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Dominion Energy

APR 1 8 2019

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
2018 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Enclosed is the Kewaunee Power Station (KPS) 2018 Annual Radioactive Effluent Release Report for January through December 2018. This report is submitted to meet the requirements of KPS Technical Requirements Manual Section 10.3.

If you have questions or require additional information, please feel free to contact Mr. William Zipp at 920-304-9729.

Sincerely,

William J. Zipp
for
Bradly J. McMahon
Director Kewaunee Site

Commitments made by this letter: NONE

A009
IE48
NRR

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2018 Annual Radioactive Effluent Release Report

Kewaunee Power Station

Dominion Energy Kewaunee, Inc.

DOCKET 50-305

KEWAUNEE POWER STATION

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January 1 - December 31, 2018

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0.0 SUMMARY

On October 22, 2012, Dominion made known the decision to permanently shut down the Kewaunee Power Station (KPS). On February 25, 2013, Dominion Energy Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. On May 15, 2013 the NRC docketed the certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii). Therefore the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2).

On June 15, 2017, the transfer of all spent fuel from the KPS Spent Fuel Pool (SFP) to the Independent Spent Fuel Storage Installation (ISFSI) was completed. All remaining irradiated materials were removed from the SFP in October 2017.

All radioactive liquid was drained from systems in the Auxiliary Building by the end of the first week of August 2018.

This 2018 annual effluent report was prepared for the year with two separate revisions of the ODCM. Revision 17 was used through June 30, 2018, while revision 18 was issued for use starting on July 1, 2018. Many of the required effluent samples and analyses were eliminated from the ODCM with revision 18; therefore, some of the changes to the ODCM requirements will not match some of the results documented in the report.

During 2018 all solid, liquid, and gaseous radioactive effluents from the Kewaunee Power Station were well below regulatory limits. For individual effluent streams, the quarterly limit most closely approached was:

GASEOUS:	Ingestion Pathway-Organ	Total Body	
	Quarterly Limit (mRem)	7.5	
	Actual Dose (mRem)	9.72E-05	(1st Quarter)
	% of Specification	1.30E-03	
LIQUID:	Ingestion Pathway-Organ	Bone	
	Quarterly Limit (mRem)	5.0	
	Actual Dose (mRem)	2.42E-01	(2nd Quarter)
	% of Limit	4.84E+00	
SOLID:	No upper limit for solid radioactive waste applies.		
	Cubic Meters Shipped	1.48E+01 m^3 (5.24E+02 ft^3)	

1.0 <u>INTRODUCTION</u>

This report is being submitted in accordance with the requirements of Kewaunee Technical Requirements Manual, Section 10.3.2 and the Offsite Dose Calculation Manual, Section 15.2. It includes data from all effluent releases made from January 1 - December 31, 2018. The report contains summaries of the gaseous and liquid releases made to the environment including the quantity, characterization, time duration and calculated radiation dose at the site boundary resulting from these releases. The report also includes a summation of solid radioactive waste disposal, revisions to the Process Control Program and the Offsite Dose Calculation Manual, and major changes to the radioactive liquid and gaseous waste systems. Values indicated as 0 (zero) in this report refer to actual values less than the detection limits. A table of these less than detectable (LLD) values is identified in sections 2.1 and 3.1.

1.1 Effluent Dose Limits

Specifications are set to ensure that offsite doses are maintained as low as reasonably achievable while still allowing for practical and dependable evolutions at the Kewaunee Power Station.

The Kewaunee Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used in:

1.) The calculation of radioactive liquid and gaseous effluent monitoring instrumentation alarm/trip set points.

2.) The calculation of radioactive liquid and gaseous concentrations, dose rates and cumulative quarterly and annual doses. The ODCM methodology is acceptable for use in demonstrating compliance with 10 CFR 20.1301/1302; 10 CFR 50, Appendix I; and 40 CFR 190.

2.0 GASEOUS EFFLUENTS

2.1 Lower Limits of Detection (LLD) for Gaseous Effluents

Gaseous radioactive effluents are released in both the continuous mode and the batch mode. The Auxiliary Building ventilation stack was sampled continuously for particulates, Iodine 131, Gross Alpha, Strontium 89, Strontium 90, and noble gases by an "off-line" sample train. This stack was also grab-sampled weekly for noble gases and monthly for tritium. Continuous sampling for I-131, Strontium 89, and weekly grab sampling for noble gases was eliminated in ODCM Rev. 18. There were no batch releases performed in 2018.

The LLD's for gaseous radio-analyses, as listed in Table 13.2.1-1 of the Kewaunee ODCM are:

Analysis	LLD (μCi/ml)
Gaseous Gamma Emitters	1.00E-04
Iodine 131	3.00E-12
Particulate Gamma Emitters	1.00E-11
Particulate Gross Alpha	1.00E-11
Strontium 89, 90	1.00E-11
Noble Gases, Gross Beta or Gamma	1.00E-06
Tritium (H-3)	1.00E-06

The nominal "a priori" LLD values are shown below.

Isotope	a priori LLD (μCi/ml)
a. Gaseous emissions:	
Kr-87	5.61E-08
Kr-88	1.02E-07
Xe-133	6.68E-08
Xe-133m	2.75E-07
Xe-135	2.99E-08
Xe-138	1.13E-07

b. Particulate emissions:

Mn-54	1.11E-13
Fe-59	2.27E-13
Co-58	2.28E-13
Co-60	3.57E-13
Zn-65	1.68E-13
Mo-99	2.73E-13
Cs-134	4.69E-13
Cs-137	1.68E-13
Ce-141	2.08E-13
Ce-144	1.24E-12

c. Other identifiable gamma emitters:

Ar-41	3.97E-10
Kr-85	8.63E-05
Kr-85m	4.62E-08
Kr-89	2.04E-06
Xe-127	4.20E-08
Xe-131m	1.82E-06
Xe-135m	1.90E-08
Xe-137	2.88E-07
I-131	1.32E-13

d. Composite particulate samples:

Sr-89	1.00E-14
Sr-90	1.00E-14
Gross Alpha	1.00E-14

These "a priori" LLDs represent the capabilities of the counting systems in use, not an after the fact "a posteriori" limit for a particular measurement.

2.2 Gaseous Batch Release Statistics

The following is a summation of all gaseous batch releases made during 2018.

Number of batch releases....................................0

Total time for all batch releases (min)..............0.0

Maximum time for a batch release (min)..........0.0

Average time for a batch release (min).............0.0

Minimum time for a batch release (min)...........0.0

2.3 Gaseous Effluent Data

Table 2.1 presents a quarterly summation of the total activity released and average release rates of gaseous effluents. Table 2.2 lists the quarterly sums of individual gaseous radionuclide released by continuous mode. Table 2.3 lists the quarterly sums of individual gaseous radionuclide released by batch mode. Table 2.4 presents the dose limits for gaseous effluents, and the calculated doses this year from gaseous effluents.

Table 2.1
Gaseous Effluents - Summation of all Releases

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Fission and Activation Gases					
Total Activity Released (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (µCi/sec)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Total Activity Released (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (µCi/sec)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Total Activity Released (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (µCi/sec)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
Total Activity Released (Ci)	3.67E+00	6.45E-01	0.00E+00	0.00E+00	4.32E+00
Average Release Rate (µCi/sec)	4.72E-01	8.20E-02	0.00E+00	0.00E+00	1.37E-01
Gross Alpha Released (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon-14					
Total Annual Activity Released (Ci)					0.00E+00

Table 2.2
Gaseous Effluents - Ground Level - Nuclides Released (Ci)
Continuous Mode

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Fission Gases					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium	3.67E+00	6.45E-01	0.00E+00	0.00E+00	4.32E+00

Table 2.3
Gaseous Effluents - Ground Level - Nuclides Released (Ci)
Batch Mode (1)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Fission Gases					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

1 - There were no gaseous batch discharges in 2018.

Table 2.4
Dose from Gaseous Effluents

The offsite dose limits from radioactive materials in gaseous effluents are specified in Section 13.2.2 and 13.2.3 of the Kewaunee ODCM and can be summarized as follows:

Limit	Air Dose Gamma	Air Dose Beta	Organ
Quarterly	5.0 mrad	10.0 mrad	7.5 mrem
Annual	10.0 mrad	20.0 mrad	15.0 mrem

The total releases of gaseous effluents during 2018 for each quarter and for the year were within limits. The following offsite doses were calculated using equations 2.7, 2.8, and 2.11 from the Kewaunee ODCM. Calculated offsite doses versus quarterly and annual limits are shown below:

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annual
1. Gamma- Air Dose					
Specification (mrad)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
Actual Dose (mrad)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Specification	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Beta- Air Dose					
Specification (mrad)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
Actual Dose (mrad)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Specification	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Organ Dose					
Specification (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
Total Body					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04
Bone					
Actual Dose (mrem)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Specification	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 2.4 (continued)
Dose from Gaseous Effluents

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annual
Liver					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04
Thyroid					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04
Kidney					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04
Lung					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04
GI-LLI					
Actual Dose (mrem)	9.72E-05	1.71E-05	0.00E+00	0.00E+00	1.14E-04
% of Specification	1.30E-03	2.28E-04	0.00E+00	0.00E+00	7.60E-04

2.4 Estimation of Carbon-14 in Gaseous Releases

Due to permanent plant shutdown on May 7, 2013, there were no releases of Carbon-14 from the site.

3.0 LIQUID EFFLUENTS

3.1 Lower Limits of Detection (LLD) for Liquid Effluents

Liquid radioactive effluents are released as both batch releases and continuous releases. Each batch is sampled prior to release and analyzed for gamma emitters (including Iodine 131) and tritium. A fraction of each sample is retained for a proportional composite which is then analyzed for Gross Alpha, Strontium 89, Strontium 90, Iron 55 and Nickel 63. Analysis for Iodine 131 and Strontium 89 was eliminated and analysis for Nickel 63 was added in ODCM Rev. 18.

The LLD's for liquid batch release radio-analyses, as listed in Table 13.1.1-1 of the Kewaunee ODCM are:

Analysis	LLD (µCi/ml)
Principal Gamma Emitters	1.00 E-06
Iodine 131	1.00 E-06
Tritium (H-3)	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06
Nickel 63	1.00 E-04

The actual obtained "a priori" LLD values for batch releases are shown below.

Isotope	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average a priori LLD (µCi/ml)
Mn-54	9.85E-08	1.74E-08	1.75E-08	9.98E-08	5.83E-08
Fe-59	3.78E-08	3.78E-08	3.84E-08	2.17E-07	8.28E-08
Co-58	1.30E-07	1.71E-08	1.30E-07	1.71E-08	7.36E-08
Co-60	1.70E-07	2.46E-08	2.53E-08	2.53E-08	6.13E-08
Zn-65	4.25E-08	3.23E-07	3.28E-07	2.45E-07	2.35E-07
Mo-99	7.04E-07	1.24E-07	7.03E-07	9.42E-07	6.18E-07
Cs-134	1.97E-08	7.90E-08	1.97E-08	7.85E-08	4.92E-08
Cs-137	1.77E-07	1.72E-08	1.71E-08	1.71E-08	5.71E-08
Ce-141	1.45E-07	8.25E-08	1.54E-07	1.45E-07	1.32E-07
Ce-144	7.69E-07	6.52E-07	5.03E-07	5.03E-07	6.07E-07
I-131	1.01E-07	1.11E-08	1.27E-07	1.14E-07	8.83E-08
H-3	2.90E-06	3.44E-06	2.50E-06	2.61E-06	2.86E-06
Sr-89	9.61E-09	9.43E-09	1.05E-08	1.05E-08	1.00E-08
Sr-90	7.92E-09	7.56E-09	1.19E-08	1.19E-08	9.82E-09
Gross Alpha	1.30E-08	1.31E-08	7.41E-09	7.41E-09	1.02E-08
Fe-55	6.71E-07	3.74E-07	5.58E-07	5.58E-07	5.40E-07
Ni-63	1.48E-07	6.60E-08	6.46E-08	6.46E-08	8.56E-08

Continuous liquid releases were grab-sampled weekly and analyzed for principal gamma emitters (including Iodine 131) and tritium. A fraction of each weekly sample was retained for a monthly proportional composite which was then analyzed for Gross Alpha, Strontium 89, Strontium 90, Iron 55 and Nickel 63. Continuous liquid releases were discontinued in June 2018 and the requirement for continuous release LLDs eliminated in ODCM Rev 18.

The LLD's for liquid continuous release radioanalyses, as listed in Table 13.1.1-1 of the Kewaunee ODCM are:

Analysis	LLD (µCi/ml)
Principal Gamma Emitters	5.00 E-07
Iodine 131	1.00 E-06
Tritium (H-3)	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06
Nickel 63	1.00 E-04

The actual obtained "a priori" LLD values for continuous releases are shown below.

Isotope	1st Quarter	2nd Quarter	3rd Quarter[1]	4th Quarter[1]	Average a priori LLD (µCi/ml)
Mn-54	1.11E-08	1.17E-08	NA	NA	1.14E-08
Fe-59	2.17E-08	2.00E-08	NA	NA	2.09E-08
Co-58	1.02E-08	1.02E-08	NA	NA	1.02E-08
Co-60	4.46E-09	9.46E-09	NA	NA	6.96E-09
Zn-65	2.25E-08	2.45E-08	NA	NA	2.35E-08
Mo-99	8.70E-08	7.37E-08	NA	NA	8.04E-08
Cs-134	1.04E-08	7.96E-09	NA	NA	9.18E-08
Cs-137	1.18E-08	1.43E-08	NA	NA	1.31E-08
Ce-141	1.86E-08	1.60E-08	NA	NA	1.73E-08
Ce-144	6.46E-08	7.31E-08	NA	NA	6.89E-07
I-131	1.20E-08	8.66E-09	NA	NA	1.03E-08
H-3	2.90E-06	3.44E-06	NA	NA	3.17E-06
Sr-89	7.91E-09	8.98E-09	NA	NA	8.45E-09
Sr-90	5.84E-09	8.30E-09	NA	NA	7.07E-09
Gross Alpha	4.68E-09	9.49E-09	NA	NA	7.09E-09
Fe-55	6.75E-07	3.74E-07	NA	NA	5.25E-07
Ni-63	1.55E-07	6.31E-08	NA	NA	1.09E-07

[1]Continuous liquid releases were discontinued as of 6/30/2018 and the requirement for LLDs eliminated with the issuance of Revision 18 of the ODCM.

3.2 Liquid Batch Release Statistics

The following is a summation of all liquid batch releases during 2018.

Number of batch releases..71

Total time for all batch releases (min)...............4.71E+04

Maximum time for a batch release (min)...........1780

Minimum time for a batch release (min)............27

Average time for a batch release (min)...............664

3.3 Liquid Effluent Data

The following Table 3.1 presents a quarterly summation of the total activity released and average concentration for all liquid effluents. It also presents the gross alpha activity released, volume of waste released and volume of dilution water used. Table 3.2 contains the quantity of the individual isotopes released to the unrestricted area for batch releases. Table 3.3 contains the quantity of the individual isotopes released to the unrestricted area for continuous releases. Table 3.4 presents the doses from liquid effluents for each quarter and the calculated doses this year from liquid effluents.

Table 3.1
Liquid Effluents - Summation of all Releases

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
<u>Fission and Activation Products</u>					
Total Release (Ci)	7.40E-02	3.76E-02	2.70E-03	0.00E+00	1.14E-01
Average Concentration (µCi/ml)	2.90E-08	1.73E-08	6.33E-08	0.00E+00	2.40E-08
<u>Tritium</u>					
Total Release (Ci)	7.75E+01	6.69E+01	2.45E-03	0.00E+00	1.44E+02
Average Concentration (µCi/ml)	3.04E-05	3.08E-05	5.75E-08	0.00E+00	3.03E-05
% of Specification Limit(3.0E-3 µCi/ml)	1.01E+00	1.03E+00	1.92E-03	0.00E+00	1.01E+00
<u>Dissolved and Entrained Gases</u>					
Total Release (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Concentration (µCi/ml)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Specification Limit(2.0E-4 µCi/ml)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Gross Alpha Activity</u>					
Total Release (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Volume of Waste Released</u>					
Total (liters)	2.73E+06	1.53E+06	8.85E+04	0.00E+00	4.34E+06
<u>Volume of Dilution Water</u>					
Total (liters)	2.55E+09	2.17E+09	4.26E+07	0.00E+00	4.77E+09

Table 3.2
Liquid Effluents – Nuclides Released (Ci)
Batch Mode

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
Fission and Activation Products					
Fe-55	1.94E-02	6.93E-03	1.87E-04	0.00E+00	2.60E-02
Co-60	4.27E-02	1.83E-02	4.38E-04	0.00E+00	6.14E-02
Ni-63	1.14E-02	1.28E-02	2.07E-03	0.00E+00	2.64E-02
Sb-125	4.38E-04	5.45E-05	0.00E+00	0.00E+00	4.92E-04
Cs-137	2.80E-05	6.50E-06	0.00E+00	0.00E+00	3.45E-05
Total Release	7.40E-02	3.76E-02	2.70E-03	0.00E+00	1.14E-01
Dissolved and Entrained Gases					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium					
Total Release	7.75E+01	6.69E+01	2.45E-03	0.00E+00	1.44E+02
Gross Alpha Activity					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 3.3
Liquid Effluents – Nuclides Released (Ci)
Continuous Mode

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
<u>Fission and Activation Products</u>					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Dissolved and Entrained Gases</u>					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Tritium</u>					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Gross Alpha Activity</u>					
Total Release	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 3.4
Dose from Liquid Effluents

The dose to a member of the public from total liquid radioactive releases for each quarter was below the Kewaunee ODCM limits of 1.5 mrem to the total body and less than or equal to 5 mrem to any organ. Additionally, the dose to a member of the public from total liquid radioactive releases for the year was below the Kewaunee ODCM limits of 3 mrem to the total body and less than or equal to 10 mrem to any organ.

Instantaneous release concentrations are limited by the individual radionuclide concentrations established in 10 CFR 20, Appendix B, for unrestricted areas. During the report period, none of the isotopes released exceed the concentrations specified in Appendix B. The following offsite doses were calculated using equation 1.7 from the Kewaunee ODCM.

Due to the Ni-63 activity levels and the volume of water released to the environment in 2018, the dose due to liquid effluent releases exceeded 1% for both the quarterly and annual limits for multiple organs. The highest quarterly percentage was 4.84% and highest annual percentage was 5.05%. Neither of the dose limits was at risk of being exceeded based on close monitoring of dose projections, use of the radioactive waste treatment system, and procedural guidance. There was no adverse impact to the general public.

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annual
Total Body					
Specification (mrem)	1.50E+00	1.50E+00	1.50E+00	1.50E+00	3.00E+00
Actual Dose (mrem)	4.34E-02	2.89E-02	1.44E-03	0.00E+00	7.37E-02
% of Specification	2.89E+00	1.93E+00	9.60E-02	0.00E+00	2.46E+00
Organs					
Specification (mrem)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
Bone					
Actual Dose (mrem)	2.25E-01	2.42E-01	3.82E-02	0.00E+00	5.05E-01
% of Specification	4.50E+00	4.84E+00	7.63E-01	0.00E+00	5.05E+00
Liver					
Actual Dose (mrem)	5.01E-02	3.60E-02	2.76E-03	0.00E+00	8.89E-02
% of Specification	1.00E+00	7.21E-01	5.50E-02	0.00E+00	8.89E-01
Thyroid					
Actual Dose (mrem)	1.51E-02	1.30E-02	4.73E-07	0.00E+00	2.81E-02
% of Specification	3.02E-01	2.61E-01	0.00E+00	0.00E+00	2.81E-01

Table 3.4 (continued)
Dose from Liquid Effluents

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Annual
Kidney					
Actual Dose (mrem)	1.81E-02	1.37E-02	4.73E-07	0.00E+00	3.18E-02
% of Specification	3.61E-01	2.74E-01	0.00E+00	0.00E+00	3.18E-01
Lung					
Actual Dose (mrem)	1.90E-02	1.42E-02	2.85E-05	0.00E+00	3.33E-02
% of Specification	3.80E-01	2.84E-01	1.00E-03	0.00E+00	3.33E-01
GI-LLI					
Actual Dose (mrem)	1.43E-01	7.00E-02	1.82E-03	0.00E+00	2.15E-01
% of Specification	2.86E+00	1.40E+00	3.60E-02	0.00E+00	2.15E+00

3.4 Ground Water Monitoring

The Kewaunee Power Station has 14 wells used to sample for groundwater contamination. Eight of the wells are located to monitor for leakage from the Auxiliary Building (AB). The other six wells are designated as Monitoring Wells (MW) and sample areas outside the industrial security area to identify any spread of contamination. As the data below indicates the only radionuclide identified in the AB wells is tritium, with results well below federal limits. The source of the tritium is from rain washout and air diffusion from the plant Auxiliary Building Vent due to spent fuel pool evaporation. The tritium levels have decreased in the AB wells since the plant was permanently shut down in 2013. All but one of the MW wells indicates no radionuclide contamination. MW-704 indicated tritium levels above Minimum Detectable Concentrations (MDC). CR1783 was submitted to address this issue (See Section 6.7). There were no voluntary ground water communications, no spills, and no leaks in 2018. The frequency of drawing groundwater samples was changed from quarterly to annually in May 2018.

Sample Point **Sample Date**	**Tritium** **pCi/L**	**Total Gamma Activity** **µCi/ml**
AB-707		
03/22/18	444	None Detected
05/16/18	299	None Detected
AB-708		
03/22/18	478	None Detected
05/16/18	<280	None Detected
AB-709		
03/21/18	322	None Detected
06/27/18	<256	None Detected
AB-710		
03/22/18	462	None Detected
06/26/18	540	None Detected
AB-711		
03/22/18	<281	None Detected
06/26/18	309	None Detected
AB-712		
03/21/18	316	None Detected
06/27/18	<256	None Detected

Sample Point Sample Date	Tritium pCi/L	Total Gamma Activity µCi/ml
AB-715		
03/24/18	<281	None Detected
07/18/18	<372	None Detected
AB-717		
03/23/18	<281	None Detected
07/19/18	<372	None Detected
MW-701		
03/28/18	<277	None Detected
08/16/18	<365	None Detected
MW-702		
03/28/18	<277	None Detected
08/16/18	<365	None Detected
MW-703		
03/27/18	<277	None Detected
09/27/18	<345	None Detected
MW-704		
03/27/18	<277	None Detected
09/27/18	660	None Detected
10/10/18 (follow up sample)	929	None Detected
MW-705		
03/25/18	<277	None Detected
10/10/18	<305	None Detected
MW-706		
03/25/18	<277	None Detected
10/09/18	<305	None Detected

4.0 METEOROLOGICAL DATA

Meteorological data is no longer required to be reported in accordance with the Kewaunee ODCM Rev. 18, Section 15.2.

5.0 SOLID WASTE DISPOSAL

Table 5.1 is a summation of solid radioactive waste shipped during 2018. Presented are the types of waste streams, waste classification, and major nuclides.

Shipment, Manifest 2018-05-14-01, was shipped out on 5/14/2018. The shipment was categorized as Unclassified. This was due to one or more radioactive filters driving the classification to Greater Than Class C (GTCC) based on failing the concentration averaging criteria for shallow land disposal. The shipment was sent for processing so the filters could be blended with other sites low level waste so it could be disposed of at a level lower than GTCC.

Table 5.1
Solid Waste and Irradiated Fuel Shipments

A. Solid Radioactive Waste Shipped Off-Site for Burial or Disposal

1. Type of Waste with Estimate of Major Nuclide Composition

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.05E+02	2.97E+00	3.72E+00
B	1.19E+02	3.38E+00	1.69E+02
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	3.71E+01	1.05E+00	1.40E+01
All	2.61E+02	7.40E+00	1.87E+02

Major nuclides for the above table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, Sb-125, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
All	0.00E+00	0.00E+00	0.00E+00

Major nuclides for the above table: NA

Table 5.1 (continued)
Solid Waste and Irradiated Fuel Shipments

Irradiated Components	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
All	0.00E+00	0.00E+00	0.00E+00

Major nuclides for the above table: NA

Other Waste – Metals: SFP racks.	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	2.63E+02	7.44E+00	2.83E-01
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
All	2.63E+02	7.44E+00	2.83E-01

Major nuclides for the above table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Nb-94, Tc-99, I-129, Cs-137, Ce-144, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm243, Cm-244

Sum of All Low-Level Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	3.68E+02	1.04E+01	4.01E+00
B	1.19E+02	3.38E+00	1.69E+02
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	3.71E+01	1.05E+00	1.40E+01
All	5.24E+02	1.48E+01	1.87E+02

Major nuclides for the above table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, Sb-125, I-129, Cs-137, Ce-144, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244

Table 5.1 (continued)
Solid Waste and Irradiated Fuel Shipments

B. Irradiated Fuel Shipments

Number of Shipments	Mode of Transportation	Destination
None	NA	NA

No irradiated fuel shipments were made from the Kewaunee Power Station during 2018.

6.0 SUPPLEMENTAL INFORMATION

6.1 Abnormal Releases or Abnormal Discharges

No abnormal releases or abnormal discharges were made from the Kewaunee Power Station during the report period.

6.2 Non-routine Planned Discharges

No non-routine planned discharges were made from the Kewaunee Power Station during the reporting period.

6.3 Program Revisions

In accordance with Technical Requirements Manual Section 10.3.2, the revisions to the Process Control Program, Offsite Dose Calculation Manual, and Radiological Environmental Monitoring Program are listed below.

6.3.1 Process Control Program

Revision 11 of procedure NAD-01.16, Solid Radioactive Waste Process Control Program (PCP) was issued on March 15, 2018.

6.3.2 Offsite Dose Calculation Manual

Revision 18 of the Kewaunee Power Station Offsite Dose Calculation Manual (ODCM) was issued on June 30, 2018. See Appendix A.

6.3.3 Radiological Environmental Monitoring Manual

Revision 21 of the Kewaunee Power Station Radiological Environmental Monitoring Manual (REMM) was issued on January 1, 2018. See Appendix B.

6.4 Major Changes to the Radioactive Liquid, Gaseous and Solid Waste Systems

The following discussion points are taken from the ODCM Section 15.1 as related to the changes made to radioactive waste systems in 2018:

a) System abandonment evaluations were performed for the radioactive waste systems using procedure OP-KW-DEC-SYC-001, System Evaluation and Categorization, and documented on Attachment B, SSC Category Determination Document. Refer to Appendix C, Documentation for Major Changes to Radioactive Waste Systems in 2018, which contains the evaluations performed for each of the changes. System abandonment screenings were performed for these systems and documented in CR1382. The screenings determined that the changes to the systems could be performed in accordance with 10CFR50.59.

b) The SSC Category Determination Documents for these systems provide sufficient information to totally support the reason for the changes without benefit of additional or supplemental information (Refer to Appendix C).

c) The SSC Category Determination Documents for these systems provide a description of the equipment, components, and processes involved and interfaces with other plant systems (Refer to Appendix C).

d) The changes to these systems have had no adverse effect on predicted releases of radioactive materials in liquid and gaseous effluents and/or the quantity of solid waste. This was substantiated by comparing the effluent results of the 2017 and 2018 Annual Radiological Effluent Release Reports.

e) The changes to these systems have had no adverse effect on the expected maximum exposure to individuals in the UNRESTRICTED AREA or to the general population. This was substantiated by comparing the effluent results of the 2017 and 2018 Annual Radiological Effluent Release Reports and the ambient TLD results from the 2017 and 2018 Annual Radiological Environmental Operating Reports.

f) A comparison of the predicted releases of radioactive materials in liquid and gaseous effluents and/or the quantity of solid waste indicated the actual results were the same or less based on the changes to these systems.

g) There is no exposure expected by plant personnel as a result of the changes to these systems.

h) Refer to Appendix C for FSRG review and acceptance documentation for these changes to the radioactive waste systems.

6.5 Effluent Monitoring System Inoperability

6.5.1 There were no effluent radiation monitors inoperable for the consecutive time period listed in the ODCM for this report period.

6.6 Corrections to Previous Reports

6.6.1 None.

6.7 Other

6.7.1 Condition Report CR1608 was submitted on February 2, 2018.

Radiation Protection not notified prior to R-13 sample skid pump being taken out of service for maintenance.

The R-13 sample skid pump was taken out of service for maintenance at 0745 on 2/7/18. Radiation Protection (RP) was not notified prior to the pump being secured. RP discovered this at 0830 when an RP technician was getting set to perform the weekly R-13 filter change out. The RP tech contacted RP supervision to inform them of the situation. RP supervisor directed the RP tech to note the issue on the sample cover sheet and to analyze the in-service R-14 filters to determine whether or not there was any radioactivity (there was none). The RP tech changed out the R-13 filters for analysis and swapped to the new set of filters on the R-14 sample skid. RP supervision contacted Operations to discuss the reason why RP needs to be notified prior to securing R-13 (or R-14 if that unit is lined up for sampling instead of R-13).

There was no loss of auxiliary building ventilation effluent monitoring or sampling during this occurrence. R-14 effluent monitoring instrumentation was still in service at the time R-13 was taken out of service. ODCM sampling and instrumentation requirements were met. What did occur was the loss of accurate accounting of the volume of the sample flow used in calculating the activity of the particulate sample filter. Whenever R-13 is going to be taken OOS, RP is contacted to allow the swap over to R-14 to provide continuity in continuous sampling of the effluent flow from the auxiliary building ventilation and to accurately determine start and stop times for sample volume calculation.

There have not been any identified particulate radioisotopes from the weekly auxiliary building ventilation air sample for decades. The in-service R-14 filter sample analysis identified no detectable particulate radioisotopes. There is no longer a source of radioiodine or noble gases in the auxiliary building.

The CR recommended that Operations determine a method to ensure RP is notified prior to removing R-13 from service so that R-14 can be set up for sampling with new filters.

The method chosen by Operations was to revise OP-KW-NOP-RM-001 to contain a detailed note and step to check that new filters are aligned prior to stopping R-13 or R-14. NOP-RM-001 revision 11 was issued on 7/18/2018 with the change incorporating the required information.

6.7.2 Condition Report CR1783 was submitted on October 2, 2018.

Detectable Level of Tritium Identified in Groundwater Monitoring Well MW-704

During the routine sampling and analysis of Groundwater Monitoring Well MW-704, a detectable level of tritium was identified. The level of tritium measured in the sample was 660 pCi/L, which is below the action level of 10,000 pCi/L and the reporting level of 20,000 pCi/L for tritium required by RP-KW-001-028, Groundwater Protection Program, and the KPS Radiological Environmental Monitoring Manual (REMM), Section 2.2.1 (Table 2.2.1-D). The result of the gamma analysis of the sample was less than the Minimum Detectable Concentration (<MDC). Previous tritium and gamma sample results (last sample date was 3/23/18) were less <MDC for MW-704.

The most likely source of the detectable tritium in Groundwater Monitoring MW-704 is the recent multiple discharges of radioactive liquid from draining the Spent Fuel Pool and cleaning the Auxiliary Building sumps and tanks. These discharges, which were performed in accordance with the KPS Offsite Dose Calculation Manual (ODCM) and completed in July 2018, contained tritium. MW-704 is located at the southeast corner of the KPS parking lot near the shoreline of Lake Michigan, south of the outlet of the discharge canal. Although the hydrogeological gradient of groundwater flow at the KPS site is generally from west to east toward Lake Michigan, the multiple radioactive liquid discharges, the location of the sample well just downstream of the discharge point, and the recent higher lake levels may have combined to cause the detectable level of tritium in MW-704.

The sampling frequency for MW-704 was increased from annual to quarterly to monitor the trend.

The first follow up sample was taken October 10, 2018. The results were 929 pCi/L.

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Appendix A

Kewaunee Power Station

Offsite Dose Calculation Manual (ODCM)

Revision 18
June 30, 2018

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Dominion Energy Kewaunee, Inc.

Kewaunee Power Station

OFFSITE DOSE CALCULATION MANUAL (ODCM)

Revision 18

DATE: June 30, 2018

Approved By:	Daniel J. Shannon / Manager - Radiological Protection and Chemistry	6-20-18 Date
Approved By:	William Zipp / Nuclear Decommissioning Coordinator	6/20/2018 Date
Reviewed By:	Timothy P. Olson / #18-010 Facility Safety Review Group	6/20/2018 Date
Approved By:	Stewart Yuen / Director – Kewaunee Site	6/21/2018 Date

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Kewaunee Power Station

Offsite Dose Calculation Manual

PART I - RADIOACTIVE EFFLUENT CONTROLS

11.0 INTRODUCTION

The Kewaunee OFFSITE DOSE CALCULATION MANUAL (ODCM) is established and maintained pursuant to Technical Requirements Manual Section 10.1.1. The ODCM consists of two parts: Radiological Effluent Controls, Part I, and Calculational Methodologies, Part II.

Part I, Radiological Effluent Controls, includes: (1) The Radioactive Effluent Control Specifications (RECS) and Radiological Environmental Monitoring Programs (REMP) required by Technical Requirements Manual 10.1 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Radioactive Effluent Release Reports required by Technical Requirements Manual 10.3.1 and 10.3.2, respectively.

Part II, Calculational Methodologies: provides the methodology to manually calculate radiation dose rates and doses to individual persons in UNRESTRICTED AREAS due to the routine release of gaseous and liquid effluents. Computer programs are utilized to routinely estimate the doses due to radioactivity in gaseous and liquid effluents. Manual dose calculations are performed when computerized calculations are not available.

The methodology stated in this manual is acceptable for use in demonstrating compliance with 10CFR20.1302; 10CFR50, Appendix I; and 40CFR190.

More conservative calculational methods and/or conditions (e.g., location and/or exposure pathways) expected to yield higher computed doses than appropriate for the maximally exposed person may be assumed in the dose evaluations.

The ODCM will be maintained at the station for use as a reference guide and training document of accepted methodologies and calculations. Changes will be made to the ODCM calculational methodologies and parameters as is deemed necessary to assure reasonable conservatism in keeping with the principles of 10CFR50.36a and Appendix I for demonstrating radioactive effluents are ALARA.

11.1 Change Process

Instructions for defining the responsibilities and requirements for revision and control of both the ODCM and the RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM) are located in approved station procedure for Revision and Control of the REMM and ODCM.

13.0 USE AND APPLICATION

13.0.1 Definitions

---NOTE---

Terms defined in the OFFSITE DOSE CALCULATION MANUAL appear in capitalized type and are applicable throughout the Radiological Effluent Controls Normal Conditions and Bases and the Calculational Methodologies.

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes CONTINGENCY MEASURES to be taken under designated Nonconformances within specified Restoration Times.
CHANNEL CHECK	A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.
CHANNEL FUNCTIONAL TEST	A CHANNEL FUNCTIONAL TEST consists of injecting a simulated signal into the channel as close to the primary sensor as practicable to verify that it is FUNCTIONAL, including alarm and/or trip initiating action.
CHANNEL CALIBRATION	A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The CHANNEL CALIBRATION shall encompass all devices in the channel required for channel FUNCTIONALITY. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps.
FUNCTIONAL - FUNCTIONALITY	A structure, system or component (SSC), shall be FUNCTIONAL or have FUNCTIONALITY when it is capable of performing its specified function(s) as set forth in the Current License Basis. FUNCTIONALITY does not apply to specified safety functions, but does apply to the ability of non-TS SSCs to perform other specified functions that have a necessary support function.

MEMBER(S) OF THE PUBLIC	MEMBER(S) OF THE PUBLIC means any individual except when that individual is receiving an OCCUPATIONAL DOSE.
OCCUPATIONAL DOSE	OCCUPATIONAL DOSE means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. OCCUPATIONAL DOSE does not include doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released under 10 CFR 35.75, from voluntary participation in medical research programs, or as a MEMBER OF THE PUBLIC.
OFFSITE DOSE CALCULATION MANUAL	The OFFSITE DOSE CALCULATION MANUAL shall contain the current methodology and parameters used in the calculation of offsite doses due to radioactive liquid effluents, in the calculation of liquid effluent monitoring alarm/trip setpoints, in the conduct of the Radiological Environmental Monitoring Program. Shall also contain the Radioactive Effluent Controls and Radiological Environmental Operating and Radioactive Effluent Release Reports required by Technical Requirements Manual 10.3.1 and 10.3.2.
ODCM NORMAL CONDITIONS (DNC)	Specify minimum requirements for ensuring safe plant decommissioning activities. The Contingency Measures associated with a DNC state Nonconformances that typically describe the ways in which the requirements of the DNC can fail to be met. Specified with each stated Nonconformance are Contingency Measures and Restoration Time(s).
ODCM VERIFICATION REQUIREMENTS (DVR)	Verification requirements are requirements relating to test, calibration, or inspection to assure that the necessary FUNCTIONALITY of systems and components are maintained, that plant decommissioning activities will be maintained within the current licensing basis, and that the ODCM Normal Condition (DNC) will be met.

PROCESS CONTROL PROGRAM	The PROCESS CONTROL PROGRAM shall contain the current formulae, sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of solid radioactive wastes, based on demonstrated processing of actual or simulated wet solid wastes, will be accomplished in such a way as to ensure compliance with 10 CFR Part 20, 10 CFR Part 61, 10 CFR Part 71, Federal and State regulations, burial ground requirements, and other requirements governing the disposal of the radioactive waste. Licensee initiated changes to the PCP, which was approved by the Commission prior to implementation: 1. Shall be documented and records of reviews performed shall be retained as required by the quality assurance program. The documentation shall contain: a. Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s). b. A determination that the change will maintain the overall conformance of the solidified waste product to existing requirements of Federal, State, or other applicable regulations. 2. Shall become effective upon review and acceptance by the FSRG.
PUBLIC DOSE	PUBLIC DOSE means the dose received by a MEMBER OF THE PUBLIC from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of a licensee. PUBLIC DOSE does not include OCCUPATIONAL DOSE or doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released under 10 CFR 35.75, or from voluntary participation in medical research programs.
PURGE - PURGING	PURGE or PURGING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.
RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM)	The REMM shall contain the current methodology and parameters used in the conduct of the radiological environmental monitoring program.
SITE BOUNDARY	The SITE BOUNDARY shall be that line beyond which the land is neither owned, leased, nor otherwise controlled by the licensee. (See Plant Drawing A-408)
SOURCE CHECK	A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

UNRESTRICTED AREA	An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY, access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.
VENTILATION EXHAUST TREATMENT SYSTEM	A VENTILATION EXHAUST TREATMENT SYSTEM is any system designed and installed to reduce gaseous radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through HEPA filters for the purpose of removing particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on tritium or other non-particulate effluents.
VENTING	VENTING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during venting. Vent, used in system names, does not imply a VENTING process.

13.0 USE AND APPLICATION

13.0.2 Logical Connectors

Logical Connectors are discussed in Section 7.2 of the Technical Requirements Manual and are applicable throughout the OFFSITE DOSE CALCULATION MANUAL and Bases.

13.0 USE AND APPLICATION

13.0.3 Restoration Times

Restoration Times are discussed in Section 7.3 of the Technical Requirements Manual and are applicable throughout the OFFSITE DOSE CALCULATION MANUAL and Bases.

When "Immediately" is used as a Restoration Time, the Contingency Measure should be pursued without delay in a controlled manner.

13.0 USE AND APPLICATION

13.0.4 Frequency

Frequency is discussed in Section 7.4 of the Technical Requirements Manual and is applicable throughout the OFFSITE DOSE CALCULATION MANUAL and Bases

13.0 USE AND APPLICATION

13.0.5 ODCM Normal Condition (DNC) Applicability

DNC 13.0.5.1 DNCs shall be met during the specified conditions in the Applicability.

DNC 13.0.5.2 Upon discovery of a failure to meet the DNC, the Contingency Measures of the associated Nonconformance shall be met, except as provided in DNC 13.0.5.4.

DNC 13.0.5.3 When it is discovered that a DNC has not been met and the associated contingency measures are not satisfied within the specified restoration time (or an associated contingency measure is not provided), the equipment subject to the DNC is in a nonconforming condition. In this situation, appropriate actions shall be taken as necessary to provide assurance of continued safe plant decommissioning activities. In addition a Condition Report shall be initiated and assessment of reasonable assurance of safety shall be conducted. Items to be considered for this assessment include the following:

- Availability of redundant or backup equipment;
- Compensatory measures, including limited administrative controls;
- Safety function and events protected against;
- Probability of needing the safety function; and
- Conservatism and margins.

If this assessment concludes that safety is sufficiently assured, then plant decommissioning activities may continue while prompt corrective action is taken.

DNC 13.0.5.4 Equipment removed from service or declared nonfunctional to comply with Contingency Measures may be returned to service under administrative control solely to perform testing required to demonstrate its FUNCTIONALITY or the FUNCTIONALITY of other equipment. This is an exception to DNC 13.0.5.2 for the system returned to service under administrative control to perform the testing required to demonstrate FUNCTIONALITY.

13.0 USE AND APPLICATION

13.0.6 ODCM VERIFICATION REQUIREMENTS (DVR) Applicability

DVR 13.0.6.1 DVRs shall be met during the specified conditions in the Applicability for individual DNCs, unless otherwise stated in the DVR. Failure to meet a DVR, whether such failure is experienced during the performance of the DVR or between performances of the DVR, shall be failure to meet the DNC. Failure to perform a DVR within the specified Frequency shall be failure to meet the DNC except as provided in DVR 13.0.6.3. DVR's do not have to be performed on nonfunctional equipment or variables outside specified limits

DVR 13.0.6.2 Each Verification Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the specified DVR frequency.

DVR 13.0.6.3 When it is discovered that a DVR frequency (including the 1.25 times extension) has not been met, the equipment subject to the DVR is in a nonconforming condition. In this situation, a Condition Report shall be initiated and, if indicated, determination to evaluate the impact on plant safety shall be performed in a timely fashion and in accordance with plant procedures.

Actions should be taken to restore conformance with the DNCs / DVRs in a timely fashion.

13.1 RADIOACTIVE LIQUID EFFLUENTS

13.1.1 Liquid Effluents Concentration

DNC 13.1.1 The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to:

a. 10 times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases.

APPLICABILITY: During release via the monitored pathway.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeds limits.	A.1 Initiate ACTION to restore concentration to within limits.	Immediately
B. CONTINGENCY MEASURES <u>OR</u> RESTORATION TIME not met.	B.1 Initiate a CR	In accordance with Corrective Action Program
	<u>AND</u>	
	B.2 Explain in the next Radioactive Effluent Release Report why the CONTINGENCY MEASURE was not met in a timely manner.	In accordance with Radioactive Effluent Release Report

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.1.1.1	Perform radioactive liquid waste sampling and activity analysis.	In accordance with Table 13.1.1-1
-----NOTE----- In this DVR the results of DVR 13.1.1.1 shall be used in accordance with the methodology and parameters of the ODCM.		In accordance with Table 13.1.1-1
DVR 13.1.1.2	Verify the results of the DVR 13.1.1.1 analyses to assure that the concentrations at the point of release are maintained within the limits of DNC 13.1.1.	

Table 13.1.1-1 (Page 1 of 2)
Radioactive Liquid Waste Sampling and Analysis

LIQUID RELEASE TYPE		TYPE OF ACTIVITY ANALYSIS	SAMPLE TYPE	SAMPLE FREQUENCY	MINIMUM ANALYSIS FREQUENCY	LOWER LIMIT OF DETECTION (LLD) (a)
1. Batch Waste Release Tanks (b)						
	a.	Principal Gamma Emitters(c)	Grab Sample	Each Batch (f)	Each Batch (g)	1×10^{-6} µCi/ml
	b.	H-3	Grab Sample	Each Batch (f)	Each Batch (g)	1×10^{-5} µCi/ml
	c.	Gross Alpha	Composite (d)	Each Batch (f)	184 days (e)	5×10^{-7} µCi/ml
	d.	Sr-90	Composite (d)	Each Batch (f)	184 days (e)	5×10^{-8} µCi/ml
	e.	Fe-55	Composite (d)	Each Batch (f)	184 days (e)	1×10^{-6} µCi/ml
	f.	Ni-63	Composite (d)	Each Batch (f)	184 days (e)	1×10^{-4} µCi/ml

Table 13.1.1-1 (Page 2 of 2)
Radioactive Liquid Waste Sampling and Analysis

(a) The LLD is defined, for purposes of these DNC's, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 * S_b}{E^* V^* 2.22 \times 10^{6*} Y^* \exp^{(-\lambda \Delta t)}}$$

Where:

- LLD is the a priori lower limit of detection as defined above, as µCi per unit mass or volume,
- s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,
- E is the counting efficiency, as counts per disintegration,
- V is the sample size in units of mass or volume,
- 2.22×10^6 is the number of disintegrations per minute per microcurie,
- Y is the fractional radiochemical yield, when applicable,
- λ is the radioactive decay constant for the particular radionuclide, and
- Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.
- Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement..

(b) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed to assure representative sampling.

(c) The principal gamma emitters for which the LLD requirement applies, includes the following radionuclides: Mn-54, Fe-59, Co-60, Cs-134, Cs-137, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identified, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Section 15.2.

(d) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

(e) At a minimum, analyze semi-annually if batch releases were made within the six (6) month period. A grab sample of the batch volume can substitute for the composite.

(f) Draw sample for each batch volume.

(g) Complete prior to each release.

BASES

This DNC is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than ten times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC and (2) the limits of 10 CFR Part 20.1301 to the population.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

13.1 RADIOACTIVE LIQUID EFFLUENTS

13.1.2 Liquid Effluents Dose

DNC 13.1.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials released in liquid effluents released to UNRESTRICTED AREAS shall be limited to:

a. ≤ 1.5 mrem to the total body and ≤ 5 mrem to any organ during any calendar quarter; and

b. ≤ 3 mrem to the total body and ≤ 10 mrem to any organ during any calendar year.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Calculated dose to a MEMBER OF THE PUBLIC from the release of radioactive materials in liquid effluents to UNRESTRICTED AREAS exceeds limits.	A.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report that (1) Identifies the cause(s) for exceeding the limit(s) and; (2) Defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with DNC 13.1.2.	30 days

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
B. Calculated dose to a MEMBER OF THE PUBLIC from the release of radioactive materials in liquid effluents exceeds 2 times the limits.	B.1 Calculate the annual dose to a MEMBER OF THE PUBLIC which includes contributions from direct radiation from the facility (including outside storage tanks, etc.).	Immediately
	AND	
	B.2 Verify that the limits of DNC 13.4.1 have not been exceeded.	Immediately
C. CONTINGENCY MEASURE B.2 and Associated RESTORATION TIME not met.	C.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report, as defined in 10 CFR 20.2203 (a)(4), of CONTINGENCY MEASURE A.1 shall also include the following: (1) The corrective action(s) to be taken to prevent recurrence of exceeding the limits of DNC 13.4.1 and the schedule for achieving conformance, (2) An analysis that estimates the dose to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s), and (3) Describes the levels of radiation and concentrations of radioactive material involved and the cause of the exposure levels or concentrations.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.1.2.1	Determine cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year in accordance with the methodology and parameters in the ODCM.	31 days

BASES

This DNC is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10 CFR 50. The DNC implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated.

The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

13.1 RADIOACTIVE LIQUID EFFLUENTS

13.1.3 Liquid Radwaste Treatment System

DNC 13.1.3 The Liquid Radwaste Treatment System, as described in the ODCM, shall be used to reduce the radioactive material in liquid wastes prior to their discharge when the projected dose, due to the liquid effluent, to UNRESTRICTED AREAS would exceed in a 31 day period:

a. > 0.06 mrem to the total body; or

b. > 0.2 mrem to any organ.

APPLICABILITY: At all times, except for the parts of the system taken permanently out of service.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Radioactive liquid waste being discharged without treatment and in excess of the above limits.	A.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report that includes: (1) An explanation of why liquid radwaste was being discharged without treatment, identification of any non-functional / inoperable equipment or subsystems, and the reason for the non-functional / inoperability, (2) ACTION(s) taken to restore the non-functional / inoperable equipment to FUNCTIONAL / OPERABLE status, and (3) Summary description of ACTION(s) taken to prevent a recurrence.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.1.3.1	Project the doses due to liquid effluents from the facility to UNRESTRICTED AREAS in accordance with the methodology and parameters specified in the ODCM.	31 days

BASES

The requirement that the appropriate portions of this system be used, when specified, provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable."

This DNC implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50.

The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

13.1 LIQUID EFFLUENTS

13.1.4 Liquid Holdup Tanks

DNC 13.1.4 The quantity of radioactivity contained in unprotected outdoor liquid storage tanks shall be limited to less than the amount that would result in concentrations less than the limits in 10 CFR20, Appendix B, Table II, Column 2, at the nearest potable water supply and surface water supply in an UNRESTRICTED AREA, excluding tritium.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Level of radioactivity exceeds the limits in any listed tank.	A.1 Suspend addition of radioactive material.	Immediately
	<u>AND</u>	
	A.2 Initiate measures to reduce content to within the limits.	48 hours
	<u>AND</u>	
	A.3 Describe the events leading to the condition in the Radioactive Effluent Release Report.	Prior to submittal of next Radioactive Effluent Release Report

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.1.4.1	Sample and analyze radioactive liquid located in unprotected outdoor liquid storage tanks for level of radioactivity.	31 days during addition of radioactive liquid to the tanks

13.1 LIQUID EFFLUENTS

13.1.4 Liquid Holdup Tanks

BASES

The tanks listed in this Normal Condition include outdoor tanks that are not surrounded by liners, dikes or walls capable of holding the tank contents and do not have tank overflows and surrounding area drains connected to the radwaste treatment system.

Technical Requirements Manual 10.1.3 requires a program to ensure that the quantity of radioactive material contained in the specified tanks provides assurance that, in the event of an uncontrolled release of any such tank's contents, the resulting concentration would be less than the limits of 10 CFR 20, Appendix B Table II, Column 2 at the nearest potable water supply and the nearest surface water supply in an UNRESTRECTED AREA. Tank quantities shall be determined in accordance with Standard Review Plan, Section 15.7.3, "Postulated Radioactive Release due to Tank Failures."

13.2 RADIOACTIVE GASEOUS EFFLUENTS

13.2.1 Gaseous Effluents Dose Rate

DNC 13.2.1 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 tritium and for all radionuclides in particulate form with half-lives > 8 days, ≤ 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. The dose rate(s) at or beyond the SITE BOUNDARY due to radioactive gaseous effluents exceeds limits.	A.1 Restore the release rate to within the limit.	Immediately
B. CONTINGENCY MEASURES <u>OR</u> RESTORATION TIME not met.	B.1 Initiate a CR	In accordance with Corrective Action Program
	<u>AND</u>	
	B.2 Explain in the next Radioactive Effluent Release Report why the CONTINGENCY MEASURE was not met in a timely manner.	In accordance with Radioactive Effluent Release Report

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.2.1.1	The dose rate due to tritium and all radionuclides in particulate form with half-lives > 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 13.2.1-1	In accordance with Table 13.2.1-1

Table 13.2.1-1 (Page 1 of 2)
Radioactive Gaseous Waste Sampling and Analysis

GASEOUS RELEASE TYPE		TYPE OF ACTIVITY ANALYSIS	SAMPLE TYPE	SAMPLE FREQUENCY	MINIMUM ANALYSIS FREQUENCY	LOWER LIMIT OF DETECTION (LLD) (a)
1. Auxiliary Building Vent						
	a.	Principal Gamma Emitters (b)	Particulate Sample	Continuous (c)	31 days (SAFSTOR) 7 days (Major Decommissioning Activities*)	1×10^{-11} µCi/ml
	b.	Gross Alpha	Particulate Sample	Continuous (c)	31 days (SAFSTOR) 7 days (Major Decommissioning Activities*)	1×10^{-11} µCi/ml
	c.	H-3	Grab Sample	31 days	31 days	1×10^{-6} µCi/ml
	d.	Sr-90	Composite Particulate Sample	Continuous (c)	184 days (d)	1×10^{-11} µCi/ml

* Reference 10 CFR 50.2

Table 13.2.1-1 (Page 2 of 2)
Radioactive Gaseous Waste Sampling and Analysis

(a) The LLD is defined, for purposes of these DNC's, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 * S_b}{E * V * 2.22 \times 10^6 * Y * \exp^{(-\lambda \Delta t)}}$$

Where:

- LLD is the a priori lower limit of detection as defined above, as μCi per unit mass or volume,
- s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,
- E is the counting efficiency, as counts per disintegration,
- V is the sample size in units of mass or volume,
- 2.22×10^6 is the number of disintegrations per minute per microcurie,
- Y is the fractional radiochemical yield, when applicable,
- λ is the radioactive decay constant for the particular radionuclide, and
- Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting.
- Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

(b) The principal gamma emitters for which the LLD requirement applies exclusively are the following radionuclides: Mn-54, Co-60, Cs-134, Cs-137, and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Section 15.2.

(c) The ratio of the sample flow rate to the sampled flow stream flow rate shall be known (based on sampler and ventilation system flow measuring devices or periodic flow estimates) for the time period covered by each dose or dose rate calculation made in accordance with ODCM DNC 13.2.1 and 13.2.3.

(d) At a minimum, analyze semi-annually.

BASES

This DNC is provided to ensure that the dose rates at any time to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY are less than or equal to 1500 mrem/yr to any organ. This dose rate limit provides additional assurance that radioactive material discharged in gaseous effluents will be maintained ALARA, and ensure that the exposures of MEMBERS OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, will not exceed the annual average concentrations specified in Appendix B, Table 2, Column 1 of 10 CFR 20. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

13.2 RADIOACTIVE GASEOUS EFFLUENTS

13.2.2 Gaseous Effluent Dose - Noble Gas

Content deleted. No longer applicable.

13.2 RADIOACTIVE GASEOUS EFFLUENTS

13.2.3 Gaseous Effluent Dose – Tritium and Particulate

DNC 13.2.3 The dose to a MEMBER OF THE PUBLIC from tritium, and all radionuclides in particulate form with half-lives > 8 days, in gaseous effluents, released to areas at or beyond the SITE BOUNDARY (Plant Drawing A-408) shall be limited to the following:

a. ≤ 7.5 mrem to any organ during any calendar quarter, and

b. ≤ 15 mrem to any organ during any calendar year.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. The calculated dose from the release of tritium, and radionuclides in particulate form with half-lives > 8 days released in gaseous effluents at or beyond the SITE BOUNDARY exceeds limits.	A.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report that (1) Identifies the cause(s) for exceeding the limit(s) and; (2) Defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with DNC 13.2.3.	30 days

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
B. Calculated dose to a MEMBER OF THE PUBLIC from the release of radioactive materials in liquid effluents exceeds 2 times the limits.	B.1 Calculate the annual dose to a MEMBER OF THE PUBLIC which includes contributions from direct radiation from the facility (including outside storage tanks, etc.).	Immediately
	AND	
	B.2 Verify that the limits of DNC 13.4.1 have not been exceeded.	Immediately
C. CONTINGENCY MEASURE B.2 and Associated RESTORATION TIME not met.	C.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report, as defined in 10 CFR 20.2203 (a)(4), of CONTINGENCY MEASURE A.1 shall also include the following: (1) The corrective action(s) to be taken to prevent recurrence of exceeding the limits of DNC 13.4.1 and the schedule for achieving conformance, (2) An analysis that estimates the dose to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s), and (3) Describes the levels of radiation and concentrations of radioactive material involved and the cause of the exposure levels or concentrations.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.2.3.1	Determine cumulative dose contributions for the current calendar quarter and current calendar year for tritium, and radionuclides in particulate form with half-lives > 8 days in accordance with the methodology and parameters in the ODCM.	31 days

BASES

This DNC is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The DNC's are the guides set forth in Section II.C of Appendix I. The contingency measures provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable."

The ODCM calculational methods specified in the DVR's implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977.

These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate limitations for tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man, in areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

13.2 RADIOACTIVE GASEOUS EFFLUENTS

13.2.4 GASEOUS RADWASTE TREATMENT SYSTEM

DNC 13.2.4 The VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent air doses due to gaseous effluent releases to areas at and beyond the SITE BOUNDARY (Plant Drawing A-408) would be:

a. > 0.3 mrem to any organ in 31 day period.

APPLICABILITY: At all times, except for the parts of the system taken permanently out of service.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Radioactive gaseous waste is being discharged without treatment. AND Projected doses due to the gaseous effluent, from the facility, at and beyond the SITE BOUNDARY would exceed limits.	A.1 Prepare and submit to the NRC, pursuant to Section 15.3, a Special Report that includes the following: (1) Explanation of why gaseous radwaste was being discharged without treatment, (2) Identification of any non-functional / inoperable equipment or subsystems and the reason for the non-functional / inoperability, (3) ACTION(s) taken to restore the non-functional / inoperable equipment to FUNCTIONAL / OPERABLE status, and (4) Summary description of ACTION(s) taken to prevent a recurrence.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.2.4.1	Project the doses due to gaseous effluents from each facility at and beyond the SITE BOUNDARY in accordance with the methodology and parameters in the ODCM.	31 days

BASES

The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable."

This DNC implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in section II.D of Appendix I to 10 CFR Part 50.

The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

13.2 GASEOUS EFFLUENTS

13.2.5 Gas Storage Tanks

Content deleted. No longer applicable.

13.3 INSTRUMENTATION

13.3.1 Radioactive Liquid Effluent Monitoring Instrumentation

DNC 13.3.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table 13.3.1-1 shall be FUNCTIONAL with:

a. The minimum FUNCTIONAL channel(s) in service.

b. The alarm/trip setpoints set to ensure that the limits of DNC 13.1.1 are not exceeded.

APPLICABILITY: During release via the monitored pathway.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required.	A.1 Suspend the release of radioactive liquid effluents monitored by the affected channel.	Immediately
	<u>OR</u>	
	A.2 Declare the channel non-functional.	Immediately
	<u>OR</u>	
	A.3 Change the setpoint so it is acceptably conservative.	Immediately

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
B. Liquid Radwaste Effluent Line (R-18) non-functional prior to or during effluent releases.	-----------NOTE---------------- Prior to initiating an effluent release, complete sections B.1.1 and B.1.2 ----------------------------------	
	B.1.1 Analyze at least 2 independent samples in accordance with Table 13.1.1-1.	Prior to initiating a release
	AND	
	B.1.2 -----------NOTE---------------- Verification ACTION will be performed by at least 2 separate technically qualified members of the facility staff. ---------------------------------- Independently verify the release rate calculations and discharge line valving.	Prior to initiating a release
	OR	
	B.2 Suspend release of radioactive effluents via this pathway	Immediately

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
C. CONTINGENCY MEASURES OR RESTORATION TIME of A or B not met.	C.1 Initiate a CR	In accordance with Corrective Action Program
	AND	
	C.2 Explain in the next Radioactive Effluent Release Report why the CONTINGENY MEASURE was not met in a timely manner.	In accordance with Radioactive Effluent Release Report

VERIFICATION REQUIREMENTS

NOTE
Refer to Table 13.3.1-1 to determine which DVRs apply for each function.

VERIFICATION		FREQUENCY
DVR 13.3.1.1	Perform CHANNEL CHECK.	24 hours
DVR 13.3.1.2	Perform SOURCE CHECK.	Prior to release
DVR 13.3.1.3	Perform CHANNEL FUNCTIONAL TEST	92 days
DVR 13.3.1.4	Perform CHANNEL CALIBRATION.	18 months

Table 13.3.1-1
Radioactive Liquid Effluent Monitoring Instrumentation

INSTRUMENT	REQUIRED CHANNELS PER INSTRUMENT	VERIFICATION REQUIREMENTS
1. Gross Radioactivity Monitors Providing Alarm and Automatic Termination of Release		
a. Liquid Radwaste Effluent Line (R-18)	1	DVR 13.3.1.1 DVR 13.3.1.2 DVR 13.3.1.3 DVR 13.3.1.4

BASES

The radioactive liquid effluent instrumentation, required FUNCTIONAL by this DNC, is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluent. The alarm/trip setpoints for these instruments shall be calculated and adjusted in accordance with methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding ten (10) times the values 10 CFR Part 20, Appendix B, Table 2, Column 2. The FUNCTIONALITY and use of this instrumentation is consistent with the appropriate requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

13.3 INSTRUMENTATION

13.3.2 Radioactive Gaseous Effluent Monitoring Instrumentation

DNC 13.3.2 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 13.3.2-1 shall be FUNCTIONAL with:

a. The minimum FUNCTIONAL channel(s) in service.

APPLICABILITY: During release via the monitored pathway.

ACTIONS

-------------------- NOTE --------------------
Separate NON-CONFORMANCE entry is allowed for each channel.

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Less than the minimum number of channels FUNCTIONAL.	A.1 Restore non-functional channel(s) to FUNCTIONAL status.	30 days.
B. Sampler Flow rate Measuring Devices (for the Auxiliary Building Ventilation Sampler) non-functional prior to or during releases	B.1 Estimate the flow rate for the non-functional channel(s).	4 hours <u>AND</u> Once per 4 hours thereafter
C. Particulate Samplers (for the Auxiliary Building Ventilation system) non-functional prior to or during releases	C.1 Continuously collect samples using auxiliary sampling equipment as required in Table 13.2.1-1.	12 hours
D. CONTINGENCY MEASURES <u>OR</u> RESTORATION TIME A, B, or C not met.	D.1 Initiate a CR <u>AND</u> D.2 Explain in the next Radioactive Effluent Release Report why the CONTINGENCY MEASURE was not met in a timely manner.	In accordance with Corrective Action Program In accordance with Radioactive Effluent Release Report

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.3.2.1	Perform CHANNEL CHECK.	24 hours
DVR 13.3.2.2	Perform CHANNEL CHECK.	31 days
DVR 13.3.2.3	Perform CHANNEL FUNCTIONAL TEST.	92 days
DVR 13.3.2.4	Perform CHANNEL CALIBRATION.	18 months

Table 13.3.2-1
Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	REQUIRED CHANNELS PER INSTRUMENT	NON-CONFORMANCE	VERIFICATION REQUIREMENTS
1. Auxiliary Building Vent			
a. Particulate Sampler (R-13 or R-14)	1	C	DVR 13.3.2.2
b. Sample Flow-Rate Monitor (R-13 or R-14)	1	B	DVR 13.3.2.1 DVR 13.3.2.3 DVR 13.3.2.4

BASES

The radioactive gaseous effluent instrumentation, required FUNCTIONAL by this DNC, is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design criteria 60, 63 and 64 in Appendix A to 10 CFR Part 50.

13.4 RADIOACTIVE EFFLUENTS TOTAL DOSE

13.4.1 Radioactive Effluents Total Dose

DNC 13.4.1 The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to ≤ 25 mrem to the total body or any organ, except the thyroid, which shall be limited to ≤ 75 mrem.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Estimated dose or dose commitment due to direct radiation and the release of radioactive materials in liquid or gaseous effluents exceeds the limits.	A.1 Verify the condition resulting in doses exceeding these limits has been corrected.	Immediately
B. CONTINGENCY MEASURES A.1 and RESTORATION TIME not met.	B.1 --------------NOTE------------- This is the Special Report required by DNC 13.1.2, or 13.2.3 supplemented with the following. ---------------------------------- Submit a Special Report, pursuant to Section 15.3, including a request for a variance in accordance with the provisions of 40 CFR 190. This submission is considered a timely request, and a variance is granted until staff ACTION on the request is complete.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
DVR 13.4.1.1	Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with VERIFICATION REQUIREMENTS 13.1.2.1, and 13.2.3.1 in accordance with the methodology and parameters in the ODCM.	12 months
DVR 13.4.1.2	Cumulative dose contributions from direct radiation from the facility shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under conditions set forth in ODCM DNC 13.4.1.A.	12 months

BASES

This normal condition is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The DNC requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem. It is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the facility remains within twice the dose design objectives of Appendix I, and if direct radiation doses from the facility are kept small.

The Special Report will describe a course of ACTION that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff ACTION is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in ODCM Normal Condition 13.3.1 and 13.4.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

13.5 RADIOLOGICAL ENVIRONMENTAL MONITORING

13.5.1 Monitoring Program

This Kewaunee Program is established by the RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM) and implemented by approved station procedures. This program is required by Technical Requirements Manual 10.1.1 and ODCM.

The radiological environmental monitoring program required by this DNC provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring.

13.5 RADIOLOGICAL ENVIRONMENTAL MONITORING

13.5.2 Land Use Census Program

This Kewaunee Land Use Census Program is implemented by the RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM) and Land Use Census Program procedure.

BASES

This DNC is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

13.5 RADIOLOGICAL ENVIRONMENTAL MONITORING

13.5.3 Interlaboratory Comparison Program

This Kewaunee Interlaboratory Comparison Program is implemented by the RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM) and approved station procedures.

BASES

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring (developed using the guidance in Regulatory Guide 1.21, Revision 1, April 1974 and Regulatory Guide 4.1, Revision 1, April 1975) in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

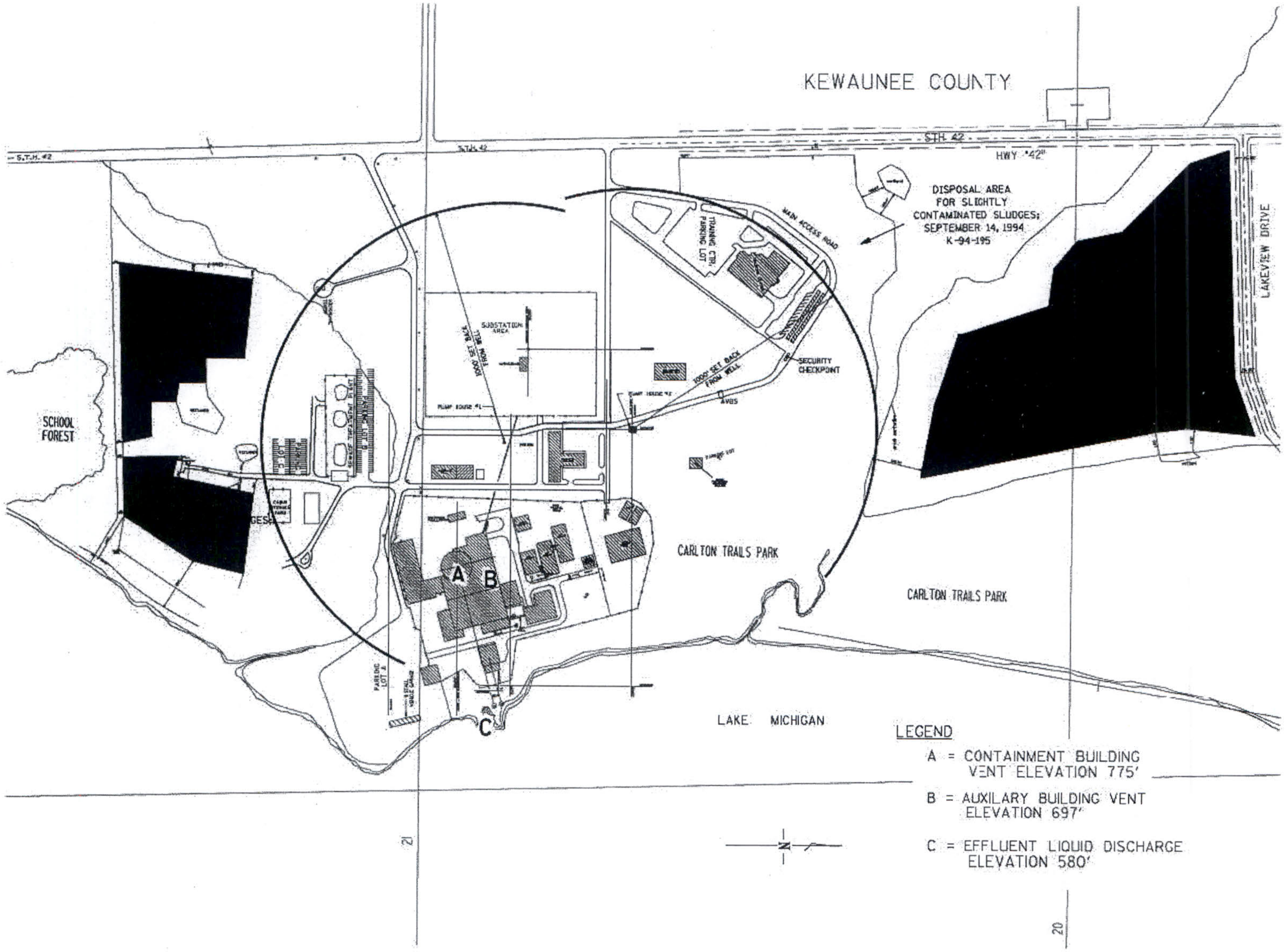
14.0 DESIGN FEATURES

14.1 GASEOUS AND LIQUID EFFLUENT RELEASE POINTS

14.1.1 Figure 14.1-1 presents the locations of radioactive effluent release points at the plant.

14.1.2 Plant drawing A-408, "Radiological Survey Site Map" depicts the site area by illustrating the SITE BOUNDARY.

FIGURE 14.1-1


KEWAUNEE COUNTY
STH 42
HWY "42"
DISPOSAL AREA
FOR SLIGHTLY
CONTAMINATED SLUDGES;
SEPTEMBER 14, 1994
K-94-195
LAKEVIEW DRIVE
MAIN ACCESS ROAD
TRAINING CTR. PARKING LOT
SUBSTATION AREA
1000' SET BACK FROM WELL
SECURITY CHECKPOINT
SCHOOL FOREST
CARLTON TRAILS PARK
CARLTON TRAILS PARK
LAKE MICHIGAN
A
B
C
21
20
LEGEND
A = CONTAINMENT BUILDING VENT ELEVATION 775'
B = AUXILARY BUILDING VENT ELEVATION 697'
C = EFFLUENT LIQUID DISCHARGE ELEVATION 580'

15.0 ADMINISTRATIVE CONTROLS

15.1 Major Changes to Radioactive Waste Systems[1]

Licensee initiated major changes to the radioactive waste systems (liquid, gaseous and solid) shall be reported to the Commission in the Radioactive Effluent Release Report for the period in which the evaluation was reviewed by FSRG. The discussion of each change shall contain:

a. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR Part 50.59,

b. Sufficient information to totally support the reason for the change without benefit of additional or supplemental information,

c. A description of the equipment, components and processes involved and the interfaces with other plant systems,

d An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the license application and amendments thereto,

e. An evaluation of the change, which shows the expected maximum exposures to individuals in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto,

f. A comparison of the predicted releases of radioactive materials in liquid and gaseous effluents and in solid waste to the actual releases for the period in which the changes are to be made;

g. An estimate of the exposure to plant operating personnel as a result of the change, and

h. Documentation of the fact that the change was reviewed and found acceptable by the FSRG.

Changes shall become effective upon review and acceptance by the FSRG.

[1]Licensees may choose to submit the information called for in this requirement as part of the periodic USAR update.

15.0 ADMINISTRATIVE CONTROLS

15.2 Radioactive Effluent Release Report

The Radioactive Effluent Release Report to be submitted by May 1 of each year shall include:

a. A summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility following the format of Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974.

b. An assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the facility during the previous calendar year.

c. An assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from facility releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, the previous calendar year to show conformance with 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation.

   All assumptions used in making these assessments, i.e., specific activity, exposure time and location, shall be included in these reports. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

d. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility. The material provided shall be consistent with the objectives outlined in the ODCM and the PCP, and in conformance with 10 CFR 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.

e. A list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

f. Any changes made during the reporting period to the PROCESS CONTROL PROGRAM (PCP) and to the OFFSITE DOSE CALCULATION MANUAL (ODCM), as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the land use census pursuant to DNC 13.5.2.

15.0 ADMINISTRATIVE CONTROLS

15.3 Special Reports

Special reports may be required covering inspections, tests, and maintenance activities. These special reports are determined on an individual basis. Their preparation and submittal are designated in the ODCM Contingency Measures for each Normal Condition.

Special reports shall be submitted to the Director of the NRC Regional Office listed in Appendix D, 10 CFR Part 20, with a copy to the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington D.C. 20555 within the time period specified for each report.

These Special Report(s) are in lieu of a Licensee Event Report

Kewaunee Power Station

Offsite Dose Calculation Manual

<u>PART II - CALCULATIONAL METHODOLOGIES</u>

1.0 LIQUID EFFLUENTS METHODOLOGY

1.1 Radiation Monitoring Instrumentation and Controls

The liquid effluent monitoring instrumentation and controls installed at Kewaunee for controlling and monitoring normal radioactive material releases in accordance with 10 CFR 50, Appendix A, Criteria 60 and 64, are summarized as follows:

1) Alarm (and Automatic Termination) – R-18 provides this function on the liquid radwaste effluent line.

2) Liquid Tank Controls – All radioactive liquid tanks are located inside the Auxiliary Building and contain the suitable confinement systems and drains to prevent direct, unmonitored release to the environment. A liquid radioactive waste flow diagram with the applicable, associated radiation monitoring instrumentation and controls is presented as Figure 1.

1.2 Liquid Effluent Monitor Setpoint Determination

Per the requirements of Technical Requirements Manual 10.1.2 and ODCM Normal Condition 13.3.1, alarm setpoints shall be established for the liquid effluent monitoring instrumentation to ensure that the release concentration limits of ODCM Normal Condition 13.1.1 are met (i.e., the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREA shall be limited to ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides. The following equation[1] must be satisfied to meet the liquid effluent restrictions:

$$c \leq \frac{10 \times C(F+f)}{f} \qquad (1.1)$$

[1] Adapted from NUREG-0133 to include the application of 10 times the Effluent Concentration (EC) of 10 CFR 20, Appendix B, Table 2, Column 2.

where:

$10 \times C$ = ten times the effluent concentration limit of 10 CFR 20, Appendix B, Table 2, Column 2, in µCi/ml.

c = the setpoint, in µCi/ml, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release; the setpoint, which is inversely proportional to the volumetric flow of the effluent line and proportional to the volumetric flow of the dilution stream plus the effluent stream, represents a value which, if exceeded, would result in concentrations exceeding the limits of ODCM Normal Condition 13.1.1.

f = the flow rate at the radiation monitor location in volume per unit time, but in the same units as F, below.

F = the dilution water flow rate as measured prior to the release point, in volume per unit time.

[Note that if no dilution is provided, $c \leq C$. Also, note that when (F) is large compared to (f), then $(F + f) \approx F$.]

1.2.1 Liquid Effluent Monitors (Radwaste)

The setpoints for the liquid effluent monitors at the Kewaunee Power Station are determined by the following equations:

$$\mathrm{SP} \leq \frac{(\mathrm{DW}+\mathrm{RR}) \times \sum (\mathrm{C_i} \times \mathrm{SEN_i})}{\sum \frac{\mathrm{C_i}}{10 \times \mathrm{EC_i}} \times \mathrm{RR}} + \mathrm{bkg} \qquad (1.2)$$

where:

SP = alarm setpoint corresponding to the maximum allowable release rate (cpm)

C_i = the concentration of radionuclide "i" in the liquid effluent (µCi/ml), to include gamma emitters only

$10 \times EC_i$ = ten times the EC value corresponding to radionuclide "i" from 10 CFR 20, Appendix B, Table 2, Column 2 (µCi/ml)

SEN_i = the sensitivity value to which the monitor is calibrated for radionuclide "i" (cpm per µCi/ml). The default calibration value from Table 1.1 may be used for gamma emitting radionuclides in lieu of nuclide specific values.

DW = the dilution water flow rate at the time of release (gal/min).

RR = the liquid effluent release rate (gal/min).

bkg = the background of the monitor (cpm).

The radioactivity monitor setpoint equation (1.2) remains valid during periods when the dilution water is at its lowest or zero. Reduction of the waste stream flow (RR) may be necessary during these periods to meet the discharge criteria. At its lowest value, (DW + RR) equals RR and equation (1.2) reverts to the following equation:

$$SP \leq \frac{\sum (C_i \times SEN_i)}{\sum \frac{C_i}{(10 \times EC_i)}} + bkg \qquad (1.3)$$

1.2.2 Conservative Default Values

Non-gamma emitting radionuclides (H-3, Fe-55, Ni-63, Sr-90) are not detected by the effluent monitor and, therefore, are not directly included in the above setpoint equation. These non-gamma radionuclides can, however, contribute a sizable fraction of the total EC limit. The method specified below for establishing default setpoints provides conservatism to account for these non-gamma emitters and ensures that the setpoint meets the requirements of ODCM Normal Condition 13.3.1 including all radionuclides.

Conservative alarm setpoints can be determined through the use of generic default parameters based on the following:

a) substitution of a default effective EC (EC_e) value

where:

$$EC_e = \frac{\sum C_i}{\sum \frac{C_i}{(EC_i)}} \qquad (1.4)$$

b) substitution of the lowest operational dilution water flow, in gal/min and,

c) substitution of the highest effluent release rate, in gal/min,

d) substitution of a default monitor sensitivity.

The default setpoint equation is provided below:

$$SP \leq \frac{EC_e \times SEN \times (DW + RR)}{RR} + bkg \qquad (1.5)$$

1.3 Liquid Effluent Concentration Limits – 10 CFR 20

ODCM Normal Condition 13.1.1 limits the concentration of radioactive material in liquid effluents (after dilution) to less than ten times the concentrations as specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases. Release rates are controlled and radiation monitor alarm setpoints are established to ensure that these concentration limits are not exceeded. In the event any liquid release results in an alarm setpoint being exceeded, an evaluation of compliance with the concentration limits of ODCM Normal Condition 13.1.1 may be performed using the following equation:

where:

$$\sum\left[\left(C_i \div (10 \times EC_i)\right) \times \left(RR \div (RR + DW)\right)\right] \leq 1 \qquad (1.6)$$

C_i = concentration of radionuclide "i" in the undiluted liquid effluent (μCi/ml)

$10 \times EC_i$ = ten times the EC value corresponding to radionuclide "i" from 10 CFR 20, Appendix B, Table 2, Column 2 (μCi/ml)

RR = the liquid effluent release rate (gal/min)

DW = the dilution water flow rate at the time of the release (gal/min)

1.4 Liquid Effluent Dose Calculation – 10 CFR 50

ODCM Normal Condition 13.1.2 limits the dose or dose commitment to MEMBERS OF THE PUBLIC from radioactive materials in liquid effluents from the Kewaunee Power Station to:

- during any calendar quarter;

  ≤ 1.5 mrem to total body

  ≤ 5.0 mrem to any organ

- during any calendar year;

  ≤ 3.0 mrem to total body

  ≤ 10.0 mrem to any organ.

Per Verification Requirement 13.1.2.1, the following calculational methods may be used for determining the dose or dose commitment due to the liquid radioactive effluents from Kewaunee.

$$D_o = \frac{1.67E-02 \times VOL}{RR + DW} \times \sum (C_i \times A_{io}) \qquad (1.7)$$

where:

D_o	=	dose or dose commitment to organ "o", including total body (mrem)
A_{io}	=	site-related ingestion dose commitment factor to the total body or any organ "o" for radionuclide "i" (mrem/hr per µCi/ml) (Table 1.2)
C_i	=	average concentration of radionuclide "i", in undiluted liquid effluent representative of the volume VOL (µCi/ml)
VOL	=	volume of liquid effluent released (gal)
RR	=	the liquid effluent release rate (gal/min)
DW	=	average dilution water discharge rate during release period (gal/min)
1.67E-02	=	conversion factor (hr/min)

The site-related ingestion doses/dose commitment factors (A_{io}) are presented in Table 1.2 and have been derived in accordance with guidance of NUREG-0133 by the equation:

$$A_{io} = 1.14E+05[(U_w \div D_w) + (U_F \times BF_i)]DF_i \quad (1.8)$$

where:

A_{io}	=	composite dose parameter for the total body or critical organ "o" of an adult for radionuclide "i", for the fish ingestion and water consumption pathways (mrem/hr per µCi/ml)
1.14E+05	=	conversion factor (pCi/µCi × ml/kg ÷hr/yr)
U_w	=	adult water consumption (730 kg/yr)
D_w	=	dilution factor from the near field area within ¼ mile of the release point to the nearest potable water intake for the adult water consumption (84[2], unitless)
U_F	=	adult fish consumption (21 kg/yr)
BF_i	=	bioaccumulation factor for radionuclide "i" in fish from Table 1.3 (pCi/kg per pCi/1)
DF_i	=	dose conversion factor for radionuclide "i" for adults in pre-selected organ "o", from Table E-11 of Regulatory Guide 1.109, 1977 and NUREG 0172, 1977 (mrem/pCi)

The radionuclides included in the periodic dose assessment per the requirements of ODCM Normal Condition 13.1.2 and Verification Requirement 13.1.2.1 are those as identified by gamma spectral analysis of the liquid waste samples collected and analyzed per Verification Requirement 13.1.1.1, Table 13.1.1-1.

Radionuclides requiring radiochemical analysis (e.g., Sr-90) will be added to the dose analysis at a frequency consistent with the required minimum analysis frequency of Table 13.1.1-1.

[2] Adapted from the Kewaunee Final Environmental Statement, Section V.

1.5 Liquid Effluent Dose Projections

ODCM Normal Condition 13.1.3 requires that the liquid radioactive waste processing system be used to reduce the radioactive material levels in the liquid waste prior to release when the 31 day projected doses exceed:

- 0.06 mrem to the total body, or
- 0.2 mrem to any organ.

The applicable liquid waste streams and processing systems are as delineated in Figure 1.

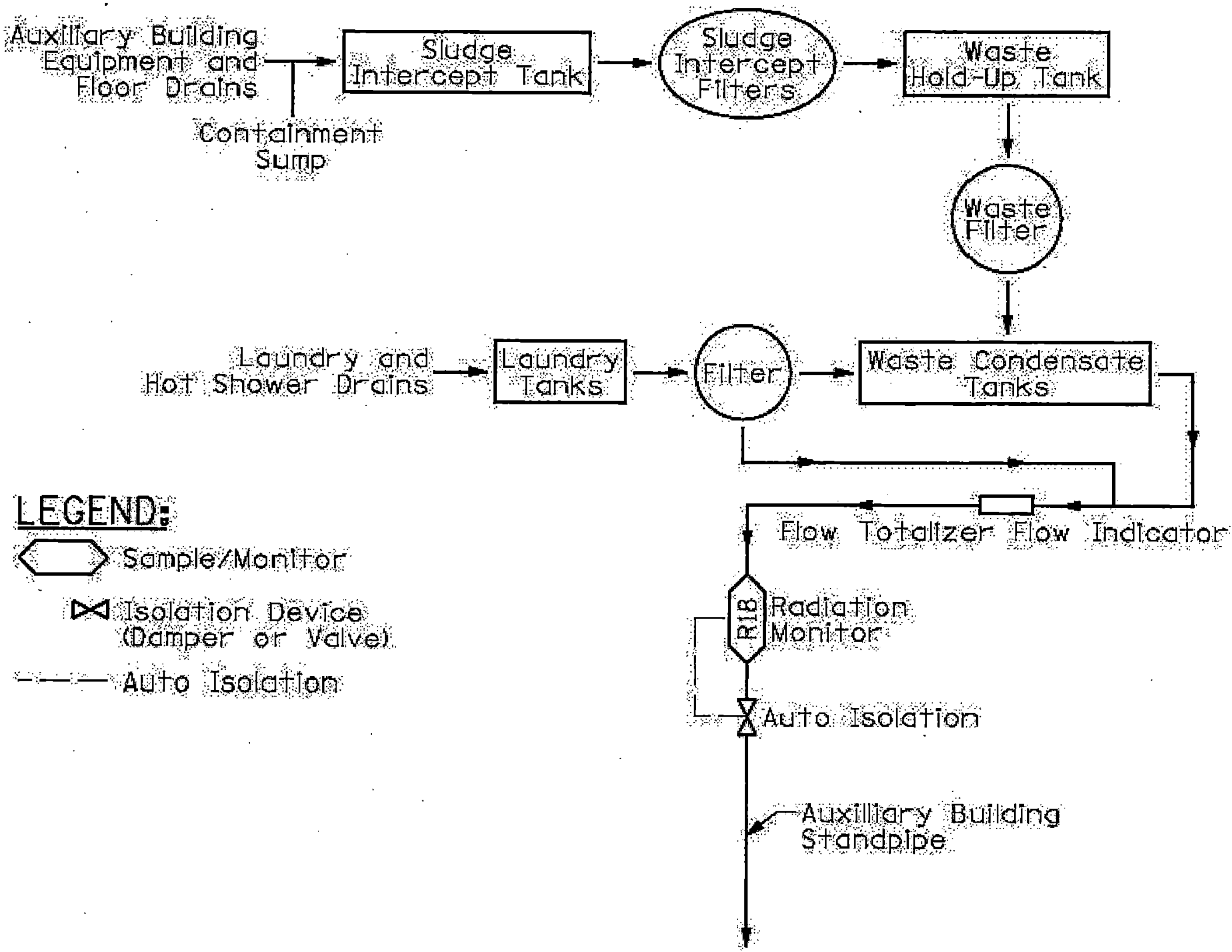
Dose projections are made at least once per 31 days by the following equations:

$$D_{tbp} = D_{tb}(31 \div d) \qquad (1.9)$$

$$D_{maxp} = D_{max}(31 \div d) \qquad (1.10)$$

where:

D_{tbp}	=	the total body dose projection for current 31 day period (mrem)
D_{tb}	=	the total body dose to date for current 31 day period as determined by equation (1.7) (mrem)
D_{maxp}	=	the maximum organ dose projection for current 31 day period (mrem)
D_{max}	=	the maximum organ dose to date for current 31 day period as determined by equation (1.7) (mrem)
d	=	the number of days to date for current 31 day period
31	=	the number of days in a 31 day period



ODCM FIGURE 1
LIQUID RADIOACTIVE EFFLUENT FLOW DIAGRAM

Table 1.1
Parameters for Liquid Alarm Setpoint Determinations

Parameter	Actual Value	Units	Comments
EC_e	calculated	µCi/ml	Calculate as needed
C_i	measured	µCi/ml	Taken from gamma spectral analysis of liquid effluent
EC_i	as determined	µCi/ml	Taken from 10 CFR 20, Appendix B, Table 2, Col. 2
Sensitivity (SEN) R-18	1.0E+08	cpm per µCi/ml	Radwaste effluent (value based on Cs-137) Refer to Plant Drawing E-2021
Release Rate (RR) R-18	as determined	gpm	Determined prior to release; release rate can be adjusted for ODCM limit compliance
Background (bkg) R-18	as determined	cpm	Determined prior to release
Setpoint (SP) R-18*	calculated	cpm	Default alarm setpoints at conservative values may be used as deemed appropriate and desirable for assuring regulatory compliance and for maintaining releases ALARA.

* The alarm setpoint for R-18 cannot exceed the linear calibration range of the radiation monitor in accordance with CAP 37265 and DCR 26981 (5.00E+05+bkg cpm).

Table 1.2 (Page 1 of 2)
Site Related Ingestion Dose Commitment Factors
(mrem/hr per µCi/ml)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H-3	-	3.30E-1	3.30E-1	3.30E-1	3.30E-1	3.30E-1	3.30E-1
C-14	3.13E+4	6.26E+3	6.26E+3	6.26E+3	6.26E+3	6.26E+3	6.26E+3
Na-24	4.09E+2	4.09E+2	4.09E+2	4.09E+2	4.09E+2	4.09E+2	4.09E+2
P-32	1.39E+6	8.62E+4	5.36E+4	-	-	-	1.56E+5
Cr-51	-	-	1.28E+0	7.63E-1	2.81E-1	1.69E+0	3.21E+2
Mn-54	-	4.38E+3	8.36E+2	-	1.30E+3	-	1.34E+4
Mn-56	-	1.10E+2	1.96E+1	-	1.40E+2	-	3.52E+3
Fe-55	6.61E+2	4.57E+2	1.06E+2	-	-	2.55E+2	2.62E+2
Fe-59	1.04E+3	2.45E+3	9.40E+2	-	-	6.85E+2	8.17E+3
Co-57	-	2.11E+1	3.51E+1	-	-	-	5.36E+2
Co-58	-	8.99E+1	2.02E+2	-	-	-	1.82E+3
Co-60	-	2.58E+2	5.70E+2	-	-	-	4.85E+3
Ni-63	3.13E+4	2.17E+3	1.05E+3	-	-	-	4.52E+2
Ni-65	1.27E+2	1.65E+1	7.52E+0	-	-	-	4.18E+2
Cu-64	-	1.01E+1	4.72E+0	-	2.53E+1	-	8.57E+2
Zn-65	2.32E+4	7.38E+4	3.33E+4	-	4.93E+4	-	4.65E+4
Zn-69	4.93E+1	9.43E+1	6.56E+0	-	6.13E+1	-	1.42E+1
Br-82	-	-	2.27E+3	-	-	-	2.61E+3
Br-83	-	-	4.05E+1	-	-	-	5.83E+1
Br-84	-	-	5.24E+1	-	-	-	4.12E-4
Br-85	-	-	2.15E+0	-	-	-	-
Rb-86	-	1.01E+5	4.71E+4	-	-	-	1.99E+4
Rb-88	-	2.90E+2	1.54E+2	-	-	-	4.00E-9
Rb-89	-	1.92E+2	1.35E+2	-	-	-	-
Sr-89	2.24E+4	-	6.44E+2	-	-	-	3.60E+3
Sr-90	5.52E+5	-	1.35E+5	-	-	-	1.59E+4
Sr-91	4.13E+2	-	1.67E+1	-	-	-	1.97E+3
Sr-92	1.57E+2	-	6.77E+0	-	-	-	3.10E+3
Y-90	5.85E-1	-	1.57E-2	-	-	-	6.21E+3
Y-91m	5.53E-3	-	2.14E-4	-	-	-	1.62E-2
Y-91	8.58E+0	-	2.29E-1	-	-	-	4.72E+3
Y-92	5.14E-2	-	1.50E-3	-	-	-	9.00E+2
Y-93	1.63E-1	-	4.50E-3	-	-	-	5.17E+3
Zr-95	2.70E-1	8.67E-2	5.87E-2	-	1.36E-1	-	2.75E+2
Zr-97	1.49E-2	3.01E-3	1.38E-3	-	4.55E-3	-	9.34E+2
Nb-95	4.47E+2	2.49E+2	1.34E+2	-	2.46E+2	-	1.51E+6
Nb-97	3.75E+0	9.48E-1	3.46E-1	-	1.11E+0	-	3.50E+3
Mo-99	-	1.07E+2	2.04E+1	-	2.43E+2	-	2.49E+2
Tc-99m	9.11E-3	2.58E-2	3.28E-1	-	3.91E-1	1.26E-2	1.52E+1
Tc-101	9.37E-3	1.35E-2	1.32E-1	-	2.43E-1	6.90E-3	-
Ru-103	4.61E+0	-	1.99E+0	-	1.76E+1	-	5.39E+2
Ru-105	3.84E-1	-	1.52E-1	-	4.96E+0	-	2.35E+2
Ru-106	6.86E+1	-	8.68E+0	-	1.32E+2	-	4.44E+3
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-

Table 1.2 (Page 2 of 2)
Site Related Ingestion Dose Commitment Factors
(mrem/hr per µCi/ml)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Ag-110m	1.04E+0	9.62E-1	5.71E-1	-	1.89E+0	-	3.92E+2
Sb-124	9.48E+0	1.79E-1	3.76E+0	2.30E-2	-	7.38E+0	2.69E+2
Sb-125	6.06E+0	6.77E-2	1.44E+0	6.16E-3	-	4.67E+0	6.67E+1
Te-125m	2.57E+3	9.31E+2	3.44E+2	7.73E+2	1.04E+4	-	1.03E+4
Te-127m	6.49E+3	2.32E+3	7.91E+2	1.66E+3	2.64E+4	-	2.18E+4
Te-127	1.05E+2	3.79E+1	2.28E+1	7.81E+1	4.29E+2	-	8.32E+3
Te-129m	1.10E+4	4.11E+3	1.74E+3	3.79E+3	4.60E+4	-	5.55E+4
Te-129	3.01E+1	1.13E+1	7.33E+0	2.31E+1	1.27E+2	-	2.27E+1
Te-131m	1.66E+3	8.11E+2	6.76E+2	1.28E+3	8.22E+3	-	8.05E+4
Te-131	1.89E+1	7.89E+0	5.96E+0	1.55E+1	8.27E+1	-	2.67E+0
Te-132	2.42E+3	1.56E+3	1.47E+3	1.73E+3	1.50E+4	-	7.39E+4
I-130	2.79E+1	8.23E+1	3.25E+1	6.97E+3	1.28E+2	-	7.08E+1
I-131	1.54E+2	2.20E+2	1.26E+2	7.20E+4	3.76E+2	-	5.79E+1
I-132	7.49E+0	2.00E+1	7.01E+0	7.01E+2	3.19E+1	-	3.76E+0
I-133	5.24E+1	9.11E+1	2.78E+1	1.34E+4	1.59E+2	-	8.19E+1
I-134	3.91E+0	1.06E+1	3.80E+0	1.84E+2	1.69E+1	-	9.26E-3
I-135	1.63E+1	4.28E+1	1.58E+1	2.82E+3	6.86E+1	-	4.83E+1
Cs-134	2.98E+5	7.09E+5	5.79E+5	-	2.29E+5	7.61E+4	1.24E+4
Cs-136	3.12E+4	1.23E+5	8.86E+4	-	6.85E+4	9.39E+3	1.40E+4
Cs-137	3.82E+5	5.22E+5	3.42E+5	-	1.77E+5	5.89E+4	1.01E+4
Cs-138	2.64E+2	5.22E+2	2.59E+2	-	3.84E+2	3.79E+1	2.23E-3
Ba-139	1.02E+0	7.30E-4	3.00E-2	-	6.83E-4	4.14E-4	1.82E+0
Ba-140	2.15E+2	2.69E-1	1.41E+1	-	9.16E-2	1.54E-1	4.42E+2
Ba-141	4.98E-1	3.76E-4	1.68E-2	-	3.50E-4	2.13E-4	-
Ba-142	2.25E-1	2.31E-4	1.42E-2	-	1.95E-4	1.31E-4	-
La-140	1.52E-1	7.67E-2	2.03E-2	-	-	-	5.63E+3
La-142	7.79E-3	3.54E-3	8.82E-4	-	-	-	2.59E+1
Ce-141	3.17E-2	2.14E-2	2.43E-3	-	9.95E-3	-	8.19E+1
Ce-143	5.58E-3	4.13E+0	4.57E-4	-	1.82E-3	-	1.54E+2
Ce-144	1.65E+0	6.90E-1	8.87E-2	-	4.10E-1	-	5.58E+2
Pr-143	5.60E-1	2.25E-1	2.77E-2	-	1.30E-1	-	2.45E+3
Pr-144	1.83E-3	7.61E-4	9.31E-5	-	4.29E-4	-	-
Nd-147	3.83E-1	4.42E-1	2.65E-2	-	2.59E-1	-	2.12E+3
W-187	2.96E+2	2.47E+2	8.65E+1	-	-	-	8.10E+4
Np-239	2.97E-2	2.92E-3	1.61E-3	-	9.10E-3	-	5.98E+2

Table 1.3
Bioaccumulation Factors (BFi)
(pCi/kg per pCi/liter)*

Element	Freshwater Fish
H	9.0E-01
C	4.6E+03
Na	1.0E+02
P	3.0E+03
Cr	2.0E+02
Mn	4.0E+02
Fe	1.0E+02
Co	5.0E+01
Ni	1.0E+02
Cu	5.0E+01
Zn	2.0E+03
Br	4.2E+02
Rb	2.0E+03
Sr	3.0E+01
Y	2.5E+01
Zr	3.3E+00
Nb	3.0E+04
Mo	1.0E+01
Tc	1.5E+01
Ru	1.0E+01
Rh	1.0E+01
Ag	2.3E+00
Sb	1.0E+00
Te	4.0E+02
I	1.5E+01
Cs	2.0E+03
Ba	4.0E+00
La	2.5E+01
Ce	1.0E+00
Pr	2.5E+01
Nd	2.5E+01
W	1.2E+03
Np	1.0E+01

* Values in this Table are taken from Regulatory Guide 1.109 except for phosphorus which is adapted from NUREG/CR-1336 and silver and antimony which are taken from UCRL 50564, Rev. 1, October 1972.

2.0 Gaseous Effluents Methodology

2.1 Radiation Monitoring Instrumentation and Controls

The gaseous effluent monitoring instrumentation and controls at Kewaunee for controlling and monitoring normal radioactive material releases in accordance with 10 CFR 50, Appendix A, Criteria 60 and 64, are summarized as follows:

2.1.1 Auxiliary Building Vent

The Auxiliary Building vent receives discharges from the Auxiliary Building radwaste processing area ventilation and Auxiliary Building general area. All effluents pass through the R-13 and/or R-14 channels which contain a particulate sampler.

Effluent flow rates are determined by installed flow measurement equipment, if available, or fan operation (fan configuration). Sampler flow rates are determined by flow rate instrumentation.

2.1.2 Non-routine Discharge Locations

Periodically, non-routine breaches are made in the Auxiliary and Containment buildings that might allow the release of the atmosphere, which contains some levels of radioactivity. These breaches include, but are not limited to, opening the Containment equipment hatch, holes cut in walls or ceilings to allow for moving equipment in or out of the Radiologically Controlled Areas (RCAs). All efforts to maintain these areas at negative pressure will be made. IF negative pressure cannot be maintained (i.e., more exhaust than supply fan volume), THEN supply ventilation to the area must be secured. If the auxiliary building ventilation is out of service (e.g., loss of power or fan failure), a conservative release rate of 5125 cfm may be used (KPS Modification No. KW-16-02022, SAFSTOR III Ventilation). Criteria for determining if and when a release occurs from these areas is provided in implementing procedures. As possible, the effects of these possible releases shall be evaluated beforehand. Any actual releases shall be documented and included in the monthly, quarterly and annual reports as appropriate.

A gaseous radioactive waste flow diagram with the applicable, associated radiation monitoring instrumentation and controls is presented as Figure 2.

2.2

2.2 Gaseous Effluent Instantaneous Dose Rate Calculations - 10 CFR 20

2.2.1 SITE BOUNDARY Dose Rate – Tritium and Particulates

ODCM Normal Condition 13.2.1.a limits the dose rate to ≤ 1500 mrem/yr to any organ for tritium and particulates with half-lives greater than 8 days. To demonstrate compliance with this limit, an evaluation is performed at a frequency no greater than that corresponding to the sampling and analysis time period for continuous releases per Table 13.2.1-1. The following equation may be used for the dose rate evaluation:

$$\dot{D}_o = \chi/Q \times \sum \left(R_i \times \dot{Q}_i \right) \qquad (2.1)$$

where:

$\dot{D}_o$ = average organ dose rate over the sampling time period (mrem/yr)

χ/Q = atmospheric dispersion to the controlling SITE BOUNDARY for the inhalation pathway (sec/m³, from Table 2.1)

R_i = dose parameter for radionuclide "i", (mrem/yr per μCi/m³) for the teen, lung, ground plane inhalation pathways from Tables 2.3 and 2.13

$\dot{Q}_i$ = average release rate over the appropriate sampling period and analysis frequency for radionuclide "i", tritium or other radionuclide in particulate form with half-life greater than 8 days (μCi/sec)

2.3 Gaseous Effluent Dose Calculations - 10 CFR 50

2.3.1 UNRESTRICTED AREA Dose - Tritium and Particulates

Per the requirements of ODCM Normal Condition 13.2.3, a periodic assessment shall be performed to evaluate compliance with the quarterly dose limit (≤ 7.5 mrem) and calendar year limit (≤ 15 mrem) to any organ. The following equation may be used to evaluate the maximum organ dose due to releases of tritium and particulates with half-lives greater than 8 days:

$$D_{aop} = 3.17E-08 \times W \times SF_p \times \sum (R_i \times Q_i) \tag{2.2}$$

where:

D_{aop}	=	dose or dose commitment for age group "a" to organ "o", including the total body, via pathway "p" from tritium and radionuclides in particulate form with half-life greater than eight days (mrem)
W	=	atmospheric dispersion parameter to the controlling location(s) as identified in Table 2.1
χ/Q	=	atmospheric dispersion for ground plane, vegetation, meat and milk pathways, and H-3 dose contribution via other pathways (sec/m^3)
D/Q	=	atmospheric deposition for ground plane, vegetation, meat and milk exposure pathways (1/m^2)
R_i	=	dose factor for radionuclide "i", (mrem/yr per μCi/m^3) or (m^2 - mrem/yr per μCi/sec) from Table 2.2 through 2.13 for each age group "a" and the applicable pathway "p" as identified in Table 2.1. Values for R_i were derived in accordance with the methods described in NUREG-0133. For additional ODCM DCFs that may be used in active DECON, refer to Table D-1 through D-3 in Calculation RA-0065, Rev 0.
Q_i	=	cumulative release over the period of interest for radionuclide "i" -- radioactive material in particulate form with half-life greater than 8 days (μCi).

SF_p = seasonal correction factor to account for the fraction of the period that the applicable exposure pathway does exist.

1) For milk and vegetation exposure pathways:

$$= \frac{\textit{\# of months in the period that grazing occurs}}{\textit{total \# of months in period}}$$

= 0.5 for annual calculations

2) For inhalation and ground plane exposure pathways: = 1.0

The location of exposure pathways and the maximum organ dose calculation may be based on the available pathways in the surrounding environment of Kewaunee as identified by the annual land-use census. Otherwise, the dose will be evaluated based on the predetermined controlling pathways as identified in Table 2.1.

2.4 Gaseous Effluent Dose Projection

ODCM Normal Condition 13.2.4 requires that the VENTILATION EXHAUST TREATMENT SYSTEM be used to reduce radioactive material levels prior to discharge when projected doses exceed one-half the annual design objective rate in any 31 days, i.e., exceeding:

- 0.3 mrem, maximum organ.

The applicable gaseous release sources and processing systems are as delineated in Figure 2.

Dose projections are performed at least once per 31 days by the following equations:

$$D_{maxp} = D_{max} \times (31 \div d) \qquad (2.13)$$

where:

D_{maxp}	=	maximum organ dose projection for current 31 day period (mrem)
D_{max}	=	maximum organ dose to date for current 31 day period as determined by equation (2.2) (mrem)
d	=	number of days to date in current 31 day period
31	=	number of days in a 31 day period

2.5 Environmental Radiation Protection Standards 40 CFR 190

For the purpose of implementing ODCM Normal Condition 13.4.1 on the EPA environmental radiation protection standard and Technical Requirements Manual 10.3.2 on reporting requirements, dose calculations may be performed using the above equations with the substitution of average or actual meteorological parameters for the period of interest and actual applicable pathways as needed. Any exposure attributable to on-site sources will be evaluated based on the results of the environmental monitoring program (TLD measurements) or by calculational methods. NUREG-0543 describes acceptable methods for demonstrating compliance with 40 CFR Part 190 when radioactive effluents exceed the Appendix I portion of the specifications.

2.6 Total Dose

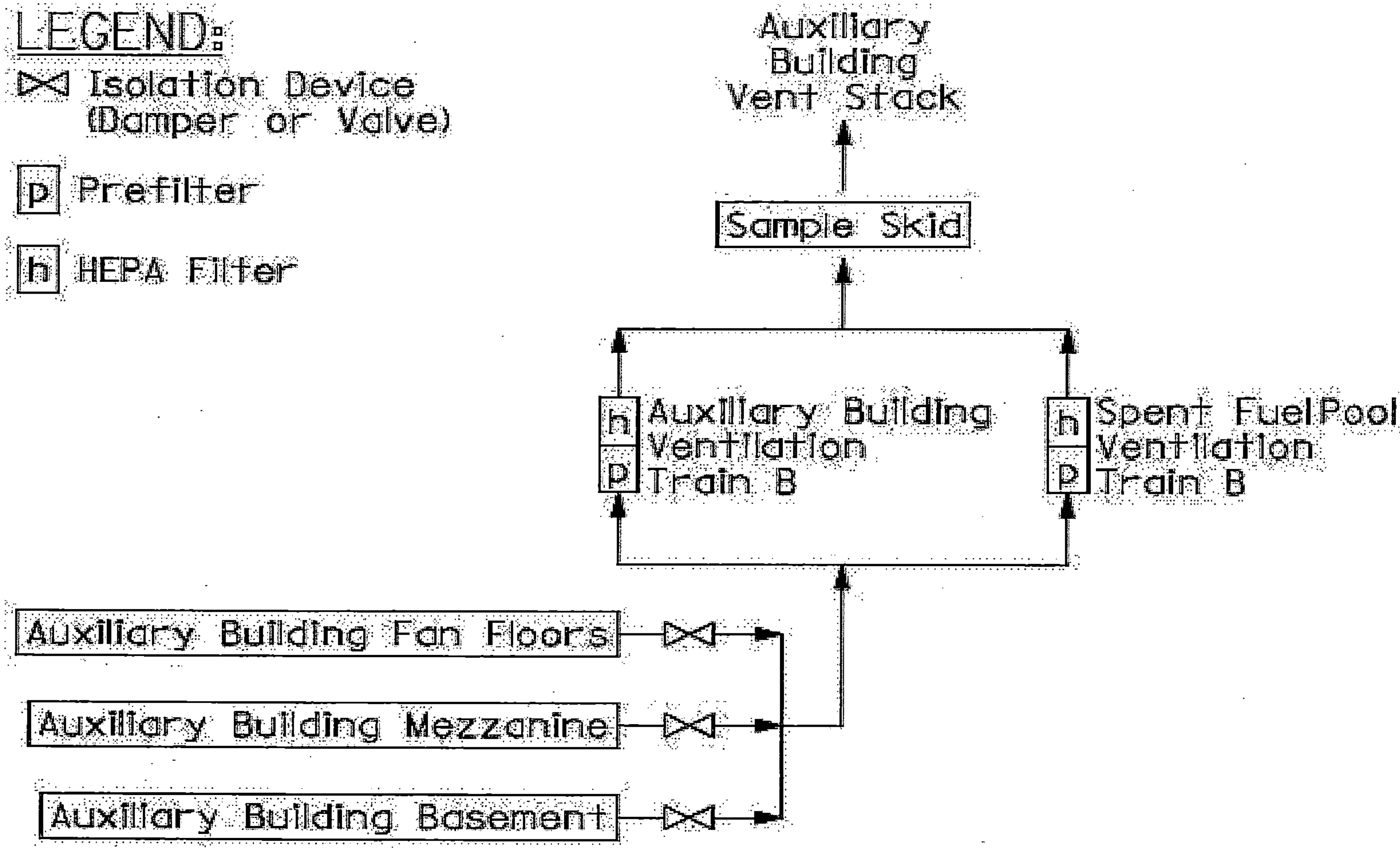
The purpose of this section is to describe the method used to calculate the cumulative dose contributions from liquid and gaseous effluents in accordance with KPS Technical Requirements Manual 10.1.2 for total dose. This method can also be used to demonstrate compliance with the Environmental Protection Agency (EPA) 40CFR190, "Environmental Standards for the Uranium Fuel Cycle".

Compliance with the KPS Technical Requirements Manual 10.1.2 dose objectives for the maximum individual demonstrates compliance with the EPA limits to any MEMBER OF THE PUBLIC, since the design dose objectives from 10CFR50, Appendix I are much lower than the 40CFR190 dose limits to the general public. With the calculated doses from the releases of radioactive materials in liquid or gaseous effluents exceeding twice the limits outlined in ODCM DNC 13.1.2 and 13.2.3, a special analysis shall be performed. The purpose of this analysis is to demonstrate if the total dose to any MEMBER OF THE PUBLIC (real individual) from all uranium fuel cycle sources (including direct radiation contributions from the facility, from outside storage areas and from all real pathways) is limited to less than or equal to 25 mrem per year to the total body or any organ, except the thyroid, which is limited to 75 mrem per year.

If required, the total dose to a MEMBER OF THE PUBLIC will be calculated for all significant effluent release points for all real pathways including direct radiation. Effluent releases from Point Beach Nuclear Plant must also be considered due to its proximity. Calculations will be based on the equations in Sections 1.4 and 2.3.1, with the exception that usage factors and other site specific parameters may be modified using more realistic assumptions, where appropriate.

The direct radiation component from the facility can be determined using environmental TLD results. These results will be corrected for natural background and for actual occupancy time of any areas accessible to the general public at the location of maximum direct radiation. It is recognized that by including the results from the environmental TLDs into the sum of total dose component, the direct radiation dose may be overestimated. The TLD measurements may include the exposure from ground plane deposition, and shoreline deposition, which have already been included in the summation of the significant dose pathways to the general public. However, this conservative method can be used, if required, as well as any other method for estimating the direct radiation dose from contained radioactive sources within the facility. The methodology used to incorporate the direct radiation component into total dose estimates will be outlined whenever total doses are reported.

Therefore, the total dose will be determined based on the most realistic site specific data and parameters to assess the real dose to any MEMBER OF THE PUBLIC.



ODCM FIGURE 2
GASEOUS RADIOACTIVE EFFLUENT FLOW DIAGRAM

Table 2.1

Controlling Locations, Pathways and
Atmospheric Dispersion for Dose Calculations

ODCM Normal Condition	Location	Pathways	Atmospheric Dispersion	
			χ/Q (sec/m^3)	D/Q (1/m^2)
13.2.1.b	Site Boundary (0.81 mile, N)	Inhalation, Ground Plane	2.50E-06	N/A
13.2.3	Garden 4 (0.96 mile SSW)	Inhalation, Vegetation, Meat, Milk, and Ground Plane	8.30E-07	3.20E-09

The following tables from TSD 18-017, Dispersion and Deposition Coefficients for KPS SAFSTOR and DECON, are placed here as a reference as needed for additional detailed calculations. Table 2.1 uses the values as listed under Auxiliary Vent SAFSTOR Winter under column No Decay and Undepleted.

Table 18 - Recommended X/Q and D/Q Values for Site Boundary Calculations

Release Type	cfm	Sector	Distance from Site (miles)	X/Q No Decay Undepleted (sec/m^3)	X/Q 2.260 Day Decay Undepleted (sec/m^3)	X/Q 8.000 Day Decay Depleted (sec/m^3)	D/Q (m^{-2})
Ground Release	0	NNW	0.81	1.8E-06	1.8E-06	1.6E-06	7.7E-09
Auxiliary Vent Normal Ops	54,000	N	0.81	1.2E-06	1.2E-06	1.0E-06	6.4E-09
Reactor Vent Normal Ops	26,000	N	0.99	7.7E-08	7.7E-08	7.6E-08	2.7E-09
Auxiliary Vent SAFSTOR Summer	36,125	N	0.81	1.8E-06	1.8E-06	1.6E-06	7.9E-09
Auxiliary Vent SAFSTOR Winter	9,000	N	0.81	2.5E-06	2.5E-06	2.2E-06	8.7E-09
Auxiliary Vent Out-Of-Service	5,125	N	0.81	2.6E-06	2.5E-06	2.3E-06	8.7E-09

Table 69 - Release Point Critical Receptors, Dispersion and Deposition Coefficients

Release Type	cfm	Critical Receptor	Sector	Distance from Site (miles)	X/Q No Decay Undepleted (sec/m^3)	X/Q 2.260 Day Decay Undepleted (sec/m^3)	X/Q 8.000 Day Decay Depleted (sec/m^3)	D/Q (m^{-2})
Ground Release	0	Garden 4	SSW	0.96	5.40E-07	5.40E-07	4.70E-07	4.30E-09
Auxiliary Vent Normal Ops	54000	Garden 4	SSW	0.96	3.20E-07	3.20E-07	2.90E-07	2.40E-09
Reactor Vent Normal Ops	26000	Milk 4	SW	1.3	6.50E-08	6.40E-08	6.30E-08	1.30E-09
Auxiliary Vent SAFSTOR Summer	36125	Garden 4	SSW	0.96	5.00E-07	4.90E-07	4.40E-07	2.80E-09
Auxiliary Vent SAFSTOR Winter	9000	Garden 4	SSW	0.96	8.30E-07	8.20E-07	7.30E-07	3.20E-09
Auxiliary Vent Out-Of-Service	5125	Garden 4	SW	1.3	8.90E-07	8.80E-07	7.50E-07	3.20E-09

Table 2.2 (Page 1 of 2)

R_i Inhalation Pathway Dose Factors – ADULT

(mrem/yr per μCi/m_3)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	1.26E+3	1.26E+3	1.26E+3	1.26E+3	1.26E+3	1.26E+3
C-14	1.82E+4	3.41E+3	3.41E+3	3.41E+3	3.41E+3	3.41E+3	3.41E+3
Na-24	1.02E+4	1.02E+4	1.02E+4	1.02E+4	1.02E+4	1.02E+4	1.02E+4
P-32	1.32E+6	7.71E+4	-	-	-	8.64E+4	5.01E+4
Cr-51	-	-	5.95E+1	2.28E+1	1.44E+4	3.32E+3	1.00E+2
Mn-54	-	3.96E+4	-	9.84E+3	1.40E+6	7.74E+4	6.30E+3
Mn-56	-	1.24E+0	-	1.30E+0	9.44E+3	2.02E+4	1.83E-1
Fe-55	2.46E+4	1.70E+4	-	-	7.21E+4	6.03E+3	3.94E+3
Fe-59	1.18E+4	2.78E+4	-	-	1.02E+6	1.88E+5	1.06E+4
Co-57	-	6.92E+2	-	-	3.70E+5	3.14E+4	6.71E+2
Co-58	-	1.58E+3	-	-	9.28E+5	1.06E+5	2.07E+3
Co-60	-	1.15E+4	-	-	5.97E+6	2.85E+5	1.48E+4
Ni-63	4.32E+5	3.14E+4	-	-	1.78E+5	1.34E+4	1.45E+4
Ni-65	1.54E+0	2.10E-1	-	-	5.60E+3	1.23E+4	9.12E-2
Cu-64	-	1.46E+0	-	4.62E+0	6.78E+3	4.90E+4	6.15E-1
Zn-65	3.24E+4	1.03E+5	-	6.90E+4	8.64E+5	5.34E+4	4.66E+4
Zn-69	3.38E-2	6.51E-2	-	4.22E-2	9.20E+2	1.63E+1	4.52E-3
Br-82	-	-	-	-	-	1.04E+4	1.35E+4
Br-83	-	-	-	-	-	2.32E+2	2.41E+2
Br-84	-	-	-	-	-	1.64E-3	3.13E+2
Br-85	-	-	-	-	-	-	1.28E+1
Rb-86	-	1.35E+5	-	-	-	1.66E+4	5.90E+4
Rb-88	-	3.87E+2	-	-	-	3.34E-9	1.93E+2
Rb-89	-	2.56E+2	-	-	-	-	1.70E+2
Sr-89	3.04E+5	-	-	-	1.40E+6	3.50E+5	8.72E+3
Sr-90	9.92E+7	-	-	-	9.60E+6	7.22E+5	6.10E+6
Sr-91	6.19E+1	-	-	-	3.65E+4	1.91E+5	2.50E+0
Sr-92	6.74E+0	-	-	-	1.65E+4	4.30E+4	2.91E-1
Y-90	2.09E+3	-	-	-	1.70E+5	5.06E+5	5.61E+1
Y-91m	2.61E-1	-	-	-	1.92E+3	1.33E+0	1.02E-2
Y-91	4.62E+5	-	-	-	1.70E+6	3.85E+5	1.24E+4
Y-92	1.03E+1	-	-	-	1.57E+4	7.35E+4	3.02E-1
Y-93	9.44E+1	-	-	-	4.85E+4	4.22E+5	2.61E+0
Zr-95	1.07E+5	3.44E+4	-	5.42E+4	1.77E+6	1.50E+5	2.33E+4
Zr-97	9.68E+1	1.96E+1	-	2.97E+1	7.87E+4	5.23E+5	9.04E+0
Nb-95	1.41E+4	7.82E+3	-	7.74E+3	5.05E+5	1.04E+5	4.21E+3
Nb-97	2.22E-1	5.62E-2	-	6.54E-2	2.40E+3	2.42E+2	2.05E-2
Mo-99	-	1.21E+2	-	2.91E+2	9.12E+4	2.48E+5	2.30E+1
Tc-99m	1.03E-3	2.91E-3	-	4.42E-2	7.64E+2	4.16E+3	3.70E-2
Tc-101	4.18E-5	6.02E-5	-	1.08E-3	3.99E+2	-	5.90E-4

Table 2.2 (Page 2 of 2)

R_i Inhalation Pathway Dose Factors – ADULT

(mrem/yr per µCi/m^3)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	1.53E+3	-	-	5.83E+3	5.05E+5	1.10E+5	6.58E+2
Ru-105	7.90E-1	-	-	1.02E+0	1.10E+4	4.82E+4	3.11E-1
Ru-106	6.91E+4	-	-	1.34E+5	9.36E+6	9.12E+5	8.72E+3
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	1.08E+4	1.00E+4	-	1.97E+4	4.63E+6	3.02E+5	5.94E+3
Sb-124	3.12E+4	5.89E+2	7.55E+1	-	2.48E+6	4.06E+5	1.24E+4
Sb-125	5.34E+4	5.95E+2	5.40E+1	-	1.74E+6	1.01E+5	1.26E+4
Te-125m	3.42E+3	1.58E+3	1.05E+3	1.24E+4	3.14E+5	7.06E+4	4.67E+2
Te-127m	1.26E+4	5.77E+3	3.29E+3	4.58E+4	9.60E+5	1.50E+5	1.57E+3
Te-127	1.40E+0	6.42E-1	1.06E+0	5.10E+0	6.51E+3	5.74E+4	3.10E-1
Te-129m	9.76E+3	4.67E+3	3.44E+3	3.66E+4	1.16E+6	3.83E+5	1.58E+3
Te-129	4.98E-2	2.39E-2	3.90E-2	1.87E-1	1.94E+3	1.57E+2	1.24E-2
Te-131m	6.99E+1	4.36E+1	5.50E+1	3.09E+2	1.46E+5	5.56E+5	2.90E+1
Te-131	1.11E-2	5.95E-3	9.36E-3	4.37E-2	1.39E+3	1.84E+1	3.59E-3
Te-132	2.60E+2	2.15E+2	1.90E+2	1.46E+3	2.88E+5	5.10E+5	1.62E+2
I-130	4.58E+3	1.34E+4	1.14E+6	2.09E+4	-	7.69E+3	5.28E+3
I-131	2.52E+4	3.58E+4	1.19E+7	6.13E+4	-	6.28E+3	2.05E+4
I-132	1.16E+3	3.26E+3	1.14E+5	5.18E+3	-	4.06E+2	1.16E+3
I-133	8.64E+3	1.48E+4	2.15E+6	2.58E+4	-	8.88E+3	4.52E+3
I-134	6.44E+2	1.73E+3	2.98E+4	2.75E+3	-	1.01E+0	6.15E+2
I-135	2.68E+3	6.98E+3	4.48E+5	1.11E+4	-	5.25E+3	2.57E+3
Cs-134	3.73E+5	8.48E+5	-	2.87E+5	9.76E+4	1.04E+4	7.28E+5
Cs-136	3.90E+4	1.46E+5	-	8.56E+4	1.20E+4	1.17E+4	1.10E+5
Cs-137	4.78E+5	6.21E+5	-	2.22E+5	7.52E+4	8.40E+3	4.28E+5
Cs-138	3.31E+2	6.21E+2	-	4.80E+2	4.86E+1	1.86E-3	3.24E+2
Ba-139	9.36E-1	6.66E-4	-	6.22E-4	3.76E+3	8.96E+2	2.74E-2
Ba-140	3.90E+4	4.90E+1	-	1.67E+1	1.27E+6	2.18E+5	2.57E+3
Ba-141	1.00E-1	7.53E-5	-	7.00E-5	1.94E+3	1.16E-7	3.36E-3
Ba-142	2.63E-2	2.70E-5	-	2.29E-5	1.19E+3	-	1.66E-3
La-140	3.44E+2	1.74E+2	-	-	1.36E+5	4.58E+5	4.58E+1
La-142	6.83E-1	3.10E-1	-	-	6.33E+3	2.11E+3	7.72E-2
Ce-141	1.99E+4	1.35E+4	-	6.26E+3	3.62E+5	1.20E+5	1.53E+3
Ce-143	1.86E+2	1.38E+2	-	6.08E+1	7.98E+4	2.26E+5	1.53E+1
Ce-144	3.43E+6	1.43E+6	-	8.48E+5	7.78E+6	8.16E+5	1.84E+5
Pr-143	9.36E+3	3.75E+3	-	2.16E+3	2.81E+5	2.00E+5	4.64E+2
Pr-144	3.01E-2	1.25E-2	-	7.05E-3	1.02E+3	2.15E-8	1.53E-3
Nd-147	5.27E+3	6.10E+3	-	3.56E+3	2.21E+5	1.73E+5	3.65E+2
W-187	8.48E+0	7.08E+0	-	-	2.90E+4	1.55E+5	2.48E+0
Np-239	2.30E+2	2.26E+1	-	7.00E+1	3.76E+4	1.19E+5	1.24E+1

Table 2.3 (Page 1 of 2)

R_i Inhalation Pathway Dose Factors – TEEN

(mrem/yr per μCi/m^3)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	1.27E+3	1.27E+3	1.27E+3	1.27E+3	1.27E+3	1.27E+3
C-14	2.60E+4	4.87E+3	4.87E+3	4.87E+3	4.87E+3	4.87E+3	4.87E+3
Na-24	1.38E+4	1.38E+4	1.38E+4	1.38E+4	1.38E+4	1.38E+4	1.38E+4
P-32	1.89E+6	1.10E+5	-	-	-	9.28E+4	7.16E+4
Cr-51	-	-	7.50E+1	3.07E+1	2.10E+4	3.00E+3	1.35E+2
Mn-54	-	5.11E+4	-	1.27E+4	1.98E+6	6.68E+4	8.40E+3
Mn-56	-	1.70E+0	-	1.79E+0	1.52E+4	5.74E+4	2.52E-1
Fe-55	3.34E+4	2.38E+4	-	-	1.24E+5	6.39E+3	5.54E+3
Fe-59	1.59E+4	3.70E+4	-	-	1.53E+6	1.78E+5	1.43E+4
Co-57	-	6.92E+2	-	-	5.86E+5	3.14E+4	9.20E+2
Co-58	-	2.07E+3	-	-	1.34E+6	9.52E+4	2.78E+3
Co-60	-	1.51E+4	-	-	8.72E+6	2.59E+5	1.98E+4
Ni-63	5.80E+5	4.34E+4	-	-	3.07E+5	1.42E+4	1.98E+4
Ni-65	2.18E+0	2.93E-1	-	-	9.36E+3	3.67E+4	1.27E-1
Cu-64	-	2.03E+0	-	6.41E+0	1.11E+4	6.14E+4	8.48E-1
Zn-65	3.86E+4	1.34E+5	-	8.64E+4	1.24E+6	4.66E+4	6.24E+4
Zn-69	4.83E-2	9.20E-2	-	6.02E-2	1.58E+3	2.85E+2	6.46E-3
Br-82	-	-	-	-	-	-	1.82E+4
Br-83	-	-	-	-	-	-	3.44E+2
Br-84	-	-	-	-	-	-	4.33E+2
Br-85	-	-	-	-	-	-	1.83E+1
Rb-86	-	1.90E+5	-	-	-	1.77E+4	8.40E+4
Rb-88	-	5.46E+2	-	-	-	2.92E-5	2.72E+2
Rb-89	-	3.52E+2	-	-	-	3.38E-7	2.33E+2
Sr-89	4.34E+5	-	-	-	2.42E+6	3.71E+5	1.25E+4
Sr-90	1.08E+8	-	-	-	1.65E+7	7.65E+5	6.68E+6
Sr-91	8.80E+1	-	-	-	6.07E+4	2.59E+5	3.51E+0
Sr-92	9.52E+0	-	-	-	2.74E+4	1.19E+5	4.06E-1
Y-90	2.98E+3	-	-	-	2.93E+5	5.59E+5	8.00E+1
Y-91m	3.70E-1	-	-	-	3.20E+3	3.02E+1	1.42E-2
Y-91	6.61E+5	-	-	-	2.94E+6	4.09E+5	1.77E+4
Y-92	1.47E+1	-	-	-	2.68E+4	1.65E+5	4.29E-1
Y-93	1.35E+2	-	-	-	8.32E+4	5.79E+5	3.72E+0
Zr-95	1.46E+5	4.58E+4	-	6.74E+4	2.69E+6	1.49E+5	3.15E+4
Zr-97	1.38E+2	2.72E+1	-	4.12E+1	1.30E+5	6.30E+5	1.26E+1
Nb-95	1.86E+4	1.03E+4	-	1.00E+4	7.51E+5	9.68E+4	5.66E+3
Nb-97	3.14E-1	7.78E-2	-	9.12E-2	3.93E+3	2.17E+3	2.84E-2
Mo-99	-	1.69E+2	-	4.11E+2	1.54E+5	2.69E+5	3.22E+1
Tc-99m	1.38E-3	3.86E-3	-	5.76E-2	1.15E+3	6.13E+3	4.99E-2
Tc-101	5.92E-5	8.40E-5	-	1.52E-3	6.67E+2	8.72E-7	8.24E-4

Table 2.3 (Page 2 of 2)

R_i Inhalation Pathway Dose Factors – TEEN

(mrem/yr per μCi/m³)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	2.10E+3	-	-	7.43E+3	7.83E+5	1.09E+5	8.96E+2
Ru-105	1.12E+0	-	-	1.41E+0	1.82E+4	9.04E+4	4.34E-1
Ru-106	9.84E+4	-	-	1.90E+5	1.61E+7	9.60E+5	1.24E+4
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	1.38E+4	1.31E+4	-	2.50E+4	6.75E+6	2.73E+5	7.99E+3
Sb-124	4.30E+4	7.94E+2	9.76E+1	-	3.85E+6	3.98E+5	1.68E+4
Sb-125	7.38E+4	8.08E+2	7.04E+1	-	2.74E+6	9.92E+4	1.72E+4
Te-125m	4.88E+3	2.24E+3	1.40E+3	-	5.36E+5	7.50E+4	6.67E+2
Te-127m	1.80E+4	8.16E+3	4.38E+3	6.54E+4	1.66E+6	1.59E+5	2.18E+3
Te-127	2.01E+0	9.12E-1	1.42E+0	7.28E+0	1.12E+4	8.08E+4	4.42E-1
Te-129m	1.39E+4	6.58E+3	4.58E+3	5.19E+4	1.98E+6	4.05E+5	2.25E+3
Te-129	7.10E-2	3.38E-2	5.18E-2	2.66E-1	3.30E+3	1.62E+3	1.76E-2
Te-131m	9.84E+1	6.01E+1	7.25E+1	4.39E+2	2.38E+5	6.21E+5	4.02E+1
Te-131	1.58E-2	8.32E-3	1.24E-2	6.18E-2	2.34E+3	1.51E+1	5.04E-3
Te-132	3.60E+2	2.90E+2	2.46E+2	1.95E+3	4.49E+5	4.63E+5	2.19E+2
I-130	6.24E+3	1.79E+4	1.49E+6	2.75E+4	-	9.12E+3	7.17E+3
I-131	3.54E+4	4.91E+4	1.46E+7	8.40E+4	-	6.49E+3	2.64E+4
I-132	1.59E+3	4.38E+3	1.51E+5	6.92E+3	-	1.27E+3	1.58E+3
I-133	1.22E+4	2.05E+4	2.92E+6	3.59E+4	-	1.03E+4	6.22E+3
I-134	8.88E+2	2.32E+3	3.95E+4	3.66E+3	-	2.04E+1	8.40E+2
I-135	3.70E+3	9.44E+3	6.21E+5	1.49E+4	-	6.95E+3	3.49E+3
Cs-134	5.02E+5	1.13E+6	-	3.75E+5	1.46E+5	9.76E+3	5.49E+5
Cs-136	5.15E+4	1.94E+5	-	1.10E+5	1.78E+4	1.09E+4	1.37E+5
Cs-137	6.70E+5	8.48E+5	-	3.04E+5	1.21E+5	8.48E+3	3.11E+5
Cs-138	4.66E+2	8.56E+2	-	6.62E+2	7.87E+1	2.70E-1	4.46E+2
Ba-139	1.34E+0	9.44E-4	-	8.88E-4	6.46E+3	6.45E+3	3.90E-2
Ba-140	5.47E+4	6.70E+1	-	2.28E+1	2.03E+6	2.29E+5	3.52E+3
Ba-141	1.42E-1	1.06E-4	-	9.84E-5	3.29E+3	7.46E-4	4.74E-3
Ba-142	3.70E-2	3.70E-5	-	3.14E-5	1.91E+3	-	2.27E-3
La-140	4.79E+2	2.36E+2	-	-	2.14E+5	4.87E+5	6.26E+1
La-142	9.60E-1	4.25E-1	-	-	1.02E+4	1.20E+4	1.06E-1
Ce-141	2.84E+4	1.90E+4	-	8.88E+3	6.14E+5	1.26E+5	2.17E+3
Ce-143	2.66E+2	1.94E+2	-	8.64E+1	1.30E+5	2.55E+5	2.16E+1
Ce-144	4.89E+6	2.02E+6	-	1.21E+6	1.34E+7	8.64E+5	2.62E+5
Pr-143	1.34E+4	5.31E+3	-	3.09E+3	4.83E+5	2.14E+5	6.62E+2
Pr-144	4.30E-2	1.76E-2	-	1.01E-2	1.75E+3	2.35E-4	2.18E-3
Nd-147	7.86E+3	8.56E+3	-	5.02E+3	3.72E+5	1.82E+5	5.13E+2
W-187	1.20E+1	9.76E+0	-	-	4.74E+4	1.77E+5	3.43E+0
Np-239	3.38E+2	3.19E+1	-	1.00E+2	6.49E+4	1.32E+5	1.77E+1

Table 2.4 (Page 1 of 2)
R_i Inhalation Pathway Dose Factors - CHILD
(mrem/yr per $\mu Ci/m^3$)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	1.12E+3	1.12E+3	1.12E+3	1.12E+3	1.12E+3	1.12E+3
C-14	3.59E+4	6.73E+3	6.73E+3	6.73E+3	6.73E+3	6.73E+3	6.73E+3
Na-24	1.61E+4	1.61E+4	1.61E+4	1.61E+4	1.61E+4	1.61E+4	1.61E+4
P-32	2.60E+6	1.14E+5	-	-	-	4.22E+4	9.88E+4
Cr-51	-	-	8.55E+1	2.43E+1	1.70E+4	1.08E+3	1.54E+2
Mn-54	-	4.29E+4	-	1.00E+4	1.58E+6	2.29E+4	9.51E+3
Mn-56	-	1.66E+0	-	1.67E+0	1.31E+4	1.23E+5	3.12E-1
Fe-55	4.74E+4	2.52E+4	-	-	1.11E+5	2.87E+3	7.77E+3
Fe-59	2.07E+4	3.34E+4	-	-	1.27E+6	7.07E+4	1.67E+4
Co-57	-	9.03E+2	-	-	5.07E+5	1.32E+4	1.07E+3
Co-58	-	1.77E+3	-	-	1.11E+6	3.44E+4	3.16E+3
Co-60	-	1.31E+4	-	-	7.07E+6	9.62E+4	2.26E+4
Ni-63	8.21E+5	4.63E+4	-	-	2.75E+5	6.33E+3	2.80E+4
Ni-65	2.99E+0	2.96E-1	-	-	8.18E+3	8.40E+4	1.64E-1
Cu-64	-	1.99E+0	-	6.03E+0	9.58E+3	3.67E+4	1.07E+0
Zn-65	4.26E+4	1.13E+5	-	7.14E+4	9.95E+5	1.63E+4	7.03E+4
Zn-69	6.70E-2	9.66E-2	-	5.85E-2	1.42E+3	1.02E+4	8.92E-3
Br-82	-	-	-	-	-	-	2.09E+4
Br-83	-	-	-	-	-	-	4.74E+2
Br-84	-	-	-	-	-	-	5.48E+2
Br-85	-	-	-	-	-	-	2.53E+1
Rb-86	-	1.98E+5	-	-	-	7.99E+3	1.14E+5
Rb-88	-	5.62E+2	-	-	-	1.72E+1	3.66E+2
Rb-89	-	3.45E+2	-	-	-	1.89E+0	2.90E+2
Sr-89	5.99E+5	-	-	-	2.16E+6	1.67E+5	1.72E+4
Sr-90	1.01E+8	-	-	-	1.48E+7	3.43E+5	6.44E+6
Sr-91	1.21E+2	-	-	-	5.33E+4	1.74E+5	4.59E+0
Sr-92	1.31E+1	-	-	-	2.40E+4	2.42E+5	5.25E-1
Y-90	4.11E+3	-	-	-	2.62E+5	2.68E+5	1.11E+2
Y-91m	5.07E-1	-	-	-	2.81E+3	1.72E+3	1.84E-2
Y-91	9.14E+5	-	-	-	2.63E+6	1.84E+5	2.44E+4
Y-92	2.04E+1	-	-	-	2.39E+4	2.39E+5	5.81E-1
Y-93	1.86E+2	-	-	-	7.44E+4	3.89E+5	5.11E+0
Zr-95	1.90E+5	4.18E+4	-	5.96E+4	2.23E+6	6.11E+4	3.70E+4
Zr-97	1.88E+2	2.72E+1	-	3.89E+1	1.13E+5	3.51E+5	1.60E+1
Nb-95	2.35E+4	9.18E+3	-	8.62E+3	6.14E+5	3.70E+4	6.55E+3
Nb-97	4.29E-1	7.70E-2	-	8.55E-2	3.42E+3	2.78E+4	3.60E-2
Mo-99	-	1.72E+2	-	3.92E+2	1.35E+5	1.27E+5	4.26E+1
Tc-99m	1.78E-3	3.48E-3	-	5.07E-2	9.51E+2	4.81E+3	5.77E-2
Tc-101	8.10E-5	8.51E-5	-	1.45E-3	5.85E+2	1.63E+1	1.08E-3

Table 2.4 (Page 2 of 2)

R_i Inhalation Pathway Dose Factors - CHILD

(mrem/yr per $\mu Ci/m^3$)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	2.79E+3	-	-	7.03E+3	6.62E+5	4.48E+4	1.07E+3
Ru-105	1.53E+0	-	-	1.34E+0	1.59E+4	9.95E+4	5.55E-1
Ru-106	1.36E+5	-	-	1.84E+5	1.43E+7	4.29E+5	1.69E+4
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	1.69E+4	1.14E+4	-	2.12E+4	5.48E+6	1.00E+5	9.14E+3
Sb-124	5.74E+4	7.40E+2	1.26E+2	-	3.24E+6	1.64E+5	2.00E+4
Sb-125	9.84E+4	7.59E+2	9.10E+1	-	2.32E+6	4.03E+4	2.07E+4
Te-125m	6.73E+3	2.33E+3	1.92E+3	-	4.77E+5	3.38E+4	9.14E+2
Te-127m	2.49E+4	8.55E+3	6.07E+3	6.36E+4	1.48E+6	7.14E+4	3.02E+3
Te-127	2.77E+0	9.51E-1	1.96E+0	7.07E+0	1.00E+4	5.62E+4	6.11E-1
Te-129m	1.92E+4	6.85E+3	6.33E+3	5.03E+4	1.76E+6	1.82E+5	3.04E+3
Te-129	9.77E-2	3.50E-2	7.14E-2	2.57E-1	2.93E+3	2.55E+4	2.38E-2
Te-131m	1.34E+2	5.92E+1	9.77E+1	4.00E+2	2.06E+5	3.08E+5	5.07E+1
Te-131	2.17E-2	8.44E-3	1.70E-2	5.88E-2	2.05E+3	1.33E+3	6.59E-3
Te-132	4.81E+2	2.72E+2	3.17E+2	1.77E+3	3.77E+5	1.38E+5	2.63E+2
I-130	8.18E+3	1.64E+4	1.85E+6	2.45E+4	-	5.11E+3	8.44E+3
I-131	4.81E+4	4.81E+4	1.62E+7	7.88E+4	-	2.84E+3	2.73E+4
I-132	2.12E+3	4.07E+3	1.94E+5	6.25E+3	-	3.20E+3	1.88E+3
I-133	1.66E+4	2.03E+4	3.85E+6	3.38E+4	-	5.48E+3	7.70E+3
I-134	1.17E+3	2.16E+3	5.07E+4	3.30E+3	-	9.55E+2	9.95E+2
I-135	4.92E+3	8.73E+3	7.92E+5	1.34E+4	-	4.44E+3	4.14E+3
Cs-134	6.51E+5	1.01E+6	-	3.30E+5	1.21E+5	3.85E+3	2.25E+5
Cs-136	6.51E+4	1.71E+5	-	9.55E+4	1.45E+4	4.18E+3	1.16E+5
Cs-137	9.07E+5	8.25E+5	-	2.82E+5	1.04E+5	3.62E+3	1.28E+5
Cs-138	6.33E+2	8.40E+2	-	6.22E+2	6.81E+1	2.70E+2	5.55E+2
Ba-139	1.84E+0	9.84E-4	-	8.62E-4	5.77E+3	5.77E+4	5.37E-2
Ba-140	7.40E+4	6.48E+1	-	2.11E+1	1.74E+6	1.02E+5	4.33E+3
Ba-141	1.96E-1	1.09E-4	-	9.47E-5	2.92E+3	2.75E+2	6.36E-3
Ba-142	5.00E-2	3.60E-5	-	2.91E-5	1.64E+3	2.74E+0	2.79E-3
La-140	6.44E+2	2.25E+2	-	-	1.83E+5	2.26E+5	7.55E+1
La-142	1.30E+0	4.11E-1	-	-	8.70E+3	7.59E+4	1.29E-1
Ce-141	3.92E+4	1.95E+4	-	8.55E+3	5.44E+5	5.66E+4	2.90E+3
Ce-143	3.66E+2	1.99E+2	-	8.36E+1	1.15E+5	1.27E+5	2.87E+1
Ce-144	6.77E+6	2.12E+6	-	1.17E+6	1.20E+7	3.89E+5	3.61E+5
Pr-143	1.85E+4	5.55E+3	-	3.00E+3	4.33E+5	9.73E+4	9.14E+2
Pr-144	5.96E-2	1.85E-2	-	9.77E-3	1.57E+3	1.97E+2	3.00E-3
Nd-147	1.08E+4	8.73E+3	-	4.81E+3	3.28E+5	8.21E+4	6.81E+2
W-187	1.63E+1	9.66E+0	-	-	4.11E+4	9.10E+4	4.33E+0
Np-239	4.66E+2	3.34E+1	-	9.73E+1	5.81E+4	6.40E+4	2.35E+1

Table 2.5 (Page 1 of 2)

R_i Inhalation Pathway Dose Factors - INFANT

(mrem/yr per μCi/m^3)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	6.47E+2	6.47E+2	6.47E+2	6.47E+2	6.47E+2	6.47E+2
C-14	2.65E+4	5.31E+3	5.31E+3	5.31E+3	5.31E+3	5.31E+3	5.31E+3
Na-24	1.06E+4	1.06E+4	1.06E+4	1.06E+4	1.06E+4	1.06E+4	1.06E+4
P-32	2.03E+6	1.12E+5	-	-	-	1.61E+4	7.74E+4
Cr-51	-	-	5.75E+1	1.32E+1	1.28E+4	3.57E+2	8.95E+1
Mn-54	-	2.53E+4	-	4.98E+3	1.00E+6	7.06E+3	4.98E+3
Mn-56	-	1.54E+0	-	1.10E+0	1.25E+4	7.17E+4	2.21E-1
Fe-55	1.97E+4	1.17E+4	-	-	8.69E+4	1.09E+3	3.33E+3
Fe-59	1.36E+4	2.35E+4	-	-	1.02E+6	2.48E+4	9.48E+3
Co-57	-	6.51E+2	-	-	3.79E+5	4.86E+3	6.41E+2
Co-58	-	1.22E+3	-	-	7.77E+5	1.11E+4	1.82E+3
Co-60	-	8.02E+3	-	-	4.51E+6	3.19E+4	1.18E+4
Ni-63	3.39E+5	2.04E+4	-	-	2.09E+5	2.42E+3	1.16E+4
Ni-65	2.39E+0	2.84E-1	-	-	8.12E+3	5.01E+4	1.23E-1
Cu-64	-	1.88E+0	-	3.98E+0	9.30E+3	1.50E+4	7.74E-1
Zn-65	1.93E+4	6.26E+4	-	3.25E+4	6.47E+5	5.14E+4	3.11E+4
Zn-69	5.39E-2	9.67E-2	-	4.02E-2	1.47E+3	1.32E+4	7.18E-3
Br-82	-	-	-	-	-	-	1.33E+4
Br-83	-	-	-	-	-	-	3.81E+2
Br-84	-	-	-	-	-	-	4.00E+2
Br-85	-	-	-	-	-	-	2.04E+1
Rb-86	-	1.90E+5	-	-	-	3.04E+3	8.82E+4
Rb-88	-	5.57E+2	-	-	-	3.39E+2	2.87E+2
Rb-89	-	3.21E+2	-	-	-	6.82E+1	2.06E+2
Sr-89	3.98E+5	-	-	-	2.03E+6	6.40E+4	1.14E+4
Sr-90	4.09E+7	-	-	-	1.12E+7	1.31E+5	2.59E+6
Sr-91	9.56E+1	-	-	-	5.26E+4	7.34E+4	3.46E+0
Sr-92	1.05E+1	-	-	-	2.38E+4	1.40E+5	3.91E-1
Y-90	3.29E+3	-	-	-	2.69E+5	1.04E+5	8.82E+1
Y-91m	4.07E-1	-	-	-	2.79E+3	2.35E+3	1.39E-2
Y-91	5.88E+5	-	-	-	2.45E+6	7.03E+4	1.57E+4
Y-92	1.64E+1	-	-	-	2.45E+4	1.27E+5	4.61E-1
Y-93	1.50E+2	-	-	-	7.64E+4	1.67E+5	4.07E+0
Zr-95	1.15E+5	2.79E+4	-	3.11E+4	1.75E+6	2.17E+4	2.03E+4
Zr-97	1.50E+2	2.56E+1	-	2.59E+1	1.10E+5	1.40E+5	1.17E+1
Nb-95	1.57E+4	6.43E+3	-	4.72E+3	4.79E+5	1.27E+4	3.78E+3
Nb-97	3.42E-1	7.29E-2	-	5.70E-2	3.32E+3	2.69E+4	2.63E-2
Mo-99	-	1.65E+2	-	2.65E+2	1.35E+5	4.87E+4	3.23E+1
Tc-99m	1.40E-3	2.88E-3	-	3.11E-2	8.11E+2	2.03E+3	3.72E-2
Tc-101	6.51E-5	8.23E-5	-	9.79E-4	5.84E+2	8.44E+2	8.12E-4

Table 2.5 (Page 2 of 2)

R_i Inhalation Pathway Dose Factors - INFANT

(mrem/yr per $\mu Ci/m^3$)

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	2.02E+3	-	-	4.24E+3	5.52E+5	1.61E+4	6.79E+2
Ru-105	1.22E+0	-	-	8.99E-1	1.57E+4	4.84E+4	4.10E-1
Ru-106	8.68E+4	-	-	1.07E+5	1.16E+7	1.64E+5	1.09E+4
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	9.98E+3	7.22E+3	-	1.09E+4	3.67E+6	3.30E+4	5.00E+3
Sb-124	3.79E+4	5.56E+2	1.01E+2	-	2.65E+6	5.91E+4	1.20E+4
Sb-125	5.17E+4	4.77E+2	6.23E+1	-	1.64E+6	1.47E+4	1.09E+4
Te-125m	4.76E+3	1.99E+3	1.62E+3	-	4.47E+5	1.29E+4	6.58E+2
Te-127m	1.67E+4	6.90E+3	4.87E+3	3.75E+4	1.31E+6	2.73E+4	2.07E+3
Te-127	2.23E+0	9.53E-1	1.85E+0	4.86E+0	1.03E+4	2.44E+4	4.89E-1
Te-129m	1.41E+4	6.09E+3	5.47E+3	3.18E+4	1.68E+6	6.90E+4	2.23E+3
Te-129	7.88E-2	3.47E-2	6.75E-2	1.75E-1	3.00E+3	2.63E+4	1.88E-2
Te-131m	1.07E+2	5.50E+1	8.93E+1	2.65E+2	1.99E+5	1.19E+5	3.63E+1
Te-131	1.74E-2	8.22E-3	1.58E-2	3.99E-2	2.06E+3	8.22E+3	5.00E-3
Te-132	3.72E+2	2.37E+2	2.79E+2	1.03E+3	3.40E+5	4.41E+4	1.76E+2
I-130	6.36E+3	1.39E+4	1.60E+6	1.53E+4	-	1.99E+3	5.57E+3
I-131	3.79E+4	4.44E+4	1.48E+7	5.18E+4	-	1.06E+3	1.96E+4
I-132	1.69E+3	3.54E+3	1.69E+5	3.95E+3	-	1.90E+3	1.26E+3
I-133	1.32E+4	1.92E+4	3.56E+6	2.24E+4	-	2.16E+3	5.60E+3
I-134	9.21E+2	1.88E+3	4.45E+4	2.09E+3	-	1.29E+3	6.65E+2
I-135	3.86E+3	7.60E+3	6.96E+5	8.47E+3	-	1.83E+3	2.77E+3
Cs-134	3.96E+5	7.03E+5	-	1.90E+5	7.97E+4	1.33E+3	7.45E+4
Cs-136	4.83E+4	1.35E+5	-	5.64E+4	1.18E+4	1.43E+3	5.29E+4
Cs-137	5.49E+5	6.12E+5	-	1.72E+5	7.13E+4	1.33E+3	4.55E+4
Cs-138	5.05E+2	7.81E+2	-	4.10E+2	6.54E+1	8.76E+2	3.98E+2
Ba-139	1.48E+0	9.84E-4	-	5.92E-4	5.95E+3	5.10E+4	4.30E-2
Ba-140	5.60E+4	5.60E+1	-	1.34E+1	1.60E+6	3.84E+4	2.90E+3
Ba-141	1.57E-1	1.08E-4	-	6.50E-5	2.97E+3	4.75E+3	4.97E-3
Ba-142	3.98E-2	3.30E-5	-	1.90E-5	1.55E+3	6.93E+2	1.96E-3
La-140	5.05E+2	2.00E+2	-	-	1.68E+5	8.48E+4	5.15E+1
La-142	1.03E+0	3.77E-1	-	-	8.22E+3	5.95E+4	9.04E-2
Ce-141	2.77E+4	1.67E+4	-	5.25E+3	5.17E+5	2.16E+4	1.99E+3
Ce-143	2.93E+2	1.93E+2	-	5.64E+1	1.16E+5	4.97E+4	2.21E+1
Ce-144	3.19E+6	1.21E+6	-	5.38E+5	9.84E+6	1.48E+5	1.76E+5
Pr-143	1.40E+4	5.24E+3	-	1.97E+3	4.33E+5	3.72E+4	6.99E+2
Pr-144	4.79E-2	1.85E-2	-	6.72E-3	1.61E+3	4.28E+3	2.41E-3
Nd-147	7.94E+3	8.13E+3	-	3.15E+3	3.22E+5	3.12E+4	5.00E+2
W-187	1.30E+1	9.02E+0	-	-	3.96E+4	3.56E+4	3.12E+0
Np-239	3.71E+2	3.32E+1	-	6.62E+1	5.95E+4	2.49E+4	1.88E+1

Table 2.6 (Page 1 of 2)

R_i Vegetation Pathway Dose Factors - ADULT

(mrem/yr per μCi/m³) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	2.26E+3	2.26E+3	2.26E+3	2.26E+3	2.26E+3	2.26E+3
C-14	8.97E+5	1.79E+5	1.79E+5	1.79E+5	1.79E+5	1.79E+5	1.79E+5
Na-24	2.76E+5	2.76E+5	2.76E+5	2.76E+5	2.76E+5	2.76E+5	2.76E+5
P-32	1.40E+9	8.73E+7	-	-	-	1.58E+8	5.42E+7
Cr-51	-	-	2.79E+4	1.03E+4	6.19E+4	1.17E+7	4.66E+4
Mn-54	-	3.11E+8	-	9.27E+7	-	9.54E+8	5.94E+7
Mn-56	-	1.61E+1	-	2.04E+1	-	5.13E+2	2.85E+0
Fe-55	2.09E+8	1.45E+8	-	-	8.06E+7	8.29E+7	3.37E+7
Fe-59	1.27E+8	2.99E+8	-	-	8.35E+7	9.96E+8	1.14E+8
Co-57	-	1.17E+7	-	-	-	2.97E+8	1.95E+7
Co-58	-	3.09E+7	-	-	-	6.26E+8	6.92E+7
Co-60	-	1.67E+8	-	-	-	3.14E+9	3.69E+8
Ni-63	1.04E+10	7.21E+8	-	-	-	1.50E+8	3.49E+8
Ni-65	6.15E+1	7.99E+0	-	-	-	2.03E+2	3.65E+0
Cu-64	-	9.27E+3	-	2.34E+4	-	7.90E+5	4.35E+3
Zn-65	3.17E+8	1.01E+9	-	6.75E+8	-	6.36E+8	4.56E+8
Zn-69	8.75E-6	1.67E-5	-	1.09E-5	-	2.51E-6	1.16E-6
Br-82	-	-	-	-	-	1.73E+6	1.51E+6
Br-83	-	-	-	-	-	4.63E+0	3.21E+0
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	2.19E+8	-	-	-	4.32E+7	1.02E+8
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	9.96E+9	-	-	-	-	1.60E+9	2.86E+8
Sr-90	6.05E+11	-	-	-	-	1.75E+10	1.48E+11
Sr-91	3.20E+5	-	-	-	-	1.52E+6	1.29E+4
Sr-92	4.27E+2	-	-	-	-	8.46E+3	1.85E+1
Y-90	1.33E+4	-	-	-	-	1.41E+8	3.56E+2
Y-91m	5.83E-9	-	-	-	-	1.71E-8	-
Y-91	5.13E+6	-	-	-	-	2.82E+9	1.37E+5
Y-92	9.01E-1	-	-	-	-	1.58E+4	2.63E-2
Y-93	1.74E+2	-	-	-	-	5.52E+6	4.80E+0
Zr-95	1.19E+6	3.81E+5	-	5.97E+5	-	1.21E+9	2.58E+5
Zr-97	3.33E+2	6.73E+1	-	1.02E+2	-	2.08E+7	3.08E+1
Nb-95	1.42E+5	7.91E+4	-	7.81E+4	-	4.80E+8	4.25E+4
Nb-97	2.90E-6	7.34E-7	-	8.56E-7	-	2.71E-3	2.68E-7
Mo-99	-	6.25E+6	-	1.41E+7	-	1.45E+7	1.19E+6
Tc-99m	3.06E+0	8.66E+0	-	1.32E+2	4.24E+0	5.12E+3	1.10E+2
Tc-101	-	-	-	-	-	-	-

Table 2.6 (Page 2 of 2)

R_i Vegetation Pathway Dose Factors - ADULT

(mrem/yr per μCi/m³) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	4.80E+6	-	-	1.83E+7	-	5.61E+8	2.07E+6
Ru-105	5.39E+1	-	-	6.96E+2	-	3.30E+4	2.13E+1
Ru-106	1.93E+8	-	-	3.72E+8	-	1.25E+10	2.44E+7
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	1.06E+7	9.76E+6	-	1.92E+7	-	3.98E+9	5.80E+6
Sb-124	1.04E+8	1.96E+6	2.52E+5	-	8.08E+7	2.95E+9	4.11E+7
Sb-125	1.36E+8	1.52E+6	1.39E+5	-	1.05E+8	1.50E+9	3.25E+7
Te-125m	9.66E+7	3.50E+7	2.90E+7	3.93E+8	-	3.86E+8	1.29E+7
Te-127m	3.49E+8	1.25E+8	8.92E+7	1.42E+9	-	1.17E+9	4.26E+7
Te-127	5.76E+3	2.07E+3	4.27E+3	2.35E+4	-	4.54E+5	1.25E+3
Te-129m	2.55E+8	9.50E+7	8.75E+7	1.06E+9	-	1.28E+9	4.03E+7
Te-129	6.65E-4	2.50E-4	5.10E-4	2.79E-3	-	5.02E-4	1.62E-4
Te-131m	9.12E+5	4.46E+5	7.06E+5	4.52E+6	-	4.43E+7	3.72E+5
Te-131	-	-	-	-	-	-	-
Te-132	4.29E+6	2.77E+6	3.06E+6	2.67E+7	-	1.31E+8	2.60E+6
I-130	3.96E+5	1.17E+6	9.90E+7	1.82E+6	-	1.01E+6	4.61E+5
I-131	8.09E+7	1.16E+8	3.79E+10	1.98E+8	-	3.05E+7	6.63E+7
I-132	5.74E+1	1.54E+2	5.38E+3	2.45E+2	-	2.89E+1	5.38E+1
I-133	2.12E+6	3.69E+6	5.42E+8	6.44E+6	-	3.31E+6	1.12E+6
I-134	1.06E-4	2.88E-4	5.00E-3	4.59E-4	-	2.51E-7	1.03E-4
I-135	4.08E+4	1.07E+5	7.04E+6	1.71E+5	-	1.21E+5	3.94E+4
Cs-134	4.66E+9	1.11E+10	-	3.59E+9	1.19E+9	1.94E+8	9.07E+9
Cs-136	4.20E+7	1.66E+8	-	9.24E+7	1.27E+7	1.89E+7	1.19E+8
Cs-137	6.36E+9	8.70E+9	-	2.95E+9	9.81E+8	1.68E+8	5.70E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	2.95E-2	2.10E-5	-	1.96E-5	1.19E-5	5.23E-2	8.64E-4
Ba-140	1.29E+8	1.62E+5	-	5.49E+4	9.25E+4	2.65E+8	8.43E+6
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	1.97E+3	9.92E+2	-	-	-	7.28E+7	2.62E+2
La-142	1.40E-4	6.35E-5	-	-	-	4.64E-1	1.58E-5
Ce-141	1.96E+5	1.33E+5	-	6.17E+4	-	5.08E+8	1.51E+4
Ce-143	1.00E+3	7.42E+5	-	3.26E+2	-	2.77E+7	8.21E+1
Ce-144	3.29E+7	1.38E+7	-	8.16E+6	-	1.11E+10	1.77E+6
Pr-143	6.34E+4	2.54E+4	-	1.47E+4	-	2.78E+8	3.14E+3
Pr-144	-	-	-	-	-	-	-
Nd-147	3.34E+4	3.86E+4	-	2.25E+4	-	1.85E+8	2.31E+3
W-187	3.82E+4	3.19E+4	-	-	-	1.05E+7	1.12E+4
Np-239	1.42E+3	1.40E+2	-	4.37E+2	-	2.87E+7	7.72E+1

Table 2.7 (Page 1 of 2)

R_i Vegetation Pathway Dose Factors - TEEN

(mrem/yr per μCi/m^3) for H-3 and C-14 (m^2 x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	2.59E+3	2.59E+3	2.59E+3	2.59E+3	2.59E+3	2.59E+3
C-14	1.45E+6	2.91E+5	2.91E+5	2.91E+5	2.91E+5	2.91E+5	2.91E+5
Na-24	2.45E+5	2.45E+5	2.45E+5	2.45E+5	2.45E+5	2.45E+5	2.45E+5
P-32	1.61E+9	9.96E+7	-	-	-	1.35E+8	6.23E+7
Cr-51	-	-	3.44E+4	1.36E+4	8.85E+4	1.04E+7	6.20E+4
Mn-54	-	4.52E+8	-	1.35E+8	-	9.27E+8	8.97E+7
Mn-56	-	1.45E+1	-	1.83E+1	-	9.54E+2	2.58E+0
Fe-55	3.25E+8	2.31E+8	-	-	1.46E+8	9.98E+7	5.38E+7
Fe-59	1.81E+8	4.22E+8	-	-	1.33E+8	9.98E+8	1.63E+8
Co-57	-	1.79E+7	-	-	-	3.34E+8	3.00E+7
Co-58	-	4.38E+7	-	-	-	6.04E+8	1.01E+8
Co-60	-	2.49E+8	-	-	-	3.24E+9	5.60E+8
Ni-63	1.61E+10	1.13E+9	-	-	-	1.81E+8	5.45E+8
Ni-65	5.73E+1	7.32E+0	-	-	-	3.97E+2	3.33E+0
Cu-64	-	8.40E+3	-	2.12E+4	-	6.51E+5	3.95E+3
Zn-65	4.24E+8	1.47E+9	-	9.41E+8	-	6.23E+8	6.86E+8
Zn-69	8.19E-6	1.56E-5	-	1.02E-5	-	2.88E-5	1.09E-6
Br-82	-	-	-	-	-	-	1.33E+6
Br-83	-	-	-	-	-	-	3.01E+0
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	2.73E+8	-	-	-	4.05E+7	1.28E+8
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	1.51E+10	-	-	-	-	1.80E+9	4.33E+8
Sr-90	7.51E+11	-	-	-	-	2.11E+10	1.85E+11
Sr-91	2.99E+5	-	-	-	-	1.36E+6	1.19E+4
Sr-92	3.97E+2	-	-	-	-	1.01E+4	1.69E+1
Y-90	1.24E+4	-	-	-	-	1.02E+8	3.34E+2
Y-91m	5.43E-9	-	-	-	-	2.56E-7	-
Y-91	7.87E+6	-	-	-	-	3.23E+9	2.11E+5
Y-92	8.47E-1	-	-	-	-	2.32E+4	2.45E-2
Y-93	1.63E+2	-	-	-	-	4.98E+6	4.47E+0
Zr-95	1.74E+6	5.49E+5	-	8.07E+5	-	1.27E+9	3.78E+5
Zr-97	3.09E+2	6.11E+1	-	9.26E+1	-	1.65E+7	2.81E+1
Nb-95	1.92E+5	1.06E+5	-	1.03E+5	-	4.55E+8	5.86E+4
Nb-97	2.69E-6	6.67E-7	-	7.80E-7	-	1.59E-2	2.44E-7
Mo-99	-	5.74E+6	-	1.31E+7	-	1.03E+7	1.09E+6
Tc-99m	2.70E+0	7.54E+0	-	1.12E+2	4.19E+0	4.95E+3	9.77E+1
Tc-101	-	-	-	-	-	-	-

Table 2.7 (Page 2 of 2)

R_i Vegetation Pathway Dose Factors - TEEN

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	6.87E+6	-	-	2.42E+7	-	5.74E+8	2.94E+6
Ru-105	5.00E+1	-	-	6.31E+2	-	4.04E+4	1.94E+1
Ru-106	3.09E+8	-	-	5.97E+8	-	1.48E+10	3.90E+7
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	1.52E+7	1.44E+7	-	2.74E+7	-	4.04E+9	8.74E+6
Sb-124	1.55E+8	2.85E+6	3.51E+5	-	1.35E+8	3.11E+9	6.03E+7
Sb-125	2.14E+8	2.34E+6	2.04E+5	-	1.88E+8	1.66E+9	5.00E+7
Te-125m	1.48E+8	5.34E+7	4.14E+7	-	-	4.37E+8	1.98E+7
Te-127m	5.51E+8	1.96E+8	1.31E+8	2.24E+9	-	1.37E+9	6.56E+7
Te-127	5.43E+3	1.92E+3	3.74E+3	2.20E+4	-	4.19E+5	1.17E+3
Te-129m	3.67E+8	1.36E+8	1.18E+8	1.54E+9	-	1.38E+9	5.81E+7
Te-129	6.22E-4	2.32E-4	4.45E-4	2.61E-3	-	3.40E-3	1.51E-4
Te-131m	8.44E+5	4.05E+5	6.09E+5	4.22E+6	-	3.25E+7	3.38E+5
Te-131	-	-	-	-	-	-	-
Te-132	3.90E+6	2.47E+6	2.60E+6	2.37E+7	-	7.82E+7	2.32E+6
I-130	3.54E+5	1.02E+6	8.35E+7	1.58E+6	-	7.87E+5	4.09E+5
I-131	7.70E+7	1.08E+8	3.14E+10	1.85E+8	-	2.13E+7	5.79E+7
I-132	5.18E+1	1.36E+2	4.57E+3	2.14E+2	-	5.91E+1	4.87E+1
I-133	1.97E+6	3.34E+6	4.66E+8	5.86E+6	-	2.53E+6	1.02E+6
I-134	9.59E-5	2.54E-4	4.24E-3	4.01E-4	-	3.35E-6	9.13E-5
I-135	3.68E+4	9.48E+4	6.10E+6	1.50E+5	-	1.05E+5	3.52E+4
Cs-134	7.09E+9	1.67E+10	-	5.30E+9	2.02E+9	2.08E+8	7.74E+9
Cs-136	4.29E+7	1.69E+8	-	9.19E+7	1.45E+7	1.36E+7	1.13E+8
Cs-137	1.01E+10	1.35E+10	-	4.59E+9	1.78E+9	1.92E+8	4.69E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	2.77E-2	1.95E-5	-	1.84E-5	1.34E-5	2.47E-1	8.08E-4
Ba-140	1.38E+8	1.69E+5	-	5.75E+4	1.14E+5	2.13E+8	8.91E+6
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	1.80E+3	8.84E+2	-	-	-	5.08E+7	2.35E+2
La-142	1.28E-4	5.69E-5	-	-	-	1.73E+0	1.42E-5
Ce-141	2.82E+5	1.88E+5	-	8.86E+4	-	5.38E+8	2.16E+4
Ce-143	9.37E+2	6.82E+5	-	3.06E+2	-	2.05E+7	7.62E+1
Ce-144	5.27E+7	2.18E+7	-	1.30E+7	-	1.33E+10	2.83E+6
Pr-143	7.12E+4	2.84E+4	-	1.65E+4	-	2.34E+8	3.55E+3
Pr-144	-	-	-	-	-	-	-
Nd-147	3.63E+4	3.94E+4	-	2.32E+4	-	1.42E+8	2.36E+3
W-187	3.55E+4	2.90E+4	-	-	-	7.84E+6	1.02E+4
Np-239	1.38E+3	1.30E+2	-	4.09E+2	-	2.10E+7	7.24E+1

Table 2.8 (Page 1 of 2)

R_i Vegetation Pathway Dose Factors - CHILD

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	4.01E+3	4.01E+3	4.01E+3	4.01E+3	4.01E+3	4.01E+3
C-14	3.50E+6	7.01E+5	7.01E+5	7.01E+5	7.01E+5	7.01E+5	7.01E+5
Na-24	3.83E+5	3.83E+5	3.83E+5	3.83E+5	3.83E+5	3.83E+5	3.83E+5
P-32	3.37E+9	1.58E+8	-	-	-	9.30E+7	1.30E+8
Cr-51	-	-	6.54E+4	1.79E+4	1.19E+5	6.25E+6	1.18E+5
Mn-54	-	6.61E+8	-	1.85E+8	-	5.55E+8	1.76E+8
Mn-56	-	1.90E+1	-	2.29E+1	-	2.75E+3	4.28E+0
Fe-55	8.00E+8	4.24E+8	-	-	2.40E+8	7.86E+7	1.31E+8
Fe-59	4.01E+8	6.49E+8	-	-	1.88E+8	6.76E+8	3.23E+8
Co-57	-	2.99E+7	-	-	-	2.45E+8	6.04E+7
Co-58	-	6.47E+7	-	-	-	3.77E+8	1.98E+8
Co-60	-	3.78E+8	-	-	-	2.10E+9	1.12E+9
Ni-63	3.95E+10	2.11E+9	-	-	-	1.42E+8	1.34E+9
Ni-65	1.05E+2	9.89E+0	-	-	-	1.21E+3	5.77E+0
Cu-64	-	1.11E+4	-	2.68E+4	-	5.20E+5	6.69E+3
Zn-65	8.12E+8	2.16E+9	-	1.36E+9	-	3.80E+8	1.35E+9
Zn-69	1.51E-5	2.18E-5	-	1.32E-5	-	1.38E-3	2.02E-6
Br-82	-	-	-	-	-	-	2.04E+6
Br-83	-	-	-	-	-	-	5.55E+0
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	4.52E+8	-	-	-	2.91E+7	2.78E+8
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	3.59E+10	-	-	-	-	1.39E+9	1.03E+9
Sr-90	1.24E+12	-	-	-	-	1.67E+10	3.15E+11
Sr-91	5.50E+5	-	-	-	-	1.21E+6	2.08E+4
Sr-92	7.28E+2	-	-	-	-	1.38E+4	2.92E+1
Y-90	2.30E+4	-	-	-	-	6.56E+7	6.17E+2
Y-91m	9.94E-9	-	-	-	-	1.95E-5	-
Y-91	1.87E+7	-	-	-	-	2.49E+9	5.01E+5
Y-92	1.56E+0	-	-	-	-	4.51E+4	4.46E-2
Y-93	3.01E+2	-	-	-	-	4.48E+6	8.25E+0
Zr-95	3.90E+6	8.58E+5	-	1.23E+6	-	8.95E+8	7.64E+5
Zr-97	5.64E+2	8.15E+1	-	1.17E+2	-	1.23E+7	4.81E+1
Nb-95	4.10E+5	1.59E+5	-	1.50E+5	-	2.95E+8	1.14E+5
Nb-97	4.90E-6	8.85E-7	-	9.82E-7	-	2.73E-1	4.13E-7
Mo-99	-	7.83E+6	-	1.67E+7	-	6.48E+6	1.94E+6
Tc-99m	4.65E+0	9.12E+0	-	1.33E+2	4.63E+0	5.19E+3	1.51E+2
Tc-101	-	-	-	-	-	-	-

Table 2.8 (Page 2 of 2)

R_i Vegetation Pathway Dose Factors - CHILD

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	1.55E+7	-	-	3.89E+7	-	3.99E+8	5.94E+6
Ru-105	9.17E+1	-	-	8.06E+2	-	5.98E+4	3.33E+1
Ru-106	7.45E+8	-	-	1.01E+9	-	1.16E+10	9.30E+7
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	3.22E+7	2.17E+7	-	4.05E+7	-	2.58E+9	1.74E+7
Sb-124	3.52E+8	4.57E+6	7.78E+5	-	1.96E+8	2.20E+9	1.23E+8
Sb-125	4.99E+8	3.85E+6	4.62E+5	-	2.78E+8	1.19E+9	1.05E+8
Te-125m	3.51E+8	9.50E+7	9.84E+7	-	-	3.38E+8	4.67E+7
Te-127m	1.32E+9	3.56E+8	3.16E+8	3.77E+9	-	1.07E+9	1.57E+8
Te-127	1.00E+4	2.70E+3	6.93E+3	2.85E+4	-	3.91E+5	2.15E+3
Te-129m	8.54E+8	2.39E+8	2.75E+8	2.51E+9	-	1.04E+9	1.33E+8
Te-129	1.15E-3	3.22E-4	8.22E-4	3.37E-3	-	7.17E-2	2.74E-4
Te-131m	1.54E+6	5.33E+5	1.10E+6	5.16E+6	-	2.16E+7	5.68E+5
Te-131	-	-	-	-	-	-	-
Te-132	6.98E+6	3.09E+6	4.50E+6	2.87E+7	-	3.11E+7	3.73E+6
I-130	6.21E+5	1.26E+6	1.38E+8	1.88E+6	-	5.87E+5	6.47E+5
I-131	1.43E+8	1.44E+8	4.76E+10	2.36E+8	-	1.28E+7	8.18E+7
I-132	9.20E+1	1.69E+2	7.84E+3	2.59E+2	-	1.99E+2	7.77E+1
I-133	3.59E+6	4.44E+6	8.25E+8	7.40E+6	-	1.79E+6	1.68E+6
I-134	1.70E-4	3.16E-4	7.28E-3	4.84E-4	-	2.10E-4	1.46E-4
I-135	6.54E+4	1.18E+5	1.04E+7	1.81E+5	-	8.98E+4	5.57E+4
Cs-134	1.60E+10	2.63E+10	-	8.14E+9	2.92E+9	1.42E+8	5.54E+9
Cs-136	8.06E+7	2.22E+8	-	1.18E+8	1.76E+7	7.79E+6	1.43E+8
Cs-137	2.39E+10	2.29E+10	-	7.46E+9	2.68E+9	1.43E+8	3.38E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	5.11E-2	2.73E-5	-	2.38E-5	1.61E-5	2.95E+0	1.48E-3
Ba-140	2.77E+8	2.43E+5	-	7.90E+4	1.45E+5	1.40E+8	1.62E+7
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	3.23E+3	1.13E+3	-	-	-	3.15E+7	3.81E+2
La-142	2.32E-4	7.40E-5	-	-	-	1.47E+1	2.32E-5
Ce-141	6.35E+5	3.26E+5	-	1.43E+5	-	4.07E+8	4.84E+4
Ce-143	1.73E+3	9.36E+5	-	3.93E+2	-	1.37E+7	1.36E+2
Ce-144	1.27E+8	3.98E+7	-	2.21E+7	-	1.04E+10	6.78E+6
Pr-143	1.48E+5	4.46E+4	-	2.41E+4	-	1.60E+8	7.37E+3
Pr-144	-	-	-	-	-	-	-
Nd-147	7.16E+4	5.80E+4	-	3.18E+4	-	9.18E+7	4.49E+3
W-187	6.47E+4	3.83E+4	-	-	-	5.38E+6	1.72E+4
Np-239	2.55E+3	1.83E+2	-	5.30E+2	-	1.36E+7	1.29E+2

Table 2.9 (Page 1 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - ADULT

(mrem/yr per $\mu Ci/m^3$) for H-3 and C-14 (m^2 x mrem/yr $\mu Ci/sec$) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	7.63E+2	7.63E+2	7.63E+2	7.63E+2	7.63E+2	7.63E+2
C-14	3.63E+5	7.26E+4	7.26E+4	7.26E+4	7.26E+4	7.26E+4	7.26E+4
Na-24	2.54E+6	2.54E+6	2.54E+6	2.54E+6	2.54E+6	2.54E+6	2.54E+6
P-32	1.71E+10	1.06E+9	-	-	-	1.92E+9	6.60E+8
Cr-51	-	-	1.71E+4	6.30E+3	3.80E+4	7.20E+6	2.86E+4
Mn-54	-	8.40E+6	-	2.50E+6	-	2.57E+7	1.60E+6
Mn-56	-	4.23E-3	-	5.38E-3	-	1.35E-1	7.51E-4
Fe-55	2.51E+7	1.73E+7	-	-	9.67E+6	9.95E+6	4.04E+6
Fe-59	2.98E+7	7.00E+7	-	-	1.95E+7	2.33E+8	2.68E+7
Co-57	-	1.28E+6	-	-	-	3.25E+7	2.13E+6
Co-58	-	4.72E+6	-	-	-	9.57E+7	1.06E+7
Co-60	-	1.64E+7	-	-	-	3.08E+8	3.62E+7
Ni-63	6.73E+9	4.66E+8	-	-	-	9.73E+7	2.26E+8
Ni-65	3.70E-1	4.81E-2	-	-	-	1.22E+0	2.19E-2
Cu-64	-	2.41E+4	-	6.08E+4	-	2.05E+6	1.13E+4
Zn-65	1.37E+9	4.36E+9	-	2.92E+9	-	2.75E+9	1.97E+9
Zn-69	-	-	-	-	-	-	-
Br-82	-	-	-	-	-	3.72E+7	3.25E+7
Br-83	-	-	-	-	-	1.49E-1	1.03E-1
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	2.59E+9	-	-	-	5.11E+8	1.21E+9
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	1.45E+9	-	-	-	-	2.33E+8	4.16E+7
Sr-90	4.68E+10	-	-	-	-	1.35E+9	1.15E+10
Sr-91	3.13E+4	-	-	-	-	1.49E+5	1.27E+3
Sr-92	4.89E-1	-	-	-	-	9.68E+0	2.11E-2
Y-90	7.07E+1	-	-	-	-	7.50E+5	1.90E+0
Y-91m	-	-	-	-	-	-	-
Y-91	8.60E+3	-	-	-	-	4.73E+6	2.30E+2
Y-92	5.42E-5	-	-	-	-	9.49E-1	1.58E-6
Y-93	2.33E-1	-	-	-	-	7.39E+3	6.43E-3
Zr-95	9.46E+2	3.03E+2	-	4.76E+2	-	9.62E+5	2.05E+2
Zr-97	4.26E-1	8.59E-2	-	1.30E-1	-	2.66E+4	3.93E-2
Nb-95	8.25E+4	4.59E+4	-	4.54E+4	-	2.79E+8	2.47E+4
Nb-97	-	-	-	-	-	5.47E-9	-
Mo-99	-	2.52E+7	-	5.72E+7	-	5.85E+7	4.80E+6
Tc-99m	3.25E+0	9.19E+0	-	1.40E+2	4.50E+0	5.44E+3	1.17E+2
Tc-101	-	-	-	-	-	-	-

Table 2.9 (Page 2 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - ADULT

(mrem/yr per $\mu Ci/m^3$) for H-3 and C-14 (m^2 x mrem/yr $\mu Ci/sec$) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	1.02E+3	-	-	3.89E+3	-	1.19E+5	4.39E+2
Ru-105	8.57E-4	-	-	1.11E-2	-	5.24E-1	3.38E-4
Ru-106	2.04E+4	-	-	3.94E+4	-	1.32E+6	2.58E+3
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	5.83E+7	5.39E+7	-	1.06E+8	-	2.20E+10	3.20E+7
Sb-124	2.57E+7	4.86E+5	6.24E+4	-	2.00E+7	7.31E+8	1.02E+7
Sb-125	2.04E+7	2.28E+5	2.08E+4	-	1.58E+7	2.25E+8	4.86E+6
Te-125m	1.63E+7	5.90E+6	4.90E+6	6.63E+7	-	6.50E+7	2.18E+6
Te-127m	4.58E+7	1.64E+7	1.17E+7	1.86E+8	-	1.54E+8	5.58E+6
Te-127	6.72E+2	2.41E+2	4.98E+2	2.74E+3	-	5.30E+4	1.45E+2
Te-129m	6.04E+7	2.25E+7	2.08E+7	2.52E+8	-	3.04E+8	9.57E+6
Te-129	-	-	-	-	-	-	-
Te-131m	3.61E+5	1.77E+5	2.80E+5	1.79E+6	-	1.75E+7	1.47E+5
Te-131	-	-	-	-	-	-	-
Te-132	2.39E+6	1.55E+6	1.71E+6	1.49E+7	-	7.32E+7	1.45E+6
I-130	4.26E+5	1.26E+6	1.07E+8	1.96E+6	-	1.08E+6	4.96E+5
I-131	2.96E+8	4.24E+8	1.39E+11	7.27E+8	-	1.12E+8	2.43E+8
I-132	1.64E-1	4.37E-1	1.53E+1	6.97E-1	-	8.22E-2	1.53E-1
I-133	3.97E+6	6.90E+6	1.01E+9	1.20E+7	-	6.20E+6	2.10E+6
I-134	-	-	-	-	-	-	-
I-135	1.39E+4	3.63E+4	2.40E+6	5.83E+4	-	4.10E+4	1.34E+4
Cs-134	5.65E+9	1.34E+10	-	4.35E+9	1.44E+9	2.35E+8	1.10E+10
Cs-136	2.61E+8	1.03E+9	-	5.74E+8	7.87E+7	1.17E+8	7.42E+8
Cs-137	7.38E+9	1.01E+10	-	3.43E+9	1.14E+9	1.95E+8	6.61E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	4.70E-8	-	-	-	-	8.34E-8	1.38E-9
Ba-140	2.69E+7	3.38E+4		1.15E+4	1.93E+4	5.54E+7	1.76E+6
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	4.49E+0	2.26E+0	-	-	-	1.66E+5	5.97E-1
La-142	-	-	-	-	-	3.03E-8	-
Ce-141	4.84E+3	3.27E+3	-	1.52E+3	-	1.25E+7	3.71E+2
Ce-143	4.19E+1	3.09E+4	-	1.36E+1	-	1.16E+6	3.42E+0
Ce-144	3.58E+5	1.50E+5	-	8.87E+4	-	1.21E+8	1.92E+4
Pr-143	1.59E+2	6.37E+1	-	3.68E+1	-	6.96E+5	7.88E+0
Pr-144	-	-	-	-	-	-	-
Nd-147	9.42E+1	1.09E+2	-	6.37E+1	-	5.23E+5	6.52E+0
W-187	6.56E+3	5.48E+3	-	-	-	1.80E+6	1.92E+3
Np-239	3.66E+0	3.60E-1	-	1.12E+0	-	7.39E+4	1.98E-1

Table 2.10 (Page 1 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - TEEN

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	9.94E+2	9.94E+2	9.94E+2	9.94E+2	9.94E+2	9.94E+2
C-14	6.70E+5	1.34E+5	1.34E+5	1.34E+5	1.34E+5	1.34E+5	1.34E+5
Na-24	4.44E+6	4.44E+6	4.44E+6	4.44E+6	4.44E+6	4.44E+6	4.44E+6
P-32	3.15E+10	1.95E+9	-	-	-	2.65E+9	1.22E+9
Cr-51	-	-	2.78E+4	1.10E+4	7.13E+4	8.40E+6	5.00E+4
Mn-54	-	1.40E+7	-	4.17E+6	-	2.87E+7	2.78E+6
Mn-56	-	7.51E-3	-	9.50E-3	-	4.94E-1	1.33E-3
Fe-55	4.45E+7	3.16E+7	-	-	2.00E+7	1.37E+7	7.36E+6
Fe-59	5.20E+7	1.21E+8	-	-	3.82E+7	2.87E+8	4.68E+7
Co-57	-	2.25E+6	-	-	-	4.19E+7	3.76E+6
Co-58	-	7.95E+6	-	-	-	1.10E+8	1.83E+7
Co-60	-	2.78E+7	-	-	-	3.62E+8	6.26E+7
Ni-63	1.18E+10	8.35E+8	-	-	-	1.33E+8	4.01E+8
Ni-65	6.78E-1	8.66E-2	-	-	-	4.70E+0	3.94E-2
Cu-64	-	4.29E+4	-	1.09E+5	-	3.33E+6	2.02E+4
Zn-65	2.11E+9	7.31E+9	-	4.68E+9	-	3.10E+9	3.41E+9
Zn-69	-	-	-	-	-	-	-
Br-82	-	-	-	-	-	-	5.64E+7
Br-83	-	-	-	-	-	-	1.91E-1
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	4.73E+9	-	-	-	7.00E+8	2.22E+9
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	2.67E+9	-	-	-	-	3.18E+8	7.66E+7
Sr-90	6.61E+10	-	-	-	-	1.86E+9	1.63E+10
Sr-91	5.75E+4	-	-	-	-	2.61E+5	2.29E+3
Sr-92	8.95E-1	-	-	-	-	2.28E+1	3.81E-2
Y-90	1.30E+2	-	-	-	-	1.07E+6	3.50E+0
Y-91m	-	-	-	-	-	-	-
Y-91	1.58E+4	-	-	-	-	6.48E+6	4.24E+2
Y-92	1.00E-4	-	-	-	-	2.75E+0	2.90E-6
Y-93	4.30E-1	-	-	-	-	1.31E+4	1.18E-2
Zr-95	1.65E+3	5.22E+2	-	7.67E+2	-	1.20E+6	3.59E+2
Zr-97	7.75E-1	1.53E-1	-	2.32E-1	-	4.15E+4	7.06E-2
Nb-95	1.41E+5	7.80E+4	-	7.57E+4	-	3.34E+8	4.30E+4
Nb-97	-	-	-	-	-	6.34E-8	-
Mo-99	-	4.56E+7	-	1.04E+8	-	8.16E+7	8.69E+6
Tc-99m	5.64E+0	1.57E+1	-	2.34E+2	8.73E+0	1.03E+4	2.04E+2
Tc-101	-	-	-	-	-	-	-

Table 2.10 (Page 2 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - TEEN

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	1.81E+3	-	-	6.40E+3	-	1.52E+5	7.75E+2
Ru-105	1.57E-3	-	-	1.97E-2	-	1.26E+0	6.08E-4
Ru-106	3.75E+4	-	-	7.23E+4	-	1.80E+6	4.73E+3
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	9.63E+7	9.11E+7	-	1.74E+8	-	2.56E+10	5.54E+7
Sb-124	4.59E+7	8.46E+5	1.04E+5	-	4.01E+7	9.25E+8	1.79E+7
Sb-125	3.65E+7	3.99E+5	3.49E+4	-	3.21E+7	2.84E+8	8.54E+6
Te-125m	3.00E+7	1.08E+7	8.39E+6	-	-	8.86E+7	4.02E+6
Te-127m	8.44E+7	2.99E+7	2.01E+7	3.42E+8	-	2.10E+8	1.00E+7
Te-127	1.24E+3	4.41E+2	8.59E+2	5.04E+3	-	9.61E+4	2.68E+2
Te-129m	1.11E+8	4.10E+7	3.57E+7	4.62E+8	-	4.15E+8	1.75E+7
Te-129	-	-	-	1.67E-9	-	2.18E-9	-
Te-131m	6.57E+5	3.15E+5	4.74E+5	3.29E+6	-	2.53E+7	2.63E+5
Te-131	-	-	-	-	-	-	-
Te-132	4.28E+6	2.71E+6	2.86E+6	2.60E+7	-	8.58E+7	2.55E+6
I-130	7.49E+5	2.17E+6	1.77E+8	3.34E+6	-	1.67E+6	8.66E+5
I-131	5.38E+8	7.53E+8	2.20E+11	1.30E+9	-	1.49E+8	4.04E+8
I-132	2.90E-1	7.59E-1	2.56E+1	1.20E+0	-	3.31E-1	2.72E-1
I-133	7.24E+6	1.23E+7	1.72E+9	2.15E+7	-	9.30E+6	3.75E+6
I-134	-	-	-	-	-	-	-
I-135	2.47E+4	6.35E+4	4.08E+6	1.00E+5		7.03E+4	2.35E+4
Cs-134	9.81E+9	2.31E+10	-	7.34E+9	2.80E+9	2.87E+8	1.07E+10
Cs-136	4.45E+8	1.75E+9	-	9.53E+8	1.50E+8	1.41E+8	1.18E+9
Cs-137	1.34E+10	1.78E+10	-	6.06E+9	2.35E+9	2.53E+8	6.20E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	8.69E-8	-	-	-	-	7.75E-7	2.53E-9
Ba-140	4.85E+7	5.95E+4	-	2.02E+4	4.00E+4	7.49E+7	3.13E+6
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	8.06E+0	3.96E+0	-	-	-	2.27E+5	1.05E+0
La-142	-	-	-	-	-	2.23E-7	-
Ce-141	8.87E+3	5.92E+3	-	2.79E+3	-	1.69E+7	6.81E+2
Ce-143	7.69E+1	5.60E+4	-	2.51E+1	-	1.68E+6	6.25E+0
Ce-144	6.58E+5	2.72E+5	-	1.63E+5	-	1.66E+8	3.54E+4
Pr-143	2.92E+2	1.17E+2	-	6.77E+1	-	9.61E+5	1.45E+1
Pr-144	-	-	-	-	-	-	-
Nd-147	1.81E+2	1.97E+2	-	1.16E+2	-	7.11E+5	1.18E+1
W-187	1.20E+4	9.78E+3	-	-	-	2.65E+6	3.43E+3
Np-239	6.99E+0	6.59E-1	-	2.07E+0	-	1.06E+5	3.66E-1

Table 2.11 (Page 1 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - CHILD

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	1.57E+3	1.57E+3	1.57E+3	1.57E+3	1.57E+3	1.57E+3
C-14	1.65E+6	3.29E+5	3.29E+5	3.29E+5	3.29E+5	3.29E+5	3.29E+5
Na-24	9.23E+6	9.23E+6	9.23E+6	9.23E+6	9.23E+6	9.23E+6	9.23E+6
P-32	7.77E+10	3.64E+9	-	-	-	2.15E+9	3.00E+9
Cr-51	-	-	5.66E+4	1.55E+4	1.03E+5	5.41E+6	1.02E+5
Mn-54	-	2.09E+7	-	5.87E+6	-	1.76E+7	5.58E+6
Mn-56	-	1.31E-2	-	1.58E-2	-	1.90E+0	2.95E-3
Fe-55	1.12E+8	5.93E+7	-	-	3.35E+7	1.10E+7	1.84E+7
Fe-59	1.20E+8	1.95E+8	-	-	5.65E+7	2.03E+8	9.71E+7
Co-57	-	3.84E+6	-	-	-	3.14E+7	7.77E+6
Co-58	-	1.21E+7	-	-	-	7.08E+7	3.72E+7
Co-60	-	4.32E+7	-	-	-	2.39E+8	1.27E+8
Ni-63	2.96E+10	1.59E+9	-	-	-	1.07E+8	1.01E+9
Ni-65	1.66E+0	1.56E-1	-	-	-	1.91E+1	9.11E-2
Cu-64	-	7.55E+4	-	1.82E+5	-	3.54E+6	4.56E+4
Zn-65	4.13E+9	1.10E+10	-	6.94E+9	-	1.93E+9	6.85E+9
Zn-69	-	-	-	-	-	2.14E-9	-
Br-82	-	-	-	-	-	-	1.15E+8
Br-83	-	-	-	-	-	-	4.69E-1
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	8.77E+9	-	-	-	5.64E+8	5.39E+9
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	6.62E+9	-	-	-	-	2.56E+8	1.89E+8
Sr-90	1.12E+11	-	-	-	-	1.51E+9	2.83E+10
Sr-91	1.41E+5	-	-	-	-	3.12E+5	5.33E+3
Sr-92	2.19E+0	-	-	-	-	4.14E+1	8.76E-2
Y-90	3.22E+2	-	-	-	-	9.15E+5	8.61E+0
Y-91m	-	-	-	-	-	-	-
Y-91	3.91E+4	-	-	-	-	5.21E+6	1.04E+3
Y-92	2.46E-4	-	-	-	-	7.10E+0	7.03E-6
Y-93	1.06E+0	-	-	-	-	1.57E+4	2.90E-2
Zr-95	3.84E+3	8.45E+2	-	1.21E+3	-	8.81E+5	7.52E+2
Zr-97	1.89E+0	2.72E-1	-	3.91E-1	-	4.13E+4	1.61E-1
Nb-95	3.18E+5	1.24E+5	-	1.16E+5	-	2.29E+8	8.84E+4
Nb-97	-	-	-	-	-	1.45E-6	-
Mo-99	-	8.29E+7	-	1.77E+8	-	6.86E+7	2.05E+7
Tc-99m	1.29E+1	2.54E+1	-	3.68E+2	1.29E+1	1.44E+4	4.20E+2
Tc-101	-	-	-	-	-	-	-

Table 2.11 (Page 2 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - CHILD

(mrem/yr per $\mu Ci/m^3$) for H-3 and C-14 (m^2 x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	4.29E+3	-	-	1.08E+4	-	1.11E+5	1.65E+3
Ru-105	3.82E-3	-	-	3.36E-2	-	2.49E+0	1.39E-3
Ru-106	9.24E+4	-	-	1.25E+5	-	1.44E+6	1.15E+4
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	2.09E+8	1.41E+8	-	2.63E+8	-	1.68E+10	1.13E+8
Sb-124	1.09E+8	1.41E+8	2.40E+5	-	6.03E+7	6.79E+8	3.81E+7
Sb-125	8.70E+7	1.41E+6	8.06E+4	-	4.85E+7	2.08E+8	1.82E+7
Te-125m	7.38E+7	2.00E+7	2.07E+7	-	-	7.12E+7	9.84E+6
Te-127m	2.08E+8	5.60E+7	4.97E+7	5.93E+8	-	1.68E+8	2.47E+7
Te-127	3.06E+3	8.25E+2	2.12E+3	8.71E+3	-	1.20E+5	6.56E+2
Te-129m	2.72E+8	7.61E+7	8.78E+7	8.00E+8	-	3.32E+8	4.23E+7
Te-129	-	-	-	2.87E-9	-	6.12E-8	-
Te-131m	1.60E+6	5.53E+5	1.14E+6	5.35E+6	-	2.24E+7	5.89E+5
Te-131	-	-	-	-	-	-	-
Te-132	1.02E+7	4.52E+6	6.58E+6	4.20E+7	-	4.55E+7	5.46E+6
I-130	1.75E+6	3.54E+6	3.90E+8	5.29E+6	-	1.66E+6	1.82E+6
I-131	1.30E+9	1.31E+9	4.34E+11	2.15E+9	-	1.17E+8	7.46E+8
I-132	6.86E-1	1.26E+0	5.85E+1	1.93E+0	-	1.48E+0	5.80E-1
I-133	1.76E+7	2.18E+7	4.04E+9	3.63E+7	-	8.77E+6	8.23E+6
I-134	-	-	-	-	-	-	-
I-135	5.84E+4	1.05E+5	9.30E+6	1.61E+5	-	8.00E+4	4.97E+4
Cs-134	2.26E+10	3.71E+10	-	1.15E+10	4.13E+9	2.00E+8	7.83E+9
Cs-136	1.00E+9	2.76E+9	-	1.47E+9	2.19E+8	9.70E+7	1.79E+9
Cs-137	3.22E+10	3.09E+10	-	1.01E+10	3.62E+9	1.93E+8	4.55E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	2.14E-7	-	-	-	-	1.23E-5	6.19E-9
Ba-140	1.17E+8	1.03E+5	-	3.34E+4	6.12E+4	5.94E+7	6.84E+6
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	1.93E+1	6.74E+0	-	-	-	1.88E+5	2.27E+0
La-142	-	-	-	-	-	2.51E-6	-
Ce-141	2.19E+4	1.09E+4	-	4.78E+3	-	1.36E+7	1.62E+3
Ce-143	1.89E+2	1.02E+5	-	4.29E+1	-	1.50E+6	1.48E+1
Ce-144	1.62E+6	5.09E+5	-	2.82E+5	-	1.33E+8	8.66E+4
Pr-143	7.23E+2	2.17E+2	-	1.17E+2	-	7.80E+5	3.59E+1
Pr-144	-	-	-	-	-	-	-
Nd-147	4.45E+2	3.60E+2	-	1.98E+2	-	5.71E+5	2.79E+1
W-187	2.91E+4	1.72E+4	-	-	-	2.42E+6	7.73E+3
Np-239	1.72E+1	1.23E+0	-	3.57E+0	-	9.14E+4	8.68E-1

Table 2.12 (Page 1 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - INFANT

(mrem/yr per $\mu Ci/m^3$) for H-3 and C-14 (m^2 x mrem/yr $\mu Ci/sec$) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
H-3	-	2.38E+3	2.38E+3	2.38E+3	2.38E+3	2.38E+3	2.38E+3
C-14	3.23E+6	6.89E+5	6.89E+5	6.89E+5	6.89E+5	6.89E+5	6.89E+5
Na-24	1.61E+7	1.61E+7	1.61E+7	1.61E+7	1.61E+7	1.61E+7	1.61E+7
P-32	1.60E+11	9.42E+9	-	-	-	2.17E+9	6.21E+9
Cr-51	-	-	1.05E+5	2.30E+4	2.05E+5	4.71E+6	1.61E+5
Mn-54	-	3.89E+7	-	8.63E+6	-	1.43E+7	8.83E+6
Mn-56	-	3.21E-2	-	2.76E-2	-	2.91E+0	5.53E-3
Fe-55	1.35E+8	8.72E+7	-	-	4.27E+7	1.11E+7	2.33E+7
Fe-59	2.25E+8	3.93E+8	-	-	1.16E+8	1.88E+8	1.55E+8
Co-57	-	8.95E+6	-	-	-	3.05E+7	1.46E+7
Co-58	-	2.43E+7	-	-	-	6.05E+7	6.06E+7
Co-60	-	8.81E+7	-	-	-	2.10E+8	2.08E+8
Ni-63	3.49E+10	2.16E+9	-	-	-	1.07E+8	1.21E+9
Ni-65	3.51E+0	3.97E-1	-	-	-	3.02E+1	1.81E-1
Cu-64	-	1.88E+5	-	3.17E+5	-	3.85E+6	8.69E+4
Zn-65	5.55E+9	1.90E+10	-	9.23E+9	-	1.61E+10	8.78E+9
Zn-69	-	-	-	-	-	7.36E-9	-
Br-82	-	-	-	-	-	-	1.94E+8
Br-83	-	-	-	-	-	-	9.95E-1
Br-84	-	-	-	-	-	-	-
Br-85	-	-	-	-	-	-	-
Rb-86	-	2.22E+10	-	-	-	5.69E+8	1.10E+10
Rb-88	-	-	-	-	-	-	-
Rb-89	-	-	-	-	-	-	-
Sr-89	1.26E+10	-	-	-	-	2.59E+8	3.61E+8
Sr-90	1.22E+11	-	-	-	-	1.52E+9	3.10E+10
Sr-91	2.94E+5	-	-	-	-	3.48E+5	1.06E+4
Sr-92	4.65E+0	-	-	-	-	5.01E+1	1.73E-1
Y-90	6.80E+2	-	-	-	-	9.39E+5	1.82E+1
Y-91m	-	-	-	-	-	-	-
Y-91	7.33E+4	-	-	-	-	5.26E+6	1.95E+3
Y-92	5.22E-4	-	-	-	-	9.97E+0	1.47E-5
Y-93	2.25E+0	-	-	-	-	1.78E+4	6.13E-2
Zr-95	6.83E+3	1.66E+3	-	1.79E+3	-	8.28E+5	1.18E+3
Zr-97	3.99E+0	6.85E-1	-	6.91E-1	-	4.37E+4	3.13E-1
Nb-95	5.93E+5	2.44E+5	-	1.75E+5	-	2.06E+8	1.41E+5
Nb-97	-	-	-	-	-	3.70E-6	-
Mo-99	-	2.12E+8	-	3.17E+8	-	6.98E+7	4.13E+7
Tc-99m	2.69E+1	5.55E+1	-	5.97E+2	2.90E+1	1.61E+4	7.15E+2
Tc-101	-	-	-	-	-	-	-

Table 2.12 (Page 2 of 2)

R_i Grass-Cow-Milk Pathway Dose Factors - INFANT

(mrem/yr per μCi/m^3) for H-3 and C-14 (m² x mrem/yr μCi/sec) for others

Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	T.Body
Ru-103	8.69E+3	-	-	1.81E+4	-	1.06E+5	2.91E+3
Ru-105	8.06E-3	-	-	5.92E-2	-	3.21E+0	2.71E-3
Ru-106	1.90E+5	-	-	2.25E+5	-	1.44E+6	2.38E+4
Rh-103m	-	-	-	-	-	-	-
Rh-106	-	-	-	-	-	-	-
Ag-110m	3.86E+8	2.82E+8	-	4.03E+8	-	1.46E+10	1.86E+8
Sb-124	2.09E+8	3.08E+6	5.56E+5	-	1.31E+8	6.46E+8	6.49E+7
Sb-125	1.49E+8	1.45E+6	1.87E+5	-	9.38E+7	1.99E+8	3.07E+7
Te-125m	1.51E+8	5.04E+7	5.07E+7	-	-	7.18E+7	2.04E+7
Te-127m	4.21E+8	1.40E+8	1.22E+8	1.04E+9	-	1.70E+8	5.10E+7
Te-127	6.50E+3	2.18E+3	5.29E+3	1.59E+4	-	1.36E+5	1.40E+3
Te-129m	5.59E+8	1.92E+8	2.15E+8	1.40E+9	-	3.34E+8	8.62E+7
Te-129	2.08E-9	-	1.75E-9	5.18E-9	-	1.66E-7	-
Te-131m	3.38E+6	1.36E+6	2.76E+6	9.35E+6	-	2.29E+7	1.12E+6
Te-131	-	-	-	-	-	-	-
Te-132	2.10E+7	1.04E+7	1.54E+7	6.51E+7	-	3.85E+7	9.72E+6
I-130	3.60E+6	7.92E+6	8.88E+8	8.70E+6	-	1.70E+6	3.18E+6
I-131	2.72E+9	3.21E+9	1.05E+12	3.75E+9	-	1.15E+8	1.41E+9
I-132	1.42E+0	2.89E+0	1.35E+2	3.22E+0	-	2.34E+0	1.03E+0
I-133	3.72E+7	5.41E+7	9.84E+9	6.36E+7	-	9.16E+6	1.58E+7
I-134	-	-	1.01E-9	-	-	-	-
I-135	1.21E+5	2.41E+5	2.16E+7	2.69E+5	-	8.74E+4	8.80E+4
Cs-134	3.65E+10	6.80E+10	-	1.75E+10	7.18E+9	1.85E+8	6.87E+9
Cs-136	1.96E+9	5.77E+9	-	2.30E+9	4.70E+8	8.76E+7	2.15E+9
Cs-137	5.15E+10	6.02E+10	-	1.62E+10	6.55E+9	1.88E+8	4.27E+9
Cs-138	-	-	-	-	-	-	-
Ba-139	4.55E-7	-	-	-	-	2.88E-5	1.32E-8
Ba-140	2.41E+8	2.41E+5	-	5.73E+4	1.48E+5	5.92E+7	1.24E+7
Ba-141	-	-	-	-	-	-	-
Ba-142	-	-	-	-	-	-	-
La-140	4.03E+1	1.59E+1	-	-	-	1.87E+5	4.09E+0
La-142	-	-	-	-	-	5.21E-6	-
Ce-141	4.33E+4	2.64E+4	-	8.15E+3	-	1.37E+7	3.11E+3
Ce-143	4.00E+2	2.65E+5	-	7.72E+1	-	1.55E+6	3.02E+1
Ce-144	2.33E+6	9.52E+5	-	3.85E+5	-	1.33E+8	1.30E+5
Pr-143	1.49E+3	5.59E+2	-	2.08E+2	-	7.89E+5	7.41E+1
Pr-144	-	-	-	-	-	-	-
Nd-147	8.82E+2	9.06E+2	-	3.49E+2	-	5.74E+5	5.55E+1
W-187	6.12E+4	4.26E+4	-	-	-	2.50E+6	1.47E+4
Np-239	3.64E+1	3.25E+0	-	6.49E+0	-	9.40E+4	1.84E+0

Table 2.13 (Page 1 of 2)

R_i Ground Plane Pathway Dose Factors

(m^2 x mrem/yr per μCi/sec)

Nuclide	Any Organ
H-3	-
C-14	-
Na-24	1.21E+7
P-32	-
Cr-51	4.68E+6
Mn-54	1.34E+9
Mn-56	9.05E+5
Fe-55	-
Fe-59	2.75E+8
Co-57	4.37E+8
Co-58	3.82E+8
Co-60	2.16E+10
Ni-63	-
Ni-65	2.97E+5
Cu-64	6.09E+5
Zn-65	7.45E+8
Zn-69	-
Br-82	4.57E+7
Br-83	4.89E+3
Br-84	2.03E+5
Br-85	-
Rb-86	8.98E+6
Rb-88	3.29E+4
Rb-89	1.21E+5
Sr-89	2.16E+4
Sr-90	-
Sr-91	2.19E+6
Sr-92	7.77E+5
Y-90	4.48E+3
Y-91m	1.01E+5
Y-91	1.08E+6
Y-92	1.80E+5
Y-93	1.85E+5
Zr-95	2.48E+8
Zr-97	2.94E+6
Nb-95	1.36E+8
Nb-97	2.28E+6
Mo-99	4.05E+6
Tc-99m	1.83E+5
Tc-101	2.04E+4
Ru-103	1.09E+8

Table 2.13 (Page 2 of 2)

R_i Ground Plane Pathway Dose Factors

(m^2 x mrem/yr per μCi/sec)

Nuclide	Any Organ
Ru-105	6.36E+5
Ru-106	4.21E+8
Rh-103m	-
Rh-106	-
Ag-110m	3.47E+9
Sb-124	2.87E+9
Sb-125	6.49E+9
Te-125m	1.55E+6
Te-127m	9.17E+4
Te-127	3.00E+3
Te-129m	2.00E+7
Te-129	2.60E+4
Te-131m	8.03E+6
Te-131	2.93E+4
Te-132	4.22E+6
I-130	5.53E+6
I-131	1.72E+7
I-132	1.24E+6
I-133	2.47E+6
I-134	4.49E+5
I-135	2.56E+6
Cs-134	6.75E+9
Cs-136	1.49E+8
Cs-137	1.04E+10
Cs-138	3.59E+5
Ba-139	1.06E+5
Ba-140	2.05E+7
Ba-141	4.18E+4
Ba-142	4.49E+4
La-140	1.91E+7
La-142	7.36E+5
Ce-141	1.36E+7
Ce-143	2.32E+6
Ce-144	6.95E+7
Pr-143	-
Pr-144	1.83E+3
Nd-147	8.40E+6
W-187	2.36E+6
Np-239	1.71E+6

APPENDIX A

Content deleted. No longer applicable.

APPENDIX B

Content deleted. No longer applicable.

APPENDIX C

Content deleted. No longer applicable.

APPENDIX D

Content deleted. No longer applicable.

Appendix B

Kewaunee Power Station

Radiological Environmental Monitoring Manual (REMM)

Revision 21
January 1, 2018

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Dominion Energy Kewaunee, Inc.

Kewaunee Power Station

RADIOLOGICAL ENVIRONMENTAL MONITORING MANUAL (REMM)

Revision 21

DATE: January 1, 2018

Approved By:	DJ Shannon / Manager – Radiological Protection and Chemistry	Date:	12-13-17
Approved By:	WF Zipp / Licensing	Date:	12/13/17
Reviewed By:	TP Olson / #17-024 Facility Safety Review Group	Date:	12/14/17
Reviewed By:	SJ Yuen / Director-Kewaunee Site	Date:	12/18/17

Table of Contents

Tables & Figures

1.0 Introduction

1.1 Purpose

The purpose of this document is to define the Radiological Environmental Monitoring Program (REMP) for the Kewaunee Power Station (KPS). The REMP is required by ODCM 13.5.

This document is known as the Radiological Environmental Monitoring Manual (REMM) and is intended to serve as a tool for program administration and as a guidance document for contractors which implement the monitoring program.

1.2 Scope

This program defines the sampling and analysis schedule which was developed to provide representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from plant decommissioning activities. This monitoring program implements Section IV.B.2 of Appendix I to 10CFR Part 50 and thereby verifies that the measurable concentrations of radioactivity and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for the development of this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. This program has been developed in accordance with NUREG 0472.

On October 22, 2012, Dominion made known the decision to permanently shut down the Kewaunee Power Station (KPS). On February 25, 2013, Dominion Energy Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. On May 15, 2013 the NRC docketed the certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii). Therefore, the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). On June 15th, 2017 transfer of all spent nuclear fuel into dry cask storage was completed.

On April 24, 2017 Radiation Safety and Control Services, Inc. (RSCS) submitted Technical Support Document No. 16-086 Rev. 2, Kewaunee Shut-Down Environmental Radionuclides of Concern and Radiological Environmental Monitoring Manual Changes, to KPS. This document evaluated the radionuclides of concern for environmental releases after permanent shutdown of KPS. The result of the evaluation was the optimization of the environmental program due to radioactive decay and reduced source terms during the decommissioning phase of the plant.

The program will provide field and analytical data on the air, aquatic, and terrestrial radioecology of the area near the Kewaunee Power Station so as to:

1. Determine the effects of the decommissioning activities of the Kewaunee Power Station on the environment;
2. Serve as a gauge of the operating effectiveness of in-plant control of waste discharges; and
3. Provide data on the radiation dose to the public by direct or indirect pathways of exposure.

1.3 Implementation

This document is considered, by reference, to be part of the Offsite Dose Calculation Manual. This is as required by KPS Technical Requirements Manual (TRM) 10.1.1. The REMM is controlled as a separate document for ease of revision, use in the field and use by contractors. This format was approved by the NRC as part of TS Amendment No. 64, which provided Radiological Effluent Technical Specifications (RETS) for KPS.

The REMP is set up to be implemented by a vendor and controlled by KPS in accordance with Nuclear Administrative Directive NAD-01.20, "Radiological Environmental Monitoring Program." Monthly reviews of the vendor's progress report are performed by KPS in accordance with this manual in section 3.4. Annual reviews and submittals of the vendor's report and raw data are checked and approved by KPS in accordance with procedure RP-KW-HSP-HPE-280. All sample collection, preparation, and analysis are performed by the vendor except where noted. Procedure RP-KW-HSP-HPE-164 outlines the environmental sample collection performed by KPS.

Periodic reviews of monitoring data and an annual land use census will be used to develop modifications to the existing monitoring program. Upon approval, these modifications will be incorporated into this document per RP-KW-280, so that it will accurately reflect the current radiological environmental monitoring program in effect for KPS.

The remainder of this document is divided into two sections. The first section, 2.0 REMP Requirements, describes the different TRM and REMM requirements associated with the REMP. The second section, 3.0 REMP Implementation, describes the specific requirements used to implement the REMP.

2.0 REMP Requirements

KPS TS Amendment No. 104 implemented the guidance provided in Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications (RETS)." These changes included:

1. Incorporation of *programmatic controls* in the Administrative Controls section of the TS to satisfy existing regulatory requirements for RETS, and

2. Relocation of the *procedural details* on radioactive effluents monitoring, radiological environmental monitoring, reporting details, and other related specifications from the TS to the ODCM.

Relocating the procedural details to the ODCM allows for revising these requirements using the 10CFR50.59 process instead of requiring prior NRC approval using the TS Amendment process.

The RETS requirements were incorporated verbatim into the ODCM, Revision 6. Several of these requirements pertain only to the environmental monitoring program and therefore have been relocated into this document (REMM, Revision 3 and 4) and are identified as REMM requirements.

All KPS TS related REMM requirements were removed from KPS TS and placed in the Technical Requirements Manual as part of TRM Revision 0 on 4/26/2016.

2.1 ODCM 13.5 Requirements

ODCM 13.5 provides the programmatic control, which requires a program to monitor for radiation and radionuclides in the environs of the plant. This is the reason for the existence of the REMP. ODCM 13.5 also provides the programmatic control which requires:

a. The program to perform the monitoring, sampling, analysis, and reporting in accordance with the methodology and parameters in the ODCM,

b. A land use census to be performed, and

c. Participation in an Interlaboratory Comparison Program.

The details of each requirement are described in the REMM requirements stated below.

TRM 10.3.1 requires an "Annual Radiological Environmental Operating Report," be submitted to the NRC each year. The specific contents of this report are detailed in REMM 2.4.1. Additional specific reporting requirements are listed in the other REMM requirements.

2.2 REMM Requirements

The following REMM requirements include the procedural details that were originally located in the KPS RETS section and then relocated into Revision 6 of the ODCM, as discussed above. These requirements are specific to the radiological environmental monitoring program and have been relocated into this document for ease of use and completeness.

The REMM requirements for the Monitoring Program, Land Use Census, and the Interlaboratory Comparison Program include a detailed operating requirement (numbered 2.2.1, 2.2.2, and 2.2.3 respectively) and an associated verification requirement (numbered 2.3.1, 2.3.2, and 2.3.3 respectively), along with the basis for the requirement. Reporting requirements are listed in requirement REMM 2.4.1.

ODCM 13.0, USE AND APPLICATION, apply to both the ODCM and REMM.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REMM 2.2.1 The radiological environmental monitoring program shall be conducted as specified in Table 2.2.1-A.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Radiological Environmental Monitoring Program not conducted as specified in REMM Table 2.2.1-A.	A.1 Prepare and submit to the NRC in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.	In accordance with the Annual Radiological Environmental Operating Report frequency.
B. Level of radioactivity in an environmental sampling medium at a specified location exceeds the reporting levels of REMM Table 2.2.1-D when averaged over any calendar quarter. <u>OR</u>	B.1 ------------NOTES------------ 1. Only applicable if the radioactivity/radionuclides are the result of plant effluents. 2. For radionuclides other than those in REMM Table 2.2.1-D, this report shall indicate the methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC. ----------------------------------	

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
More than one of the radionuclides in REMM Table 2.2.1-D are detected in the environmental sampling medium and Concentration 1 / Reporting level 1 + Concentration 2 / Reporting level 2 + ...≥ 1.0. OR Radionuclides other than those in REMM Table 2.2.1-D are detected in an environmental sampling medium at a specified location which are the result of plant effluents and the potential annual dose to a MEMBER OF THE PUBLIC from all radionuclides is ≥ the calendar year limits of DNC 13.1.2, DNC 13.2.2, DNC 13.2.3	Prepare and submit to the NRC, a Special Report, pursuant to DNC 15.3, that (1) Identifies the cause(s) for exceeding the limit(s) and (2) Defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year limits of DNC 13.1.2, DNC 13.2.2, DNC 13.2.3 OR B.2 -------------NOTES------------ 1. Only applicable if the radioactivity/radionuclides are not the result of plant effluents. 2. For radionuclides other than those in REMM Table 2.2.1-D, this report shall indicate the methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC. ----------------------------------- Report and describe the condition in the Annual Radiological Environmental Operating Report.	30 days In accordance with the Annual Radiological Environmental Operating Report frequency.

ACTIONS (continued)

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
C. Fresh leafy vegetation samples unavailable from one or more of the sample locations required by REMM Table 2.2.1-A.	C.1 Identify specific alternative locations for obtaining replacement samples and add them to the Radiological Environmental Operating Program. AND C.2 When changes in sampling locations are permanent, then the sampling schedule in the REMM will be updated to reflect the new routine and alternative sampling locations. This revision will be submitted in the next Annual Radiological Environmental Operating Report.	30 days

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
REMM 2.3.1	Collect and analyze radiological environmental monitoring samples pursuant to the requirements of REMM Table 2.2.1-A and the detection capabilities required by Table 2.2.1-A.	In accordance with REMM Table 2.2.1-A

BASES

The radiological environmental monitoring program required by this requirement provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station decommissioning activities. This monitoring program implements Section IV.B.2 of Appendix I to 10CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. Program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 2.3.1-A are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

RADIOLOGICAL ENVIRONMENTAL MONITORING LAND USE CENSUS

REMM 2.2.2 A land use census shall:

a. Be conducted,

b. Identify within a distance of 8 km (5 miles) the location, in each of the 10 meteorological sectors, of the nearest residence, and the nearest garden > 50 m^2 (500 ft^2) producing broad leaf vegetation. Sampling of leaf vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Requirements for broad leaf vegetation sampling in REMM Table 2.2.1-A item 4c shall be followed, including analysis of control samples.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Land use census identifies location(s) that yields a calculated dose, dose commitment greater than the values currently being calculated in ODCM 13.2.3.1.	A.1 Identify the new location(s) in the next Radiological Environmental Operating Program.	In accordance with the Radiological Environmental Operating Report.

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
B. Land use census identifies location(s) that yields a calculated dose, or dose commitment (via the same exposure pathway) greater than 20% at a location from which samples are currently being obtained in accordance with REMM 2.2.1.	B.1 Add the new location(s) to the Radiological Environmental Operating Program.	30 days
	AND	
	B.2 Delete the sampling locations(s), excluding the control station location, having the lowest calculated dose, dose commitment(s) or D/Q value, via the same exposure pathway, from the Radiological Environmental Operating Program.	In accordance with Radiological Environmental Operating Report.
	AND	
	B.3 Submit in the next Radiological Environmental Operating Report documentation for a change which includes revised figures(s) and table(s) reflecting the new location(s) with information supporting the change in sampling locations.	

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
REMM 2.3.2	Conduct the land use census during the growing season using that information that will provide the best results, such as by a door-to-door survey, aerial survey, reporting the results of the land use census in the Annual Radiological Environmental Operating Report, or by consulting local agriculture authorities.	12 months

BASES

This requirement is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the door-to-door survey, from aerial survey or from consulting with local agricultural authorities. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/yr) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made:

1. 20% of the garden was used for growing leafy vegetation (i.e., similar to lettuce and cabbage), and
2. A vegetation yield of 2 kg/m^2.

RADIOLOGICAL ENVIRONMENTAL MONITORING INTERLABORATORY COMPARISON PROGRAM

REMM 2.2.3 Analyses shall be performed on all radioactive materials, supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission.

APPLICABILITY: At all times.

ACTIONS

NON-CONFORMANCE	CONTINGENCY MEASURES	RESTORATION TIME
A. Analyses not performed as required.	A.1 Report the corrective actions taken to prevent a recurrence to the NRC in the Annual Radiological Environmental Operating Report.	In accordance with the Annual Radiological Environmental Operating Report.

VERIFICATION REQUIREMENTS

VERIFICATION		FREQUENCY
REMM 2.3.3	Report a summary of the results obtained as part of the Interlaboratory Comparison Program in the Annual Radiological Environmental Operating Report.	In accordance with the Annual Radiological Environmental Operating Report.

BASES

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10CFR Part 50.

REMM 2.4.1 Reporting Requirements

2.4.1 The Annual Radiological Environmental Operating Report shall include:

a. Summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with pre-operational studies, with operational controls as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant decommissioning activities on the environment. The reports shall also include the results of land use censuses required by REMM 2.2.2.

b. The results of analyses of radiological environmental samples and of environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the Radiological Environmental Monitoring Manual (REMM), as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report when applicable.

c. A summary description of the radiological environmental monitoring program; legible maps covering all sampling locations keyed to a table giving distances and directions from the centerline of one reactor; the results of licensee participation in the Interlaboratory Comparison Program, required by REMM 2.2.3; discussion of all deviations from the sampling schedule of Table 2.2.1-A; and discussion of all analyses in which the LLD required by Table 2.3.1-A was not achievable.

Discussion

KPS TRM 10.3.1 provides the programmatic control, which requires that an Annual Radiological Environmental Operating Report be submitted to the NRC. It also states that this report shall include summaries, interpretations, and analysis of trends of the results of the REMP for the reporting period.

The procedural details of this report are included in this requirement. REMM 2.2.1/2.3.1, 2.2.2/2.3.2, and 2.2.3/2.3.3 also include specific reporting requirements. These requirements reference this REMM, along with TRM 10.3.1, as the method for reporting deviations from the current program during the reporting period, and require that this information be included in the Annual Radiological Environmental Operating Report.

3.0 REMP Implementation

The Radiological Environmental Monitoring Program for KPS is under the direction of a Contracted Vendor (CV). This section describes this program, as required by REMM 2.2.1 and the process the CV uses to perform it.

3.1 Sampling Requirements

Table 2.2.1-A identifies the various samples required by the REMP. Identified in the "available sample locations" column in Table 2.2.1-A are the sample locations selected, in conjunction with the vendor, to meet or exceed the REMP requirements. Table 2.2.1-B includes the same requirements as in Table 2.2.1-A, but presents the information in a different format by identifying the type of samples required at each location and the collection frequency. Table 2.2.1-C identifies the location and description of each sample location. Figure 1 shows the physical location of each sample point on an area map.

3.2 Analysis Methodology

Analytical procedures and counting methods employed by the CV will follow those recommended by the U.S. Public Health Service publication, Radioassay Procedures for Environmental Samples, January 1967; and the U.S. Atomic Energy Commission Health and Safety Laboratory, HASL Procedures Manual (HASL-300), 1972. The manual is also available on-line at www.eml.st.dhs.gov/publications/procman.

Updated copies shall be kept on file at KPS or can be obtained from the CV with sufficient notification.

3.3 Detection Capability (LLD) Requirements

The required detection capabilities for environmental sample and analysis are tabulated in terms of lower limits of detection (LLDs) in Table 2.3.1-A. The LLDs required by Table 2.3.1-A are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3.4 Contracted Vendor Reporting Requirements

Monthly Progress Reports

Monthly progress reports will include a tabulation of completed analytical data on samples obtained during the previous 30 day period. Included in the report are the status of field collections and graphic representations indicating possible trends. One copy of the reports will be submitted within 30 to 60 days of the reporting month. Monthly progress reports are reviewed for:

- ☐ Reasonableness
- ☐ Consistency
- ☐ Accuracy
- ☐ Completeness
- ☐ Recognition of deficiencies
- ☐ Examination of any past deficiencies and corrective actions taken
- ☐ Recommendations for any modifications or improvements to the REMM

Notify the vendor of any unusual or abnormal data noted during the review, including an evaluation of the applicability of REMM Specification 2.2.1.b.

The review shall include determination of the need to make notifications to State and Local Agencies due to levels of radioactive materials in water samples.

Annual Reports

Annual reports will be submitted in two parts. Part I, to be submitted to the NRC, will be prepared in accordance with NRC Regulatory Guide 4.8. It will contain an introductory statement, a summary of results, description of the program, discussion of the results, and summary table. Part II of the annual report will include tables of analytical data for all samples collected during the reporting period, together with graphic presentation where trends are evident and statistical evaluation of the results. Gamma scan data will be complemented by figures of representative spectra if requested by KPS. Draft copies of each annual report will be due 60 days after completion of the annual period. After final review of the draft document, one photoready copy of the revised annual report will be sent to KPS for printing.

Non-Routine Reports

If analyses of any samples collected show abnormally high levels of radioactivity, KPS will be notified by telephone immediately after data becomes available.

Action Limits

The CV will report any radioactive concentrations found in the environmental samples which exceed the reporting levels shown in Table 2.2.1-D, CV to KPS column. These levels are set below the NRC required reporting levels (KPS to NRC column) so actions can be initiated to prevent exceeding the NRC concentration limits.

3.5 Quality Control Program

To ensure the validity of the data, the CV maintains a quality control (QC) program, which employs quality control checks, with documentation, of the analytical phase of its environmental monitoring studies. The program is defined in the CV's QC Program Manual, and procedures are presented in the CV QC Procedures Manual. The program shall be reviewed and meet the requirements of Regulatory Guide 4.15 and 10CFR21. All data related to quality control will be available for review by Dominion Energy Kewaunee upon reasonable prior notification. Proprietary information will be identified so that it may be treated accordingly.

Updated copies of the Quality Control Program Manual and the Quality Assurance Program Manual shall be kept on file at KPS or can be obtained from the CV with sufficient notification.

3.6 Sample Descriptions

A description of each of the samples required by this program follows:

Ambient Radiation

Two packets of thermo-luminescent dosimeters ($CaSO_4$: Dy cards) are placed at fifteen locations as follows:

- Four at the ISFSI fence as part of inner ring locations (K-1m, K-1o, K-1q, K-1r)
- Four inner ring locations (K-1f, K-25, K-27, K-30)
- Six outer ring locations (K-3, K-5, K-8, K-17, K-39, K-43)
- One control location (K-2)

One packet is changed quarterly and one annually. Annual TLDs will serve as an emergency set to be read when needed. They will be exchanged annually (without reading) if not read during the year. To insure the precision of the measurement, each packet will contain two cards with four dosimeters each (four sensitive areas each for a total of eight). For protection against moisture each set of cards is sealed in a plastic bag and placed in a plastic container.

Each card is individually calibrated for self-irradiation and light response. Fading is guaranteed by the manufacturer (Teledyne Isotopes) not to exceed 20% in one year. Minimum sensitivity for the multi-area dosimeter is 0.5 mR defined as 3 times the standard deviation of the background. Maximum Error (1 standard deviation) - ^{60}Co Gamma +/-0.2 mR or +/-3%, whichever is greater. The maximum spread between areas on the same dosimeter is 3.5% at 1 standard deviation.

Reporting units for TLDs are mR/91 days for quarterly TLDs and mR/exposure period for annual TLDs.

Tests for uniformity and reproducibility of TLDs as specified in NRC Regulatory Guide 4.13 are performed annually.

Airborne Particulates

Airborne particulates are collected at four locations (K-1f, K-2(control), K-8, and K-43) on a continuous basis on a 47 mm diameter membrane filter of 0.8 micron porosity at a volumetric rate of approximately one cubic foot per minute (CFM). The filters are changed weekly, placed in glassine protective envelopes, and dispatched by U.S. Mail to the CV for Gamma Isotopic Analysis. Filter samples are analyzed weekly for gross beta activity after sufficient time (usually 3 to 5 days) has elapsed to allow decay of Radon and Thoron daughters. If gross beta concentrations in air particulate samples are greater than ten (10) times the yearly mean of the control samples, gamma isotopic analysis shall be performed on the individual samples. Quarterly composites from each location receive Gamma Isotopic Analysis using a Germanium detector. All identifiable gamma-emitters are quantified. Reporting units are pCi/m^3.

Surface Water

Surface water is sampled monthly from Lake Michigan at the KPS discharge (K-1d).

Samples are collected monthly at the Green Bay Municipal Pumping station between Kewaunee and Green Bay (K-9) – both raw and treated water is collected.

Monthly samples are also taken, when available, from creek locations (K-1b, K-1e) that pass through the reactor site. The samples are taken at a point near the mouth of each creek and at the shore of the drainage pond. The water is analyzed for gross beta activity in:

a. The total residue,
b. The dissolved solids, and
c. The suspended solids.

The samples are also analyzed for K-40 and by Gamma Isotopic Analysis. Quarterly composites from all locations are analyzed for tritium, and Sr-90. Reporting units are pCi/l.

Well Water

One gallon of drinking water samples are taken once every three months from one off-site well, (K-13) and two on-site wells (K-1h and K-1t). All samples are analyzed for gross beta in the total residue, K-40, tritium, and by Gamma Isotopic Analysis. Samples from one on-site well are analyzed for Sr-90. Samples from K-1h and K-1t are also analyzed for gross alpha. Reporting units are pCi/l.

Shoreline Sediment

Shoreline sediment samples are taken semi-annually from three locations (K-1c, K-1j, K-9) in areas with potential for recreational value.

Fish

Fish are collected once per year (third quarter) near the discharge area (K-1d). An alternate source for fish is a local fish market (e.g., LaFond's in Kewaunee). Flesh is separated from the bones and analyzed for gross beta activity and by Gamma Isotopic Analysis. The bones are analyzed for gross beta activity and Sr-90. Reporting units are pCi/g wet weight.

Vegetables

Annually, during the 3rd quarter, samples of five varieties of vegetables grown and marketed for human consumption are collected from K-26, depending upon the availability of samples. If samples are not available from this location, samples may be obtained from any local source so there is some sample of record. The location will be documented. In addition, two varieties of leafy vegetables from the highest predicted X/Q and D/Q, if available, are collected annually from the farmland owned by Dominion Energy Kewaunee (K-23 a and b) and rented to a private individual for growing crops. The analyses performed are the same as for grass. Reporting units are pCi/g wet weight.

Soil

Twice during the growing season samples of the top two inches of soil are collected from five locations (K-1f, K-3(control), K-34, K-35, K-38). The soil is analyzed for gross alpha and gross beta activities, for Sr-90, and Gamma Isotopic Analysis to identify and quantify gamma-emitting manmade radionuclides. Reporting units are pCi/g dry weight.

Cattle feed

Once per year, during the first quarter when grass is not available, cattle feed (such as hay or silage) is collected from the six dairy farms (K-3(control), K-5, K-34, K-35, K-38, K-39). The analyses performed are the same as for grass. Reporting units are pCi/g wet weight.

Grass

Grass is collected three times per year (2nd, 3rd, and 4th quarters) from the six dairy farms (K-3(control), K-5, K-35, K-34, K-38, and K-39) and from two on-site locations (K-1b and K-1f). The samples are analyzed for gross beta activity, for Sr-90, and Gamma Isotopic Analysis to identify and quantify gamma-emitting radionuclides. Reporting units are pCi/g wet weight.

Groundwater Monitoring Wells

The Groundwater Protection Program (RP-KW-001-028, Groundwater Protection Program) consists of 14 wells. Figure 2 shows the locations of the 14 installed groundwater monitoring wells. The wells and locations are identified with a diamond shape in Figure 2. The wells are labeled MW (Monitoring Well) and AB (Auxiliary Building).

Results of analyses and a description of any event above Reporting Levels will be included in the Annual Radioactive Effluent Release Report for the 14 wells.

Any results exceeding the limits of Table 2.2.1-D shall be reported in accordance with section 2.2.1-B of the REMM, as well as:

- ☐ Informal notification to the State and Local Agencies before the end of the next business day.
- ☐ Providing a copy of the written 30 day NRC report to State and Local Agencies.

Table 2.2.1-A *Radiological Environmental Monitoring Program*				
Exposure Pathway And/Or Sample	Minimum Required Samples [a]	Available Sample Locations [b]	Sampling, Collection and Analysis Frequency	Type of Analysis
1. Ambient Radiation[c]	8 Inner Ring locations	**K-1f, K-1m, K-1o, K-1q, K-1r, K-25, K-27, K-30,**	See Table 2.2.1-B	Gamma dose
	6 Outer Ring locations	**K-3, K-5, K-8, K-17, K-39, K-43**		
	1 Control location	**K-2**		
	1 Population center	**K-43**		
	1 Special interest location	**K-8**		
	1 Nearby resident	**K-27**		
2. Airborne Particulates	3 samples close to the site boundary in highest average X/Q	**K-1f, K-8, K-43**	See Table 2.2.1.B Continuous sampler operation	Particulates; gross beta analysis[e] Gamma isotopic of composite (by location) [f]
	1 sample from the closest community having the highest X/Q	**K-43**	Particulates See Table 2.2.1-B	
	1 sample from a control location	**K-2[d]**	See Table 2.2.1-B	
3. Waterborne a. Surface[g]	1 Upstream sample 1 Downstream sample	**K-1b, K-1d K-1e, , K-9[J]**	Grab sample See Table 2.2.1-B	Gross Beta, Gamma isotopic K-40 [f] Composite of grab samples for tritium, K-40 and Sr-90
b. Well	1-2 location likely to be affected [d] 1 off-site location	**K-1h, K-1t[h]** **K-13**	Grab sample See Table 2.2.1-B	Gamma isotopic [f], tritium and K-40 analysis Gross Beta, one well for Sr-90
c. Shoreline Sediment	1 sample from downstream area with potential for recreational value	**K-1c, K-1j, K-9**	Grab sample See Table 2.2.1-B	Gamma isotopic [f] analysis Gross Beta, Sr-90

Table 2.2.1-A *Radiological Environmental Monitoring Program*				
Exposure Pathway And/Or Sample	Minimum Required Samples [a]	Available Sample Locations [b]	Sampling, Collection and Analysis Frequency	Type of Analysis
4. Ingestion				
a. Fish	1 random sample of commercially and recreationally important species in the vicinity of the plant.	**K-1d**	See Table 2.2.1-B	Gamma Isotopic[f] and Gross Beta on edible portions, Gross Beta and Sr-90 on bones
b. Food Products	Samples of leafy vegetables grown nearest each of two different offsite locations within 5 miles of the plant since milk sampling is no longer performed.[k]	2 samples **K-23a, K-23b** – and one more location if available 1 sample 15-30 km distant since milk sampling is no longer performed. **K-26**	See Table 2.2.1-B	Gamma Isotopic[f] Analysis.
5. Miscellaneous samples not identified in NUREG-0472[k]				
a. Soil	None required	**K-1f, K-34, K-35** **K-38** **K-3**, (control)	See Table 2.2.1-B	Gross Alpha/Beta Sr-90 Gamma Isotopic[f]
b. Cattle feed	None required	**K-5, K-35** **K-34, K-38, K-39** **K-3**,(control)	See Table 2.2.1-B	Gross Beta Sr-90 Gamma Isotopic[f]
c. Grass	None required	**K-1b, K-1f, K-35, K-39** **K-5, K-34, K-38** **K-3**,(control)	See Table 2.2.1-B	Gross Beta Sr-90 Gamma Isotopic[f]

Table Notations for Table 2.2.1-A	
a.	The samples listed in this column describe the minimum sampling required to meet REMP requirements.
b.	Additional details of sample locations are provided in Table 2.2.1-C and Figure 1. The REMP requires that samples to be taken from each of the "available sample locations" listed (see section 3.1). Deviations from the required sampling schedule will occur if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, reasonable efforts shall be made to complete corrective actions prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented, as required by REMM 2.4.1.c, in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the REMM. The cause of the unavailability of samples for that pathway and the new location(s) for obtaining replacement samples will be identified in the Annual Radiological Environmental Operating Report.
c.	For the purposes of this table, each location will have 2 packets of thermoluminescent dosimeters (TLDs). The TLDs are CaSO4: Dy cards with 2 cards/packet and 4 dosimeters/card (four sensitive areas each for a total of eight dosimeters/packet). The NRC guidance of 40 stations is not an absolute number. The number of direct radiation monitoring stations has been reduced according to geographical limitations; e.g., Lake Michigan. The frequency of analysis or readout for TLD systems depends upon the characteristics of the specific system used and selection is made to obtain optimum dose information with minimal fading.
d.	The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites that provide valid background data may be substituted.
e.	Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.
f.	Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
g.	The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area near the mixing zone.
h.	Well water samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.
i.	In the event elevated analyses are reported by CV for gamma isotopic or tritium, a review will be conducted with the option to retest additional analysis for hard to detect isotopes or alpha emitters. The additional test may include Fe-55, Ni-63, or alpha emitters anticipated on current plant conditions.
j.	Two samples to be collected, Raw and Treated
k.	See Regulatory Guide 4.1, Revision 2. Broadleaf vegetables, as well as grass, soil, and cattle feed, are a sufficient substitute if milk samples are not performed.

Table 2.2.1-B Type and Frequency of Collection						
Location	Weekly	Monthly	Quarterly	Semi-Annually		Annually
K-1b		SW	GR[a]			
K-1c				SS[b]		
K-1d		SW				FI[c]
K-1e		SW				
K-1f	AP[g],		GR[a] TLD	SO		
K-1h			WW			
K-1j				SS[b]		
K-1m			TLD			
K-1o			TLD			
K-1q			TLD			
K-1r			TLD			
K-1t			WW			
K-2	AP[g],		TLD			
K-3			GR[a] TLD	SO		CF[d]
K-5			GR[a] TLD			CF[d]
K-8	AP[g],		TLD			
K-9		SW[i]		SS[b]		
K-13			WW			
K-17			TLD			
K-23a						GLV[e]
K-23b						GLV[e]
K-25			TLD			
K-26						GLV[e]
K-27			TLD			
K-30			TLD			
K-31			TLD			
K-34			GR[a]	SO		CF[d]
K-35			GR[a]	SO		CF[d]
K-38			GR[a]	SO		CF[d]
K-39			GR[a] TLD			CF[d]

Table Notations for Table 2.2.1-B

a. Three times a year, second (April, May, June), third (July, August, September), and fourth (October, November, December) quarters
b. To be collected in May and November
c. Annually in third quarter (July, August, or September)
d. First (January, February, March) quarter only
e. Alternate since milk sampling is no longer performed
f. Second and third quarters
g. The frequency may be increased dependent on the dust loading.
h. Two water samples are collected, North (K-14a) and South (K-14b) of Two Creeks Rd.
i. Two samples, raw and treated

Code	**Description**	**Code**	**Description**	**Code**	**Description**
AP	Airborne Particulate	GR	Grass	SW	Surface Water
CF	Cattle feed	SO	Soil	WW	Well Water
FI	Fish	SS	Shoreline Sediment		
GLV	Green Leafy Vegetable	TLD	Thermo-luminescent Dosimeter		

Table 2.2.1-C *Sampling Locations, Kewaunee Power Station*			
Code	**Type[a]**	**Distance (Miles)[b] and Sector**	**Location**
K-1			Onsite – generic code
K-1b	I	0.12 N	Middle Creek 87°32'8.62"W 44°20'44.80"N
K-1c	I	0.10 N	500′ North of Condenser Discharge 87°32'4.21"W 44°20'39.76"N
K-1d	I	0.10 E	Condenser Discharge 87°32'1.87"W 44°20'32.71"N
K-1e	I	0.12 S	South Creek 87°32'5.03"W 44°20'25.04"N
K-1f	I	0.12 S	Meteorological Tower 87°32'10.53"W 44°20'26.17"N
K-1h	I	0.12 NW	North Well 87°32'18.05"W 44°20'39.15"N
K-1j	I	0.10 S	500′ south of Condenser Discharge 87°31'58.75"W 44°20'29.33"N
K-1m	I	0.15 N	ISFSI East 87°32'8.78"W 44°20'37.13"N
K-1o	I	0.16 N	ISFSI North 87°32'9.19"W 44°20'40.11"N
K-1q	I	0.16 N	ISFSI West 87°32'13.41"W 44°20'39.86"N
K-1r	I	0.13 N	ISFSI West 87°32'14.25"W 44°20'39.09"N
K-1t	I	0.10 ESE	Security Building 87°32'4.47"W 44°20'30.79"N
K-2	C	8.91 NNE	WPS Operations Building in Kewaunee 87°29'59.62"W 44°28'25.49"N
K-3	C	5.9 N	Lyle and John Siegmund Farm, N2815 Hwy 42, Kewaunee 87°32'35.98"W 44°25'39.21"N
K-5	I	3.2 NNW	Ed Paplham Farm, E4160 Old Settlers Rd, Kewaunee 87°33'47.10"W 44°23'2.83"N

Table 2.2.1-C *Sampling Locations, Kewaunee Power Station*			
Code	**Type**[a]	**Distance (Miles)**[b] **and Sector**	**Location**
K-8	C	4.85 WSW	Saint Isadore the Farmer Church, 18424 Tisch Mills Rd, Tisch Mills 87°37'50.85"W 44°19'18.48"N
K-9	C	11.5 NNE	Green Bay Municipal Pumping Station, six miles east of Green Bay (sample source is Lake Michigan from Rostok Intake 2 miles north of Kewaunee) 87°46'16.94"W 44°29'16.55"
K-13	C	3.0 SSW	Rand's General Store, Two Creeks 87°33'48.23"W 44°18'8.69"N
K-17	I	4.0 W	Jansky's Farm, N885 Cty Tk B, Kewaunee 87°36'47.52"W 44°21'21.62"N
K-23a	I	0.5 W	0.5 miles west of plant, Kewaunee site 87°32'3.38"W 44°21'12.12"N
K-23b	I	0.6N	0.6 miles north of plant, Kewaunee site 87°32'43.93"W 44°20'32.36"N
K-25	I	1.9 SW	Wotachek Farm, E3968 Cty Tk BB, Two Rivers 87°34'10.67"W 44°19'38.81"N
K-26[c]	C	9.1 SSW	Wilfert's Vegetable Stand 7528 Manitou Dr., Two Rivers 87°39'3.75"W 44°11'21.60"N
K-27	I	1.53 NW	Schleis Farm, E4298 Sandy Bay Rd 87°33'6.93"W 44°21'22.96"N
K-30	I	0.8 N	End of site boundary 87°32'2.61"W 44°21'12.86"N
K-31	I	6.35 NNW	E. Krok Substation, Krok Road 87°34'19.86"W 44°25'43.82"N
K-34	I	2.7 N	Leon and Vicky Struck Farm, N1549 Lakeshore Drive, Kewaunee 87°31'14.33"W 44°22'48.13"N
K-35[d]	C	6.71 WNW	Duane Ducat Farm, N1215 Sleepy Hollow, Kewaunee 87°40'1.53"W 44°22'10.90"N
K-38	I	2.45 WNW	Dave Sinkula Farm, N890 Town Hall Road, Kewaunee 87°34'56.92"W 44°21'22.64"N
K-39	I	3.46 N	Francis Wotja Farm, N1859 Lakeshore Road, Kewaunee 87°31'14.28"W 44°23'28.25"N

Table 2.2.1-C *Sampling Locations, Kewaunee Power Station*			
Code	**Type[a]**	**Distance (Miles)[b] and Sector**	**Location**
K-43[e]	I	2.71 SSW	Gary Maigatter Property, 17333 Highway 42, Two Rivers 87°33'42.99"W 44°18'26.63"N

Table Notations for Table 2.2.1-C

a. I = indicator; C = control.
b. Distances are measured from reactor stack.
c. Location K-18 was changed because Schmidt's Food Stand went out of business. It was replaced by Bertler's Fruit Stand (K-26). It was replaced with Sandy's Vegetable in 2007. The location as of 2009 is Wilfert's Vegetable Stand.
d. Removed from the program in fall of 2001, back to program in August 2008.
e. K-7 moved to a nearby location and relabeled K-43, within 0.2 miles of original, August/September 2010.

Table 2.2.1-D

Reporting Levels for Radioactivity Concentrations in Environmental Samples

Medium	Radionuclide	Reporting Levels	
		CV to KPS[a]	KPS to NRC[b]
Airborne Particulate (pCi/m3)	Gross Beta	1	--
	Cs-134	1	10
	Cs-137	1	20
Water (pCi/l)	Gross Alpha	10	--
	Gross Beta	30	--
	H-3	10,000	20,000[c]
	Mn-54	100	1,000
	Co-60	30	300
	Cs-134	10	30
	Cs-137	20	50
	Sr-90	8[d]	- -
Grass, Cattle Feed, and Green Leafy Vegetables (pCi/g wet)	Gross Beta	30	- -
	Cs-134	0.2	1
	Cs-137	0.2	2
	Sr-90	1	- -
Soil, Shoreline Sediments (pCi/g)	Gross Beta	50	- -
	Cs-134	5	- -
	Cs-137	5	- -
	Sr-90	5	- -
Fish (pCi/g wet)	Gross Beta (Flesh, Bones)	10	--
	Mn-54	--	30.0
	Co-60	--	10.0
	Cs-134 (Flesh)	1	1.0
	Cs-137 (Flesh)	2	2.0
	Sr-90 (Bones)	2	--

a. Radionuclides will be monitored by the CV and concentrations above the listed limits will be reported to KPS.

b. Concentrations above the listed limits will be reported to NRC as required by REMM 2.2.1.b.

c. For drinking water samples, this is 40CFR Part 141 value. If no drinking water pathway exists, then a value of 30,000 pCi/l may be used.

d. The Sr-90 values are based on the EPA drinking water standards. See note "e." of Table 2.3.1-A for further information

Table 2.3.1-A
Detection Capabilities for Environmental Sample Analysis[a]
Lower Limit of Detection (LLD)[b,c]

Analysis	Water (pCi/l)	Airborne Particulate (pCi/m^3)	Fish (pCi/kg, wet)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4	0.01			
H-3	2000[d]				
Mn-54	15		130		
Co-60	15		130		
Cs-134	15	0.05	130	60	150
Cs-137	18	0.06	150	80	180
Sr-90[e]	5				

Table Notations for Table 2.3.1-A

a. This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environment Operating Report.

b. Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

c. The LLD is defined, for purposes of these requirements, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \times V \times 2.22 \times Y \times \exp(-\gamma \Delta t)}$$

Where:

LLD is the <u>a priori</u> lower limit of detection as defined above, as picocuries per unit mass or volume,

S_b is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

γ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting,

Typical values of E, V, Y, and Δt should be used in calculation.

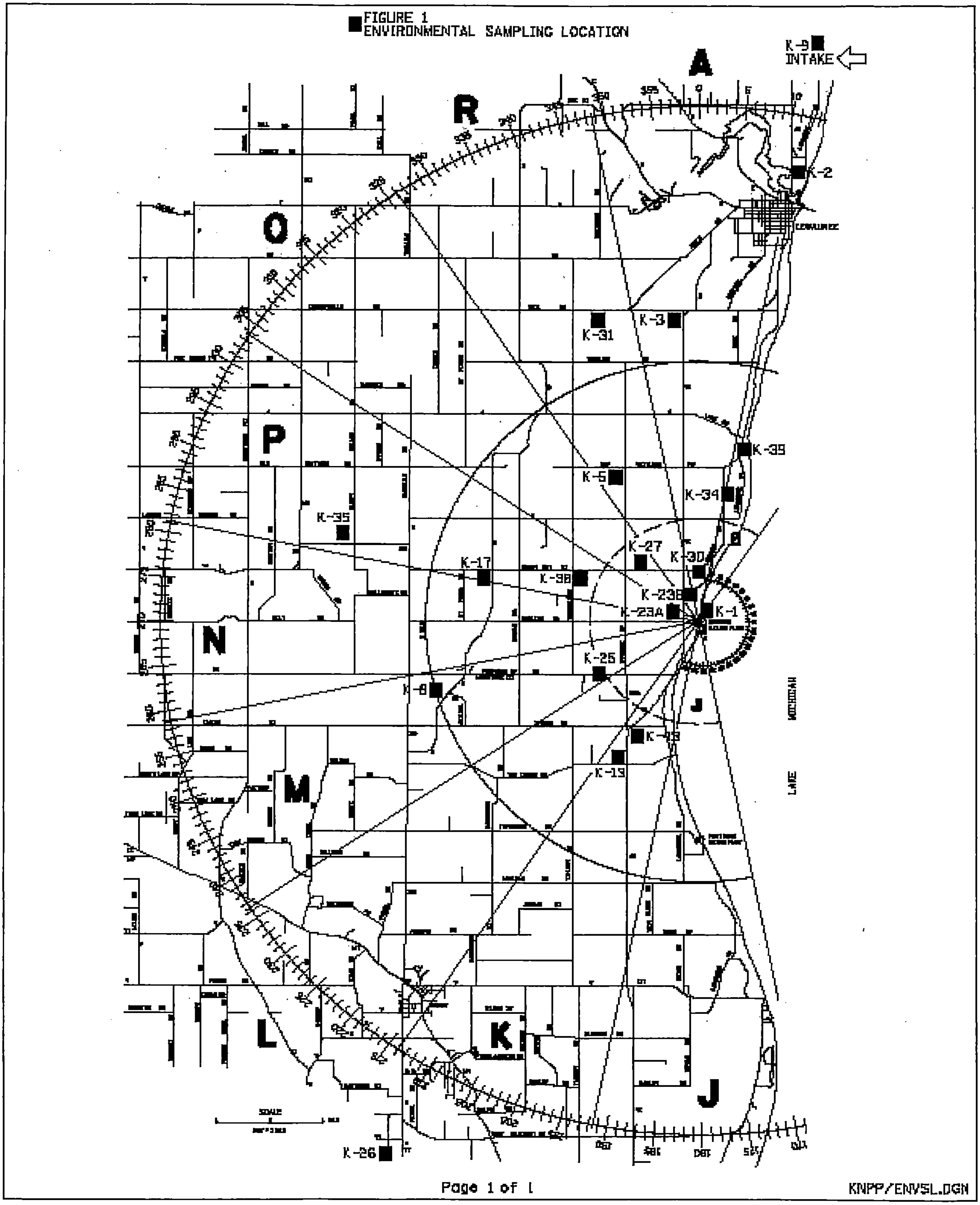
Table Notations for Table 2.3.1-A (con't)

It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

d. If no drinking water pathway exists, a value of 3,000 pCi/l may be used.

e. This is NOT a NUREG-0472 required value. It is based on EPA drinking water standards, which tie into the NEI Groundwater Protection Initiative that was implemented at KPS on August 4, 2006.

FIGURE1



Rev. 21
January 1, 2018

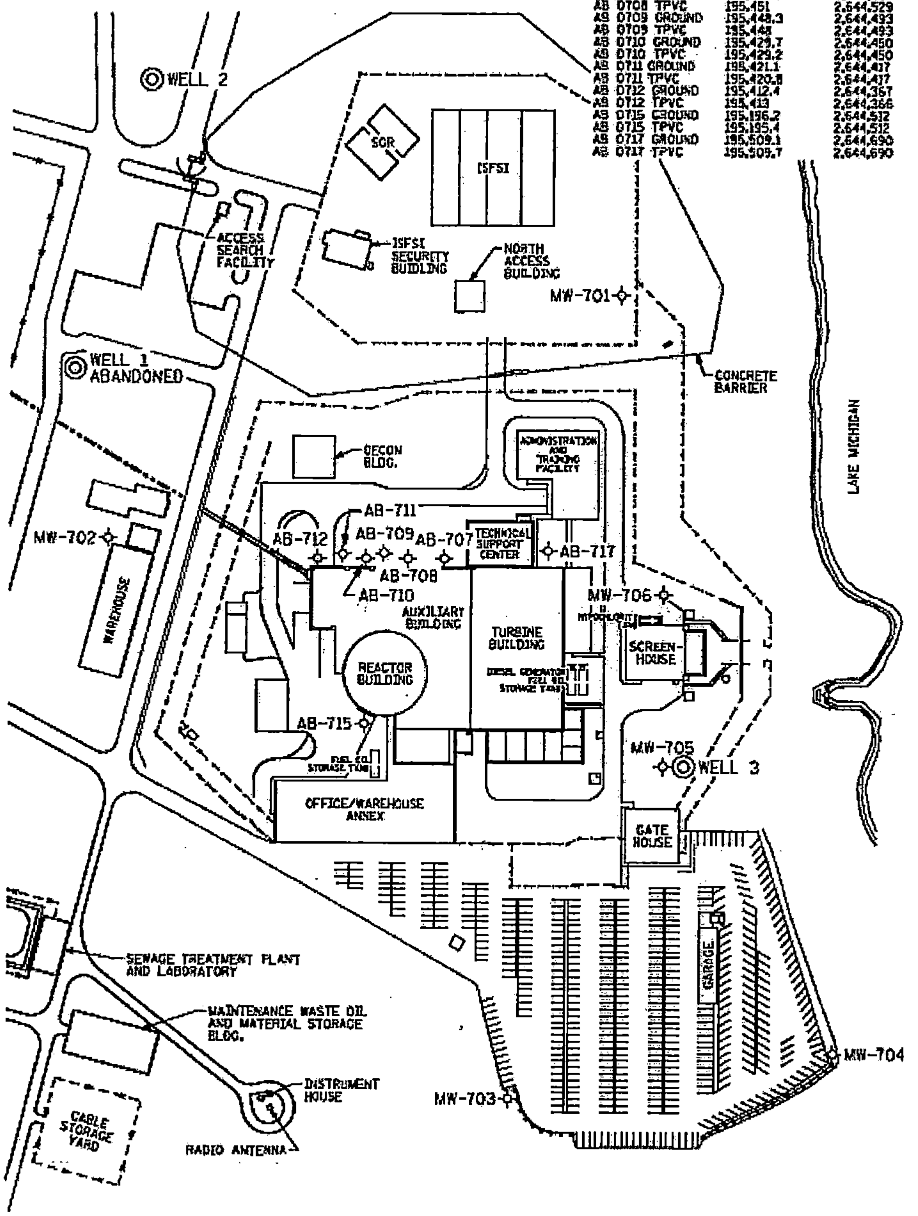
FIGURE 2

FIGURE 2
WELL LOCATIONS

NOTES:
1. LOCATIONS OF MONITORING WELLS SURVEYED BY STS ON JUNE 21, 2007.
2. LOCATIONS OF WATER SUPPLY WELLS ARE ESTIMATED.
3. COORDINATES ARE IN NAD 1927 WISCONSIN STATE PLANE CENTRAL.

LEGEND:
8' HIGH FENCE
SUPPLY WELL
MONITORING WELL

LOCATION	NORTHING	EASTING	ELEVATION
MW-0701 GROUND	195,059.5	2,644,681	605.828
MW-0701 TPVC	195,059	2,644,681	605.627
MW-0702 GROUND	195,372.1	2,644,096	607.897
MW-0702 TPVC	195,371.5	2,644,097	607.905
MW-0703 GROUND	194,761.4	2,644,838	603.112
MW-0703 TPVC	194,762.3	2,644,838	602.685
MW-0704 GROUND	194,938.2	2,644,268	608.315
MW-0704 TPVC	194,938.7	2,644,268	608.302
MW-0705 GROUND	195,264.4	2,644,927	605.335
MW-0705 TPVC	195,264.4	2,644,927	604.912
MW-0706 GROUND	195,491.2	2,644,365	605.402
MW-0706 TPVC	195,491.2	2,644,365	605.997
AB 0707 GROUND	195,461	2,644,563	606.0152
AB 0707 TPVC	195,460.4	2,644,563	605.6723
AB 0708 GROUND	195,451.3	2,644,530	606.0315
AB 0708 TPVC	195,451	2,644,529	605.5165
AB 0709 GROUND	195,448.3	2,644,493	606.1195
AB 0709 TPVC	195,448	2,644,493	605.8593
AB 0710 GROUND	195,429.7	2,644,450	606.1493
AB 0710 TPVC	195,429.2	2,644,450	605.8672
AB 0711 GROUND	195,421.1	2,644,417	605.8649
AB 0711 TPVC	195,420.8	2,644,417	605.4903
AB 0712 GROUND	195,412.4	2,644,367	605.5062
AB 0712 TPVC	195,413	2,644,366	605.1851
AB 0715 GROUND	195,196.2	2,644,512	605.1393
AB 0715 TPVC	195,195.4	2,644,512	605.4299
AB 0717 GROUND	195,509.1	2,644,690	605.4198
AB 0717 TPVC	195,509.7	2,644,690	605.2917



Page 1 OF 1

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Appendix C

Kewaunee Power Station

Documentation for Major Changes to Radioactive Waste Systems in 2018

System abandonment evaluations per procedure OP-KW-DEC-SYC-001, System Evaluation and Categorization Attachment B - SSC Category Determination Document

And

FSRC Review and Approval Documentation

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Kewaunee CRS ▸ CR: Abandonment Screening Documentation

Print

CR_ID	1382
Short description	Abandonment Screening Documentation
Site	Kewaunee
Discovery Date/Time	9/18/2017 12:00 PM
Submitter	William G Swanson (Generation - 4)
Submitters Dept	1. Operations
Supervisor	Bradly J McMahon (Generation - 4)
Unit 1 Mode	N/A
Unit ISFSI?	No
Revision #	
Long Description	System abandonment screenings were performed for system abandonment project for SAFSTOR III (attached). Screenings were performed to engulf systems that can be abandoned as a result of Spent Fuel being emptied to ISFSI pad and License Amendment approval that plant systems are no longer required for storage of spent fuel in Spent Fuel Pool. This CR was written to have a place for easier retrieval for future abandonment preparations.
Initial Actions	Wrote CR.
Recom Actions:	Maintain capability to retrieve this CR for future abandonments.
additional Contacts	
Tag #:	
Equipment Location	NA
Equipment Description	NA
Plant System	Various
OP-AA-102 Review Reqd?	No
Operability Assesment	N/A
Operability Comments	None
Functionality Assessment	N/A
Reportable Condition	None
Reportability Comments	None
Is Equipment Important to Emergency Response WM-KW-100 values	No
O/R Comments	
Significance (screening)	4
Potential Repeat (screening)	No
Previous Issue	No History required for Sig 4 issues.
CRT Comments	CR written to capture System Abandonment Screenings only. No other actions are required from this CR. Close to No Actions Required.
Work Order #	
Comments	
Status	To Records
Attachments	Screenings thru September 2017 for abandonments for SAFSTOR III.pdf Screens thru 2018 for SAFSTOR III abandonments.pdf

Content Type: Item
Version: 16.0
Created at 9/18/2017 2:34 PM by William G Swanson (Generation - 4)
Last modified at 10/30/2018 4:04 PM by System Account

Close

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1.0 Doc Type: Report Revision No.: 0 Date: 4/19/2018

Sub Type: DEC

Document Number (ID): SYS-02-DSERT

Title: Service Water System

1.1 Brief description or reason for revision: Abandonment of all of the Service Water System not previously Abandoned on other interconnecting systems DSERT Packages. Only portion of the SW System that will remain for SAFSTOR III is the Standpipes.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: The entire Service Water System will be Abandoned except for system Standpipes that will remain Available until Station Decommissioning. Included in the Abandonment of the SW System is Abandonment of both SW Chlorination Systems.

The following SSCs will be Abandoned:

SW Pump/Motor 1A1: 145-441 / 1-023 / 1-506
SW Pump/Motor 1A2: 145-442 / 1-022 / 1-507
SW Pump/Motor 1B2: 145-444 / 1-029 / 1-609
SW Motor Breaker cube 1B1: 1-608
SW Strainer/Motor 1A1: 158-011 / 1-242 / MCC52D-A4
SW Strainer/Motor 1A2: 158-012 / 1-243 / MCC52D-A5
SW Strainer/Motor 1B1: 158-013 / 1-294
SW Strainer/Motor 1B2: 158-014 / 1-252 / MCC62D-A5
Sodium Bisulfate Pump: 143-145 / 1-1380
Sodium Bisulfate Pump: 143-146 / 1-1381
Sodium Hypochlorite Pump : 143-144 / 1-1378
Sodium Hypochlorite Pump : 143-143 / 1-1379
SW Chlorination Pump 1A: 143-125 / 1-1209A / MCC35C-B4
SW Chlorination Pump 1B: 143-126 / 1-1209A / MCC35C-B4
Traveling Water Screen/Motor 1A1: 167-021 / 1-123 / MCC52D-A6
Traveling Water Screen/Motor 1A2: 167-022 / 1-154 / MCC35C-B8
Traveling Water Screen/Motor 1B1: 167-023 / 1-124 / MCC45C-A7
Traveling Water Screen/Motor 1B2: 167-024 / 1-155 / MCC62D-A6
SW Header isolation valve: SW-3A / CV-31038 / SV-33040

SW Header isolation valve: SW-3B / CV-31040 / SV-33041
SW Strainer Backwash Valve: SW-30A1 / SV-33018 / CV-31153
SW Strainer Backwash Valve: SW-30A2 / SV-33019 / CV-31154
SW Strainer Backwash Valve: SW-30B1 / SV-33020 / CV-31155
SW Strainer Backwash Valve: SW-30B2 / SV-33021 / CV-31156
Travelling Water Screen Backwash Valve: SW-202A1 / SV-33010
Travelling Water Screen Backwash Valve: SW-202A2 / SV-33011
Travelling Water Screen Backwash Valve: SW-202B1 / SV-33012
Travelling Water Screen Backwash Valve: SW-202B2 / SV-33013
Aux Building SW Header A Isolation Valve: SW-10A / MV-32011 / MCC52A-A4 / 1-408
Aux Building SW Header B Isolation Valve: SW-10B / MV-32012 / MCC62A-C5 / 1-409
Turbine Building SW Header A Isolation Valve: SW-4A / CV-31084 / SV-33043
Turbine Building SW Header A Isolation Valve: SW-4B / CV-31085 / SV-33044
SW Supply to AFW Pump A: SW-601A/MV-32029 / 1-401 / MCC52C-B2
SW Supply to AFW Pump B: SW-601B/MV-32030 / 1-402 / MCC62C-B2
SW Supply to TDAFW Pump: SW-502/MV-32031 / 1-073 / BRA104-15BKR
SW Return from CC Heat Exchanger A: SW-1300A / MV-32009 / 1-399 / MCC52B-D3
SW Return from CC Heat Exchanger B: SW-1300B / MV-32010 / 1-403 / MCC62E-H1
SW Return bypass from CC Heat Exchanger A: SW-1306A / CV -31406 / SV-33906 / BRC121-6BKR
SW Return bypass from CC Heat Exchanger B: SW-1306B / CV-31407 / SV-33907 / BRD115-30BKR
SW Return from SFP Heat Exchanger: SW-1601 / CV-31086
SW Emergency Supply to CC: SW-1400 / MV-32083 / 1-365 / MCC52B-B2
SW Return from Generator Coolers: SW-2602 / CV-31068
SW Supply to SGBT Tank: SW-2303 / CV-31053
Cont Cooling SW Return Header 1A: SW-903A / MV-32060 / 1-394 / MCC52E-F5 (DSERT SYS 16)
Cont Cooling SW Return Header 1B: SW-903B / MV-32061 / 1-395/ MCC52E-G1(DSERT SYS 16)
Cont Cooling SW Return Header 1C: SW-903C / MV-32058 / 1-396 /MCC62E-B1 (DSERT SYS 16)
Cont Cooling SW Return Header 1D: SW-903D / MV-32059 / 1-397 / MCC62E-B2 (DSERT SYS 16)
Containment Cooling SW Return Header 1B Bypass: SW-904B / CV-31120 / SV-33036
Containment Cooling SW Return Header 1D Bypass: SW-904D / CV-31119 / SV-33035
Chlorination System Control Valve CI-610A / CV 31921 / SV-33898
Chlorination System Control Valve CI-610B / CV 31922 / SV-33899
Chlorination System Control Valve CI-606A / CV 31917 / SV-33894
Chlorination System Control Valve CI-606B / CV 31919 / SV-33896
DI Supply to Chlorination System Control Valve DW-5100-33-4A / CV 31918 / SV-33895
DI Supply to Chlorination System Control Valve DW-5100-33-4B / CV 31920 / SV-33897
Circulating Water Chlorine Monitoring Water Pump: 1-801 / MCC35C-A3
Gen Seal Oil H2 Side Control Valve / SW-2920-1 / SV-35111

Gen Seal Oil Air Side Control valve / SW-2910-1 / SV-35112
Forebay SW Dilution Valve / SW-5071 / SV-33887
Augmented Water System SW Supply Valve: SW-3116 / SV-33914
Fire Station Hose #28
Fire Station Hose #29
Fire Station Hose #30
Fire Station Hose #31
Fire Station Hose #32
Fire Station Hose #34
Fire Station Hose #35

The Following instruments, sensing lines, and switches will be abandoned:
PS-16065, PS-16066, PS-16067, PS-16068, PI-11007, ES-19478, DPS-16419, DPI-11021, PI-11008, ES-19479, ES-19480, DPS-16421, DPI-11085, PI-11010, ES-19481, DPS-16422, DPI-11086, Chlorine Recorder 28331, Chlorine Monitor 74118, PT-21006, PS-15524J, PS-16005, PI-11332, PS-16004, TI-12009, PI-21005, PS-15522J, PI-41503, PS-16003, A-47051-P, PI-41506, PI-11331, TI-12008, TE-14163, TE-14161, TE-14160, DPI-11103, ARP-47053-D, PI-11102, PI-11351, FS-16802, ARP-47051-O, SER-099, PI-11352, FS-16803, FS-16806, ES-46065, ES-46061, ES-46062, FT-17411, FT-17408, FT-17409, PI-11155, TT-17345, ES-46552, TT-17344, ES-46553, FT-17410, PI-11154, TT-17343, FE-27060, FIT-23160, FIT-23161, FE-27193, FE-27192, FI-18325, FIT-23162, FE-27194, FIT-23163, FE-27195, PS-16115, FE-27085, ARP-47052-P, TT-17355, TT-17354, TT-17356, PI-11354, PI-11353, TT-17347, PI-11016, TT-17348, TI-12410, PI-11303J, TC-26306, TT-26312, TT-17340, PI-61386, ES-46510, ES-46509, ES-46511, ES-46512, PI-11059J, PI-11058J, LI-18086, LT-24085, Chlorine Recorder 28332, Chlorine Monitor 74119, DPI-11654, PI-11433, PI-11434, FE-27087, PB-19610, FE-27086, FI-18293

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-202-1 Flow Diagram Service Water System, Rev. CX
Abandon:
Everything on drawing.
Note: the EDG SW heat exchangers were Abandoned under System 10 DSERT.

DECM -202-2 Flow Diagram Service Water System Abandonment Drawing, Rev. D
Abandon:
Everything on drawing except 24" SW Standpipe, its associated vent, and drains from roof (6" line), Waste Disposal System (2" line), and Steam Relief stack drains (2" line).

Available:
The Standpipe and referenced drains and vents will remain Available for SAFSTOR III.

DECM-202-3 Flow Diagram Service Water System Abandonment Drawing, Rev. F
Abandon:
Everything on drawing except 24" and 18" SW Standpipes, associated vents, and drains from roof (8" line), Turbine Building Sump Pump System (3" line), and capped Heater Drain Tank connection (2" line).

Available:
The Standpipes and referenced drains and vents will remain Available for SAFSTOR III.

DECM-204-1 Condensate & Gland Seal Systems Abandonment Drawing, Rev. F
Abandon:
2" SW line and valve AFW-120

DECM-208-1 Flow Diagram Fire Protection System Abandonment Drawing, rev. B
Abandon:
1-1/2" line from SW system up to SW21-1 supply valve to Jockey Pump.

DECM 209-1 Flow Diagram Make-up Water Systems Abandonment Drawing, Rev. A
Abandon:
SW lines to Acid and Caustic Troughs and 1" SW line from Electric Shop Cooling Coil

OPERM-209-5 Water Treatment Augmented Water System, Rev. E
Abandon:
6" SW line from header to SW-3116

DECM-215 Circulating Water System Abandonment Drawing, Rev. A
Abandon:
4" line from SW Strainer Backwash all the way to the Discharge Tunnel.
Complete Recirculating Water System

DECM-218 Flow Diagram Spent Fuel Pool Cooling and Clean-up System Abandonment Drawing, Rev. 0
Abandon:
6" SW Emergency Makeup to SFP to SW-1500

DECM-219 Secondary Sampling Systems Abandonment Drawing, Rev. B
Abandon:
2" SW Supply to Cooler including SW-2200
2" and ¾ SW return lines from Cooler including SW-2212, SW-2205, and SW-2206
3/4" SW supply to Heating Boiler Sample Cooler up to SW-2331

DECM-394 Service Water Pretreatment System Abandonment Drawing, Rev. B
Abandon:
3" SW Supply to SW-2800
SW Line to CW Pump Bearing Cooler up to and including SW(T)-281 and SW-130

DECM-547 Flow Diagram Service Water System Containment Cooling Abandonment Drawing, Rev. 0:
Abandon:
Everything on drawing

DECM-588 Flow Diagram Air Cond. Cooling Water Piping Abandonment Drawing, Rev. 0
Abandon:
All SW Supplies and returns for CRAC Units and Aux Blg FCUs.

DECM-605-1 Heating System Abandonment Drawing, Rev. C
Abandon:
SW Supply and Return from Boric Acid Evap Cond Return Unit.

DECM-605-3 Heating System – Electric Heating Boiler Abandonment Drawing, Rev. B
Abandon:
SW Supply and Return for Sample Cooler
SW Supply and Return for Blowdown Separator Cooler

DECM-606 Flow Diagram Air Cond. Cooling Water Piping Abandonment Drawing, Rev. F
Abandon:
SW Supply and Returns to all cooling units on drawing

DECM-1274 Flow Diagram Chlorination System Abandonment Drawing, Rev. 0
Abandon:
Entire Service Water Chlorination System

DECXK-100-19 Flow Diagram Component Cooling System Abandonment Drawing, Rev. B
Abandon:
2" SW Supply to SW-1400

DECXK-100-400 15 GPM Boric Acid Evap. + Gas Stripper Flow Diagram Abandonment Drawing, Rev. A
Abandon:
SW Supply and Return to Distillate Cooler

OPERXK-100-829 Radioactive Waste Evaporator Flow Diagram Rev. 10R
Abandon:
½" SW Supply to Dist Sample Cooler

DECE-244 Circuit Diagram Generator and 4160V Equipment Abandonment Drawing, Rev. C
Abandon:
1-609 1-023 / SW Pump B2
1-608 Removed SW Pump B1
1-507 1-022 / SW Pump A2
1-506 1-023 / SW Pump A1

DECE-256 Circuit Diagram 480V MCC 1-32D, 1-35C, 1-35F, 1-42D, 1-45C, & 1-45F Abandonment Drawing, Rev. J
Abandon:
MCC35C-B4 Service Water Chemical Injection System
MCC35C-A3 1-801 Circulating Water Chlorine Monitoring Water Pump
MCC35C-B8 1-154 Traveling Water Screen 1A2
MCC45C-A7 1-124 Traveling Water Screen 1B1

DECE-258 Circuit Diagram 480V MCC 1-52A, 1-52F, & 1-52B Abandonment Drawing, Rev. Q
Abandon:
MCC52A-A4 1-408 / SW-10A
MCC52B-D3 1-399/SW-1300A
MCC52B-B2 1-365 / SW-1400

DECE-259 Circuit Diagram 480V MCC 1-62D & 1-62E Abandonment Drawing, Rev. M
Abandon:
MCC62E-H1 SW-1300B/1-408
MCC62D-A6 1-155 / Traveling Water Screen 1B2
MCC62D-A5 1-252 / SW Strainer 1B2

DECE-260 Circuit Diagram 480V MCC 1-52C, 1-52E, & 1-62C Abandonment Drawing, Rev. M
Abandon:
MCC52C-B2 1-401 / SW-601A
MCC62C-B2 1-402 / SW-601B

DECE-261 Circuit Diagram 480V MCC 1-62A, 1-52D, 1-5262 & 1-62B Abandonment Drwg, Rev. K
Abandon:
MCC62A-C5 1-409 / SW-10B
MCC52D-A6 1-123 / Traveling Water Screen 1A1
MCC52D-A4 1-242 / SW Strainer 1A1
MCC52D-A5 1-243 / SW Strainer 1A2

DECE-844 Wiring Diagram DC Auxiliary & Emergency AC Sheet-2 Abandonment Drawing, Rev. H
Abandon:
BRD-115-30BKR SW-1306B Control Circuit
BRA-104-15BKR SW-502/MV-32031

DECE-885 Lighting Panels RP-7, RPA8, RPA9, RPA10, RPA11, RPA12 Abandonment Drwg, Rev. A
Abandon:
RPA9-BKR-7 Solenoid valve SV-33914 / SW-3116

DECE-2341 Schematic Diagram Fuse Panel RR-175 AC Safeguard 6 Abandonment Drwg, Rev. P
Abandon:
FUG-10 SV33041 / SW-3B
FUG-11 SV-33044 / SW-4B

DECE-2344 Schematic Diagram Fuse Panel RR-175 AC Safeguard 6 Abandonment Drwg, Rev. 0
Abandon:
FUG-36 SV33035/SW-904D

E-3118 Schematic Diagram Fuse Panel SD-100 AC Safeguard 5 Abandonment Drawing, Rev. 0
Abandon:
FUG-7 SV33040 / SW-3A

E-3216 Wiring Diagram Computer 120V AC Distribution, Rev. Z
Abandon:
BRC-121-6 BKR Control Circuit SW-1306A

E-3122 Schematic Diagram Fuse Panel SD-100 AC Safeguard 5 Drawing, Rev. H
Abandon:
FUG-33 1-408 / SW-10A
FUG-37 SV-33036 / SW-904B

E-3123 Schematic Diagram Fuse Panel SD-100 AC Safeguard 5 Drawing, Rev. F
Abandon:
FUG-47 SV33043 / SW-4A

E-3650 Wiring Diagram A.C. Distr. Cab. BRA-127, Term. Cab. TB2654 & TB2534, Transfer Switch BRA-115 and Isolation Cab. BRA-126 Abandonment Drawing, Rev. 0
Abandon:
BRA-127-12 BKR TWS Control Panel
BRA-127-18 BKR SW backwash Panel

E-3654 Wiring Diagram A.C. Distribution Cab. BRB-127, Term. Cabinets TB2655 & TB2535, and Isolation Cabinet BRB-126 Abandonment Drawing, Rev. C
Abandon:
BRB-127-20 BKR TWS Control Panel
BRB-127-24 BKR SW backwash Panel

E-3982 Service Water Chlor/Dechlor Control Wiring Diagram, Rev. 0
Abandon:
Everything on Drawing

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The Service Water (SW) System supplies water from Lake Michigan for cooling equipment in the steam plant, Containment fan coil units, and Reactor auxiliary systems. The purpose of the SW System is to provide redundant cooling water supplies for the engineered safeguards equipment required during post-accident conditions and for single non-redundant supplies to other systems, including balance of plant equipment. The SW System utilizes:

- Three pumps with two redundant headers
- Strainers
- Isolation valves
- Four Traveling Water Screens.

These components are powered from emergency buses, with the exception of Traveling Water Screens 1A2 and 1B1 which are powered from non-emergency buses.
The SW System is designed with two redundant headers, each capable of providing for all anticipated post-accident heat removal requirements, including leakage allowances, at the highest expected lake water temperature. Each header is capable of supplying cooling water to balance of plant (BOP) equipment requirements. The SW System is also designed to automatically start the necessary number of pumps to maintain adequate system pressure.

Various redundant safeguard equipment and coolers are supplied with SW from each Aux Bldg header. Examples of major equipment include: four Containment fan coil units, the Auxiliary Feedwater (AFW) Pumps, and the Component Cooling (CC) water heat exchangers. Some non-safety Class 1 and non-redundant coolers and equipment are supplied from SW headers. Some examples include the CW Pump seals and bearing coolers, Traveling Water Screen wash nozzles, Fire Protection Jockey Pump, and Spent Fuel Pool Emergency Makeup Valve. The Diesel Generator Cooler Heat Exchanger is supplied by the Main Service Water Header.

Basis for Category

On February 25, 2013, Dominion Energy – Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. Upon docketing of the subsequent certification for permanent removal of fuel from the reactor vessel pursuant to 10CFR50.82(a)(1)(ii), the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). The spent fuel pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor vessel and the spent fuel pool (SPF) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

The basis for the abandonment category of the Service Water System (02) is determined by screening to the following criteria:

NOTE: SW System standpipes will remain available until station dismantling.

1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. For safe storage and handling of radioactive waste or spent fuel.
3. The requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other commitments safe storage of spent fuel, or Radiological Effluent Monitoring / Offsite Dose Calculation Manual for KPS.
4. The requirement of SSC's that support the execution of plans and programs at KPS (e.g. Security Plan, Fire Protection Program, Emergency Management Plan, Radiation Protection Program.
5. Support day to day operations in the decommissioning plant.

6. Support plant decommissioning efforts.

The abandoned portions of the SW are not required to support the above criteria.

Regulatory Impact

Fire Protection – Some of the fire house stations as identified in this DSERT package were supplied from the SW System. FPEE-074 "Evaluation of Fire Protection Program for SAFSTOR 3 Long Term Dormancy" has evaluated the water supply system for SAFSTOR 3 as only being Fire Pump B and the outside header. There will not be any permanently installed hose stations within the Power Plant.

An ODCM revision will be completed to update the ODCM to SAFSTOR III parameters once all plant discharges from the SFP and RWST are complete.

Plant Impact

The partial ABANDONMENT of the Service Water System does not result in any required changes to SSC's, procedures, programs, processes, etc.

The partial ABANDONMENT of the Service Water System has no impact on any temporary changes that are active as of 4/24/2018.

The Drawing Control Team did not identify any outstanding drawing changes that are required to be dispositioned as a result of the portion of the Service Water System that will be ABANDONED.

This package does not negatively impact the Environmental Permits, Security Plan, REMM/ODCM, Fire Protection Plan, Health Physics requirements, or insurance requirements.

This DSERT package does not impact the ISFSI.

5.0 Special conditions to support categorization(s):

The SW System shall not be abandoned until the systems it currently serves have been abandoned.

6.0 Assumptions/Open Items to be validated or dispositioned:

OPEN ITEMS: This abandonment changes the radioactive waste system (liquid) by abandoning the SW System which provides dilution water flow for liquid discharges. Therefore the requirements of ODCM 15.1 apply (e.g., FSRG review is required and it is to be reported to the NRC in the Annual Radioactive Effluent Release Report.)

7.0 Expected duration for SSC category if **NOT** ABANDONED:

Standpipes that will remain Available until Station Decommissioning.

8.0 **PREPARE** and **ATTACH** the following documents:

- 50.59 Screening titled "SSC Abandonments Per OP-KW-DEC-SYS-001 for SSC's identified in Part I.a Approved: 9/13/2017. See CR1382 for referenced screening.
- See attached drawing update DUR 18-16

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 4-30-18
Type Of Review Fire Protection	Name (Print) Michael Townsend	Approval Signature	Date 4/26/18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 4-25-18
Type Of Review Environmental Compliance	Name (Print) Ted Maloney	Approval Signature Ted Maloney	Date 4/25/18

10.0 Review and Approval:

Brian Klamer

Prepared By (Print/Sign) — Date: 4/24/18

TP Olson

Reviewed By (Screen Qual.) (Print/Sign) — Date: 4/25/18

TP Olson

Technical Support (Print/Sign) — Date: 4/25/18

William Swanson

Concurrence by DSERT Coordinator (Print/Sign) — Date: 4/26/18

Bradly J McMahon

FSRG (Print/Sign), if required — Date: 5-1-18

FSRG Meeting Number: 18-007

1.0 Doc Type: Report Revision No.: 1 Date: 3/6/2018
Sub Type: DEC
Document Number (ID): SYS-07-1-DSERT
Title: Steam Generator Blowdown Treatment

1.1 Brief description or reason for revision: Complete system abandonment

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:
SGBT Blowdown Tank 153-131
SGBT Monitor Tank 1B 153-452
SGBT Hold Up Tank 1B 153-512
SGBT Ion Exchange Pre-Filter 169-351
SGBT Ion Exchanger 1B 135-332
SGBT Ion Exchanger Post Filter 1B 169-342
SGBT Hold-Up Tank 1B Transfer Pump & Motor 145-452/1-704
SGBT Monitor Tank 1B Discharge Pump & Motor 145-462/1-706

The following instrument boundaries will be abandoned along with their respective sensing lines: PS-16110, PS-16111, LA-16710, LA-16711, LA-16704, DPI-11348, LA-16705, PI11328, DPI-11360, LA-16708, LA-16709, PI-11330, DPI-11653, TI-12141, PI-11324, & DPI-11326.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

DECM-202-2 Service Water System Abandonment Drawing, Rev. D
Abandon:
3" drain from SGBT Tank up to Auxiliary Building Standpipe

DECM-202-3 Service Water System Abandonment Drawing, Rev. F
Abandon:
SW line downstream of SW-2320 through the SGBT Heat Exchanger

DECM-219 Secondary Sampling System Abandonment Drawing, Rev. B
Abandon:
All three samples from Heating Boiler (Blowdown / HS / FW) through sample cooler to drain

DECM-350 Flow Diagram-Reactor Plant Misc. Vents, Drains & Sump Pump Piping Abandonment Drawing, Rev. D
Abandon:
2" line from SGBT Ion Exchanger & Filters up to 2" drain to sump

DECM-368 Steam Generator Blowdown Treatment System Abandonment Drawing, Rev. C
Abandon:
SGBT Tank to BT-62 at Condenser
SGBT Tank up to and including valves BT-100B, BT-100A & SW-2321
Remaining portion of SGBT System starting at (& including) valves BT-130 and BT-108 up to BT-336 & BT-205. This includes the following:

- SGBT Hold Up Tank and Transfer Pump
- SGBT Monitor Tank and Discharge Pump
- SGBT Ion Exchange Pre-filter
- SGBT Ion Exchanger 1B
- SGBT Ion Exchange Post Filter 1B
- 3" line downstream DW-274 to Spent Resin Storage Tank
- 1-1/2" Flush line downstream DW-272B

Note: Administrative update included in this revision:

- 3" and 4" vents on SGBT Monitor and Holdup Tanks / Standpipes not highlighted in Rev. 0 of the SGBT DSERT package
- 2" line from SGBT Holdup Tank 1A bottom tap to its associated standpipe not highlighted in Rev. 0 of the SGBT DSERT package

DECM-385 Flow Diagram Radioactive Waste Solidification System Abandonment Drwg, Rev. 0
Abandon:
1" line downstream RWS-10 to SGBT Ion-Exchanger

DECM-436 Steam Generator Blowdown System Modification Abandonment Drawing, Rev. E
Abandon:
Hydrop valves BT-4A and BT-4B through SGBT Tank (including Inst Standpipe) up to and including valves BT-1006, BT-50-1, BT-56-1, BT-61, BT-100A & BT-100B.

DECM-605-2 Heating System Abandonment Drwg, Rev. B
Abandon:
3/4" Blowdown line from BT-501 to Sample Cooler and SGBT Tank
1-1/2" line from BT-602 to SGBT Tank

DECE-256 Circuit Diagram 480V MCC 1-32D, 1-35C, 1-35F, 1-42D, 1-45C, & 1-45F Abandonment Drwg, Rev. J
Abandon from the electrical breaker out:
MCC 1-42D-C3 SGBT Holdup Tank Transfer Pump B
MCC 1-42D-C4 SGBT Monitor Tank Discharge Pump B

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The Steam Generator Blowdown System assists in maintaining secondary chemistry of the Steam Generators and the Main Steam System by removing contaminants. Also, the SGB System provides the means to monitor SG tube integrity and has the ability to transfer radioactive contaminated water from the SGs to the Steam Generator Blowdown Treatment System following a Steam Generator tube rupture. The SGB System operates in three Modes:

Mode I
Normal operation is from plant startup to 50% power and 50% power to plant shutdown. The water removed from the steam generators is discharged to Lake Michigan via the Auxiliary Building standpipe.

Mode II
Normal operation is from 50% to 100% power. The water removed from the SGs is processed through heat exchangers and filters before returning to the condenser.

Mode III
Emergency operation, following a Steam Generator tube rupture, is to transfer the radioactive contaminated water to the SGBT System.

The Steam Generator Blowdown Treatment System processes radioactive contaminated water. During normal plant operation, radioactive water from the Waste Disposal System is periodically transferred to the SGBT System for processing. In an emergency, Steam Generator tube rupture, SGB System is aligned to Mode III. SGBT System pumps the radioactive water through filters and ion exchangers to remove contaminants. When the water is processed sufficiently, it is discharged to Lake Michigan via the Auxiliary Building Standpipe.

The basis for the abandonment category of the SGBT (07) is determined by screening to the following criteria:
1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. For safe storage and handling of radioactive waste or spent fuel.
3. The requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other

commitments safe storage of spent fuel, or Radiological Effluent Monitoring / Offsite Dose Calculation Manual for KPS.

4. The requirement of SSC's that support the execution of plans and programs at KPS (e.g. Security Plan, Fire Protection Program, Emergency Management Plan, Radiation Protection Program.
5. Support day to day operations in the decommissioning plant.
6. Support plant decommissioning efforts.

Regulatory Impact

An ODCM revision will be completed to update the ODCM to SAFSTOR III parameters once all plant discharges from the SFP and RWST are complete.

Plant Impact

There is no impact on any temporary changes that are active as of 3/7/2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

5.0 Special conditions to support categorization(s):

Fuel Oil Heating Boiler shall be Abandoned prior to System 07 Abandonment because Fuel Oil Heating Boiler Blowdown goes to SGBT.

SFP and RWST discharges shall be completed prior to System 07 Abandonment.

6.0 Assumptions/Open Items to be validated or dispositioned:

OPEN ITEMS: This abandonment changes the radioactive waste system (liquid) by abandoning the SGBT System. Therefore the requirements of ODCM 15.1 apply (e.g., FSRG review is required and it is to be reported to the NRC in the Annual Radioactive Effluent Release Report.)

7.0 Expected duration for SSC category if **NOT** ABANDONED:

NA

8.0 **PREPARE** and **ATTACH** the following documents:

- 50.59 Screening titled "SSC Abandonments per OP-KW-DEC-SYS-001 for SSC's identified in Part I.a Approved: 9/13/2017. See CR1382 for referenced screening.
- See attached drawing update DUR 18-08

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Type Of Review Security	Name (Print) Brian Pres	Approval Signature	Date 3-14-18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 3/13/18
Type Of Review Fire Protection	Name (Print) Brian Kleiman	Approval Signature	Date 3/13/2018

10.0 Review and Approval:

Brian Kleiman /	3/13/2018
Prepared By (Print/Sign)	Date
TP OLSON /	3/13/2018
Reviewed By (Screen Qual.) (Print/Sign)	Date
TP OLSON /	3/13/2018
Technical Support (Print/Sign)	Date
William Swanson	3/18/18
Concurrence by DSERT Coordinator (Print/Sign)	Date
TP OLSON	3/27/2018
FSRG (Print/Sign), if required	Date

FSRG Meeting Number: 18-005

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1.0 Doc Type: Report Revision No.: 1 Date: 1/18/2018
Sub Type: DEC
Document Number (ID): SYS-15-1-DSERT
Title: AAC-Auxiliary Building Air Conditioning

1.1 Brief description or reason for revision: Complete abandonment of the remaining portions of the Auxiliary Building Air Conditioning System

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: This shall be a complete abandonment of the AAC system including the chiller, air handler, fans, dampers, controls, pumps, valves, ductwork and piping associated with the AAC system. The heating steam, instrument air, service water, and 480 volt system components associated with the AAC system shall also be abandoned as part of this DSERT package.

The following fire dampers within the system shall remain available and be considered part of the fire protection system.

AAC-FD-1, AAC-FD-2, AAC-FD-3, AAC-FD-4, AAC-FD-5, AAC-FD-6, AAC-FD-7, AAC-FD-8, AAC-FD-9, AAC-FD-10, ACA-FD-7, ACA-FD-8
Note: AAC-FD-9 and AAC-FD-10 are covered by Control Room Air Conditioning abandonment package SYS-25-1-DSERT.

The following equipment shall be abandoned:

169-153 Auxiliary Building Toilet and Locker Room Exhaust Fan
155-131 Auxiliary Building AC Fan Coil Unit
162-081 Auxiliary Building AC Compressor, Crankcase Heater, chiller skid
145-321 Aux Building AC Chiller Pump
132-271 Hot Chem Lab Exhaust Fan 1A

TC-26308, TC-26314, PC26006, HUC28049, DPI-11228, PT17062, PT17061, TI12158, PI11390, TI12157, PI11389, PI11392, PI11391, PI11729, DPI11655, DPI11696, PI11729, & ES-19491

AOVs: HS-2103, HS-1132, HS-341, HS-2011,

SOVs: SV33272, SV33567, SV33380, SV33381

SV33272 cannot be abandoned unless Control Room Ventilation has been abandoned

MODs: MD32365

AODs: AAC-1/CD34029, AAC-30/CD34002,

AAC-1/CD34029 cannot be abandoned unless Control Room Ventilation has been abandoned.

AAC30 shall be fail closed as a boundary damper by isolating air to CD34002

The following shall be used as boundary isolation:

AAC-30

The Steam Exclusion and Zone SV Dampers within the AAC system were dispositioned for abandonment under System 14 Zone SV/Steam Exclusion.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-604

Abandon:
155-131 Auxiliary Building AC Fan Coil Unit
132-271 Hot Chem Lab Exhaust Fan 1A
Preheat Coil, Cold Deck, Hot Deck and Reheat Coil Control Systems
Ensure Control Room Ventilation Abandoned prior to the following:
169-153 Auxiliary Building Toilet and Locker Room Exhaust Fan

Maintain:
Fire Dampers AAC-FD-1, AAC-FD-2, AAC-FD-3, AAC-FD-4, AAC-FD-5, AAC-FD-6, AAC-FD-7, AAC-FD-8, ACA-FD-7, ACA-FD-8.

OPERM-605-1 Flow Diagram Heating Steam

Abandon:
Steam to Aux Building AC humidifier downstream of valve HS-2010
Ensure Control Room Ventilation Abandoned prior to the following:
Steam to Aux Building Hot Water Converter
Hot water heating loop from Hot Water Converter to Aux Building preheat coil and Aux building heating coil including Aux Building primary hot water heating pump, Aux building preheat coil pump, Aux building heating coil pump, and all valves and piping.

OPERM-606 Flow Diagram Air Conditioning and Cooling Water Flow Diagram
Abandon:
145-321 Aux Building AC Chiller Pump
162-081 Auxiliary Building AC Compressor and Crankcase Heater
155-131 Auxiliary Building AC Fan Coil Unit
Chilled water loop piping including expansion tank, pump, etc. from chiller to cooling coil in Aux AC FCU
SW-2360 through SW-2362, the Aux AC chiller condenser and back to SW-2365

E-257 Circuit Diagram 480 Volt MCC 1-35E & 1-45E
Abandon:
MCC35E-C4 to 1-592 Hot Chem Lab Hood Exhaust Fan Motor 1A and MD32365
MCC35E-A5 to 1-511 Aux Building Preheat Coil Hot Water Heating Pump Motor
MCC35E-A2 to 1-512 Aux Building Primary Water Heating Pump Motor
MCC-45E-A5 to 1-200 Aux Building AC Heating Pump Motor
MCC45E-C4 to 1-460 Aux Building AC Compressor Motor
MCC45E-B1 to 1-461 Aux Building AC Chiller Pump Motor
MCC35E-C7 to 1-230 Aux Building AC Fan Motor
Ensure Control Room Ventilation Abandoned prior to the following:
MCC45E-A3 to 1-285 Aux Building Toilet and Locker Room Exhaust Fan Motor

E-2350 Schematic Diagram, Fuse panel RR-172
Abandon:
Fuse 1 to SV-33272, SV-33567 and CV-31347

E-879 Lighting Panels, RPA1, RPA2, RPA3, RPA4, RPA5, RPA6
Abandon:
RPA 6, bkr 9 to Aux AC Roll Filter

OPERM-213-5 Flow Diagram Station and Instrument Air
Abandon:
IA-34002 to PC26006 and AAC-30

OPERM-213-7 Flow Diagram Station and Instrument Air System
Abandon:
IA-1321 to Control Cabinet Aux Building AC
IA-31162-1 and IA-31162-2 to TC-26308, TC-26314 and HS-341

Ensure Control Room Ventilation Abandoned prior to the following:
IA-34029 to CD34029/AAC1

OPERM-209-3 Flow Diagram Potable water
Abandon:
Ensure Control Room Ventilation Abandoned prior to the following:
PW-650 to Aux Building Hot Water Converter and Aux Building AC unit

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The air distribution ducts of AAC are provided with safety-related zone isolation dampers at all Zone SV barrier penetrations (Zone SV functions previously abandoned).

The AAC System has no active safety-related functions, except for Zone SV/Steam Exclusion dampers installed in duct penetrations through Zone SV and Steam Exclusion barriers (Steam Exclusion and Zone SV functions previously abandoned).

AAC shall support the station Fire Plan in maintaining the fire ratings of walls, floors or ceilings by being fitted with fire dampers at all fire barrier penetrations.

The AAC System shall provide a ventilation flow path to protect occupants of the Hot Chemistry Lab from the effects of airborne contaminants.

The AAC System shall provide a ventilation flow path from the Sample Room to protect occupants from the effects of airborne contaminants.

The AAC System shall provide cooling, heating, and humidification to occupied areas of the Auxiliary Building so that personnel may carry out their duties in a year round healthy and comfortable environment.

The AAC System shall provide a ventilation flow path through the Auxiliary Building Toilet and Locker Room to maintain a healthy environment for personnel.

Basis for Category

There is no significant discussion in the USAR or other basis documents related to the functioning of the Aux Building AC system.

The Zone SV and Steam Exclusion functions within the AAC system were previously abandoned.

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

Therefore the abandonment of the AAC system has no adverse effect.

Additionally all areas served by the Aux Building AC system shall no longer be occupied.

Regulatory Impact
See CR 1382 for screening

Plant Impact
No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 1-18-2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment does not a change the radioactive waste system (gaseous) and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRC review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

None

6.0 Assumptions/Open Items to be validated or dispositioned:

- Control Room & CAS Reheat Coil abandoned (CRAC abandoned)
- Aux Bldg Preheat Coil abandoned

7.0 Expected duration for SSC category if **NOT** ABANDONED:

NA complete abandonment

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Michael Townsend		1/22/18
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 1-22-18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 1-22-18
Type Of Review N/A	Name (Print) N/A	Approval Signature N/A	Date N/A

10.0 Review and Approval:

Brian O'Connell / ______ 1/22/18
Prepared By (Print/Sign) Date

MARK SIEVERT / ______ 1/22/18
Reviewed By (Screen Qual.) (Print/Sign) Date

TP OLSON ______ 1/25/18
Technical Support (Print/Sign) Date

William Swanson ______ 1/23/18
Concurrence by DSERT Coordinator (Print/Sign) Date

~~N/A~~ TP OLSON ______ 4/1/19
FSRG (Print/Sign), if required 19-004 Date

FSRG Meeting Number: ~~N/A~~ 19-004

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1.0 Doc Type: Report Revision No.: 0 Date: 2/7/18
Sub Type: DEC
Document Number (ID): SYS-17-1-DSERT
Title: ACA-Auxiliary Building Ventilation

1.1 Brief description or reason for revision: Partial abandonment to abandon all Fan Coil Units and one train of Auxiliary Building Exhaust. One train of Aux Building Supply and Exhaust shall remain available indefinitely.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: This is a partial abandonment of System 17, Auxiliary Building Ventilation (ACA) including fans, fan coil units, associated ductwork, dampers, and instrumentation. The B Train of Aux Building Supply and Exhaust along with the B train of Spent Fuel Pool (SFP) Sweep shall remain available. This abandonment plan should be coordinated with DC KW-16-02022 SAFSTOR III Ventilation, which will establish the SAFSTOR III ventilation configuration. The heating steam, instrument air, service water, and 480 volt system components associated with the abandoned portions of the ACA system shall also be abandoned as part of this DSERT package.

The following equipment shall remain available:

1B Aux Building Supply Fan
1B Aux Building Exhaust Fan
1B SFP Exhaust Fan
MD32360/ACA-1 and MD-32361/ACA-2 Elevator A Machine room ventilation dampers
All Fire Dampers,
Control dampers and ductwork associated with the available fans shall be available.
Pneumatic control shall be abandoned so auto dampers shall become manual dampers.

The following air operator damper actuators shall be abandoned. The abandonment is to be performed in conjunction with DC KW-16-02022 SAFSTOR III Ventilation. DC KW-16-02022 shall convert these dampers to manual dampers and the air operators can then be abandoned.

CD34024/ASV31B SFP Exhaust Fan B Boundary Damper
CD34021/ASV51B Exhaust Fan B Boundary Damper
CD34038/ACA3B Aux Building Supply Air Ventilation Fan B Discharge Damper

Boundary Dampers
CD34023/ASV-31A A SFP Exhaust Fan Discharge Damper, air supply abandoned
CD34022/ASV-51A A Aux Building Exhaust Fan Discharge Damper, air supply abandoned
CD34025/ASV-66 Toilet and Locker Room Exhaust Fan isolation Damper, air supply abandoned
CD34016/ASV30 ASV area to SFP Exhaust fan boundary damper, air supply abandoned damper repositioned shut

The following equipment shall be abandoned:
1A Aux Building Exhaust Fan
1A SFP Exhaust Fan
SFP Supply Fan
1D Aux Basement FCU
1B Aux Mezz FCU
1A Fan Floor FCU
Toilet and Locker Room Exhaust Fan

Solenoid valves
33265, 33266, 33281, 33420, 3326401, 3326402, 33419, 3326301, 3326302, 33421, 33267, 33258,

The following equipment was previously abandoned under SYS-17-DSERT rev 0.:
1A Aux Building Supply Fan
1A Aux Building Basement FCU
1B Aux Building Basement FCU
1C Aux Building Basement FCU
1A Aux Building Mezz FCU
1B Aux Building Fan Floor FCU
1A CRDM Room FCU
1B CRDM Room FCU
Charging Pump Room FCU
CCW Pump Room FCU
1A RHR Pit FCU
1B RHR Pit FCU

HRSR Exhaust Fan
HRSR Sampling Room Air Handling Unit
HRSR Condensing unit
Decon Room Exhaust Fan
Decon Room Ceiling Fan
132-477 Weld Shop Room exhaust fan

FE27175, FI18363, DPI11688, DPS16445, DPI11686, DPI11687, FI18361, FE27173, FI18360, FE27172, FE27176, FI18364, FE27174, FI18362, 16574, 16392, 16353, 16354, 16391, HD26341, HD26351, TE14172, TE14173, TE14152, TE14153, TE14148, TE14149, TE14150, TE14151, TE14178, TE14179, TE14180, TE14181, PI 17046, TE14158, TE14159, TE14182, TE14183, POS37053, POS37054, PS16147, TC20200, T22040, PS16147, TS16243, TS16244, PI11263,

Motor Operated Dampers – MD32000, MD32330, MD32331, MD32332, MD32333,

Solenoid Valves – SW851/33781, SW1261/33778, 33280, 33360, 33365, 33707, & 33713.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-601 Flow Diagram Turbine & Aux Building Ventilation

Maintain:
1B Aux Building Supply Fan
1B Aux Building Exhaust Fan
1B SFP Exhaust Fan
MD32360/ACA-1 and MD-32361/ACA-2 Elevator A Machine room ventilation dampers
Fire Dampers: ABV-FD1, ABV-FD2, ABV-FD3, ABV-FD4, ABV-FD5, ABV-FD6, ABV-FD7, ABV-FD8, ABV-FD9, ABV-FD10, ABV-FD11, ABV-FD-12, ABV-FD13, ABV-FD14, ABV-FD15, ABV-FD16, ABV-FD17, & ABV-FD18.

Abandon:
1A Aux Building Exhaust Fan
1A SFP Exhaust Fan
SFP Supply Fan
1D Aux Basement FCU
1B Aux Mezz FCU
1A Fan Floor FCU

OPERM-606 Flow Diagram Air Conditioning and Cooling Water Flow Diagram
Abandon:
Aux Mezz 1B FCU from SW1219B to SW1225

OPERM-588 Flow Diagram Air Cond. Cooling Water Piping
Abandon:
Aux Basement 1D FCU from SW1006D to SW100B
Aux Fan Floor 1A FCU from SW1016A to SW101B

E-254 Circuit Diagram 480V 1-35A, 1-35D, 1-45A, 1-45D
Abandon:
MCC35D-A3 to 1-453 SFP Supply Fan Motor

E-257 Circuit Diagram 480 Volt MCC 1-35E & 1-45E
Maintain:
MCC45E-D1 to 1-273 Aux Exhaust Fan 1B Motor
MCC45E-A6 to 1-311 Aux Supply Fan 1B Motor
MCC45E-E2 to 1-340 SFP Exhaust Fan 1B Motor
Abandon:
MCC35E-D4 to 1-272 Aux Exhaust Fan 1A Motor
MCC35E-E2 to 1-339 SFP Exhaust Fan 1A Motor

E-258 Circuit Diagram 480 Volt MCC 1-62A, 1-52F, 1-52B
Abandon:
MCC52F-D6 to 1-1082 Aux Fan Floor 1A FCU

E-259 Circuit Diagram 480V MCC1-62D & 62E
Abandon:
MCC62E-J7 to 1-136 Aux Mezz FCU 1B Motor
MCC62E-G4 to 1-1085 Aux Basement FCU 1D Motor

OPERM-213-5 Flow Diagram Station and Instrument Air System
Abandon:
IA34024 to CD34024/ASV31B
IA34023 to CD34023/ASV31A
IA34022 to CD34022/ASV51A
IA34021 to CD34021/ASV51B
IA34025 to CD34025/ASV66
IA34016 to CD34016/ASV30

OPERM-213-6 Flow Diagram Station and Instrument Air System
Abandon:
IA1450 to Aux Building Supply Vent Control Cabinet, CD-34038/ASV3B, CV31313 and CV31314

E-2350 Schematic Diagram Fuse Panel RR172

Abandon:

Fuse FUG3 to SV33281

Fuse FUG4 to SFP Exhaust Filter 1A and 1B Deluge valves

E-2351 Schematic Diagram, Fuse Panel RR172

Abandon:

Fuse FUG9 to 33265, 33266, 33258

Fuse FUG10 to numerous ASV damper indicating lights

E-2343 Schematic Diagram, Fuse panel RR175

Abandon:

Fuse FUG26 to 33416, 33417, 33418, 33419, 33420, 33421, 33425, 33426, 33427, 33428

E-2328 Schematic Diagram, Fuse panel RR-170

Abandon:

Fuse FUG24 to 3326101, 3326102, 3326201, 3326202, 3326301, 3326302, 3326401, 3326402, 3326801, 3326802, 3327001, 3327002, 33271, 33267, 33259, 33260, 33328, 33329, 33366, 33254

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The ACA System shall provide emergency cooling to areas containing equipment required for safe shutdown and accident mitigation of limiting events. The ACA System shall provide sufficient cooling to maintain the following areas below the EQ limit for equipment reliability:

Auxiliary Building Basement, Auxiliary Building Mezzanine, Auxiliary Building Fan Floor, RHR Pump Pits, and CRDM Equipment Room.

The ACA shall support the station Fire Plan in maintaining the fire ratings of walls, floors or ceilings by being fitted with fire dampers at all fire barrier penetrations.

The Spent Fuel Pool Sweep Ventilation Sub-System (SFP) shall support all fuel handling operations and movements of heavy loads over the SFP when it contains irradiated fuel of less than 30 days old.

The ACA System shall provide ventilation for the High Radiation Sample Room to maintain comfortable conditions and to protect personnel from the effects of airborne contaminants.

The ACA System shall maintain a negative pressure in the Auxiliary Building, with respect to atmosphere, and direct the air flow from areas of low contamination through areas of progressively higher contamination.

The ACA System shall provide a supply of outdoor ventilation air and cold weather heating to the Auxiliary Building to maintain space temperatures within acceptable limits for the operation of critical equipment.

During normal operations, the ACA System shall provide a ventilation flow path across the SFP to exhaust vapors evaporating from its surface.

The ACA System shall provide a means of ventilation of the Heating Boiler Room.

Basis for Category

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no specified function in meeting a regulation or in the prevention or mitigation of an accident. Although there is no specified requirement to maintain ventilation or a negative pressure in the Auxiliary Building, parts of the ACA system will remain available to support radiological monitoring as described below.

The requirements for controlling, monitoring and reporting radioactive effluent releases are contained in several regulations, including 10CFR20, 10CFR50, and 40CFR190. The NRC has supplemented these regulations with Regulatory Guides 1.109 and 1.21, and NUREGs 0472, 0133, and 0543. ANI Section 5.1 lists the nuclear insurance requirements related to radioactive effluent monitoring. These regulatory and ANI requirements will remain applicable until the 10CFR50 license is terminated and all radioactive materials are removed from the site.

Maintenance of negative pressure in the RCA is not specifically stated in the regulatory and insurance requirements, however, the ability to accurately and consistently monitor and control gaseous radiological releases at background levels of detection depends on it. Compliance with radioactive discharge concentration limits and doses to members of the public offsite, although very small, requires accurate determination of radioactivity concentrations and release rates during normal and abnormal conditions. Using continuous ventilation and negative pressure, with the discharge flow through a monitored Auxiliary Building vent stack, assures that release rates are accurately and consistently determined and continue to meet regulatory and insurance requirements described above.

Regulatory Impact
See CR 1382 for screening

Plant Impact
No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 1-7-2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact the ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment changes the radioactive waste system (gaseous) by abandoning one train of the Aux Building Ventilation filtration System. Therefore the requirements of ODCM 15.1 apply **(e.g., FSRG review is required and it is to be reported to the NRC in the Annual Radioactive Effluent Release Report.)**

5.0 Special conditions to support categorization(s):

This abandonment Plan should be worked in conjunction with DC KW-2016-02022 SAFSTOR III Ventilation.

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **<u>NOT</u>** ABANDONED:

The System is expected to remain available indefinitely until the Auxiliary Building is decommissioned.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Michael Townsend		2/8/18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 2/27/18
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 2-9-18
Type Of Review	Name (Print)	Approval Signature	Date

10.0 Review and Approval:

BRIAN O'CONNELL / 2/8/18
Prepared By (Print/Sign) Date

MARK SIEVERT / 2/12/18
Reviewed By (Screen Qual.) (Print/Sign) Date

William Zipp 2/8/2018
Technical Support (Print/Sign) Date

William Swanson 2/26/18
Concurrence by DSERT Coordinator (Print/Sign) Date

TP OLSON / 2/27/18
FSRG (Print/Sign), if required Date

FSRG Meeting Number: 18-003

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1.0 Doc Type: Report Revision No.: 0 Date: 1/31/2018
Sub Type: DEC
Document Number (ID): SYS-18-1-DSERT
Title: Reactor Building Ventilation

1.1 Brief description or reason for revision:
This revision moves the A CFCU Service Water return line boundary from SW-903A to SW-902A. This allows the actuator 32060 to be removed from SW-903A Service Water Return Header Motor Operated Valve.
Cntmt FCU A and Dome Fan A will be abandoned. This will complete abandonment of RBV.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:
This is a complete functional abandonment of the remaining portions of System 18, Reactor Building Ventilation System (RBV) including the 1A Containment Fan Coil Unit (CFCU), Containment Dome Vent Fan A and associated ductwork, including dampers and instrumentation. This shall be a complete abandonment of RBV.

Service Water supports the RBV system and shall be isolated from the 1A Containment Fan Coil Unit as indicated in Section 3.

The 480 volt system supports the RBV system and shall be isolated as indicated in Section 3.
The instrument air system supports the RBV system. The instrument air system shall be isolated from the RBV system to individual components as indicated in Section 3.
The following instrument boundaries were abandoned along with their respective sensing lines, thermo wells etc:

H-28010, TE-15127, TE-13189, TE-15187, TE-13069

The following damper acts as a boundary damper:

TAV-11 Turbine Building Air Damper to RBV System

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-602 Reactor and Shield Building Ventilation

Abandon:

Containment Fan Coil Unit A along with its associated ductwork to the reactor coolant pump vault 1B, reactor building 606' and 592' elevations, CD-34187 and RBV-150A.

Containment Dome Vent Fan A will be abandoned.

OPERM-403 Flow Diagram Reactor Building Vent. System Post LOCA Hydrogen Control

Abandon:

Vent flow path through LOCA-2B, LOCA-100B to Aux Building Exhaust up to LOCA-3B and LOCA-10B.
Complete abandonment

OPERM-213-6 Flow Diagram Station and Instrument Air System

Abandon:

IA-1453 Manual Isolation to LOCA-100B

OPERM-547 Flow Diagram Service water System Containment Cooling

Abandon:

Service Water piping for CFCU A from SW-900A to SW-902A.

E-235 Circuit Diagram 480V SWGR Safeguard Buses

Abandon:

Breaker 15105 to A CFCU Fan motor 1-120

E-258 Circuit Diagram 480V MCC 1-52A, 1-52F, 1-52B

Abandon:

Breaker MCC52B-A3 to 1-583 Containment Dome Fan A.

E-260 Circuit Diagram 480V MCC 1-52C, 1-52E, 1-62C

Abandon:

Breaker MCC52E-F5 1-394, SW-903A MOV

E-2906 Schematic Diag, Fuse panel RR 171 DC Safeguard 5

Abandon:

Fuses FUG 44 to SV33809, Note: fuses previously pulled drawing to be updated.
Fuses FUG 45 to SV33810
Fuses FUG 46 to SV33750, SV33751

E-2331 Schematic Diag, Fuse panel RR 170 AC Safeguard 5
Abandon:
FUG 15 to MD32348

E-2332 Schematic Diag, Fuse panel RR 170 AC Safeguard 5
Abandon:
FUG 18 to Relay 52X/15104

E-2327 Schematic Diag, Fuse panel RR 170 AC Safeguard 5
Abandon:
Fuses FUG 34 to SV33789
FUG 38 to SV33815

E-3335 Schematic Diag, Fuse Panel RR172 AC Safeguard 1
Abandon:
FUG 55 to SV-33395

E-2341 Schematic Diag, Fuse panel RR-175 AC Safeguard 6
Abandon:
Fuses FUG 15 to MD32349

E-2344 Schematic Diag, Fuse panel RR175 AC Safeguard 6
Abandon:
Fuses FUG 36 to SV33035
Fuses FUG 37 to SV33788
Fuses FUG 38 to SV33814

E-2932 Schematic Diag – Fuse panel 176 DC Safeguard 6
Abandon:
Fuses FUG 42 to SV33752, SV33753
Fuses FUG 44 to SV33811
Fuses FUG 45 to SV33812

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The RBV System shall provide cooling and ventilation to the Containment to ensure that temperature, pressure, and air quality are maintained within acceptable limits to support operability of equipment and safety and comfort of personnel during refueling and maintenance activities.

The RBV CFCU Subsystem shall provide Post-LOCA cooling to the Containment to control temperature and pressure within design basis requirements.

The RBV CFCU Emergency Discharge Dampers shall automatically open when containment pressure exceeds 3.85 psig.

The RBV Purge and Vent Subsystem four CIVs shall automatically close upon receipt of a containment isolation signal.

The Containment Vacuum Relief Subsystem shall prevent damage to the Containment vessel from negative pressure inside the Containment.

RBV CFCUs A and B support safe shutdown following an Appendix R Fire Event in the Dedicated Zone. CFCUs C and D support safe shutdown following a fire in the Alternate Zone.

The RBV Post-LOCA Hydrogen Control Subsystem shall provide a means of preventing hydrogen concentration in containment from exceeding 3.5 percent.

The RBV CFCU Subsystem shall provide cooling to the Containment general space and the RC Pump Vaults so that the Containment environment is maintained within the limits of acceptability to support operability of equipment required to control reactor operation.

Basis for Category

On February 25, 2013, DEK submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. Upon docketing of the subsequent certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii), the 10 CFR Part 50 license will no longer authorize KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

The basis for the abandoned category for the Reactor Building Ventilation (RBV) is determined by the following criteria:

The RBV is not required:
1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. To prevent or mitigate the consequences of a Fuel Handling Accident or Gas Decay Tank rupture.
3. For safe storage and handling of radioactive waste or spent fuel.
4. To support Technical Specifications, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, or other commitments. Provide support of the Spent Fuel Safety Management Program, or radiological effluent monitoring.
5. To support the execution of plans and programs of Kewaunee Power Station.
6. Support day to day operations in the decommissioning plant.
7. Support plant decommissioning efforts.

Regulatory Impact

TECHNICAL SPECIFICATIONS Rev 220

Technical Specifications Rev 220 has no requirements for the RBV system.

TECHNICAL REQUIREMENTS MANUAL (TRM) Rev 70

TRM Rev 70 has no requirements for the RBV system

USAR Rev 26

5.4 CONTAINMENT VESSEL AIR HANDLING SYSTEM
The Reactor Building Ventilation (RBV) System originally consisted of a total of eight subsystems. Two subsystems remain partially in service, the balance of subsystems having been abandoned. Only the subsystems remaining in service will be described in this chapter.

The Containment Vessel Air Handling System consists of two of these RBV subsystems as follows:

The Containment Vessel Air Cooling Subsystem is considered part of the Containment Vessel Air Handling System and cools the air inside the Reactor Containment Vessel. One containment fan coil unit is available to cool the Reactor Containment Vessel. The fan coil unit is connected to ductwork which distributes the cool air to the reactor coolant pump vaults, the ring duct above the refueling floor and various other floor levels in Reactor Containment Vessel. The Containment Dome Ventilation Subsystem employs a single fan to pull air from the Reactor Containment Vessel dome through separate fan inlet ducts and discharge the air in the area above the operating level of containment. The containment fan coil unit then cools the dome air and returns it to the containment.

5.4.1 Design Conditions
The function of the Air Cooling System is to remove heat from inside the Reactor Containment Vessel.
5.4.1.1 Design Basis
The fan-coil unit of the Containment Air Cooling System is utilized to distribute air adequately over equipment and around occupied spaces for ventilation service. Operation of motors and other electrical equipment in the containment will provide heating within the Reactor Containment Vessel when required.
5.4.2 System Design
The Containment Vessel Air Handling System is shown in Figure 5.4-1. The Containment Air Cooling System consists of one fan-coil unit located in the Reactor Containment Vessel. The fan-coil unit will recirculate and cool the Reactor Containment Vessel atmosphere. The fan-coil unit uses service water as the heat removal medium and discharges the cooled air through ducts to provide adequate distribution.

6.0 Engineered Safety Features

6.3 CONTAINMENT AIR COOLING SYSTEM
6.3.1 Design Basis
6.3.1.1 Containment Heat Removal Systems
Adequate heat removal capability for the containment is provided by the Containment Air Cooling System.

The Containment Air Cooling System was originally designed to cool the containment atmosphere in the event of a design basis loss-of-coolant or main steam line break accident. KPS has permanently ceased operation. Therefore, the Containment Air Cooling System is now operated, as needed, to maintain the containment environment suitable for personnel access and the long term SAFSTOR of the station. Containment Air Cooling no longer has a containment pressure limiting/reducing function.

6.3.2.1 Containment Air Cooling System Characteristics
The Containment Air Cooling System consists of a fan-coil unit, a duct distribution system, four emergency discharge dampers and the associated instrumentation and controls. The heat sink for the fan coil unit is provided by the Service Water System.

6.3.2.2 Actuation Provisions
The fan coil unit has a flow rate capacity of 44,000 cfm under normal conditions.

Overload protection for the fan motor is provided by an overcurrent trip device. The breaker for the fan motor can be operated manually from the control room.

The motor of the fan coil unit is rated 125 hp. Short circuit and overload protection is provided in the feeder breaker for the motor.

Resistance Temperature Detectors (RTDs) are located in the ductwork, including one downstream of the Containment Fan Coil Unit. Temperature indicators and temperature alarms are provided in the control room.

6.3.2.3 Flow Distribution and Flow Characteristics
The duct distribution system is designed to promote good mixing of the containment air and ensures that the recirculated cooled air will reach all areas. The distribution system is represented schematically in Figure 5.4-1.

The system includes a ring header and branch ducts to the primary compartments for distribution of cooled air from the fan-coil discharge. The cooled air is circulated upward from the lower primary compartments, through the steam generator compartments to the operating floor level.

The fan-coil unit has an emergency discharge damper (permanently "failed" open) installed in its discharge duct at the operating floor level.

Table B Classification of Systems and Components

- Safeguards Fan Coil Units I

Reactor Building Ventilation System

- Containment Purge and Vent System (Containment Isolation Valves are Class I) III
- Containment Dome Fans I*
- Post-LOCA Hydrogen Control System (Containment Isolation Valves are Class I) III
- Containment Vacuum Relief System I*
- Containment Fan Coil Units (includes fans, coils, and housings) I*
- CRDM Shroud Cooling System II
- Reactor Gap and Neutron Detector Cooling System (excluding Class I piping segment in the reactor cavity) II
- Reactor Support Cooling System II

On February 25, 2013, DEK submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. Upon docketing of the subsequent certification for permanent removal of fuel from the reactor vessel pursuant to 10 CFR 50.82(a)(1)(ii), the 10 CFR Part 50 license will no longer authorize KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

LICENSING COMMITMENTS

A search of licensing commitments using the following file path "S:\KEWAUNEE\4\DATA1\LICENSING\Commitments\COMTRAKS\TRUECOMMITMENTS\ALL TRUE Commitments by Number" did not identify any open commitments related to the Reactor Building Ventilation System

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics or Insurance requirements.

This abandonment of the remaining portions of the Reactor Building Ventilation system is not a major change to the radioactive waste system (gaseous) and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRC review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

Plant Impact

The abandonment of the RBV system shall eliminate all installed HVAC from containment.

The upper containment hatch is to remain open to the Auxiliary Building. Auxiliary Building ventilation will remain inservice to provide a negative pressure in containment relative to the environment. The Aux Building Ventilation will monitor any radioactive release through the Aux Building Vent Stack.

Portable equipment will be used to maintain containment above freezing and maintain containment habitable.

There is no impact on any temporary changes as of 8/29/2017.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact the ISFSI therefore does not require FSRC approval.

5.0 Special conditions to support categorization(s):

None

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

NA

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required NA
- Proposed DUs for appropriate drawings Attached

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Brian VkLeman		1/31/2018
Type Of Review	Name (Print)	Approval Signature	Date
Radiation Protection	Daniel J. Shannon		1-31-18
Type Of Review	Name (Print)	Approval Signature	Date
Security	Brian Presl		1-31-18

10.0 Review and Approval:

Brian O'Connell
Prepared By (Print/Sign) — Date: 1/31/2018

MARK SIEVERT /
Reviewed By (Screen Qual.) (Print/Sign) — Date: 1/31/2018

TP OLSON /
Technical Support (Print/Sign) — Date: 2/1/18

Rick Smythe
Concurrence by DSERT Coordinator (Print/Sign) — Date: 2-1-18

~~N/A~~ TPOLSON /
FSRG (Print/Sign), if required 19-004 — Date: ~~N/A~~ 4/1/19

FSRG Meeting Number: ~~N/A~~ 19-004

1.0 Doc Type: Report Revision No.: 0 Date: 8/6/2017
Sub Type: DEC
Document Number (ID): SYS-21-DSERT
Title: Spent Fuel Pool Cooling System

1.1 Brief description or reason for revision: Abandonment of Spent Fuel Pool and Spent Fuel Pool Cooling.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:

Spent Fuel Pool Cooling and Cleanup System (SFP).

The Spent Fuel Pool Cooling System will be abandoned, as it is no longer required to be available to perform functions and/or provide support for the safe storage and handling of spent fuel.

The following instrument boundaries will be abandoned along with their respective sensing lines: PI-11073, PI-11074, DPI-11305, DPI-11306, DPI-11015, PI-11030, DPI-11055, TI-12007, TI-12088, TI-12012, TC-16311, LT-24091, LT-24092, and DPI-11014.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-218, Flow Diagram Fuel Pool Cooling and Clean-Up System
Abandoned (Red):
Everything identified on this drawing is being abandoned, except for Emergency SW Makeup to SFP. Complete drawing.

XK-100-36, Chemical and Volume Control System
Abandoned (Red):
Piping to and from SFP, including CVC-410. Complete drawing.

E-258, Circuit Diagram 480V MCC 1-52A, 1-52F, & 1-52B
Abandoned (Red):
Spent Fuel Pool Pump A, MCC-52B, B3

E-259, Circuit Diagram 480V MCC 1-62D, & 1-62E
Abandoned (Red):
Spent Fuel Pool Pump B, MCC-62E, G1

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The purpose of the Spent Fuel Pool (SFP) Cooling and Cleanup System is to remove decay heat from the spent fuel, filter and demineralize the water in the spent fuel pools, maintain boron concentration as required in the SFP water, and maintain the SFP temperature below a maximum temperature of 150 deg F.

The spent fuel pool currently has storage locations for 990 fuel assemblies in high-density storage racks in the North and South Spent Fuel Pools. Additional high-density storage racks, with spaces for 215 additional fuel assemblies have been added in the North Canal Pool.

The basic SFP System components for normal cooling and cleanup of the spent fuel pools include:

SFP Liners

SFP Pumps A and B

SFP Filters A and B

SFP Heat Exchanger (HX)

Associated valves, piping and instrumentation.

Each SFP pump supplies about 1/2 the total design flow of the SFP heat exchanger tube side.

The purification and cleanup components consist of:

SFP Demineralizer (Demin.) Prefilter

SFP Demin.

SFP Demin. Post-Filter

Refueling Water Purification Pump

Associated piping, manual valves, and instrumentation

Redundancy of the components used in this system is not required because of the large heat absorption capacity of the water in the spent fuel pools. If one SFP pump should fail, the remaining duplicate pump can handle the heat load. Since the possibility of failure of the SFP heat exchanger exists, the Residual Heat Removal heat exchanger can be used as a backup by diverting SFP coolant through existing interconnections.

The return lines discharge into the pools above the top of the fuel. Loss of coolant from the spent fuel pools by line failure and subsequent siphon action is prevented by installation of check valves. The SFP suction piping connects to the SFP well above the fuel assemblies to prevent loss of cooling or shielding due to a system failure. The spent fuel racks are designed with neutron absorbing plates between the storage cells. The racks in pools A and B contain boron carbide plates. The Canal Racks contain Boral plates. The neutron absorbing plates prevent criticality with non-borated water in the pools. A leak detection system is installed and allows checking the liner welded seams for leaks.

Basis for Category

The Spent Fuel Pool Cooling and Cleanup system, including the RWST, is being abandoned, as it does not support any of the functions below due to the following reason:

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. Fuel Handling Accident as defined in Updated safety Analysis Report (USAR).
3. For safe storage and handling of radioactive waste or spent fuel.
4. The Requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other commitments, safe storage of spent fuel, or support of the Radiological Effulent Monitoring / Offsite Dose Calculation Manual for KPS.
5. The requirement of SSCs that support the execution of plans and programs at KPS(e.g. Security Plan, Fire Protection Program, Emergency Management Plan, Radiation Protection Program).
6. Support day to day operations in the decommissioning plant.
7. Support decommissioning efforts.

Regulatory Impact

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

Plant Impact

Updated Safety Analysis Report (USAR)

1.3.2 Nuclear and Radiation Controls (GDC 17 - GDC 18)
2. Monitoring Fuel and Waste Storage

1.3.3 Fuel and Waste Storage Systems (GDC 66 - GDC 69)
1. Prevention of Fuel Storage Criticality
2. Fuel and Waste Storage Decay Heat
3. Fuel and Waste Storage Radiation Shielding
4. Protection Against Radioactivity Release From Spent Fuel and Waste Storage

1.8 ATOMIC ENERGY COMMISSION (AEC) GENERAL DESIGN CRITERIA
I. Overall Plant Requirements
Criterion 3 - Fire Protection
Criterion 66 – Prevention Of Fuel Storage Criticality
Criterion 67 – Fuel and Waste Storage Decay Heat
Criterion 68 – Fuel and Waste Storage Radiation Shielding
Criterion 69 – Protection Against Radioactivity Release From Spent Fuel and Waste Storage
Withheld under 10 CFR 2.390 (d) (1)

5.2.1.3 Fuel Transfer Penetration
The fuel transfer penetration provided is for fuel movement between the reactor refueling cavity in the Reactor Containment Vessel and the spent fuel pool. This penetration consists of a 20-inch stainless steel pipe installed inside a 24 inch pipe. The inner pipe acts as the transfer tube and is fitted with a testable double-gasketed blind flange in the reactor refueling cavity. A standard, normally closed gate valve in the spent fuel pool canal is also provided to isolate the refueling cavity from the spent fuel pool. This arrangement prevents leakage through the transfer tube. The outer pipe is welded to the Reactor Containment Vessel. Bellows expansion joints are provided between the two pipes to compensate for any differential movement.

8.1.1.1 Performance Standards
All electrical systems and components vital to Spent Fuel Pool Emergency Makeup (i.e., Service Water), including the Diesel Generators (DGs) are designed to Class I* standards so that their integrity is not impaired by the Design Basis Earthquake. Similarly, they are designed so that their operation will not be impaired by tornado imposed loads.

8.1.1.2 Emergency Power
Note: There no longer remain safety-related, engineered safety feature, or engineered safeguards electrical loads or buses. However, those buses providing electrical power to emergency fuel pool makeup or fire protection features may still be referred to as "safety buses."

The emergency power systems as designed meet the intent of the 10 CFR 50, Appendix A, GDC 17, adopted February 20, 1971, as amended July 7, 1971.

The intent of GDC 17 is twofold:
• Avoid the risk associated with immediate controlled shutdown.
• Minimize the risk associated with this level of electrical degradation by limiting the operating time (in the applicable technical specification LCO modes) and by limiting activities that could cause an "inadvertent plant shutdown" (Reference 1).

Each element of the intent of the GDC addresses risks predicated upon OPERATION of the reactor. Therefore, the INTENT of the GDC was achieved when the station was permanently shut down and Dominion Energy Kewaunee, Inc. (DEK) lost the legal authority to place fuel within the reactor vessel (by virtue of having submitted the certification of permanent cessation of operation per the requirements of 10 CFR 50.82).
The risk associated with an immediate controlled shutdown has been eliminated. The risk related to a level of electrical degradation that was minimized by limiting "operating time" has been eliminated when the unit was permanently shut down. The risk associated with an "inadvertent plant shutdown" was also eliminated because the reactor may no longer be operated.

This ensures that the intent of GDC-17 has been achieved by the station when the station achieved safe shutdown of the unit, transferred all fuel to the Spent Fuel Pool (SFP), and certified that the reactor was permanently defueled – and thereby became legally prohibited from placing fuel in the reactor, and thereby legally prohibited from operating the reactor.
Independent alternate power systems are provided with adequate capacity to supply Spent Fuel Pool emergency makeup, Spent Fuel Pool Cooling, Fire Protection, and building heating loads.

The plant is supplied with normal, standby and emergency power sources as follows:
1. The main source of auxiliary power is supplied from the American Transmission Company's
138 kV and 345 kV transmission systems. The reserve auxiliary and tertiary auxiliary transformers can both be powered from either transmission system through the interconnecting auto transformer.
2. Two diesel generators are connected to the safety buses to supply emergency power in the event of loss of all other ac auxiliary power.
3. Emergency power for instruments and for control is supplied from two 125V dc station batteries.

Note prior to section 8.2.2: *Withheld under 10 CFR 2.390 (d) (1)*
Thus, given an undetected failure, the capability to clear and restore off-site power to the Kewaunee plant will not be lost, and the restoration of off-site power (assuming the grid is available) will be made within the time period (seven days) in which the plant can be

maintained in a safe condition without off-site ac power. Assessments have shown that in excess of 15 days is available to establish SFP makeup capability before evaporation will lower SFP inventory to ≥ 3 feet above the stored fuel (Reference 10).

CHAPTER 9 AUXILIARY AND EMERGENCY SYSTEMS

The Auxiliary and Emergency Systems are supporting systems required to insure the safe operation or servicing of the Spent Fuel Pool Cooling, Fire Protection, and related support systems.

The systems considered in this Section are:

• Auxiliary Coolant System

This system provides for transferring heat from stored irradiated fuel and other selected heat loads to the Service Water System and consists primarily of the following two systems:

a. The Spent Fuel Pool Cooling System removes the heat generated by spent fuel elements stored in the spent fuel pool.

b. The Component Cooling System removes heat from the RHR System when the 1A RHR Heat Exchanger is placed in service to support Spent Fuel Pool Cooling.

• Fuel Handling System

This system provides for handling fuel assemblies, Rod Cluster Control Assemblies (RCCAs) and material irradiation specimens.

9.3.1 Design Basis The Auxiliary Coolant System consists of two systems the Component Cooling System and the Spent Fuel Pool Cooling System as shown in Figure 9.3-1 through Figure 9.3-4.

9.3.1.3 Spent Fuel Pool Cooling System The Spent Fuel Pool Cooling System (SFPCS) is designed to remove the decay heat from the spent fuel assemblies stored in the SFP, maintain the SFP water temperature below a maximum temperature of 150°F, and maintain the SFP cooling function during a seismic event. The current licensing requirement is to maintain the maximum bulk temperature of the SFP water below150°F for all scenarios. Maintaining the SFP bulk temperature at 150°F or less is consistent with the current operation and design of the SFPCS components, piping, instrumentation and controls, as well as the SFP structure.

Before the Stretch Power Uprate (SUR), the design of the SFPCS was adequate to maintain the SFP water temperature below 150°F with the maximum number of fuel assemblies (1205) stored in the pool (Reference 1 and Reference 2). The SUR increased the core power level from 1650 MWt to 1772 MWt. Since the decay heat rate of the spent fuel is a function of the core power level, the SFP cooling duty heat load increased following SUR. This increase resulted in higher heat loads transferred to the Service Water System (SWS) and increased the operating temperatures in the SFP.

SFP heat load calculations performed for SUR were showing that when using a set of conservative assumptions (i.e., a service water temperature of 80°F, initial pool temperature of 120°F, 5 percent tube plugging of the SFPCS heat exchanger, a completely full SFP, and full core off-load to the pool at 168 hours), the resulting SFP temperature was calculated to be approximately 163°F. Further analysis, considering a loss of the SFPCS, determined the SFP water temperature will rise from163°F to the boiling point of 212°F in about 5.25 hours; whereas, it would take about 6.5 hours for the SFP water to reach 212°F from 150°F. For the worst-case scenario, the boil-off rate of the SFP water is 42 gpm. It was determined that with a service water temperature of 66.7°F, the SFP temperature would not exceed 150°F assuming all other conservative assumptions (Reference 3).

Due to the conservatism in the heat load calculations and the remote probability that the maximum allowable service water temperature and 5 percent plugging of SFP Heat Exchanger tubes would occur simultaneously and coincident with a full core offload, a heat load calculation is performed each time prior to fuel movement to the spent fuel pool that more accurately bounds the conditions seen at core offload. This calculation, based on expected service water temperature and SFP heat exchanger performance capability, will determine the adequacy of the SFP cooling capability and incore hold time (ICHT). Additional cooling is available from the "A" RHR Heat Exchanger through existing piping and valving arrangements. The current minimum ICHT is 100 hours as shown in the Technical Requirements Manual. Due to changes implemented during the SUR, the cycle-specific decay heat load calculation is now the controlling method for ensuring the adequacy of the SFPCS prior to core offload to the SFP (Reference 3 and Reference 4).

Since there is a large capacity for heat absorption in the spent fuel pool, active system components are not redundant. Alternate cooling capability can be made available under anticipated malfunctions or failures.

In addition to the cooling mode, the system contains provisions for full flow filtering and for demineralization of a portion of the main circulation flow.

The spent fuel pool cannot be drained as a result of component failure due to valving and piping arrangements.

9.3.1.4 Codes and Classifications All piping and components of the Auxiliary Coolant System are designed to the applicable codes listed in Table9.3-4. Carbon steel is used in the Component Cooling System since the component cooling water contains a corrosion inhibitor. Austenitic stainless steel is used throughout the RHR and the Spent Fuel Pool Cooling Systems.

9.3.2.3 Spent Fuel Pool Cooling System The Spent Fuel Pool Cooling System consists of two half-capacity pumps, a heat exchanger, two half-capacity filters, a demineralizer with pre- and post-filters, and associated piping, valves, and instrumentation. The spent fuel pool pumps draw water from the pool, circulate it through the filters and heat exchanger, and return it to the pool. Redundancy of this equipment is not required because of the large heat capacity of the spent fuel pool. If one of the two pumps should fail, the remaining pump could easily handle the heat load. If a pump should fail while spent fuel assemblies are stored in the pool, sufficient time exists to either repair the failed pump or to connect a temporary pump in the system. Heat exchanger failure is not considered to be likely; however, tube plugging is a short-term operation and can be accomplished before a significant increase in pool temperature occurs. Alternate cooling provisions are available from the 1A RHR heat exchanger through existing piping and valving arrangements.

The clarity and purity of the spent fuel pool water is maintained by passing the full cooling flow through the two half-capacity filters. Each filter is capable of removing particulates down to 15 microns in size. In addition, approximately 10 percent of the cooling flow is passed through a purification loop consisting of a pre-filter, demineralizer, and post-filter, and then is returned to the spent fuel pool.

The spent fuel pool pump suction lines are located well above the fuel assemblies and a system failure cannot result in loss of pool water. The return lines enter the pool above the top of the fuel assemblies and the lines contain check valves at the point of entry into the pool shielding concrete. Thus, line failure outside of the spent fuel pool cannot cause a loss of pool water due to siphon action.

Since the full spent fuel pool cooling flow is drawn from the pool surface through adjustable skimmer boxes, the Spent Fuel Pool Cooling System also serves as a skimming system, since the full cooling flow is filtered.

The refueling water purification pump is used to circulate water from the RWST through the purification loop of the Spent Fuel Pool Cooling System and back to the tank. This provides water cleanup capability following fuel handling.

9.3.3.3 Spent Fuel Pool Cooling System Components Design parameters for the Spent Fuel Pool Cooling System components are presented in Table9.3-3. In addition to the design service water temperature condition of 66°F, the Spent Fuel Pool Cooling System has been analyzed and determined to be acceptable for elevated service water temperatures of up to 80°F (see Reference 1 and Reference2).

9.3.3.3.1 Spent Fuel Pool Heat Exchanger The spent fuel pool heat exchanger is of the shell and horizontal U-tube type with tubes welded into the tube sheet. Spent fuel pool water circulates through the tube side and is cooled by the service water flowing through the shell side. The shell material is carbon steel and the tube and head material is austenitic stainless steel.

9.3.3.3.2 Spent Fuel Pool Pumps Two single-stage horizontal, end suction, centrifugal 50 percent capacity pumps circulate spent fuel pool water for cooling and purification. Pump operation is manually controlled from the Control Room. The spent fuel pumps are powered from independent safety buses. (Reference 5) All wetted surfaces of the pumps are austenitic stainless steel.

9.3.3.3.3 Spent Fuel Pool Filters Two 50 percent capacity filters remove particulate matter down to 15microns from the total spent fuel pool cooling flow. The filter vessel is constructed of austenitic stainless steel.

9.3.3.3.4 Spent Fuel Pool Demineralizer The spent fuel pool demineralizer is sized to pass approximately 60 gpm of the circulation flow and to provide adequate purification of the fuel pool for unrestricted access to the working area.

9.3.3.3.5 Spent Fuel Pool Valves Manual stop valves are used to isolate equipment and lines. Flow control is provided for the purification loop. A self-contained constant flow control valve maintains a constant purification flow. Valves in contact with the spent fuel pool water are austenitic stainless steel.

9.3.3.3.6 Spent Fuel Pool Piping All piping in contact with the spent fuel pool water is austenitic stainless steel. The piping is welded except where flanges are provided to facilitate maintenance.

9.3.4.1.3 Spent Fuel Pool Cooling System This manually controlled system may be safely shut down for reasonable time periods for maintenance or replacement of malfunctioning components. The components are designed to the codes given in Table 9.3-4.

9.3.4.2.3 Spent Fuel Pool Cooling System If leaking fuel assemblies are in the spent fuel pool, a small quantity of fission products may enter the pool water. The purification loop is provided to remove these fission products in order to maintain low water radioactivity levels.

The probability of inadvertently draining water from the spent fuel pool is essentially zero. Since the pump suction connections extend no more than 2 feet below normal water level, there is no possibility of inadvertently draining pool water below that level. Also, the pool water return lines enter the pool above the top of the fuel assemblies and contain check valves at the point of entry into the pool shielding concrete. Therefore, draining the pool below the level of the fuel by a siphon effect is not possible.

The results of the natural circulation analysis indicate that sufficient margin exists to bulk fluid boiling following a loss of forced flow with a full core offload (Reference 1). Both temperature and level indicators in the pool would alert the operator to a loss of cooling. Local and remote alarms are provided for spent fuel pool level. A remote alarm is provided for spent fuel pool temperature. This allows the operator to take corrective measures to restore cooling capability to the spent fuel pool-cooling loop. Complete loss of heat removal capability is not considered credible since there are two 50 percent capacity pumps available and alternate cooling provisions can easily be made with a RHR heat exchanger. In the event the entire core has to be unloaded and stored, and one pump is out of service, two Nuclear Safety Design Class I* sources of makeup water (the RWST and a 6" service water supply line) are available to provide the necessary alternate SFP makeup cooling capability until the failed pump is placed into service. One pump may not have been able to remove the heat load under a worst-case refueling cycle scenario. In an event of a total loss of the SFP cooling system function, alternate standby cooling is provided by evaporative cooling process. (Reference 6)

9.3.4.3.2 Spent Fuel Pool Cooling System The most serious failure possible with this system is a complete loss of water in the spent fuel pool. Several provisions have been made to protect against this possibility. The possibility of a line failure causing complete drainage is precluded by the fact that the suction lines do not extend more than 2 feet below normal operating level. This leaves a margin of 23 feet above the top of the fuel assemblies. The return lines enter the pool above the top of the fuel assemblies and have check valves installed immediately adjacent to their penetration into the spent fuel pool wall, thus preventing siphoning of water from the pool in the highly unlikely event of a line failure.

Table 9.3-3 SPENT FUEL POOL COOLING SYSTEM COMPONENT DATA

Table 9.3-5 AUXILIARY COOLANT SYSTEM FAILURE ANALYSES

Figure 9.3-4 SPENT FUEL POOL COOLING AND CLEANUP SYSTEMS-FLOW DIAGRAM

9.5 FUEL HANDLING SYSTEM

The Fuel Handling System consists basically of:

- The reactor refueling cavity; and
- The spent fuel pool, which is kept full of water.

9.5.1 Design Basis

9.5.1.1 Prevention of Fuel Storage Criticality

Criterion: Criticality in the new and spent fuel storage pools shall be prevented by physical systems or processes. Such means, as geometrically safe configurations shall be emphasized over procedural controls (GDC 66).

The new and spent fuel storage racks have accommodations as defined in Table9.5-1. The physical design maintains margin to criticality. Procedural controls prevent placing fuel elements in the wrong location. In addition, the spent fuel pool has areas set aside for accepting the spent-fuel shipping casks. Cask loading is done underwater. Borated water is used to fill the spent fuel storage pool at a concentration to match the desired concentration.1 The fuel in the spent fuel pool and new fuel storage pit is stored vertically in an array with sufficient center-to-center distance or solid neutron absorber between assemblies to assure K(eff) <0.95, even if unborated water were to fill the space between the assemblies (see Holtec Report HI-992208 in Reference 10).

Detailed instructions and procedures are available for use by fuel handling personnel. These instructions and procedures, combined with the design of the fuel handling facilities and the fuel handling equipment incorporating built-in interlocks and safety features, provide assurance that no incident could occur during fuel handling operations that would result in a hazard to public health and safety. Kewaunee complies with 10CFR50.68.

9.5.1.2 Fuel and Waste Storage Decay Heat Criterion: Reliable decay heat removal systems shall be designed to prevent damage to the fuel in storage facilities and to waste storage tanks that could result in radioactivity release which would result in undue risk to the health and safety of the public (GDC 67).

9.5.1.3 Fuel and Waste Storage Radiation Shielding

Criterion: Adequate shielding for radiation protection shall be provided in the design of spent fuel and waste storage facilities (GDC 68).

Adequate shielding for radiation protection is provided, by conducting all spent fuel transfer and storage operations underwater. This permits visual control of the operation at all times while maintaining personnel exposure during fuel handling operations ALARA. Spent Fuel Pool water level is continuously indicated by a level transmitter, which displays and alarms in the Spent Fuel Pool heat exchanger room and causes an audible alarm in the Control Room on high or low level. Water removed from the spent fuel storage pool must be pumped out since there are no gravity drains. Gamma radiation is continuously monitored in the Auxiliary Building. A high radiation level signal is alarmed locally and is annunciated in the Control Room.

9.5.1.4 Protection Against Radioactivity Release From Spent Fuel and Waste Storage
Criterion: Provisions shall be made in the design of fuel and waste storage facilities such that no undue risk to the health and safety of the public could result from an accidental release of radioactivity (GDC 69).

All fuel storage facilities are contained and equipment designed so that accidental releases of radioactivity directly to the atmosphere are monitored and do not exceed the guidelines of 10 CFR50.67. The fuel transfer canal and spent fuel storage pool are Class I reinforced concrete structures with Class I* seamwelded stainless steel plate liners. These structures are designed to withstand the design basis earthquake loadings so that the liner prevents leakage even in the event the reinforced concrete develops cracks. All operating areas in the fuel storage facilities are ventilated. The exhausts of the ventilation system in the Waste Storage and Drumming Areas are monitored for radioactivity and are discharged via the vent through the top of the Auxiliary Building.

9.5.2.1 Major Structures Required For Fuel Handling

9.5.2.1.1 Refueling Water Storage Tank The function of the RWST is to supply borated water to the spent fuel pool for makeup.
Level instrumentation on the RWST consists of two channels. Each channel provides remote Control Room indication as well as low and low-low level annunciation in the Control Room. One channel also provides indication on the Plant Process Computer System (PPCS). Both channels are energized from emergency power.
The tank design parameters are given in Chapter 6.

9.5.2.1.2 Spent Fuel Pool The spent fuel pool is designed for the underwater storage of spent fuel assemblies, RCCAs, burnable poison rod assemblies, thimble plugs, etc. after their removal from the reactor. The pool is sized to accommodate a total of 1205 assemblies (Reference 6) and a fuel-shipping cask.
The spent fuel storage pool is divided into three storage compartments and a fuel transfer canal as shown in Figure 9.5-2. The storage compartments and the fuel transfer canal are connected by fuel transfer slots except for the opening between the north pool and the canal pool, these slots can be closed off with pneumatically sealed gates. The slot between the north pool and the canal pool must remain open whenever fuel is stored in the canal pool to provide for proper cooling. The elevations of the slot bottoms are above the

elevation of the top of the stored spent fuel. The pneumatically sealed gate inflation system is supplied by the instrument air system whose air compressors are capable of being powered by the emergency diesel generators. The instrument air supply is backed up by a nitrogen cylinder supply.

The original spent fuel racks have been replaced with high-density spent fuel racks, permitting a larger number of spent fuel assemblies to be stored in the pool. These high-density racks located in the north and south pools, are double-walled stainless steel cans with a boron carbide plate sandwiched in between. The center-to-center spacing has been reduced from 21inches to 10 inches minimum, thereby increasing the maximum combined storage capability of the north and south pools from 168 assemblies to 990 assemblies (see *NRC Safety Evaluation Report* in Reference 4).

An additional storage pool was created at the north end of the fuel transfer canal. The canal pool has the capacity to store 215 fuel assemblies. The racks in the canal pool are designed to store old (cool) spent fuel assemblies. The racks are constructed from stainless steel materials and use Boral as the neutron absorber (Reference 6)

Design Change Request 3633 reconfigured the seismic support components in the north pool to provide clearance for the placement of a spent fuel shipping cask. A whole pool multi-rack (WPMR) analysis was performed to simulate the dynamic behavior of the rack structures with the modified support configuration. This WPMR method was previously used to analyze the racks that were added to the canal pool.

Spent fuel assemblies are handled by a long-handled tool suspended from an overhead monorail electric hoist and manipulated by an operator standing on a movable bridge over the pool.

NOTE: *Withheld under 10CFR2.390 (d) (1)* The spent fuel pool structure, with its 3-foot to 6-foot thick walls, is designed as a Class I structure that fully meets the seismic and tornado design criteria given in Appendix B.

The fuel pool structure is also designed to withstand the hydraulic pressure of the contained water, as well as other credible static and dynamic loadings.

In addition, the spent fuel storage structure has been designed to minimize the loss of water due to a dropped cask accident.

NOTE: *Withheld under 10CFR2.390 (d) (1)* The bottom of the pool is a reinforced concrete slab 6 feet 8inches thick that conforms to the ACI Standard Code Requirements for Reinforced Concrete (ACI-318-63) and attains a minimum compressive strength of 4000 psi.

All reinforcing bars are made from intermediate grade, new billet steel and conform to ASTM A 615 Grade 60 specifications.

NOTE: *Withheld under 10CFR2.390 (d) (1)* All inside surfaces of the spent fuel pool are lined with type 304 stainless steel plate with a minimum thickness of 3/16 inch.

A leakage detection and collection system is also provided.

9.5.2.1.3 Spent Fuel Storage Racks (North and South Pool)

The spent fuel storage racks are ruggedly constructed of fusion-welded, type 304 stainless steel structural members. Individual storage compartments are provided in which the top of the fuel is below the top flange of the fuel storage compartments. Storage racks in 9 x 10 arrays are arranged in parallel rows. The fuel assemblies are spaced on 10-inch centers (minimum) for high-density storage. The individual arrays are fastened together by bars, which run horizontal near the top and bottom of the rack assembly forming a unified lattice arrangement. Each can is welded to the lattice forming the rack assembly as a single rigid structure. This framework is capable of absorbing considerable impact energy without permanent deformation.

9.5.2.1.4 Spent Fuel Storage Racks (Canal Pool) The racks installed in the canal pool are constructed of type 304 stainless steel structural members. Individual storage compartments (cells) are provided in which the top of the stored fuel is below the top edge of the cells. The racks consist of 4 free standing rack modules. One of the modules contains an array that is 5 cells wide by 10 cells long. The other three modules contain 5 cell by 11 cell arrays. The cell walls are welded to the walls of adjacent cells along the vertical seams. The cells are also welded to the base plate of each module. The base plates are supported by adjustable pedestals that rest on stainless steel bearing pads that are located on the floor of the fuel transfer canal.

9.5.3 System Evaluation
9.5.3.1 Incident Protection
9.5.3.1.1 Fuel Handling

Underwater transfer of spent fuel provides essential ease and corresponding safety in handling operations. Water is an effective, economic, and transparent radiation shield and a reliable cooling medium for removal of decay heat.

Basic provisions to ensure the safety of fuel handling operations are:

1. Gamma radiation levels in the Control Room and fuel storage areas are continuously monitored as described in Section 11.2.3. These monitors provide an audible alarm at the initiating detector indicating an unsafe condition.

   An analysis is presented in Section 14.2.1 concerning damage to one complete assembly, assumed as a conservative limit for evaluating environmental consequences of a fuel handling accident. This analysis takes no credit for removal of fission products by the Spent Fuel Pool Ventilation System.

9.5.3.1.2 Tornado Missile

From Section 2.7.2 and a review of literature on tornado considerations (Reference 1, Reference 2 and Reference3) in the design of spent fuel storage facilities, it may be concluded that:

1. the probability of a tornado occurrence is in the order of 1 in 20,000;
2. massive loss of water due to tornado-induced wind forces or tornado-generated missile cannot happen;
3. both the water cushion that remains above the stored spent fuel and the spent fuel storage racks afford a high degree of protection to stored fuel from tornado missiles.

The spent fuel pool structure and fuel storage racks provide adequate protection for stored spent fuel against the damaging effects of all credible tornado missiles. The structure precludes missile entry from all directions except for the open tops of the pools.

Table 9.5-1 FUEL HANDLING DATA
Table 9.5-2 DESIGN CONFORMANCE WITH SAFETY GUIDE 13

Table B.2.1 Definition of Nuclear Safety Design Classifications (NSDC)
The spent fuel pool is classified as a Class I structure (including fuel transfer tubes and valves) I
Nuclear Fuel Handling and Storage
- New Fuel Storage Racks I*
- Spent Fuel Storage I
- Spent Fuel Pool Liner I*
- Fuel Transfer System (Including Fuel Transfer Carriage, Containment Upender and Auxiliary Building Upender) III
- Spent Fuel Pool Cooling System (Piping and valving whose failure could result in significant release of pool water) I*
- Spent Fuel Pool Cooling System (portions not Class I) III

11.2.2.2.3 Fuel Handling Shielding
Spent fuel is stored in the spent fuel pool, which is located adjacent to the abandoned containment. Radial shielding for the spent fuel is provided by 5-foot thick concrete walls. The pool is flooded with borated water to a level such that the normal water height above the stored fuel assemblies is approximately 25 feet.

14.0.1 Safety Analyses Applicable after Permanent Cessation of Power Operation
Dominion Energy Kewaunee (DEK) has submitted letters for certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii). The 10 CFR Part 50 license for Kewaunee Power Station (KPS) no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel, as specified in 10 CFR 50.82(a)(2).
DEK is placing KPS in a condition designated as SAFSTOR in which most fluid systems are drained and the plant is left in a stable condition until final dismantlement. The irradiated fuel will be stored in the spent fuel pool (SFP) and in the Independent Spent Fuel Storage Installation (ISFSI) until it is shipped offsite. In this configuration, the SFP and its systems are dedicated only to spent fuel storage. In this condition, the number of credible accidents/transients is significantly smaller than for a plant authorized to operate the reactor or emplace or retain fuel in the reactor vessel.

14.2.1 Fuel Handling Accident
The following fuel-handling accident has been evaluated to ensure that no hazards are created:
Permanently Shutdown (Applies only to the Spent Fuel Pool after 90 days beyond the permanent reactor shutdown) (Sections 14.2.1.1–14.2.1.4)
• A fuel assembly or RCCA is dropped in the spent fuel pool

14.2.1.1 Accident Description

This FHA analysis is applicable after 90 days beyond the shutdown of Kewaunee reload Cycle 32 and assumes all fuel is moved to the Spent Fuel Pool prior to 90 days after permanent reactor shutdown.

Technical Specifications

4.3 Fuel Storage

Spent fuel shall not be stored in the spent fuel pool.

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel. No changes are required to Technical Specifications.

Technical Requirements Manual (TRM)

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel. No changes are required of the TRM.

Licensing Commitments

On May 15, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

Radiological Effluent Monitoring/Offsite Dose Calculation Manual

There are no impacts.

Plant Impact

No changes are required to SSCs, procedures, programs, processes, etc.

There is no impact on any temporary changes that are active as of 8/6/17.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

5.0 Special conditions to support categorization(s):

None

6.0 Assumptions/Open Items to be validated or dispositioned:

SFP underwater work, including removal of irradiated hardware (e.g., RCCAs and materials in debris baskets), is required to be completed prior to abandonment of SFP Cooing and Cleanup System.

7.0 Expected duration for SSC category if **NOT** ABANDONED:

None

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Type Of Review Engineering	Name (Print) Brian Kleiman	Approval Signature [signature]	Date 8/29/2017
Type Of Review Fire Protection	Name (Print) Michael Townsend	Approval Signature [signature]	Date 8/31/17
Type Of Review Security	Name (Print) David Falk	Approval Signature [signature]	Date 8/29/2017
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature [signature]	Date 9-7-17
Type Of Review	Name (Print)	Approval Signature	Date

10.0 Review and Approval:

William G. Swanson [signature] — 8/29/17
Prepared By (Print/Sign) — Date

Brian Kleiman / [signature] — 8/29/2017
Reviewed By (Screen Qual.) (Print/Sign) — Date

Jack Gadzala / [signature] — 8/29/2017
Nuclear Licensing (Print/Sign) — Date

William Swanson [signature] — 9/7/17
Concurrence by DSERT Coordinator (Print/Sign) — Date

~~NA~~ BA T Olson / [signature] — ~~NA~~ BA 4/1/19
FSRC (Print/Sign), if required — Date

FSRC Meeting Number: ~~NA~~ BA 19-004

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1.0 Doc Type: Report Revision No.: 2 Date: 12/5/2017
Sub Type: DEC
Document Number (ID): SYS-22-2-DSERT
Title: Htg Steam, FO Boiler & Distribution Sys

1.1 Brief description or reason for revision: Revision 0 abandoned heating steam to the Containment Purge and Vent Preheat and Reheat Coils, Boric Acid Evaporator and Boric Acid Batching Tank. Revision 1 abandoned the Electric Steam Boiler. Revision 2 shall perform a complete abandonment of the remainder of the heating steam system including the oil fired boiler and steam distribution equipment.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: The remainder of the entire heating steam system shall be abandoned. Some of the equipment shall be abandoned under the ventilation system (hot water or steam is provided to such systems as Control Room AC System, for example). These systems must no longer need heating steam prior to this abandonment. The abandonment performed under this DSERT package and the associated ventilation systems will result in a complete abandonment of the heating steam system. Equipment to be abandoned includes the oil fired steam boiler, oil tank, oil pumps, piping, valves, heating steam piping, steam coils, steam unit heaters, automatic valves, and all controls and indication for the heating steam system and oil fired boiler.

Heating steam to the steam converters and hot water heating loops shall be abandoned under the System specific DSERT packages for the following systems.

System 15 Aux Building AC System
System 19 Admin Building Ventilation
System 25 Control Room AC
System 64A Office Warehouse Annex AC
System 67 TSC Ventilation

The Control Room Humidification Boiler is abandoned under system 25 and system 15 as these are the areas it serves.

Steam supplied to the following systems are abandoned under this DSERT package:

System 16 Turbine Building and Screenhouse Ventilation
System 17 Aux Building Ventilation
System 32A Waste Evaporator
System 27B Service Water Pretreatment

Instrument air, makeup water, and electrical systems shall be isolated from the heating steam system.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-605-1, Flow Diagram Heating System
Abandon:
All Unit Heaters, steam piping, preheat and reheat steam coils, controls and indication

The following systems may or may not have been abandoned at the time of heating steam abandonment: Control Room AC, Admin Building Vent, Aux Building AC, Warehouse Annex Vent, TSC Vent and Service Water Pretreatment. Ensure steam/hot water to these systems is no longer required prior to abandonment of the heating steam system. The steam converters and hot water loops to these systems shall be abandoned as the systems are abandoned.

OPERM-605-2 Flow Diagram Heating System
Abandon: Entire Drawing
Including; Oil fired steam boiler, feed pumps, condensate transfer pumps, deaerator, surge tank, controls and piping

OPERM-605-3 Flow Diagram Heating System, Electric Heating Boiler
Abandon: HS-5000C and upstream condensate return line

OPERM-206 Blead Steam and Heater Vents
Abandon: BS-270 to steam supply line to heating steam system and associated line trap

OPERM-211 Flow Diagram Turbine and Aux Building Traps and Drains
Abandon: Bleed steam supply line to heating steam system and associated line trap

OPERM-220 Flow Diagram Fuel Oil Systems
Abandon: Entire heating boiler fuel oil system including: Fuel oil storage, fuel oil pumps, control and shutoff valves, piping and controls.

OPERM-216 Misc Gas Piping
Abandon: MG-110 to Heating Boiler Burner,

OPERM-214 Flow Diagram, Chemical Injection
Abandon: CI-210 to oil fired boiler deaerator

OPERM-394 Flow Diagram, Service Water Pretreatment
Abandon: Steam and condensate to service water pretreatment water heater

OPERM-601 Flow Diagram Turb & Aux Building Vent
Abandon:
1-206 Heating Boiler Roof Ventilator
ACA-100 Heating Boiler Roof Ventilator Damper
ACA-101 Heating Boiler Relief Vent Damper
1-219 Heating Boiler Forced Draft Fan

OPERM-213-6 Station and Instrument Air System
Abandon:
IA-1452 to HS-361B and HS-371B Steam Control valves to Aux Building Supply

OPERM-213-7 Station and Instrument Air System
Abandon:
IA-1348 to HS-5 and heating steam control panel
IA-1326 to HS-310-2 and SW-2357 heating and cooling to maint shop

E-253, Circuit Diagram 480V MCC 1-32F, 1-42F, 1-32G & 1-42G
Abandon:
MCC 1-32G (C6) UH-2G
MCC 1-32G (C7) UH-2H
MCC 1-42G (B1) UH-1A
MCC 1-42G (B2) UH-2A
MCC 1-32F (B1) UH-2F
MCC 1-42F (A1) UH-2E
MCC 1-42G (A6) BS270/32001 bleed steam to heating steam MV

E-250, Circuit Diagram 480V MCC 1-32C, 1-42C, & 1-42H
Abandon:
MCC 1-32C (A6) UH-11A
MCC 1-32C (A7) UH-11D
MCC 1-42C (A4) UH-2M

MCC 1-42C (A5) UH-11B
MCC 1-42C (A6) UH-11C
MCC 1-42H (B5) Welding Shop Unit Heaters

E-254, Circuit Diagram 480V MCC 1-35A, 1-35D, 1-45A & 1-45D

Abandon:
MCC 1-35D (A4) UH-4A
MCC 1-35D (A5) UH-4C
MCC 1-35D (B4) UH-4E
MCC 1-45D (B6) UH-4B
MCC 1-45D (B7) UH-4D
MCC 1-45D (B8) UH-4F

E-255, Circuit Diagram 480V MCC 1-35B, & 1-45B

Abandon:
MCC 1-35B (B4) UH-3A
MCC 1-35B (B5) UH-2K
MCC 1-45B (B1) UH-3B
MCC 1-45B (B2) UH-2L

E-256, Circuit Diagram 480V MCC 1-32D, 1-35C, 1-35F, 1-42D, 1-45C & 1-45F

Abandon:
MCC 1-35F (B2) UH-2D
MCC 1-45F (B2) UH-2B
MCC 1-45F (B3) UH-2C
MCC 1-42D (A6) Heating Boiler Fuel Oil Pump 1B
MCC 1-42D (A7) Heating System Condensate Transfer Pump 1B
MCC 1-42D (B6) Heating Boiler Feed Pump 1B

E-257, Circuit Diagram 480V MCC 1-35E & 1-45E

Abandon:
MCC 1-35E (A1) UH-4G
MCC 1-45E (B2) UH-4K
MCC 1-45E (C3) UH-4H

E-3072, Circuit Diagram 480V MCC 1-46C

Abandon:
MCC 1-46C (A7) Heating Boiler Feed Pump 1A
MCC 1-46C (B6) Heating System Condensate Transfer Pump 1A
MCC 1-46C (A2) Heating Boiler Control Transformers HB & HBA (Single Phase)
MCC 1-46C (A5) Heating Boiler Fuel Oil Pump 1A
MCC 1-46C (A6) Heating Boiler Forced Draft Fan
MCC 1-46C (B4) Heating Boiler Area Roof Vent Fan and Dampers

E-3093 Lighting Panels LPB11, LPB12 & LRPB4 Fixture & Equipment List

Abandon:

LRPB4 (15) to boiler relief vent

LRPB4 (16) to SV33032 Fuel Oil Pump Suction Valve

E-3882, Wiring Diagram Augmented Water Enclosure

Abandon:

LRPB-20 Circuit 9 UH-16A and UH-16B

LRPB-20 Circuit 11 UH-16C and UH-16D

E-889, Lighting Panels RPB1, RPB2, RPB3, RPB4, RPB5, RPB6

Abandon:

RPB2 Circuit 5 – UH-7C

RPB2 Circuit 7 – UH-15A

RPB2 Circuit 4 – UH-7D

RPB2 Circuit 6 – UH-8D

RPB2 Circuit 10 – UH-8C

RPB4 Circuit 7 – UH-9C

RPB4 Circuit 9 – UH-9B

RPB5 Circuit 6 – UH-9A

RPB6 Circuit 3 – UH-8G

RPB6 Circuit 5 – UH-8H

E-879, Lighting Panels RPA1, RPA2, RPA3, RPA4, RPA5, RPA6

Abandon:

RPA1 Circuit 4 – UH-7M

RPA1 Circuit 5 – UH-7L

RPA1 Circuit 6 – UH-7N

RPA4 Circuit 4 – UH-8A

RPA4 Circuit 5 – UH-8B

RPA4 Circuit 7 – UH-7A

RPA5 Circuit 5 – UH-6D

RPA5 Circuit 15 – UH-8K

RPA5 Circuit 17 – UH-8L

E-890, Lighting Panels RPB7, RPB8, RPB9, RPB10, RPB11, RPB12

Abandon:

RPB9 Circuit 10 – UH-12A and UH-12C

E-885, Lighting Panels RPA7, RPA8, RPA9, RPA10, RPA11, RPA12

Abandon:

RPA8 Circuit 5 – UH-6C

RPA9 Circuit 11 – UH-5A

RPA9 Circuit 12 – UH-8F

RPA10 Circuit 6 – UH-14B and UH-14C
RPA10 Circuit 7 – UH-14A
RPA12 Circuit 10 – UH-12D and UH-12B

E-891, Lighting Panels RPB13, RPB14, RPB15, RPB16, RPB17, RPB18
Abandon:
RPB13 Circuit 6 – UH-6B and UH-14D
RPB16 Circuit 18 – UH-7E and UH-7H and UH-7K
RPB16 Circuit 2 – UH-8E
RPB16 Circuit 8 – UH-7G and UH-7F and UH-7J
RPB16 Circuit 16 – UH-10A

E-886, Lighting Panels RPA13, RPA14, RPA15, RPA16, RPA17, RPA18
Abandon:
RPA15 Circuit 6 – UH-6A

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The Heating Steam system supplies environmental heat to the power plant. Heat is conveyed to the various areas in the form of steam or hot water, and the heat transfer media are pumped back to their source to form closed loops. Heating steam is used in 69 unit heaters and in six reheat and preheat coils of several ventilation systems. Process steam is also condensed in four converters to generate hot water for heating the Administration Building, Auxiliary Building, Technical Support Center, and Warehouse Annex.

Heating Steam is supplied from a separate plant Heating Boiler, complete with combustion control and automatic startup, flame failure, and shutdown controls. The Heating System also provides humidifying steam from an electric boiler to humidify the Control Room and the Auxiliary Building.

The steam pressure is reduced to 55 psig by a pressure-reducing valve. Steam distribution headers convey the low-pressure steam to 69 unit heaters that heat various spaces in the plant. In each unit heater (UH), room air is blown by a fan through a set of coils that are heated by steam condensing inside of them. The condensate is drained by automatic steam traps to the return header.

Basis for Category

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

Therefore the abandonment of the heating steam system has no adverse effect.

Regulatory Impact

See CR 1382 for screening

Plant Impact

No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 12-5-2017.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment does not a change the radioactive waste system (gaseous) and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRC review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

Hot water heating no longer required for the Admin Building, Office Warehouse Annex, TSC, and Aux Building AC area and Control Room.

Additionally steam for service water pretreatment is no longer required.

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

The heating steam system is expected to be completely abandoned by summer of 2018.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Brian Kleiman	[signature]	12/14/2017
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature [signature]	Date 12/13/17
Type Of Review Security	Name (Print) Brian Prest	Approval Signature [signature]	Date 12/12/17
Type Of Review N/A	Name (Print) N/A	Approval Signature N/A	Date N/A

10.0 Review and Approval:

Brian O'Connell / [signature] — 12/13/17
Prepared By (Print/Sign) — Date

Brian Kleiman / [signature] — 12/14/2017
Reviewed By (Screen Qual.) (Print/Sign) — Date

TP Olson / [signature] — 12/14/2017
Technical Support (Print/Sign) — Date

William Swanson [signature] — 12/11/17
Concurrence by DSERT Coordinator (Print/Sign) — Date

~~NA~~ TB WCO 12/11/17 TP Olson [signature] — 4/1/19 ~~NA~~ TB WCO 12/11/17
FSRG (Print/Sign), if required — Date

FSRG Meeting Number: ~~NA~~ TB WCO 12/11/17 19-004

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1.0 Doc Type: Report Revision No.: 0 Date: 4/24/2018
Sub Type: DEC
Document Number (ID): SYS-30-1-DSERT
Title: (MDS) Miscellaneous Drains and Sumps System
1.1 Brief description or reason for revision: MDS shall be required through decommissioning but additional items can be abandoned for SSIII.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:

Portions of the Miscellaneous Drains and Sumps system are being categorized as partially abandoned to support day to day operations of the facility. These portions of the system will also be required to support the dismantlement activities and will remain under the administrative control of Operations with configuration control maintained.

The Misc Sumps and Drains System interacts with multiple systems. There are drain and vent lines to various tanks, valve packing leakoffs, floor drains, sumps and trenches that drain to the MDS. The MDS is evaluated up to the first Boundary valve between the systems.

Power supplies to the various pieces of electrical equipment were assessed from the breaker to the electrical load. Upstream of the breakers was not assessed here in.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-350 Flow Diagram – Reactor Plant Misc. Vents, Drains & Sump Pump Piping

Maintain:
1A & 1B RHR Pit Pumps
1A & 1B Annulus Sump Pumps
Sump Tank

1A & 1B Sump Tank Pumps
Sludge Intercept tank
1A & 1B Waste Area Sump Pumps
Basement Trench
MDR-201A to RHR Sump Pit **(Gagged Open)**
MDR-201B to RHR Sump Pit **(Gagged Open)**
RHR-36A Drain to RHR sump Pit
RHR-36B Drain to RHR sump pit

Abandon:
SI-55A stem leakoff to Deaerator Drain Tank
SI-55B stem leakoff to Deaerator Drain Tank
RHR-4A stem leakoff to Deaerator Drain Tank
RHR-4B stem leakoff to Deaerator Drain Tank
RHR-6A stem leakoff to Deaerator Drain Tank
RHR-6B stem leakoff to Deaerator Drain Tank
4" overflow Reactor Makeup Water Tank
6" Overflow Refueling Water Storage Tank

OPERM-100-131 Flow Diagram Waste Disposal System

Maintain:
1A & 1B TSC Lab Sump Pumps
1A & 1B Laundry Tanks
1B Laundry Pump
Sludge Intercepter
Sludge Intercepter Pump
Waste Holdup Tank
Waste Evap Feed Pump
Sump Tank
1A & 1B Waste Condensate Tanks
1B Waste Condensate Pump
R-18

Abandon:
Reactor Cavity C sump Pump to Sump A
1A & 1B Containment Sump A pumps to MDR-135

OPERM-368 Steam Generator Blowdown Treatment System

Maintain:
Lines from Laundry pumps and Waste Condensate Pumps, through R-18 to discharges and lines from Laundry pumps and Waste Condensate Pumps To waste condensate tanks and Waste Holdup tanks.

OPERM-539, Flow Diagram Reactor Plant Misc. Vents, Drains & Sump Pump Piping

Abandon: all remaining active inservice equipment on this drawing
Containment Spray 1A & 1B Seal Leakoffs
Charging Pump 1A, 1B & 1C Stuffing Box Leakoffs
Safety Injection 1A & 1B Seal Leakoffs

OPERM-213-5 Station & Instrument Air
Abandon:
IA-1606 to SV33330/CV31341/MDR-201A and SV33331/CV31342/MDR-201B
Note: MDR-201A and MDR201B need to be gagged open so RHR pump pits drain to RHR sump.
IA-31136 to SV33145/CV31136/MDR-134
IA-31137 to SV33146/CV31137/MDR-135

OPERXK-100-36 Chemical and Volume Control System
Maintain:
Demins vent and drain valves isolation valves CVC-510A, CVC-510B, CVC-503A, CVC-503B, CVC-511, CVC-505, CVC-512A, CVC-512B, CVC-507A, CVC-507B, to DH6 on OPERM-350
Letdown pre-filter drain valve LD-39A to Drain header
Letdown Heat Exchanger drain valves MDR-270, MDR-271, MDR-272, MDR-273
Seal Water Filter Drain valve CVC-264 to drain header
Seal Injection filter drain valves CVC-230A and CVC-230B to drain header

OPERXK-100-37 Chemical and Volume Control System
Maintain:
CVC-857A, CVC-855A, CVC-855B, CVC-857B, CVC-859, CVC-860, CVC-861, CVC-865, CVC-936, CVC-944B, CVC-945B, CVC-944A, CVC-945A, drains and vents to drain headers

OPERM-217 Internal Containment Spray System
Abandon:
ICS-20A relief valve discharge to DDT
ICS-20B relief valve discharge to DDT

OPERXK-100-400 Boric Acid Evap and Gas Stripper
Maintain:
Various drains from the Boric Acid Evap to the Sump Tank

DECM-385 Radioactive Waste Solidification System
Maintain:
RWS-12 to Drain header no. 2

E-251, Circuit Diagram 480V MCC 1-32E
Abandon:
Bus 1-32E, Breaker C3, Containment Sump A Pump 1A
Bus 1-32E, Breaker D2, Reactor Cavity Sump Pump

E-252, Circuit Diagram 480V MCC 1-42E

Abandon:

Bus 1-42E, Breaker B3, Containment Sump A Pump 1B

E-889, Lighting Panels RPB1, RPB2, RPB3, RPB4, RPB5, RPB6

Abandon:

RPB-1, CKT 12, Safeguard Area Sump Pump System, **Note: Batteries for these pumps need to be abandoned and discarded.**

E-2303 Fuse panel RR171 DC Safeguard 5

Abandon:

Fug 26 to SV33330 MDR-201A RHR Pump Pit A to Sump SV

E-2313 Fuse panel RR176 DC Safeguard 6

Abandon:

Fug 26 to SV33331 MDR-201B RHR Pump Pit B to Sump SV

E-2887, Circuit Diagram 480V MCC 1-46B

Abandon:

Bus 1-46B, Breaker 2MN, TSC Sanitary Ejector Pump 1A

Bus 1-46B, Breaker 3IJ, TSC Sanitary Ejector Pump 1B

Note: Must be done before sewage treatment plant is abandoned and after TSC is no longer occupied.

E-2302 Fuse panel RR171 DC Safeguard 5

Abandon:

Fug20 to SV33145/MDR-134

E-2312 Fuse panel RR176 DC Safeguard 6

Abandon:

Fug20 to SV33146/MDR-135

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The MDS System provides separate drains and sumps that require physical separation based on radiological, environmental, chemical, or toxicological reasons. Pumps are installed in the sumps to transfer these liquid wastes to other systems for processing and/or disposal. The MDS System collects drainage from the floor drains, deaerated equipment drains and leaks, and the decontamination area drains.

The Miscellaneous Drains and Sumps (MDS) System fulfills three essential purposes:

• Provides isolation from other building drains due to radioactive or other waste contamination considerations.
• Provides pumps to transfer waste from the sumps to the disposal facilities since the associated sumps are at the lowest building elevations.
• Provides for the re-routing of vents and drains post-accident to the containment and/or Shield Building Annulus.

Basis for Category
On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of the MDS System may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Regulatory Impact
See CR1382

Plant Impact
No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 4/19/2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact the ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment does not represent a major change to the radioactive waste systems (liquid, gaseous and solid) and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRG review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

MDR-201Aand MDR-201B need to be gagged open to allow the RHR pump pits to drain to the RHR sump pit. There will be no station air available to these valves to open them.

The 1A and 1B TSC Sanitary Ejector Pumps must be abandoned before the sewage treatment plant is abandoned and after the TSC is no longer occupied..

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

Until the plant is decommissioned.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Type Of Review Fire Protection	Name (Print) Michael Townsend	Approval Signature	Date 4/26/18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 4-25-18
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 4-25-18

10.0 Review and Approval:

Brian O'Connell / [signature] — 4/25/18

Prepared By (Print/Sign) — Date

T Polson [signature] — 4/25/18

Reviewed By (Screen Qual.) (Print/Sign) — Date

T Polson [signature] — 4/25/18

Technical Support (Print/Sign) — Date

William Swanson [signature] — 4/26/18

Concurrence by DSERT Coordinator (Print/Sign) — Date

N/A T Polson [signature] — N/A 4/1/19

FSRG (Print/Sign), if required — Date

FSRG Meeting Number: N/A 19-004

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1.0 Doc Type: Report Revision No.: 1 Date: 6/19/2018
Sub Type: DEC
Document Number (ID): SYS-32D-1-DSERT
Title: Solid Radioactive Waste

Brief description or reason for revision: Complete system abandonment. Spent Resin Storage Tank, Dewatering Pump, and all support equipment are being abandoned. Radwaste compactor is being maintained, but has one power supply and is independent of the rest of system.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:

This is completing abandonment of the Solid Radioactive Waste system.

The following instrument boundaries will be abandoned along with their respective sensing lines: ES-19496, LI-18038, LT-24007, PI-11317, PI-11426, PS-16134, PI-11424, PS-16172, & FI-18291

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

OPERM-385, Flow Diagram Radioactive Waste Solidification
Abandon:
Entire Drawing

Boundary valves:
RWS-11, Solid Waste Metering Tank Dewatering Pump to Waste Holdup Tank.

OPERM-213-12, Flow Diagram – Station Air
Abandon:
SA-442, Air to Spent Resin Storage Tank Room (Boundary)

OPERM-209-2, Flow Diagram Make-Up and Demineralized Water Systems
Abandon:
Boundary valves:
MU-1040, Rx MU Water to Spent Resin Storage Tank & Waste Concentrates Holdup Tank

E-263, Circuit Diagram 480V MCC 1-45G & 1-32H
Abandoned from the electrical breaker out:
MCC 1-45G (F5) Spent Resin Storage Tank Inlet RWS 40/MV32351
MCC 1-45G (B4) Dewatering Pump 1-735

E-2473, Wiring Diagram-Auxiliary Relay Cabinet & Distribution Panel
Available:
Distribution Panel RW1-1 Circuit 9, Mux 4 A/C Unit (Security equipment)

Abandon:
Distribution Panel RW1-1 Circuit 1, Solidification Panel A (Power to 24007 and 33349 which support Spent Resin Storage Tank operation)

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The Solid Radioactive Waste system is designed to collect, prepare and package Solid Radioactive Waste for shipment to a processor or direct to a burial site.

Functions of the Solid Radioactive Waste system include the following:

- Solidification processing performed remotely to minimize personnel radiation exposure.
- Compacting dry active waste to minimize the volume required to be transported to a burial site.
- Packaging radioactive solid wastes in acceptable waste containers prior to shipment to a licensed burial site.
- Ensuring storage, labeling, surveying, and identification of solid waste packages are in accordance with plant procedures.
- Ensuring the radiation level on contact of the packaged wastes meet the requirements.

Basis for Category

On May 14, 2013 the NRC docketed the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. Therefore, the 10 CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel as specified in 10 CFR 50.82(a)(2). The Spent Fuel Pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor and the spent fuel pool (SFP) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

The abandoned items identified above of Solid Radioactive Waste System do not perform a function or provide support for any of items 1-7 below. Radwaste Compactor is the only item left that supports #3 & #6 below. And the Compactor is not considered part of this system.

1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. Fuel Handling Accident and Gas Decay Tank Rupture as defined in Updated safety Analysis Report (USAR).
3. For safe storage and handling of radioactive waste or spent fuel.
4. The Requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other commitments, safe storage of spent fuel, or support of the Radiological Effulent Monitoring / Offsite Dose Calculation Manual for KPS.
5. The requirements of SSCs that support the execution of plans and programs at KPS (e.g., Security Plan, Fire Protection Plan, Emergency Management Plan, Radiation Protection Program).
6. Support day to day operations in the decommissioning plant.
7. Support decommissioning efforts.

Regulatory Impact
Defueled Safety Analysis Report (DSAR) (UCR 2017-002-000)

4.1.2.1.2 Solids Processing
The Waste Disposal System is designed to package solid wastes for removal to offsite facilities. Dry Active Waste (DAW) materials such as paper and plastic are collected, analyzed, packaged and shipped from the site per Kewaunee's Solid Radioactive Waste Process Control Program (PCP).

The PCP contains the current formulae, sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of solid radioactive wastes, based on demonstrated processing of actual or simulated wet solid wastes, will be accomplished in such a way as to ensure compliance with 10 CFR Part 20, 10 CFR Part 61, 10 CFR Part 71, Federal and State regulations, burial site or waste processing facility requirements, and other requirements governing the processing and disposal of the radioactive waste.

4.1.3.2 Solid Wastes
Solid wastes consist of filters, spent resins and DAW materials such as paper and plastic. All solid wastes are packaged as described in Section 4.1.2.1.2, "Solids Processing" for removal to an offsite facility.

Technical Requirements Manual (formally in Technical Specifications)

10.3.2 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the monitoring of the facility in the previous year shall be submitted by May 1 of each year in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility. The material provided shall be consistent with the objectives outlined in the ODCM and Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR Part 50, Appendix I, Section IV.B.1.

Offsite Dose Calculation Manual (ODCM):
The Solid Radioactive Waste system is not explicitly identified in the ODCM. However it is mentioned in the following administrative section:

15.1 Major Changes to Radioactive Waste Systems
15.2 Radioactive Effluent Release Report

Licensing Commitments
A search of licensing commitments using the following file path S:\KEWAUNEE\4\DATA1\LICENSING\Commitments\COMTRAKS\TRUECOMMITMENTS\ALL TRUE Commitments by Number, did not identify any open commitments related to the Solid Radioactive Waste system

Plant Impact
No changes are required to SSCs, procedures, programs, processes, etc.

There is no impact on any temporary changes that are active as of 6/19/18.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

5.0 Special conditions to support categorization(s):

None

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

Available SSCs in the Solid Radioactive Waste system are expected to remain available until plant demolition.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review Fire Protection	Name (Print) Brian Kleiman	Approval Signature	Date 8/30/18
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 8-28-18
Type Of Review Radiation Protection	Name (Print) Mark Perovtki	Approval Signature	Date 8-28-18
Type Of Review	Name (Print)	Approval Signature	Date
Type Of Review	Name (Print)	Approval Signature	Date

10.0 Review and Approval:

William Swanson — 8/28/18
Prepared By (Print/Sign) — Date

Brian Kleiman — 8/30/18
Reviewed By (Screen Qual.) (Print/Sign) — Date

TP OLSON — 8/30/2018
Technical Support (Print/Sign) — Date

William Swanson — 8/28/18
Concurrence by DSERT Coordinator (Print/Sign) — Date

TP OLSON — 8/30/2018
FSRG (Print/Sign), if required — Date

FSRG Meeting Number: 18-014 8/30/2018

1.0 Doc Type: Report Revision No.: 13 Date: 12/21/2017
Sub Type: DEC
Document Number (ID): SYS-45-13-DSERT
Title: Radiation Monitoring System (RMS)
For RMS Channels R-5, R-10 and R-17
1.1 Brief description or reason for revision: Partial abandonment of Radiation Monitoring, full abandonment of R-5 & R-10, SFP Area monitors; and R-17, Component Cooling liquid process monitor.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: RMS channels R-5, R-10, and R-17. These are area monitors for the Spent Fuel Pool; and liquid process monitor for Component Cooling Water system in the plant, respectively. All are manufactured by Nuclear Research Company (NRC) and were installed as part of the original equipment, and were later upgraded to NRC equipment as part of DCR 2172. The R-10 monitor serves as a backup for the R-5 monitor per DC-KW-14-02007.

This is a partial abandonment of the Radiation Monitoring System consisting of a complete functional abandonment of the Channels R-5 and R-10, SFP Area monitors; and R-17, the liquid process monitor for the Component Cooling Water system, and the associated sample valves. The abandonment for these monitors will take place after the Spent Fuel Pool is emptied. The area monitors R-5 and R-10 are ion chamber type detectors for detecting gamma radiation. The R-17 channel consists of scintillation detector for detecting gamma radiation. Each channel consists of a detector, power supplies, and the local display located in the Auxiliary Building, and display readouts in the Control Room. These detector assemblies all contain a check source that will be removed during the abandonment process. The common PS-100 Power Supplies are not being abandoned at this time as these power supplies provide power to other RMS channels which are not part of this package.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

The affected drawings for abandonment are listed on CM-KW-DWG-201 – Attachment A, as follows:
OPERM – 601 Flow Diagram Turbine & Aux. Building Ventilation
OPERXK – 100-19 Flow Diagram – Component Cooling System
M-761 – Location and Details of Radiation Monitors
E-2019 - Integrated Logic Diagram RMS
E-2021 - Integrated Logic Diagram RMS
E-2427 - Schematic Diagram Radiation Monitors Channels R16, R17, & R18
E-3734 - W/D RMS Channels R1, R2, R4, R5, R6, R7, R9, & R10
E-3735 - W/D 120VAC Distribution Fuse Panel TB2401
E-3745 - Integrated Logic Diagram Area RMS Channels R1, R2, R4, R5, R6, R7, R9, & R10
E-3748 - Integrated Logic Diagram RMS Channels R11, R12, R13, R14
E-3757 - Wiring Diagram Process RMS Channels R15, R16, R17, R18, R19, R20, & R23

E-3760- W/D Process Radiation Monitoring Power Sources
Remove Fuse 6 from RR191 Fuse Block that feeds R-17

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The purpose of the Radiation Monitoring System (RMS) is to provide information to plant personnel on radioactivity levels in the plant areas, and fluid processes (air and liquid). It also serves to isolate any discharge from the plant in the event radioactivity levels are too high, preventing or minimizing inadvertent/uncontrolled release to the environment. Channels R-5 and R-10 were designed to inform the Operators of radiation in the Spent Fuel Pool area in the Auxiliary Building. The R-17 monitor is designed to monitor the Component Cooling System for radiation indicative of a reactor coolant leak into the Component Coolant Water system. A leak into the Component Cooling Water system can occur from Reactor Coolant Pump thermal barriers, the Chemical and Volume Control System, or from the Residual Heat Removal heat exchangers. If leakage/radiation is detected, an alarm notifies the Control Room Operator, who can then take actions as necessary. No automatic actions are performed by any of these monitors. The detectors for these channels also contain a check source that should be removed during the abandonment process.

Basis for Category

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, since the RCS, CVCS, RHR and CCW systems are drained and abandoned there is no potential source of leakage into the CCW system.

The SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

The analyzed accident and operational event applicable to KPS in the permanently shut down and defueled condition is a fuel handling accident (FHA) in the auxiliary building. With all of the spent fuel removed from the Spent Fuel Pool, the fuel handling accident is no longer applicable. RMS channels R5, R10, and R17 can be abandoned.

Regulatory Impact

See CR 1382 for screening

Plant Impact

No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 12-21-2017.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment does not change the radioactive waste system and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRG review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

The abandonment of RMS Channels R-5 and R-10 cannot be performed until the Spent Fuel Pool is drained and cleaned.

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

NA

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review Fire Protection	Name (Print) Michael Townsend	Approval Signature	Date 12/26/17
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 1-9-18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 1-9-18
Type Of Review N/A	Name (Print) N/A	Approval Signature N/A	Date N/A

10.0 Review and Approval:

Brian O'Connell /
Prepared By (Print/Sign) — Date: 12/26/17

Mark Sievert /
Reviewed By (Screen Qual.) (Print/Sign) — Date: 1/9/18

TP Olson /
Technical Support (Print/Sign) — Date: 1/9/18

William Swanson
Concurrence by DSERT Coordinator (Print/Sign) — Date: 12/27/17

~~N/A~~ TB TPOLSON/ 19-004
FSRG (Print/Sign), if required — Date: ~~N/A~~ TB 4/1/19

FSRG Meeting Number: ~~N/A~~ TB 19-004

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1.0 Doc Type: Report Revision No.: 14 Date: 12/5/2017
Sub Type: DEC
Document Number (ID): SYS-45-14-DSERT
Title: Radiation Monitoring System (RMS)
For RMS Channels R-16 and R-20
1.1 Brief description or reason for revision: Partial Abandonment of Rad Monitoring, full abandonment of R16, Cntmt FCU Service Water return; and R20, Aux Bldg SW Return.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: RMS channels R16 and R20. These are process monitors for the Containment Fan Coil Unit Service Water Return (R16), and Auxiliary Building Service Water Return (R20) in the plant. Both channels are manufactured by Nuclear Research Company (NRC) and were installed as part of the original equipment, and were later upgraded to NRC equipment as part of DCR 2172.

This is a partial abandonment of the Radiation Monitoring System consisting of a complete functional abandonment of the Channel R16, the process monitor for the Containment Fan Coil Unit Service Water Return; and Channel R20, the process monitor for the Auxiliary Building Service Water Return. The abandonment will also include the associated sample valves, and check sources. The process monitor R16 utilizes a Gamma scintillation detector for detecting gamma radiation, identifying a radiation leak into the Service Water returns from the Containment Fan Coil Units. The process monitor R20 utilizes a Gamma scintillation detector for detecting gamma radiation in the Auxiliary Building Service Water Return, an indication of radiation leakage into the Service Water cooling from the Component Cooling Water system from various pumps and heat exchangers located in the Auxiliary Building. Each channel consists of a detector, power supplies, and the local display. Both channels also provide display readouts in the Control Room. The common PS-100 Power Supplies are not being abandoned at this time as these power supplies provide power to other RMS channels which are not part of this package.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

The affected drawings for abandonment are listed on CM-KW-DWG-201 – Attachment A, as follows:
APM 202-2 Analytical Part Flow-Service Water System
E-2019 - Integrated Logic Diagram RMS
E-2021 - Integrated Logic Diagram RMS
E-2422 - Schematic Diagram Process Radiation Monitors Channels R13, R20, & R21
E-2427 - Schematic Diagram Process Radiation Monitors Channels R16, R17, & R18
E-3748 - Integrated Logic Diagram RMS Channels R11, R12, R13, R14
E-3757 - Wiring Diagram Process RMS Channels R15, R16, R17, R18, R19, R20 & R23

E-845 Wiring Diagram, DC Auxiliary & Emergency AC
Abandon: **THIS CAN ONLY BE DONE WHEN ALL THE LISTED RAD MONITORS ARE ABANDONED UNDER SEPARATE PACKAGES FOR EACH CIRCUIT**
BRB113 Circuit 7 to R11, R12, R14, R15, R16, R17, R18, R19
BRA114 Circuit 14 to R13, R20, R21, R22, R23

If circuit can be abandoned submit drawing change for abandonment as appropriate.

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The purpose of the Radiation Monitoring System (RMS) is to provide information to plant personnel on radioactivity levels in the plant areas, and fluid processes (air and liquid). It also serves to isolate any discharge from the plant in the event radioactivity levels are too high, preventing or minimizing inadvertent/uncontrolled release to the environment. Channels R16 and R20 were designed to inform the Operators of radiation in the Service Water Returns from Containment Fan Coil Units, or the Service Returns from Auxiliary Building. These could indicate a possible leak into the Service Water cooling from Containment Fan Coil Units following a Loss of Coolant Accident (LOCA), or the Spent Fuel Pool Heat Exchanger, or the Component Cooling Water Heat Exchanger. Both of these heat exchangers are located in the Auxiliary Building. If leakage/radiation is detected, an alarm notifies the Control Room Operator, who can then take appropriate actions based on the level of radiation detected, possibly shutting equipment down to isolate the leak. No automatic actions from these two channels are performed. Operators take action based on the alarms in the Control Room.

Basis for Category

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

The containment vent, and SW system are being abandoned. Therefore, they no longer contain potential effluent release paths. Therefore, the former design function for monitoring the radiological conditions within the process flow or its immediate vicinity has been rendered obsolete. Therefore, the affected radiation monitors may be abandoned without and adverse impact.

Regulatory Impact

See CR 1382 for screening

Plant Impact

No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 12-5-2017.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

CR1520 Has been initiated to remove R20 from the next ODCM revision.

This abandonment does not a change the radioactive waste system and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRG review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

The abandonment of RMS Channel R20 cannot be performed until Service Water to SFP Heat Exchanger has been isolated/abandoned in the Auxiliary Building.

The Abandonment of RMS Channel R16 cannot be performed until service water to the Containment Fan Coil Units has been abandoned.

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if <u>**NOT**</u> ABANDONED:

NA

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Michael Townsend	[signature]	12/11/17
Type Of Review	Name (Print)	Approval Signature	Date
Security	Brian Presl	[signature]	12/11/17
Type Of Review	Name (Print)	Approval Signature	Date
Radiation Protection	Daniel J. Shannon	[signature]	12/11/17
Type Of Review	Name (Print)	Approval Signature	Date

10.0 Review and Approval:

BRIAN O'CONNELL / [signature] — 12/11/17
Prepared By (Print/Sign) — Date

MARK SIEVERT / [signature] — 12/11/17
Reviewed By (Screen Qual.) (Print/Sign) — Date

TP OLSEN / [signature] — 12/13/2017
Technical Support (Print/Sign) — Date

William Swanson [signature] — 12/11/17
Concurrence by DSERT Coordinator (Print/Sign) — Date

~~RA~~ TPOLSEN / [signature] — ~~RA~~ 4/1/19
FSRG (Print/Sign), if required — Date

FSRG Meeting Number: ~~RA~~ 19-004

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1.0 Doc Type: Report Revision No.: 0 Date: 3/20/2018
Sub Type: DEC
Document Number (ID): SYS-45-19-DSERT
Title: Radiation Monitoring System (RMS)
For RMS Channels R-13, R-14,

1.1 Brief description or reason for revision: Partial abandonment of the Radiation Monitoring system. R-13 and R-14 Aux Building Stack Radiation Detectors shall be abandoned. 143-116 R-13 Aux Building Vent A Monitor Pump and 143-117 R-14 Aux Building Vent B Monitor Pump and associated air sampling equipment (e.g., Particulate Sampler and Sample Flow Rate Monitor) shall remain available to perform continuous air particulate sampling of the Auxiliary Building Stack effluent releases.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☒ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: RMS channels R-13, and R-14. R-13 and R-14 detectors are Aux Building Vent Stack Monitors for detecting, monitoring and isolating a potential noble release from the Auxiliary Building.

This is a partial abandonment of the Radiation Monitoring System consisting of a complete functional abandonment R-13 and R-14 Aux Building Stack Radiation Detectors.

Power shall remain available to R-13 Aux Building Vent A Monitor Pump and R-14 Aux Building Vent B Monitor pump and associated air sampling equipment (e.g., Particulate Sampler and Sample Flow Rate Monitor) to perform continuous air particulate sampling of the Auxiliary Building Stack effluent releases.

The common PS-100 Power Supplies are not being abandoned at this time as these power supplies provide power to other RMS channels which are not part of this package.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

E-258 Circuit Diagram 480V MCC 1-52A, 1-52F, 1-52B

Maintain:

MCC52F-B3 breaker to 1-1223, R-13 Aux Building Vent A Monitor Pump motor

E-3075 Circuit Diagram 480V MCC 1-62J

Maintain:

MCC62J-2EF breaker to 1-1224 R-14 Aux Building Vent B Monitor Pump motor

OPERM-601 Flow Diagram Turbine and Aux Building Ventilation

Abandon:

29098, R-13 Aux Building Vent A Detector
29099, R-14 Aux Building Vent B Detector

E-3760 - W/D Process Radiation Monitoring Power Sources

Remove Fuse 2 from RR190 Fuse Block that feeds R-13
Remove Fuse 4 from RR191 Fuse Block that feeds R-14

E-2019 - Integrated Logic Diagram RMS

Abandon:

R-13 and R-14 to the following alarm windows, 47011, 47012, 47013, and 47014

E-2021 - Integrated Logic Diagram RMS

Abandon:

R-13 and R-14 Channel descriptions and data

E-2170 – Schematic Drawing Radiation Monitoring Relays

Abandon:

A train power to R-13 relays RMXA2/29098, RMXA/29098, RMXA1/29098, RMXAF/29098
A train power to R-14 relays RMXA1/29099, RMXA/29099

E-2171 - Schematic Drawing Radiation Monitoring Relays
Abandon:
B train Power to R-13 relays RMXB/29098
B train power to R14 relays RMXB/29099, RMXB1/29099, RMXBF/29099

E-3748 - Integrated Logic Diagram RMS Channels R11, R12, R13, R14
Abandon:
R-13 and R-14 from Table J Radiation Process Monitors

E-2422 – Schematic Diagram Process Radiation Monitors R13, R20, & R21
Abandon:
Channel R13 81050 Aux Building Vent Exhaust (29098)

E-2426 – Schematic Diagram Process Radiation Monitors R12, R14, & R15
Abandon:
Channel R14 81051 Aux Bldg Vent Exhaust (29099)

4.0 Evaluation (Basis for choosing category type):

Purpose/Function
The purpose of the Radiation Monitoring System (RMS) is to provide information to plant personnel on radioactivity levels in the plant areas, and fluid processes (air and liquid). It also serves to isolate any discharge from the plant in the event radioactivity levels are too high, preventing or minimizing inadvertent/uncontrolled release to the environment.

The Aux. Bldg. Vent Monitors detect radiation passing through the Aux. Bldg. Vent to the atmosphere. Monitors R-13 and R-14 each consists of an off-line sampler. The gaseous detector is a beta sensitive plastic scintillation detector. Remote indication and alarms are provided adjacent to the Waste Disposal System Panel. A high level alarm shuts down normal ventilation fans except the SFP vent fans. A high level also activates the ASV System, activates the SFP Vent System in the filtration mode only, initiates isolation of all ducting to the Aux. Bldg. Vent, and closes the gas release valve from the gas decay tanks. If the signal for high radiation is from Monitor R-13, then the R-11/R-12 sample discharge is diverted to the Containment; AS-35/SV-33621 closes and AS-31/SV-33622 opens. The Gas Release Valve WG-36/CV-31215 is an unloading valve located in the 2" discharge header from the gas decay tanks. The 2" Containment Vent System isolates with LOCA-100B/CV-31725 closing and/or LOCA-2B/MV-32146 closing.

Basis for Category

ASV system, R-11, R12, WG-36, LOCA-100A & B have been previously abandoned.

DC KW-14-02006 Disable R-13/R-14 Trip of Aux Building Exhaust Fans, eliminated the function to isolate all ducting to the Aux Building Vent system after permanent plant shutdown.

The Gaseous Radwaste Treatment System (Waste gas decay tanks, compressors, etc.), were previously abandoned under SYS-32B-DSERT so the isolation function of the gas release valve from the gas decay tanks is no longer required.
On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

DCR KW-16-02017 SAFSTOR III Area Radiation Monitoring System, has been installed to provide radiation monitoring in selected areas including containment.

The monitoring of radioactive releases is prescribed by AEC GDC 17. The GDC requires monitoring of releases during "normal operations, from anticipated transients, and from accident conditions." With the permanent shutdown and defueling of the nuclear unit, these conditions are no longer possible. Radiation Protection (RP) has determined that continued sampling of the AB Exhaust Vent via a filtered particulate sample is sufficient to demonstrate compliance with Offsite Dose Calculation Manual (ODCM) limits.

R-13 and R-14 AB Vent Monitor Pumps and associated air sampling equipment (e.g., Particulate Sampler and Sample Flow Rate Monitor) remain available to collect particulate air samples as required by the ODCM.

Based on this RMS channels R-13 and R-14, can be abandoned.

Regulatory Impact
See CR 1382 for screening

Plant Impact
No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 3-20-2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

Since these noble gas monitors R-13 and R-14 are not associated with the Ventilation Exhaust Treatment System, and the Gaseous Radwaste Treatment System has already been abandoned (i.e., Waste Gas Decay Tanks), the abandonment of these monitors does not represent a major change to the radwaste system and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRG review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

None

6.0 Assumptions/Open Items to be validated or dispositioned:

NA

7.0 Expected duration for SSC category if **NOT** ABANDONED:

The R13 and R14 Aux Building Vent Monitor Pumps and associated air sampling equipment (e.g., Particulate Sampler and Sample Flow Rate Monitor) are expected to be in operation until plant decommissioning.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Brian Kleiman		3/27/18
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 3/26/18
Type Of Review Security	Name (Print) Brian Presl	Approval Signature	Date 3-26-18
Type Of Review N/A	Name (Print) N/A	Approval Signature N/A	Date N/A

10.0 Review and Approval:

Brian O'Connell / ______ 3/26/2018
Prepared By (Print/Sign) Date

Brian Kleiman ______ 3/27/18
Reviewed By (Screen Qual.) (Print/Sign) Date

TP Olson ______ 3/28/2018
Technical Support (Print/Sign) Date

William Swanson ______ 3/28/18
Concurrence by DSERT Coordinator (Print/Sign) Date

~~N/A~~ TPO TP OLSON / ______ ~~N/A~~ TPO 4/1/19
FSRG (Print/Sign), if required Date

FSRG Meeting Number: ~~N/A~~ TPO 19-004

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1.0 Doc Type: Report Revision No.: 0 Date: 11/9/2017
Sub Type: DEC
Document Number (ID): SYS-63-DSERT
Title: Meteorological Data Acquisition System

1.1 Brief description or reason for revision: Engineering Technical Evaluation ETE-KW-2016-0001, revision 0 determined the meteorological towers and associated instruments would no longer be required once meteorological data was no longer required by the site Emergency Plan and the Offsite Dose Calculation Manual section 15.2b was revised to no longer require an annual summary of hourly meteorological data collected over the previous year.

The ISFSI – Only Emergency Plan (IOEP) became effective on 6/29/2017. The IOEP does not require the use of meteorological data because there are no postulated events that would result in offsite dose consequences large enough to require offsite emergency planning.

The current revision, revision 17, of the Offsite Dose Calculation Manual (ODCM) still contains section 15.2b that requires the use of meteorological instrumentation to develop an annual summary of hourly meteorological conditions. Condition Report 1479 has been initiated to track the revision of the ODCM as described in in ETE-KW-2016-0001.

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries: The assessed boundaries for the Meteorological Data Acquisition System (system 63) are the primary and backup meteorological towers and their associated instrumentation.

The following equipment within the assessed boundaries is ABANDONED:
LRPB1-37BKR: Meteorological Data Racks (East) Circuit Breaker
LRPB1-39BKR: Meteorological Data Racks (West) Circuit Breaker
MCC46C-A4: Meteorological 60 Meter Tower Instruments Feed Circuit Breaker
Distribution Panel for Backup Meteorological Tower Instrument Power
Distribution Panel for Backup Meteorological Tower Service Power
Distribution Panel for Primary Meteorological Tower Instrument Power (NOTE: This will remove power from OCA Camera #96. Security personnel have stated this camera is no longer required and not currently in use.)
Distribution Panel for Primary Meteorological Tower Service Power
100 Amp Disconnect at Primary Meteorological Tower

480/220 Volt Transformer at Primary Meteorological Tower
Double Throw Disconnect Switch at Primary Meteorological Tower
Circuit Interrupting Device in Pole Mounted Box for Feed from Wisconsin Public Service (WPS) Distribution System
Circuit Interrupting Device Associated with Backup Meteorological Tower Instrument Power
Circuit Interrupting Device Associated with Backup Meteorological Tower Service Power
Circuit Interrupting Device Associated with Primary Meteorological Tower Instrument Power
Circuit Interrupting Device Associated with Primary Meteorological Tower Service Power

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings <u>**NOT**</u> incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

E-2885, Lighting Panel LRPB1, LRPB2, LRPB5 & RPB29
ABANDON – LRPB1-37BKR: Meteorological Data Racks (East) Circuit Breaker
LRPB1-39BKR: Meteorological Data Racks (West) Circuit Breaker

E-3072, Circuit Diagram 480V MCC 1-46C
ABANDON - MCC46C-A4: Meteorological 60 Meter Tower Instruments Feed Circuit Breaker

E-3333, Power Distribution 10MTR & 60 MTR Met Towers
ABANDON – Entire drawing (Note: Ground wires shown on drawing will be removed when the primary and backup towers are physically taken down under the abandonment plan.)

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The function of the Meteorological Data Acquisition System (system 63) was to provide information to Control Room personnel, Technical Support Center (TSC) personnel, and Emergency Offsite Facility (EOF) personnel concerning the status of meteorological conditions at Kewaunee Power Station (KPS). This information could be used to determine the potential hazard of an inadvertent radiological release to the environment and therefore warn government officials of the radioactive plume pathway.

Basis for Category

On February 25, 2013, Dominion Energy – Kewaunee (DEK) submitted a certification of permanent cessation of power operations pursuant to 10 CFR 50.82(a)(1)(i), stating that DEK has decided to permanently cease power operation of KPS on May 7, 2013. Upon docketing of the subsequent certification for permanent removal of fuel from the reactor vessel pursuant to 10CFR50.82(a)(1)(ii), the 10 CFR Part 50 license no longer authorizes KPS to operate the reactor or emplace or retain fuel in the reactor vessel, as specified in 10 CFR 50.82(a)(2). The spent fuel pool was permanently emptied of all nuclear fuel in June 2017. License Amendment 220 added a Technical Specification that spent fuel shall not be stored in the spent fuel pool. With the reactor vessel and the spent fuel pool (SPF) emptied of fuel, the reactor, reactor primary system, secondary system, and SFP (including its support systems) are no longer in operation and have no function and no regulatory requirement related to the safe storage and management of irradiated fuel.

The basis for the abandonment category of the Meteorological Data Acquisition System (system 63) is determined by screening to the following criteria:

1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. For safe storage and handling of radioactive waste or spent fuel.
3. The requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other commitments safe storage of spent fuel, or Radiological Effluent Monitoring / Offsite Dose Calculation Manual for KPS.
4. The requirement of SSC's that support the execution of plans and programs at KPS (e.g. Security Plan, Fire Protection Program, Emergency Management Plan, Radiation Protection Program.
5. Support day to day operations in the decommissioning plant.
6. Support plant decommissioning efforts.

The Meteorological Data Acquisition System (system 63) is not required to support any of the above criteria except for the annual reporting of meteorological data required by the ODCM, section 15.2b. The ODCM is planned to be revised to remove this requirement, reference Condition Report 1479.

On May 14, 2013, Dominion Energy –Kewaunee (DEK) certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10CFR part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the Kewaunee Power Station (KPS) reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

The Meteorological Data Acquisition System (system 63) may be abandoned per ETE-KW-2016-0001. The meteorological tower instrumentation provided two basic functions:

1) Providing real time meteorological information to the plant staff to ensure appropriate steps could be taken to mitigate the effects of accidents upon station personnel and the public.

2) Providing a source of meteorological data for periodic reporting.

The KPS licensing basis no longer includes postulated accidents as they are explained in NRC endorsed guidance for 10CFR50.59. Accidents subject to 10CFR50.59, per NEI 96-07, involve a failure of, or a challenge to the nuclear fuel or fission product barrier. With all irradiated fuel permanently removed from use or storage in the Spent Fuel Pool under the Part 50 license, and as reflected in the deletion of all accidents previously analyzed in the KPS USAR, the KPS meteorological tower instruments no longer provide a Part 50 design function. On 10/17/2014, the NRC issued Dominion Energy – Kewaunee an exemption to 10CFR50.47(b)(10) stating, "The NRC is granting exemption from portions of the rule language that would reduce the range of protective actions developed for emergency workers and the public. Consideration of evacuation, sheltering, or the use of potassium iodide will no longer be necessary. Evacuation times will no longer need to be developed or updated. Protective actions for the ingestion exposure pathway EPZ will not need to be developed." This eliminates the first of the two meteorological instrument functions.

Second, per ETE-KW-2016-0001, the periodic reporting requirement of 10CFR50.36a(2) can be met using conservative meteorological estimates rather than gathered data. Therefore, this functional capability may also be abandoned without an adverse effect upon a design function.

Regulatory Impact

Reference applicable 50.59 Screening attached to Condition report CR1382.

Plant Impact

The abandonment of the Meteorological Data Acquisition System (system 63) does not result in any required changes to SSC's, procedures, programs, processes, etc. with the exception of the revision required for the Offsite Dose Calculation Manual to use conservative meteorological estimates in place of hourly recorded data. Condition Report 1479 has been initiated to track the revision of the Offsite Dose Calculation Manual.

The abandonment of the Meteorological Data Acquisition System (system 63) has no impact on any temporary changes that are active as of 11/9/2017.

The Drawing Control Team did not identify any outstanding drawing changes that are required to dispositioned as a result of the Meteorological Data Acquisition System (system 63) being abandoned.

This package does not negatively impact the Environmental Permits, Security Plan, Fire Protection Plan, Health Physics requirements, or insurance requirements.

This DSERT package does not impact the ISFSI. Therefore, the package does not require FSRG approval.

5.0 Special conditions to support categorization(s):

Section 15.2b of Offsite Dose Calculation Manual, revision 17, needs to be revised to remove the requirement to provide an annual summary of hourly meteorological data collected over the previous year and use conservative meteorological estimates instead, as described in Engineering Technical Evaluation ETE-KW-2016-0001. Condition Report 1479 has been initiated to track the revision of the Offsite Dose Calculation Manual.

6.0 Assumptions/Open Items to be validated or dispositioned:

None.

7.0 Expected duration for SSC category if **NOT** ABANDONED:

N/A. The Meteorological Data Acquisition System (system 63) will be abandoned in its entirety.

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Michael Townsend		11/21/17
Type Of Review Security	Name (Print) David Falk	Approval Signature	Date 11-27-17
Type Of Review Radiation Protection	Name (Print) Daniel J. Shannon	Approval Signature	Date 11-20-17
Type Of Review Emergency Planning	Name (Print) DWIGHT VOGPAHL	Approval Signature	Date 11-21-17

10.0 Review and Approval:

MARK SIEVERT /
Prepared By (Print/Sign) — Date: 11/20/17

BRIAN O'CONNELL /
Reviewed By (Screen Qual.) (Print/Sign) — Date: 11/20/17

TPOLSON /
Technical Support (Print/Sign) — Date: 11/20/2017

William Swanson /
Concurrence by DSERT Coordinator (Print/Sign) — Date: 11/30/17

~~N/A~~ 11/20/17 TPOLSON /
FSRG (Print/Sign), if required — Date: 4/1/19

FSRG Meeting Number: ~~N/A~~ 11/20/17 19-004

1.0 Doc Type: Report Revision No.: 0 Date: 5/30/2018
Sub Type: DEC
Document Number (ID): SYS-85-DSERT
Title: Sewage Treatment System (SDP)

1.1 Brief description or reason for revision: The Sewage Treatment Plant (SDP) is being completely abandoned. All new septic tanks have been installed and tied to the remaining occupied buildings (gatehouse, maintenance building, and ISFSI Security Building).

2.0 System Category (Check Appropriate):

NOTE:	*A SSC may be divided and have more than one category determination depending upon its functional requirements.*

☐ Available (Category A) ☒ Abandoned (Category X)

Describe the assessed boundaries:

Sewage Treatment Plant (SDP)

The Sewage Treatment Plant is being categorized as abandoned. All facilities and drains to the Sewage Treatment Plant will be flushed and terminated to the SDP. The SDP will be shut down, isolated from receiving any wastes, and cleaned.

3.0 **Mark up** the affected drawings using color coding to identify system category type and boundaries. These drawings are to include system, electrical one-line and distribution, and select building and isometric drawings. Related system drawings **NOT** incorporated in the system category require an explanation. **REFER** to Step 2.7 for a list of drawings.

WPS-SDP1, M-659/M-662, Rev. F, 9-20-88
The entire drawing should be color coded Red to represent the "Abandon" status.

WPS-SDP2, WSK-161, DCR 1705, 4-18-88
The entire drawing should be color coded Red to represent the "Abandon" status.

WPS-SDP3, K54103-8, Rev. A, 4-18-88
The entire drawing should be color coded Red to represent the "Abandon" status.

E-2886, Circuit Diagram 480V MCC 1-46A, 1-46D
Bus 1-46D, Breaker 1GH(L), Sewage Treatment Plant (MCC-46E), should be color coded Blue to represent the "Evaluated " status. 1-194 and shown as Leads lifted to underground wiring.

E-2887, Circuit Diagram 480V MCC 1-46B
MCC-46B, Cub. 2MN, TSC Sanitary Ejector Pump 1A, 1-911
MCC-46B, Cub. 3IJ, TSC Sanitary Ejector Pump 1B, 1-912

E-3864, Circuit Diagram 480V MCC 1-46E
Blower No.1 (A1), Blower No.2 (A2), Blower No. 3 (A3), Comminutor (B1), Transfer Pump 1 (B2), Transfer Pump 2 (B3), Final clarifier (B4), Lift Sta. Comp. 1 (C3), and Lift Sta. Comp. 2 (C4) abandoned; color coded RED.

M-229, Yard Piping
Lines capped or plugged, as required.

M-377, Office/Warehouse Annex Underground Utility Plan
Lines capped or plugged, as required.

M-659, Sanitary Sewer System Plot Plan, Profiles & Field Piping
Everything.

M-662, Sanitary Sewer System Plot Plan – Profile – Sections
Lines capped or plugged, as required.

XK-54167-2, Trailer Site Plan Site Details
Lines capped or plugged, as required.

XK-54167-40, Administrative & Training Facility, Basement Power & Lighting Plan One Line Diagram
MDP 3 Bkr 5, Sanitary Ejection Pumps

4.0 Evaluation (Basis for choosing category type):

Purpose/Function

The Sewage Treatment Plant (SDP) receives solids and liquids from the KPS sewer system and soil pipes from all the plant restrooms. The SDP breaks down the solid waste products by means of aerobic microorganisms that multiply rapidly in the proper environment.

The SDP process uses a mixed waste flow with the solid waste being accumulated in a sludge storage tank and the treated liquid effluent being discharged to the creek near the SDP. The creek flows into Lake Michigan. The SDP has a design capability of 20,000 gpd.

Basis for Category

The system is NOT required to support day to day operations of the facility in SAFSTOR III and beyond.

1. To prevent or mitigate the consequences of a design basis accident of a permanently defueled plant.
2. Fuel Handling Accident as defined in Updated safety Analysis Report (USAR).
3. For safe storage and handling of radioactive waste or spent fuel.
4. The Requirements of Technical Specifications, Technical Requirements Manual, License Requirements, Design Basis, permits, regulatory requirements, insurance requirements, other commitments, safe storage of spent fuel, or support of the Radiological Effulent Monitoring / Offsite Dose Calculation Manual for KPS.
5. The requirements of SSCs that support the execution of plans and programs at KPS (e.g., Security Plan, Fire Protection Plan, Emergency Management Plan, Radiation Protection Program).
6. Support day to day operations in the decommissioning plant.
7. Support decommissioning efforts.

The Sewage Treatment Plant has been replaced by three Holding Tanks and will not be required to support any of the items above. The Sewage Treatment Plant (SDP) is being completely abandoned. Holding Tanks for the ISFSI Security Building, the Gatehouse (previously Security Building), and the Maintenance Building are installed.

On May 14, 2013, DEK certified the following to the NRC: "Pursuant to 10CFR50.82(a)(1)(ii), DEK hereby certifies to the NRC that as of May 14, 2013 all fuel has been permanently removed from the KPS reactor vessel and placed into the KPS spent fuel pool. As stated in 10CFR50.82(a)(2), upon docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel." This renders the KPS reactor incapable of starting up, operating, or shutting down. Safe shutdown has been permanently achieved.

Therefore SSC functions necessary to support the startup, operation, or shutdown of the KPS reactor may be disabled without adverse effects provided that the SSCs under consideration perform no other design function.

Per License Amendment 220, DEK is no longer allowed to place irradiated fuel in the SFP. Therefore, the functions of SFP Cooling and Make-Up may be disabled without an adverse effect provided that the SSCs under consideration perform no other design function.

Therefore functions and SSCs supporting functions that support operation or monitoring of the KPS SFP may be abandoned/disabled without an adverse effect.

Moreover, the SSCs under consideration have no function in meeting a regulation or in the prevention or mitigation of an accident.

Therefore, the abandonment of the SDP has no adverse effect.

Regulatory Impact (Documented in CR 1382)

Updated Safety Analysis Report (USAR)
Sewage treatment is mentioned in section 11.1.2.4 of the USAR.

11.1.2.4 Solids Processing
The Service Water Pretreatment Lagoon sludge has the potential to become contaminated at very low levels. This sludge can be disposed of by land application to an area on-site at KPS provided the criteria identified in the *NRC Safety Evaluation Report* and the Wisconsin Department of Natural Resources' Mandatory Operation Permit are complied with. Similarly, sewage treatment sludge has the potential to become contaminated at very low levels. This

sludge can also be disposed of by land application.
None of the USAR information related to the SDP meets the definition of a design function or ensuring that a design function will be achieved.

Technical Specifications

None

Technical Requirements Manual (TRM)

None

Offsite Dose Calculation Manual (ODCM)

A review of the ODCM did not identify any specific requirements associated with the Sewage Treatment Plant and related SSCs that are being categorized as available. Sewage Treatment is identified in section 1.6 as follows:

1.6 Onsite Disposal of Low-Level Radioactively Contaminated Waste Streams

During the normal operation of Kewaunee, the potential exists for in-plant process streams, which are not normally radioactive to become contaminated with very low levels of radioactive materials. These waste streams are normally separated from the radioactive streams. However, due mainly to infrequent minor system leaks and anticipated operation occurrences, the potential exist for these systems to become slightly contaminated. At Kewaunee, the secondary system demineralizer resins, the service water pretreatment system sludges, the make-up water system resins, and the sewage treatment plant sludges are waste streams that have the potential to become contaminated at very low levels. During the yearly testing of a batch of pre-treatment sludge, it was found approximately 15,000 cubic feet of sludge had been contaminated with Cs-137 and Co-60.

The potential radiation doses to MEMBERS OF THE PUBLIC from these onsite disposal methods are well below 1 mrem per year. This dose is in keeping with the guidelines of the National Council on Radiation Protection (NCRP) in their Report No. 91, in which the NCRP established a "negligible individual risk level" at a dose rate of 1 mrem per year. It is for these type wastes that the NRC acknowledged in Information Notice No. 83-05 and 88-22 that the levels of radioactive material are so low that control and disposal as a radwaste are not warranted. The potential risks to man are negligible and the disposal costs as a radwaste are unwarranted and costly.

This waste material will be monitored and evaluated prior to disposal to ensure its radioactive material content is negligible. It shall then be disposed of in a normal conventional manner with records being maintained of all materials disposed of using these methods.

Approvals for specific alternate disposal methods are listed in Appendix D. Currently, only service water pretreatment (SWPT) facility lagoon sludge and sewage treatment plant sludge have been approved for disposal by land spreading.

Licensing Commitments

None

Plant Impact

Holding Tanks installed for the Gatehouse, Maintenance Building, and ISFSI Security Building prior to abandonment of SDP.

No other changes are required to SSCs, procedures, programs, processes, etc.
There is no impact on any temporary changes that are active as of 5-31-2018.

The Drawing Control Team did not identify any outstanding drawing changes that required disposition as a result of system abandonment.

This DSERT package does not impact ISFSI, therefore does not require FSRG approval.

This package does not negatively impact the Environmental Permits, Security Plan, REMM\ODCM, Fire Protection Plan, Health Physics Requirements or Insurance requirements.

This abandonment does not represent a major change to the radioactive waste systems (liquid, gaseous, and solid) and therefore the requirements of ODCM 15.1 do not apply (e.g., FSRC review is not required and it is not required to be reported to the NRC in the Annual Radioactive Effluent Release Report).

5.0 Special conditions to support categorization(s):

Holding Tanks installed and in service for Gatehouse (previously Security Building), Maintenance Building and ISFSI Security Building, with all lines flushed and terminated to SDP.

6.0 Assumptions/Open Items to be validated or dispositioned:

None

7.0 Expected duration for SSC category if **NOT** ABANDONED:

None

8.0 **PREPARE** and **ATTACH** the following documents:

- Completed 10 CFR 50.59 Screening or Evaluation, if required
- Proposed DUs for appropriate drawings

9.0 Technical Concurrence:

Type Of Review	Name (Print)	Approval Signature	Date
Fire Protection	Brian Kleiman	[signature]	6/13/18
Type Of Review	Name (Print)	Approval Signature	Date
Radiation Protection	Daniel J. Shannon	[signature]	6/13/18
Type Of Review	Name (Print)	Approval Signature	Date
Environmental	Ted Maloney	Ted Maloney	6/13/18
Type Of Review	Name (Print)	Approval Signature	Date
Chemistry	Darryl Holschbach	[signature]	6/13/18

10.0 Review and Approval:

William Swanson [signature] — 6/12/18
Prepared By (Print/Sign) — Date

Brian Kleiman [signature] — 6/13/18
Reviewed By (Screen Qual.) (Print/Sign) — Date

T P OLSON [signature] — 6/13/18
Technical Support (Print/Sign) — Date

William Swanson [signature] — 6/13/2018
Concurrence by DSERT Coordinator (Print/Sign) — Date

~~N/A~~ TPOLSON/ [signature] — ~~N/A~~ 4/1/19
FSRG (Print/Sign), if required — Date

FSRG Meeting Number: ~~N/A~~ 19-004

Facility Safety Review Group

February 27, 2018 **1000 Hours**

ATTENDEES:

Quorum

Leader: TP Olson, Manager – Technical Support *(1)*
DP Shannon – RP/Chemistry Manager *(1)*
JC Arcand – Maintenance Manager *(1)*
BJ McMahon. Manager Nuclear Operations *(1)*

FSRG Coordinator: JM Schuh, Administrative Assistant

Presenters: JR Barbier – Security
BD O'Connell - Engineer

(1) Indicates Leader and Members required for quorum per LI-KW-600.
(nv) Non-Voting Member

The Leader called the meeting to order and noted that quorum requirements were met. The following items were discussed as noted.

FSRG 18-004 <u>SYS-17-1-DSERT Auxiliary Building Ventilation Abandonment</u>
Presenter: B O'Connell, *Approved*

This abandonment changes the radioactive waste system (gaseous) by abandoning one train of the Aux Building Ventilation Filtration System. Therefore the requirements of ODCM 15.1 apply (e.g. FSRG review is required and it is to be reported to the NRC in the Annual Radioactive Effluent Release Report.)

<u>Discussion:</u> FSRG reviewed and discussed SYS-17-1-DSERT and identified no safety issues or concerns.

FSRG recommended approval of SYS-17-1-DSERT, Auxiliary Building Ventilation Abandonment

FSRG 18-005

SIP-SS-10.08, Security Assessment Programs, Rev 1
Presenter: J Barbier, *Approved*

This procedure is being revised to accurately depict the necessary audit determination factors and criteria.

Discussion:

FSRG reviewed and discussed SIP-SS-10.08 and identified no safety issues or concerns.

FSRG recommended approval of SIP-SS-10.08, Security Assessment Programs, Rev 1.

FSRG 18-006

SIP-SS-20.01, Issuance and Control of Site Badges, Proxy Cards and Visitor Badges, Rev 1
Presenter: J Barbier, *Approved w/comments*

This procedure is being revised to update guidance to reflect the new PA configuration. The title of this procedure has also been changed to better align with the content of the procedure.

Discussion:

FSRG reviewed and discussed SIP-SS-20.01 and identified no safety issues or concerns.

- Editorial Changes
- and vs or

FSRG recommended approval of SIP-SS-20.01, Issuance and Control of Site Badges, Proxy Cards and Visitor Badges, Rev 1 pending final review of changes from the FSRG Leader.

FSRG 18-007

SIP-SS-20.05, Lock, Key, Combination and Password Control, Rev 1
Presenter: J Barbier, *Approved w/comments*

This procedure is being revised to update guidance to reflect the new PA configuration and associated security control devices.

Discussion:

FSRG reviewed and discussed SIP-SS-20.05 and identified no safety issues or concerns.

- Editorial/Administrative Changes

FSRG recommended approval of SIP-SS-20.05, Lock, Key, Combination and Password Control, Rev 1 pending final review of changes from the FSRG Leader.

FSRG 18-008 SIP-SS-30.03, Operation, Use and Testing of Communications Equipment, Rev 1
Presenter: J Barbier, *Approved w/comments*

This procedure is being revised to update guidance to reflect the new PA configuration and associated security equipment.

Discussion: FSRG reviewed and discussed SIP-SS-30.03 and identified no safety issues or concerns.

- Administrative Change

FSRG recommended approval of SIP-SS-30.03, Operation, Use and Testing of Communications Equipment, Rev 1 pending final review of changes from the FSRG Leader.

FSRG 18-009 SIP-SS-40.04, Protective Strategy, Rev 1
Presenter: J Barbier, *Approved w/comments*

This procedure is being revised to update guidance to reflect the new PA configuration, update guidance for the provided protected positions and provide clarity for what actions to take for CAS abandonment/relocation in an emergency.

Discussion: FSRG reviewed and discussed SIP-SS-40.04 and identified no safety issues or concerns.

- FSRG requested Security validate contingency equipment is properly staged at designated locations.
- FSRC requested Security validate that actions for loss of radio base station are consistent with the new equipment design and add additional information on the change in the document package.

FSRG recommended approval of SIP-SS-40.04, Protective Strategy, Rev 1 pending final review of changes from the FSRG Leader.

The meeting was adjourned at 1018.

Submitted by: John Schuh 3/1/18
JM Schuh Date
Recording Secretary

APPROVED: 3/1/18
TP Olson Date
FSRG Leader

APPROVED: 3/1/18
SJ Yuen Date
Plant Manager

DOMINION
Kewaunee Power Station **FSRG MTG # 18-005**

Facility Safety Review Group

March 27, 2018 **1000 Hours**

ATTENDEES:

Quorum

Leader: TP Olson, Manager – Technical Support *(1)*
JC Arcand – Maintenance Manager *(1)*
BJ McMahon. Manager Nuclear Operations *(1)*

FSRG Coordinator: JM Schuh, Administrative Assistant

Presenters: BM Kleiman – Engineering Technical Support

(1) Indicates Leader and Members required for quorum per LI-KW-600.
(nv) Non-Voting Member

The Leader called the meeting to order and noted that quorum requirements were met. The following items were discussed as noted.

FSRG 18-012 SYS-07-DSERT Steam Generator Blowdown Treatment System DSERT Package
Presenter: B Kleiman, *Approved*

FSRG required as this DSERT Package will require an update to the ODCM

Discussion: FSRG reviewed and discussed SYS-07-DSERT and identified no safety issues or concerns.

FSRG recommended approval SYS-07-DSERT, Steam Generator Blowdown Treatment System DSERT Package.

The meeting was adjourned at 1003.

Submitted by: John Schuh 3/28/18
JM Schuh Date
Recording Secretary

APPROVED: 3/28/18
TP Olson Date
FSRG Leader

APPROVED: 4/2/18
SJ Yuen Date
Plant Manager

DOMINION
Kewaunee Power Station **FSRG MTG # 18-007**

Facility Safety Review Group

May 1, 2018 **1400 Hours**

ATTENDEES:

Quorum

Leader: BJ McMahon, Manager – Operations & Maintenance

Reviewer: R Smythe – Shift Supervisor

FSRG Coordinator: JM Schuh, Administrative Assistant

Presenters: BM Kleiman – Technical Support

(1) Indicates Leader and Members required for quorum per LI-KW-600.
(nv) Non-Voting Member

The Leader called the meeting to order and noted that quorum requirements were met. The following items were discussed as noted.

FSRG 18-014 SYS-02-DSERT Service Water System
Presenter: BM Kleiman, *Approved*

DSERT package requires review as SW is identified in ODCM.

Discussion: FSRG reviewed and discussed SYS-02-DSERT, Service Water System and identified no safety issues or concerns.

FSRG recommended approval of SYS-02-DSERT, Service Water System.

The meeting was adjourned at 1403.

Submitted by: ______________________ 5/3/18
JM Schuh Date
Recording Secretary

APPROVED: ______________________ 5-7-18
BJ McMahon Date
FSRG Leader

APPROVED: ______________________ 5-14-18
SJ Yuen Date
Plant Manager

Facility Safety Review Group

August 30, 2018 **1300 Hours**

ATTENDEES:

Quorum

Leader: TP Olson, Manager – Operations/Maintenance *(1)*
DP Shannon – RP/Chemistry Manager *(1)*

FSRG Coordinator: JM Schuh, Administrative Assistant

(1) Indicates Leader and Members required for quorum per LI-KW-600.
(nv) Non-Voting Member

The Leader called the meeting to order and noted that quorum requirements were met. The following items were discussed as noted.

FSRG 18-027 SYS-32D-1-DSERT, Solid Radioactive Waste System Abandonment, Rev. 1
Approved

SYS-32D-1-DSERT provides for abandonment of the Spent Resin Storage Tank, Dewatering Pump and all support equipment.

Discussion: FSRG reviewed and discussed the changes to SYS-32D-1-DSERT and identified no safety issues or concerns.

FSRG recommended approval of SYS-32D-1-DSERT, Solid Radioactive Waste System Abandonment, Rev. 1

The meeting was adjourned at 1310.

Submitted by: John Schuh 10/10/18

JM Schuh
Recording Secretary
Date

APPROVED: 10/11/2018

TP Olson
FSRG Leader
Date

APPROVED: 10/11/18

B McMahon
ISFSI Site Director
Date

Facility Safety Review Group

April 1, 2019 **0902 Hours**

ATTENDEES:

Quorum

Leader: TP Olson, Manager – Operations/Maintenance *(1)*
DJ Shannon, Manager – RP/Chemistry Manager *(1)*
WF Zipp, Manager – Engineering/Tech Support *(1)*

FSRG Coordinator: JM Schuh, Administrative Assistant

Guests: Bart Steckler – Radiation Protection

(1) Indicates Leader and Members required for quorum per LI-KW-600.
(nv) Non-Voting Member

The Leader called the meeting to order and noted that quorum requirements were met. The following items were discussed as noted.

FSRG 19-006 Review of Major Changes to the Radioactive Liquid, Gaseous and Solid Waste Systems
Presenter: Steckler, *Approved*

To ensure FSRG finds the evaluation acceptable to where radioactive effluents are not adversely affected and there is no exposure expected to plant personnel.

FSRG reviewed the changes to the following systems in accordance with ODCM Section 15.1:

- SYS-45-13-DSERT Radiation Monitoring System (R-5, R-10, R-17)
- SYS-15-1-DSERT Auxiliary Building Air Conditioning
- SYS-18-1-DSERT Reactor Building Ventilation
- SYS-21-DSERT Spent Fuel Pool Cooling
- SYS-22-2-DSERT Heating Boiler and Distribution
- SYS-30-1-DSERT Miscellaneous Drains and Sumps
- SYS-45-14-DSERT Radiation Monitoring System (R-16, R-20)

- SYS-45-19-DSERT Radiation Monitoring System (R-13, R-14)
- SYS-63-DSERT Meteorological Data Acquisition System
- SYS-85-DSERT Sewage Treatment Plant

a) System abandonment evaluations were performed for these systems using procedure OP-KW-DEC-SYC-001, System Evaluation and Categorization, and documented on Attachment B, SSC Category Determination Document. System abandonment screenings were performed for these systems and documented in CR1382. The screenings determined that the changes to the systems could be performed in accordance with 10CFR50.59.

b) The SSC Category Determination Documents for these systems provide sufficient information to totally support the reason for the changes without benefit of additional or supplemental information.

c) The SSC Category Determination Documents for these systems provide a description of the equipment, components, and processes involved and interfaces with other plant systems.

d) The changes to these systems have had no adverse effect on predicted releases of radioactive materials in liquid and gaseous effluents and/or the quantity of solid waste. This was substantiated by comparing the effluent results of the 2017 and 2018 Annual Radiological Effluent Release Reports.

e) The changes to these systems have had no adverse effect on the expected maximum exposure to individuals in the UNRESTRICTED AREA or to the general population. This was substantiated by comparing effluent results of the 2017 and 2018 Annual Radiological Effluent Release Reports and the ambient TLD results from the 2017 and 2018 Annual Radiological Environmental Operating Reports.

f) A comparison of the predicted releases of radioactive materials in liquid and gaseous effluents and/or the quantity of solid waste indicated the actual results were the same or less based on the changes to these systems.

g) There is no exposure expected by plant personnel as a result of the changes to these systems.

Discussion: FSRG has reviewed and found these changes to the radioactive waste systems are acceptable in accordance with ODCM 15.1.

FSRG recommended approval of the above listed DSERT packages.

The meeting was adjourned at 0915.

Submitted by: Jolyn Schuh 4/3/19
JM Schuh Date
Recording Secretary

APPROVED: TPO 4/3/2019
TP Olson Date
FSRG Leader

APPROVED: BJ McMahon 04/03/2019
BJ McMahon Date
ISFSI Site Director

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