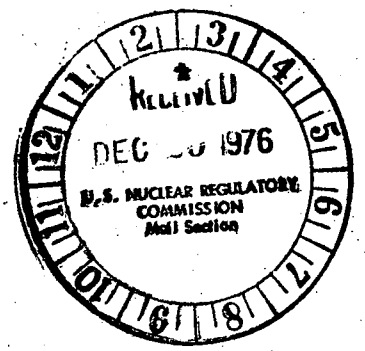
IOWA ELECTRIC LIGHT AND POWER COMPANY

General Office

CEDAR RAPIDS, IOWA

December 9, 1976
IE-76-1933

LEE LIU
VICE PRESIDENT – ENGINEERING



Mr. George Lear, Chief
Operating Reactors Branch 3
Division of Operating Reactors
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Lear:

Your letter of September 3, 1976 requested additional information for evaluating Duane Arnold Energy Center compliance with Appendix I to 10CFR50. The purpose of this letter is to transmit our response to that request for information.

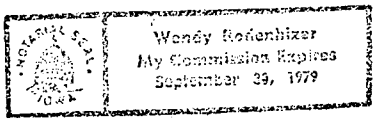
Three originals and 37 copies of this submittal are transmitted herewith. This submittal, consisting of this letter and the attachment hereto, is true and accurate to the best of my knowledge and belief.

Iowa Electric Light and Power Company

By: _____
Lee Liu
Vice President, Engineering

Subscribed and sworn to before me on this 9th day of December, 1976.

_____
Notary Public in and for the State of Iowa.



LL/RFS/ms
Attachment
cc: R. Salmon
D. Arnold
R. Lowenstein
L. Root
J. Shea (NRC)
J. Keppler (NRC)
File A-107

See Reports

12851

RESPONSES

TO

ADDITIONAL INFORMATION REQUESTED

FOR

DUANE ARNOLD ENERGY CENTER

TABLE OF CONTENTS

1. Provide the information requested in Chapter 4 of NUREG-0016 "Calculation of Release of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors (BWR-GALE Code)" April 1976. (formerly Appendix D of Regulatory Guide 1.CC). Refer to question No. 1 in Enclosure 2 of our letter of February 17, 1976.

Responses to Information Requested in Chapter 4 of NUREG-0016

	Request	Response
4.1	General	
	1) Maximum core thermal power	1658 MWt
	2) Tritium released from each reactor in	
	a) Liquid effluents	20 Ci/yr*
	b) Gaseous effluents	21 Ci/yr*
4.2	Nuclear Steam Supply System	
	1) Total steam flow rate	7,147,000 lb/hr
	2) Mass of reactor coolant in reactor vessel at full power	289,000 lb
4.3	Reactor Coolant Cleanup System	
	1) Average flow rate	70,000 lb/hr
	2) Demineralizer	
	a) Type	Powdex
	b) Size	26 ft^3
	3) Regeneration frequency	NA
	4) Regenerant	
	a) Volume	NA
	b) Activity	NA

*Note: Based on GALE calculations

Request	Response
4.4 Condensate Demineralizers	
1) Average flow	14,500 gpm 7.25 x 10^6 lb/hr
2) Demineralizer type	Powdex
3) Demineralizers	
a) Number	5
b) Size	234 ft^3
4) Regeneration frequency	NA
5) Ultrasonic resin cleaning	
a) Is it used?	No
b) Volume associated with use	NA
6) Regenerant	
a) Volume	NA
b) Activity	NA

4.5 Liquid Waste Processing Systems

1a.

System	Sources	Flow Rate* (gal/day)	PCA*
High Purity	Equipment Drains:		
	Drywell	3400	1.0
	Containment, Reactor Bldg., Fuel Pool	3720	0.01
	Radwaste Bldg.	1060	0.01
	Turbine Bldg.	2960	0.01

*Note: Based on NUREG-0016

4.5 1a. Continued

System	Sources	Flow Rate* (gal/day)	PCA*
	Resin Rinse	5000	0.002
	Cleanup Phase Separator Decant	640	0.002
	Condensate Demineralizer Backwash	8100	Negligible
Low Purity Floor Drains:			
	Drywell	700	1.0
	Containment, Reactor Bldg., Fuel Pool	2000	0.01
	Radwaste Bldg.	1000	0.01
	Turbine Bldg.	2000	0.01
Chemical	Lab Drains	500	0.02
	Chem Lab.	100	0.02

1b.

System	Collection Time (days)	Processing Time (days)	Discharge Time (days)
High Purity	0.16	0.03	0
Low Purity	0.7	0.03	0
Chemical	2.7	0.6	0

1c.

System	Equipment	Number	Capacity or Process Rate
High Purity	Collection Tanks	1	10,000 gal.
	Filter	1	110 gpm (120 ft^2)
	Ionex	1	110 gpm (35 ft^3)
	Sample Tanks	2	10,000 gal

*Note: Based on NUREG-0016

4.5 1c. Continued

System	Equipment	Number	Capacity or Process Rate
Low Purity	Collection Tank	1	10,000 gal
	Filter	1	110 gpm (120 ft^2)
	Ionex	1	110 gpm (35 ft^3)
	Sample Tank	1	10,000 gal
Chemical	Collection Tank	1	4,000 gal
	Filter	1	2 gpm
	Ionex	1	2 gpm (35 ft^3)
	Sample Tank	1	4,000 gal

1.d

System	Process Step	Decontamination Factors*		
		Iodine	Cesium	Others
High Purity	Collection Tank	1	1	1
	Filter	1	1	1
	Ionex	100	10	100
	Sample Tanks	1	1	1
Low Purity	Collection Tank	1	1	1
	Filter	1	1	1
	Ionex	100	2	100
	Sample Tank	1	1	1

*Note: Based on NUREG-0016

4.5 1d. Continued

System	Process Step	Decontamination Factors*		
		Iodine	Cesium	Others
Chemical	Collection Tank	1	1	1
	Filter	1	1	1
	Ionex	100	2	100
	Sample Tank	1	1	1

1e.

System	Fraction Discharge
High Purity	0.01
Low Purity	0.1
Chemical	1.0

1f. NA

1g. See Appendix A

2. See Appendix B

Request	Response
4.6 Main Condenser and Turbine Gland Seal Air Removal Systems	
1) The holdup time for offgases from the main condenser air ejector prior to processing by the offgas treatment system	0.5 hr
2) Offgas treatment system	
a) Type	** (see next page)
b) Air inleakage per condenser shell	18.5 scfm
c) Number of condenser shells	2

*Note: Based on NUREG-0016.

4.6 2. Continued

**Process Offgas (Steam Jet Air Ejector)

Noncondensible radioactive offgas is continuously removed from the main condenser by the air ejector during plant operation. This is the major source and is larger than all other sources combined. The air ejector offgas will normally contain activation gases, principally N-16, 0-19, and N-13. The N-16 and 0-19 isotopes have short half-lives and quickly decay. The 10-minute half-life N-13 isotope is present in small amounts which are further reduced by decay. The air ejector offgas also contains the radioactive noble gas parents of biologically significant Sr-89, Sr-90, Ba-140, and Cs-137 isotopes. The concentration of these noble gases depends upon the usually extremely small amount of tramp uranium in the coolant and on the cladding surfaces, and the number and size of fuel cladding leaks.

Radioactive particulate daughters are retained on the HEPA filters and on the charcoal. The offgas is discharged to the environs via the plant stack. The activity of the gas entering and leaving the offgas treatment system is continuously monitored. Thus, the system performance is known to the operator at all times.

Mechanical Vacuum Pump Offgas

During unit startup, air is removed from the main condenser by a mechanical vacuum pump. The mechanical vacuum pump exhaust is

4.6 2. Continued

** Continued

discharged to the plant stack. The mechanical vacuum pump will normally be in service only during startup at a time when little or no radioactive gas is present. It will be isolated upon the receipt of a high radiation signal from the main steam line radiation monitoring system.

Request	Response
d) Iodine source term from condenser	
i) I-131	5 Ci/yr*
ii) I-133	5 Ci/yr*
3) Charcoal Delay System	
a) Mass of Charcoal	37 tons
b) Operating Temperature	77°F
c) Dew point temperature	45°F
d) Dynamic adsorption coefficient for Xe	330 cc/g
e) Dynamic adsorption coefficient for Kr	18.5 cc/g
4) Cryogenic Distillation System	
a) Fraction of gases partitioned	NA
b) Holdup in system	NA
c) Storage following distillation	NA
d) Expected system leakage rate	NA

*Note: Based on GALE Assumptions

Request	Response
4.6 Continued	
5) Gland seal steam	
a) Flow rate	7,147 lb/hr
b) Steam source	Primary steam
6) Gland seal condenser	
a) Vented gas holdup time	0.029 hrs
b) Iodine partition factor	100
c) Fraction of iodine released through system vent	1.0
d) Gland seal off-gas system	***
7) See Appendix C	

***Gland Seal Condenser Offgas

The gland seal condenser exhauster discharges into a separate holdup piping system. A holdup of approximately two minutes is provided to permit decay of the short lived radioactive gases present. These are principally N-13, N-16, N-17, and 0-19. The release rate of radioactive gas is less than 0.1% of that from the air ejector offgas system. The gland seal exhaust gas flows past the elevated release point radiation monitors prior to release so its contribution to the release rate is included in the measured total.

4.7 Ventilation and Exhaust Systems

1, 2)

Building	Equipment	Decontamination Factors* Iodine	Particulates
Containment	HEPA and Charcoal	10	100
Turbine	None	1	1
Radwaste	None	1	1
Reactor	None	1	1

3) See Appendix A for release rates. The radioactive particulate size distribution information does not exist for Duane Arnold. The gaseous radwaste treatment system meets the requirements of Regulatory Guide 1.112 and satisfies the criteria according to the BWR GALE Code.

4) Duane Arnold Source Parameters

RX Building

Location is 42° 06' 02" N
91° 46' 36" W

Centered on N-S, E-W directions.

Area of roof = 140' x 140'
Height = 896' 5-3/16"-757'6"

Turbine Building

Located East of and adjoining RX Building
Area of roof = 257' x 137'
Height = 833'10" - 757' 6"

*Note: Based on NUREG-0016

4.7 4) Continued

Vent Stacks (3)

Located at NE corner of RX Building
Diameter = 6'
Height - 911' 10-5/8" - 757'6"
Flow Rate - 63,000 cfm
Exit Velocity = $\frac{63 \times 10^3}{60 \pi R^2}$ = 37.14 ft/sec

Off Gas Stack

Located 180' East and 560' South of RX Building

Diameter = 2'
Height = 1083'6" - 755'6"
Flow rate = 4300 cfm
Exit Velocity = $\frac{4300}{60 \pi R^2}$ = 22.81 ft/sec

Gaseous effluent temperature information is not measured at Duane Arnold, however, because of the distance between the offgas treatment system and the release point at the stack it is assumed to reach the ambient temperature at time of release.

Offgas flow is measured at Duane Arnold via RTD's.

5) Containment Building

a) Purge frequency: 4/yr

b) Purge duration: 8 hr

c) Continuous purge rate: NA

2. The annual production date of agricultural products for the 50 mile radius as submitted was extrapolated from Linn and Benton Counties. Justify the use of this data in lieu of providing the data by sectors in the manner indicated in Sections 2.1.3.1 and 2.1.3.2 of Regulatory Guide 4.2, Rev 1 as requested.

The annual production data of agricultural products was extrapolated from data for Linn and Benton Counties, because

1. Linn and Benton Counties include most of the land within 20 miles of the plant.
2. Data from other counties was not available.
3. The production was assumed to be uniform within 50 miles of the plant.
4. If the production rate more than 20 miles from the plant was actually five times that of Linn and Benton Counties, the total population dose would increase about 60%. This would not make any additional equipment cost-beneficial.

The following information is in support of point 4 above.

Milk production was based on data for the area within 50 miles of the plant, thus only meat, fruits and vegetables were extrapolated.

Linn and Benton Counties have a total area of 1435 square miles or 18 percent of the area within 50 miles of the plant. For this analysis these counties will be represented by the area within 20 miles of the plant (1257 square miles or 16 percent of the area within 50 miles of the plant).

The cost-benefit analysis was based on the assumption that the agricultural production rate was uniform over the entire area within 50 miles of the plant. If, in fact, the production rate outside 20 miles is greater than that inside 20 miles, what is the effect on the total population dose?

Table 2 shows the effect of higher production rates outside 20 miles of the plant on crop and meat doses. For example:

> If the production rate outside 20 miles were five times that inside 20 miles, the total production would be 4.36 times that used in the cost-benefit analysis. The production weighted dispersion parameters would be smaller however since the parameters for the farther distances would be more heavily weighted. The product of relative total production and the dispersion parameters would be:
>
> a) 1.83E-08 for the stack X/Q
>
> b) 4.95E-11 for the stack relative deposition
>
> c) 1.02E-07 for the vent X/Q
>
> d) 5.86E-11 for the vent relative deposition.

Taking the ratio of these numbers to the similar numbers for the uniform production assumption gives the relative doses for crops and meat via each release point and isotope type. Thus,

a) C-14 and H-3 doses from the stack would increase by a factor of 3.08.

b) Iodine and particulate doses from the stack would increase by a factor of 2.17.

c) C-14 and H-3 doses from the vent would increase by a factor of 2.97.

d) Iodine and particulate doses from the vent would increase by a factor of 2.02.

Table 2 was derived from Table 1 by weighting the dispersion parameters by the relative production rate in each region.

The table below shows the fraction of the total crop and meat dose which is attributable to each dispersion parameter:

Stack X/Q	0.05
Stack Relative Deposition	0.08
Vent X/Q	<0.01
Vent Relative Deposition	0.87

When these dose fractions are multiplied by the relative doses from Table 2, the following table results:

Relative Production Rate Outside 20 Miles	Relative Dose
1.	1.00
1.5	1.14
2.	1.28
3.	1.54
5.	2.09
10.	3.45

When these relative doses are applied to the meat and crop doses of the Base Case, Table 3 results. This table shows that the population dose increases by 59 percent when the production rate outside 20 miles is five times greater than the production rate inside 20 miles. Table 4 shows that no equipment is closer than a factor of 2.6 to becoming cost-beneficial. Therefore, since the crop production does not vary widely within 50 miles of the plant, extrapolating the Linn and Benton County data to 50 miles did not effect the cost-benefit analysis.

Table 1

Determination of Meteorological Parameters
for All Food Pathways (Grazing Season Values)

Direction	Distance	Sector Fraction	Stack		Vent	
			X/Q sec/m^3	Specific Deposition $1/m^2$	X/Q sec/m^3	Specific Deposition $1/m^2$
N	1-5	0.01	1.65E-07	2.07E-09	1.06E-06	2.24E-09
	5-10	0.03	6.25E-08	2.39E-10	3.87E-07	4.54E-10
	10-20	0.12	2.01E-08	6.47E-11	1.14E-07	9.82E-11
	20-30	0.20	1.08E-08	3.19E-11	5.73E-08	3.63E-11
	30-40	0.28	7.19E-09	2.06E-11	3.78E-08	1.84E-11
	40-50	0.36	5.30E-09	1.37E-11	2.78E-08	1.14E-11
	Total		1.20E-08	5.27E-11	6.79E-08	6.43E-11
NNE	1-5	0.01	9.47E-08	1.57E-09	4.91E-07	1.53E-09
	5-10	0.03	4.15E-08	1.68E-10	2.79E-07	2.75E-10
	10-20	0.12	1.35E-08	4.32E-11	8.36E-08	6.01E-11
	20-30	0.20	7.23E-09	2.08E-11	4.23E-08	2.22E-11
	30-40	0.28	4.84E-09	1.33E-11	2.81E-08	1.13E-11
	40-50	0.36	3.58E-09	8.88E-12	2.07E-08	6.97E-12
	Total		7.90E-09	3.70E-11	4.71E-08	4.09E-11
NE	1-5	0.01	6.75E-08	1.03E-09	3.35E-07	9.93E-10
	5-10	0.03	3.26E-08	1.38E-10	2.09E-07	1.73E-10
	10-20	0.12	1.04E-08	4.02E-11	6.23E-08	3.62E-11
	20-30	0.20	5.48E-09	1.72E-11	3.13E-08	1.33E-11
	30-40	0.28	3.66E-09	9.89E-12	2.08E-08	6.77E-12
	40-50	0.36	2.70E-09	6.19E-12	1.53E-08	4.19E-12
	Total		5.99E-09	2.77E-11	3.47E-08	2.55E-11
ENE	1-5	0.01	7.15E-08	6.07E-10	4.91E-07	7.91E-10
	5-10	0.03	2.07E-08	5.55E-11	1.19E-07	1.15E-10
	10-20	0.02	7.32E-09	1.28E-11	3.70E-08	2.79E-11
	20-30	0.20	4.15E-09	6.06E-12	1.91E-08	1.05E-11
	30-40	0.28	2.84E-09	4.05E-12	1.27E-08	5.44E-12
	40-50	0.36	2.13E-09	2.90E-12	9.44E-09	3.32E-12
	Total		4.61E-09	1.27E-11	2.37E-08	1.95E-11
E	1-5	0.01	9.06E-08	8.41E-10	4.82E-07	9.34E-10
	5-10	0.03	2.08E-08	7.60E-11	7.81E-08	1.14E-10
	10-20	0.12	7.33E-09	1.74E-11	2.39E-08	2.77E-11
	20-30	0.20	4.16E-09	7.87E-12	1.23E-08	1.05E-11
	30-40	0.28	2.85E-09	5.04E-12	8.17E-09	5.46E-12
	40-50	0.36	3.14E-09	3.55E-12	6.03E-09	3.34E-12
	Total		4.81E-09	1.70E-11	1.69E-08	2.09E-11

Table 1

Determination of Meteorological Parameters
for All Food Pathways (Grazing Season Values)

Direction	Distance	Sector Fraction	Stack		Vent	
			X/Q sec/m^3	Specific Deposition $1/m^2$	X/Q sec/m^3	Specific Deposition $1/m^2$
ESE	1-5	0.01	7.02E-08	7.08E-10	3.29E-07	9.35E-10
	5-10	0.03	2.32E-08	6.52E-11	6.20E-08	1.12E-10
	10-20	0.12	8.46E-09	1.53E-11	1.85E-08	2.44E-11
	20-30	0.20	4.86E-09	7.24E-12	9.36E-09	9.04E-12
	30-40	0.28	3.34E-09	4.74E-12	6.18E-09	4.62E-12
	40-50	0.36	2.52E-09	3.26E-12	4.53E-09	2.85E-12
	Total		5.23E-09	1.48E-11	1.26E-08	1.98E-11
SE	1-5	0.01	5.80E-08	1.02E-09	2.22E-07	1.16E-09
	5-10	0.03	2.51E-08	9.74E-11	6.53E-08	1.55E-10
	10-20	0.12	8.93E-09	2.21E-11	1.96E-08	3.64E-11
	20-30	0.20	5.10E-09	9.93E-12	1.00E-08	1.38E-11
	30-40	0.28	3.49E-09	6.35E-12	6.59E-09	7.21E-12
	40-50	0.36	2.62E-09	4.47E-12	4.83E-09	4.44E-12
	Total		5.43E-09	2.11E-11	1.21E-08	2.70E-11
SSE	1-5	0.01	5.06E-08	1.20E-09	1.70E-07	1.24E-09
	5-10	0.03	2.76E-08	1.20E-10	6.29E-08	1.63E-10
	10-20	0.12	1.00E-08	2.71E-11	1.91E-08	3.84E-11
	20-30	0.20	5.83E-09	1.21E-11	9.79E-09	1.46E-11
	30-40	0.28	4.02E-09	7.64E-12	6.46E-09	7.65E-12
	40-50	0.36	3.03E-09	5.38E-12	4.73E-09	4.71E-12
	Total		5.92E-09	2.53E-11	1.13E-08	2.87E-11
S	1-5	0.01	3.78E-08	7.34E-10	1.46E-07	7.68E-10
	5-10	0.03	1.94E-08	7.67E-11	5.84E-08	1.11E-10
	10-20	0.12	7.14E-09	1.72E-11	1.81E-08	2.98E-11
	20-30	0.20	4.19E-09	7.40E-12	9.42E-09	1.16E-11
	30-40	0.28	2.90E-09	4.50E-12	6.25E-09	6.26E-12
	40-50	0.36	2.19E-09	3.19E-12	4.59E-09	3.82E-12
	Total		4.26E-09	1.56E-11	1.07E-08	2.00E-11
SSW	1-5	0.01	3.58E-08	4.89E-10	2.01E-07	6.57E-10
	5-10	0.03	2.15E-08	5.24E-11	1.42E-07	1.43E-10
	10-20	0.02	7.30E-09	1.17E-11	4.27E-08	3.46E-11
	20-30	0.20	4.03E-09	5.40E-12	2.17E-08	1.30E-11
	30-40	0.28	2.73E-09	3.65E-12	1.44E-08	6.68E-12
	40-50	0.36	2.03E-09	2.63E-12	1.06E-08	4.07E-12
	Total		4.18E-09	1.09E-11	2.36E-08	2.09E-11

Table 1

Determination of Meteorological Parameters
for All Food Pathways (Grazing Season Values)

Direction	Distance	Sector Fraction	Stack		Vent	
			X/Q sec/m^3	Specific Deposition 1/m^2	X/Q sec/m^3	Specific Deposition 1/m^2
SW	1-5	0.01	4.14E-08	4.79E-10	2.82E-07	7.20E-10
	5-10	0.03	2.07E-08	5.12E-11	2.49E-07	1.70E-10
	10-20	0.12	7.11E-09	1.09E-11	7.80E-08	4.52E-11
	20-30	0.20	3.97E-09	4.65E-12	4.05E-08	1.71E-11
	30-40	0.25	2.69E-09	3.02E-12	2.71E-08	8.85E-12
	40-50	0.36	2.00E-09	2.18E-12	2.01E-08	5.32E-12
	Total		4.16E-09	1.02E-11	4.26E-08	2.55E-11
WSW	1-5	0.01	4.24E-08	4.53E-10	2.14E-07	6.62E-10
	5-10	0.03	2.09E-08	4.81E-11	3.29E-07	1.45E-10
	10-20	0.12	7.01E-09	1.06E-11	1.05E-07	3.70E-11
	20-30	0.20	3.85E-09	4.81E-12	5.46E-08	1.39E-11
	30-40	0.28	2.60E-09	3.24E-12	3.67E-08	7.19E-12
	40-50	0.36	1.92E-09	2.31E-12	2.74E-08	4.34E-12
	Total		4.08E-09	9.96E-12	5.57E-08	2.18E-11
W	1-5	0.01	4.53E-08	5.57E-10	3.28E-07	7.53E-10
	5-10	0.03	1.48E-08	5.68E-11	2.23E-07	1.53E-10
	10-20	0.12	4.78E-09	1.22E-11	7.23E-08	4.18E-11
	20-30	0.20	2.58E-09	5.17E-12	3.83E-08	1.59E-11
	30-40	0.28	1.72E-09	3.26E-12	2.57E-08	8.33E-12
	40-50	0.36	1.26E-09	2.31E-12	1.92E-08	5.00E-12
	Total		2.92E-09	1.15E-11	4.04E-08	2.44E-11
WNW	1-5	0.01	8.78E-08	8.46E-10	5.93E-07	1.06E-09
	5-10	0.03	3.00E-08	1.23E-10	2.29E-07	1.82E-10
	10-20	0.12	9.51E-09	3.62E-11	6.78E-08	3.84E-11
	20-30	0.20	5.02E-09	1.49E-11	3.40E-08	1.42E-11
	30-40	0.28	3.34E-09	8.37E-12	2.25E-08	7.18E-12
	40-50	0.36	2.45E-09	5.12E-12	1.65E-08	4.45E-12
	Total		5.74E-09	2.37E-11	4.00E-08	2.71E-11
NW	1-5	0.01	1.28E-07	1.11E-09	9.40E-07	1.15E-09
	5-10	0.03	3.93E-08	1.70E-10	2.54E-07	2.30E-10
	10-20	0.12	1.23E-08	5.17E-11	7.45E-08	4.84E-11
	20-30	0.20	6.46E-09	2.16E-11	3.73E-08	1.78E-11
	30-40	0.28	4.28E-09	1.23E-11	2.46E-08	9.05E-12
	40-50	0.36	3.14E-09	7.50E-12	1.80E-08	5.60E-12
	Total		7.56E-09	3.29E-11	4.68E-08	3.23E-11
NNW	1-5	0.01	1.31E-07	1.17E-09	1.07E-06	1.48E-09
	5-10	0.03	5.72E-08	2.44E-10	3.49E-07	3.37E-10
	10-20	0.12	1.78E-08	7.64E-11	1.02E-07	6.95E-11
	20-30	0.20	9.25E-09	3.01E-11	5.10E-08	2.55E-11
	30-40	0.28	6.14E-09	1.62E-11	3.36E-08	1.30E-11
	40-50	0.36	4.52E-09	9.75E-12	2.47E-08	8.04E-12
	Total		1.04E-08	4.23E-11	6.19E-08	4.49E-11
Overall Total			5.94E-09	2.28E-11	3.43E-08	2.90E-11

Table 2

Relative Production Rate Outside 20 miles	Relative Production Rate Total	Relative Production Rate Times Dispersion Factor				Ratio			
		Stack X/Q	Stack δ	Vent X/Q	Vent δ	Stack X/Q	Stack δ	Vent X/Q	Vent δ
1.	1.	5.94E-9	2.28E-11	3.43E-8	2.90E-11	1.00	1.00	1.00	1.00
1.5	1.42	7.49E-9	2.62E-11	4.27E-8	3.27E-11	1.26	1.15	1.24	1.13
2.	1.84	9.03E-9	2.95E-11	5.11E-8	3.64E-11	1.52	1.29	1.49	1.26
3.	2.68	1.21E-8	3.62E-11	6.79E-8	4.38E-11	2.04	1.59	1.98	1.51
5.	4.36	1.83E-8	4.95E-11	1.02E-7	5.86E-11	3.08	2.17	2.97	2.02
10.	8.56	3.38E-8	8.29E-11	1.86E-7	9.57E-11	5.69	3.64	5.42	3.30

Table 3

Relative Production Rate Outside 20 miles	Crop and Meat Dose (man-rem)	Total 1980 Population Dose (man-rem)	Increase in Population Dose over Uniform Crop Distribution (%)
1	47.9	88.6	3
1.5	54.6	95.3	8
2	61.3	102.0	15
3	73.7	114.4	29
5	100.0	140.7	59
10	165.1	205.8	132

Table 4

Cost-Benefit Ratios for Alternate Cases

Case	Purpose	Annual Δ Doses from Base man-rem	Annual Δ Doses from Prev Case man-rem	Annual Δ Costs from Base dollars	Annual Δ Costs from Prev Case dollars	Cost-Benefit Ratios from Base $/man-rem	Cost-Benefit Ratios from Prev Case $/man-rem
	Gland Seal						
D-1	Double holdup time	1.65E-02	-	>5,000	-	>3.0E+05	-
D-2	Add HEPA & charcoal	2.35E 00	-	14,600	-	6.2E+03	-
	SJAE						
E-1	Operate at 0 F dewpont	2.96E 00	-	155,300	-	5.2E+04	-
E-2	Add 2 more beds	1.20E 00	-	45,800	-	3.8E+04	-
E-3	Remove 2 beds	-1.46E 00[a]	-	-45,800[b]	-	3.1E+04	-
	Drywell						
F-2	Remove charcoal	-2.39E+01	-	-9,300	-	3.9E+02	-
F-3	Remove HEPA & charcoal	-2.45E+01	6.00E-01	-18,100	-8,800	7.4E+02	1.5E+04
	Turbine Bldg						
G-1	Add HEPA	1.04E-01	-	59,400	-	5.7E+05	-
G-2	Add HEPA & charcoal	2.69E+01	2.68E+01	120,700	61,300	4.5E+03	2.2E+03
G-3	Add clean steam	2.65E+01	-	>150,000	-	>5.7E+03	-
	Auxiliary Bldg						
H-1	Add HEPA	6.25E-01	-	76,200	-	1.2E+05	-
H-3	Add HEPA & charcoal	2.45E+01	2.39E+01	153,100	76,900	6.2E+03	3.2E+03
	Radwaste Bldg						
I-1	Add charcoal	7.02E 00	-	18,100	-	2.6E+03	-
I-2	Remove HEPA	-3.44E 00	-	-17,300	-	5.0E+03	-

a Negative dose changes are increases in dose

b Negative costs are decreases in costs

3. Provide information on grazing season (give dates), feeding regimes for cattle (such as grazing practices, green chop-feeding, corn and grass sileage feeding and hay feeding), pasture grass density (Kg/m^2) and yield statistics (Kg/m^2) for harvested forage crops for beef and dairy cattle feeding.

The following information is provided on the grazing season and feeding regimes for cattle. Because there is considerable variability in the production of forages and the feeding and grazing programs for cattle, the data must be considered as estimates for average conditions:

Calendar Dates for Grazing Season and Feeding Pattern

Forage	Range	Intensive Period	Portion of Yr
Grass pastures	Apr. 20-Dec. 1	May 15- Nov. 1	42-50%
Alfalfa	Apr. 15-May 10	Apr. 30 - May 10	42-50%
Alfalfa	Oct. 20-Dec. 1	November	12.5%
Red Clover	Apr. 15-May 10	May 1-Oct. 1	25-42%
Corn stalks	Oct. 1-Apr. 1	Oct. 1-Jan. 1	25-33%
Green Chop	May 1-Oct. 1	May 20-Sept. 20	33%
Silage	All year feeding practice by some	Dec. 15-May 15	42%
Hay	All year feeding practice by some	Dec. 15-May 15	42%

3. Continued

Pasture Grass Density. This is difficult to assess since the density varies throughout the year, and the pasture grass is not normally harvested and stored. However, using the values which are common to hay harvesting, which should add some conservatisms, it is estimated that the pasture grass density is 0.4 kg/m^2 of dry matter.

Annual Yield of Forage Crops. This yield is based upon the average harvest which is estimated as 1.2 kg/m^2 of dry matter.

APPENDIX A

SOURCE TERMS BY RADIONUCLIDE

DUANE ARNOLD
BASE CASE

NUCLIDE	COOLANT CONC. %MICROCURIES/G¤	GASEOUS RELEASE RATE %CURIES PER YEAR¤ CONTAINMENT BLDG.	TURBINE BLDG.	AUXILIARY BLDG.	RADWASTE BLDG.	GLAND SEAL	AIR EJECTOR	MECH VAC PUMP	TOTAL
KR-83M	1.100E-03	0.0	0.0	0.0	0.0	2.5E 01	2.4E 01	0.0	4.9E 01
KR-85M	1.900E-03	3.0E 00	6.8E 01	3.0E 00	0.0	4.3E 01	2.3E 03	0.0	2.4E 03
KR--85	6.000E-06	0.0	0.0	0.0	0.0	0.0	1.4E 02	0.0	1.4E 02
KR--87	6.600E-03	3.0E 00	1.3E 02	3.0E 00	0.0	1.5E 02	6.0E 00	0.0	2.9E 02
KR--88	6.600E-03	3.0E 00	2.3E 02	3.0E 00	0.0	1.5E 02	1.5E 03	0.0	1.9E 03
KR--89	4.100E-02	0.0	0.0	0.0	0.0	6.4E 02	0.0	0.0	6.4E 02
XE131M	4.700E-06	0.0	0.0	0.0	0.0	0.0	4.8E 01	0.0	4.8E 01
XE133M	9.000E-05	0.0	0.0	0.0	0.0	2.0E 00	3.3E 01	0.0	3.5E 01
XE-133	2.600E-03	6.6E 01	2.5E 02	6.6E 01	1.0E 01	5.9E 01	1.0E 04	2.3E 03	1.3E 04
XE135M	8.400E-04	4.6E 01	6.5E 02	4.6E 01	0.0	1.8E 01	0.0	0.0	7.6E 02
XE-135	7.200E-03	3.4E 01	6.3E 02	3.4E 01	4.5E 01	1.6E 02	0.0	3.5E 02	1.3E 03
XE-137	4.700E-02	0.0	0.0	0.0	0.0	7.8E 02	0.0	0.0	7.8E 02
XE-138	2.800E-02	7.0E 00	1.4E 03	7.0E 00	0.0	5.9E 02	0.0	0.0	2.0E 03
TOTAL NOBLE GASES									2.3E 04
I--131	4.912E-03	1.7E-02	1.9E-01	1.7E-01	5.0E-02	2.2E-02	0.0	3.0E-02	4.8E-01
I--133	1.936E-02	6.8E-02	7.6E-01	6.8E-01	1.8E-01	8.8E-02	0.0	0.0	1.8E 00
C---14		0.0	0.0	0.0	0.0	0.0	9.5E 00	0.0	9.5E 00
AR--41		2.5E 01	0.0	0.0	0.0	0.0	0.0	0.0	2.5E 01
H----3		0.0	1.1E 01	0.0	0.0	0.0	1.1E 01	0.0	2.1E 01

0.0 APPEARING IN THE TABLE INDICATES RELEASE IS LESS THAN 1.0 CI/YR FOR NOBLE GAS, 0.0001 CI/YR FOR I

DUANE ARNOLD
BASE CASE

AIRBORNE PARTICULATE RELEASE RATE
%CURIES PER YEAR%

NUCLIDE	CONTAINMENT BLDG.	TURBINE BLDG.	AUXILIARY BLDG.	RADWASTE BLDG.	MECH VAC. PUMP	TOTAL
CR--51	3.0E-06	1.3E-02	3.0E-04	9.0E-05	0.0	1.3E-02
MN--54	3.0E-05	6.0E-04	3.0E-03	3.0E-04	0.0	3.9E-03
FE--59	4.0E-06	5.0E-04	4.0E-04	1.5E-04	0.0	1.1E-03
CO--58	6.0E-06	6.0E-04	6.0E-04	4.5E-05	0.0	1.3E-03
CO--60	1.0E-04	2.0E-03	1.0E-02	9.0E-04	0.0	1.3E-02
ZN--65	2.0E-05	2.0E-04	2.0E-03	1.5E-05	0.0	2.2E-03
SR--89	9.0E-07	6.0E-03	9.0E-05	4.5E-06	0.0	6.1E-03
SR--90	5.0E-08	2.0E-05	5.0E-06	3.0E-06	0.0	2.8E-05
ZR--95	4.0E-06	1.0E-04	4.0E-04	5.0E-07	0.0	5.0E-04
SB-124	2.0E-06	3.0E-04	2.0E-04	5.0E-07	0.0	5.0E-04
CS-134	4.0E-05	3.0E-04	4.0E-03	4.5E-05	3.0E-06	4.4E-03
CS-136	3.0E-06	5.0E-05	3.0E-04	4.5E-06	2.0E-06	3.6E-04
CS-137	5.5E-05	6.0E-04	5.5E-03	9.0E-05	1.0E-05	6.3E-03
BA-140	4.0E-06	1.1E-02	4.0E-04	1.0E-06	1.1E-05	1.1E-02
CE-141	1.0E-06	6.0E-04	1.0E-04	2.6E-05	0.0	7.3E-04

DUANE ARNOLD LIQUID EFFLUENTS
BASE CASE

NUCLIDE	HALF-LIFE %DAYS¤	CONCENTRATION IN PRIMARY COOLANT %MICRO CI/ML¤	ANNUAL RELEASES TO DISCHARGE CANAL HIGH PURITY %CURIES¤	LOW PURITY %CURIES¤	CHEMICAL %CURIES¤	TOTAL LWS %CURIES¤	ADJUSTED TOTAL %CI/YR¤	DETERGENT WASTES %CI/YR¤	TOTAL %CI/YR¤
CORROSION AND ACTIVATION PRODUCTS									
NA 24	6.25E-01	7.65E-03	0.00335	0.00541	0.00000	0.00876	0.01527	0.0	0.01500
P 32	1.43E 01	1.83E-04	0.00009	0.00018	0.00000	0.00027	0.00047	0.0	0.00047
CR 51	2.78E 01	4.58E-03	0.00220	0.00464	0.00001	0.00685	0.01194	0.0	0.01200
MN 54	3.03E 02	5.50E-05	0.00003	0.00006	0.00000	0.00008	0.00014	0.0	0.00014
MN 56	1.07E-01	3.86E-02	0.00955	0.00713	0.00000	0.01668	0.02907	0.0	0.02900
FE 55	9.50E 02	9.16E-04	0.00044	0.00094	0.00000	0.00138	0.00241	0.0	0.00240
FE 59	4.50E 01	2.75E-05	0.00001	0.00003	0.00000	0.00004	0.00007	0.0	0.00007
CO 58	7.13E 01	1.83E-04	0.00009	0.00019	0.00000	0.00028	0.00048	0.0	0.00048
CO 60	1.92E 03	3.67E-04	0.00018	0.00038	0.00000	0.00055	0.00096	0.0	0.00096
NI 65	1.07E-01	2.31E-04	0.00006	0.00004	0.00000	0.00010	0.00017	0.0	0.00017
CU 64	5.35E-01	2.60E-02	0.01087	0.01680	0.00001	0.02767	0.04823	0.0	0.04800
ZN 65	2.45E 02	1.83E-04	0.00009	0.00019	0.00000	0.00028	0.00048	0.0	0.00048
ZN 69M	5.75E-01	1.74E-03	0.00073	0.00116	0.00000	0.00189	0.00330	0.0	0.00330
ZN 69	3.96E-02	0.0	0.00061	0.00119	0.00000	0.00180	0.00314	0.0	0.00310
W187	9.56E-01	2.66E-04	0.00012	0.00021	0.00000	0.00033	0.00058	0.0	0.00058
NP239	2.35E 00	6.32E-03	0.00295	0.00580	0.00001	0.00875	0.01525	0.0	0.01500
FISSION PRODUCTS									
BR 83	1.00E-01	2.64E-03	0.00063	0.00045	0.00000	0.00108	0.00188	0.0	0.00190
BR 84	2.21E-02	3.78E-03	0.00014	0.00007	0.00000	0.00021	0.00036	0.0	0.00036
RB 89	1.07E-02	3.27E-03	0.00022	0.00053	0.00000	0.00075	0.00130	0.0	0.00130
SR 89	5.20E 01	4.16E-05	0.00004	0.00009	0.00000	0.00014	0.00024	0.0	0.00024
SR 90	1.03E 04	5.50E-06	0.00000	0.00001	0.00000	0.00001	0.00001	0.0	0.00001
SR 91	4.03E-01	3.41E-03	0.00136	0.00193	0.00000	0.00329	0.00574	0.0	0.00570
Y 91M	3.47E-02	0.0	0.00071	0.00118	0.00000	0.00189	0.00329	0.0	0.00330
Y 91	5.88E 01	3.66E-05	0.00002	0.00005	0.00000	0.00007	0.00012	0.0	0.00012
SR 92	1.13E-01	2.75E-03	0.00198	0.00151	0.00000	0.00349	0.00609	0.0	0.00610
Y 92	1.47E-01	4.76E-03	0.00238	0.00287	0.00000	0.00526	0.00916	0.0	0.00920
Y 93	4.25E-01	3.42E-03	0.00138	0.00199	0.00000	0.00337	0.00588	0.0	0.00590
ZR 95	6.50E 01	6.41E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
NB 95	3.50E 01	6.41E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
NB 98	3.54E-02	2.82E-03	0.00023	0.00012	0.00000	0.00035	0.00061	0.0	0.00061
MO 99	2.79E 00	1.81E-03	0.00085	0.00169	0.00000	0.00254	0.00443	0.0	0.00440
TC 99M	2.50E-01	1.65E-02	0.00611	0.00777	0.00000	0.01389	0.02421	0.0	0.02400
TC101	9.72E-03	5.96E-02	0.00030	0.00014	0.00000	0.00044	0.00077	0.0	0.00077
RU103	3.96E 01	1.83E-05	0.00001	0.00002	0.00000	0.00003	0.00005	0.0	0.00005
RH103M	3.96E-02	0.0	0.00001	0.00002	0.00000	0.00003	0.00004	0.0	0.00004
TC104	1.25E-02	5.34E-02	0.00055	0.00027	0.00000	0.00082	0.00142	0.0	0.00140
RU105	1.85E-01	1.62E-03	0.00052	0.00052	0.00000	0.00105	0.00182	0.0	0.00180
RH105M	5.21E-04	0.0	0.00052	0.00052	0.00000	0.00105	0.00183	0.0	0.00180
RH105	1.50E 00	0.0	0.00003	0.00012	0.00000	0.00015	0.00027	0.0	0.00027
TE129M	3.40E 01	3.66E-05	0.00002	0.00004	0.00000	0.00005	0.00010	0.0	0.00010
TE129	4.79E-02	0.0	0.00001	0.00002	0.00000	0.00003	0.00006	0.0	0.00006
TE131M	1.25E 00	8.52E-05	0.00004	0.00007	0.00000	0.00011	0.00020	0.0	0.00020
TE131	1.74E-02	0.0	0.00001	0.00001	0.00000	0.00002	0.00004	0.0	0.00004
I131	8.05E 00	4.91E-03	0.00234	0.00487	0.00007	0.00729	0.01270	0.0	0.01300
TE132	3.25E 00	9.07E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
I132	9.58E-02	2.63E-02	0.00605	0.00426	0.00000	0.01031	0.01797	0.0	0.01800
I133	8.75E-01	1.94E-02	0.00855	0.01486	0.00008	0.02350	0.04096	0.0	0.04100
I134	3.67E-02	5.55E-02	0.00480	0.00245	0.00000	0.00725	0.01264	0.0	0.01300
CS134	7.49E 02	2.75E-05	0.00013	0.00141	0.00000	0.00154	0.00268	0.0	0.00270

DUANE ARNOLD
BASE CASE

LIQUID EFFLUENTS %CONTINUED□

NUCLIDE	HALF-LIFE %DAYS□	CONCENTRATION IN PRIMARY COOLANT %MICRO CI/ML□	ANNUAL RELEASES TO DISCHARGE CANAL HIGH PURITY %CURIES□	LOW PURITY %CURIES□	CHEMICAL %CURIES□	TOTAL LWS %CURIES□	ADJUSTED TOTAL %CI/YR□	DETERGENT WASTES %CI/YR□	TOTAL %CI/YR□
I135	2.74E-01	1.88E-02	0.00692	0.00846	0.00001	0.01539	0.02682	0.0	0.02700
CS136	1.30E 01	1.82E-05	0.00009	0.00092	0.00000	0.00100	0.00175	0.0	0.00170
CS137	1.10E 04	6.42E-05	0.00031	0.00329	0.00000	0.00359	0.00626	0.0	0.00630
BA137M	1.77E-03	0.0	0.00029	0.00307	0.00000	0.00336	0.00586	0.0	0.00590
CS138	2.24E-02	6.67E-03	0.00254	0.00621	0.00000	0.00875	0.01525	0.0	0.01500
BA139	5.76E-02	7.30E-03	0.00109	0.00062	0.00000	0.00171	0.00297	0.0	0.00300
BA140	1.28E 01	3.66E-04	0.00018	0.00037	0.00000	0.00054	0.00095	0.0	0.00095
LA140	1.67E 00	0.0	0.00001	0.00005	0.00000	0.00006	0.00011	0.0	0.00011
BA141	1.25E-02	6.67E-03	0.00007	0.00003	0.00000	0.00010	0.00018	0.0	0.00018
LA141	1.62E-01	0.0	0.00018	0.00016	0.00000	0.00034	0.00059	0.0	0.00059
CE141	3.24E 01	2.75E-05	0.00001	0.00003	0.00000	0.00004	0.00008	0.0	0.00008
BA142	7.64E-03	3.95E-03	0.00001	0.00000	0.0	0.00001	0.00002	0.0	0.00002
LA142	6.39E-02	3.68E-03	0.00070	0.00041	0.00000	0.00111	0.00193	0.0	0.00190
CE143	1.36E 00	2.68E-05	0.00001	0.00002	0.00000	0.00004	0.00006	0.0	0.00006
PR143	1.37E 01	5.66E-05	0.00002	0.00004	0.00000	0.00005	0.00010	0.0	0.00010
ALL OTHERS		1.98E-03	0.00001	0.00003	0.00000	0.00004	0.00007	0.0	0.00007
TOTAL %EXCEPT TRITIUM□		4.08E-01	0.08374	0.11794	0.00020	0.20188	0.35189	0.0	0.35000

TRITIUM RELEASE 20 CURIES PER YEAR

DUANE ARNOLD
COMPLIANCE BASE CASE B

LIQUID EFFLUENTS

NUCLIDE	HALF-LIFE %DAYS¤	CONCENTRATION IN PRIMARY COOLANT %MICRO CI/ML¤	ANNUAL RELEASES TO DISCHARGE CANAL HIGH PURITY %CURIES¤	LOW PURITY %CURIES¤	CHEMICAL %CURIES¤	TOTAL LWS %CURIES¤	ADJUSTED TOTAL %CI/YR¤	DETERGENT WASTES %CI/YR¤	TOTAL %CI/YR¤
CORROSION AND ACTIVATION PRODUCTS									
NA 24	6.25E-01	7.85E-03	0.00335	0.00541	0.00021	0.00897	0.01544	0.0	0.01500
P 33	1.43E 01	1.83E-04	0.00009	0.00018	0.00003	0.00030	0.00051	0.0	0.00051
CR 51	2.78E 01	4.58E-03	0.00220	0.00464	0.00072	0.00756	0.01302	0.0	0.01300
MN 54	3.03E 02	5.50E-05	0.00003	0.00006	0.00001	0.00009	0.00016	0.0	0.00016
MN 56	1.07E-01	3.86E-02	0.00955	0.00713	0.00001	0.01669	0.02873	0.0	0.02900
FE 55	9.50E 02	9.16E-04	0.00044	0.00094	0.00015	0.00153	0.00264	0.0	0.00260
FE 59	4.50E 01	2.75E-05	0.00001	0.00003	0.00000	0.00005	0.00008	0.0	0.00008
CO 58	7.13E 01	1.83E-04	0.00009	0.00019	0.00003	0.00030	0.00052	0.0	0.00052
CO 60	1.92E 03	3.67E-04	0.00018	0.00038	0.00006	0.00061	0.00105	0.0	0.00110
NI 65	1.07E-01	2.31E-04	0.00006	0.00004	0.00000	0.00010	0.00017	0.0	0.00017
CU 64	5.33E-01	2.60E-02	0.01087	0.01680	0.00055	0.02821	0.04856	0.0	0.04900
ZN 65	2.45E 02	1.83E-04	0.00009	0.00019	0.00003	0.00031	0.00053	0.0	0.00053
ZN 69M	5.75E-01	1.74E-03	0.00073	0.00116	0.00004	0.00193	0.00333	0.0	0.00330
ZN 69	3.46E-02	0.0	0.00061	0.00119	0.00004	0.00185	0.00318	0.0	0.00320
W187	9.96E-01	2.66E-04	0.00012	0.00021	0.00001	0.00034	0.00059	0.0	0.00059
NP239	2.35E 00	1.32E-03	0.00295	0.00580	0.00061	0.00935	0.01610	0.0	0.01600
FISSION PRODUCTS									
BR 83	1.00E-01	2.64E-03	0.00063	0.00045	0.00000	0.00108	0.00186	0.0	0.00190
BR 84	2.21E-02	3.72E-03	0.00014	0.00007	0.00000	0.00021	0.00036	0.0	0.00036
RB 89	1.07E-02	3.27E-03	0.00022	0.00053	0.00000	0.00075	0.00128	0.0	0.00130
SR 89	5.20E 01	9.16E-05	0.00004	0.00009	0.00001	0.00015	0.00027	0.0	0.00027
SR 90	1.03E 04	5.50E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
SR 91	4.03E-01	3.41E-03	0.00136	0.00193	0.00004	0.00334	0.00574	0.0	0.00570
Y 91M	3.47E-02	0.0	0.00071	0.00118	0.00003	0.00192	0.00330	0.0	0.00330
Y 91	5.88E 01	3.66E-05	0.00002	0.00005	0.00001	0.00008	0.00013	0.0	0.00013
SR 92	1.13E-01	2.75E-03	0.00198	0.00151	0.00000	0.00349	0.00601	0.0	0.00600
Y 92	1.47E-01	4.76E-03	0.00238	0.00287	0.00002	0.00527	0.00908	0.0	0.00910
Y 93	4.25E-01	3.42E-03	0.00138	0.00199	0.00005	0.00342	0.00589	0.0	0.00590
ZR 95	6.50E 01	6.41E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
NB 95	3.50E 01	6.41E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
NB 98	3.54E-02	2.82E-03	0.00023	0.00012	0.00000	0.00035	0.00060	0.0	0.00060
MO 99	2.79E 00	1.81E-03	0.00085	0.00169	0.00019	0.00273	0.00469	0.0	0.00470
TC 99M	2.50E-01	1.65E-02	0.00611	0.00777	0.00025	0.01413	0.02433	0.0	0.02400
TC101	9.72E-03	5.96E-02	0.00030	0.00014	0.00000	0.00044	0.00076	0.0	0.00076
RU103	3.96E 01	1.83E-05	0.00001	0.00002	0.00000	0.00003	0.00005	0.0	0.00005
RH103M	3.96E-02	0.0	0.00001	0.00002	0.00000	0.00003	0.00005	0.0	0.00005
TC104	1.25E-03	5.34E-02	0.00055	0.00027	0.00000	0.00082	0.00140	0.0	0.00140
RU105	1.85E-01	1.62E-03	0.00052	0.00052	0.00000	0.00105	0.00181	0.0	0.00180
RH105M	5.21E-04	0.0	0.00052	0.00052	0.00000	0.00105	0.00181	0.0	0.00180
RH105	1.50E 00	0.0	0.00003	0.00012	0.00002	0.00017	0.00029	0.0	0.00029
TE129M	3.40E 01	3.66E-05	0.00002	0.00004	0.00001	0.00006	0.00010	0.0	0.00010
TE129	4.79E-02	0.0	0.00001	0.00002	0.00000	0.00004	0.00006	0.0	0.00006
TE131M	1.25E 00	8.92E-05	0.00004	0.00007	0.00001	0.00012	0.00021	0.0	0.00021
TE131	1.74E-02	0.0	0.00001	0.00001	0.00000	0.00002	0.00004	0.0	0.00004
I131	8.05E 00	4.91E-03	0.00234	0.00487	0.00069	0.00791	0.01361	0.0	0.01400
TE132	3.25E 00	9.07E-06	0.00000	0.00001	0.00000	0.00001	0.00002	0.0	0.00002
I132	9.58E-02	2.63E-02	0.00605	0.00426	0.00000	0.01032	0.01776	0.0	0.01800
I133	8.75E-01	1.94E-02	0.00855	0.01486	0.00082	0.02424	0.04172	0.0	0.04200
I134	3.67E-02	5.59E-02	0.00480	0.00245	0.00000	0.00725	0.01249	0.0	0.01200
CS134	7.49E 02	2.75E-05	0.00013	0.00141	0.00023	0.00177	0.00304	0.0	0.00300

DUANE ARNOLD LIQUID EFFLUENTS %CONTINUED%
COMPLIANCE BASE CASE B

NUCLIDE	HALF-LIFE %DAYS%	CONCENTRATION IN PRIMARY COOLANT %MICRO CI/ML%	ANNUAL RELEASES TO DISCHARGE CANAL: HIGH PURITY %CURIES%	LOW PURITY %CURIES%	CHEMICAL %CURIES%	TOTAL LWS %CURIES%	ADJUSTED TOTAL %CI/YR%	DETERGENT WASTES %CI/YR%	TOTAL %CI/YR%
I135	2.79E-01	1.88E-02	0.00692	0.00846	0.00010	0.01548	0.02665	0.0	0.02700
CS136	1.30E 01	1.82E-05	0.00009	0.00092	0.00014	0.00114	0.00196	0.0	0.00200
CS137	1.10E 04	6.42E-05	0.00031	0.00329	0.00053	0.00413	0.00710	0.0	0.00710
BA137M	1.77E-03	0.0	0.00029	0.00307	0.00050	0.00386	0.00664	0.0	0.00660
CS138	2.24E-02	6.67E-03	0.00254	0.00621	0.00000	0.00875	0.01506	0.0	0.01500
BA139	5.76E-02	7.30E-03	0.00109	0.00062	0.00000	0.00171	0.00294	0.0	0.00290
BA140	1.28E 01	3.66E-04	0.00018	0.00037	0.00005	0.00060	0.00103	0.0	0.00100
LA140	1.67E 00	0.0	0.00001	0.00005	0.00003	0.00009	0.00016	0.0	0.00016
BA141	1.25E-02	6.67E-03	0.00007	0.00003	0.00000	0.00010	0.00018	0.0	0.00018
LA141	1.62E-01	0.0	0.00018	0.00016	0.00000	0.00034	0.00058	0.0	0.00058
CE141	3.24E 01	2.75E-05	0.00001	0.00003	0.00000	0.00005	0.00008	0.0	0.00008
BA142	7.64E-03	3.95E-03	0.00001	0.00000	0.0	0.00001	0.00002	0.0	0.00002
LA142	6.39E-02	3.68E-03	0.00070	0.00041	0.00000	0.00111	0.00191	0.0	0.00190
CE143	1.38E 00	2.68E-05	0.00001	0.00002	0.00000	0.00004	0.00006	0.0	0.00006
PR143	1.37E 01	3.66E-05	0.00002	0.00004	0.00001	0.00006	0.00010	0.0	0.00010
ALL OTHERS		1.98E-03	0.00001	0.00003	0.00000	0.00004	0.00007	0.0	0.00007
TOTAL %EXCEPT TRITIUM%		4.08E-01	0.08374	0.11794	0.00627	0.20796	0.35796	0.0	0.36000

TRITIUM RELEASE 20 CURIES PER YEAR

APPENDIX B

PIPING AND INSTRUMENTATION DRAWINGS

for

LIQUID RADWASTE

OVERSIZE DOCUMENT PAGE PULLED

SEE APERTURE CARDS

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 4

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