EXHIBIT A
MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263

LICENSE AMENDMENT REQUEST DATED JULY 1, 1975

PROPOSED CHANGES TO TECHNICAL SPECIFICATIONS
APPENDIX A, OF PROVISIONAL OPERATING
LICENSE DPR-22

Pursuant to 10CFR50.59, the holders of Provisional Operating License DPR-22 hereby propose the following changes to Appendix A, Technical Specifications:

1. SPECIFICATIONS 3/4.6.A AND 3/4.6.B, REACTOR VESSEL FRACTURE TOUGHNESS

PROPOSED CHANGE

Replace pages 115, 116, 122, 130, and 131 with the corresponding pages from Exhibit B. Insert new pages 116A, 122A, 122B, 122C, and 131A from Exhibit B.

REASON FOR CHANGE

The General Electric Company has performed a standard backfit analysis of the Monticello reactor vessel to determine proposed operating limits based on 10CFR50 Appendix G. The results of this analysis have been incorporated in revised Specifications 3/4.6.A and 3/4.6.B and Figures 3.6.1 through 3.6.4. When this revision is incorporated in the Monticello Technical Specifications, plant operating procedures and surveillance will conform to 10CFR50 Appendix G and Appendix H.

2. PROPOSED SPECIFICATION 3/4.11, SEALED SOURCE CONTAMINATION

PROPOSED CHANGE

Add new Specification 3/4.11, "Sealed Source Contamination," as contained in the Exhibit B pages 189B, 189C, 189D, and 189E.

REASON FOR CHANGE

This proposed change is being submitted at the request of the Regulatory Staff. It provides for the leakage testing, inventory, storage, and disposal of sealed radioactive sources.

3. SPECIFICATION 3.2.D, AIR EJECTOR OFF-GAS SYSTEM

PROPOSED CHANGE

a. Revise Specification 3.2.D.1 to read:

> 1. Except as specified in 3.2.D.2 and 3.2.D.3, both steam jet air ejector monitors shall be operable during reactor power operation. the trip settings for the air ejector monitors, except as specified in 3.2.D.4, shall be set to close the recombiner train inlet valve(s) within 30 minutes at a radiation level not to exceed the equivalent of the maximum permitted stack release rate after a decay time of 120 minutes.

b. Revise Specification 3.2.D.4 to read:

> 4. If operation is necessary with the Off-Gas Holdup System recombiners bypassed, the trip settings for the air ejector monitors shall be reset to close the stack off-gas isolation valve within 15 minutes at a radiation level not to exceed the equivalent of the maximum permitted stack release rate after a decay time of 30 minutes.

REASON FOR CHANGE

The Technical Specifications now require the air ejector monitor trip setting to be less than the equivalent of the maximum permitted stack release rate based on a 30-minute decay period. The trip settings are now the same for all modes of operation of the Off-Gas System.

There are three principal modes in which the Off-Gas System may function, depending on the operability of various components in the system. They are:

Mode	Estimated Holdup Time
1 - Compressed Storage	50 - 250 hours
2 - Recombiners Only	2 - 10 hours
3 - Original Off-Gas System	0.5 - 1 hour

3. SPECIFICATION 3.2.D, AIR EJECTOR OFF-GAS SYSTEM

REASON FOR CHANGE (continued)

The proposed changes would permit the air ejector monitor trip setting to be raised whenever the recombiners are in operation to a setting based on the equivalent of the maximum permitted stack release rate with a decay period of 120 minutes. 120 minutes corresponds to the minimum expected Off-Gas System holdup time with the recombiners in operation.

With the recombiners inoperable and bypassed (Mode 3), the air ejector monitor trip settings would revert to the currently specified value. Shifting from Modes 1 or 2 to Mode 3 requires a plant shutdown at which time the necessary trip setting changes would be made.

The current Specification, to be placed in effect when the modifications to the Off-Gas System are completed and fully operational, is overly restrictive and can lead to an unnecessary power reduction. Because of the higher than average rate of fuel clad defects at Monticello, the proportion of short-lived radionuclides in the off-gas stream is higher than normal. This shift in the distribution of the mixture of nuclides in the off-gas stream has only a slight effect on the stack release rate. The effect of the large fraction of short-lived nuclides at the air ejector monitors, however, is to greatly increase the measured radiation levels.

4. SPECIFICATION 3.8.A.3, MAXIMUM PERMITTED I-131 RELEASE RATE AND BASES

PROPOSED CHANGE

a. Change this Specification to read:

   3. The maximum release rate of radioiodine 131 (I-131) shall not exceed a rate Q, in microcuries/sec:

$$\frac{Q_1}{40} + \frac{QRS}{2.7} \leq 1$$

b. Change the second paragraph of the 3/4.8.A Bases on page 177A to state the correct location of the critical pathway dairy farm as 3700 meters in the NNE sector (stack $X/Q = 2.5 \times 10^{-8}$ sec/m^3 and ground level $X/Q = 4.3 \times 10^{-7}$ sec/m^3). Refer to the attached Exhibit B page 177A.

REASON FOR CHANGE

Specification 3.8.A.3, to be placed into effect when the modifications to the Off-Gas System are completed and fully operational, is now based on the incorrect dairy farm location. Evaluation by NSP and the NRC Regulatory Staff has shown that the farm located 3700 meters from the site in the NNE sector constitutes the critical pathway.

4. SPECIFICATION 3.8.A.3, MAXIMUM PERMITTED I-131 RELEASE RATE AND BASES

REASON FOR CHANGE (continued)

The proposed equation is based on Regulalatory Guide 1.42 and atmospheric dispersion factors calculated by the NRC Regulatory Staff.

5. SPECIFICATION 3/4.8.E, AUGMENTED OFF-GAS SYSTEM AND BASES

PROPOSED CHANGE

a. Change Specification 3.8.E.2 to read:

   2. Except as specified in Specification 3.8.E.3 below, at least one hydrogen monitor downstream of each operating recombiner shall be operable during power operation.

b. Change Specification 3.8.E.3 to read:

   3. If the above specified downstream hydrogen monitors are not operable, offgas flow to the compressed storage subsystem shall be terminated.

c. Change Specification 4.8.E.2 to read:

   2. Condenser air inleakage shall be evaluated weekly and used in conjunction with the latest steam jet air ejector off-gas isotopic analysis and Figure 4.8.1 to determine that the limit of Specification 3.8.E.4 will not be exceeded.

d. Delete Specification 4.8.E.3.

e. Add new Figure 4.8.1, "Offgas Storage Tank Gross Activity Limits," as included on page 176A of Exhibit B.

f. Revise the 3/4.8.E Bases to reflect changes (a) through (e) above. Refer to pages 179A and 179B of Exhibit B.

REASON FOR CHANGE

Change (a) deletes the requirement for one operable hydrogen monitor upstream of each operating recombiner. Planned modifications to the recombiner inlet flow control loops will remove the upstream monitors.

5. SPECIFICATION 3/4.8.E, AUGMENTED OFF-GAS SYSTEM AND BASES

REASON FOR CHANGE (continued)

Following modification, the inlet flow control loop will be based on volumetric flow rate in lieu of hydrogen mass flow rate. Hydrogen concentration will be assumed as the maximum design value at all times. This modification eliminates the requirement for inlet hydrogen measurement, inventory processing, and mass flow computation.

The Off-gas System has been operating since startup in a mode which will be made permanent by the planned modification. Currently the inventory processors are programmed to assume a continuous hydrogen concentration equal to the design maximum in accordance with Specification 3.8.E.3. The effect of this mode of operation is to reduce the system flow capability significantly below the original design value, but not to the point of affecting normal plant operation.

Change (b) deletes the provision for allowing recombiner operation without an operable inlet hydrogen monitor. This provision will no longer be needed when the upstream monitors are removed. Change (b) is also revised to require only termination of flow to the compressed storage subsytem when the required downstream hydrogen monitor is not operable. This would permit recombiner operation without requiring a return to the original Off-Gas System in the event that no hydrogen monitor is operable. Other instrumentation would be used to verify satisfactory operation of the recombiners. All Off-Gas System components upstream of the compressed storage subsystem are designed to withstand a hydrogen detonation. The recombiner outlet hydrogen monitors serve to protect the compressed storage subsystem components from a detonation that could result from excessive concentrations of hydrogen. If the downstream hydrogen monitors are inoperable, it is necessary to stop offgas flow to the compressed storage subsystem.

Changes (c), (d), and (e) revise the method of complying with the maximum tank contents limit of 22,000 Curies dose equivalent Xe-133. During startup testing of the augmented Off-Gas System, it was found that the compressed storage tank radiation monitors do not perform their intended function.

The use of individual tank radiation monitors to measure gross radioactivity is not feasible for the following reasons:

a. Each individual monitor is exposed to "shine" from adjacent storage tanks.

b. Each monitor becomes saturated due to the buildup of radioactive particulates (primarily Rb-88 and Cs-138 with high energy gamma radiation) and does not respond to changes in the noble gas inventory of the tank.

5. SPECIFICATION 3/4.8.E, AUGMENTED OFF-GAS SYSTEM AND BASES

REASON FOR CHANGE (continued)

Experience has also shown that the installed tank sampling system cannot be used to draw a representative sample of the contents of a tank while it is being filled. This is currently required by the Technical Specifications in the event a tank monitor is inoperable. The location of the sample connections (in some cases on the tank fill lines) and stratification of gas have been found to be responsible.

Calculations have been performed to determine the relationship between air ejector off-gas activity and composition and consenser air inleakage. The results of these calculations are presented in Exhibit B Figure 4.8.1. A summary of the technique used in performing these calculations is included as Appendix A to Exhibit A.

It is proposed that compliance with the 22,000 Curie dose equivalent Xe-133 tank contents limit be demonstrated by monitoring total system air inleakage and the average air ejector noble gas release rate. Using Figure 4.8.1 and the results of the most recent determination of noble gas isotopic composition at the air ejector, the contents of a storage tank can be verified to be below the activity limit.

Only under conditions of a high "equilibrium" type off-gas isotopic distribution, low condenser air inleakage, and high off-gas release rate is there the potential for exceeding the 22,000 Ci limit. As demonstrated in Appendix A to this Exhibit, Figure 4.8.1 is conservative.

6. TABLE OF CONTENTS AND LIST OF FIGURES

PROPOSED CHANGE

Replace pages v and vi with the attached Exhibit B pages.

REASON FOR CHANGE

This change revises the Table of Contents and List of Figures to include the new Specification 3/4.11 and the new Figures 3.6-1 through 3.6-4 and 4.8.1.

APPENDIX A TO EXHIBIT A

LICENSE AMENDMENT REQUEST DATED JULY 1, 1975

NORTHERN STATES POWER COMPANY
NUCLEAR SUPPORT SERVICES DEPARTMENT

TECHNICAL REPORT

OFFGAS STORAGE TANK CONTENTS FOR VARIOUS OFFGAS MIXTURES AND AIR INLEAKAGES AT THE MONTICELLO NUCLEAR GENERATING PLANT

Date: March 13, 1975

Revised: June 5, 1975

1.0 Purpose

Change 12 to the Monticello Technical Specifications issued by the USAEC Directorate of Licensing on November 15, 1973 placed a limit on the radioactivity that could be contained in an offgas storage tank of 22,000 curies dose equivalent Xe-133. The basis for this limit was accidental release of the contents of a tank by an operator error 12 hours after completion of filling. The release was assumed to occur over an eight hour period due to the flow restricting nozzle in the discharge line. Under accident 100-meter meteorology conditions, a whole body dose of 20 mRem would result to an individual at the site boundary. This dose corresponds to the Unusual Event annual gamma dose level.

To provide assurance that the 22,000 curie limit would not be exceeded, it was believed that the tank radiation monitors could be calibrated in terms of gross gaseous activity. During startup testing, however, it was found that the presence of Ru-88 prevented the monitors from responding to gross gaseous activity changes.

It has been suggested that the tank radiation monitors may not be required. It should be possible to determine the maximum possible gross activity in a storage tank by measuring total air inleakage, steam jet air ejector off-gas activity, and steam jet air ejector offgas isotopic composition. To determine the relationship between these parameters and tank activity in terms of dose equivalent Xe-133, the Monticello offgas system was modeled and a computer program developed to perform the necessary calculations.

2.0 Results

Results of calculations of offgas storage tank content in terms of Xe-133 dose equivalent curies as a function of offgas isotopic distribution and total air inleakage are summarized in Tables 1 and 2.

Table	SJAE Monitor Trip Setting Holdup	Discharge Valve Interlock Delay
1	30 min (current TS)	12 hr
2	2 hr (proposed TS)	12 hr

Table 1 presents the results of the analysis for the current value of the steam jet air ejector monitor trip setting. Offgas is assumed to be released at the maximum permitted trip setting of $\bar{E}_{gamma} \cdot Q_{tot} = 0.18$, where Q_{tot} is based on a decay time of 30 minutes. The 22,000 curie limit is exceeded only at 3 CFM with a 90% equilibruim type distribution and at inleakages of less than 6 CFM with a 100% equilibrium distribution.

Table 2 presents the results of the analysis using the proposed maximum air ejector monitor trip setting which is based on a decay time of 120 minutes. Again, the 22,000 curie limit is exceeded only at extreme combinations of low inleakage and high equilibrium offgas composition.

TABLE 1. SUMMARY OF RESULTS

STORAGE TANK ACTIVITY IN DOSE EQUIVALENT CURIES XE-133 12 HOURS AFTER COMPLETION OF TANK FILL

RECOIL	DIFF	EQ	QTOT(5MN)	QTOT(30MN)	EGAM(30MN)	3 CFM	6 CFM	9 CFM	12 CFM	15 CFM	18 CFM	21 CFM	24 CFM	27 CFM	30 CFM
1.0	0.0	0.0	1.562E 06	1.872E 05	9.613E-01	551.	604.	964.	1053.	1096.	1116.	1116.	1110.	1095.	1079.
0.9	0.1	0.0	1.392E 06	1.917E 05	9.391E-01	1331.	1514.	1649.	1716.	1736.	1726.	1705.	1673.	1636.	1596.
0.9	0.0	0.1	1.525E 06	1.926E 05	9.347E-01	1703.	1635.	1649.	1650.	1633.	1603.	1566.	1526.	1485.	1443.
0.8	0.2	0.0	1.256E 06	1.952E 05	9.226E-01	1957.	2083.	2198.	2247.	2248.	2220.	2176.	2124.	2069.	2012.
0.8	0.1	0.1	1.348E 06	1.967E 05	9.153E-01	2399.	2294.	2298.	2286.	2249.	2198.	2139.	2076.	2014.	1952.
0.8	0.0	0.2	1.432E 06	1.967E 05	9.058E-01	3036.	2547.	2441.	2341.	2252.	2166.	2085.	2007.	1934.	1865.
0.7	0.3	0.0	1.144E 06	1.961E 05	9.065E-01	2471.	2551.	2644.	2684.	2668.	2624.	2563.	2495.	2424.	2353.
0.7	0.2	0.1	1.204E 06	1.999E 05	9.005E-01	2450.	2815.	2811.	2789.	2736.	2669.	2592.	2512.	2432.	2354.
0.7	0.1	0.2	1.299E 06	2.023E 05	8.896E-01	3614.	3181.	3036.	2934.	2834.	2732.	2632.	2536.	2443.	2356.
0.7	0.0	0.3	1.432E 06	2.059E 05	8.741E-01	4594.	3721.	3368.	3149.	2975.	2825.	2692.	2570.	2460.	2359.
0.6	0.4	0.0	1.050E 06	2.006E 05	8.974E-01	2901.	2942.	3026.	3048.	3020.	2961.	2887.	2805.	2721.	2636.
0.6	0.3	0.1	1.095E 06	2.025E 05	8.888E-01	3347.	3236.	3228.	3197.	3134.	3052.	2960.	2866.	2772.	2681.
0.6	0.2	0.2	1.156E 06	2.051E 05	8.775E-01	4064.	3636.	3499.	3356.	3267.	3173.	3059.	2947.	2840.	2739.
0.6	0.1	0.3	1.242E 06	2.088E 05	8.619E-01	5007.	4197.	3883.	3678.	3504.	3345.	3198.	3063.	2937.	2820.
0.6	0.0	0.4	1.372E 06	2.14[illegible]E 05	8.393E-01	6443.	5055.	4467.	4107.	3834.	3607.	3411.	3238.	3083.	2944.
0.5	0.5	0.0	9.710E 05	2.026E 05	8.883E-01	3265.	3273.	3346.	3356.	3317.	3247.	3161.	3066.	2973.	2880.
0.5	0.4	0.1	1.002E 06	2.047E 05	8.794E-01	3767.	3588.	3573.	3534.	3462.	3368.	3265.	3158.	3053.	2951.
0.5	0.3	0.2	1.042E 06	2.074E 05	8.660E-01	4425.	4000.	3870.	3766.	3650.	3526.	3401.	3277.	3158.	3045.
0.5	0.2	0.3	1.096E 06	2.111E 05	8.528E-01	5323.	4563.	4277.	4012.	3906.	3743.	3586.	3439.	3301.	3173.
0.5	0.1	0.4	1.175E 06	2.164E 05	8.319E-01	6622.	5378.	4885.	4540.	4280.	4056.	3855.	3673.	3508.	3357.
0.5	0.0	0.5	1.300E 06	2.248E 05	8.009E-01	8670.	6662.	5741.	5261.	4866.	4549.	4276.	4042.	3834.	3649.
0.4	0.6	0.0	9.030E 05	2.044E 05	8.808E-01	3577.	3557.	3620.	3623.	3573.	3492.	3396.	3293.	3190.	3087.
0.4	0.5	0.1	9.227E 05	2.065E 05	8.716E-01	4079.	3882.	3963.	3819.	3737.	3634.	3521.	3405.	3290.	3179.
0.4	0.4	0.2	9.461E 05	2.092E 05	8.603E-01	4720.	4299.	4174.	4069.	3946.	3816.	3680.	3547.	3416.	3296.
0.4	0.3	0.3	9.817E 05	2.126E 05	8.458E-01	5572.	4851.	4588.	4401.	4227.	4056.	3892.	3736.	3589.	3451.
0.4	0.2	0.4	1.026E 06	2.178E 05	8.264E-01	6757.	5620.	5162.	4864.	4615.	4391.	4187.	3999.	3826.	3667.
0.4	0.1	0.5	1.096E 06	2.252E 05	7.992E-01	8517.	6762.	6016.	5551.	5191.	4889.	4624.	4385.	4179.	3968.
0.4	0.0	0.6	1.212E 06	2.374E 05	7.582E-01	11405.	8635.	7417.	6678.	6138.	5705.	5342.	5030.	4757.	4515.
0.3	0.7	0.0	8.439E 05	2.059E 05	8.760E-01	3849.	3804.	3856.	3853.	3795.	3706.	3600.	3489.	3377.	3267.
0.3	0.6	0.1	8.594E 05	2.081E 05	8.651E-01	4344.	4134.	4111.	4061.	3973.	3861.	3735.	3615.	3492.	3373.
0.3	0.5	0.2	8.700E 05	2.108E 05	8.540E-01	4967.	4548.	4426.	4322.	4196.	4057.	3914.	3772.	3636.	3505.
0.3	0.4	0.3	8.819E 05	2.142E 05	8.402E-01	5774.	5065.	4839.	4600.	4485.	4310.	4140.	3977.	3822.	3676.
0.3	0.3	0.4	9.143E 05	2.189E 05	8.222E-01	6881.	5808.	5393.	5115.	4874.	4652.	4444.	4252.	4073.	3907.
0.3	0.2	0.5	9.504E 05	2.256E 05	7.980E-01	8405.	6834.	6180.	5762.	5427.	5137.	4877.	4642.	4430.	4235.
0.3	0.1	0.6	1.006E 06	2.357E 05	7.636E-01	10769.	8407.	7384.	6753.	6274.	5879.	5539.	5241.	4976.	4738.
0.3	0.0	0.7	1.101E 06	2.533E 05	7.167E-01	14644.	11117.	9461.	8460.	7735.	7159.	6681.	6272.	5917.	5603.
0.2	0.8	0.0	7.921E 05	2.073E 05	8.682E-01	4067.	4020.	4067.	4055.	3990.	3892.	3779.	3661.	3542.	3425.
0.2	0.7	0.1	7.974E 05	2.094E 05	8.595E-01	4573.	4350.	4324.	4270.	4176.	4057.	3928.	3796.	3666.	3540.
0.2	0.6	0.2	8.039E 05	2.121E 05	8.488E-01	5176.	4759.	4643.	4536.	4406.	4261.	4111.	3963.	3819.	3682.
0.2	0.5	0.3	8.122E 05	2.154E 05	8.356E-01	5941.	5277.	5047.	4873.	4698.	4520.	4344.	4175.	4014.	3863.
0.2	0.4	0.4	8.231E 05	2.198E 05	8.189E-01	6944.	5957.	5578.	5316.	5062.	4860.	4650.	4454.	4270.	4099.
0.2	0.3	0.5	8.380E 05	2.258E 05	7.971E-01	8319.	6589.	6305.	5923.	5607.	5325.	5069.	4835.	4621.	4424.
0.2	0.2	0.6	8.597E 05	2.346E 05	7.674E-01	10319.	8244.	7362.	6805.	6371.	6002.	5676.	5390.	5130.	4895.
0.2	0.1	0.7	8.942E 05	2.484E 05	7.245E-01	13491.	10395.	9039.	8206.	7584.	7077.	6645.	6270.	5939.	5644.
0.2	0.0	0.8	9.572E 05	2.734E 05	6.573E-01	19300.	14332.	12110.	10769.	9804.	9043.	8415.	7882.	7420.	7014.
0.1	0.9	0.0	7.463E 05	2.065E 05	8.734E-01	4297.	4212.	4251.	4234.	4161.	4057.	3938.	3812.	3687.	3565.
0.1	0.8	0.1	7.467E 05	2.106E 05	8.547E-01	4773.	4539.	4510.	4452.	4353.	4228.	4092.	3954.	3818.	3686.
0.1	0.7	0.2	7.472E 05	2.132E 05	8.444E-01	5354.	4939.	4827.	4719.	4586.	4436.	4281.	4126.	3977.	3834.
0.1	0.6	0.3	7.478E 05	2.164E 05	8.318E-01	6080.	5439.	5222.	5053.	4877.	4696.	4516.	4342.	4176.	4019.
0.1	0.5	0.4	7.486E 05	2.205E 05	8.162E-01	7012.	6080.	5729.	5401.	5251.	5030.	4819.	4619.	4431.	4256.

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TABLE 1. SUMMARY OF RESULTS (continued)

PAGE 861

STORAGE TANK ACTIVITY IN DOSE EQUIVALENT CURIES XE-133 12 HOURS AFTER COMPLETION OF TANK FILL

RECOIL	/DIFF	/EQ	QTOT(5MN)	QTOT(30 MN)	EGAM(30MN)	3 CFM	6 CFM	9 CFM	12 CFM	15 CFM	18 CFM	21 CFM	24 CFM	27 CFM	30 CFM
0.1	0.4	0.5	7.496E 05	2.260E 05	7.964E-01	8252.	6933.	6403.	6050.	5749.	5474.	5221.	4987.	4771.	4572.
0.1	0.3	0.6	7.510E 05	2.337E 05	7.702E-01	9983.	8124.	7345.	6845.	6443.	6094.	5782.	5501.	5246.	5013.
0.1	0.2	0.7	7.531E 05	2.452E 05	7.342E-01	12568.	9902.	8751.	8032.	7481.	7020.	6621.	6269.	5954.	5671.
0.1	0.1	0.8	7.567E 05	2.641E 05	6.615E-01	16848.	12847.	11079.	9997.	9198.	8553.	8009.	7539.	7127.	6761.
0.1	0.0	0.9	7.636E 05	3.016E 05	5.968E-01	25301.	18662.	15678.	13879.	12590.	11581.	10751.	10049.	9444.	8914.
0.0	1.0	0.0	7.056E 05	2.045E 05	8.540E-01	4464.	4382.	4415.	4392.	4314.	4204.	4076.	3947.	3816.	3689.
0.0	0.9	0.1	7.022E 05	2.114E 05	8.505E-01	4934.	4705.	4674.	4613.	4506.	4378.	4237.	4093.	3951.	3814.
0.0	0.8	0.2	6.980E 05	2.141E 05	8.406E-01	5510.	5096.	4986.	4879.	4742.	4588.	4428.	4268.	4114.	3966.
0.0	0.7	0.3	6.929E 05	2.172E 05	8.288E-01	6200.	5577.	5370.	5206.	5030.	4846.	4663.	4484.	4314.	4152.
0.0	0.6	0.4	6.865E 05	2.211E 05	8.140E-01	7069.	6162.	5854.	5617.	5392.	5172.	4959.	4756.	4566.	4387.
0.0	0.5	0.5	6.782E 05	2.262E 05	7.958E-01	8198.	6966.	6462.	6152.	5863.	5594.	5343.	5109.	4893.	4692.
0.0	0.4	0.6	6.669E 05	2.330E 05	7.725E-01	9724.	8030.	7332.	6875.	6499.	6165.	5863.	5587.	5335.	5104.
0.0	0.3	0.7	6.506E 05	2.428E 05	7.415E-01	11849.	9545.	8542.	7906.	7406.	6979.	6603.	6267.	5965.	5691.
0.0	0.2	0.8	6.260E 05	2.578E 05	6.983E-01	15252.	11880.	10408.	9495.	8804.	8234.	7745.	7316.	6937.	6598.
0.0	0.1	0.9	5.829E 05	2.839E 05	6.340E-01	21092.	15946.	13658.	12262.	11239.	10419.	9733.	9144.	8629.	8173.
0.0	0.0	1.0	4.888E 05	3.409E 05	5.260E-01	33819.	24609.	20742.	18293.	16545.	15183.	14067.	13126.	12317.	11610.

TABLE 2. SUMMARY OF RESULTS WITH NEW SJAE MONITOR TRIP SETTING

STORAGE TANK ACTIVITY IN DOSE EQUIVALENT CURIES XE-133 12 HOURS AFTER COMPLETION OF TANK FILL

RECOIL	DIFF	ZEU	GTOT(5MN)	GTOT(120MN)	EGAM(120MN)	3 CFM	6 CFM	9 CFM	12 CFM	15 CFM	18 CFM	21 CFM	24 CFM	27 CFM	30 CFM
1.0	0.0	0.0	7.775E 06	1.970E 05	9.135E-01	2743.	4002.	4799.	5243.	5465.	5553.	5563.	5524.	5455.	5368.
0.9	0.1	0.0	5.872E 06	2.132E 05	8.514E-01	5567.	6331.	6696.	7176.	7260.	7229.	7131.	6996.	6841.	6676.
0.9	0.0	0.1	7.119E 06	2.267E 05	8.154E-01	7952.	7634.	7700.	7795.	7623.	7484.	7312.	7125.	6931.	6738.
0.8	0.2	0.0	4.656E 06	2.244E 05	8.035E-01	7256.	7724.	8150.	8332.	8334.	8231.	8069.	7876.	7670.	7459.
0.8	0.1	0.1	5.324E 06	2.317E 05	7.766E-01	9473.	9056.	9073.	9025.	8882.	8679.	8445.	8199.	7951.	7706.
0.8	0.0	0.2	6.456E 06	2.447E 05	7.355E-01	13725.	11313.	10636.	10198.	9809.	9438.	9065.	8745.	8426.	8125.
0.7	0.3	0.0	3.679E 06	2.367E 05	7.801E-01	8380.	8650.	8964.	9101.	9049.	8897.	8692.	8462.	8221.	7980.
0.7	0.2	0.1	4.253E 06	2.383E 05	7.555E-01	10381.	9905.	9892.	9812.	9633.	9392.	9121.	8840.	8559.	8284.
0.7	0.1	0.2	4.821E 06	2.497E 05	7.209E-01	13415.	11808.	11270.	10891.	10519.	10143.	9772.	9413.	9071.	8746.
0.7	0.0	0.3	5.765E 06	2.690E 05	6.691E-01	18565.	15037.	13609.	12723.	12022.	11417.	10875.	10386.	9939.	9530.
0.6	0.4	0.0	5.325E 06	2.355E 05	7.642E-01	9182.	9312.	9579.	9650.	9559.	9375.	9138.	8880.	8615.	8351.
0.6	0.3	0.1	3.542E 06	2.426E 05	7.419E-01	10964.	10468.	10437.	10335.	10132.	9866.	9570.	9266.	8963.	8668.
0.6	0.2	0.2	3.748E 06	2.526E 05	7.126E-01	13528.	12102.	11648.	11304.	10941.	10562.	10182.	9810.	9454.	9115.
0.6	0.1	0.3	4.313E 06	2.678E 05	6.722E-01	17394.	14585.	13488.	12775.	12171.	11620.	11111.	10638.	10201.	9795.
0.6	0.0	0.4	5.104E 06	2.936E 05	6.130E-01	23971.	18808.	16619.	15279.	14263.	13420.	12691.	12047.	11472.	10952.
0.5	0.5	0.0	2.910E 06	2.391E 05	7.527E-01	9783.	9807.	10025.	10061.	9941.	9729.	9471.	9193.	8909.	8629.
0.5	0.4	0.1	3.035E 06	2.457E 05	7.326E-01	11414.	10870.	10825.	10708.	10467.	10203.	9890.	9569.	9251.	8941.
0.5	0.3	0.2	3.202E 06	2.546E 05	7.071E-01	13603.	12298.	11899.	11577.	11221.	10840.	10454.	10074.	9709.	9360.
0.5	0.2	0.3	3.439E 06	2.671E 05	6.740E-01	16699.	14316.	13417.	12806.	12259.	11741.	11250.	10788.	10356.	9953.
0.5	0.1	0.4	3.800E 06	2.861E 05	6.292E-01	21410.	17368.	15727.	14677.	13839.	13111.	12462.	11875.	11342.	10855.
0.5	0.0	0.5	4.416E 06	3.185E 05	5.651E-01	29447.	22627.	19668.	17867.	16533.	15449.	14529.	13730.	13023.	12393.
0.4	0.6	0.0	2.587E 06	2.414E 05	7.446E-01	10250.	10192.	10372.	10380.	10238.	10005.	9730.	9436.	9138.	8846.
0.4	0.5	0.1	2.655E 06	2.480E 05	7.257E-01	11735.	11171.	11115.	10987.	10753.	10456.	10130.	9796.	9466.	9146.
0.4	0.4	0.2	2.743E 06	2.559E 05	7.032E-01	13657.	12437.	12077.	11772.	11421.	11039.	10647.	10262.	9890.	9535.
0.4	0.3	0.3	2.861E 06	2.666E 05	6.752E-01	16239.	14138.	13369.	12627.	12318.	11821.	11343.	10868.	10459.	10057.
0.4	0.2	0.4	3.026E 06	2.816E 05	6.392E-01	19894.	16546.	15199.	14320.	13587.	12929.	12327.	11774.	11265.	10797.
0.4	0.1	0.5	3.283E 06	3.044E 05	5.910E-01	25464.	20217.	17987.	16596.	15522.	14617.	13826.	13124.	12494.	11924.
0.4	0.0	0.6	3.718E 06	3.436E 05	5.236E-01	34992.	26495.	22756.	20489.	18851.	17504.	16391.	15434.	14595.	13851.
0.3	0.7	0.0	2.329E 06	2.442E 05	7.372E-01	10623.	10500.	10649.	10636.	10475.	10227.	9937.	9631.	9322.	9018.
0.3	0.6	0.1	2.366E 06	2.494E 05	7.205E-01	11985.	11404.	11341.	11204.	10960.	10653.	10316.	9973.	9633.	9305.
0.3	0.5	0.2	2.399E 06	2.574E 05	7.004E-01	13697.	12541.	12210.	11918.	11570.	11187.	10792.	10402.	10025.	9665.
0.3	0.4	0.3	2.450E 06	2.662E 05	6.761E-01	15912.	14012.	13338.	12842.	12359.	11878.	11408.	10956.	10532.	10131.
0.3	0.3	0.4	2.517E 06	2.787E 05	6.459E-01	18891.	15990.	14849.	14064.	13421.	12808.	12237.	11706.	11214.	10756.
0.3	0.2	0.5	2.613E 06	2.963E 05	6.075E-01	23112.	18794.	16994.	15845.	14925.	14125.	13411.	12766.	12181.	11647.
0.3	0.1	0.6	2.760E 06	3.232E 05	5.569E-01	29557.	23073.	20268.	18534.	17221.	16136.	15203.	14384.	13656.	13003.
0.3	0.0	0.7	3.012E 06	3.693E 05	4.874E-01	40809.	30413.	25883.	23144.	21160.	19586.	18277.	17159.	16187.	15324.
0.2	0.8	0.0	2.116E 06	2.460E 05	7.318E-01	10928.	10752.	10875.	10845.	10669.	10409.	10107.	9790.	9471.	9160.
0.2	0.7	0.1	2.124E 06	2.513E 05	7.163E-01	12185.	11591.	11521.	11377.	11125.	10809.	10465.	10114.	9767.	9432.
0.2	0.6	0.2	2.132E 06	2.578E 05	6.983E-01	13726.	12622.	12314.	12031.	11686.	11302.	10905.	10511.	10130.	9767.
0.2	0.5	0.3	2.147E 06	2.660E 05	6.768E-01	15667.	13917.	13310.	12853.	12390.	11921.	11457.	11011.	10587.	10187.
0.2	0.4	0.4	2.155E 06	2.7[illegible] 05	6.500E-01	18179.	15595.	14601.	13917.	13303.	12722.	12173.	11659.	11178.	10731.
0.2	0.3	0.5	2.172E 06	2.906E 05	6.169E-01	21559.	17854.	16334.	15350.	14531.	13801.	13137.	12530.	11974.	11464.
0.2	0.2	0.6	2.196E 06	3.111E 05	5.767E-01	26355.	21058.	18603.	17382.	16273.	15331.	14504.	13766.	13103.	12503.
0.2	0.1	0.7	2.233E 06	3.420E 05	5.263E-01	33688.	25957.	22571.	20490.	18937.	17671.	16594.	15657.	14830.	14093.
0.2	0.0	0.8	2.296E 06	3.952E 05	4.554E-01	46299.	34381.	29051.	25834.	23518.	21694.	20186.	18906.	17799.	16826.
0.1	0.9	0.0	1.942E 06	2.475E 05	7.275E-01	11183.	10961.	11064.	11019.	10831.	10559.	10248.	9922.	9596.	9278.
0.1	0.8	0.1	1.952E 06	2.525E 05	7.130E-01	12348.	11744.	11669.	11519.	11261.	10958.	10687.	10229.	9877.	9536.
0.1	0.7	0.2	1.919E 06	2.564E 05	6.965E-01	13752.	12666.	12397.	12121.	11773.	11394.	10995.	10598.	10215.	9847.
0.1	0.6	0.3	1.903E 06	2.658E 05	6.773E-01	15477.	13844.	13291.	12861.	12415.	11954.	11496.	11052.	10630.	10230.
0.1	0.5	0.4	1.884E 06	2.750E 05	6.545E-01	17647.	15300.	14416.	13792.	13215.	12658.	12126.	11623.	11152.	10711.

TABLE 2. SUMMARY OF RESULTS WITH NEW SJAE MONITOR TRIP SETTING (continued)

PAGE 861

STORAGE TANK ACTIVITY IN DOSE EQUIVALENT CURIES XE-133 12 HOURS AFTER COMPLETION OF TANK FILL

RECOIL	DIFF	EQ	QTOT(5MIN)	QTOT(120MN)	EGAM(120MIN)	3 CFM	6 CFM	9 CFM	12 CFM	15 CFM	18 CFM	21 CFM	24 CFM	27 CFM	30 CFM
0.1	0.4	0.5	1.858E 06	2.870E 05	6.273E-01	20458.	17187.	15873.	14998.	14251.	13570.	12942.	12363.	11828.	11334.
0.1	0.3	0.6	1.824E 06	3.031E 05	5.939E-01	24245.	19729.	17837.	16623.	15648.	14600.	14042.	13359.	12739.	12174
0.1	0.2	0.7	1.775E 06	3.260E 05	5.522E-01	29622.	23339.	20625.	18930.	17631.	16545.	15604.	14774.	14033.	13366.
0.1	0.1	0.8	1.700E 06	3.610E 05	4.986E-01	37859.	28868.	24896.	22464.	20669.	19219.	17997.	16941.	16015.	15193.
0.1	0.0	0.9	1.571E 06	4.214E 05	4.271E-01	52062.	38401.	32260.	28558.	25907.	23830.	22125.	20679.	19432.	18347.
0.0	1.0	0.0	1.794E 06	2.468E 05	7.235E-01	11398.	11139.	11224.	11166.	10967.	10687.	10367.	10034.	9702.	9377.
0.0	0.9	0.1	1.771E 06	2.534E 05	7.102E-01	12464.	11871.	11791.	11637.	11373.	[illegible]045.	10788.	10325.	9966.	9623.
0.0	0.8	0.2	1.745E 06	2.590E 05	6.951E-01	13773.	12739.	12464.	12195.	11854.	11469.	11068.	10670.	10283.	9914.
0.0	0.7	0.3	1.713E 06	2.656E 05	6.777E-01	15326.	13785.	13275.	12868.	12434.	11960.	11526.	11065.	10663.	10264.
0.0	0.6	0.4	1.674E 06	2.734E 05	6.574E-01	17234.	15071.	14272.	13695.	13146.	12608.	12089.	11595.	11131.	10695.
0.0	0.5	0.5	1.624E 06	2.841E 05	6.336E-01	19635.	16669.	15526.	14736.	14043.	13396.	12797.	12238.	11719.	11237.
0.0	0.4	0.6	1.560E 06	2.974E 05	6.052E-01	22749.	18787.	17152.	16085.	15205.	14423.	13715.	13070.	12481.	11940.
0.0	0.3	0.7	1.474E 06	3.154E 05	5.707E-01	26946.	21616.	19345.	17904.	16772.	15605.	14954.	14193.	13509.	12888.
0.0	0.2	0.8	1.351E 06	3.410E 05	5.279E-01	32914.	25637.	22461.	20490.	18999.	17769.	16714.	15789.	14970.	14236.
0.0	0.1	0.9	1.163E 06	3.802E 05	4.735E-01	42070.	31807.	27243.	24458.	22417.	20783.	19414.	18238.	17211.	16303.
0.0	0.0	1.0	6.369E 05	4.480E 05	4.018E-01	57901.	42474.	35511.	31319.	28327.	25994.	24084.	22473.	21067.	19878.

3.0 Monticello Offgas System Model

Figure 1 is a simplified flow diagram of the Monticello modified offgas system. Fission gases in the reactor vessel were assumed to be released at t=0 in accordance with Table 3. Correlation between these empirical relations and actual BWR releases has been shown to be good.

A delay of five minutes from the reactor vessel to the air ejector monitors has been assumed. This value is routinely used in monitor calibration. All other delay times upstream of the compressed storage subsystem are assumed to be negligable except the 42-inch pipe holdup.

Individual isotopic release rates (uCi/sec) are given initially by:

$$Q(i,0) = K_1(F_R 8.43\times10^{11}\, y_i\lambda_i + F_D 3.19\times10^{10} y_i\sqrt{\lambda_i} + F_E 5.28\times10^{7} y_i)$$

Fifteen isotopes were considered in the model (Table 2). Total release rate in the vessel is therefore:

$$Q_{tot}(0) = \sum_{i=1,15} Q(i,0)$$

Constant K_1 is selected so that the offgas release rate is equal to the maximum air ejector monitor trip setting. This trip point is the $Q_{tot}(t=5\text{ min})$ that results when:

$$\frac{Q_{tot}(t=30\text{ min})\,\overline{E}_{gamma}}{0.18} = 1$$

The release rate of an isotope at any time is given by:

$$Q(i,t) = Q(i,0)e^{-\lambda_i t}$$

and the total release rate at any time is:

$$Q_{tot}(t) = \sum_{i=1,15} Q(i,t)$$

At time $t=t_d$, the offgas stream reaches the compressed storage subsystem and enters a storage tank. t_d is given by:

$$t_d(\text{min}) = 5 + \frac{(\text{pipe vol})(\text{pipe pres})}{(\text{inleakage scfm})(1\text{ atmos})}$$

$$= 5 + \frac{(4650)(10.0)}{L(\text{scfm})(14.69)}$$

The number of curies of an isotope at any time, t', after beginning tank fill is given by the differential equation:

$$\frac{d\,C(i,t')}{dt'} = Q(i,t_d) - \lambda_i\, C(i,t')$$

where $C(i,0) = 0$

This equation has an exact solution:

$$C(i,t') = Q(i,t_d)\,\frac{(1-e^{-\lambda_i t'})}{\lambda_i}$$

and:

$$C_{tot}(t') = \sum_{i=1,15} C(i,t')$$

$$C_{\substack{XE133\\EQUIV}}(t') = \sum_{i=1,15} C(i,t')(E_{gammai}/E_{gamma\ 13})$$

Tank pressure as a function of filling time is:

$$p(\text{psig}) = \frac{(\text{inleakage scfm})(t\ \text{min})(14.69\ \text{psi})}{(\text{tank volume})}$$

$$= \frac{L(\text{scfm})t\ (\text{min})\ 14.69}{1250}$$ neglecting temperature changes

and the time to fill a tank becomes:

$$t_f(\text{min}) = \frac{(285)(1250)}{L(\text{scfm})\ 14.69}$$

XE-133 dose equivalent activity in the tank after a delay of t_{intk} when the tank discharge valve can be opened becomes therefore:

$$C_{\substack{XE133\\EQUIV}} = \sum_{i=1,15} Q(i,0)\, e^{-(t_d+t_{intk})\lambda_i}\, \frac{(1 - e^{-\lambda_i t_f})}{\lambda_i}\, \frac{E_{gammai}}{E_{gamma13}}$$

4.0 Computer Program

A Fortran program was written to perform the calculations outline in Section 3.0. Storage tank contents was calculated as a function of fill time and tank pressure for the following parameter variations:

Offgas distribution	Recoil Fraction, F_R	0 to 1.0, 0.1 steps
	Diffusion Fraction, F_D	0 to 1.0, 0.1 steps
	Equilibrium Fraction, F_E	0 to 1.0, 0.1 steps
Total air inleakage	3 to 30 cfm, 1 cfm steps	

For each combination of offgas distribution and air inleakage, the program calculated the following quantities:

Release rate (uci/sec) Q_{tot} (t) for t up to 600 hours

Average gamma disintegration energy vs. t

Average beta disintegration energy vs. t

Q(i,t) for all 15 isotopes vs. t

C(i,t') for all 15 isotopes vs. t'

$C_{tot}(t')$

$C_{XE133 \, EQUIV}(t')$

t_f'

Normalized $Q(i,t)/y_i\lambda_i$ vs. λ_i Characteristic plot

Program output for the 100% equilibrium distribution and 3 CFM total air inleakage is attached.

A series of additional calculations were also performed to determine the maximum possible tank activity for offgas release rates at the steam jet air ejector less than the maximum permitted trip setting. Calculations were performed for air ejector monitor release rates of 10% to 100% of the maximum trip setting in 10% increments to establish the maximum permitted air ejector monitor release rate for any given air inleakage or offgas composition which will not exceed the 22,000 curie limit on tank activity. These results m be used to determine an operating limit curve.

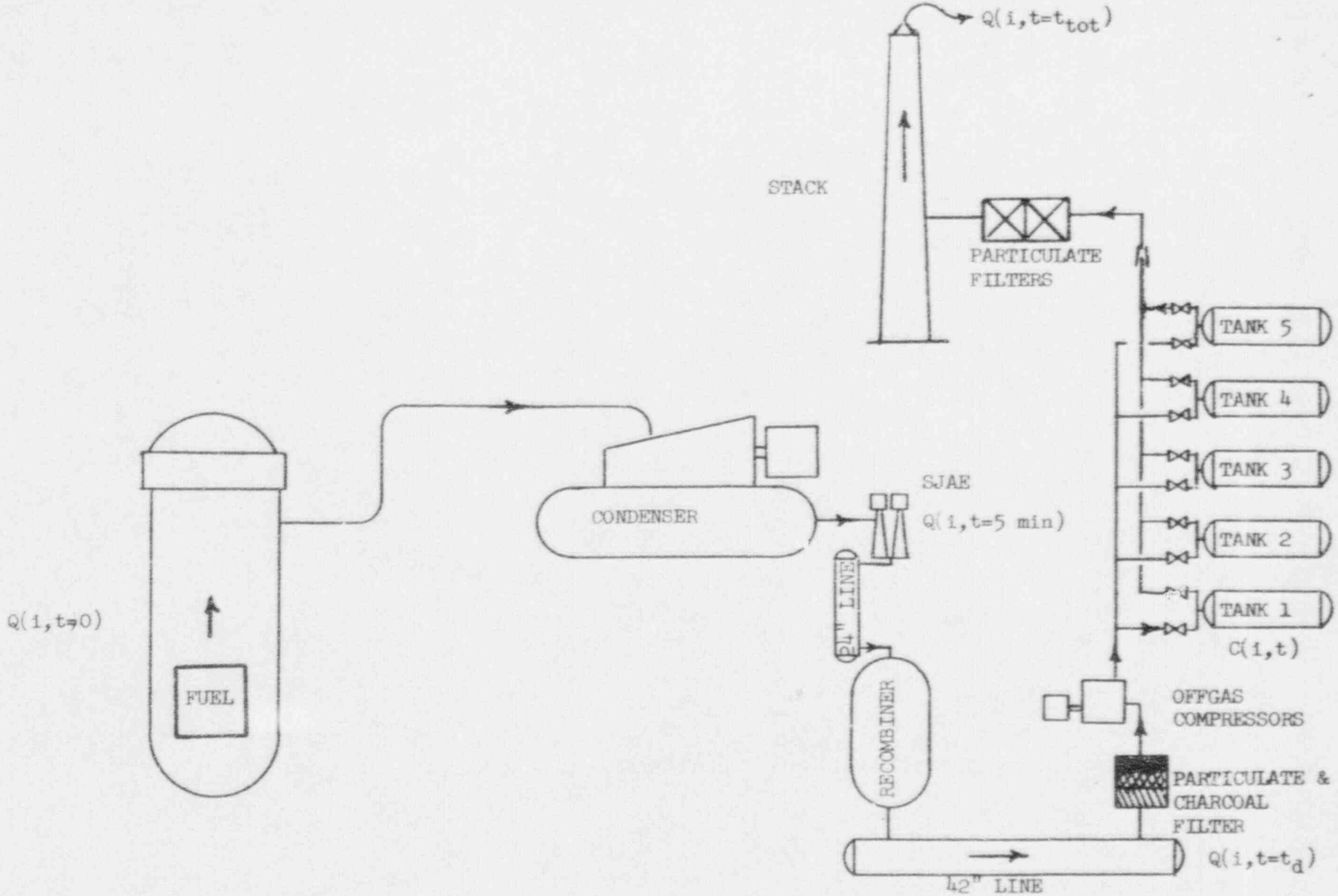


FIGURE 1. OFFGAS SYSTEM MODEL

TABLE 2. FISSION GASES CONSIDERED IN ANALYSIS

NO. (i)	ISOTOPE	FISSION YIELD(%)	DECAY CONSTANT(sec^{-1})	$\bar{E}$ GAMMA (MEV/dis)
1	KR90	5.00	2.10E-2	2.10
2	XE139	5.40	1.69E-2	0.450
3	KR89	4.59	3.61E-3	2.22
4	XE137	6.00	2.96E-3	0.194
5	XE138	5.90	8.14E-4	1.18
6	XE135M	1.80	7.22E-4	0.432
7	KR87	2.53	1.52E-4	0.793
8	KR83M	0.520	1.03E-4	0.00248
9	KR88	3.56	6.90E-5	1.95
10	KR85M	1.30	4.38E-5	0.159
11	XE135	6.30	2.10E-5	0.247
12	XE133M	0.160	3.48E-6	0.0420
13	XE133	6.69	1.52E-6	0.0454
14	XE131M	0.0220	6.68E-7	0.0201
15	KR85	0.271	2.04E-9	0.00220

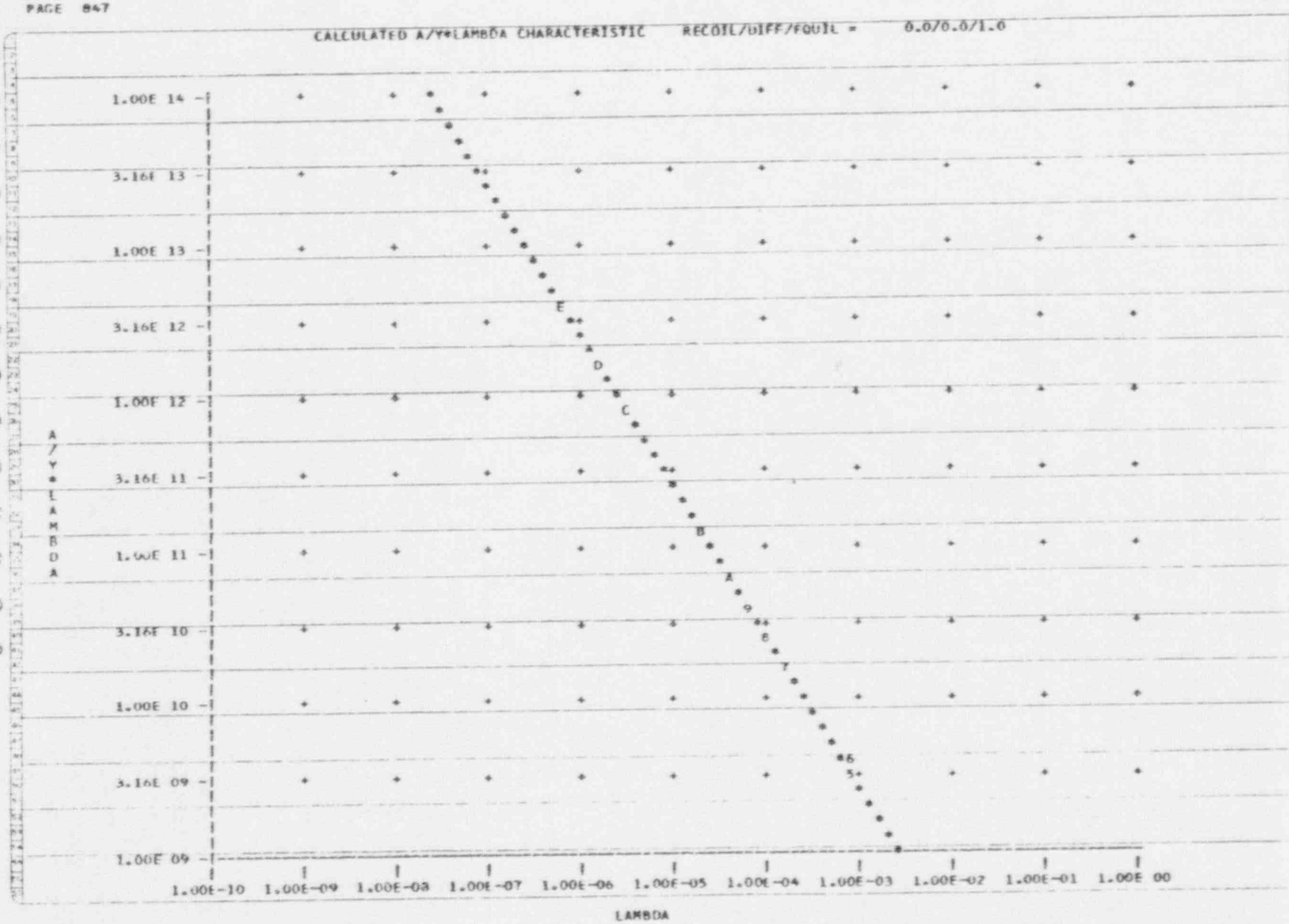
Ref: ORNL-4923 & NEDO-10237

TABLE 3. MODELING OF FISSION GAS RELEASE RATE

RELEASE MECHANISM	MODEL
RECOIL	$Q(i,t=0) = F_R K_R y_i \lambda_i$
DIFFUSION	$Q(i,t=0) = F_D K_D y_i \lambda_i^{1/2}$
EQUILIBRIUM	$Q(i,t=o) = F_E K_E y_i$

$Q(i,t)$	Release rate of fission gas i at time t
F_R, F_D, F_E	Fraction of total offgas release attributed to recoil, diffusion, and equilibrium mechanisms
K_R, K_D, K_E	Power dependent constants
y_i	Fission fractional yield of fission gas i
λi	Decay constant of fission gas i

Ref: GEI-92823A


CALCULATED A/Y*LAMBDA CHARACTERISTIC RECOIL/DIFF/EQUIL = 0.0/0.0/1.0
A/Y*LAMBDA
1.00E 14
3.16E 13
1.00E 13
3.16E 12
1.00E 12
3.16E 11
1.00E 11
3.16E 10
1.00E 10
3.16E 09
1.00E 09
1.00E-10
1.00E-09
1.00E-08
1.00E-07
1.00E-06
1.00E-05
1.00E-04
1.00E-03
1.00E-02
1.00E-01
1.00E 00
LAMBDA

43032A

RELEASE RATE LIMITED TO MAXIMUM PERMITTED AT STEAM JET AIR EJECTOR

FRACTION RECOIL = 0.0
FRACTION DIFFUSION = 0.0
FRACTION EQUILIBRIUM = 1.0

HOLDUP TIME HR-MIN	INDIVIDUAL ISOTOPE RELEASE RATES (UCI/SEC) KR90 / KR88	XE139 / KR85M	KR89 / XE135	XE137 / XE135M	XE138 / XE133	XE135M / XE131M	KR87 / KR85	KR83M	TOTAL RATE OF RELEASE (UCI/SEC)	EBAR GAMMA / EBAR BETA (MEV)
0- 0	1.3399E 05	1.4471E 05	1.2300E 05	1.6079E 05	1.5811E 05	4.8237E 04	6.7709E 04	1.3935E 04	1.3411E 06	6.6071E-01
	9.5401E 04	3.4838E 04	1.6883E 05	4.2877E 03	1.7928E 05	5.8956E 02	7.2623E 03			6.2424E-01
0- 5	2.4605E 02	9.0913E 02	4.1646E 04	6.6161E 04	1.2385E 05	3.8843E 04	6.4777E 04	1.3511E 04	8.3687E 05	6.6678E-01
	9.3447E 04	3.4383E 04	1.6777E 05	4.2832E 03	1.7920E 05	5.8944E 02	7.2623E 03			5.4556E-01
0-30	5.1374E-12	8.8973E-09	1.8530E 02	7.8043E 02	3.6528E 04	1.3151E 04	5.1570E 04	1.1577E 04	5.8371E 05	5.2795E-01
	8.4259E 04	3.2196E 04	1.6257E 05	4.2609E 03	1.7879E 05	5.8885E 02	7.2623E 03			3.6301E-01
1- 0	0.0	0.0	2.7914E-01	3.7880E 00	6.4392E 03	3.5856E 03	3.9226E 04	9.6177E 03	5.1197E 05	4.6770E-01
	7.4417E 04	2.9756E 04	1.5654E 05	4.2343E 03	1.7830E 05	5.8614E 02	7.2622E 03			3.3131E-01
2- 0	0.0	0.0	6.3349E-07	8.9743E-05	4.5045E 02	2.6653E 02	2.2695E 04	6.6380E 03	4.4801E 05	4.0178E-01
	5.8049E 04	2.5415E 04	1.4514E 05	4.1816E 03	1.7733E 05	5.8673E 02	7.2622E 03			2.9343E-01
3- 0	0.0	0.0	1.4376E-12	2.1025E-09	2.4043E 01	1.9812E 01	1.3131E 04	4.5814E 03	4.0765E 05	3.5240E-01
	4.5281E 04	2.1707E 04	1.3457E 05	4.1295E 03	1.7636E 05	5.8532E 02	7.2621E 03			2.6796E-01
4- 0	0.0	0.0	0.0	0.0	1.2833E 00	1.4727E 00	7.5970E 03	3.1820E 03	3.7672E 05	3.1015E-01
	3.5321E 04	1.8541E 04	1.2477E 05	4.0781E 03	1.7540E 05	5.8391E 02	7.2621E 03			2.4968E-01
5- 0	0.0	0.0	0.0	0.0	6.8497E-02	1.0947E-01	4.3954E 03	2.1824E 03	3.5196E 05	2.7397E-01
	2.7552E 04	1.5836E 04	1.1569E 05	4.0273E 03	1.7444E 05	5.8251E 02	7.2620E 03			2.3628E-01
6- 0	0.0	0.0	0.0	0.0	3.6561E-03	8.1371E-03	2.5430E 03	1.5062E 03	3.3164E 05	2.4317E-01
	2.1492E 04	1.3526E 04	1.0726E 05	3.9772E 03	1.7349E 05	5.8111E 02	7.2620E 03			2.2619E-01
7- 0	0.0	0.0	0.0	0.0	1.9515E-04	6.0485E-04	1.4713E 03	1.0396E 03	3.1459E 05	2.1707E-01
	1.6765E 04	1.1553E 04	9.9452E 04	3.9277E 03	1.7254E 05	5.7972E 02	7.2619E 03			2.1834E-01
8- 0	0.0	0.0	0.0	0.0	1.0416E-05	4.4961E-05	8.5125E 02	7.1749E 02	3.0004E 05	1.9498E-01
	1.3077E 04	9.8676E 03	9.2211E 04	3.8788E 03	1.7160E 05	5.7832E 02	7.2619E 03			2.1200E-01
9- 0	0.0	0.0	0.0	0.0	5.5597E-07	3.3421E-06	4.9250E 02	4.9520E 02	2.8745E 05	1.7630E-01
	1.0201E 04	8.4281E 03	8.5497E 04	3.8305E 03	1.7066E 05	5.7693E 02	7.2618E 03			2.0670E-01
10- 0	0.0	0.0	0.0	0.0	2.9675E-08	2.4843E-07	2.8495E 02	3.4178E 02	2.7641E 05	1.6049E-01
	7.9573E 03	7.1987E 03	7.9272E 04	3.7828E 03	1.6973E 05	5.7555E 02	7.2617E 03			2.0213E-01
20- 0	0.0	0.0	0.0	0.0	0.0	0.0	1.1976E 00	8.3826E 00	2.1124E 05	8.6104E-02
	6.6371E 02	1.4875E 03	3.7221E 04	3.3374E 03	1.6069E 05	5.6187E 02	7.2612E 03			1.7351E-01
30- 0	0.0	0.0	0.0	0.0	0.0	0.0	5.0333E-03	2.0560E-01	1.8073E 05	6.3804E-02
	5.5359E 01	3.0737E 02	1.7477E 04	2.9444E 03	1.5214E 05	5.4852E 02	7.2607E 03			1.5841E-01
40- 0	0.0	0.0	0.0	0.0	0.0	0.0	7.1154E-05	5.0426E-03	1.6270E 05	5.3601E-02
	4.6175E 00	6.3513E 01	8.2061E 03	2.5977E 03	1.4404E 05	5.3549E 02	.2601E 03			1.5027E-01

INDIVIDUAL ISOTOPE RELEASE RATES (UCI/SEC)

HOLDUP TIME HR-MIN	KR90 / KR88	XE139 / KR85M	KR89 / XE135	XE137 / XE133M	XE138 / XE133	XE135M / XE131M	KR87 / KR85	KR83M	TOTAL RATE OF RELEASE (UCI/SEC)	EBAR GAMMA / EBAR BETA (MEV)
50- 0	0.0	0.0	0.0	0.0	0.0	0.0	8.8906E-08	1.2368E-04	1.5031E 05	4.8356E-02
	3.8514E-01	1.3124E 01	3.8531E 03	2.2918E 03	1.3637E 05	5.2277E 02	7.2596E 03			1.4610E-01
60- 0	0.0	0.0	0.0	0.0	0.0	0.0	3.7366E-10	3.0334E-06	1.4071E 05	4.5625E-02
	3.2124E-02	2.7119E 00	1.8092E 03	2.0220E 03	1.2910E 05	5.1034E 02	7.2591E 03			1.4409E-01
70- 0	0.0	0.0	0.0	0.0	0.0	0.0	1.5704E-12	7.4398E-08	1.3262E 05	4.4187E-02
	2.6795E-03	5.6037E-01	8.4949E 02	1.7839E 03	1.2223E 05	4.9822E 02	7.2585E 03			1.4323E-01
80- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8247E-09	1.2544E 05	4.3401E-02
	2.2349E-04	1.1579E-01	3.9887E 02	1.5738E 03	1.1572E 05	4.8638E 02	7.2580E 03			1.4295E-01
90- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4754E-11	1.1887E 05	4.2939E-02
	1.8641E-05	2.3927E-02	1.8729E 02	1.3885E 03	1.0956E 05	4.7482E 02	7.2575E 03			1.4298E-01
100- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0977E-12	1.1276E 05	4.2636E-02
	1.5548E-06	4.9442E-03	6.7958E 01	1.2250E 03	1.0373E 05	4.6354E 02	7.2569E 03			1.4317E-01
200- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7978E 04	4.0639E-02
	0.0	7.0168E-10	4.5805E-02	3.4999E 07	6.0012E 04	3.6446E 02	7.2516E 03			1.4759E-01
300- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2354E 04	3.7830E-02
	0.0	0.0	2.3659E-05	9.9993E 01	3.4721E 04	2.8656E 02	7.2463E 03			1.5486E-01
400- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7583E 04	3.3849E-02
	0.0	0.0	1.2427E-08	2.8568E 01	2.0088E 04	2.2530E 02	7.2410E 03			1.6531E-01
500- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9043E 04	2.8749E-02
	0.0	0.0	6.4732E-12	8.1621E 00	1.1623E 04	1.7715E 02	7.2357E 03			1.7679E-01
600- 0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4096E 04	2.2991E-02
	0.0	0.0	0.0	2.3319E 00	6.7244E 03	1.3928E 02	7.2303E 03			1.9407E-01

4?0322

XE-133 EQUIVALENT OFFGAS IN COMPRESSED STORAGE TANK
TOTAL AIR INLEAKAGE = 3 CFM
OFFGAS MIXTURE RECOIL/DIFF/EQUIL =0.0/0.0/1.0
RELEASE AT THE SJAE MONITOR LIMIT

T(HRS)	PRESSURE (PSIG)	INDIVIDUAL ISOTOPES (CI) KR90 / KR88	XE139 / KR85M	KR89 / XE135	XE137 / XE133M	XE138 / XE133	XE135M / XE131M	KR87 / KR85	KR83M	TOTAL CI	XE133 EQV CI
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0			
10.0	21.2	0.0	0.0	0.0	0.0	0.0	0.0	2.809E-02	1.884E-01	7.276E 03	1.274E 04
		1.573E 01	3.891E 01	1.121E 03	1.163E 02	5.702E 03	2.010E 01	2.614E 02			
20.0	42.3	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.930E-01	1.359E 04	2.121E 04
		1.704E 01	4.695E 01	1.648E 03	2.189E 02	1.110E 04	3.972E 01	5.228E 02			
30.0	63.5	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	1.932E 04	2.778E 04
		1.715E 01	4.861E 01	1.895E 03	3.094E 02	1.621E 04	5.887E 01	7.841E 02			
40.0	84.6	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	2.444E 04	3.335E 04
		1.716E 01	4.896E 01	2.011E 03	3.892E 02	2.105E 04	7.757E 01	1.046E 03			
50.0	105.6	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	2.962E 04	3.831E 04
		1.716E 01	4.903E 01	2.066E 03	4.596E 02	2.563E 04	9.583E 01	1.307E 03			
60.0	127.0	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	3.433E 04	4.286E 04
		1.716E 01	4.904E 01	2.091E 03	5.218E 02	2.997E 04	1.137E 02	1.568E 03			
70.0	148.1	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	3.878E 04	4.711E 04
		1.716E 01	4.905E 01	2.103E 03	5.766E 02	3.407E 04	1.310E 02	1.829E 03			
80.0	169.3	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	4.300E 04	5.109E 04
		1.716E 01	4.905E 01	2.109E 03	6.250E 02	3.796E 04	1.480E 02	2.091E 03			
90.0	190.5	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	4.700E 04	5.484E 04
		1.716E 01	4.905E 01	2.112E 03	6.677E 02	4.164E 04	1.644E 02	2.352E 03			
100.0	211.6	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	5.080E 04	5.839E 04
		1.716E 01	4.905E 01	2.113E 03	7.053E 02	4.513E 04	1.808E 02	2.613E 03			
110.0	232.8	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	5.441E 04	6.174E 04
		1.716E 01	4.905E 01	2.113E 03	7.385E 02	4.842E 04	1.964E 02	2.874E 03			
120.0	253.9	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	5.784E 04	6.491E 04
		1.716E 01	4.905E 01	2.114E 03	7.679E 02	5.155E 04	2.120E 02	3.136E 03			
130.0	275.1	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	6.110E 04	6.7515 04
		1.716E 01	4.905E 01	2.114E 03	7.937E 02	5.450E 04	2.271E 02	3.397E 03			
134.7	285.0	0.0	0.0	0.0	0.0	0.0	0.0	2.821E-02	1.932E-01	6.257E 04	6.926E 04
		1.716E 01	4.905E 01	2.114E 03	8.047E 02	5.583E 04	2.340E 02	3.519E 03			
146.7	285.0	0.0	0.0	0.0	0.0	0.0	0.0	3.969E-05	2.257E-03	5.758E 04	5.790E 04
		8.711E-01	7.394E 00	8.533E 02	6.924E 02	5.228E 04	2.274E 02	3.518E 03			

LICENSE AMENDMENT REQUEST DATED JULY 1, 1975

EXHIBIT B

This exhibit consists of the following pages revised to incorporate the proposed Technical Specification changes:

v
vi
48
48A
115
116
116A (new page)
122
122A (new page)
122B (new page)
122C (new page)
130
131
131A (new page)
169
173
173A
176A (new page)
177A
179A
179B
189B (new page)
189C (new page)
189D (new page)
189E (new page)

LIST OF FIGURES

3.0 LIMITING CONDITIONS FOR OPERATION	4.0 SURVEILLANCE REQUIREMENTS
B. Emergency Core Cooling Subsystems Actuation When irradiated fuel is in the reactor vessel and the reactor water temperature is above 212°F, the limiting conditions for operation for the instrumentation which initiates the emergency core cooling sybsystems are given in Table 3.2.2. C. Control Rod Block Actuation The limiting conditions of operation for the instrumentation that initiates control rod block are given in Table 3.2.3. D. Air Ejector Off-Gas System 1. Except as specified in 3.2.D.2 and 3.2.D.3, both steam jet air ejector off-gas radiation monitors shall be operable during reactor power operation. The trip settings for the air ejector monitors, except as specified in 3.2.D.4, shall be set to close the recombiner train inlet valve(s) within 30 minutes at a radiation level not to exceed the equivalent of the maximum permitted stack release rate after a decay time of 120 minutes.	

3.0 LIMITING CONDITIONS FOR OPERATION	4.0 SURVEILLANCE REQUIREMENTS

2. From and after the date that one of the two steam jet air ejector off-gas radiation monitors is made or found to be inoperable, continued reactor power operation is permissible provided the inoperable radiation monitor instrument channel is tripped.

3. Upon loss of both steam jet air ejector off-gas radiation monitors, an orderly shut-down shall be initiated and the reactor shall be in cold shutdown within 24 hours.

4. If operation is necessary with the Off-Gas Holdup System recombiners bypassed, the trip settings for the air ejector monitors shall be reset to close the stack off-gas isolation valve within 15 minutes at a radiation level not to exceed the equivalent of the maximum permitted stack release rate after a decay time of 30 minutes.

3.0 LIMITING CONDITIONS FOR OPERATION

3.6 PRIMARY SYSTEM BOUNDARY

Applicability:

Applies to the operating status of the reactor coolant system.

Objective:

To assure the integrity and safe operation of the reactor coolant system.

Specification:

A. Reactor Coolant Heatup and Cooldown

1. The average rate of reactor coolant temperature change during normal heatup or cooldown shall not exceed 100°F/hr. when averaged over a one-hour period.

2. The pump in an idle recirculation loop shall not be started unless the temperature of the coolant within the idle recirculation loop is within 50°F of the reactor coolant temperature.

4.0 SURVEILLANCE REQUIREMENTS

4.6 PRIMARY SYSTEM BOUNDARY

Applicability:

Applies to the periodic examination and testing requirements for the reactor coolant system.

Objective:

To determine the condition of the reactor coolant system and the operation of the safety devices related to it.

Specification:

A. Reactor Coolant Heatup and Cooldown

During heatups and cooldowns the following temperatures shall be recorded at least every 15 minutes until 3 consecutive readings at each location are within 5 °F.

a. Reactor vessel shell adjacent to shell flange.

b. Reactor vessel bottom drain.

c. Recirculation loops A and B.

d. Reactor vessel bottom head.

3.0 LIMITING CONDITIONS FOR OPERATION

B. Reactor Vessel Temperature and Pressure

1. During in-service hydrostatic or leak testing, the reactor vessel shell temperatures specified in 4.6.B.1 shall be at or above the higher of the temperatures shown on the two curves of Figure 3.6.2 where the dashed curve, "RPV Beltline Region," is increased by the expected shift in RT_{NDT} from Figure 3.6.1.

2. During heatup by non-nuclear means (except with the reactor vessel vented), cooldown following nuclear shutdown, or low level physics tests the reactor vessel shell and fluid temperatures specified in 3.6.A shall be at or above the higher of the temperatures of Figure 3.6.3 where the dashed curve, "RPV Beltline Region," is increased by the expected shift in RT_{NDT} from Figure 3.6.1.

3. During all operation with a critical reactor, other than for low level physics tests or at times when the reactor vessel is vented, the reactor vessel shell and fluid temperatures specified in 3.6.A shall be at or above the higher of the temperatures of Figure 3.6.4 where the dashed curve, "RPV Beltline Region," is increased by the expected shift in RT_{NDT} from Figure 3.6.1.

4.0 SURVEILLANCE REQUIREMENTS

B. Reactor Vessel Temperature and Pressure

1. During in-service hydrostatic or leak testing when the vessel pressure is above 312 psig, the following temperatures shall be recorded at least every 15 minutes.

   a. Reactor vessel shell adjacent to shell flange.

   b. Reactor vessel bottom head.

2. Test specimens representing the reactor vessel, base weld, and weld heat affected zone metal shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The material sample program shall conform to ASTM E 185-66. Samples shall be withdrawn at one fourth and three fourths service life.

3. Neutron flux wires shall be installed in the reactor vessel adjacent to the reactor vessel wall at the core midplane level. The wires shall be removed and tested during the first refueling outage to experimentally verify the calculated value of neutron fluence at one fourth of the beltline shell thickness that is used to determine the NDTT shift from Figure 3.6.1.

3.0 LIMITING CONDITIONS FOR OPERATION

4. The reactor vessel head bolting studs shall not be under tension unless the temperature of the vessel head flange and the head are $\geq 70^{o}F$.

C. Coolant Chemistry

1. The steady state radioiodine concentration in the reactor coolant shall not exceed 5 microcuries of I-131 dose equivalent per gram of water.

4.0 SURVEILLANCE REQUIREMENTS

4. When the reactor vessel head studs are under tension and the reactor is in the Cold Shutdown Condition, the reactor vessel shell flange temperature shall be permanently recorded.

C. Coolant Chemistry

1. (a) A sample of reactor coolant shall be taken at least every 96 hours and

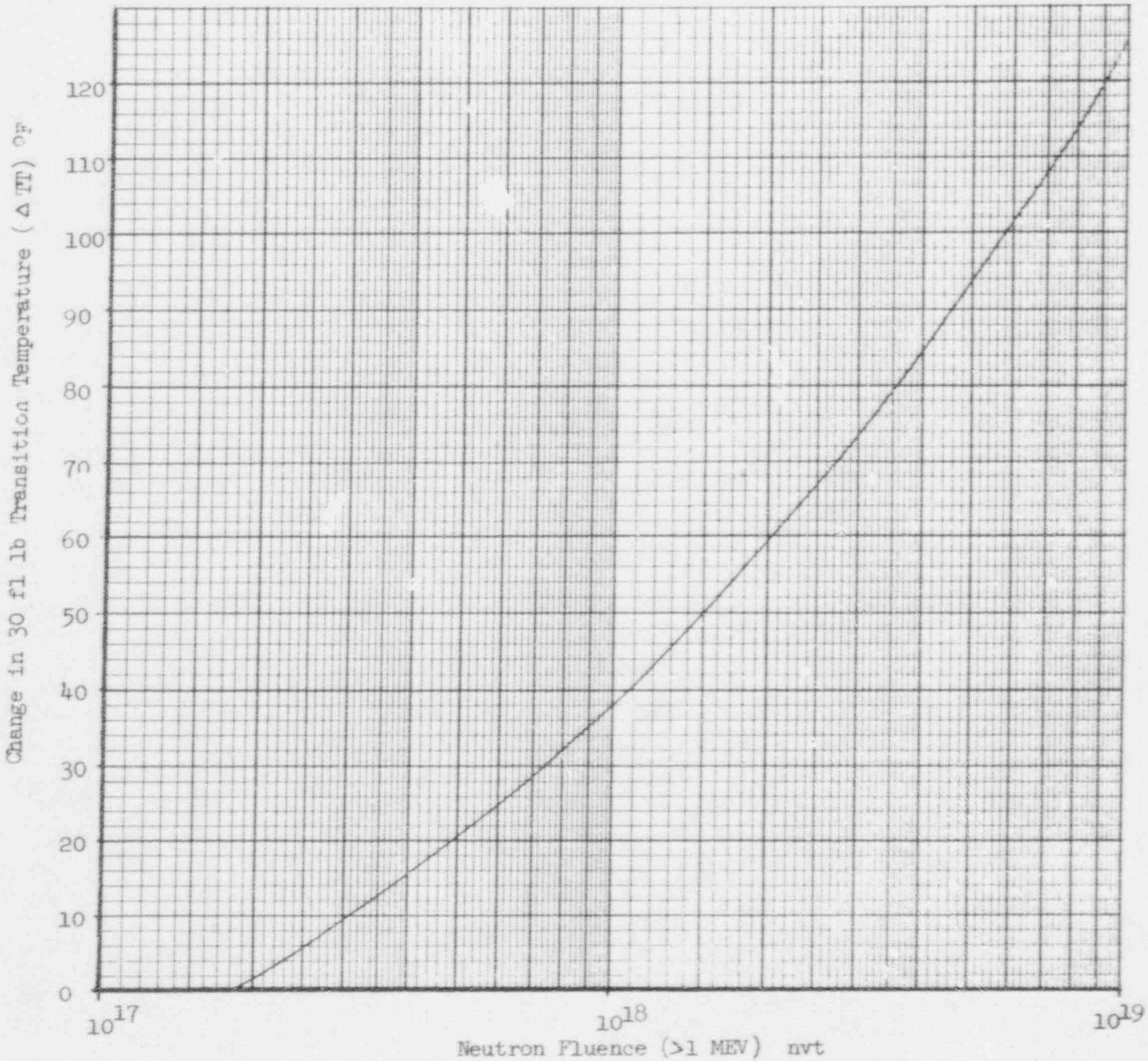


FIGURE 3.6.1 Change in Charpy V Transition Temperature versus Neutron Exposure

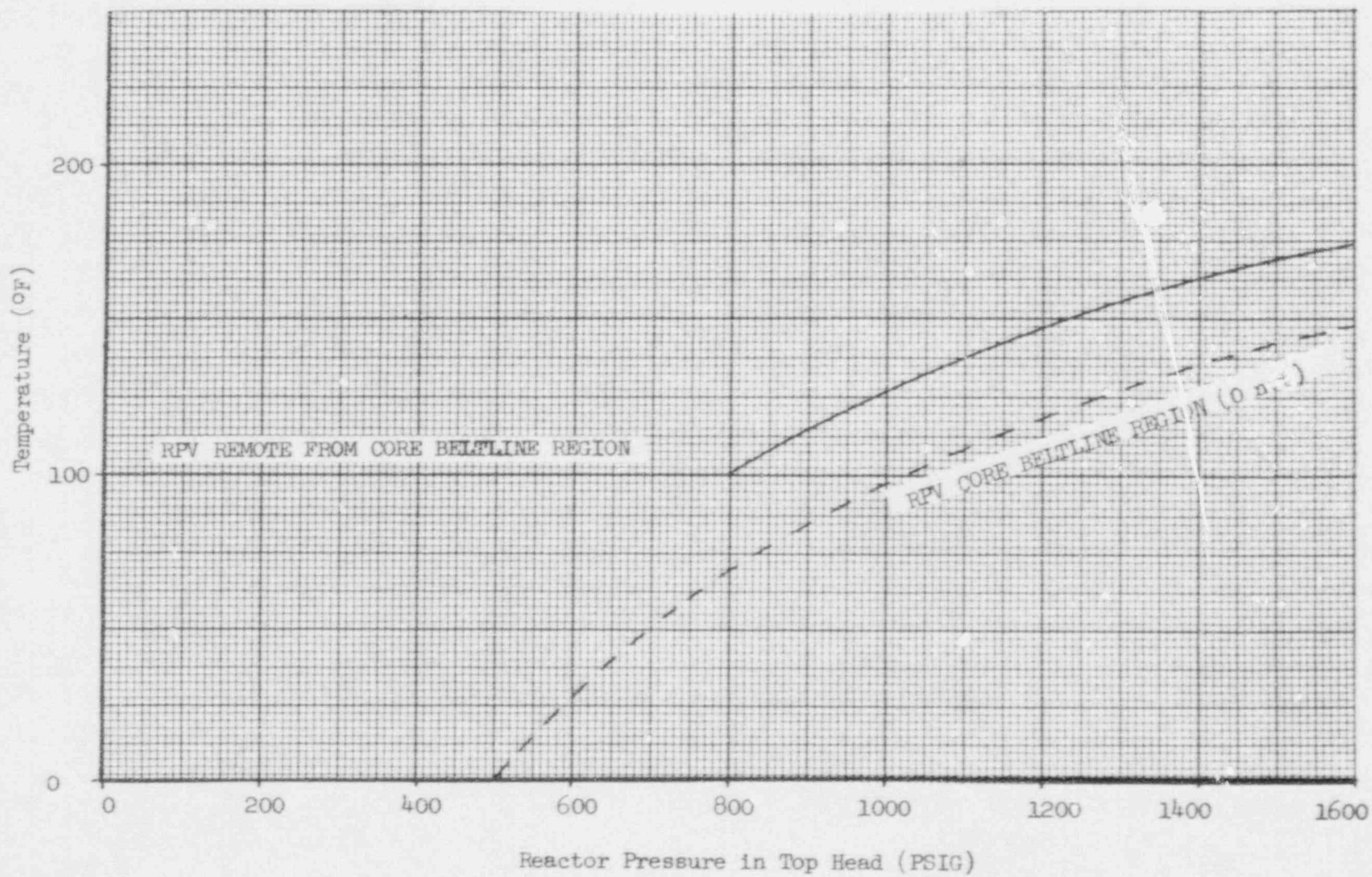


FIGURE 3.6.2 Minimum Temperature versus Pressure for Pressure Tests

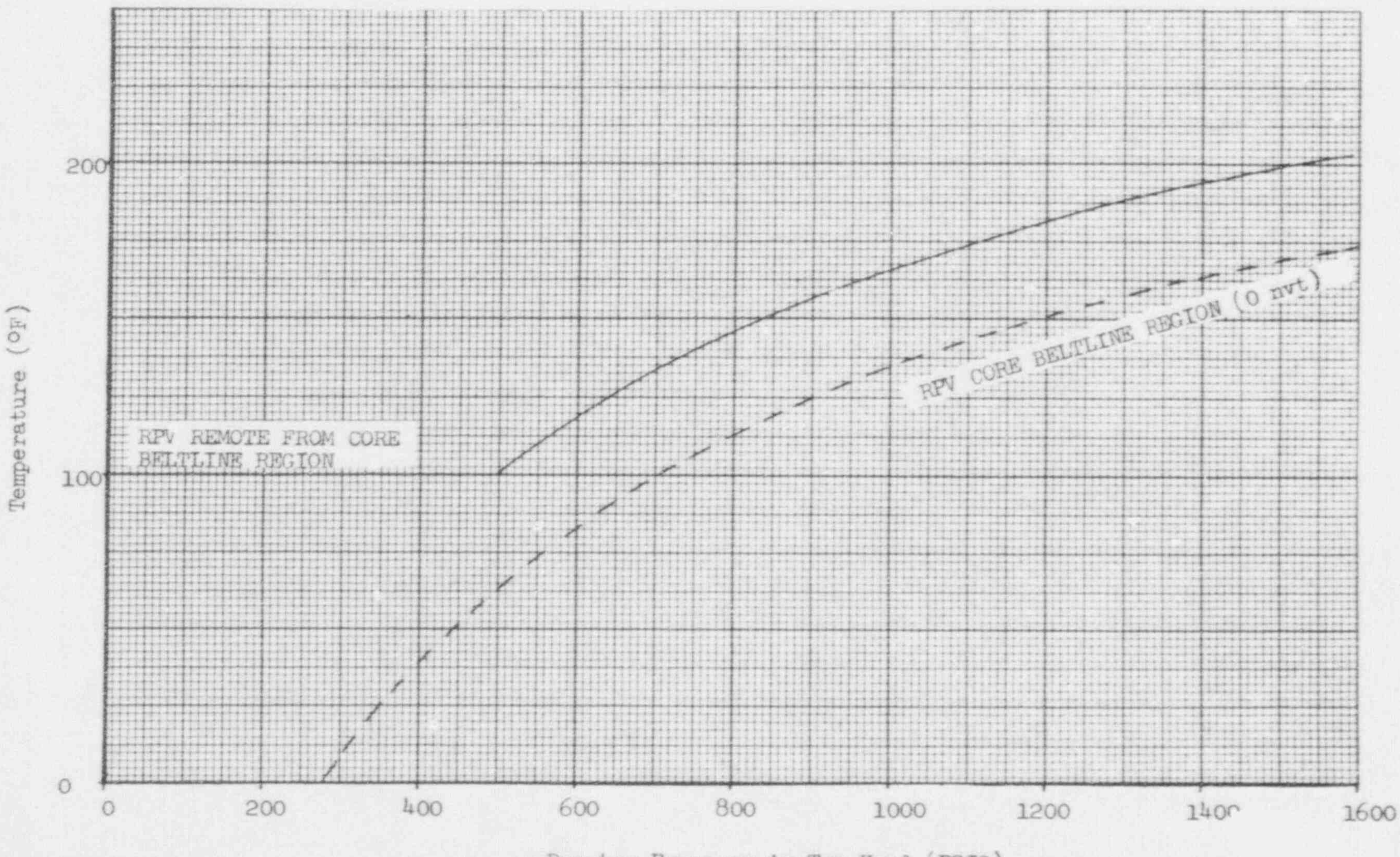


FIGURE 3.6.3 Minimum Temperature versus Pressure for Mechanical Heatup or Cooldown Following Nuclear Shutdown

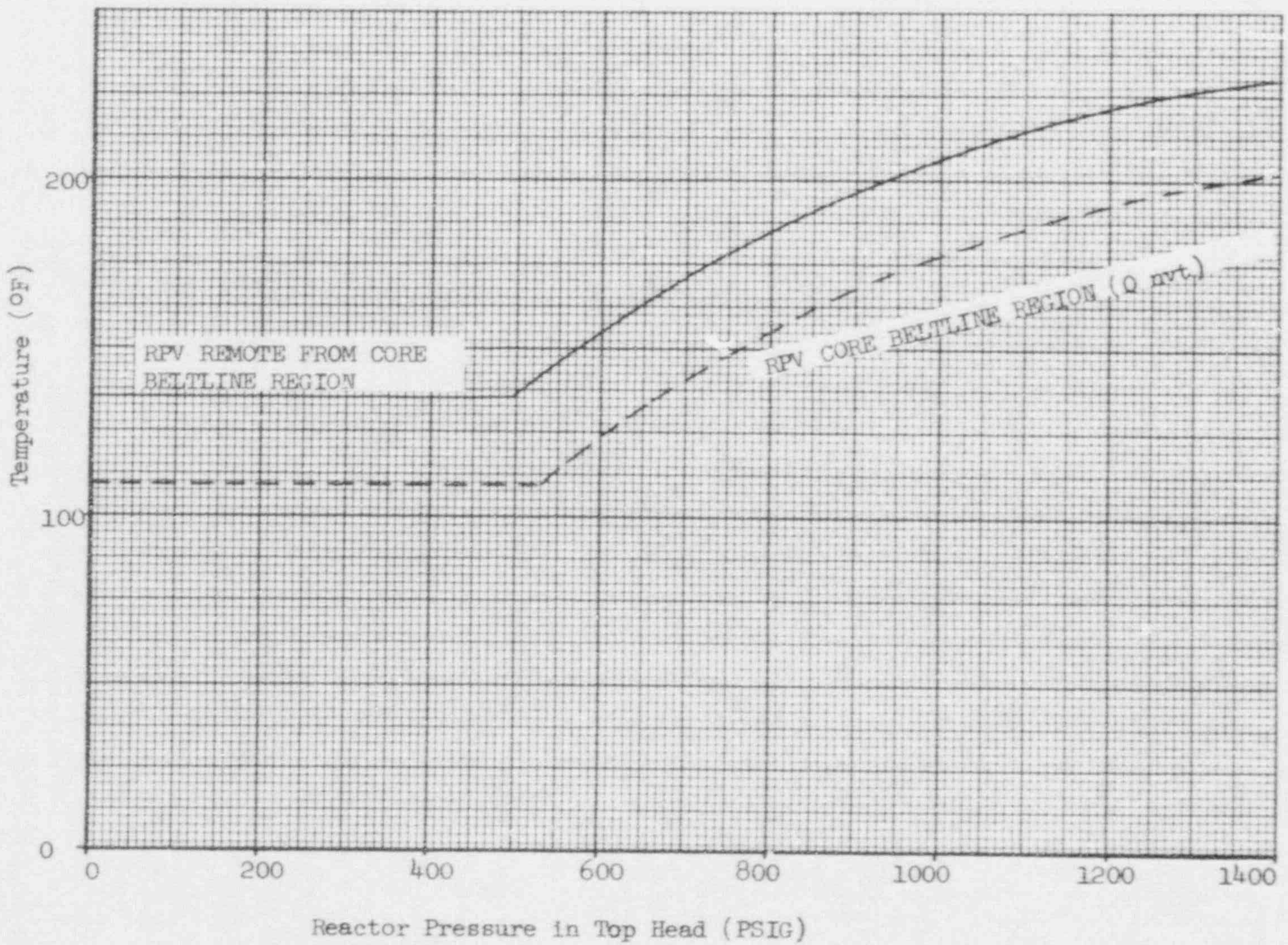


FIGURE 3.6.4 Minimum Temperature versus Pressure for Core Operation

Bases 3.6 and 4.6:

A. Reactor Coolant Heatup and Cooldown

The vessel has been analyzed for stresses caused by thermal and pressure transients. Heating and cooling transients throughout plant life at uniform rates of 100°F per hour were considered in the temperature range of 100 to 546°F and were shown to be within the requirements for stress intensity and fatigue limits of Section III of the ASME Boiler and Pressure Vessel Code.

During reactor operation, the temperature of the coolant in an idle recirculation loop is expected to remain at reactor coolant temperature unless it is valved out of service. Requiring the coolant temperature in an idle loop to be within 50°F of the reactor coolant temperature before the pump is started assures that the change in coolant temperature at the reactor vessel nozzles and bottom head region are within the conditions analyzed for the reactor vessel thermal and pressure transients.

B. Reactor Vessel Temperature and Pressure

Operating limits on the reactor vessel pressure and temperature during normal heatup and cooldown and during inservice hydrostatic testing were established using Appendix G of the Summer 1972 Addenda to Section III of the ASME Boiler and Pressure Vessel Code, 1971 Edition, as a guide. These operating limits assure that a large postulated surface flaw, having a depth of one-quarter of the material thickness, can be safely accommodated in regions of the vessel shell remote from discontinuities. For the purpose of setting these operating limits the reference temperature, RT_{NDT}, of the vessel material was estimated from impact test data taken in accordance with requirements of the Code to which this vessel was designed and manufactured (1965 Edition including Summer 1966 Addenda). Where the dropweight NDT temperature was known, the reference temperature used was the NDT temperature. Where the dropweight NDT temperature was not known, the reference temperature used was the temperature at which 30 ftlb of energy was expected to occur on the basis of reported Charpy V notch test data. For areas of the vessel shell remote from the core beltline region, the highest NDTT permitted by the vessel purchase specification for any vessel pressure boundary material is +40°F and this value is used for the RT_{NDT} in lieu of certified test results.

The fracture toughness of all ferritic steels gradually and uniformly decreases with exposure to fast neutrons above a threshold value, and it is prudent and conservative to account for this in the operation of the reactor pressure vessel. Two types of information are needed in this analysis: a) A relationship between the change in fracture toughness of the reactor pressure vessel steel and the neutron fluence (integrated neutron flux), and b) A measure of the neutron fluence at the point of interest in the reactor pressure vessel wall.

Bases 3.6 and 4.6 - Continued:

A relationship between neutron fluence and change in Charpy V notch test 30 ftlb transition temperature has been developed for SA302B/SA533 steel based on at least 35 experimental data points as shown in Figure 3.6.1. In turn this change in transition temperature can be related to a change in the temperature ordinate shown in Figure G 2110-1 in Appendix G of Section III of the ASME Boiler and Pressure Vessel Code.

The neutron fluence at any point in the pressure vessel wall can be computed from core physics data. The neutron fluence can also be measured experimentally on the inside diameter of the vessel wall. At present, valid experimental measurements can be made only over time periods of less than 5 years because of the limitations of the dosimeter materials. This causes no problem because of the exact relationship between thermal power produced and the number of neutrons produced from a given core geometry. A single experimental measurement in a time period of one year can be used to predict the fluence for the life of the plant in thermal energy output if no great changes in core geometry are made.

The vessel pressurization temperatures at any time period can be determined from the thermal energy output of the plant and its relation to the neutron fluence and from Figure 3.6.1 used in conjunction with Figure 3.6.2 (pressure tests), Figure 3.6.3 (mechanical heatup or cooldown following nuclear shutdown), or Figure 3.6.4 (operation with a critical core). During the first fuel cycle, only calculated neutron fluence values can be used. At the first refueling, neutron dosimeter wires which are installed adjacent to the vessel wall are removed to verify the calculated neutron fluence.

Figure 3.6.1 will be conservative for the Monticello reactor vessel. Reactor vessel material samples are provided, however, to verify the relationship expressed by Figure 3.6.1. Three sets of mechanical test specimens representing the base metal, weld metal, and weld heat affected zone (HAZ) metal have been placed in the vessel and can be removed and tested as required. These samples will receive neutron exposure more rapidly than the vessel wall and therefore will lead the vessel in integrated neutron flux exposure. An analysis and report will be submitted to the Commission on all such surveillance specimens removed from the reactor vessel in accordance with 10CFR50, Appendix H. These reports shall include the information specified in ASTM E-185-66, "Recommended Practices for Surveillance Tests on Structural Materials in Nuclear Reactors," and information obtained on the level of integrated fast neutron irradiation received by the specimens and actual vessel material.

The requirements for cold bolt-up of the reactor vessel closure are based on the NDT temperature plus 60°F which is derived from the requirements of the ASME Boiler and Pressure Vessel Code to which the vessel was built. The NDT temperature of the closure flanges, adjacent head and shell material, and stud material is a maximum of 10°F. The minimum temperature for bolt-up is therefore 10° + 60° = 70°F. The neutron radiation fluence at the closure flanges is well below 10^{17} n/cm^2 (E>1 MEV) and therefore radiation effects will be minor and will not influence this temperature.

1. The maximum release rates of gross radioactivity shall not exceed a rate Q, in curies/sec:

$$Q_1\left(\frac{\bar{E}_\gamma}{0.18}\right) + Q_{RS}\left(\frac{\bar{E}_\gamma}{0.028} + \frac{\bar{E}_\beta}{0.019}\right) \leq 1$$

2. The release rates of gross radioactivity shall not exceed 16 percent of the limit in Specification 3.8.A.1 averaged over any calendar quarter.

3. The maximum release rate of radioiodine 131 (I-131) shall not exceed a rate Q, in microcuries/sec:

$$\frac{Q_1}{40} + \frac{Q_{RS}}{2.7} \leq 1$$

4. The release rate of I-131 shall not exceed 4 percent of the limit in Specification 3.8.A.3 averaged over any calendar quarter.

5. The maximum release rates of radioactive particulates with half-lives greater than 8 days shall not exceed a rate Q, in microcuries/sec:

$$\frac{Q_1}{9.5\times10^9\ \overline{MPC_a}} + \frac{Q_{RS}}{2\times10^8\ \overline{MPC_a}} \leq 1$$

where $\overline{MPC_a}$ is the composite maximum permissible concentration in air in uCi/ml determined using Appendix B, Table II, Column 1 and Notes of 10 CFR 20.

1. Radioactive gases released from the off-gas stack and reactor building vent shall be continuously monitored. Station records of off-gas stack release rates of gross gaseous radioactivity shall be maintained on an hourly basis to assure that the specified rates are not being exceeded, and to yield information concerning general integrity of the fuel cladding. Records of isotopic analysis shall be maintained. The off-gas stack and reactor building vent monitoring system shall be functionally tested monthly and calibrated quarterly with an appropriate standard radiation source. Each monitor, as described, shall have a sensor check at least daily.

2. A steam jet air ejector off-gas sample shall be taken and an isotopic analysis for at least six fission product gases; Xe-138, Xe-135, Xe-133, Kr-88, Kr-85m, Kr-87 shall be made at least weekly and following each refueling or other occurrence which could alter significantly the mixture of radionuclides.

3. Two independent samples of each tank shall be taken and analyzed for gross beta-gamma activity and the valve line-up checked prior to discharge of liquid effluents.

4. If the limits of 3.8.C cannot be met, radioactive liquid effluents shall not be released.

D. Radioactive Liquid Storage

The maximum gross radioactivity in liquid storage in the Waste Sample, Floor Drain Sample, Waste Surge, and Condensate Storage Tanks shall be less than 30 curies except for tritium and dissolved noble gases. If this condition cannot be met, the liquids in these tanks shall be recycled to tanks within the radwaste facility until the condition is met.

E. Augmented Off-Gas System

1. If the hydrogen concentration in the off-gas downstream of the recombiners reaches four percent, the recombiner off-gas flow shall be stopped automatically by closing the valves upstream of the recombiners.

2. Except as specified in Specification 3.8.E.3 below, at least one hydrogen monitor downstream of each operating recombiner shall be operable during power operation.

3. The performance and results of independent samples and valve checks shall be logged.

D. Radioactive Liquid Storage

1. A sample shall be taken, analyzed, and recorded within 72 hours of each addition to a liquid waste storage tank to which Specification 3.8.D. applies.

2. If the sample analysis indicates that the total radioactivity in the liquid waste storage tanks of Specification 3.8.D exceeds 30 curies, except for tritium and dissolved noble gases, the liquids in these tanks shall be recycled to reduce the radioactivity to less than 30 curies within 24 hours of this sampling.

E. Augmented Off-Gas System

1. The hydrogen monitors shall be functionally tested monthly and calibrated quarterly with an appropriate gas mixture source. Each monitor shall have a sensor check at least daily.

2. Condenser air inleakage shall be evaluated weekly and used in conjunction with the latest steam jet air ejector off-gas isotopic analysis and Figure 4.8.1 to determine that the limit of Specification 3.8.E.4 will not be exceeded.

3.0 LIMITING CONDITIONS FOR OPERATION

3. If the above specified downstream hydrogen monitors are not operable, offgas flow to the compressed storage subsystem shall be terminated.

4. The maximum gross radioactivity contained in one gas decay tank after 12 hours hold-up that can be discharged directly to the environs shall be less than 22,000 curies of Xe-133 dose equivalent. If these conditions cannot be met, the stored radioactive gas shall be recycled within 24 hours to other gas decay tanks until the condition is met.

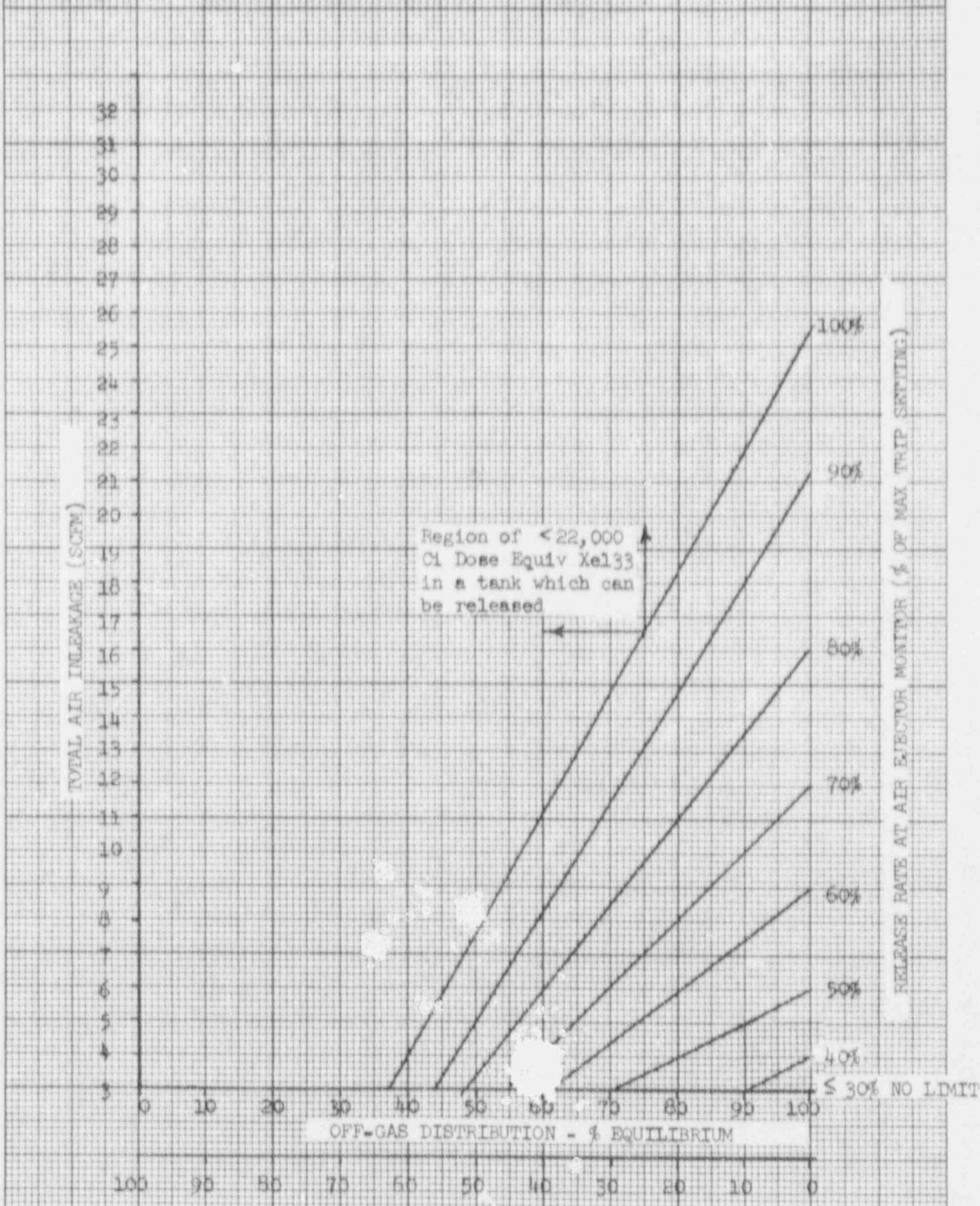
5. During normal plant operation, radioactive gaseous waste shall have a minimum holdup of 12 hours except for low radioactivity gaseous waste resulting from purge and fill operations associated with refueling and reactor startup. Holdup times for radioactive gaseous waste in the gas decay tanks shall be maximized consistent with plant operation.

4.0 SURVEILLANCE REQUIREMENTS

F. Environmental Monitoring Program

The environmental monitoring program given in Table 4.8.1 shall be conducted.

Figure 4.8.1 Off-Gas Storage Tank Gross Activity Limits



Bases Continued:

Detailed meteorological calculations for several locations off site have been made by the AEC staff and the most critical 22.5° sector was determined to be at 600 m to the south-southeast at the site boundary. The annual average diffusion parameter value for the off-gas stack release was determined to be 1.5×10^{-7} sec/m^3 and for the reactor building vent release to be 7.2×10^{-6} sec/m^3.

The method utilized by the staff to determine annual thyroid dose of 1500 mRem to a child for I-131 releases from the off-gas stack and the reactor building vent is given in Regulatory Guide 1.42. Based on this method, the maximum I-131 concentration in milk from an existing cow would occur in the NNE sector at a distance of 3700 m which has an annual average diffusion parameter value of 2.5×10^{-8} sec/m^3 for the off-gas stack and 4.3×10^{-7} sec/m^3 for the reactor building vent. Taking into account the five month grazing season, a release rate of I-131 from the off-gas stack of 40 uCi/sec or from the reactor building vent of 2.7 uCi/sec could result in an annual thyroid dose of 1500 mRem to a child drinking this milk.

In order to limit I-131 releases in the gaseous effluents to as low as practical, quarterly average release rates have been established which would require investigative actions at 2 percent of the maximum release rate and plant actions at 4 percent of the maximum release rate. These release rates are significantly below 10 CFR Part 20 limits and are factors of 2 and 4, respectively, above the as low as practical objective of 1 percent of 10 CFR Part 20 limits.

The AEC staff performed an analysis similar to that used to determine the maximum release rate of I-131 for the radioactive particulates with half-lives greater than 8 days. A reduction factor of 700 on the MPC_a to allow for possible ecological chain effects similar to those associated with the cow-milk-child thyroid for radioiodine was used. The annual average diffusion parameters at 600 m in the south-southeast sector given previously were used for both the off-gas stack and reactor building vent releases. Based on these calculations, a continuous release rate of radioactive particulates with half-lives greater than 8 days in the amount of $9.5 \times 10^9 \overline{MPC_a}$ uCi/sec from the off-gas stack or $2 \times 10^8 \overline{MPC_a}$ uCi/sec from the reactor building vent would not result in annual organ doses in excess of the limits specified in 10 CFR Part 20.

In order to limit radioactive particulate releases in gaseous effluents to as low as practical, quarterly average release rates have been established which would require investigative actions at 2 percent of the maximum release rate and plant actions at 8 percent of the maximum release rate. These release rates are significantly below 10 CFR Part 20 limits and are factors of 2 and 8, respectively, above the as low as practical objectives of 1 percent of 10 CFR Part 20 limits.

Bases continued:

Each batch to be released will conform to 10 CFR Part 20 release limits on an instantaneous basis, i.e., annual averaging will not be used as permitted by 10 CFR Part 20. See Section 9.2.3 of the FSAR. The radioactivity level in the discharge canal for a given release of waste will be the highest when the discharge canal flow is lowest. This occurs during "closed cycle" cooling tower operation at which time the cooling tower blowdown of approximately 36 cubic feet per second is the major flow in the discharge canal. The rate of pumping the radwaste effluent into the discharge canal is variable and can, therefore, be controlled to maintain the concentration within the specified limit. This type of operation will be employed only when the river flow is very low and will result in further dilution between discharge canal effluent and the river.

D. Radioactive Liquid Storage

The waste sample, floor drain sample, waste surge, and condensate storage tanks are not contained in a Class I structure. The maximum gross radioactivity in liquid storage in the specified tanks has been limited on the basis of an accidental spill from all stated tanks due to a seismic event great enough to damage them. Assuming a low recorded river flow of 1000 ft^3/sec, a day period over which the radioactive liquid wastes are diluted in the river, and consumption of the water by individuals at standard man consumption rate (3000 ml/day), the single intake by an individual would not exceed one-third the yearly intake allowable by 10 CFR Part 20 for unidentified radioisotopes (1×10^{-7} uCi/ml). The factor of 3 was applied to 10 CFR Part 20 limits as recommended for situations in which population groups could be exposed.

The sampling frequency has been established so that if the maximum amount of gross radioactivity is exceeded, action can be taken to reduce the radioactivity to a level below the specified limit.

E. Augmented Off-Gas System

The hydrogen monitors are used to detect possible hydrogen buildups which could result in a possible hydrogen explosion. Isolation of the off-gas flow would prevent the hydrogen explosion and possible damage to the augmented off-gas system.

Experience has shown that a daily check with monthly testing and quarterly calibration assures proper operation of the hydrogen monitors.

The maximum gross radioactivity in one gas decay tank has been limited on the basis that accidental release of its contents to the environs by operator error after 12 hours decay should not result in exceeding the dose equivalent to the maximum quarterly release rate specified in Specification 3.8.A.2. Staff analysis of an elevated release under accident meteorology for a minimum release period of 8 hours indicated a release of 22,000 curies of Xe-133 or the dose equivalent would result in a whole body dose of 20 mRem at the nearest site boundary.

Bases Continued:

Calculations have been performed to determine the relationship between steam jet air ejector off-gas acitivity and composition a d condenser air inleakage. These calculations were used to determine the curves presented in Figure 4.8.1. The results of the weekly measurement of condenser air inleakage and the average daily air ejector off-gas release rate are used in conjunction with the most recent off-gas isotopic analysis to determine if the maximum permitted Xe-133 dose equivalent tank radioactivity contents may be exceeded. Daily analysis is adequate to determine that if the maximum amount of gross activity in a decay tank may be exceeded, action can be taken to reduce the radioactivity to a level below the specified limit.

F. Environmental Monitoring Program

It is recognized that a precise determination of environmental dose from a certain emission from the stack is only possible by direct measurement. Such information will be provided by the environmental monitoring program conducted at and around the site. If the stack emission ever reaches a level such that it is measureable in the environment, such measurements will provide a basis for adjusting the proposed stack limit long before the effect in the environment is of any concern for permissible dose. In this regard, it is important to realize that averaging emission rate over a period of one calendar year as permitted by 10 CFR Part 20 represents a very large safety margin between conditions at any one instant (any minute, hour, or day) and the long-term dose of interest.

3.0 LIMITING CONDITIONS FOR OPERATION

3.11 SEALED SOURCE CONTAMINATION

Applicability:

Applies to each sealed source containing more than 0.1 microcurie of plutonium or other special nuclear material (including alpha radiation) and to each sealed source containing more than the exempt quantities of byproduct materials listed in 10CFR30.71.

Objective:

To assure that leakage from sealed sources containing byproduct and special nuclear radioactive materials does not exceed allowable limits.

Specification:

A. Contamination

1. Each sealed source shall be free of removable contamination in excess of 0.005 microcuries per 100% smear test.

4.0 SURVEILLANCE REQUIREMENTS

4.11 SEALED SOURCE CONTAMINATION

Applicability:

Applies to the periodic testing of sealed sources containing more than 0.1 microcurie of plutonium or other special nuclear material (including alpha radiation) and to each sealed source containing more than the exempt quantities of byproduct materials listed in 10CFR30.71.

Objective:

To verify the leak tightness of sealed radioactive sources.

Specification:

A. Contamination

1. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an agreement State, as follows:

3.0 LIMITING CONDITIONS FOR OPERATION	4.0 SURVEILLANCE REQUIREMENTS
2. Each sealed source with removable contamination in excess of the limit in 3.11.A.1 shall be immediately withdrawn from use and: a. Either decontaminated and repaired, or b. Disposed of in accordance with the regulations of the Commission	a. Each sealed source, except startup sources subject to core flux, containing radioactive material, other than Hydrogen 3, with a half-life greater than 30 days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. b. The periodic leak test required does not apply to sealed sources that are stored and not being used. The sources exempted from this test shall be tested for leakage prior to any use or transfer to another user unless they have been leak tested within six months prior to the date of use or transfer. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, sealed sources shall not be put into use until tested for leakage. c. Startup sources shall be leak tested prior to and following any repair or maintenance and before being subjected to core flux.

3.0 LIMITING CONDITIONS FOR OPERATION	4.0 SURVEILLANCE REQUIREMENTS
	2. The leakage test shall be capable of detecting the presence of 0.005 microcuries of radioactive material per 100% smear test of the sample. B. Records 1. A complete inventory of radioactive materials in possession shall be maintained current at all times. 2. The following records shall be retained for two years: a. Test results in microcuries, for tests performed pursuant to 4.11.A. b. Record of annual physical inventory verifying accountability of sources on record.

Bases 3.11 and 4.11:

The program, facilities, personnel, and procedures for safe storage, handling, and use of sealed sources containing radioactive materials is described in Supplement No. 2 to the Application for Conversion of DPR-22 to Full Term, submitted by Northern States Power Company on August 16, 1974. The surveillance program described in these specifications is a part of the program to detect and control contamination of areas in the plant by such radioactive materials.

Small quantities of byproduct materials are exempt from licensing by 10CFR30.18 and therefore are exempt from leakage tests in these specifications. Inhalation or injestion of such small quantities of byproduct materials from a sealed source would result in less than one maximum permissible body burden for total body irradiation. Sources containing less than 0.1 microcurie of plutonium are exempt from leakage tests by 10CFR70.39(c) and therefore such quantities of special nuclear materials (including alpha emitters) are exempt from leakage tests in these specifications. The acceptance criteria of less than 0.005 microcurie on the test sample is also based on 10CFR70.39(c).