WOLF CREEK NUCLEAR OPERATING CORPORATION

Wolf Creek Generating Station

Docket No: 50-482
Facility Operating License No: NPF-42

SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Report No: 14

Reporting Period: July 1, 1991 through December 31, 1991

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EXECUTIVE SUMMARY

The purpose of the Semiannual Radioactive Effluent Release Report is to report on the quantities of liquid and gaseous effluents and solid waste released from Wolf Creek Generating Station (WCGS). This report covers the period beginning on July 1, 1991, and ending on December 31, 1991.

Section I provides a summary of the quantities of radioactive liquid and gaseous effluents for this reporting period. The format is similar to that recommended in Regulatory Guide 1.21, Revision 1. An elevated release pathway does not exist at WCGS, therefore, all airborne releases are considered to be ground level releases. The concurrent meteorological condition gaseous pathway dose determination is met by the WCGS Offsite Dose Calculation Manual methodology of assigning all gaseous pathways to a hypothetical individual residing at the highest annual X/Q and D/Q location. This results in a conservative estimate of dose to a member of the public rather than determining each pathway dose for each release condition. A conservative error of thirty percent has been estimated in effluent data.

Sections II, III, and IV provide additional information required by Regulatory Guide 1.21, Revision 1 and Technical Specification 6.9.1.7.

Attachment 1 provides actual values to replace the estimated values for liquid effluents provided in Semiannual Radioactive Effluent Release Report No. 13. Analysis results for the Second Quarter of Report No. 13 were not completed prior to submission of the report. Actual results of Quarter 2 liquid effluents indicated the presence of Fe-55 in the liquid batch composite. The change increases the total curies released and increases the cumulative dose. Because analysis results for the Fourth Quarter of 1991 have not yet been completed, Fe-55 activity and doses in liquid effluents are presented as an estimate.

Offsite Dose Calculation Manual (ODCM), Revision 8, was approved by the Plant Safety Review Committee during this reporting period. This revision includes a deletion of the requirements to obtain tritium grab samples of the ventilation exhaust from the spent fuel pool area. A complete copy of the ODCM is included as Attachment 2 of this report.

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SECTION I

REPORT OF RADIOACTIVE EFFLUENTS (1991): LIQUID

	Unit	Quarter 3	Quarter 4
A. Fission and Activation Products			
1. Total Release (not including tritium, gases, alpha)	Ci	7.27E-01	9.78E-01[4]
2. Average Diluted Concentration During Period	uCi/ml	1.69E-07	1.78E-07
3. Percent of Applicable Limit[1]	%	1.45E+01	1.96E+01
B. Tritium			
1. Total Release	Ci	1.84E+02	5.12E+01
2. Average Diluted Concentration During Period	uCi/ml	4.28E-05	9.33E-06
3. Percent of Applicable Limit[2]	%	1.43E+00	3.11E-01
C. Dissolved and Entrained Gases			
1. Total Release	Ci	6.87E+00	6.66E+00
2. Average Diluted Concentration During Period	uCi/ml	1.60E-05	1.21E-06
3. Percent of Applicable Limit[3]	%	8.00E-01	6.05E-01
D. Gross Alpha Radioactivity			
1. Total Release	Ci	2.74E-05	1.84E-05
E. Volume of waste released (prior to dilution)	liters	3.70E+06	1.90E+07
F. Volume of dilution water used	liters	4.30E+09	5.47E+09

[1] The applicable limit for the Wolf Creek Generating Station is 5 Curies per year. (Reference 10 CFR 50, Appendix I, "Guides On Design Objectives For Light-Water-Cooled Nuclear Power Reactors", paragraph A.2.) The value printed here is derived by dividing the total release Curies by 5 Curies and then multiplying the result by 100.

[2] This value is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})\ (100)}{(\text{MPC, Appendix B, Table II 10CFR20})}$$

[3] This value is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})\ (100)}{(\text{2E-4 from ODCM Section 2.1})}$$

[4] 6.62E-01 of the 9.78E-01 Curies in Quarter 4 are due to Fe-55 estimated from the Quarter 3 Composite results.

LIQUID EFFLUENTS

NUCLIDES RELEASED	Unit	Continuous Mode Quarter 3	Continuous Mode Quarter 4	Batch Mode Quarter 3	Batch Mode Quarter 4
H-3	Ci	1.66E-02	7.01E-02	1.84E+02	5.11E+01
Be-7	Ci	0.00E+00	0.00E+00	0.00E+00	2.75E-03
Na-24	Ci	0.00E+00	0.00E+00	0.00E+00	5.50E-04
Cr-51	Ci	0.00E+00	0.00E+00	4.97E-03	3.92E-02
Mn-54	Ci	<1.21E-03	<8.71E-03	7.96E-03	2.30E-03
Fe-55	Ci	<2.42E-03	<1.74E-02	5.27E-01	6.62E-01[1]
Fe-59	Ci	<1.21E-03	<8.71E-03	2.60E-04	3.77E-03
Co-57	Ci	0.00E+00	0.00E+00	9.48E-04	1.16E-03
Co-58	Ci	<1.21E-03	<8.71E-03	3.08E-02	5.45E-02
Co-60	Ci	<1.21E-03	<8.71E-03	1.30E-01	6.98E-02
Zn-65	Ci	<1.21E-03	<8.71E-03	9.61E-05	<8.07E-04
Sr-89	Ci	<1.21E-04	<8.71E-04	9.12E-05	1.15E-04[1]
Sr-90	Ci	<1.21E-04	<8.71E-04	<6.42E-05	<8.07E-05
Sr-92	Ci	0.00E+00	0.00E+00	1.13E-04	0.00E+00
Nb-95	Ci	0.00E+00	0.00E+00	7.36E-04	1.54E-03
Nb-97	Ci	0.00E+00	0.00E+00	2.02E-06	0.00E+00
Zr-95	Ci	0.00E+00	0.00E+00	4.61E-04	6.96E-04
Zr-97	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mo-99	Ci	<1.21E-03	<8.71E-03	<6.42E-04	<8.07E-04
Tc-99M	Ci	0.00E+00	0.00E+00	1.53E-04	2.08E-05
Ru-103	Ci	0.00E+00	0.00E+00	4.13E-04	5.65E-04
Ag-110M	Ci	0.00E+00	0.00E+00	4.08E-03	1.76E-04
Sn-113	Ci	0.00E+00	0.00E+00	1.76E-04	8.53E-05
Sn-117M	Ci	0.00E+00	0.00E+00	1.70E-04	2.77E-04
Sb-124	Ci	0.00E+00	0.00E+00	1.40E-03	8.65E-03
Sb-125	Ci	0.00E+00	0.00E+00	9.26E-03	2.84E-02
Sb-126	Ci	0.00E+00	0.00E+00	1.01E-04	1.44E-05
I-131	Ci	<2.42E-03	<1.74E-02	9.56E-04	2.06E-03
Cs-134	Ci	<1.21E-03	<8.71E-03	2.31E-03	4.58E-02
Cs-136	Ci	0.00E+00	0.00E+00	0.00E+00	1.91E-04
Cs-137	Ci	<1.21E-03	<8.71E-03	3.45E-03	4.96E-02
Ba-139	Ci	0.00E+00	0.00E+00	8.71E-04	2.46E-03
La-140	Ci	0.00E+00	0.00E+00	1.08E-04	3.47E-04
Ce-141	Ci	<1.21E-03	<8.71E-03	7.63E-05	2.99E-04
Ce-144	Ci	<1.21E-03	<8.71E-03	3.49E-04	1.62E-04
Hf-181	Ci	0.00E+00	0.00E+00	0.00E+00	1.65E-05
Np-239	Ci	0.00E+00	0.00E+00	2.32E-05	0.00E+00
Gross Alpha	Ci	<2.42E-04	<1.74E-03	2.74E-05	1.84E-05
Ar-41	Ci	<2.42E-02	<1.74E-01	<1.28E-02	<1.61E-02
Kr-85M	Ci	<2.42E-02	<1.74E-01	8.29E-05	<1.61E-02

LIQUID EFFLUENTS
CONTINUED

NUCLIDES RELEASED	Unit	Continuous Mode Quarter 3	Continuous Mode Quarter 4	Batch Mode Quarter 3	Batch Mode Quarter 4
Kr-85	Ci	<2.42E-02	<1.74E-01	7.66E-01	1.89E-01
Kr-87	Ci	<2.42E-02	<1.74E-01	<1.28E-02	<1.61E-02
Kr-88	Ci	<2.42E-02	<1.74E-01	<1.28E-02	<1.61E-02
Xe-131M	Ci	<2.42E-02	<1.74E-01	1.21E-01	2.19E-01
Xe-133M	Ci	<2.42E-02	<1.74E-01	2.74E-02	8.51E-03
Xe-133	Ci	<2.42E-02	<1.74E-01	5.94E+00	6.24E+00
Xe-135M	Ci	<2.42E-02	<1.74E-01	<1.28E-02	<1.61E-02
Xe-135	Ci	<2.42E-02	<1.74E-01	6.90E-03	<1.61E-02

NOTE: Less than values are calculated using the lower limit of detection (LLD) values listed in Table 2-1 of the ODCM multiplied by the volume of waste discharged during the respective quarter. The less than values are not included in the summation for the total release values.

[1] The Fe-55 and Sr-89 values for Quarter 4 are based on the Quarter 3 Composite results.

LIQUID CUMULATIVE DOSE SUMMARY (1991)
TABLE 1

	ODCM CALCULATED DOSE	ODCM[1] LIMIT	% OF LIMIT
QUARTER 1 OF 1991			
TOTAL DOSE (mrem) FOR BONE	3.33E-03	5.00E+00	6.66E-02
TOTAL DOSE (mrem) FOR LIVER	1.77E-02	5.00E+00	3.54E-01
TOTAL DOSE (mrem) FOR TOTAL BODY	1.61E-02	1.50E+00	1.07E+00
TOTAL DOSE (mrem) FOR THYROID	1.27E-02	5.00E+00	2.54E-01
TOTAL DOSE (mrem) FOR KIDNEY	1.42E-02	5.00E+00	2.84E-01
TOTAL DOSE (mrem) FOR LUNG	1.35E-02	5.00E+00	2.70E-01
TOTAL DOSE (mrem) FOR GI-LLI	1.55E-02	5.00E+00	3.10E-01
QUARTER 2 OF 1991			
TOTAL DOSE (mrem) FOR BONE	7.79E-03	5.00E+00	1.56E-01
TOTAL DOSE (mrem) FOR LIVER	3.78E-02	5.00E+00	7.56E-01
TOTAL DOSE (mrem) FOR TOTAL BODY	3.42E-02	1.50E+00	2.28E+00
TOTAL DOSE (mrem) FOR THYROID	2.84E-02	5.00E+00	5.68E-01
TOTAL DOSE (mrem) FOR KIDNEY	3.04E-02	5.00E+00	6.08E-01
TOTAL DOSE (mrem) FOR LUNG	3.07E-02	5.00E+00	6.14E-01
TOTAL DOSE (mrem) FOR GI-LLI	5.07E-02	5.00E+00	1.01E+00
QUARTER 3 OF 1991			
TOTAL DOSE (mrem) FOR BONE	1.47E-01	5.00E+00	2.94E+00
TOTAL DOSE (mrem) FOR LIVER	3.13E-01	5.00E+00	6.26E+00
TOTAL DOSE (mrem) FOR TOTAL BODY	2.46E-01	1.50E+00	1.64E+01
TOTAL DOSE (mrem) FOR THYROID	7.75E-02	5.00E+00	1.55E+00
TOTAL DOSE (mrem) FOR KIDNEY	1.45E-01	5.00E+00	2.90E+00
TOTAL DOSE (mrem) FOR LUNG	9.26E-02	5.00E+00	1.85E+00
TOTAL DOSE (mrem) FOR GI-LLI	1.87E-01	5.00E+00	3.74E+00
QUARTER 4 OF 1991			
TOTAL DOSE (mrem) FOR BONE	5.36E-01	5.00E+00	1.07E+01
TOTAL DOSE (mrem) FOR LIVER	9.88E-01	5.00E+00	1.98E+01
TOTAL DOSE (mrem) FOR TOTAL BODY	7.44E-01	1.50E+00	4.96E+01
TOTAL DOSE (mrem) FOR THYROID	4.05E-02	5.00E+00	8.10E-01
TOTAL DOSE (mrem) FOR KIDNEY	3.47E-01	5.00E+00	6.94E+00
TOTAL DOSE (mrem) FOR LUNG	1.41E-01	5.00E+00	2.82E+00
TOTAL DOSE (mrem) FOR GI-LLI	1.38E-01	5.00E+00	2.76E+00
TOTAL FOR 1991			
TOTAL DOSE (mrem) FOR BONE	6.94E-01	1.00E+01	6.94E+00
TOTAL DOSE (mrem) FOR LIVER	1.36E+00	1.00E+01	1.36E+01
TOTAL DOSE (mrem) FOR TOTAL BODY	1.04E+00	3.00E+00	3.47E+01
TOTAL DOSE (mrem) FOR THYROID	1.59E-01	1.00E+01	1.59E+00
TOTAL DOSE (mrem) FOR KIDNEY	5.37E-01	1.00E+01	5.37E+00
TOTAL DOSE (mrem) FOR LUNG	2.78E-01	1.00E+01	2.78E+00
TOTAL DOSE (mrem) FOR GI-LLI	3.91E-01	1.00E+01	3.91E+00

[1] Based on ODCM Section 2.2 which restricts dose to the whole body to less than or equal to 1.5 mrem per quarter and 3.0 mrem per year. Dose restriction to any organ is less than or equal to 5 mrem per quarter and 10 mrem per year.

NOTE: The values for Quarters 1 and 2 of 1991 given above differ from the values reported in Semiannual Radioactive Effluent Release Report No. 13 due to adjustment for Fe-55 and Sr-90 composite data.

LIQUID CUMULATIVE DOSE SUMMARY (1991)
TABLE 2

A. Fission and Activation Products (not including H-3, gases, alpha)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
1. Total Release - (Ci)	9.03E-02	7.17E-01	7.27E-01	9.78E-01	2.51E+00
2. Maximum Organ Dose (mrem)	5.00E-03	2.23E-02	2.39E-01	9.48E-01	1.21E+00
3. Organ Dose Limit (mrem)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
4. Percent of Limit	1.00E-01	4.46E-01	4.78E+00	1.90E+01	1.21E+01
B. Tritium					
1. Total Release (Ci)	1.25E+02	3.57E+02	1.84E+02	5.12E+01	7.17E+02
2. Maximum Organ Dose (mrem)	1.27E-02	2.84E-02	7.39E-02	4.04E-02	1.55E-01
3. Organ Dose Limit (mrem)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
4. Percent of Limit	2.54E-01	5.68E-01	1.48E+00	8.08E-01	1.55E+00

This table is included to show the correlation between Curies released and the associated calculated maximum organ dose. WCGS ODCM methodology is used to calculate the maximum organ dose which assumes that an individual drinks the water and eats fish from the discharge point. ODCM Section 2.2 organ dose limits are used.

NOTE: The Quarter 4 Category A values were calculated based on the Quarter 3 Fe-55 concentration.

REPORT OF RADIOACTIVE EFFLUENTS (1991): AIRBORNE

	Unit	Quarter 3	Quarter 4
A. Fission and Activation Gases			
1. Total Release	Ci	8.40E+02	1.68E+03
2. Average Release Rate for Period	uCi/sec	1.04E+05	2.90E+02
3. Percent of ODCM Limit[1]	%	6.30E-01	1.28E+00
B. Iodines			
1. Total Iodine-131	Ci	2.02E-03	3.73E-04
2. Average Release Rate for Period	uCi/sec	3.62E-04	4.70E-05
3. Percent of Applicable Limit[2]	%	2.02E-01	3.73E-02
C. Particulates			
1. Particulates with Half-lives > 8 days	Ci	3.46E-07	1.66E-06
2. Average Release Rate for Period	uCi/sec	4.36E-07	2.08E-07
3. Percent of ODCM Limit[3]	%	2.44E-06	1.17E-05
4. Gross Alpha Radioactivity	Ci	1.30E-08	0.00E+00
D. Tritium			
1. Total Release	Ci	2.82E+00	4.71E+00
2. Average Release Rate for Period	uCi/sec	8.56E-01	5.98E-01
3. Percent of ODCM Limit[4]	%	2.68E-02	4.48E-02

[1] The percent of ODCM limit for fission and activation gases is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Qtrly Total Beta Airdose})(100)}{10 \text{ mrad}} \text{ or } \frac{(\text{Qtrly Total Gamma Airdose})(100)}{5 \text{ mrad}}$$

The largest value calculated between Gamma and Beta airdose is listed as the % of ODCM Limit.

[2] The percent of ODCM limit for iodine is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Total Curies of Iodine-131})(100)}{1 \text{ Curie}}$$

[3] The percent of ODCM limit for particulates is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Highest Organ Dose Due to Particulates})(100)}{7.5 \text{ mrem}}$$

[4] The percent of ODCM limit for tritium is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Highest Organ Dose Due to H-3})(100)}{7.5 \text{ mrem}}$$

NOTE: This type of methodology is used since the ODCM ties release limits to doses rather than Curie release rates.

GASEOUS EFFLUENTS

NUCLIDES RELEASED	Unit	Continuous Mode Quarter 3	Continuous Mode Quarter 4	Batch Mode Quarter 3	Batch Mode Quarter 4
1. Fission and Activation Gases					
Ar-41	Ci	0.00E+00	0.00E+00	4.49E-01	0.00E+00
Kr-85	Ci	0.00E+00	0.00E+00	1.54E+01	7.29E+01
Kr-85M	Ci	3.20E-01	0.00E+00	1.02E-03	0.00E+00
Kr-87	Ci	<4.57E+01	<4.53E+01	4.93E-06	<6.80E+00
Kr-88	Ci	6.14E-01	<3.41E+01	7.46E-05	<5.11E+00
Xe-131M	Ci	8.21E-01	1.18E+01	7.70E+00	3.34E+01
Xe-133	Ci	3.67E+02	9.98E+01	4.38E+02	1.46E+03
Xe-133M	Ci	1.93E+00	<5.08E+01	2.54E+00	5.51E+00
Xe-135	Ci	5.20E+00	<4.19E+00	3.76E-01	<6.29E-01
Xe-135M	Ci	0.00E+00	0.00E+00	5.00E-04	0.00E+00
Xe-138	Ci	<9.58E+01	<9.51E+01	<1.36E+00	<1.43E+01
Total	Ci	3.76E+02	1.12E+02	4.64E+02	1.57E+03
2. Halogens (Gaseous)					
I-131	Ci	1.93E-03	3.73E-04	9.15E-05	<3.93E-06
I-133	Ci	1.27E-04	<2.62E-02	1.60E-09	<3.93E-04
Total	Ci	2.06E-03	3.73E-04	9.15E-05	0.00E+00
3. Particulates and Tritium					
H-3	Ci	2.39E+00	4.18E+00	4.27E-01	5.29E-01
Mn-54	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Fe-59	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Co-58	Ci	<2.64E-03	1.66E-06	3.46E-07	<3.93E-05
Co-60	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Zn-65	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Mo-99	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Cs-134	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Cs-137	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Ce-141	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Ce-144	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Sr-89	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Sr-90	Ci	<2.64E-03	<2.62E-03	<3.76E-05	<3.93E-05
Gross Alpha	Ci	1.30E-08	<2.62E-03	<3.76E-05	<3.93E-05
Total	Ci	2.39E+00	4.18E+00	4.27E-01	5.29E-01

NOTE: Less than values for Noble Gases are calculated using the lower limit of detection (LLD) values obtained at WCGS multiplied by the volume of air discharged during the respective quarter. For the Halogens and Particulates the ODCM LLD values are used.

GASEOUS CUMULATIVE DOSE SUMMARY (1991)
Table 1

	ODCM CALCULATED DOSE	ODCM[1] LIMIT	% OF LIMIT
QUARTER 1 OF 1991			
TOTAL DOSE (mrem) FOR BONE	1.13E-05	7.50E+00	1.51E-04
TOTAL DOSE (mrem) FOR LIVER	2.93E-03	7.50E+00	3.91E-02
TOTAL DOSE (mrem) FOR TOTAL BODY	2.93E-03	7.50E+00	3.91E-02
TOTAL DOSE (mrem) FOR THYROID	2.93E-03	7.50E+00	3.91E-02
TOTAL DOSE (mrem) FOR KIDNEY	2.93E-03	7.50E+00	3.91E-02
TOTAL DOSE (mrem) FOR LUNG	2.93E-03	7.50E+00	3.91E-02
TOTAL DOSE (mrem) FOR GI-LLI	2.93E-03	7.50E+00	3.91E-02
QUARTER 2 OF 1991			
TOTAL DOSE (mrem) FOR BONE	1.69E-04	7.50E+00	2.25E-03
TOTAL DOSE (mrem) FOR LIVER	2.51E-03	7.50E+00	3.35E-02
TOTAL DOSE (mrem) FOR TOTAL BODY	2.42E-03	7.50E+00	3.23E-02
TOTAL DOSE (mrem) FOR THYROID	3.69E-03	7.50E+00	4.92E-02
TOTAL DOSE (mrem) FOR KIDNEY	2.44E-03	7.50E+00	3.25E-02
TOTAL DOSE (mrem) FOR LUNG	2.41E-03	7.50E+00	3.21E-02
TOTAL DOSE (mrem) FOR GI-LLI	2.40E-03	7.50E+00	3.20E-02
QUARTER 3 OF 1991			
TOTAL DOSE (mrem) FOR BONE	3.51E-03	7.50E+00	4.68E-02
TOTAL DOSE (mrem) FOR LIVER	5.12E-03	7.50E+00	6.83E-02
TOTAL DOSE (mrem) FOR TOTAL BODY	3.60E-03	7.50E+00	4.80E-02
TOTAL DOSE (mrem) FOR THYROID	1.16E+00	7.50E+00	1.55E+01
TOTAL DOSE (mrem) FOR KIDNEY	7.37E-03	7.50E+00	9.83E-02
TOTAL DOSE (mrem) FOR LUNG	1.61E-03	7.50E+00	2.15E-02
TOTAL DOSE (mrem) FOR GI-LLI	1.93E-03	7.50E+00	2.57E-02
QUARTER 4 OF 1991			
TOTAL DOSE (mrem) FOR BONE	6.56E-04	7.50E+00	8.75E-03
TOTAL DOSE (mrem) FOR LIVER	4.43E-03	7.50E+00	5.91E-02
TOTAL DOSE (mrem) FOR TOTAL BODY	4.15E-03	7.50E+00	5.53E-02
TOTAL DOSE (mrem) FOR THYROID	2.17E-01	7.50E+00	2.89E+00
TOTAL DOSE (mrem) FOR KIDNEY	4.85E-03	7.50E+00	6.47E-02
TOTAL DOSE (mrem) FOR LUNG	3.76E-03	7.50E+00	5.01E-02
TOTAL DOSE (mrem) FOR GI-LLI	3.84E-03	7.50E+00	5.12E-02
TOTALS FOR 1991			
TOTAL DOSE (mrem) FOR BONE	4.35E-03	1.50E+01	2.90E-02
TOTAL DOSE (mrem) FOR LIVER	1.50E-02	1.50E+01	1.00E-01
TOTAL DOSE (mrem) FOR TOTAL BODY	1.31E-02	1.50E+01	8.73E-02
TOTAL DOSE (mrem) FOR THYROID	1.38E+00	1.50E+01	9.20E+00
TOTAL DOSE (mrem) FOR KIDNEY	1.76E-02	1.50E+01	1.17E-01
TOTAL DOSE (mrem) FOR LUNG	1.07E-02	1.50E+01	7.13E-02
TOTAL DOSE (mrem) FOR GI-LLI	1.11E-02	1.50E+01	7.40E-02

[1] Based on ODCM Section 3.2.2 which restricts dose during any calender quarter to less than or equal to 7.5 mrem to any organ and during any calender year to less than or equal to 15 mrem to any organ.

GASEOUS CUMULATIVE DOSE SUMMARY (1991)
TABLE 2

	Nuclides Released	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
A.	Fission and Activation Gases					
1.	Total Release (Ci)	5.36E+01	4.21E+02	8.40E+02	1.68E+03	2.99E+03
2.	Total Gamma Airdose (mrad)	3.55E-03	1.10E-02	2.18E-02	3.90E-02	7.54E-02
3.	Gamma Airdose Limit (mrad)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
4.	Percent of Gamma Airdose Limit	7.10E-02	2.20E-01	4.36E-01	7.80E-01	7.54E-01
5.	Total Beta Airdose (mrad)	4.57E-03	3.16E-02	6.30E-02	1.28E-01	2.27E-01
6.	Beta Airdose Limit (mrad)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
7.	Percent of Beta Airdose Limit (mrad)	4.57E-02	3.16E-01	6.30E-01	1.28E+00	1.14E+00
B.	Particulates					
1.	Total Particulates (Ci)	4.12E-07	2.77E-06	3.46E-07	1.66E-06	5.19E-06
2.	Maximum Organ Dose (mrem)	1.13E-05	1.65E-04	1.83E-07	8.77E-07	1.77E-04
3.	Organ Dose Limit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
4.	Percent of Limit	1.51E-04	2.20E-03	2.44E-06	1.17E-05	1.18E-03
C.	Tritium					
1.	Total Release (Ci)	4.12E+00	3.36E+00	2.82E+00	4.71E+00	1.50E+01
2.	Maximum Organ Dose (mrem)	2.93E-03	2.40E-03	2.01E-03	3.36E-03	1.07E-02
3.	Organ Dose Limit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
4.	Percent of Limit	3.91E-02	3.20E-02	2.68E-02	4.48E-02	7.13E-02
D.	Iodine					
1.	Total I-131, I-133 (Ci)	0.00E+00	2.25E-06	2.15E-03	3.73E-04	2.53E-03
2.	Maximum Orgar Dose (mrem)	0.00E+00	1.29E-03	1.16E+00	2.13E-01	1.37E+00
3.	Organ Dose L.mit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
4.	Percent of Limit	0.00E+00	1.72E-02	1.55E+01	2.84E+00	9.13E+00

This table is included to show the correlation between Curies released and the associated calculated maximum organ dose. The maximum organ dose is calculated using ODCM methodology which assumes that an individual actually resides at the release point. ODCM Section 3.2.2 organ dose limits are used.

SECTION II

Supplemental Information

Facility: Wolf Creek Generating Station License Number: NPF-42

1. ODCM Limits

A. For liquid waste effluents

A.1 The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to the concentrations specified in 10CFR20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microCurie/ml total activity.

A.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and
b. During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

B. For gaseous waste effluents

B.1 The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the whole body and less than or equal to 3000 mrems/yr to the skin, and
b. For Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

B.2 The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and
b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

B.3 The dose from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and

b. During any calendar year: Less than or equal to 15 mrems to any organ.

2. Maximum Permissible Concentrations

Water - covered in Section 1.A.
Air - covered in Section 1.B.

3. Average energy of fission and activation gaseous effluents is not applicable.

4. Measurements and Approximations of Total Radioactivity

A. Liquid Effluents

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	METHOD OF ANALYSIS	TYPE OF ACTIVITY ANALYSIS
1. Batch Waste Release Tanks	P Each Batch	P.H.A.	Principal Gamma Emmiters
		P.H.A.	I-131
a. Waste Monitor Tank	P One Batch/M	P.H.A.	Dissolved and Entrained Gases (Gamma Emitters)
b. Secondary Liquid Waste Monitor Tank	P Each Batch	L.S.	H-3
		S.A.C.	Gross Alpha
	P Each Batch	O.S.L.	Sr-89, Sr-90
		O.S.L.	Fe-55
2. Continous Releases	Daily Grab Sample	P.H.A.	Principal Gamma Emitters
		P.H.A.	I-131
a. Steam Generator Blowdown	M Grab Sample	P.H.A.	Dissolved and Entrained Gases (Gamma Emitters)
b. Turbine Building Sump	Daily Grab Sample	L.S.	H-3
		S.A.C.	Gross Alpha
c. Lime Sludge Pond	Daily Grab Sample	O.S.L.	Sr-89, Sr-90
		O.S.L.	Fe-55

P = prior to each batch
M = monthly
L. S. = liquid scintillation
P.H.A. = gamma spectrum pulse height analysis using a High Purity Germanium detector.
S.A.C. = scintillation alpha counter
O.S.L. = performed by an offsite laboratory

B. Gaseous Waste Effluents

GASEOUS, RELEASE TYPE	SAMPLING FREQUENCY	METHOD OF ANALYSIS	TYPE OF ACTIVITY ANALYSIS
Waste Gas Decay Tank	P Each Tank Grab Sample	P.H.A.	Principal Gamma Emitters
Containment Purge or Vent	P Each Purge Grab Sample	P.H.A. Gas Bubbler and L.S.	Principal Gamma Emitters H-3 (oxide)
Unit Vent	M Grab Sample	P.H.A. Gas Bubbler and L.S.	Principal Gamma Emitters H-3 (oxide)
Radwaste Building Vent	M Grab Sample	P.H.A.	Principal Gamma Emitters
For Unit Vent and Radwaste Building Vent release types listed above.	Continuous	P.H.A.	I-131 I-133
	Continuous	P.H.A. Particulate Sample	Principal Gamma Emitters
	Continuous Composite	S.A.C. Particulate Sample	Gross Alpha
	Continuous	O.S.L. Composite Particulate Sample	Sr-89, Sr-90

5. Batch Releases

There were 44 gaseous batch releases during the reporting period. The longest gaseous batch release lasted 9,800 minutes, while the shortest lasted 20 minutes. The average release lasted 3085 minutes with a total gaseous batch release time of 135,748 minutes.

There were 83 liquid batch releases during the reporting period. The longest liquid batch release lasted 175 minutes, while the shortest lasted 21 minutes. The average release lasted 115 minutes with a total liquid batch release time of 9,522 minutes.

6. Continuous Releases

There were two liquid release pathways designated as continuous releases during this reporting period. They were the Steam Generator Blowdown and Turbine Building Sump. There were two gas release pathways designated as continuous releases. These were the Unit Vent and Radwaste Building Vent.

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1991)
SOLID WASTE SHIPMENTS

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	Unit	6-Month Period	Est. Total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m3*	4.70E+00	
	Ci	9.38E+00	2.50E+01
b. Dry compressible waste, contaminated equip. etc.	m3*	5.67E+01	
	Ci	4.30E+00	2.50E+01
c. Irradiated components, control rods, etc.	m3*	0.00E+00	
	Ci	0.00E+00	0.00E+00
d. Other	m3*	0.00E+00	
	Ci	0.00E+00	0.00E+00

m3* = cubic meters

2. Estimate of major nuclide composition (by type of waste)

a. Spent resins, filter sludges, evaporator bottoms, etc.

Nuclide Name	Percent Abundance	Curies
Fe-55	38.284%	3.59E+00
Ni-63	23.124%	2.17E+00
Co-60	17.623%	1.65E+00
Co-58	9.233%	8.66E-01
Cs-137	4.232%	3.97E-01
Cs-134	3.387%	3.18E-01
Mn-54	1.310%	1.23E-01
Sb-125	1.226%	1.15E-01
H-3	.864%	8.10E-02
C-14	.717%	6.73E-02
Cm-242	.000%	0.00E+00
Pu-241	.000%	0.00E+00
I-129	.000%	0.00E+00
Tc-99	.000%	0.00E+00
Sr-90	.000%	0.00E+00
Nb-94	.000%	0.00E+00
Ni-59	.000%	0.00E+00

b. Dry compressible waste, contaminated equipment, etc.
none

Nuclide Name	Percent Abundance	Curies
Fe-55	61.417%	2.[illegible]E+00
Co-60	24.050%	1.03E+00
Ni-63	7.602%	3.27E-01
Nb-9[illegible]	1.556%	6.69E-02
Co-58	1.554%	6.68E-02
Cs-137	1.483%	6.37E-02
Mn-54	1.362%	5.85E-02
Cs-134	.917%	3.94E-02
H-3	.053%	2.28E-03
C-14	.007%	2.86E-04
Cm-242	.000%	0.00E+00
Pu-241	.000%	0.00E+00
I-129	.000%	0.00E+00
Tc-99	.000%	0.00E+00
Sr-90	.000%	0.00E+00
Nb-94	.000%	0.00E+00
Ni-50	.000%	0.00E+00

c. Irradiated components, control rods, etc.
none

d. Other
none

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
6	Truck	Barnwell, South Carolina
8	Truck	Richland, Washington

4. Class of Solid Waste
a. Class A
b. Class A
c. Not applicable
d. Not applicable

5. Type of Container
a. LSA (Strong, tight)
b. LSA (Strong, tight)
c. Not applicable
d. Not applicable

6. Solidification Agent
   a. Not applicable
   b. Not applicable
   c. Not applicable
   d. Not applicable

B. IRRADIATED FUEL SHIPMENTS (Disposition)

There were no irradiated fuel shipments during this reporting period.

SECTION III

HOURS AT EACH WIND SPEED AND DIRECTION

All gaseous releases at the Wolf Creek Generating Station are ground level releases. The meteorological data supplied in these tables cover the period from January 1, 1991, through December 31, 1991, and indicate the number of hours at each wind speed and direction for each stability class.

STABILITY CLASS: A ELEVATION: 10 METERS

WIND DIRECTION	WIND SPEED (MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	1	3	0	1	0	5
S	0	0	10	5	2	0	17
SSW	0	0	7	14	4	0	25
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	1	1	0	0	2
WNW	0	0	1	1	0	0	2
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	1	22	21	7	0	51

Periods of Calm (Hours): 0

STABILITY CLASS: B ELEVATION: 10 METERS
WIND SPEED (MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	5	7	1	0	15
NNE	0	1	1	3	0	0	5
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	1	2	0	0	0	3
SE	0	3	1	0	0	0	4
SSE	0	7	8	10	0	0	25
S	0	0	61	43	14	2	120
SSW	1	2	39	39	10	1	92
SW	0	1	7	2	0	0	10
WSW	0	0	4	8	0	0	12
W	0	0	5	1	0	0	6
WNW	0	0	1	9	5	1	16
NW	0	0	1	1	2	4	8
NNW	0	0	5	10	1	2	18
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	17	140	133	33	10	334

Periods of Calm (Hours): 0

STABILITY CLASS: C ELEVATION: 10 METERS
WIND SPEED (MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	1	1	0	0	2
NNE	0	1	2	1	0	0	4
NE	0	0	0	0	0	0	0
ENE	0	0	2	0	0	0	2
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	2	1	0	0	0	3
SSE	0	1	4	0	0	0	5
S	0	2	13	11	2	1	29
SSW	0	0	5	2	2	0	9
SW	0	0	2	3	0	0	5
WSW	0	0	0	0	1	0	1
W	0	0	0	1	1	0	2
WNW	0	0	1	5	1	1	8
NW	0	0	2	1	0	2	5
NNW	0	0	5	3	0	0	8
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	6	38	28	7	4	83

Periods of Calm (Hours): 0

STABILITY CLASS: D ELEVATION: 10 METERS

WIND SPEED (MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	29	67	40	3	1	143
NNE	1	29	40	14	3	1	88
NE	1	25	13	7	0	0	46
ENE	1	8	12	3	1	0	25
E	1	9	31	7	0	0	48
ESE	4	13	37	4	0	0	58
SE	1	15	33	2	1	0	52
SSE	0	21	89	20	1	2	133
S	1	32	287	124	40	4	488
SSW	3	26	98	37	9	0	173
SW	2	8	23	7	4	0	44
WSW	4	12	17	6	5	1	45
W	6	21	23	9	11	0	70
WNW	0	16	34	44	7	1	102
NW	1	6	26	29	6	3	71
NNW	0	17	35	46	17	0	115
VARIABLE	0	0	0	0	0	0	0
TOTAL	29	287	865	399	108	13	1701

Periods of Calm (Hours): 3

STABILITY CLASS: E ELEVATION: 10 METERS
WIND SPEED (MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	25	182	83	2	1	0	293
NNE	29	94	47	3	0	0	173
NE	45	84	12	0	0	0	141
ENE	22	68	26	0	0	0	116
E	14	104	59	2	1	0	180
ESE	16	140	43	2	0	0	201
SE	23	100	57	2	0	0	182
SSE	27	205	164	39	6	4	445
S	19	313	339	76	15	4	766
SSW	9	164	138	6	1	0	318
SW	9	70	23	4	0	0	106
WSW	18	58	24	3	0	0	103
W	12	65	38	1	0	1	117
WNW	13	52	50	11	0	1	127
NW	4	76	75	10	4	0	169
NNW	22	150	90	11	0	0	273
VARIABLE	0	0	0	0	0	0	0
TOTAL	307	1925	1268	172	28	10	3710

Periods of Calm (Hours): 119

STABILITY CLASS: F ELEVATION: 10 METERS

WIND DIRECTION	WIND SPEED (MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	40	70	9	0	1	0	120
NNE	35	48	2	0	0	0	85
NE	34	19	1	0	0	0	54
ENE	40	42	7	0	0	0	89
E	34	65	11	0	0	0	110
ESE	31	48	3	0	1	0	83
SE	20	50	4	0	0	0	74
SSE	55	100	24	2	0	0	181
S	48	124	36	1	0	0	209
SSW	21	59	10	0	0	0	90
SW	24	17	3	0	0	0	44
WSW	28	23	3	1	0	0	55
W	41	29	0	0	0	0	70
WNW	24	12	4	1	0	0	41
NW	18	33	7	0	0	0	58
NNW	38	45	17	0	0	0	100
VARIABLE	0	0	0	0	0	0	0
TOTAL	531	784	141	5	2	0	1463

Periods of Calm (Hours): 18

STABILITY CLASS: G ELEVATION: 10 METERS

WIND SPEED (MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	22	27	3	0	0	1	53
NNE	22	21	1	0	0	0	44
NE	14	7	1	0	0	0	22
ENE	2	22	4	0	0	0	28
E	13	27	3	0	0	0	43
ESE	6	13	2	0	0	0	21
SE	15	15	1	0	0	0	31
SSE	44	32	1	0	0	0	77
S	41	28	1	0	0	0	70
SSW	9	17	1	0	0	0	27
SW	10	3	0	0	0	^	13
WSW	3	1	0	0	0	0	4
W	11	8	0	0	0	0	19
WNW	14	5	0	0	0	0	19
NW	12	4	0	0	0	0	16
NNW	25	13	3	0	0	0	41
VARIABLE	0	0	0	0	0	0	0
TOTAL	263	243	21	0	0	1	528

Periods of Calm (Hours): 9

STABILITY CLASS: All ELEVATION: 10 METERS

WIND DIRECTION	WIND SPEED (MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	90	310	168	50	6	2	626
NNE	87	194	93	21	3	1	399
NE	94	135	27	7	0	0	263
ENE	65	140	51	3	1	0	260
E	62	205	104	9	1	0	381
ESE	57	215	87	6	1	0	366
SE	59	185	97	4	1	0	346
SSE	126	367	293	71	8	6	871
S	109	499	747	260	73	11	1699
SSW	43	268	298	98	26	1	734
SW	45	99	38	16	4	0	222
WSW	53	94	48	18	6	1	220
W	70	123	67	13	12	1	286
WNW	51	85	91	71	13	4	315
NW	35	119	111	41	12	9	327
NNW	85	225	155	70	18	2	555
VARIABLE	0	0	0	0	0	0	0
TOTAL	1131	3263	2495	758	185	38	7870

Periods of Calm (Hours): 149

Hours of Missing Data: 741

A plant computer changeout occurred in April 1991. The meteorological data could not be retrieved through the new system. The data being presented has been obtained through strip charts from April-December. The high number of missing hours has been attributed to the malfunctioning of the strip chart recorders.

SECTION IV

Additional Information

1. Unplanned or Abnormal Releases

On July 9, 1991, an unplanned release from Waste Gas Decay Tanks 2 and 3 occurred during sampling for a Nuclear Regulatory Commission Radiochemistry Confirmation Measurement cross check. The gas was released inside the Radwaste Building; however, because Radwaste Building Effluent Monitor GH RE-010B was out-of-service for calibration, the gas discharge was not monitored. Review of the indication on Gas Decay Tank Discharge Radioactivity Monitor GH RE-023 and the results of a grab sample, back calculations of gas activity, and ventilation flow rates, revealed that the gas discharged through the vent was well below specified release limits. This event resulted from the use of a poorly designed water trap consisting of a glass vacuum flask with a rubber stopper in the top. When the pressure became too great in the flask, the stopper was dislodged allowing the gas to escape. The water trap has been replaced.

On July 31, 1991, an unplanned release from Waste Gas Decay Tank 5 occurred while placing the "A" Hydrogen Recombiner in service. Subsequent calculations revealed that the released dose rate was 13.3 percent of the instantaneous release dose rate limit. The leakage was identified as possibly occurring from a relief valve on the gas analyzer rack. When the Waste Gas System is run on recirculation with the rack on standby, a small leak is sometimes present from the relief valve. This is not the case when the rack is lined up to the system. Actions have been initiated to repair the valve.

On September 26, 1991, a radioactive waste stream had been releasing for 21 minutes when it was discovered that the original dilution flow of 40,000 gallons per minute (gpm) was not available, only 20,000 gpm was available. The release was immediately suspended. It was later determined that the release, based on the dilution of 20,000 gpm, resulted in a maximum permissible concentration (MPC) factor of 0.66 which is 66 percent of the limit of 1 MPC.

2. Offsite Dose Calculation Manual (ODCM)

Offsite Dose Calculation Manual, Revision 8, was approved this reporting period by the Plant Safety Review Committee (PSRC) with subsequent Director Plant Operations approval on December 4, 1991. The revision included the deletion of the requirement to obtain tritium grab samples of the ventilation exhaust from the spent fuel pool area. The sample is not necessary because the exhaust goes through the unit vent which also requires a tritium grab sample but with greater frequency. As required by Technical Specification 6.14, a complete, legible copy of the entire ODCM is provided as Attachment 2.

3. Major Changes to Radwaste Treatment Systems

The following three changes were identified as being permanent changes which would alter the capacity of handling radioactive wastes or differ in the method of treatment. Therefore, these changes are considered major changes to Radwaste Treatment Systems. The information following each change description is required by ODCM Section 7.2.c which requires a justification for the change, 10 CFR 50.59 summary, and a comparison of projected effluents and doses prior to and resulting from the change.

I. Updated Safety Analysis Report (USAR) Change Request 91-053
Offsite Processing of Dry Wastes

This USAR Change Request provides for the option of collecting dry waste in a vendor's container (e.g., 8 foot x 8 foot x 20 foot sea van) with subsequent shipment offsite for processing and disposal.

a) Controls are used for the placement of wastes into the container, performance of radiation monitoring around the container, and inspection/surveillance of the container for possible leakage or deterioration. There is no increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the USAR; there is no possibility that an accident or malfunction of equipment important to safety of a different type than any evaluated previously in the USAR may be created; and the margin of safety as defined in the basis for any Technical Specification is not reduced.

b) Offsite processing of dry wastes is more efficient than the current practice of compacting dry wastes at Wolf Creek Generating Station (WCGS). The vendor has the capability of reducing waste volume by a factor of about 10, compared to onsite volume reduction by a factor of approximately 5.

c) This option uses a Department of Transportation/Nuclear Regulatory Commission approved radwaste container. It is a non-safety related prefabricated steel container, coated with anti-rust paint. Two of these containers are stored outside the radwaste building, within the radiation control area, for a residence time from several days to a few months. Once a container is filled, it is sealed and transported to the appropriate offsite processing facility.

d) The quantity of solid waste leaving the facility remains unchanged.

e) Because of the nature of the waste (dry, low-level contamination), it represents a negligible radiological hazard, if any. The radiological releases to the environment during normal conditions including anticipated normal occurrences, are expected to be negligible and within the limits of 10 CFR 20 and 10 CFR 50, Appendix I. No significant effects on air and water quality are expected.

f) The radiological releases to the environment during normal condtions including anticipated normal occurrences, remain unchanged.

g) Routine operational practices for handling radioactive waste in accordance with the Wolf Cr[illegible] enerating Station Health Physics Program and procedures mai..ain occupational exposures As Low As Reasonably Achievable (ALARA). No change to occupational exposures is expected.

h) USAR Change Request 91-053 (Safety Evaluation 91-0009) was reviewed and approved by the PSRC on August 28, 1991, meeting #486.

II. USAR Change Request 90-082
Use of Portable Radwaste Processing Skid

A temporary modification for the use of a vendor's portable radwaste processing skid was reviewed and approved by the PSRC on September 9, 1987. This temporary modification provided an optional method of processing liquid radwaste through the use of either the originally installed waste evaporator package or a vendor-provided portable demineralizer skid. Although the portable skid has remained as a temporary modification to the plant configuration, it is intended to [illegible]e a primary subsystem for the processing of liquid radwaste and therefore constitutes a major change to the Liquid Radwaste Treatment System. Because the portable radwaste processing skid has been in use since 1987, the comparisons described hereafter include actual data after the change instead of projections.

a) The use of this equipment in processing liquid radwastes does not introduce or create a new release path to the environment. Pressure integrity of the vendor's equipment maintains and does not weaken the pr[illegible]sure boundary of the plant's permanent liquid radwaste piping systems. Isolation valves exist to isolate the vendors skid from the plants permanent piping.

A rupture of the boron recycle holdup tank, primary evaporators bottoms tank, and the refueling water storage tank is evaluated in the USAR. These evaluations encompass all possible accident consequences created by the use of the additional radwaste processing equipment.

The procedure governing liquid radwaste processing with the vendor equipment addresses valve lineups, operator actions in controlling and monitoring tank levels, pressure drops across filters, and operation of pumps. [illegible]e procedure also addresses actions to be taken if there is a leak detected which includes suspension of processing, isolation of leakage, and utilizing cautions described in the WCGS Radiation Protection Manual.

Based on the evaluation completed for this modification: There is no increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the USAR; there is no possibility that an accident or malfunction of equipment important to safety of a different type than any evaluated previously in the USAR may be created; and the margin of safety as defined in the basis for any Technical Specification is not reduced.

b) Use of the portable radwaste processing skid stemmed from a concern over the large volume of solidified evaporator concentrates generated during the initial year of operation of WCGS. The use of portable demineralizers to clean up radwaste streams rather than the use of evaporators was found to be most effective in reducing the volume of solid radwaste generated. The solid radwaste from the Liquid Waste Processing System was substantially reduced to 164 cubic feet of spent demineralizer resins per year, this is less than five percent of the waste volume of 3450 cubic feet of solidified evaporator concentrates per year prior to the change.

c) This modification consists of flanges installed at the feeder header of the waste evaporator package and one for return to the waste evaporator condensate demineralizer. The vendor-provided demineralizer skid consists of one 60 cubic foot filter tank, four 30 cubic foot demineralizer vessels, one booster pump and associated piping.

d) The annual average activity of waste effluent released after the change was determined to be six times the estimated activity in the USAR. Iron and cobalt accounted for 70 percent of the activity of effluent after the change while the release in the USAR estimate is predominated by cesium and iodine, nuclides of serious significance to offsite doses.

e) The radioactive materials in the liquid effluents after the change have not resulted in an increase in the cumulative doses to the individual's whole body and organs (except GI-LLI) at the UNRESTRICTED AREA compared to the previously estimated doses in the USAR, although the activities of Tritium and nuclides of corrosion and activation products have increased. The dose (0.8 mRem/yr) to the GI is 4.7 times that of the USAR estimate. Additionally, the annual dose to the thyroid after the change is only five percent of the USAR estimate while the dose to the whole body and other organs are 50 percent of the corresponding USAR dose.

f) The annual average activity of waste effluent released after the change is only 67 percent of the release activity prior to the change. The cumulative exposure doses after the change are higher than those prior to the change. However, these doses are still a small percent of the 10 CFR 50, Appendix I limit (i.e. 12 percent of the 3 mRem/yr whole body dose and 1 5 percent of the 10 mRem/yr organ dose).

g) Exposure to plant operating personnel went down considerably. For the full year prior to the change, exposures resulting from solidification of the evaporator bottoms was 1.64 PERSON-REM. The first full year following the change resulting from the use of the Duratek skid was 0.42 PERSON-REM with 0.08 PERSON-REM for each of the years after.

h) USAR Change Request 90-082 (Safety Evaluation 91-0038) was reviewed and approved by the PSRC on September 11, 1991, meeting #488.

III. Plant Modification Request (PMR) 03484
Segmented Shield for Dewatering Resins

This modification involves segregating different types of resin to reduce the number of Type "B" Radioactive Waste shipments and uses a movable segmented shield for radiation protection of personnel during dewatering of spent resins in the shipping casks.

a) In the event of a spill of resin slurring or decant water, existing curbs or temporary barriers will contain the liquid release. Additionally, this change does not affect any equipment important to safety. There is no increase in the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the USAR; there is no possibility that an accident or malfunction of equipment important to safety of a different type than any evaluated previously in the USAR may be created; and the margin of safety as defined in the basis for any Technical Specification is not reduced.

b) Changes to 10 CFR 71, "Transportation and Packaging of Radioactive Material", will result in nearly doubling the number of Type "B" shipments which in turn results in exceeding the storage capacity of Type "B" waste at Wolf Creek Generating Station (WCGS). The number of Type "B" shipment can be reduced by segregating Chemical & Volume Control System (CVCS) resins from the less radioactive (Type "A") waste resins. Presently, WCGS's primary resins are made up of two main sources; radwaste liquid processing and the more radioactive CVCS. These two are both sluiced to the spent resin storage tank (SRST) where they decay awaiting shipment. Segregation into separate storage tanks can result in a substantial cost savings (approximately $445.00 per cubic foot) and would allow WCGS to maintain adequate resin storage capacity.

c) WCGS's current storage capability for primary resin is approximately 292 cubic feet. The segmented shield provides an additional and separate storage location where resin could be sluiced directly. The shield is to be located in the Drum Storage Building. The shield weighs approximately 54,000 pounds. Equipment used for current dewatering operations remains unchanged and is subject to their original requirements.

d) The quantity of solid waste remains the same, only segregation of the different types of resins is involved.

e) Maximum exposures to a member of the public in the UNRESTRICTED AREA and to the general population remains unchanged.

f) The releases of radioactive materials remains the same, only segregation of these materials is involved.

g) Use of the segmented shield reduces exposure to plant operating personnel.

h) PMR 3483, Revision 0, (Safety Evaluation 91-0083) was reviewed and approved by the PSRC on October 15, 1991, meeting #492L.

4. Land Use Census

There were no new locations for dose calculations identified during this report period.

5. Radioactive Shipments

There were fourteen shipments of radioactive radwaste during this report period. Six shipments were to Barnwell, South Carolina, the remaining eight shipments were to Richland, Washington.

6. Inoperability of Effluent Monitoring Instrumentation

There were no events that involved inoperable liquid or gaseous effluent monitoring instrumentation not being corrected within the time specified in ODCM Sections 2.4 or 3.4, respectively.

7. Storage Tanks

There were no events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specifications 3.11.1.4 or 3.11.2.6.

ATTACHMENT 1

Attachment 1 provides actual values to replace the estimated values for liquid effluents provided in Semiannual Radioactive Effluent Release Report No. 13. New values are denoted by bold face type.

SECTION I

REPORT OF RADIOACTIVE EFFLUENTS (1991): LIQUID

		Unit	Quarter 1	Quarter 2
A.	Fission and Activation Products			
1.	Total Release (not including tritium, gases, alpha)	Ci	9.03E-02	**7.17E-01**[4]
2.	Average Diluted Concentration During Period	uCi/ml	4.68E-10	**3.87E-09**
3.	Percent of Applicable Limit (1)	%	1.81E+00	**1.43E+01**
B.	Tritium			
1.	Total Release	Ci	1.25E+02	3.57E+02
2.	Average Diluted Concentration During Period	uCi/ml	6.48E-07	1.93E-06
3.	Percent of Applicable Limit (2)	%	2.16E-02	6.43E-02
C.	Dissolved and Entrained Gases			
1.	Total Release	Ci	4.74E-03	8.07E+00
2.	Average Diluted Concentration During Period	uCi/ml	2.46E-11	4.36E-08
3.	Percent of Applicable Limit (3)	%	1.23E-05	2.18E-02
D.	Gross Alpha Radioactivity			
1.	Total Release	Ci	0.00E+00	0.00E+00
E.	Volume of waste released (prior to dilution)	liters	3.51E+07	5.52E+07
F.	Volume of dilution water used	liters	1.93E+11	1.85E+11

1. The applicable limit for the Wolf Creek Generating Station is 5 Curies per year. (Reference 10 CFR 50, Appendix I, "Guides On Design Objectives For Light-Water-Cooled Nuclear Power Reactors", paragraph A.2.) The value printed here is derived by dividing the total release Curies by 5 Curies and then multiplying the result by 100.

2. This value is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})\ (100)}{(\text{MPC, Appendix B, Table II 10CFR20})}$$

3. This value is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})\ (100)}{(\text{2E-4 from ODCM Section 2.1})}$$

4. **5.56E-01** of the **7.17E-01** Curies in Quarter 2 are due to Fe-55.

LIQUID EFFLUENTS

NUCLIDES RELEASED	Unit	Continuous Mode Quarter 1	Continuous Mode Quarter 2	Batch Mode Quarter 1	Batch Mode Quarter 2
H-3	Ci	6.51E-02	1.67E-01	1.25E+02	3.57E+02
Cr-51	Ci	0.00E+00	0.00E+00	8.59E-05	1.60E-04
Mn-54	Ci	<1.73E-02	<2.71E-02	6.41E-04	7.01E-03
Fe-55	Ci	<3.47E-02	<5.42E-02	7.98E-02	**5.56E-01**[1]
Fe-59	Ci	<1.73E-02	<2.71E-02	<1.90E-04	<5.23E-04
Co-57	Ci	0.00E+00	0.00E+00	5.52E-05	8.03E-04
Co-58	Ci	<1.73E-02	<2.71E-02	2.26E-03	1.54E-02
Co-60	Ci	<1.73E-02	<2.71E-02	5.07E-03	1.14E-01
Zn-65	Ci	<1.73E-02	<2.71E-02	<1.90E-04	2.18E-05
Sr-89	Ci	<1 73E-03	<2.71E-02	<1.90E-05	<5.23E-05
Sr-90	Ci	<1.73E-03	<2.71E-02	**<1.90E-05**	**<5.23E-05**[1]
Sr-92	Ci	0.00E+00	0.00E+00	1.03E-05	1.01E-04
Nb-95	Ci	0.00E+00	0.00E+00	1.02E-04	8.30E-04
Zr-95	Ci	0.00E+00	0.00E+00	4.50E-05	0.00E+00
Zr-97	Ci	0.00E+00	0.00E+00	0.00E+00	1.90E-05
Mo-99	Ci	<1.73E-03	<2.71E-02	<1.90E-04	<5.23E-04
Ag-110M	Ci	0.00E+00	0.00E+00	1.40E-04	6.49E-03
Sn-113	Ci	0.00E+00	0.00E+00	0.00E+00	9.31E-05
Sn-117M	Ci	0.00E+00	0.00E+00	0.00E+00	1.32E-05
Sb-125	Ci	0.00E+00	0.00E+00	1.41E-03	1.50E-02
I-131	Ci	<3.47E-02	<5.42E-02	<3.80E-04	<1.05E-03
Cs-134	Ci	<1.73E-02	<2.71E-02	2.65E-04	3.76E-04
Cs-137	Ci	<1.73E-02	<2.71E-02	3.68E-04	7.82E-04
Ce-141	Ci	<1.73E-02	<2.71E-02	<1.90E-04	<5.23E-04
Ce-144	Ci	<1.73E-02	<2.71E-02	<1.90E-04	<5.23E-04
Gross Alpha	Ci	<3.47E-03	<5.42E-03	<3.80E-05	<1.05E-04
Ar-41	Ci	<3.47E-01	<5.42E-01	<3.80E-03	<1.05E-02
Kr-85M	Ci	<3.47E-01	<5.42E-01	<3.80E-03	<1.05E-02
Kr-85	Ci	<3.47E-01	<5.42E-01	<3.80E-03	6.10E-01
Kr-87	Ci	<3.47E-01	<5.42E-01	<3.80E-03	<1.05E-02
Kr-88	Ci	<3.47E-01	<5.42E-01	<3.80E-03	<1.05E-02
Xe-131M	Ci	<3.47E-01	<5.42E-01	<3.80E-03	9.97E-02
Xe-133M	Ci	<3.47E-01	<5.42E-01	<3.80E-03	2.28E-02
Xe-133	Ci	<3.47E-01	<5.42E-01	4.74E-03	7.33E+00
Xe-135M	Ci	<3.47E-01	<5.42E-01	<3.80E-03	<1.05E-02
Xe-135	Ci	<3.47E-01	<5.42E-01	<3.80E-03	3.38E-05

NOTE: Less than values are calculated using the lower limit of detection (LLD) values listed in Table 2-1 of the ODCM multiplied by the volume of waste discharged during the respective quarter. The less than values are not included in the summation for the total release values.

[1] The Fe-55 and Sr-90 values for the 2nd Quarter are based on the 1st Quarter Composite results. **Estimated values for Quarter 2 have now been replaced with actual test results. Additionally, note change to Sr-90 for Quarter 1 due to vendor results on a retest of sample received after Report No. 13 was submitted.**

LIQUID CUMULATIVE DOSE SUMMARY (1991)
TABLE 1

	ODCM CALCULATED DOSE	ODCM[1] LIMIT	% OF LIMIT
QUARTER 1 OF 1991			
TOTAL DOSE (mrem) FOR BONE	**3.33E-03**	5.00E+00	**6.66E-02**
TOTAL DOSE (mrem) FOR LIVER	1.77E-02	5.00E+00	3.54E-01
TOTAL DOSE (mrem) FOR TOTAL BODY	**1.61E-02***	1.50E+00	**1.07E+00***
TOTAL DOSE (mrem) FOR THYROID	1.27E-02	5.00E+00	2.54E-01
TOTAL DOSE (mrem) FOR KIDNEY	1.42E-02	5.00E+00	2.84E-01
TOTAL DOSE (mrem) FOR LUNG	1.35E-02	5.00E+00	2.70E-01
TOTAL DOSE (mrem) FOR GI-LLI	**1.55E-02***	5.00E+00	**3.10E-01***
QUARTER 2 OF 1991			
TOTAL DOSE (mrem) FOR BONE	**7.79E-03**	5.00E+00	**1.56E-01**
TOTAL DOSE (mrem) FOR LIVER	**3.78E-02**	5.00E+00	**7.56E-01**
TOTAL DOSE (mrem) FOR TOTAL BODY	**3.42E-02**	1.50E+00	**2.28E+00**
TOTAL DOSE (mrem) FOR THYROID	2.84E-02	5.00E+00	5.68E-01
TOTAL DOSE (mrem) FOR KIDNEY	3.04E-02	5.00E+00	6.08E-01
TOTAL DOSE (mrem) FOR LUNG	**3.07E-02**	5.00E+00	**6.14E-01**
TOTAL DOSE (mrem) FOR GI-LLI	**5.07E-02**	5.00E+00	**1.01E+00**
TOTAL FOR 1991			
TOTAL DOSE (mrem) FOR BONE	**1.11E-02**	1.00E+01	**1.11E-01**
TOTAL DOSE (mrem) FOR LIVER	**5.55E-02**	1.00E+01	**5.55E-01**
TOTAL DOSE (mrem) FOR TOTAL BODY	**5.03E-02**	3.00E+00	**1.68E+00**
TOTAL DOSE (mrem) FOR THYROID	4.11E-02	1.00E+01	4.11E-01
TOTAL DOSE (mrem) FOR KIDNEY	4.46E-02	1.00E+01	4.46E-01
TOTAL DOSE (mrem) FOR LUNG	**4.42E-02**	1.00E+01	**4.42E-01**
TOTAL DOSE (mrem) FOR GI-LLI	**6.62E-02**	1.00E+01	**6.62E-01**

[1] Based on ODCM Section 2.2 which restricts dose to the whole body to less than or equal to 1.5 mrem per quarter and 3.0 mrem per year. Dose restriction to any organ is less than or equal to 5 mrem per quarter and 10 mrem per year.

*** There were no significant changes to these values and are therefore reported the same as the values in Report 13.**

LIQUID CUMULATIVE DOSE SUMMARY (1991)
TABLE 2

A. Fission and Activation Products (not including H-3, gases, alpha)	Quarter 1	Quarter 2	Total
1. Total Release - (Ci)	9.03E-02	**7.17E-01**	**8.07E-01**
2. Maximum Organ Dose (mrem)	5.00E-03	**2.23E-02**	**2.73E-02**
3. Organ Dose Limit (mrem)	5.00E+00	5.00E+00	1.00E+01
4. Percent of Limit	1.00E-01	**4.46E-01**	**2.73E-01**
B. Tritium			
1. Total Release (Ci)	1.25E+02	3.57E+02	4.82E+02
2. Maximum Organ Dose (mrem)	1.27E-02	2.84E-02	4.11E-02
3. Organ Dose Limit (mrem)	5.00E+00	5.00E+00	1.00E+01
4. Percent of Limit	2.54E-01	5.68E-01	4.11E-01

This table is included to show the correlation between Curies released and the associated calculated maximum organ dose. Wolf Creek ODCM methodology is used to calculate the maximum organ dose which assumes that an individual drinks the water and eats fish from the discharge point. ODCM Section 2.2 organ dose limits are used.

NOTE: The 2nd Quarter Category A values were calculated based on the Quarter 1 Fe-55 and Sr-90 concentrations. **Estimated values for Quarter 2 have now been replaced with actual test results.**