.07E-04	3.00E-01 1.00E-03	3.00E-01 1.00E-03
FOOTNOTES:	(1)	from soil for	factor for up pasture and f y weight per p	orage	
	(2)	from soil by	factor for up edible parts o t weight per p	f crops	

1

2

3

GENERAL Page 4

4 VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS 5 6 7 8 HUMAN INHALATION RATE 9 9.17E+05 10 Cubic centimeters/hr 11 12 13 SOIL PARAMETERS Effective surface density (kg/sq m, dry weight) 14 15 (Assumes 15 cm plow layer) 2.15E+02 16 17 18 BUILDUP TIMES For activity in soil (years) 19 1.00E+02 For radionuclides deposited on ground/water (days) 3.65E+04 20 21 22 23 DELAY TIMES 24 Ingestion of pasture grass by animals (hr) Ingestion of pasture grass by unimals (hr) Ingestion of stored feed by animals (hr) Ingestion of leafy vegetables by man (hr) 0.00E+00 2.16E+03 25 26 3.36E+02 27 Ingestion of produce by man (hr) 3.36E+02 Transport time from animal feed-milk-man (day)2.00E+00Time from slaughter to consumption (day)2.00E+01 28 29 30 31 32 WEATHERING Removal rate constant for physical loss (per hr) 2.90E-03 33 34 35 36 CROP EXPOSURE DURATION 37 7.20E+02 Pasture grass (hr) 1.44E+03 38 Crops/leafy vegetables (hr) 39 40 41 AGRICULTURAL PRODUCTIVITY 42 Grass-cow-milk-man pathway (kg/sq m) 2.80E-01 43 Produce/leafy veg for human consumption (kg/sq m) 7.16E-01 44 45 46 FALLOUT INTERCEPTION FRACTIONS 2.00E-01 47 Vegetables 5.70E-01 48 Pasture 49 50 51 GRAZING PARAMETERS Fraction of year animals graze on pasture 52 4.00E-01 53 Fraction of daily feed that is pasture grass 54 4.30E-01 when animal grazes on pasture 55 56

ay 3, 2000 03:28 pmm	G P
VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS	
	۰.
ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+0
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+0
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+0
Fraction of herd slaughtered (per day)	3.81E-(
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-0
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+0
Leafy vegetables ingested	1.00E+0
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	0.00E+C
Meat	0.00E+0
Milk	0.00E+0
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA	
(Minimum fractions of food types from outside	
area listed below are actual fixed values.) Vegetables	0.00E+0
Meat	0.00E+0
Milk	0.00E+0
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+0
Milk ingestion (L/y)	1.12E+0
Meat ingestion (kg/y)	8.50E+(
Leafy vegetable ingestion (kg/y)	1.80E+(
SWIMMING PARAMETERS	o oc
Fraction of time spent swimming Dilution factor for water (cm)	0.00E+(
Dilution factor for water (cm)	1.00E+0

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САР88-РС		С	А	Ρ	8	8		Ρ	С	
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Version 2.00

Clean Air Act Assessment Package - 1988

WEATHER DATA

Non-Radon Individual Assessment May 3, 2000 03:28 pmm

Facility: Project W-519 (East of Grout Vaults 200-East Area) Address: Hanford Site City: Richland State: WA Zip: 99336 Source Category: Source Type: Stack Emission Year: 2000 Comments: Project W-519 Dataset Name: Project W-519 Dataset Date: May 3, 2000 03:28 pm Wind File: C:\CAP88PC2\WNDFILES\HS200E10.WND

ay 3	, 2000	03:28 pm	m					WEA Pag
	HARMON	IC AVERA	GE WIND	SPEEDS ('	WIND TOW	ARDS)		
		Pasqui	ll Stabi	lity Cla	99		•.	
Dir	A	В	с	D	E	F	G	Wir Fre
N	2.030	1.900	2.080	1.870	1.760	1.660	1.530	0.0
NNW	2.170	2.130	2.090	1.920	1.850	1.730	1.680	0.0
NW	1.950	1.860	1.990	1.740	1.680	1.510	1.480	0.0
WNW	1.800	1.620	1.470	1.460	1.380	1.280	1.160	0.0
W	1.560	1.460	1.390	1.330	1.240	1.150	1.140	0.0
WSW	1.510	1.340	1.290	1.190	1.120	1.120	1.040	0.0
SW	1.780	1.380	1.450	1.300	1.230	1.080	0.960	0.0
SSW	2.090	1.710	1.730	1.510	1.530	1.260	1.000	0.0
S	1.920	1.800	1.660	1.490	1.520	1.270	1.040	0.0
SSE	1.980	1.830	1.720	1.590	1.480	1.380	1.240	0.0
SE	3.190	2.650	2.460	2.470	2.450	2.000	1.830	0.1
ESE	3.290	2.820	2.780	3.150	3.390	2.660	2.690	0.2
E	3.130	2.630	2.530	2.570	2.820	2.390	2.420	0.1
ENE	4.120	3.380	3.290 2.640	3.100 2.720	2.440 2.220	1.940 1.540	2.170	0.0
NE NNE	3.140 2.270	3.390 2.120	2.040	2.000	1.830	1.470	1.490 1.320	0.0
	2.2.0	2.120	2,100	2.000	1.050	1.4/0	1.520	0.0
	ARITHM	ETIC AVE	RAGE WIN	D SPEEDS	(WIND TO	WARDS)		
		Pasqui	ll Stabi	lity Cla	SS			
Dir	A	В	с	D	E	 F	G	
		· · · · · · · · · · · · · · · · · · ·						·
N	3.120	2.890	3.220	3.120	2.870	2.530	2.240	
NNW	3.010	3.020	3.060	2.960	2.820	2.510	2.520	
NW	2.650	2.620	2.650	2.540	2.470	2.140	2.030	
WNW	2.420	2.240	2.060	2.110	1.950	1.760	1.500	
W	2.150	2.090	1.990	1.920	1.750	1.540	1.480	
WSW	2.160	1.860	1.780	1.660	1.470	1.510	1.280	
SW	2.950	2.180	2.290	2.040	2.170	1.430	1.090	
SSW	3.170	2.790 2.700	2.610	2.580 2.380	3.030 2.640	2.130 1.990	1.180 1.280	
S SSE	2.820 2.840	2.700	2.510 2.520	2.380	2.640	2.000	1.280	
SE	5.220	4.430	4.100	4.240	3.960	2.790 3.450	2.620	
ESE	5.050 5.000	4.600	4.420	4.970	4.850 4.010	3.450	3.490	
E Ene	5.000 6.080	4.530 5.470	4.090 5.580	4.430 5.540	4.010 4.150	2.820	3.180 3.020	
ene NE	6.080 4.950	5.350	5.580 4.910	5.540	4.150	2.820	2.130	
IN 2.				4.020	4.370 3.640	2.280	1.820	
NNE	3.650	3.610	3.440	<u> 1</u> (121)	5 6411			

WEATHER Page 2

		Pasqui	ll Stabi	lity Cla	55		
Dir	A	В	С	D	E	F	G
N	0.0977	0.0431	0.0374	0.2126	0.2672	0.2414	0.1006
NNW	0.1111	0.0417	0.0377	0.2401	0.2540	0.2103	0.1052
NW	0.1533	0.0624	0.0606	0.2941	0.2086	0.1515	0.0695
WNW	0.2014	0.0741	0.0602	0.3056	0.1921	0.1134	0.0532
W	0.2161	0.0831	0.0637	0.3352	0.1690	0.0914	0.0416
WSW	0.2465	0.0845	0.0775	0.3380	0.1408	0.0810	0.0317
SW	0.2539	0.0805	0.0743	0.3529	0.1486	0.0619	0.0279
SSW	0.2690	0.1041	0.0711	0.3376	0.1447	0.0584	0.0152
S	0.2401	0.0956	0.0746	0.3427	0.1585	0.0676	0.0210
SSE	0.1967	0.0820	0.0717	0.3361	0.1783	0.1004	0.0348
SE	0.1404	0.0509	0.0501	0.3120	0.2652	0.1338	0.0476
ESE	0.0512	0.0222	0.0192	0.2368	0.3732	0.2083	0.0891
E	0.0661	0.0223	0.0214	0.1716	0.3494	0.2565	0.1126
ENE	0.1531	0.0434	0.0366	0.2195	0.2859	0.1816	0.0799
NE	0.1498	0.0506	0.0380	0.2658	0.2743	0.1603	0.0612
NNE	0.1058	0.0444	0.0307	0.2423	0.2901	0,2082	0.0785
OTAL	0.1358	0.0505	0.0433	0.2674	0.2677	0.1643	0.0690
		ADDITIC	NAL WEAT	HER INFO	RMATION		
	Aver	age Air	-	285	2.0 degr .16 K		
		Pr	ecipitat		6.0 cm/y		
			Lid Hei		000 mete		
	Surfa	ce Rough	ness Len	igth: 0.	010 mete	rs	

Vertical Tem	peratu	re Grac	lients:
STABILITY	E	0.073	k/m
STABILITY	F	0.109	k/m
STABILITY	G	0.146	k/m

1 2 3 4 1(1 12 1 1 1 1 1 1 1 $\begin{array}{c} 20\\ 22\\ 23\\ 22\\ 25\\ 26\\ 27\\ 29\\ 30\\ 32\\ 33\\ 35\\ 36\\ 37\\ 38\\ 940\\ 41\\ 43\\ 44\\ 546\\ 48\\ 950\\ \end{array}$

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