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Exelon Nuclear

April 26, 2012
BW120042

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Subject: 2011 Radioactive Effluent Release Report

The attached document includes the Radioactive Effluent Release Report for Braidwood Station. This report is being submitted in accordance with 10 CFR 50.36a, "Technical specifications on effluents from nuclear power reactors," and Technical Specification 5.6.3, "Radioactive Effluent Release Report," and includes a summary of radiological liquid and gaseous effluents and solid waste released from the site from January 2011 through December 2011. In addition, a copy of the Braidwood Station Offsite Dose Calculation Manual is included in accordance with Technical Specification 5.5.1, "Offsite Dose Calculation Manual (ODCM)."

If you have any questions regarding this information, please contact Chris VanDenburgh Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,

Daniel J. Enright
Site Vice President
Braidwood Station

cc: US NRC Regional Administrator, Region III
US NRC Senior Resident Inspector - Braidwood Station
NRR Project Manager - Braidwood Station
Illinois Emergency Management Agency - Division of Nuclear Safety

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BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 1 AND 2 (Docket Numbers,50-456 and 50-457)

DOCUMENT INDEX

RADIOACTIVE EFFLUENT RELEASE REPORT

January - December 2011

Facility: BRAIDWOOD NUCLEAR POWER STATION

Licensee: EXELON GENERATION COMPANY, LLC

1. Regulatory Limits

a. For Noble Gases:

Dose Rate

1) Less than 500 mrem/year to the whole body.
2) Less than 3000 mrem/year to the skin.

Dose Gamma Radiation

1) Less than or equal to 5 mrad/quarter.
2) Less than or equal to 10 mrad/year.

Dose Beta Radiation

1) Less than or equal to 10 mrad/quarter.
2) Less than or equal to 20 mrad/year.

b. Iodine: (summed with particulate, see below)

c. Particulates with half-lives > 8 days:

Dose Rate

1) Less than 1500 mrem/year to any organ.

Dose

1) Less than or equal to 7.5 mrem/quarter to any organ.
2) Less than or equal to 15 mrem/year to any organ.

d. For Liquid

Dose

1) Less than or equal to 1.5 mrem to the whole body during any calendar quarter.
2) Less than or equal to 5 mrem to any organ during any calendar quarter.
3) Less than or equal to 3 mrem to the whole body during any calendar year.
4) Less than or equal to 10 mrem to any organ during any calendar year.

2. Maximum Permissible Concentration

   a. Fission and Activation Gases: 10CFR20 Appendix B Table 2
   b. Iodine: 10CFR20 Appendix B Table 2
   c. Particulates: 10CFR20 Appendix B Table 2
   d. Liquid Effluents: 10 X 10CFR20 Appendix B Table 2

3. Average Energy

   This item is not applicable. Release rates are calculated using an isotopic mix rather than average energy.

4. Measurements and Approximations of Total Radioactivity

   a. Fission and Activation Gases, Iodines, and Particulates

      Before being discharged, containment batch releases are analyzed for noble gas and tritium via gamma spectroscopy and liquid scintillation, respectively. Gaseous decay tanks are analyzed for noble gases before being discharged via gamma spectroscopy. Released activity is normally calculated using volume of release, which is determined by change in tank or containment pressure.

      The Auxiliary Building ventilation exhaust system is continually monitored for iodines and particulates. These samples are pulled every 7 days and analyzed via gamma spectroscopy. The particulate samples are also analyzed quarterly for gross alpha and Sr-89/90.

      Noble gas and tritium grab samples are pulled and analyzed weekly by gamma spectroscopy and liquid scintillation, respectively. The average flow at the release points and nuclide specific activity concentrations are used to calculate the activity released.

      Volumes and activities of effluents discharged from systems that are common to both units are divided between both units.

      The secondary side of both units contain tritium. Very small amounts of tritium are continually released to the atmosphere from secondary components through packing leaks, tank vents, the main condenser, etc. Bounding calculations have been performed to show that very large leaks (1000 gpd) for extended periods (1 month) at normal secondary tritium concentrations, would provide an insignificant increase (1.00E-5 mrem) in offsite dose.

      Summary

      The calculated offsite dose to the public from station gaseous effluents remains low and a small percentage of the quarterly and annual ODCM limits.

4. b. Liquid Effluents

The liquid release tanks are analyzed before discharge via gamma spectroscopy and liquid scintillation. A representative portion of this sample is saved and is composited every 31 days with other discharges that occurred. The composites are analyzed for tritium and gross alpha. The batch composites are composited quarterly and sent to a vendor for Sr-89/90 and Fe-55 analysis. Circulating Water Blowdown, Condensate Polisher Sump and Waste Water Treatment are analyzed weekly by gamma spectroscopy and for tritium. These weekly samples are composited monthly. The monthly composites are then composited quarterly and sent to a vendor for Sr-89/90 and Fe-55 analysis.

Liquid release tank volumes and concentration activities are used to calculate the activity released during the time period. The total volume of water released and the nuclide specific concentration activities are used to calculate the final activity concentrations at the discharge point.

Volumes and activities of effluents discharged from systems that are common to both units are divided between both units.

There have been no indications of additional contamination since the start of the Exelon Pond remediation and the review of results of Exelon Pond analyses indicate the tritium concentration of the pond has been and remains below the level of detectability for the values described in the ODCM. Thus, the lack of sample analyses in these cases has not affected calculated offsite dose.

Instrument Issues

On 6/10/11, it was noted that there was insufficient Exelon Pond sample for the week of 5/31/11 to 6/6/11. Operation's logbook entries indicate that the Exelon Pond pump operated for a 36 minute time period during this time frame. The compositor pulls a sample from the process stream every two hours during the Exelon Pond Pump's operation. The brief operation of the pond pump was insufficient for a sample to be obtained. IR 1227468 was written to document the missed sample based on insufficient pump run time and to capture the item in the 2011 ARERR.

The Exelon Pond composite sample that ended on 1/3/12 was found to be insufficient for analysis. Approximately 150 mL of sample was obtained when several liters was typical. IR 1309068 was written to document the occurrence. The compositor was adjusted to pull larger samples at the prescribed interval to ensure the weekly composite is large enough for analysis and further compositing.

Vacuum Breaker #1 compositor was found to be empty on 11/21/11. Heat tracing was operable and the compositor was cycling during the prescribed intervals. IR 1293134 was written to document the empty composite sample and the need for a grab sample. Upon investigation it was found that the compositor was working acceptably. No repair was necessary. Vaccum Breaker #1 compositor has been functioning without issue since then.

Summary

The calculated offsite dose to the public from station liquid effluents remains low and a small percentage of the quarterly and annual Offsite Dose Calculation Manual (ODCM) limits.

4. c. Less than the lower limit of detection (<LLD)

Samples are analyzed such that the Offsite Dose Calculation Manual (ODCM) LLD requirements are met. When a nuclide is not detected during the quarter then <LLD is reported.

d. Errata for Previous Annual Radioactive Effluent Release Reports

IR 1273923 documents a condition in which a flow loop for the 2RY-PR030C "AUX bldg ventstack WRGM I/E transmitter" was found to be out of tolerance by 17.44% between the as found condition and the expected value. The transmitter feeds the Unit 2 ventstack flow calculation. The flow loop instrument was last calibrated on 01/07/2010. All affected 2010 and 2011 effluent waste gas permits had their vent stack flow conservatively increased by 17.44% to account for the out of tolerance as found condition. The revised 2011 data that accounts for the flow discrepancy is a part of the 2011 data reported in this ARERR. The affected 2010 data has been revised and evaluated for applicable limit challenges. The change did not result in a significant increase in offsite dose or challenge any applicable offsite dose limits.

IR 1221439 documents an issue in which Fe-55 found in the 2010 second quarter Liquid Release Tank composite was not added to that quarter's permits, as required. The Fe-55 activity of 7.55E-06 uCi/mL has been added to the required permits to correct the specified timeframe. 2010 second quarter liquid effluent organ dose associated with the addition of Fe-55 saw an increase of 0.0002%. 2010 liquid effluent annual organ dose saw an increase of less that 0.0001%. 2010 second quarter liquid effluent whole body dose associated with the addition of Fe-55 saw an increase of 0.00025%. 2010 liquid effluent annual whole body dose associated with the addition of Fe-55 saw an increase of 0.0001%. Calculated dose to the public was not appreciably impacted by the correction. Model AR 1354440 has been created with a quarterly periodicity to review the vendor supplied results and update the affected permits, as required.

It was identified that the 2010 ARERR contained a unit error on page 26 of 104. The original 2010 ARERR had a "Total Activity Released (Ci)" of 4.31E+04. The unit error occurred by inserting the 4.31E+04 μCi. The correct value that should have been recorded was 4.31E-02 Ci. The affected page has been corrected, in its entirety, and is included in Attachment 7 of this report. The affected page includes revision bars in the margin.

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Est. Total Error%
A. Fission and Activation Gas Releases						
1. Total Release Activity	Ci	1.39E-01	5.82E-01	5.03E-03	3.00E-03	7.59
2. Average Release Rate	µCi/sec	1.79E-02	7.40E-02	6.33E-04	3.77E-04	
3. Percent of ODCM Limit - gamma	%	2.56E-05	1.38E-04	8.02E-07	4.78E-07	
4. Percent of ODCM Limit - beta	%	5.67E-05	2.59E-04	1.95E-06	1.16E-06	
B. Iodine Releases						
1. Total Iodine	Ci	1.41E-06	2.36E-04	7.57E-06	7.30E-07	33.20
2. Average Release Rate	µCi/sec	1.81E-07	3.00E-05	9.52E-07	9.18E-08	
3. Percent of ODCM Limit - gamma	%	1.45E-05	1.81E-04	1.45E-06	7.53E-06	
C. Particulate (> 8 day half-life) Releases						
1. Particulates with half-lives > 8 days	Ci	1.04E+00	1.13E+00	1.08E+00	1.07E+00	19.80
2. Average Release Rate	µCi/sec	1.34E-01	1.44E-01	1.36E-01	1.35E-01	
3. Percent of ODCM Limit	%	2.91E+00	3.16E+00	3.03E+00	3.00E+00	
3. Gross Activity	Ci	<LLD	<LLD	<LLD	<LLD	
D. Tritium Releases						
1. Total Release Activity	Ci	3.90E+01	4.17E+02	7.76E+01	1.86E+01	8.07
2. Average Release Rate	µCi/sec	5.02E+00	5.31E+01	9.76E+00	2.34E+00	
3. Percent of ODCM Limit	%	7.58E-02	8.09E-01	1.50E-01	3.61E-01	
E. Gross Alpha Releases						
1. Total Release Activity	Ci	<LLD	<LLD	<LLD	<LLD	19.80
2. Average Release Rate	µCi/sec	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM limit	%	N/A	N/A	N/A	N/A	
F. Carbon-14 Releases						
1. Total Release Activity	Ci	1.04E+00	1.13E+00	1.08E+00	1.07E+00	
2. Average Release Rate	µCi/sec	1.34E-01	1.44E-01	1.36E-01	1.35E-01	

Note: LLD Values are included in Appendix A of this report.

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 1 (Docket Number 50-456)
CONTINUOUS MODE AND BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1. Fission Gases									
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	8.30E-05	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	5.18E-06	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	1.32E-01	5.08E-01	5.03E-03	3.00E-03
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	2.16E-03	1.07E-02	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	4.82E-03	6.31E-02	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	<LLD	<LLD	<LLD	<LLD	1.39E-01	5.82E-01	5.03E-03	3.00E-03
2. Iodines									
I-131	Ci	1.41E-06	1.74E-05	<LLD	5.29E-07	<LLD	1.10E-08	1.66E-08	2.01E-07
I-132	Ci	<LLD	2.19E-04	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	7.55E-06	<LLD	<LLD	1.67E-07	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	1.41E-06	2.36E-04	7.55E-06	5.29E-07	<LLD	1.78E-07	1.66E-08	2.01E-07
3. Particulates									
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	1.10E-06	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	8.03E-06	1.86E-05	<LLD	<LLD	1.65E-07	7.01E-07	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 1 (Docket Number 50-456)
CONTINUOUS MODE AND BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sn-117m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	2.39E-06	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Nd-147	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	8.03E-06	1.86E-05	3.49E-06	<LLD	1.65E-07	7.01E-07	<LLD	<LLD
4. Tritium	Ci	3.65E+01	4.12E+02	7.48E+01	1.59E+01	2.55E+00	5.14E+00	2.72E+00	2.73E+00
5. Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
6. Carbon-14	Ci	1.04E+00	1.13E+00	1.08E+00	1.07E+00	N/A	N/A	N/A	N/A

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Est. Total Error%
A. Fission and Activation Gas Releases						
1. Total Activity Released	Ci	1.39E-01	8.66E-01	5.03E-03	3.00E-03	7.59
2. Average Release Rate	µCi/sec	1.79E-02	1.10E-01	6.33E-04	3.77E-04	
3. Percent of ODCM Limit - gamma	%	2.56E-05	1.83E-04	8.02E-07	4.78E-07	
4. Percent of ODCM Limit - beta	%	5.67E-05	3.69E-04	1.95E-06	1.16E-06	
B. Iodine Releases						
1. Total Iodine	Ci	8.41E-07	2.32E-04	1.77E-08	7.20E-07	33.20
2. Average Release Rate	µCi/sec	1.08E-07	2.95E-05	2.23E-09	9.06E-08	
3. Percent of ODCM Limit	%	8.66E-06	1.65E-04	1.81E-07	7.42E-06	
C. Particulate (> 8 day half-life) Releases						
1. Particulates with half-lives > 8 days	Ci	1.13E+00	9.32E-01	1.32E+00	1.46E+00	19.80
2. Average Release Rate	µCi/sec	1.45E-01	1.19E-01	1.66E-01	1.84E-01	
3. Percent of OCDM Limit	%	3.16E+00	2.61E+00	3.69E+00	4.10E+00	
4. Gross Activity	Ci	<LLD	<LLD	<LLD	<LLD	
D. Tritium Releases						
1. Total Release Activity	Ci	5.77E+01	4.74E+02	3.99E+02	3.69E+01	8.07
2. Average Release Rate	µCi/sec	7.42E+00	6.03E+01	5.02E+01	4.64E+00	
3. Percent of ODCM Limit	%	1.12E-01	9.19E-01	7.71E-01	7.17E-02	
E. Gross Alpha Releases						
1. Total Release Activity	Ci	<LLD	<LLD	<LLD	<LLD	19.80
2. Average Release Rate	µCi/sec	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM Limit	%	N/A	N/A	N/A	N/A	
F. Carbon-14 Releases						
1. Total Release Activity	Ci	1.13E+00	9.32E-01	1.32E+00	1.46E+00	
2. Average Release Rate	µCi/sec	1.45E-01	1.19E-01	1.66E-01	1.84E-01	

Note: LLD Values are included in Appendix A of this report.

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 2 (Docket Number 50-457)
CONTINUOUS MODE AND BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1. Fission Gases									
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	8.31E-05	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	5.18E0-6	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	1.32E-01	7.93E-01	5.03E-03	3.00E-03
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	2.16E-03	1.07E-02	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	4.82E-03	6.31E-02	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	<LLD	<LLD	<LLD	<LLD	1.39E-01	8.66E-01	5.03E-03	3.00E-03
2. Iodines									
I-131	Ci	8.41E-07	1.57E-05	<LLD	<LLD	<LLD	6.40E-09	1.77E-08	7.20E-07
I-132	Ci	<LLD	2.17E-04	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.11E-09	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	8.41E-07	2.33E-04	<LLD	<LLD	<LLD	9.51E-09	1.77E-08	7.20E-07
3. Particulates									
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	1.96E-09	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	9.58E-08	4.26E-07	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
GAS RELEASES
UNIT 2 (Docket Number 50-457)
CONTINUOUS MODE AND BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sn-117m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Nd-147	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Te-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113	Ci	1.61E-06	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	1.61E-06	<LLD	<LLD	<LLD	9.58E-08	4.28E-07	<LLD	<LLD
4. Tritium	Ci	5.64E+01	4.70E+02	3.98E+02	3.38E+01	1.29E+00	4.06E+00	2.39E-01	3.04E+00
5. Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
6. Carbon-14	Ci	1.13E+00	9.32E-01	1.32E+00	1.46E+00	N/A	N/A	N/A	N/A

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
LIQUID RELEASES
UNIT 1 (Docket Number 50-456)
SUMMATION OF ALL RELEASES

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Est. Total Error %
A. Fission and Activation Products						
1. Total Release	Ci	3.93E-02	2.54E-02	1.32E-03	1.14E-03	2.64
2. Average Diluted Concentration	µCi/ml	1.03E-08	4.55E-09	3.52E-10	3.20E-10	
3. Percent of applicable limit	%	*	*	*	*	
B. Tritium						
1. Total Release	Ci	1.10E+02	2.05E+02	5.90E+01	8.50E+01	5.85
2. Average Diluted Concentration	µCi/ml	2.87E-05	3.67E-05	1.58E-05	2.38E-05	
3. % of Limit (1E-2 µCi/ml)	%	2.87E-01	3.67E-01	1.58E-01	2.38E-01	
C. Dissolved Noble Gases						
1. Total Release	Ci	0.00E+00	3.77E-05	0.00E+00	0.00E+00	2.64
2. Average Diluted Concentration	µCi/ml	0.00E+00	6.77E-12	0.00E+00	0.00E+00	
3. % of Limit (2E-4 µCi/ml)	%	0.00E+00	3.38E-06	0.00E+00	0.00E+00	
D. Gross Alpha						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	14.70
E. Volume of Waste Released (prior to dilution)	liters	2.40E+05	4.52E+05	2.56E+05	2.90E+05	
F. Volume of Dilution Water	liters	7.62E+09	1.11E+10	7.48E+09	7.14E+09	

Note: LLD Values are included in Appendix A of this report.

Note: % Limit Values are included in Appendix B of this report.

*This limit is equal to 10 times the concentration values in Appendix B, Table 2, Column 2 to 10CFR20.1001-20.2402.

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
LIQUID RELEASES
UNIT 1 (Docket Numbers 50-456)
CONTINUOUS MODE & BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	5.07E-05	1.58E-04	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	9.21E-04	5.96E-04	2.85E-05	1.51E-05
Fe-55	Ci	<LLD	<LLD	<LLD	<LLD	1.55E-02	5.60E-03	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	1.28E-04	1.24E-04	5.24E-06	5.50E-06
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	5.32E-03	5.85E-03	3.46E-04	1.45E-04
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	3.37E-05	1.13E-05	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	1.45E-02	1.10E-02	7.83E-04	6.23E-04
Ni-63	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	5.70E-04
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	1.23E-04	3.59E-06	1.86E-06	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	2.55E-04	6.80E-05	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	1.28E-04	<LLD	<LLD	<LLD
Nb-97	Ci	<LLD	<LLD	<LLD	<LLD	4.56E-04	3.61E-04	2.44E-05	3.13E-06
Zr-97	Ci	<LLD	<LLD	<LLD	<LLD	1.51E-05	8.40E-06	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	4.77E-04	4.55E-04	2.60E-05	<LLD
Sn-113	Ci	<LLD	<LLD	<LLD	<LLD	1.05E-04	7.11E-05	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	1.22E-03	1.04E-03	9.00E-05	7.49E-05
I-134	Ci	<LLD	<LLD	<LLD	<LLD	7.75E-06	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	2.48E-06	1.40E-06	5.15E-06	4.20E-06
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	3.27E-05	<LLD	<LLD	<LLD
Ag-110	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	6.35E-06	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	2.08E-05	7.59E-06	1.01E-06
H-3	Ci	2.00E+01	3.00E+01	2.29E+01	2.59E+00	8.98E+01	1.75E+02	3.62E+01	8.26E+01
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	1.76E-06
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	4.56E-06	2.72E-06	<LLD
Ba-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	4.30E-06
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	1.78E-06
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	2.06E-06	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.23E-05	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.35E-06	<LLD	<LLD
Total for period	Ci	2.00E+01	3.00E+01	2.29E+01	2.59E+00	8.98E+01	1.75E+02	3.62E+01	8.26E+01

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
LIQUID RELEASES
UNIT 2 (Docket Number 50-457)
SUMMATION OF ALL RELEASES

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Est. Total Error %
A. Fission and Activation Products						
1. Total Release	Ci	3.93E-02	2.54E-02	1.32E-03	1.14E-03	2.64
2. Average Diluted Concentration	µCi/ml	1.03E-08	4.55E-09	3.52E-10	3.20E-10	
3. Percent of applicable limit	%	*	*	*	*	
B. Tritium						
1. Total Release	Ci	1.10E+02	2.05E+02	5.90E+01	8.50E+01	5.85
2. Average Diluted Concentration	µCi/ml	2.87E-05	3.67E-05	1.58E-05	2.38E-05	
3. % of Limit (1E-2 µCi/ml)	%	2.87E-01	3.67E-01	1.58E-01	2.38E-01	
C. Dissolved Noble Gases						
1. Total Activity Released	Ci	0.00E+00	3.77E-05	0.00E+00	0.00E+00	2.64
2. Average Diluted Concentration	µCi/ml	0.00E+00	6.77E-12	0.00E+00	0.00E+00	
3. % of Limit (2E-4 µCi/ml)	%	0.00E+00	3.38E-06	0.00E+00	0.00E+00	
D. Gross Alpha						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	14.70
E. Volume of Waste Released (prior to dilution)	liters	2.40E+05	4.52E+05	2.56E+05	2.90E+05	
F. Volume of Dilution Water	liters	7.62E+09	1.11E+10	7.48E+09	7.14E+09	

Note: LLD Values are included in Appendix A of this report.

Note: % Limit Values are included in Appendix B of this report.

*This limit is equal to 10 times the concentration values in Appendix B, Table 2, Column 2 to 10CFR20.1001-2402.

BRAIDWOOD NUCLEAR POWER STATION
ANNUAL EFFLUENT REPORT FOR 2011
LIQUID RELEASES
UNIT 2 (Docket Numbers 50-457)
CONTINUOUS MODE & BATCH MODE

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	5.07E-05	1.58E-04	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	9.21E-04	5.96E-04	2.85E-05	1.51E-05
Fe-55	Ci	<LLD	<LLD	<LLD	<LLD	1.55E-02	5.60E-03	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	1.28E-04	1.24E-04	5.24E-06	5.50E-06
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	5.32E-03	5.85E-03	3.46E-04	1.45E-04
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	3.37E-05	1.13E-05	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	1.45E-02	1.10E-02	7.83E-04	6.23E-04
Ni-63	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	5.70E-04
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	1.23E-04	3.59E-06	1.86E-06	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	2.55E-04	6.80E-05	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	1.28E-04	<LLD	<LLD	<LLD
Nb-97	Ci	<LLD	<LLD	<LLD	<LLD	4.56E-04	3.61E-04	2.44E-05	3.13E-06
Zr-97	Ci	<LLD	<LLD	<LLD	<LLD	1.51E-05	8.40E-06	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	4.77E-04	4.55E-04	2.60E-05	<LLD
Sn-113	Ci	<LLD	<LLD	<LLD	<LLD	1.05E-04	7.11E-05	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	1.22E-03	1.04E-03	9.00E-05	7.49E-05
I-134	Ci	<LLD	<LLD	<LLD	<LLD	7.75E-06	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	2.48E-06	1.40E-06	5.15E-06	4.20E-06
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	3.27E-05	<LLD	<LLD	<LLD
Ag-110	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	6.35E-06	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	2.08E-05	7.59E-06	1.01E-06
H-3	Ci	2.00E+01	3.00E+01	2.29E+01	2.59E+00	8.98E+01	1.75E+02	3.62E+01	8.26E+01
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	1.76E-06
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	4.56E-06	2.72E-06	<LLD
Ba-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	4.30E-06
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	1.78E-06
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	2.06E-06	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.23E-05	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.35E-06	<LLD	<LLD
Total for period	Ci	2.00E+01	3.00E+01	2.29E+01	2.59E+00	8.98E+01	1.75E+02	3.62E+01	8.26E+01

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
SOLID RADIOACTIVE WASTE
UNIT 1 AND 2 COMBINED (Docket Numbers 50-456 and 50-457)

A. Solid Waste Shipped Offsite for Burial or Disposal (Not irradiated fuel)

1. Types of Waste

Types of Waste	Total Quantity (m^3)	Total Activity (Ci)	Period	Est. Total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc	1.15 E+02	2.81E+01	Jan - Dec 2011	25
b. Dry compressible waste, contaminated equip, etc	2.27E+02	2.60E+00	Jan - Dec 2011	25
c. Irradiated components, control rods, etc	4.40E-02	5.49E-02	Jan - Dec 2011	25
d. Other (oil, reverse osmosis reject water, soil, Lagoon sediment)	0.00E+00	0.00E+00	Jan - Dec 2011	N/A

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

Major Nuclide Composition		%
a.	H-3	28.1
	Mn-54	0.68
	Fe-55	30.15
	Co-58	1.52
	Co-60	6.76
	Ni-63	22.19
b.	H-3	4.01
	C-14	1.12
	Mn-54	1.11
	Fe-55	38.36
	Co-58	12.54
	Co-60	11.87
	Ni-63	26.46
c.	Fe-55	17.63
	Co-60	78.88
	Ni-63	1.22
	Zn-65	2.16

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
1	Dibble Trucking	Duratek (Energy Solutions), Oak Ridge, TN
7	Hittman Transportation	Duratek (Energy Solutions), Oak Ridge, TN
1	Dibble Trucking	Duratek Services (Energy Solutions), Kingston, TN
6	Hittman Transportation	Duratek Services (Energy Solutions), Kingston, TN
5	Hittman Transportation	Energy Solutions LLC., Clive, UT

B. Irradiated Fuel Shipments (disposition)

No irradiated fuel shipments for January through December, 2011.

C. Changes to the Process Control Program

There were no changes to the process control program in 2011. Current revision implemented on 4/21/2006.

Summaries

Process Control Program

In 2011, there were no changes to the Process Control Program.

Effluent System Changes

In 2011, there were no changes to the gaseous radwaste discharge system.

Three changes were made that impact the liquid radwaste discharge system. Engineering Change (EC) 375873 is the installation of a diffuser on the Kankakee River bed to provide better Circulating Water Blowdown mixing. EC 378192 discusses a change of piping configuration and the installation of a second Process Radiation Monitor for the pair of Liquid Release Tanks. The final EC 362453 discusses the installation of an ultra low flow discharge path. Each of these ECs and their assosicated10CFR50.59 screening forms can be found in Attachments 2, 3 and 4.

A report that evaluated the release practices at Braidwood Station prior to the installation of the liquid radwaste modifications is included in Attachment 5. The report discusses effluent concentration reduction proposals and the resultant BD-22 tritium concentrations.

A vendor's actual results obtained from sample location BD-22 can be reviewed in Attachment 6.

These supporting documents are included to satisfy ODCM requirement 12.6.4. All liquid effluent releases have been well under Federal limits.

Limits

There were no liquid releases or gaseous releases that exceeded ODCM limits during 2011.

On 10/6/11 it was identified that the Aux Building Vent Stack WRGM 2RY-PR030C I/E transmitter was found to be out of tolerance during its periodic calibration. The Aux Building out of tolerance condition yielded a potential under response of U-2 vent stack flow by 17.44%. The 2RY-PR030C was last calibrated on 1/07/2010. The U-2 Aux Building Vent Stack flow was revised up by 17.44% for each 2011 continuous gaseous effluent permit. No limits were challenged by the upward revision. The issue was documented in IR 1273923.

Abnormal Releases

There were no abnormal liquid releases in 2011 resulting in an offsite discharge.

During the timeframe of March 1 through April 31, 2011, effluent iodine samples obtained from the Unit 1 and Unit 2 station vent stack identified detectable concentrations of iodine-131 and iodine-132. A total of 470 μCi of iodine-131/132 were released through these vents. This activity was most likely related to the events of March 2011 at the Dai-Ichi atomic power plant, Fukushima Japan and the associated trans-Pacific transportation of airborne releases. The concentrations detected at the Braidwood Generating Station and calculated doses are conservatively included in this report for completeness. This issue was documented in IR 1191071.

Instrument Inoperability

The following effluent monitoring instruments exceeded their specified inoperability time.

Liquid Radwaste Effluent Line Loop WX001 (flow instrument 0F-WX001) exceeded its inoperability time on 4/27/07. At that time, required surveillances for this effluent instrument were taken to "suspend" and were not performed because the effluent flow path was no longer in use at Braidwood Station. A design change and modification to this flow path and this instrument was started in October 2010. It was declared operable with an initial use on 12/24/11. This issue has been entered into the Corrective Action Program as IR 723658.

Liquid Radwaste Effluent Line Radiation Monitor, 0RE-PR001, exceeded its inoperability time on 11/7/10. The instrument was removed from service for modification related to the installation of an additional Liquid Radwaste Effluent Line Radiation Monitor, 0RE-PR090. The instrument was declared operable on 11/20/2011. This issue has been entered into the Corrective Action Program as IR 1136983.

Liquid Radwaste Effluent Line Radiation Monitor, 0RE-PR090, was installed in October 2010 during modification work on the liquid radwaste effluent path. This rad monitor exceeded its inoperability time on 12/28/10 due to continued installation and modification testing. The instrument was declared operable on 11/21/2011. All releases were performed in accordance with the requirements described in the ODCM for effluent releases with the instrument inoperable. This issue has been entered into the Corrective Action Program as IR 1206147.

The 0PR02J Gaseous Radwaste Effluent Monitor's 14 day time clock expired on 3/3/2011 due to emergent work associated with a calibration and firmware update. Gaseous releases had already been terminated as the time the clock expired. Extended instrument inoperability was caused by the emergent need to fabricate a CPU card and decontaminate the sample chamber. Repair, calibration, and return to service completed on 3/11/2011. This issue was documented in IR 1182611.

ODCM Changes

The ODCM was changed in 2011 to include the installation of an Independent Spent Fuel Storage Installation (ISFSI) and gaseous Carbon-14 methodology. No changes were made to the manner in which offsite dose is calculated.

40CFR190

NUREG-0543, Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard (40 CFR Part 190) states in section IV, "As long as a nuclear plant site operates at a level below the Appendix I reporting requirements, no extra analysis is required to demonstrate compliance with the 40 CFR Part 190." The organ and whole body doses reported on pages 29 through 48 are determined using 10 CFR 50 Appendix I methodology. The doses are below the limits of Appendix I.

APPENDIX A

LLD Tables

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 1 AND 2 (Docket Numbers 50-456 and 50-457)
LLD VALUES FOR GASEOUS RELEASES

Isotope	LLD (μCi/ml)
Gross Alpha	1.67E-12
H-3	6.35E-14
Ar-41	4.5913E-06
Mn-54	2.1497E-12
Co-58	1.5877E-12
Fe-59	4.4966E-12
Co-60	3.6342E-12
Zn-65	4.8392E-12
Kr-85	7.3546E-04
Kr-85m	3.6799E-06
Kr-87	3.1241E-06
Kr-88	8.1885E-06
Sr-89	2.58E-14
Sr-90	3.20E-15
Mo-99	1.3986E-12
I-131	8.8323E-13
I-133	1.2082E-12
Xe-131m	1.3129E-04
Xe-133	9.5152E-06
Xe-133m	2.9675E-05
Cs-134	1.1424E-12
Xe-135	3.3876E-06
Xe-135m	1.5886E-05
Cs-137	2.2469E-12
Xe-138	2.9252E-05
Ce-141	1.8916E-12
Ce-144	8.9517E-12

NOTE: LLD Value for total activity released is based on LLD values for individual isotopes used in the calculation.

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 1 AND 2 (Docket Numbers 50-456 and 50-457)
LLD VALUES FOR LIQUID RELEASES

Isotope	LLD µCi/ml)
Gross Alpha	3.15E-14
H-3	6.76E-12
Mn-54	5.8372E-08
Fe-55	8.60E-07
Co-58	7.1298E-08
Fe-59	1.4932E-07
Co-60	7.5278E-08
Zn-65	1.0877E-07
Sr-89	4.73E-08
Sr-90	9.40E-09
Mo-99	4.5639E-08
I-131	5.6082E-08
Xe-133	1.6782E-07
Cs-134	8.9794E-09
Cs-137	1.1319E-08
Kr-87	1.9410E-07
Kr-88	2.1870E-07
Ce-141	7.6146E-08
Ce-144	3.4518E-07
Xe-133m	4.4.131E-07
Xe-135	5.6966E-08
Xe-138	6.1010E-06

NOTE: LLD Value for Total Activity Released is based on LLD Values for individual isotopes used in the calculation.

APPENDIX B

Supplemental Information

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT COMMON

GASEOUS EFFLUENTS
SUPPLEMENTAL RELEASE INFORMATION

A. Batch Release	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	**Total**
1. Total Number of Batch Releases	10	13	3	3	**29**
2. Total Time Period for Batch Releases (minutes)	3,569	2,348	1,079	837	**7,833**
3. Maximum Time Period for a Batch Release (minutes)	1,490	996	730	632	**N/A**
4. Average Time Period for a Batch Release (minutes)	357	181	360	279	**N/A**
5. Minimum Time Period for a Batch Release (minutes)	31	10	110	87	**N/A**
B. Abnormal Releases					
1. Number of Releases	0	0	0	0	**0**
2. Total Activity Released (Ci)	0	0	0	0	**0**

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 1 (Docket Number 50-456)

GASEOUS EFFLUENTS
SUPPLEMENTAL RELEASE INFORMATION

A. Batch Release	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	**Total**
1. Total Number of Batch Releases	23	23	21	24	**91**
2. Total Time Period for Batch Releases (minutes)	14,746	13,062	4,916	8,295	**41,019**
3. Maximum Time Period for a Batch Release (minutes)	9,970	2,210	1,430	2,230	**N/A**
4. Average Time Period for a Batch Release (minutes)	641	568	234	346	**N/A**
5. Minimum Time Period for a Batch Release (minutes)	23	13	18	13	**N/A**
B. Abnormal Releases					
1. Number of Releases	0	0	0	0	**0**
2. Total Activity Released (Ci)	0	0	0	0	**0**

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 2 (Docket Number 50-457)

GASEOUS EFFLUENTS
SUPPLEMENTAL RELEASE INFORMATION

A. Batch Release	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	**Total**
1. Total Number of Batch Releases	22	26	25	30	**103**
2. Total Time Period for Batch Releases (minutes)	2,878	21,924	1,368	17,640	**43,810**
3. Maximum Time Period for a Batch Release (minutes)	833	2,530	575	2,520	**N/A**
4. Average Time Period for a Batch Release (minutes)	131	843	55	588	**N/A**
5. Minimum Time Period for a Batch Release (minutes)	14	18	11	3	**N/A**
B. Abnormal Releases					
1. Number of Releases	0	0	0	0	**0**
2. Total Activity Released (Ci)	0	0	0	0	**0**

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2011
UNIT 1 AND 2 COMBINED (Docket Numbers 50-456 and 50-457)
BRAIDWOOD NUCLEAR POWER STATION

LIQUID EFFLUENTS
SUPPLEMENTAL RELEASE INFORMATION

		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	**Total**
A.	Batch Release					
1.	Total Number of Batch Releases	13	13	14	14	**54**
2.	Total Time Period for Batch Releases (minutes)	3,591	5,846	4,368	8,116	**21,921**
3.	Maximum Time Period for a Batch Release (minutes)	562	466	1,100	3,740	**N/A**
4.	Average Time Period for a Batch Release	276	244	312	580	**N/A**
5.	Minimum Time Period for a Batch Release (minutes)	58	206	204	204	**N/A**
6.	Average Stream Flow During Periods of Release of Effluent into a Flowing Stream (liters/min)	1.08E+07	1.98E+07	3.72E+06	6.07E+06	**N/A**
B.	Abnormal Releases					
1.	Number of Releases	0	0	0	0	**0**
2.	Total Activity Released (Ci)	0.00+00	0.00+00	0.00+00	0.00E+00	**0.00E+00**

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== RELEASE DATA ==========

Total Release Duration (minutes)	5.921E+05
Total Release Volume (cf)	7.529E+10
Average Release Flowrate (cfm)	1.272E+05
Average Period Flowrate (cfm)	1.432E+05

=== NUCLIDE DATA ==========

Nuclide	uCi	Average uCi/cc	ECrcent Ratio	EC
AR-41	8.31E+01	3.90E-14	3.90E-06	1.00E-08
KR-85M	5.18E+00	2.43E-15	2.43E-08	1.00E-07
KR-85	0.00E+00	0.00E+00	0.00E+00	7.00E-07
XE-133M	1.28E+04	6.02E-12	1.00E-05	6.00E-07
KR-88	0.00E+00	0.00E+00	0.00E+00	9.00E-09
XE-131M	0.00E+00	0.00E+00	0.00E+00	2.00E-06
XE-135	6.79E+04	3.19E-11	4.55E-04	7.00E-08
XE-133	6.49E+05	3.04E-10	6.08E-04	5.00E-07
F&AG	7.30E+05	3.42E-10	1.08E-03	
I-131	1.96E+01	9.17E-15	4.58E-05	2.00E-10
I-132	2.19E+02	1.03E-13	5.13E-06	2.00E-08
I-133	7.72E+00	3.62E-15	3.62E-06	1.00E-09
Iodine	2.46E+02	1.15E-13	5.46E-05	
BR-82	2.75E+01	1.29E-14	2.58E-06	5.00E-09
Other	2.75E+01	1.29E-14	2.58E-06	
H-3	5.52E+08	2.59E-07	2.59E+00	1.00E-07
H-3	5.52E+08	2.59E-07	2.59E+00	
CO-57	1.10E+00	5.17E-16	5.75E-07	9.00E-10
C-14	4.32E+06	2.02E-09	6.75E-01	3.00E-09
CE-141	2.39E+00	1.12E-15	1.40E-06	8.00E-10
P>=8	4.32E+06	2.02E-09	6.75E-01	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== NUCLIDE DATA ==========

Nuclide	uCi	Average uCi/cc	ECrcent Ratio	EC
Total	5.57E+08	2.61E-07	3.27E+00	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1
Receptor.....: 5 Composite Crit. Receptor - IP
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== PERIOD DOSE BY AGEGROUP, PATHWAY, ORGAN (mrem) ==========

Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	0.00E+00	3.44E-07
AINHL	2.89E-03	1.51E-02	1.52E-02	1.51E-02	1.51E-02	1.51E-02	0.00E+00	1.51E-02
AVEG	1.42E-01	5.46E-02	5.50E-02	5.46E-02	5.46E-02	5.46E-02	0.00E+00	5.46E-02
ACMEAT	5.29E-02	1.43E-02	1.44E-02	1.43E-02	1.43E-02	1.43E-02	0.00E+00	1.43E-02
ACMILK	5.77E-02	2.04E-02	2.18E-02	2.04E-02	2.04E-02	2.04E-02	0.00E+00	2.04E-02
TGPD	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	0.00E+00	3.44E-07
TINHL	4.13E-03	1.55E-02	1.55E-02	1.55E-02	1.55E-02	1.55E-02	0.00E+00	1.55E-02
TVEG	2.30E-01	7.62E-02	7.65E-02	7.62E-02	7.62E-02	7.62E-02	0.00E+00	7.62E-02
TCMEAT	4.46E-02	1.12E-02	1.12E-02	1.12E-02	1.12E-02	1.12E-02	0.00E+00	1.12E-02
TCMILK	1.06E-01	3.28E-02	3.50E-02	3.28E-02	3.28E-02	3.28E-02	0.00E+00	3.28E-02
CGPD	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	0.00E+00	3.44E-07
CINHL	5.70E-03	1.41E-02	1.41E-02	1.41E-02	1.41E-02	1.41E-02	0.00E+00	1.41E-02
CVEG	5.56E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	1.58E-01	0.00E+00	1.58E-01
CCMEAT	8.40E-02	1.96E-02	1.96E-02	1.96E-02	1.96E-02	1.96E-02	0.00E+00	1.96E-02
CCMILK	2.62E-01	7.05E-02	7.49E-02	7.05E-02	7.05E-02	7.05E-02	0.00E+00	7.05E-02
IGPD	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	3.44E-07	0.00E+00	3.44E-07
IINHL	4.21E-03	8.33E-03	8.34E-03	8.33E-03	8.33E-03	8.33E-03	0.00E+00	8.33E-03
ICMILK	5.13E-01	1.37E-01	1.48E-01	1.37E-01	1.37E-01	1.37E-01	0.00E+00	1.37E-01

=== PERIOD DOSE BY AGEGROUP, ORGAN (mrem) ==========

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
ADULT	2.56E-01	1.05E-01	1.06E-01	1.05E-01	1.05E-01	1.05E-01	0.00E+00	1.05E-01
TEEN	3.86E-01	1.36E-01	1.38E-01	1.36E-01	1.36E-01	1.36E-01	0.00E+00	1.36E-01
CHILD	9.08E-01	2.62E-01	2.67E-01	2.62E-01	2.62E-01	2.62E-01	0.00E+00	2.62E-01
INFANT	5.17E-01	1.45E-01	1.56E-01	1.45E-01	1.45E-01	1.45E-01	0.00E+00	1.45E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1
Receptor.....: 5 Composite Crit. Receptor - IP
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	BONE	9.08E-01	31-day	2.25E-01	4.03E+02	3.00E-01	3.03E+02
Qrtr->End	CHILD	BONE	9.08E-01	Quarter	5.63E+00	1.61E+01	7.50E+00	1.21E+01
Year->End	CHILD	BONE	9.08E-01	Annual	1.13E+01	8.07E+00	1.50E+01	6.05E+00

Critical Pathway.....: 2 Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02
I-131	1.66E-03
I-132	1.75E-05
I-133	1.08E-05
CE-141	2.36E-06

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body)) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	TBODY	2.62E-01	31-day	1.50E-01	1.75E+02	2.00E-01	1.31E+02
Qrtr->End	CHILD	TBODY	2.62E-01	Quarter	5.25E+00	4.99E+00	7.50E+00	3.49E+00
Year->End	CHILD	TBODY	2.62E-01	Annual	1.05E+01	2.50E+00	1.50E+01	1.75E+00

Critical Pathway.....: 2 Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.07E+01
C-14	6.95E+01
I-131	3.32E-03
I-132	5.99E-05
I-133	1.95E-05
CE-141	6.60E-06

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1
Receptor.....: 4 Composite Crit. Receptor - NG
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== MAXIMUM PERIOD NG DOSE TO LIMIT (Gamma) ==========

Dose Period	Dose Type	Dose (mrad)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	Gamma	8.22E-06	31-day	1.50E-01	5.48E-03	2.00E-01	4.11E-03
Qrtr->End	Gamma	8.22E-06	Quarter	3.75E+00	2.19E-04	5.00E+00	1.64E-04
Year->End	Gamma	8.22E-06	Annual	7.50E+00	1.10E-04	1.00E+01	8.22E-05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.12E-01
KR-85M	1.75E-03
KR-85	0.00E+00
XE-133M	1.15E+00
KR-88	0.00E+00
XE-131M	0.00E+00
XE-135	3.58E+01
XE-133	6.28E+01

=== MAXIMUM PERIOD NG DOSE TO LIMIT (Beta)) ==========

Dose Period	Dose Type	Dose (mrad)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	Beta	3.19E-05	31-day	3.00E-01	1.06E-02	4.00E-01	7.98E-03
Qrtr->End	Beta	3.19E-05	Quarter	7.50E+00	4.26E-04	1.00E+01	3.19E-04
Year->End	Beta	3.19E-05	Annual	1.50E+01	2.13E-04	2.00E+01	1.60E-04

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	3.14E-02
KR-85M	1.18E-03
KR-85	0.00E+00
XE-133M	2.19E+00
KR-88	0.00E+00
XE-131M	0.00E+00
XE-135	1.93E+01
XE-133	7.85E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1

=== MULTIPLE RELEASE POINT MESSAGE ==========
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA ==========
Total Release Duration (minutes)..... 1.186E+06
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA ==========

Nuclide	uCi
CO-57	2.63E+02
NB-97	8.44E+02
AG-110	6.33E+00
SN-113	1.76E+02
SB-124	7.27E+00
SB-125	2.42E+03
BA-133	4.30E+00
TE-123M	2.94E+01
CR-51	2.09E+02
MN-54	1.56E+03
FE-59	4.50E+01
CO-58	1.17E+04
CO-60	2.69E+04
ZN-65	1.28E+02
ZR-95	1.28E+02
ZR-97	2.35E+01
NB-95	3.23E+02
AG-110M	9.57E+02
I-134	7.73E+00
CS-134	1.78E+00
CS-137	1.32E+01
LA-140	1.76E+00
CE-144	3.26E+01
Gamma	4.58E+04
AR-41	2.05E+00
XE-135M	3.35E+00
XE-133	3.23E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA ==========

Nuclide	uCi
D&EG	3.77E+01
H-3	4.58E+08
FE-55	2.11E+04
NI-63	2.62E+02
Beta	4.58E+08
Total	4.58E+08

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1
Receptor.....: 0 Liquid Receptor

=== PERIOD DOSE BY AGEGROUP, PATHWAY, ORGAN (mrem) ==========

Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	1.29E-05	8.69E-03	8.68E-03	8.68E-03	8.68E-03	8.87E-03	0.00E+00	8.70E-03
AFWFSp	8.07E-04	4.72E-03	3.60E-03	3.89E-03	3.76E-03	2.12E-02	0.00E+00	4.42E-03
TPWtr	1.23E-05	6.13E-03	6.11E-03	6.12E-03	6.12E-03	6.23E-03	0.00E+00	6.14E-03
TFWFSp	8.35E-04	3.90E-03	2.76E-03	3.05E-03	2.96E-03	1.51E-02	0.00E+00	3.54E-03
CPWtr	3.73E-05	1.18E-02	1.17E-02	1.17E-02	1.17E-02	1.18E-02	0.00E+00	1.18E-02
CFWFSp	1.07E-03	3.27E-03	2.29E-03	2.51E-03	2.46E-03	6.68E-03	0.00E+00	3.07E-03
IPWtr	2.91E-05	1.16E-02	1.15E-02	1.15E-02	1.15E-02	1.16E-02	0.00E+00	1.16E-02

=== PERIOD DOSE BY AGEGROUP, ORGAN (mrem) ==========

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
ADULT	8.20E-04	1.34E-02	1.23E-02	1.26E-02	1.24E-02	3.01E-02	0.00E+00	1.31E-02
TEEN	8.47E-04	1.00E-02	8.88E-03	9.16E-03	9.08E-03	2.14E-02	0.00E+00	9.67E-03
CHILD	1.10E-03	1.50E-02	1.40E-02	1.43E-02	1.42E-02	1.85E-02	0.00E+00	1.49E-02
INFANT	2.91E-05	1.16E-02	1.15E-02	1.15E-02	1.15E-02	1.16E-02	0.00E+00	1.16E-02

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1
Receptor.....: 0 Liquid Receptor

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	ADULT	GILLI	3.01E-02	31-day	1.50E-01	2.01E+01	2.00E-01	1.50E+01
Qrtr->End	ADULT	GILLI	3.01E-02	Quarter	3.75E+00	8.02E-01	5.00E+00	6.02E-01
Year->End	ADULT	GILLI	3.01E-02	Annual	7.50E+00	4.01E-01	1.00E+01	3.01E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	4.09E+01
CR-51	5.92E-03
MN-54	1.84E+00
FE-55	4.92E-01
FE-59	3.26E-02
CO-58	1.92E+00
CO-60	1.18E+01
NI-63	1.05E-02
ZN-65	5.19E-01
ZR-95	4.52E-03
ZR-97	2.82E-03
NB-95	4.26E+01
AG-110M	5.39E-02
I-134	6.95E-09
CS-134	1.92E-03
CS-137	1.17E-02
LA-140	9.24E-04
CE-144	3.56E-03

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body)) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	TBODY	1.49E-02	31-day	4.50E-02	3.30E+01	6.00E-02	2.48E+01
Qrtr->End	CHILD	TBODY	1.49E-02	Quarter	1.13E+00	1.32E+00	1.50E+00	9.91E-01
Year->End	CHILD	TBODY	1.49E-02	Annual	2.25E+00	6.61E-01	3.00E+00	4.95E-01

Critical Pathway.....: 0 Potable Water (PWtr)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	9.42E+01
CR-51	5.29E-05
MN-54	2.50E-01
FE-55	5.79E-01
FE-59	8.68E-03
CO-58	4.88E-01
CO-60	3.19E+00
NI-63	6.93E-02
ZN-65	8.07E-01
ZR-95	3.19E-06
ZR-97	1.54E-08
NB-95	8.41E-03
AG-110M	2.68E-04
I-134	7.53E-06
CS-134	4.00E-02
CS-137	1.70E-01
LA-140	8.61E-09
CE-144	2.83E-06

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== RELEASE DATA ==========

Total Release Duration (minutes)	5.597E+05
Total Release Volume (cf)	6.877E+10
Average Release Flowrate (cfm)	1.229E+05
Average Period Flowrate (cfm)	1.308E+05

=== NUCLIDE DATA ==========

Nuclide	uCi	Average uCi/cc	ECrcent Ratio	EC
AR-41	8.31E+01	4.27E-14	4.27E-06	1.00E-08
KR-85M	5.18E+00	2.66E-15	2.66E-08	1.00E-07
KR-85	0.00E+00	0.00E+00	0.00E+00	7.00E-07
XE-133M	1.28E+04	6.59E-12	1.10E-05	6.00E-07
KR-88	0.00E+00	0.00E+00	0.00E+00	9.00E-09
XE-131M	0.00E+00	0.00E+00	0.00E+00	2.00E-06
XE-135	6.79E+04	3.49E-11	4.98E-04	7.00E-08
XE-133	9.33E+05	4.79E-10	9.58E-04	5.00E-07
F&AG	1.01E+06	5.20E-10	1.47E-03	
I-131	1.73E+01	8.90E-15	4.45E-05	2.00E-10
I-132	2.17E+02	1.11E-13	5.56E-06	2.00E-08
I-133	3.11E-03	1.60E-18	1.60E-09	1.00E-09
Iodine	2.34E+02	1.20E-13	5.01E-05	
BR-82	5.21E-01	2.68E-16	5.36E-08	5.00E-09
Other	5.21E-01	2.68E-16	5.36E-08	
H-3	9.67E+08	4.97E-07	4.97E+00	1.00E-07
H-3	9.67E+08	4.97E-07	4.97E+00	
SN-113	1.61E+00	8.24E-16	1.03E-06	8.00E-10
C-14	4.84E+06	2.48E-09	8.28E-01	3.00E-09
CO-60	1.96E-03	1.01E-18	2.01E-08	5.00E-11
P>=8	4.84E+06	2.48E-09	8.28E-01	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== NUCLIDE DATA ==========

Nuclide	uCi	Average uCi/cc	ECrcent Ratio	EC
Total	9.73E+08	5.00E-07	5.80E+00	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2
Receptor.....: 5 Composite Crit. Receptor - IP
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== PERIOD DOSE BY AGEGROUP, PATHWAY, ORGAN (mrem) ==========

Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	0.00E+00	3.21E-07
AINHL	3.24E-03	2.62E-02	2.62E-02	2.62E-02	2.62E-02	2.62E-02	0.00E+00	2.62E-02
AVEG	1.60E-01	7.78E-02	7.81E-02	7.78E-02	7.78E-02	7.78E-02	0.00E+00	7.78E-02
ACMEAT	5.93E-02	1.85E-02	1.85E-02	1.85E-02	1.85E-02	1.85E-02	0.00E+00	1.85E-02
ACMILK	6.46E-02	2.84E-02	2.97E-02	2.84E-02	2.84E-02	2.84E-02	0.00E+00	2.84E-02
TGPD	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	0.00E+00	3.21E-07
TINHL	4.63E-03	2.67E-02	2.67E-02	2.67E-02	2.67E-02	2.67E-02	0.00E+00	2.67E-02
TVEG	2.58E-01	1.04E-01	1.05E-01	1.04E-01	1.04E-01	1.04E-01	0.00E+00	1.04E-01
TCMEAT	5.00E-02	1.39E-02	1.40E-02	1.39E-02	1.39E-02	1.39E-02	0.00E+00	1.39E-02
TCMILK	1.19E-01	4.40E-02	4.60E-02	4.40E-02	4.40E-02	4.40E-02	0.00E+00	4.40E-02
CGPD	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	0.00E+00	3.21E-07
CINHL	6.39E-03	2.40E-02	2.40E-02	2.40E-02	2.40E-02	2.40E-02	0.00E+00	2.40E-02
CVEG	6.23E-01	2.06E-01	2.07E-01	2.06E-01	2.06E-01	2.06E-01	0.00E+00	2.06E-01
CCMEAT	9.42E-02	2.36E-02	2.37E-02	2.36E-02	2.36E-02	2.36E-02	0.00E+00	2.36E-02
CCMILK	2.94E-01	9.05E-02	9.44E-02	9.05E-02	9.05E-02	9.05E-02	0.00E+00	9.05E-02
IGPD	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	3.21E-07	0.00E+00	3.21E-07
IINHL	4.72E-03	1.41E-02	1.41E-02	1.41E-02	1.41E-02	1.41E-02	0.00E+00	1.41E-02
ICMILK	5.75E-01	1.71E-01	1.81E-01	1.71E-01	1.71E-01	1.71E-01	0.00E+00	1.71E-01

=== PERIOD DOSE BY AGEGROUP, ORGAN (mrem) ==========

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
ADULT	2.87E-01	1.51E-01	1.52E-01	1.51E-01	1.51E-01	1.51E-01	0.00E+00	1.51E-01
TEEN	4.32E-01	1.89E-01	1.91E-01	1.89E-01	1.89E-01	1.89E-01	0.00E+00	1.89E-01
CHILD	1.02E+00	3.44E-01	3.49E-01	3.44E-01	3.44E-01	3.44E-01	0.00E+00	3.44E-01
INFANT	5.80E-01	1.85E-01	1.95E-01	1.85E-01	1.85E-01	1.85E-01	0.00E+00	1.85E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2
Receptor.....: 5 Composite Crit. Receptor - IP
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	BONE	1.02E+00	31-day	2.25E-01	4.52E+02	3.00E-01	3.39E+02
Qrtr->End	CHILD	BONE	1.02E+00	Quarter	5.63E+00	1.81E+01	7.50E+00	1.36E+01
Year->End	CHILD	BONE	1.02E+00	Annual	1.13E+01	9.04E+00	1.50E+01	6.78E+00

Critical Pathway.....: 2 Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02
CO-60	2.46E-06
I-131	1.32E-03
I-132	1.54E-05
I-133	3.87E-09

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body)) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	TBODY	3.44E-01	31-day	1.50E-01	2.30E+02	2.00E-01	1.72E+02
Qrtr->End	CHILD	TBODY	3.44E-01	Quarter	5.25E+00	6.56E+00	7.50E+00	4.59E+00
Year->End	CHILD	TBODY	3.44E-01	Annual	1.05E+01	3.28E+00	1.50E+01	2.30E+00

Critical Pathway.....: 2 Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	4.09E+01
C-14	5.89E+01
CO-60	7.69E-06
I-131	2.24E-03
I-132	4.50E-05
I-133	5.98E-09

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2
Receptor.....: 4 Composite Crit. Receptor - NG
Distance (meters)....: 0.0
Compass Point.....: 0.0

=== MAXIMUM PERIOD NG DOSE TO LIMIT (Gamma) ==========

Dose Period	Dose Type	Dose (mrad)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	Gamma	1.05E-05	31-day	1.50E-01	6.99E-03	2.00E-01	5.24E-03
Qrtr->End	Gamma	1.05E-05	Quarter	3.75E+00	2.80E-04	5.00E+00	2.10E-04
Year->End	Gamma	1.05E-05	Annual	7.50E+00	1.40E-04	1.00E+01	1.05E-04

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	1.66E-01
KR-85M	1.37E-03
KR-85	0.00E+00
XE-133M	9.03E-01
KR-88	0.00E+00
XE-131M	0.00E+00
XE-135	2.81E+01
XE-133	7.09E+01

=== MAXIMUM PERIOD NG DOSE TO LIMIT (Beta)) ==========

Dose Period	Dose Type	Dose (mrad)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	Beta	4.29E-05	31-day	3.00E-01	1.43E-02	4.00E-01	1.07E-02
Qrtr->End	Beta	4.29E-05	Quarter	7.50E+00	5.72E-04	1.00E+01	4.29E-04
Year->End	Beta	4.29E-05	Annual	1.50E+01	2.86E-04	2.00E+01	2.15E-04

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.34E-02
KR-85M	8.75E-04
KR-85	0.00E+00
XE-133M	1.63E+00
KR-88	0.00E+00
XE-131M	0.00E+00
XE-135	1.43E+01
XE-133	8.40E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2

=== MULTIPLE RELEASE POINT MESSAGE ==========
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA ==========
Total Release Duration (minutes)..... 1.186E+06
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA ==========

Nuclide	uCi
CO-57	2.63E+02
NB-97	8.44E+02
AG-110	6.33E+00
SN-113	1.76E+02
SB-124	7.27E+00
SB-125	2.42E+03
BA-133	4.30E+00
TE-123M	2.94E+01
CR-51	2.09E+02
MN-54	1.56E+03
FE-59	4.50E+01
CO-58	1.17E+04
CO-60	2.69E+04
ZN-65	1.28E+02
ZR-95	1.28E+02
ZR-97	2.35E+01
NB-95	3.23E+02
AG-110M	9.57E+02
I-134	7.73E+00
CS-134	1.78E+00
CS-137	1.32E+01
LA-140	1.76E+00
CE-144	3.26E+01
Gamma	4.58E+04
AR-41	2.05E+00
XE-135M	3.35E+00
XE-133	3.23E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA ==========

Nuclide	uCi
D&EG	3.77E+01
H-3	4.58E+08
FE-55	2.11E+04
NI-63	2.62E+02
Beta	4.58E+08
Total	4.58E+08

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2
Receptor.....: 0 Liquid Receptor

=== PERIOD DOSE BY AGEGROUP, PATHWAY, ORGAN (mrem) ==========

Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	1.29E-05	8.69E-03	8.68E-03	8.68E-03	8.68E-03	8.87E-03	0.00E+00	8.70E-03
AFWFSp	8.07E-04	4.72E-03	3.60E-03	3.89E-03	3.76E-03	2.12E-02	0.00E+00	4.42E-03
TPWtr	1.23E-05	6.13E-03	6.11E-03	6.12E-03	6.12E-03	6.23E-03	0.00E+00	6.14E-03
TFWFSp	8.35E-04	3.90E-03	2.76E-03	3.05E-03	2.96E-03	1.51E-02	0.00E+00	3.54E-03
CPWtr	3.73E-05	1.18E-02	1.17E-02	1.17E-02	1.17E-02	1.18E-02	0.00E+00	1.18E-02
CFWFSp	1.07E-03	3.27E-03	2.29E-03	2.51E-03	2.46E-03	6.68E-03	0.00E+00	3.07E-03
IPWtr	2.91E-05	1.16E-02	1.15E-02	1.15E-02	1.15E-02	1.16E-02	0.00E+00	1.16E-02

=== PERIOD DOSE BY AGEGROUP, ORGAN (mrem) ==========

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
ADULT	8.20E-04	1.34E-02	1.23E-02	1.26E-02	1.24E-02	3.01E-02	0.00E+00	1.31E-02
TEEN	8.47E-04	1.00E-02	8.88E-03	9.16E-03	9.08E-03	2.14E-02	0.00E+00	9.67E-03
CHILD	1.10E-03	1.50E-02	1.40E-02	1.43E-02	1.42E-02	1.85E-02	0.00E+00	1.49E-02
INFANT	2.91E-05	1.16E-02	1.15E-02	1.15E-02	1.15E-02	1.16E-02	0.00E+00	1.16E-02

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2
Receptor.....: 0 Liquid Receptor

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	ADULT	GILLI	3.01E-02	31-day	1.50E-01	2.01E+01	2.00E-01	1.50E+01
Qrtr->End	ADULT	GILLI	3.01E-02	Quarter	3.75E+00	8.02E-01	5.00E+00	6.02E-01
Year->End	ADULT	GILLI	3.01E-02	Annual	7.50E+00	4.01E-01	1.00E+01	3.01E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	4.09E+01
CR-51	5.92E-03
MN-54	1.84E+00
FE-55	4.92E-01
FE-59	3.26E-02
CO-58	1.92E+00
CO-60	1.18E+01
NI-63	1.05E-02
ZN-65	5.19E-01
ZR-95	4.52E-03
ZR-97	2.82E-03
NB-95	4.26E+01
AG-110M	5.39E-02
I-134	6.95E-09
CS-134	1.92E-03
CS-137	1.17E-02
LA-140	9.24E-04
CE-144	3.56E-03

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body)) ==========

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Strt->End	CHILD	TBODY	1.49E-02	31-day	4.50E-02	3.30E+01	6.00E-02	2.48E+01
Qrtr->End	CHILD	TBODY	1.49E-02	Quarter	1.13E+00	1.32E+00	1.50E+00	9.91E-01
Year->End	CHILD	TBODY	1.49E-02	Annual	2.25E+00	6.61E-01	3.00E+00	4.95E-01

Critical Pathway.....: 0 Potable Water (PWtr)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage

LIQUID RELEASE AND DOSE SUMMARY REPORT
------ (PERIOD BASIS - BY UNIT) ------

Release ID.....: 1 All Liquid Release Types
Period Start Date.....: 01/01/2011 00:00
Period End Date.....: 01/01/2012 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	9.42E+01
CR-51	5.29E-05
MN-54	2.50E-01
FE-55	5.79E-01
FE-59	8.68E-03
CO-58	4.88E-01
CO-60	3.19E+00
NI-63	6.93E-02
ZN-65	8.07E-01
ZR-95	3.19E-06
ZR-97	1.54E-08
NB-95	8.41E-03
AG-110M	2.68E-04
I-134	7.53E-06
CS-134	4.00E-02
CS-137	1.70E-01
LA-140	8.61E-09
CE-144	2.83E-06

ATTACHMENT 1

Wind Direction and Stability Classes

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	1	0	0	1
NNE	0	2	2	0	0	0	4
NE	0	6	10	0	0	0	16
ENE	0	11	4	0	0	0	15
E	0	7	2	0	0	0	9
ESE	0	0	3	0	0	0	3
SE	0	0	1	2	0	0	3
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	3	3	0	0	6
SW	0	0	0	0	0	0	0
WSW	0	0	4	1	1	0	6
W	0	2	4	6	0	0	12
WNW	0	7	12	3	0	0	22
NW	0	8	13	0	0	0	21
NNW	0	0	4	3	0	0	7
Variable	0	0	0	0	0	0	0
Total	0	43	62	19	1	0	125

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 2
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	2	0	0	0	3
NNE	0	3	0	0	0	0	3
NE	0	1	5	0	0	0	6
ENE	0	3	3	0	0	0	6
E	0	5	1	0	0	0	6
ESE	0	2	0	0	0	0	2
SE	0	0	2	0	0	0	2
SSE	0	0	1	0	0	0	1
S	0	0	1	3	0	0	4
SSW	0	1	1	1	1	0	4
SW	0	0	2	1	0	0	3
WSW	0	0	5	1	0	0	6
W	0	2	1	2	0	0	5
WNW	0	3	1	0	0	0	4
NW	0	7	7	0	0	0	14
NNW	0	5	2	1	0	0	8
Variable	0	0	0	0	0	0	0
Total	0	33	34	9	1	0	77

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	1	0	0	0	2
NNE	0	6	1	0	0	0	7
NE	0	5	4	0	0	0	9
ENE	0	6	2	0	0	0	8
E	0	2	0	0	0	0	2
ESE	0	2	0	0	0	0	2
SE	0	0	3	0	0	0	3
SSE	0	0	4	3	0	0	7
S	0	0	0	2	0	0	2
SSW	0	0	4	3	1	0	8
SW	0	4	5	1	0	0	10
WSW	0	6	6	2	0	0	14
W	0	8	6	2	0	0	16
WNW	0	4	4	1	0	0	9
NW	0	4	2	0	0	0	6
NNW	0	5	2	2	0	0	9
Variable	0	1	0	0	0	0	1
Total	0	54	44	16	1	0	115

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	14	56	8	0	0	78
NNE	2	13	26	7	0	0	48
NE	2	46	45	1	0	0	94
ENE	8	65	23	0	0	0	96
E	5	32	8	0	0	0	45
ESE	1	12	9	0	0	0	22
SE	1	19	33	7	0	0	60
SSE	1	29	27	4	0	0	61
S	0	8	43	7	0	0	58
SSW	0	12	32	15	0	0	59
SW	1	26	55	9	1	0	92
WSW	3	35	16	6	0	0	60
W	7	31	17	8	1	0	64
WNW	11	63	39	0	0	0	113
NW	9	32	24	1	0	0	66
NNW	4	26	34	8	0	0	72
Variable	2	0	0	0	0	0	2
Total	57	463	487	81	2	0	1090

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 2
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	6	0	0	0	0	9
NNE	5	11	1	0	1	0	18
NE	11	22	1	7	5	0	46
ENE	18	35	3	0	0	0	56
E	22	10	0	0	0	0	32
ESE	5	10	6	0	0	0	21
SE	1	20	10	0	0	0	31
SSE	1	13	5	0	0	0	19
S	0	4	22	17	0	0	43
SSW	1	6	21	13	2	0	43
SW	0	20	47	10	0	0	77
WSW	4	25	7	3	0	0	39
W	11	22	12	7	0	0	52
WNW	18	43	12	3	0	0	76
NW	18	23	6	0	0	0	47
NNW	8	19	1	0	0	0	28
Variable	0	0	0	0	0	0	0
Total	126	289	154	60	8	0	637

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 13
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	3	0	0	0	0	0	3
ENE	5	0	0	0	0	0	5
E	5	0	0	0	0	0	5
ESE	4	1	0	0	0	0	5
SE	1	0	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	1	0	0	0	0	0	1
SW	3	1	0	0	0	0	4
WSW	0	12	0	0	0	0	12
W	7	20	0	0	0	0	27
WNW	9	3	0	0	0	0	12
NW	7	0	0	0	0	0	7
NNW	3	1	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	49	38	0	0	0	0	87

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	2	0	0	0	0	0	2
NW	1	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	4	0	0	0	0	0	4

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	1	0	0	1
NNE	0	0	2	0	0	0	2
NE	0	0	10	5	0	0	15
ENE	0	5	8	5	0	0	18
E	0	1	7	3	0	0	11
ESE	0	0	0	3	0	0	3
SE	0	0	0	0	3	0	3
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	1	2	3	0	6
SW	0	0	0	0	0	0	0
WSW	0	0	1	2	0	1	4
W	0	0	6	1	0	0	7
WNW	0	3	4	7	6	3	23
NW	0	4	10	10	3	1	28
NNW	0	0	0	4	2	0	6
Variable	0	0	0	0	0	0	0
Total	0	13	49	43	17	5	127

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	2	2	0	0	0	4
NNE	0	2	1	1	0	0	4
NE	0	0	2	2	0	0	4
ENE	0	2	4	2	0	0	8
E	0	2	2	1	0	0	5
ESE	0	1	1	3	0	0	5
SE	0	0	0	1	0	0	1
SSE	0	0	1	0	0	0	1
S	0	0	0	1	3	0	4
SSW	0	1	1	1	0	1	4
SW	0	0	2	1	0	0	3
WSW	0	0	4	0	1	0	5
W	0	2	1	1	0	1	5
WNW	0	0	1	1	1	0	3
NW	0	3	6	6	1	0	16
NNW	0	1	3	2	0	0	6
Variable	0	0	0	0	0	0	0
Total	0	16	31	23	6	2	78

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	0	0	0	2
NNE	0	4	3	0	0	0	7
NE	0	3	2	1	0	0	6
ENE	0	5	2	3	0	0	10
E	0	1	1	0	0	0	2
ESE	0	0	3	0	0	0	3
SE	0	0	2	0	1	0	3
SSE	0	0	0	4	3	0	7
S	0	0	0	0	2	0	2
SSW	0	0	0	3	1	2	6
SW	0	4	4	4	1	0	13
WSW	0	6	3	2	2	0	13
W	0	2	6	2	0	1	11
WNW	0	3	6	2	2	1	14
NW	0	1	2	2	1	0	6
NNW	0	3	2	2	2	0	9
Variable	0	1	0	0	0	0	1
Total	0	33	38	25	15	4	115

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	8	23	40	8	0	80
NNE	1	6	12	16	7	1	43
NE	0	4	35	34	3	1	77
ENE	3	16	55	33	1	0	108
E	0	9	28	16	2	0	55
ESE	2	1	11	12	4	1	31
SE	0	2	14	27	13	2	58
SSE	0	4	24	13	9	0	50
S	0	0	26	34	5	2	67
SSW	0	2	16	28	15	2	63
SW	0	26	27	33	4	1	91
WSW	0	10	25	6	5	1	47
W	4	17	20	13	6	2	62
WNW	1	18	35	36	10	1	101
NW	2	13	33	39	9	0	96
NNW	1	9	21	23	6	2	62
Variable	0	1	0	0	0	0	1
Total	15	146	405	403	107	16	1092

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	9	1	0	0	12
NNE	3	4	7	3	0	1	18
NE	1	6	24	6	2	10	49
ENE	0	14	33	3	1	0	51
E	0	13	22	4	0	0	39
ESE	1	5	13	11	1	0	31
SE	0	1	8	18	3	0	30
SSE	0	3	10	8	1	0	22
S	0	0	4	10	22	1	37
SSW	0	0	6	26	22	4	58
SW	1	4	16	28	8	2	59
WSW	0	3	18	14	4	0	39
W	1	7	9	13	7	2	39
WNW	1	4	16	35	5	4	65
NW	2	3	37	28	1	0	71
NNW	2	2	25	3	0	0	32
Variable	0	0	0	0	0	0	0
Total	13	70	257	211	77	24	652

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	7	1	0	0	9
NNE	0	1	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	3	3	0	0	0	6
E	1	2	2	0	0	0	5
ESE	0	2	2	1	0	0	5
SE	0	0	1	0	0	0	1
SSE	0	2	0	0	0	0	2
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	1	0	0	0	0	1
WSW	1	0	3	2	0	0	6
W	0	0	5	11	0	0	16
WNW	0	1	9	10	0	0	20
NW	0	0	12	1	0	0	13
NNW	0	0	3	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	2	13	47	26	0	0	88

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: January - March 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	0	0	0	2
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	1	0	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	1	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	1	1	2	0	0	0	4

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	2	1	0	0	0	3
NNE	0	5	11	4	0	0	20
NE	0	7	20	1	0	0	28
ENE	0	13	1	0	0	0	14
E	0	13	0	0	0	0	13
ESE	1	12	3	0	0	0	16
SE	0	16	3	4	0	0	23
SSE	0	6	1	1	0	0	8
S	0	11	4	2	0	0	17
SSW	1	2	7	8	1	0	19
SW	1	2	11	7	0	0	21
WSW	0	4	4	3	0	0	11
W	1	7	19	10	0	0	37
WNW	0	13	18	1	0	0	32
NW	0	8	12	1	0	0	21
NNW	1	6	4	0	0	0	11
Variable	0	0	0	0	0	0	0
Total	5	127	119	42	1	0	294

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	2	2	0	0	0	4
NNE	1	1	4	0	0	0	6
NE	2	3	3	3	0	0	11
ENE	0	4	1	0	0	0	5
E	0	3	0	0	0	0	3
ESE	0	2	0	0	0	0	2
SE	1	4	3	1	0	0	9
SSE	1	2	6	0	1	0	10
S	0	4	2	1	0	0	7
SSW	0	2	4	3	1	0	10
SW	1	1	1	3	1	0	7
WSW	1	1	2	4	0	0	8
W	1	3	5	1	0	0	10
WNW	1	1	0	0	0	0	2
NW	0	1	0	0	0	0	1
NNW	0	4	2	0	0	0	6
Variable	0	0	0	0	0	0	0
Total	9	38	35	16	3	0	101

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	0	0	0	0	1
NNE	2	1	2	2	0	0	7
NE	0	5	1	2	0	0	8
ENE	0	5	3	0	0	0	8
E	0	5	0	0	0	0	5
ESE	0	3	2	0	0	0	5
SE	2	2	0	1	0	0	5
SSE	0	2	4	0	0	0	6
S	1	5	7	2	0	0	15
SSW	0	0	2	3	0	0	5
SW	0	1	1	7	2	0	11
WSW	0	1	5	0	0	0	6
W	0	1	3	4	0	0	8
WNW	0	3	4	0	0	0	7
NW	0	4	1	0	0	0	5
NNW	2	1	0	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	7	40	35	21	2	0	105

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	11	4	1	0	0	18
NNE	3	21	68	21	0	0	113
NE	5	46	48	10	0	0	109
ENE	8	51	25	0	0	0	84
E	5	19	15	0	0	0	39
ESE	2	26	12	1	0	0	41
SE	6	23	23	5	0	0	57
SSE	3	25	17	2	0	0	47
S	3	18	24	12	2	0	59
SSW	1	3	23	17	8	1	53
SW	1	7	46	20	1	0	75
WSW	0	7	27	0	0	0	34
W	0	23	33	7	0	0	63
WNW	5	18	15	11	0	0	49
NW	2	11	17	0	0	0	30
NNW	1	12	3	0	0	0	16
Variable	0	0	0	0	0	0	0
Total	47	321	400	107	11	1	887

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	6	11	3	0	0	0	20
NNE	3	24	6	0	0	0	33
NE	9	12	6	2	0	0	29
ENE	18	24	10	0	0	0	52
E	27	14	5	0	0	0	46
ESE	12	32	10	0	0	0	54
SE	3	39	19	0	0	0	61
SSE	11	28	7	2	0	0	48
S	3	23	33	5	0	0	64
SSW	1	8	16	3	5	3	36
SW	1	15	21	1	1	0	39
WSW	5	24	12	3	0	0	44
W	11	14	5	0	0	0	30
WNW	9	13	7	0	0	0	29
NW	8	4	3	0	0	0	15
NNW	5	4	0	0	0	0	9
Variable	1	0	0	0	0	0	1
Total	133	289	163	16	6	3	610

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	1	0	0	0	3
NNE	3	1	0	0	0	0	4
NE	6	1	0	0	0	0	7
ENE	4	0	2	0	0	0	6
E	12	0	0	0	0	0	12
ESE	8	3	0	0	0	0	11
SE	5	1	0	0	0	0	6
SSE	4	3	0	0	0	0	7
S	1	3	0	0	0	0	4
SSW	3	0	0	0	0	0	3
SW	0	1	0	0	0	0	1
WSW	5	4	0	0	0	0	9
W	12	12	0	0	0	0	24
WNW	1	1	0	0	0	0	2
NW	1	0	0	0	0	0	1
NNW	3	0	0	0	0	0	3
Variable	1	0	0	0	0	0	1
Total	70	31	3	0	0	0	104

Hours of calm in this stability class: 3
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	6	3	0	0	0	0	9
ENE	11	0	0	0	0	0	11
E	2	0	0	0	0	0	2
ESE	4	0	0	0	0	0	4
SE	3	0	0	0	0	0	3
SSE	1	1	0	0	0	0	2
S	1	0	0	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	2	0	0	0	0	0	2
W	5	0	0	0	0	0	5
WNW	3	0	0	0	0	0	3
NW	3	0	0	0	0	0	3
NNW	1	0	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	43	4	0	0	0	0	47

Hours of calm in this stability class: 6
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Period of Record: April - June 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	2	1	0	0	4
NNE	0	1	9	6	1	0	17
NE	0	1	9	10	5	0	25
ENE	0	5	7	6	0	0	18
E	0	5	11	0	0	0	16
ESE	0	6	5	2	2	0	15
SE	0	8	7	4	0	3	22
SSE	0	3	3	0	0	2	8
S	0	3	7	3	2	0	15
SSW	0	4	5	6	5	2	22
SW	0	0	3	8	5	0	16
WSW	0	0	4	4	1	0	9
W	0	6	3	7	7	3	26
WNW	1	4	12	23	3	0	43
NW	0	4	9	9	5	0	27
NNW	1	2	3	5	0	0	11
Variable	0	0	0	0	0	0	0
Total	2	53	99	94	36	10	294

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	1	2	0	0	4
NNE	1	1	2	1	0	0	5
NE	0	1	3	5	2	0	11
ENE	0	2	3	0	0	0	5
E	0	2	0	2	0	0	4
ESE	0	1	1	0	0	0	2
SE	0	2	2	3	0	1	8
SSE	0	2	1	6	0	0	9
S	0	1	4	1	1	1	8
SSW	0	2	1	2	0	3	8
SW	2	1	2	1	3	1	10
WSW	0	0	2	1	0	0	3
W	1	2	0	4	5	0	12
WNW	1	1	2	1	0	0	5
NW	0	0	1	1	0	0	2
NNW	0	3	1	1	0	0	5
Variable	0	0	0	0	0	0	0
Total	5	22	26	31	11	6	101

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	1	0	0	0	3
NNE	0	2	2	0	2	0	6
NE	0	0	5	2	2	0	9
ENE	0	3	2	2	0	0	7
E	0	1	3	1	0	0	5
ESE	0	3	0	0	2	0	5
SE	0	2	2	0	1	0	5
SSE	0	3	1	3	0	0	7
S	0	3	1	6	1	0	11
SSW	0	1	1	4	2	1	9
SW	0	0	1	1	6	2	10
WSW	0	0	1	2	0	0	3
W	0	1	0	5	3	0	9
WNW	0	2	3	2	2	0	9
NW	0	0	4	3	0	0	7
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	1	22	27	31	21	3	105

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	4	3	1	0	12
NNE	0	8	19	45	25	5	102
NE	0	10	45	31	17	0	103
ENE	0	14	41	33	2	0	90
E	0	11	12	19	10	4	56
ESE	2	6	7	16	7	2	40
SE	1	4	10	20	13	3	51
SSE	1	5	16	18	3	1	44
S	0	7	15	22	8	4	56
SSW	1	1	6	20	16	12	56
SW	0	4	16	28	14	4	66
WSW	0	2	10	27	5	0	44
W	0	4	8	23	7	0	42
WNW	0	3	21	23	13	8	68
NW	0	5	10	20	4	0	39
NNW	1	5	10	2	0	0	18
Variable	0	0	0	0	0	0	0
Total	6	93	250	350	145	43	887

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	5	6	5	0	0	16
NNE	0	4	13	16	0	0	33
NE	0	5	12	8	2	0	27
ENE	1	4	21	4	1	0	31
E	1	10	39	9	2	1	62
ESE	1	6	11	20	6	1	45
SE	0	8	16	37	7	0	68
SSE	0	4	14	13	6	0	37
S	0	3	25	18	17	1	64
SSW	0	4	9	24	1	12	50
SW	1	1	16	22	0	2	42
WSW	0	2	17	8	1	1	29
W	0	2	20	12	2	1	37
WNW	0	6	11	15	2	0	34
NW	0	5	10	7	0	0	22
NNW	0	4	8	1	0	0	13
Variable	0	0	0	0	0	0	0
Total	4	73	248	219	47	19	610

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	2	1	0	0	7
NNE	0	1	2	0	0	0	3
NE	0	2	3	1	0	0	6
ENE	1	1	1	0	0	0	3
E	0	2	7	2	0	0	11
ESE	0	3	2	1	0	0	6
SE	0	1	4	1	0	0	6
SSE	0	2	5	1	0	0	8
S	0	2	7	2	0	0	11
SSW	0	0	1	0	0	0	1
SW	0	3	1	0	0	0	4
WSW	0	1	3	0	0	0	4
W	0	1	5	2	0	0	8
WNW	0	1	10	8	0	0	19
NW	0	2	2	2	0	0	6
NNW	1	2	0	0	0	0	3
Variable	0	1	0	0	0	0	1
Total	2	29	55	21	0	0	107

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: April - June 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	2	0	0	0	6
NNE	1	1	2	0	0	0	4
NE	0	2	2	1	0	0	5
ENE	0	0	1	0	0	0	1
E	1	0	1	0	0	0	2
ESE	1	3	0	0	0	0	4
SE	0	0	2	0	0	0	2
SSE	0	0	1	1	0	0	2
S	1	5	1	0	0	0	7
SSW	0	2	0	0	0	0	2
SW	0	0	0	0	0	0	0
WSW	0	1	1	0	0	0	2
W	0	1	1	0	0	0	2
WNW	0	1	5	0	0	0	6
NW	1	0	0	1	0	0	2
NNW	1	1	3	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	6	21	22	3	0	0	52

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 27

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	7	3	2	0	0	13
NNE	0	8	16	5	0	0	29
NE	0	16	10	0	0	0	26
ENE	4	13	1	0	0	0	18
E	2	4	0	0	0	0	6
ESE	1	20	0	0	0	0	21
SE	0	17	0	0	0	0	17
SSE	0	27	2	0	0	0	29
S	0	15	14	0	0	0	29
SSW	0	13	16	7	0	0	36
SW	1	11	12	1	0	0	25
WSW	0	13	27	3	0	0	43
W	0	19	13	0	0	0	32
WNW	1	20	4	0	0	0	25
NW	1	22	2	0	0	0	25
NNW	0	25	13	2	0	0	40
Variable	0	0	0	0	0	0	0
Total	11	250	133	20	0	0	414

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	7	10	1	0	0	18
NNE	0	3	4	1	0	0	8
NE	1	4	2	0	0	0	7
ENE	5	6	0	0	0	0	11
E	4	1	0	0	0	0	5
ESE	0	2	0	0	0	0	2
SE	2	6	0	0	0	0	8
SSE	1	9	2	0	0	0	12
S	1	3	1	0	0	0	5
SSW	0	2	2	2	0	0	6
SW	0	3	7	0	0	0	10
WSW	0	2	6	0	0	0	8
W	1	10	1	0	0	0	12
WNW	4	5	0	0	0	0	9
NW	1	5	0	0	0	0	6
NNW	0	6	3	2	0	0	11
Variable	0	0	0	0	0	0	0
Total	20	74	38	6	0	0	138

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	7	5	0	0	0	13
NNE	0	6	3	0	0	0	9
NE	2	4	0	0	0	0	6
ENE	4	2	0	0	0	0	6
E	2	1	0	0	0	0	3
ESE	1	1	0	0	0	0	2
SE	2	1	1	0	0	0	4
SSE	0	4	1	0	0	0	5
S	0	3	2	0	0	0	5
SSW	0	2	1	0	0	0	3
SW	1	2	6	2	0	0	11
WSW	0	3	2	0	0	0	5
W	3	6	2	0	0	0	11
WNW	1	7	1	0	0	0	9
NW	2	5	1	0	0	0	8
NNW	0	12	3	0	1	0	16
Variable	1	0	0	0	0	0	1
Total	20	66	28	2	1	0	117

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	18	9	2	0	0	31
NNE	7	43	15	3	0	0	68
NE	14	20	0	0	0	0	34
ENE	16	15	0	0	0	0	31
E	7	4	0	0	0	0	11
ESE	5	14	1	0	0	0	20
SE	1	18	5	0	0	0	24
SSE	4	19	10	1	0	0	34
S	2	12	19	1	0	0	34
SSW	2	5	25	4	0	0	36
SW	1	13	22	2	0	0	38
WSW	0	13	7	1	0	0	21
W	8	15	2	0	0	0	25
WNW	11	14	3	0	0	0	28
NW	3	12	2	5	0	0	22
NNW	3	40	8	8	0	0	59
Variable	2	0	0	0	0	0	2
Total	88	275	128	27	0	0	518

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	20	26	3	0	0	0	49
NNE	15	22	3	0	0	0	40
NE	27	10	0	0	0	0	37
ENE	51	4	0	0	0	0	55
E	31	4	0	0	0	0	35
ESE	14	29	0	0	0	0	43
SE	13	20	0	0	0	0	33
SSE	8	31	0	0	0	0	39
S	5	40	7	0	0	0	52
SSW	3	14	27	0	0	0	44
SW	1	11	26	0	0	0	38
WSW	6	14	0	0	0	0	20
W	19	11	2	0	0	0	32
WNW	18	2	1	0	0	0	21
NW	17	4	4	0	0	0	25
NNW	13	24	0	0	0	0	37
Variable	0	0	0	0	0	0	0
Total	261	266	73	0	0	0	600

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	18	6	0	0	0	0	24
NNE	11	0	0	0	0	0	11
NE	12	0	0	0	0	0	12
ENE	12	0	0	0	0	0	12
E	27	0	0	0	0	0	27
ESE	16	4	0	0	0	0	20
SE	7	1	0	0	0	0	8
SSE	7	6	0	0	0	0	13
S	4	0	0	0	0	0	4
SSW	7	2	0	0	0	0	9
SW	3	2	0	0	0	0	5
WSW	12	7	0	0	0	0	19
W	26	2	0	0	0	0	28
WNW	15	0	0	0	0	0	15
NW	17	0	0	0	0	0	17
NNW	18	0	0	0	0	0	18
Variable	0	0	0	0	0	0	0
Total	212	30	0	0	0	0	242

Hours of calm in this stability class: 16
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	0	0	0	0	0	7
NNE	6	0	0	0	0	0	6
NE	2	0	0	0	0	0	2
ENE	11	0	0	0	0	0	11
E	9	0	0	0	0	0	9
ESE	7	0	0	0	0	0	7
SE	3	0	0	0	0	0	3
SSE	1	0	0	0	0	0	1
S	2	0	0	0	0	0	2
SSW	1	0	0	0	0	0	1
SW	7	0	0	0	0	0	7
WSW	8	2	0	0	0	0	10
W	20	4	0	0	0	0	24
WNW	6	0	0	0	0	0	6
NW	6	0	0	0	0	0	6
NNW	3	0	0	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	99	6	0	0	0	0	105

Hours of calm in this stability class: 51
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	5	2	0	0	11
NNE	0	4	7	9	6	0	26
NE	1	8	12	7	0	0	28
ENE	1	14	2	2	0	0	19
E	0	5	0	0	0	0	5
ESE	1	10	10	0	0	0	21
SE	0	14	5	0	0	0	19
SSE	0	14	7	1	0	0	22
S	0	11	13	2	2	0	28
SSW	0	8	21	8	7	0	44
SW	1	5	13	3	0	0	22
WSW	0	4	13	11	0	0	28
W	0	5	25	12	1	0	43
WNW	0	16	11	1	4	0	32
NW	0	10	10	1	0	0	21
NNW	0	18	22	2	3	0	45
Variable	0	0	0	0	0	0	0
Total	4	150	176	61	23	0	414

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	8	6	1	0	16
NNE	0	3	2	3	1	0	9
NE	0	3	2	2	0	0	7
ENE	3	4	3	0	0	0	10
E	2	2	1	0	0	0	5
ESE	0	1	1	0	0	0	2
SE	0	5	1	0	0	0	6
SSE	0	9	3	2	0	0	14
S	0	3	0	0	0	0	3
SSW	0	4	0	2	1	0	7
SW	0	1	6	3	1	0	11
WSW	0	0	6	2	0	0	8
W	0	4	6	1	0	0	11
WNW	1	8	1	1	0	0	11
NW	0	3	3	0	0	0	6
NNW	1	3	5	2	1	0	12
Variable	0	0	0	0	0	0	0
Total	7	54	48	24	5	0	138

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	3	6	2	0	0	11
NNE	1	3	3	3	0	0	10
NE	1	2	0	1	0	0	4
ENE	2	4	1	0	0	0	7
E	0	4	0	0	0	0	4
ESE	0	1	1	0	0	0	2
SE	0	0	0	0	1	0	1
SSE	1	3	1	0	1	0	6
S	0	2	2	0	1	0	5
SSW	0	0	0	2	0	0	2
SW	0	2	4	1	2	0	9
WSW	0	2	5	2	0	0	9
W	1	2	0	3	0	0	6
WNW	1	7	3	1	0	0	12
NW	2	4	5	1	0	0	12
NNW	0	6	8	1	1	0	16
Variable	1	0	0	0	0	0	1
Total	10	45	39	17	6	0	117

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	6	8	8	3	0	26
NNE	2	15	12	14	3	0	46
NE	3	16	27	3	0	0	49
ENE	2	20	11	1	0	0	34
E	4	8	3	0	0	0	15
ESE	3	2	7	7	0	0	19
SE	2	3	7	9	1	0	22
SSE	0	8	11	11	1	1	32
S	0	4	10	10	8	0	32
SSW	1	3	5	19	5	0	33
SW	0	4	17	17	2	0	40
WSW	0	2	19	6	0	0	27
W	4	7	6	5	1	0	23
WNW	2	8	11	5	1	2	29
NW	4	6	13	2	1	5	31
NNW	1	8	35	8	7	0	59
Variable	1	0	0	0	0	0	1
Total	30	120	202	125	33	8	518

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	4	27	10	0	0	43
NNE	1	6	18	8	0	0	33
NE	1	10	26	2	0	0	39
ENE	1	30	25	0	0	0	56
E	3	19	27	0	0	0	49
ESE	1	4	17	16	0	0	38
SE	0	12	14	8	0	0	34
SSE	0	6	14	7	0	0	27
S	0	4	32	11	1	0	48
SSW	1	3	21	28	3	0	56
SW	0	4	17	27	2	0	50
WSW	0	4	13	1	0	0	18
W	1	4	11	2	1	0	19
WNW	0	8	16	2	0	1	27
NW	2	6	17	3	2	0	30
NNW	0	10	21	4	0	0	35
Variable	0	0	0	0	0	0	0
Total	13	134	316	129	9	1	602

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	2	24	3	0	0	32
NNE	1	7	9	0	0	0	17
NE	0	3	5	0	0	0	8
ENE	2	9	2	0	0	0	13
E	1	6	11	1	0	0	19
ESE	3	5	2	2	0	0	12
SE	0	7	10	2	0	0	19
SSE	2	4	6	0	0	0	12
S	1	8	5	1	0	0	15
SSW	1	11	5	0	0	0	17
SW	1	8	2	0	0	0	11
WSW	1	7	5	0	0	0	13
W	1	5	10	2	0	0	18
WNW	0	4	13	1	0	0	18
NW	0	9	12	1	0	0	22
NNW	0	6	6	0	0	0	12
Variable	0	0	0	0	0	0	0
Total	17	101	127	13	0	0	258

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: July - September 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	8	6	0	0	0	15
NNE	0	1	5	0	0	0	6
NE	0	1	1	0	0	0	2
ENE	1	4	0	0	0	0	5
E	0	3	0	1	0	0	4
ESE	1	3	7	3	0	0	14
SE	0	4	2	0	0	0	6
SSE	1	8	1	0	0	0	10
S	2	5	0	0	0	0	7
SSW	2	7	0	0	0	0	9
SW	5	12	1	0	0	0	18
WSW	4	9	9	1	0	0	23
W	3	9	8	0	0	0	20
WNW	2	3	0	0	0	0	5
NW	1	3	4	0	0	0	8
NNW	2	1	1	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	25	81	45	5	0	0	156

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	3	0	0	0	3
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	2	0	0	0	0	2
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	1	2	0	0	0	3
SSE	0	8	0	0	0	0	8
S	0	4	10	0	0	0	14
SSW	0	1	3	0	0	0	4
SW	0	0	2	0	0	0	2
WSW	0	0	0	1	0	0	1
W	0	1	2	10	0	0	13
WNW	0	7	5	0	0	0	12
NW	0	7	5	0	0	0	12
NNW	0	2	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	33	33	11	0	0	77

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	2	0	0	0	3
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	1	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	1	0	0	0	0	1
SE	1	6	1	0	0	0	8
SSE	1	1	2	0	0	0	4
S	0	1	8	0	0	0	9
SSW	0	0	5	1	1	1	8
SW	0	1	3	0	0	0	4
WSW	0	2	3	2	0	0	7
W	0	6	4	2	0	0	12
WNW	1	6	2	0	0	0	9
NW	0	3	3	1	0	0	7
NNW	0	4	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	3	33	34	6	1	1	78

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	2	0	0	0	3
NNE	0	1	1	0	0	0	2
NE	0	0	2	0	0	0	2
ENE	0	0	0	0	0	0	0
E	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	1	0	0	0	0	1
SSE	0	5	2	0	0	0	7
S	1	2	7	2	2	0	14
SSW	2	2	5	11	0	0	20
SW	0	5	2	1	0	0	8
WSW	1	5	2	0	0	0	8
W	0	6	6	1	0	0	13
WNW	0	3	2	1	0	0	6
NW	1	1	1	0	0	0	3
NNW	0	4	3	0	0	0	7
Variable	0	0	0	0	0	0	0
Total	6	36	35	16	2	0	95

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	26	42	15	4	0	89
NNE	3	17	36	6	1	0	63
NE	5	22	17	4	0	0	48
ENE	2	33	0	0	0	0	35
E	4	5	0	0	0	0	9
ESE	3	2	1	0	0	0	6
SE	1	10	7	2	0	0	20
SSE	2	30	39	1	0	0	72
S	0	11	42	68	11	0	132
SSW	0	12	27	46	14	2	101
SW	0	12	38	9	2	2	63
WSW	3	30	19	0	0	0	52
W	6	21	28	15	0	0	70
WNW	9	31	13	5	0	0	58
NW	7	28	37	0	0	0	72
NNW	3	33	34	17	0	0	87
Variable	0	0	0	0	0	0	0
Total	50	323	380	188	32	4	977

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 9
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	5	8	1	0	0	0	14
NNE	1	7	3	0	0	0	11
NE	6	10	0	1	0	0	17
ENE	12	10	0	0	0	0	22
E	7	3	0	0	0	0	10
ESE	1	6	0	0	0	0	7
SE	2	23	13	0	0	0	38
SSE	4	57	25	3	0	0	89
S	1	42	59	26	0	0	128
SSW	3	29	37	8	2	0	79
SW	4	29	9	1	0	0	43
WSW	10	53	8	0	0	0	71
W	19	39	22	0	0	0	80
WNW	17	15	2	0	0	0	34
NW	5	16	8	0	0	0	29
NNW	2	14	1	0	0	0	17
Variable	0	0	0	0	0	0	0
Total	99	361	188	39	2	0	689

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 3
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	0	0	0	0	1
NNE	1	1	0	0	0	0	2
NE	2	0	0	0	0	0	2
ENE	5	0	0	0	0	0	5
E	9	0	0	0	0	0	9
ESE	5	6	0	0	0	0	11
SE	8	12	0	0	0	0	20
SSE	4	7	0	0	0	0	11
S	4	0	0	0	0	0	4
SSW	4	5	4	0	0	0	13
SW	3	2	2	0	0	0	7
WSW	9	35	0	0	0	0	44
W	16	8	0	0	0	0	24
WNW	11	0	0	0	0	0	11
NW	4	0	0	0	0	0	4
NNW	4	1	0	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	89	78	6	0	0	0	173

Hours of calm in this stability class: 4
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 34 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	11	0	0	0	0	0	11
ESE	6	2	0	0	0	0	8
SE	13	0	0	0	0	0	13
SSE	2	0	0	0	0	0	2
S	4	1	0	0	0	0	5
SSW	4	4	0	0	0	0	8
SW	3	0	0	0	0	0	3
WSW	3	0	0	0	0	0	3
W	12	0	0	0	0	0	12
WNW	9	0	0	0	0	0	9
NW	4	0	0	0	0	0	4
NNW	1	0	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	74	7	0	0	0	0	81

Hours of calm in this stability class: 17
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Extremely Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	1	2	0	0	3
NNE	0	0	0	1	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	2	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	0	0	2	0	0	2
SSE	0	2	7	0	0	0	9
S	0	1	5	7	0	0	13
SSW	0	1	1	3	0	0	5
SW	0	0	0	2	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	0	0	2	1	3
WNW	0	4	5	3	10	2	24
NW	0	1	8	3	0	0	12
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	9	30	23	12	3	77

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Moderately Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	0	0	0	2
NNE	0	0	0	1	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	1	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	3	3	1	0	0	7
SSE	0	2	1	1	0	0	4
S	0	1	1	5	0	0	7
SSW	0	0	3	6	1	2	12
SW	1	0	1	1	0	0	3
WSW	0	1	2	1	1	0	5
W	0	2	4	3	2	1	12
WNW	0	1	5	2	1	0	9
NW	0	4	2	1	1	0	8
NNW	0	1	4	1	1	0	7
Variable	0	0	0	0	0	0	0
Total	1	15	29	23	7	3	78

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Slightly Unstable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	3	0	0	0	3
NNE	0	0	1	1	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	1	1	0	0	2
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	1	2	3	1	0	0	7
S	2	1	3	5	0	0	11
SSW	0	4	4	3	7	4	22
SW	0	2	1	5	1	0	9
WSW	0	3	4	1	0	0	8
W	0	6	1	2	2	0	11
WNW	0	1	0	2	4	0	7
NW	0	3	3	0	0	0	6
NNW	0	0	4	3	0	0	7
Variable	0	0	0	0	0	0	0
Total	3	22	28	24	14	4	95

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Neutral - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	11	35	29	11	3	89
NNE	0	1	23	17	10	8	59
NE	3	4	15	23	9	1	55
ENE	0	7	24	4	1	0	36
E	0	6	14	0	0	0	20
ESE	2	1	2	1	0	0	6
SE	3	2	5	5	1	1	17
SSE	1	6	13	16	10	0	46
S	0	2	26	32	40	24	124
SSW	0	1	9	30	55	32	127
SW	0	4	27	24	13	10	78
WSW	0	12	19	13	1	1	46
W	2	14	11	20	6	2	55
WNW	0	11	13	19	13	9	65
NW	4	16	21	23	13	0	77
NNW	0	8	30	32	13	3	86
Variable	0	0	0	0	0	0	0
Total	15	106	287	288	196	94	986

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Slightly Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	8	2	0	0	14
NNE	0	3	1	5	1	0	10
NE	1	2	7	2	0	1	13
ENE	1	8	15	0	0	0	24
E	0	1	10	0	0	0	11
ESE	0	0	4	4	0	0	8
SE	0	2	5	14	0	0	21
SSE	0	1	20	30	9	1	61
S	0	1	31	42	39	3	116
SSW	2	3	25	39	35	4	108
SW	0	6	27	22	4	0	59
WSW	1	7	22	18	0	0	48
W	1	9	33	39	7	0	89
WNW	1	8	12	25	1	0	47
NW	0	6	15	11	0	0	32
NNW	0	6	15	11	1	0	33
Variable	0	0	0	0	0	0	0
Total	7	67	250	264	97	9	694

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Moderately Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	1	0	0	0	1
NNE	0	0	1	1	0	0	2
NE	0	2	0	2	0	0	4
ENE	0	1	3	0	0	0	4
E	0	2	1	0	0	0	3
ESE	0	0	3	2	0	0	5
SE	0	0	9	3	0	0	12
SSE	2	0	8	5	0	0	15
S	0	4	7	1	0	0	12
SSW	0	1	4	0	0	0	5
SW	0	5	3	6	2	0	16
WSW	0	0	2	4	0	0	6
W	0	6	16	25	0	0	47
WNW	1	2	15	1	0	0	19
NW	0	5	12	2	0	0	19
NNW	0	0	6	1	0	0	7
Variable	0	0	0	0	0	0	0
Total	3	28	91	53	2	0	177

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

Braidwood Generating Station

Period of Record: October - December 2011
Stability Class - Extremely Stable - 199Ft-30Ft Delta-T (F)
Winds Measured at 203 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	2	0	0	0	3
NNE	0	1	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	1	1	1	0	0	0	3
E	1	2	0	0	0	0	3
ESE	1	2	1	1	0	0	5
SE	0	1	4	1	0	0	6
SSE	1	2	5	2	0	0	10
S	0	2	8	0	0	0	10
SSW	0	1	4	0	0	0	5
SW	0	2	10	0	0	0	12
WSW	1	1	2	0	0	0	4
W	1	3	0	0	0	0	4
WNW	1	2	3	0	0	0	6
NW	1	1	5	5	0	0	12
NNW	1	3	5	1	0	0	10
Variable	0	0	0	0	0	0	0
Total	9	25	50	10	0	0	94

Hours of calm in this stability class: 4
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 3

ATTACHMENT 2

Supporting Documentation of
Engineering Change 375873

4.1.4.1 Basic System, Structure, or Component (SSC) Functions

The function of the Circulating Water (CW) blowdown system is to transfer water from the cooling lake to the Kankakee River in order to maintain proper chemistry in the cooling lake. The lake blowdown system header is also used to transfer waste water from the Sewage Treatment Facility and contaminated water from the release tanks to the Kankakee River. The CW Blowdown System provides a design flow rate of approximately 25,000 gpm with both Units in operation. Due to the configuration of the existing CW Blowdown System line outfall structure and discharge canal, liquid releases may not achieve the desired levels of mixing in the river near the discharge location.

The installation work for the Braidwood CW Blowdown river diffuser project has been divided into three separate EC's for each phase of installation work. This EC 375873 will provide the third and final phase of the installation work which consists of routing the CW Blowdown System piping from the piping termination point located near the Kankakee River west bank from the design provided in Engineering Change (EC) 375872 to a new termination point at a discharge location within the Kankakee River.

A total of seven evenly spaced 16" OD branch lines (Equipment Part Numbers - EPNs: 0CW112AA through 0CW112AG) will be attached to the 30" OD CW pipe header (EPN: 0CWE2B) that is encased in a concrete spillway. The configuration of each branch discharge line will consist of a weldolet fitting which attaches the discharge line to the 30" OD CW header pipe, a short 2 foot (approximate) segment of 16" OD pipe, and a 16" slip-on flange.

A vendor supplied flanged nozzle diffuser (EPNs: 0CW114MA through 0CW114MG) will be bolted to the end of the CW discharge pipe at each of the seven nozzle locations. A restriction orifice plate (EPNs: 0CW113MA through 0CW113MG) will be installed between the slip-on flange and the vendor supplied nozzle diffuser flange. The orifice plate diameter will vary based on the nozzle diffuser location as shown in a table on Drawing M-900, Sheet 13C included with this EC. A gasket will be installed on only one side of the orifice plate to provide a mechanical seal between the metal slip-on flange and metal orifice plate for each of the seven nozzle locations.

The orifice plate diameter was selected for each discharge line in order to balance the flow passing through each nozzle diffuser to within 10% of each other and to help maintain a pressure above vapor pressure at the discharge of the 18" globe valves (EPNs: 0CW260A/B).

A protective coating will be applied to external surfaces of the buried and submerged portions of the piping installed in this EC in order to mitigate corrosion on the external surfaces of the pipe.

A concrete spillway will be installed in this EC for the purpose of anchoring the CW blowdown line in the river bed and for dispersing CW blowdown flow exiting the nozzle diffusers in order to prevent potential erosion of the river bottom.

The nozzle diffuser configuration will consist of seven evenly spaced discharge points in order to improve the mixing of liquid releases into the Kankakee River, eliminate background noise levels and organic foam, enable improved alternative release strategies, and minimize operations constraints on timed releases.

4.1.4.2 Safety Classification of Configuration Change

The affected portions of the CW system are classified as non-safety related (Quality Class D, and Seismic Category II) and are not required for safe shutdown; therefore, this EC is classified as Non-Safety Related.

4.1.4.3 Seismic Classification

The CW systems is classified as Seismic Category II. Therefore, this EC is classified as Seismic Category II.

4.1.5 Performance Requirements and Design Conditions

The CW system piping installed in this EC will have the following design conditions:

Design Pressure: 110 PSIG
Design Temperature: 100°F
Piping Design Table (PDT): 100BB

The piping pressure and temperature ratings listed above are consistent with the design conditions for the existing CW Blowdown System piping (e.g., lines 0CW2CA-30", 0CWC2CA-18, 0CW100A-1", and 0CW101A-½"). The pressure and temperature ratings for the existing lines were obtained from Passport.

As mentioned in Section 4.1.21 and 4.1.24, the positions of globe valves 0CW260A/B and 0CW152A/B will be changed in order to direct CW blowdown flow through the new nozzle diffusers installed in this EC. The valves positions of 0CW260A/B and 0CW152A/B can be changed by manually adjusting the handwheels located in the modified instrument pit and the existing outfall structures respectively.

As discussed in Calculation BRW-02-0152-M, Revision 1, the hydraulic performance and physical parameters of the nozzle diffusers were obtained from the vendor's diffuser analysis. This analysis calculated that at the maximum NPDES allowable flow rate of 30,000 gpm, the head loss through the nozzle diffusers is 3.3 feet. This head loss was used as an input to the hydraulic model included in Calculation BRW-02-0152-M, Revision 2.

Vendor documentation indicates that the ethylene propylene diene monomer (EPDM) nozzle diffusers and gaskets have an operating temperature range of -50 deg F to +300 deg F. The temperatures that are anticipated at the nozzle diffuser installation location submerged beneath the surface of the Kankakee River are expected to be within the operating temperature range of the EPDM material. The vendor documentation listing the diffuser elastomer properties and applications is included in Tab 8 of this EC for reference.

Orifice plates of varying diameters are installed at the end of each of the seven 16" OD diffuser branch lines installed in this EC in order to balance the flow passing through each nozzle diffuser to within 10% of each other and to help maintain a pressure above vapor pressure at the discharge of the globe valves (EPNs: 0CW260A/B). The design basis for the orifice plate diameters was provided in Calculation BRW-02-0152-M, Revision 2 which was provided in support of EC 375871. The design basis of the minimum required orifice plate thickness is included in Calculation BRW-06-0174-M, Revision 1 which is provided in support of this EC package. The orifice plate design details are shown on Drawing M-900, Sheet 13C included with this EC package.

The gasket and orifice plates are specified as full faced with the corresponding bolt holes in accordance with 150 lb. class ASME B16.5 pipe flange requirements. The surface finish of the gasket surface sealing areas of the orifice plates is specified in accordance with the requirements of ASME B16.5, Section 6.4.5.3 with a serrated concentric pattern. This surface finish will serve to provide a proper seal of the bolted nozzle diffuser connection to the end of the CW piping utilizing a full-faced gasket.

The nozzle diffusers are manufactured of an EPDM elastomer material and are designed to act as a check valve to prevent reverse flow of the Kankakee River water or air back into the CW piping which could affect the performance of the CW blowdown system. There are a total of seven nozzle diffusers that will be installed in this EC for discharging the CW blowdown flow into the Kankakee River.

4.1.6 Design Requirements for Surveillance Testing and Acceptance Testing

The required testing for this EC is specified in accordance with procedure CC-AA-107-1001 with specific testing identified on Form CC-AA-107, Attachment 1, provided in this EC.

A Thermal Impact and Mixing Zone Analysis performed in 2009 by Hydroqual concluded that use of the new multi-port diffuser would significantly improve discharge dilution over the existing configuration which consists of two 18" discharge lines feeding a flume that discharges above the surface of the Kankakee River. Another study can be performed following installation if further information is needed on the thermal impact and mixing zone of the new multi-port diffuser but this is not required for this EC.

4.1.9 Affected Calculations or Design Analyses

Calculation BRW-02-0152-M, Revision 1 (Circulating Water Blowdown Hydraulic Analysis) was provided in support of EC 375871 in order to model the alternate CW blowdown flow path through the nozzle diffusers. The calculation revision specified the diameters of new restriction orifice plates that are required to be installed at the end of lines 0CW112AA through 0CW112AG in order to balance the flow through the nozzle diffusers to within 10% of each other and to help maintain a pressure above vapor pressure at the discharge of the 18" globe valves (EPNs: 0CW260A/B). The orifice diameters will vary at each nozzle diffuser location and are listed in a table on Drawing M-900, Sheet 13C included with this EC package. Minor revision 1A is provided in support of this EC package to document the diffuser spacing changing from 11' to 7' apart. The minor revision concludes that the revised diffuser spacing improves the ability of the blowdown booster pumps to meet the flow requirements in the analysis.

Calculation BRW-06-0073-M, Revision 3 (Hydraulic Transient Analysis of the Circulating Water Blowdown Pipeline) was provided in support of EC 375871 for the purpose of modeling the CW river diffuser flow path for various event scenarios that are described within the calculation. Major revision 4 is provided in support of EC 380017 to document the removal and addition of some vacuum breakers on the CW line but also to document the nozzle diffuser spacing changing from 11' to 7' apart. The major revision concludes that the revised diffuser spacing will not significantly impact the overall results of the transient analysis.

Calculation BRW-06-0174-M, Revision 2 (Orifice Sizing for CW blowdown Lines 0CWC2CA and 0CWC2CB and the River Diffuser Branch Lines) is issued in support of this EC package to provide the basis for the minimum required thickness for diffuser orifice plates 0CW113MA through 0CW113MG to ensure deformation of the orifice does not occur. The orifice plate thickness is provided on Drawing M-900, Sheet 13C included with this EC package.

The orifice plate material listed in the notes on Drawing M-900, Sheet 13C (ASTM A240 Gr. 304L) does not match the orifice plate material listed in Calculation BRW-06-0174-M (ASTM A312, TP 304L). However, as listed in the tables of ASME B31.1 Code, the maximum allowable stress value in tension (16.7 ksi for temperatures not exceeding -20 to 100 °F) for the ASTM A240 Gr. 304L material is greater than the maximum allowable stress value in tension (15.7 ksi for temperatures not exceeding -20 to 100 °F) for the ASTM A312, TP 304L material. As a result, using lower allowable stress values in Calculation BRW-06-0174-M, Revision 1 results in a conservatively larger orifice plate thickness and is therefore acceptable by engineering judgment. The grade of stainless steel (304L) specified for both the ASTM A312 and ASTM A240 materials is the same.

Calculation 2.4.1-BRW-09-0073-S was updated and reissued under Revision 0 in support of this EC package to provide an evaluation of the concrete spillway for the loads transferred from the CW piping that is installed in this EC. Minor revision 0A is also issued in support of this EC package to document the diffuser spacing changing from 11' to 7' apart. The design of the concrete spillway will remain adequate based on the revised diffuser spacing.

4.1.13 Material Requirements

The new CW system pipe and fitting materials installed in this EC are specified in accordance with Braidwood Station Piping System Installation Specification L-2739 in accordance with Piping Design Table (PDT) 100BB with the exception of the 30" OD pipe, orifice plates, fasteners, and gasket materials.

The 30" OD pipe, 0.375" wall material specified for this EC will be ASTM A134, Gr. A283C, in lieu of ASTM A155, Gr. KC65 that is specified in PDT 100BB. The purpose for this material deviation is due to the discontinuation of the ASTM specification for the ASTM A155 material. A listing of the material composition and properties is provided in Table 1 that follows:

Table 1: Comparison of Materials for the 30" OD CW Piping

ASTM Standard	UNS	Chemical Properties (max. wt% unless otherwise stated)						Mechanical Properties (ksi)		Elongation (min. %)	
		C	Mn	P	S	Si	Cu	Tensile	Yield (min.)	8 inch	2 inch
A155 Gr. KC65, A672 Gr. B65, A515 Gr. 65 [1]	K02800	0.28 [2]	0.9	0.035	0.035	0.15-0.4	-	65-85	35	19	23
A134 Gr. 283C, A283 Gr. C [1]	K02401	0.24	0.9	0.035	0.04	0.4 [3]	0.2 [4]	55-75	30	22	25

Table 1 Notes:

1. These ASTM standards are equivalent in accordance with EPRI Report 1014670 "Carbon Steel Handbook"
2. Carbon content varies depending on material thickness: $t \leq 1"$, C = 0.28, $1" < t \leq 4"$, C = 0.31, $t > 4"$, C = 0.33
3. Silicon content varies depending on material thickness: $t \leq 1.5"$, Si = 0.4, $t > 1.5"$, Si = 0.15-0.4
4. This requirement applies only when copper steel is specified

A comparison of the chemical and mechanical properties of ASTM A134, Gr. A283C and ASTM A155, Gr. KC65 is provided as follows:

- The ASTM A134, Gr. A283C material consists of similar mechanical properties to that of ASTM A155, Gr. KC65. The tensile strength and the minimum yield strength values of the ASTM A134, Gr. A283C material are slightly less then ASTM A155, Gr. KC65. However, the high end of the range specified for tensile strength of ASTM A134, Gr. A283C, is within the range specified for ASTM A155, Gr. KC65.

- The elongation percentage of the ASTM A134, Gr. A283C material is slightly greater then the elongation percentage of the ASTM A155, Gr. KC65 material. This mechanical property results in a slightly greater ductility of the ASTM A134, Gr. A283C material and, among other things, will enhance formability of the 30" pipe from the plate material.

- The carbon content for ASTM A134, Gr. A283C material is less then the carbon content for the ASTM A155, Gr. KC65 material. The carbon content affects the aforementioned mechanical properties of the materials (primarily hardness and strength). In general, the greater the carbon content, the stronger the material.

A minimum wall pipe evaluation was performed at the circulating water system design pressure (110 psig) for ASTM A134, Gr. A283C welded plate in accordance with Sargent and Lundy Mechanical Engineering Guideline MES-2.15, Revision 9, and it was determined that 0.375" wall pipe is adequate for this application. This evaluation was already included in EC 375872 and is also included in Tab 8 of this EC package for reference.

Sargent and Lundy Mechanical Engineering Guideline MES-2.15, Revision 9, Table MES-2.15-02, recommends specifying ASTM A134, Gr. A283C, for welded pipe material at operating temperatures of 200 °F or less for cold water service such as circulating water systems. As specified in Section 4.1.5 of the DCS, the pipe design temperature for the CW system is 100 °F which is within the temperatures specified in MES-2.15, Revision 9, Table MES-2.15-02.

In conclusion, the use of ASTM A134, Gr. A283C in lieu of ASTM A155, Gr. KC65 piping specified for the 30" OD pipe in this EC is acceptable.

Orifice plates will be installed at the ends of 16" OD lines 0CW112AA through 0CW112AG. The orifice plate material is specified as ASTM A312 TP304L. Calculation BRW-06-0174-M, Revision 1 (Orifice Sizing for CW blowdown Lines) is issued in support of this EC to provide the basis for the thickness of the new orifice plates installed in this EC. The calculation determines the minimum required thickness of the orifice plates to ensure that deformation of the orifice does not occur. Material properties for the allowable stress of the orifice plate are based on the ASTM material. The orifice plate material listed in the notes on Drawing M-900, Sheet 13C (ASTM A240 Gr. 304L) does not match the orifice plate material listed in Calculation BRW-06-0174-M (ASTM A312, TP 304L). However, as listed in the tables of ASME B31.1 Code, the maximum allowable stress value in tension (16.7 ksi for temperatures not exceeding -20 to 100 °F) for the ASTM A240 Gr. 304L material is greater than the maximum allowable stress value in tension (15.7 ksi for temperatures not exceeding -20 to 100 °F) for the ASTM A312, TP 304L material. As a result, using the lower allowable stress values in Calculation BRW-06-0174-M results in a conservatively larger orifice plate thickness and is therefore acceptable by engineering judgment. The grade of stainless steel specified for both materials is the same.

The materials used to fasten the nozzle diffuser bolted flanged connections in this EC are stainless steel ASTM A193, Grade B8 Class 1 bolts and ASTM A194, Grade 8 nuts. This fastener material deviates from the requirements of PDT 100BB which specifies the use of ASTM A193, Gr. B7 bolts and ASTM A194, Gr. 2H nuts. The fasteners will be used to attach the nozzle diffuser flanges to the CW pipe flanges and will be located below the surface of the Kankakee River; therefore, the stainless steel fastener materials have been selected for this application to offer corrosion protection.

Sargent & Lundy Technical Alert TA2003-0016, Issued October 28, 2003, states that if a "soft" gasket material (in lieu of a spiral wound metallic gasket) such as a elastomer material can be specified that can be adequately compressed to seal the joint with the use of a "low" strength stainless steel bolt material, then a low strength class 1 stainless steel bolt material (such as ASTM A193 Grade B8 Class 1) could be specified. As mentioned previously, the nozzle diffuser and gaskets supplied by the vendor for this EC are manufactured of an elastomer (EPDM) material.

The stainless steel fastener materials have lower tensile and yield stress values when compared to the carbon steel fasteners; therefore, the specified bolt torque for the stainless steel fasteners will be less then carbon steel fasteners. The specified "floor" bolt torque value for 1" diameter, 8 Threads Per inch (T.P.I.) ASTM A193, Grade B8 bolts listed in Procedure MA-MW-736-600, Rev. 3, Attachment 2 is 91 ft-lbs (for soft joints). By comparison the recommended minimum torque values for 1" diameter, 8 T.P.I. bolts listed in the Tideflex Technologies Series 35/35-1 check valve Installation, Operation, and Maintenance Manual is 50 ft-lbs. Since the vendor recommended torque values are lower than the torque values specified in Procedure MA-MW-736-600, Attachment 2 for ASTM A193 Grade B8 Class 1 bolting materials, the vendor specified torque values for the stainless steel bolts and nuts installed in this EC are acceptable by comparison.

It has been reported that stainless steel bolts and nuts are very susceptible to galling or 'cold welding' during tightening of the joint (Reference S&L Technical Alert TA2003-0016). To mitigate the concerns with galling of the fasteners during installation, an anti-seize compound will be applied to the surfaces of the bolts and nuts, as required, during installation. A fastener lubricant should be used that is compatible with the fastener material and the operating service conditions (system temperature and external environment). Chlorides, fluorides and sulfides present in a lubricant can cause stress corrosion cracking of the bolts, and should not be present in any such lubricants. Exelon procedure MA-MW-736-600 recommends the use of N5000 lubrication for stainless steel fasteners. In addition, the rotation speed is to be limited when tightening the stainless steel nuts in this EC. The work planning instructions of this EC provides instructions for the installation of the stainless steel fasteners.

The materials specified for the CW system piping to nozzle diffuser connection consist of dissimilar metals. The flanged connection consists of a carbon steel CW pipe flange attached to a vendor supplied EPDM rubber nozzle diffuser with 316 stainless steel backing rings. As mentioned previously, a stainless steel orifice plate will be installed in between the pipe and nozzle flanges. A vendor supplied EPDM gasket will be installed between the carbon steel flange and orifice plate to provide a mechanical seal between the carbon steel and stainless steel metal surfaces. The flange gaskets are shown on Vendor Drawing TTS-35182 included with this EC package.

There will be no gasket installed between the orifice plate and nozzle diffuser flange. The fastener material that is specified will be stainless steel for the bolts and nuts. The stainless steel fasteners will be in contact with the carbon steel CW pipe flange. This dissimilar metal connection consists of the carbon steel (anode) to the stainless steel (cathode). The carbon steel will preferentially corrode with respect to the stainless steel material. This accelerated corrosion will not be localized, but rather will be spread out over the area of the carbon steel anode. The area of the carbon steel anode is significantly greater than the area of the stainless steel cathode. Therefore, the accelerated corrosion due to the galvanic action will be significantly minimized due to the area of the anode in relation to that of the cathode. In addition, the EPDM rubber gasket material will provide some electrical insulation between the stainless steel orifice plate and the carbon steel flange which should minimize any potential galvanic corrosion between these dissimilar metal components.

For each unit, sodium hypochlorite is injected into the CW pump discharge (condenser supply) piping near the CW pumps in the lake screen house. The 24" CW Blowdown System lines tap off the CW supply piping further downstream, in the Turbine Building, just before the condenser inlet water boxes. The 24" CW blowdown lines from each unit combine into a common 36" blowdown line in the Turbine Building, which transitions to a 48" buried concrete blowdown pipe outdoors.

Sodium bisulfite is injected adjacent to the first vacuum breaker (0CW058) in the CW blowdown line located upstream of the nozzle diffusers to reduce the residual chlorine concentrations that are added upstream of this location. Sodium bisulfite injection is interlocked with the hypochlorite injection. However, once the hypochlorite injection is terminated, bisulfite injection must continue for a period of time to allow scavenging of residual sodium hypochlorite in the CW supply and blowdown lines as it travels from the hypochlorite injection point to the bisulfite injection point. Discussion for the sodium hypochlorite and sodium bisulfite injection into the CW system is provided in EC 351871, S&L Evaluation No. 2004-08051 (Evaluation of Constraints and Limitations For Sodium Bisulfite Injection into the CW Blowdown Line).

Material suitability of the gasket and nozzle diffuser for this application was primarily derived from the results of a large number of laboratory tests. Companies that design and/or manufacture materials will generally perform a great deal of tests to determine how new materials compare to existing ones in a variety of corrosive environments. These materials are usually submerged in a variety of chemicals at different temperatures. Performance is ranked according to the level of material degradation. These rankings are compiled in a chart and are usually made available to the public. By looking at the chemical compatibility of the materials listed in the charts, the suitability of many materials can be determined.

The chemical compatibility of EPDM material was obtained from an industry document Emerson Process Management, Rosemount Analytical, "Chemical Resistance Chart" PN 41-6018/rev. B, February 2005 included in Tab 8 of this EC. Based on the information provided in the compatibility chart, the EPDM material possesses suitable corrosion resistance to the chloride (~2 ppm) and sodium bisulfite (~3 ppm) concentrations expected to be present in the circulating water. Several chemical compatibility charts published by EPDM manufacturers and test laboratories indicate that EPDM's performance when exposed to sodium bisulfite is acceptable at 100°F or less. At low chloride concentrations (100 ppm or less) and temperatures (100°F or less), EPDM's performance is also acceptable. For these reasons, it is unlikely that the EPDM gasket material will experience accelerated degradation from the chloride and sodium bisulfite concentrations present in the CW Blowdown System water.

Protective coatings will be applied to the exterior surfaces of the buried carbon steel piping installed in this EC. A review of Braidwood Station Piping System Installation Specification L-2739, Form 276C "Standard Specification for Protective Coatings for Buried Piping" was conducted and it was determined that the coal tar pipe coating specified on Form 276C is not appropriate for this application due to the discontinuation of the use of this coating in the industry. Therefore, alternative protective coatings will be specified in this EC for the buried carbon steel piping.

The exterior surfaces of the carbon steel pipe installed in this EC will be shop coated in accordance with AWWA C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines. A fusion-bonded epoxy coating is recommended for un-insulated underwater, underground or embedded piping applications at temperatures less than or equal to 200 °F in accordance with Sargent & Lundy Mechanical Department Standard MES-21.4, Coatings and Linings. In addition, a fusion-bonded epoxy coating was previously specified for buried large bore piping installed in EC 372909 at Braidwood Station.

Sections of the new CW blowdown carbon steel pipe that could not be shop coated (e.g., circumferential weld locations) will be field coated in accordance with AWWA C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines, due to the installation challenges associated with field installation of the fusion-bonded epoxy coating. This liquid epoxy coating is listed as an acceptable alternative coating as specified in AWWA C213, Paragraph 4.4.5.3.

The materials that are specified for a drain line which is attached to a blind flange that is temporarily installed to the end of the 16" OD branch line 0CW112AG for pressure testing are consistent with the material requirements of PDT 100BB.

The blind flange material that is specified for the closure of the CW pipe at seven locations for pressure testing, ASTM A105, is consistent with the material requirements of PDT 100BB. The fastener materials that are specified for pressure testing are carbon steel ASTM A193, Gr. B7 bolts and ASTM A194 Grade 2H nuts. After pressure testing is complete, the fasteners will be discarded. The gaskets that are specified for pressure testing are Flexatallic Type 'CGI' for a full face flange which is consistent with the requirements of specification L-2739. These gaskets will be used to provide a mechanical seal between the slip-on flange and the blind flange located at the end of 16" OD CW lines 0CW112AA through 0CW112AG during pressure testing and will be discarded after pressure testing is complete.

This EC will heat trace valves 0CW152A/B along with a portion of 18" OD lines 0CWC2CA/B located in the outfall structure upstream of globe valves 0CW152A/B to prevent the water in the piping from freezing. Insulation is required to be installed on the portion of the CW piping that is heat traced. The insulation that is specified for the CW piping is pre-formed 1½" thick insulation in accordance with ASTM C547 in accordance with the requirements of specification L-2828, Thermal Insulation.

The materials required for this EC have been specified on the Engineering Change Material List (ECML) included with this EC.

4.1.14 Environmental Conditions and Impacts

Form EN-AA-103, Attachments 1 and 2 were reviewed and it was determined that there are potential environmental impacts. Therefore, EN-AA-103, Attachment 1 and 2, and an Interfacing Department Review sheet (Form CC-AA-102, Attachment 10F) were forwarded to the station's chemistry department for input and approval. An environmental evaluation has been completed by the station's chemistry department in accordance with EN-AA-103-1001 and there were no negative impacts associated with the implementation of this EC. The environmental review checklist and environmental evaluation is included in Tab 8 of this EC package. A summary of the environmental evaluation is provided below:

EC 375873 will not result in chemical change in the characteristics of discharges, effluents, emissions or withdrawals. The proposed activity will result in a physical change in the characteristics of liquid effluents discharged to the Kankakee River; however, the proposed change increases the mixing zone and dilution characteristics of the river.

EC 375873 will alter the NPDES permit and process diagram. Application for Construction/Operation Permit (WPC-PS-1) has been submitted to the Illinois EPA which included a revision to the NPDES permit.

EC 375873 will be consistent with the site Operating License Appendix B. There will be no impact to the environment or an unanalyzed test or experiment associated with the installation of this system.

EC 375873, installed in accordance with Braidwood Station applicable procedures, will not add or change the environmental impact, violate existing permits, or pose a change to the Final Environmental Statement.

4.1.16 Operating Experience Review

The INPO site was searched for keywords to determine if relevant operating experiences were applicable to this modification. The following is a listing of results after searching the SER/SEORs and EPIX/NPRDS databases:

INPO Searched for: "Large Bore Globe Valve"

Search Results: None

INPO Searched for: "Circulating Water and Blowdown"

Search Results:

OE 22903 - Leak at Circulating Water System Blowdown Line Vacuum Breaker – Braidwood Units 1 and 2

Background:

This OE describes a failure of a CW blowdown vacuum breaker due to low-stress, high-cycle fatigue, primarily caused by the lack of protection against pressure surges caused by the system operating methodology. The vacuum breaker failure resulted in significant amounts of water being discharged through the failed vacuum breaker over several days. The leak was not discovered until after a local resident reported water in a ditch adjacent to his property.

Summary:

This OE is particularly relevant to the river diffuser project because the vacuum breaker failure occurred upstream of the CW river diffuser branch line that is installed in EC 375871, EC 375872, and this EC. The river diffuser project will not make modifications or change the operation of the CW blowdown vacuum breakers. A major revision was issued against Calculations BRW-02-0152-M and BRW-06-0073-M for EC 375871 in order to provide a steady state and transient hydraulic model respectively of the new CW blowdown discharge flowpath. The new CW flowpath will direct CW flow through nozzle diffusers which are installed in this EC. EC 375871 installed new 18" globe valves (EPNs: 0CW260A/B) which will be used to throttle the flow through the nozzle diffusers and to maintain adequate backpressure on to ensure the vacuum breakers remain properly seated.

INPO Searched for: "Buried Piping and Freeze"

Search Results:

OE 16497 - Aborted Discharge/Release of Processed Radioactive Effluent Because of a Frozen Line at Davis Besse.

Background:

While attempting a discharge/release of processed radioactive effluent during the winter from the Miscellaneous Waste Monitor Tank (MWMT) to the Collection Box outside of the protected area, no flow was observed on the associated flow meter. Further investigation found ice blockage in the line at the discharge point in the Collection Box.

No unmonitored release occurred. However, the potential existed for an unplanned and/or undiluted release of low level radioactive waste water to the environment if the pipe should freeze and burst at a point outside of the Collection Box. The piping was installed approximately 18" deep at the point of entrance to the Collection Box.

Summary:

This OE highlights the need to ensure buried piping and piping located outdoors is not exposed to freezing temperatures. This is particularly a concern when there is stagnant water in the piping which is exposed to freezing temperatures.

After implementation of EC 375873, blowdown flow will be directed through the new CW Blowdown System nozzle diffusers and will discharge directly into the Kankakee River. The old CW Blowdown System flow path, which directed CW blowdown flow through 18" OD lines 0CWC2CA and 0CWC2CB and discharged CW onto a concrete spillway located outside of the outfall structure, will be isolated by closing globe valves 0CW152A/B. A portion of the isolated CW piping is located in the outfall structure and may be exposed to freezing temperatures during the winter months. To prevent freezing of the water within the CW piping, valves 0CW 152A/B as well as a portion of 18" OD lines 0CWC2CA/B located within the outfall structure upstream of globe valves 0CW152A/B will be heat traced in this EC.

INPO Searched for: "Buried Piping and Corrosion"

Search Results:

OE23565 - Unexpected fill conditions were found during an excavation of Buried Nuclear Service Water Piping - Catawba Nuclear

Background:

Unexpected fill conditions were found during an excavation of buried nuclear service water piping. The piping was found enveloped in washed crushed stone instead of the expected earth fill at the location of excavation. The excavation was performed to assess the extent of conditions of coating damage and externally initiated corrosion damage. Since the existing pipe conditions were excellent, the backfill plan was changed to use washed crushed stone based on the recommendations of subject matter experts.

Summary:

As stated in the work planning instructions of this EC, the pipe backfill material shall be a granular material with a maximum particle size of 0.75 inches [such as IDOT #67 aggregate (ASTM D448) or a finer gradation aggregate] as recommended in specification AWWA C210, Section 4.8.3 and specification AWWA C213, Section 4.6.3 respectively for coated buried piping. Alternatively, controlled low strength material (bash concrete) may be used in lieu of granular material for the bedding installation. No deviation of the backfill requirements is allowed without prior approval and concurrence of design engineering.

4.1.19 System Operational Requirements

This EC will change the operational requirements of the CW Blowdown System at Braidwood Station. After implementation of this EC, flow will be directed through the nozzle diffusers for discharge into the Kankakee River. The previous flow path for CW Blowdown System flow through 18" OD lines 0CWC2CA/B located at the outfall structure concrete spillway will remain in place as a viable alternate flow path. Procedure BwOP CW-12, Circulating Water Blowdown system Fill, Startup, Operation, and Shutdown will be updated as a result of the new flow path for discharge of the CW Blowdown System.

4.1.21 Procedure Changes

The CW Blowdown System mechanical line-up procedure, BwOp CW-M2, will be updated in this EC to list the position of the 18" globe valves (EPNs: 0CW260A/B) installed in the instrument pit extension as open. In addition, the 18" globe valves (EPNs: 0CW152A/B) installed in the outfall structure will be listed as closed. The valves are shown on Drawings M-44, Sheet 13A and M-44, Sheet 13C and are included with this EC package.

This EC will install a new flow path for CW Blowdown System discharge to the Kankakee River. Therefore, Procedure BwOP CW-12, Circulating Water Blowdown System Fill, Startup, Operation, and Shutdown will require update in support of this EC.

Procedure 0BWOS XFT-A5 will be updated to add a surveillance of the heat tracing that will be installed on the existing CW blowdown system 18" OD piping (lines: 0CWC2CA/B) and globe valves 0CW152A/B located in the outfall structure.

Minor updates will be required to the following procedures as a result of this EC:

- BwOP TR-2
- BwOP WX-501T2
- BwOP WX-526T2
- BwOP CW-1
- BwOP CW-2
- BwOP CW-13
- BwOP CW-14
-

The aforementioned procedures have been listed on Attachment 9 of CC-AA-102, Attachment 9 and this form is included with this EC package. These procedures are also listed on the ADL of this EC package.

4.1.22 Training Requirements

The procedure/training impact review form CC-AA-102, Attachment 9, has been included in this EC for the station to identify any potentially impacted training.

4.1.24 Layout and Arrangement Requirements

The routing of the CW piping that is provided with this EC has been developed in conjunction with input received from Exelon and their installation contractor. The contractor, 'D' Construction, provided a conceptual layout of the CW piping which would best accommodate their proposed location of a cofferdam in the Kankakee River. The cofferdam will be required for the installation of piping as well as the diffuser nozzle ports which will discharge onto a concrete spillway located in the river bed as part of this EC.

Installation activities associated with the placement, welding, and coating of the buried CW piping installed in this EC will take place in an excavated trench. Adequate space will be required to inspect the pipe welds and apply the protective coating at the weld joints.

The 2" branch lines (0CW111A/B) that were installed in EC 375872 will be utilized for pressure testing of the new CW piping installed in this EC. The 2" lines are located in the instrument pit extension downstream of globe valves 0CW260A and 0CW260B. EC 375871 provided sections of removable grating installed at El. 555'-4" to allow for periodic valve maintenance. The grating section(s) can be removed, as required, in order to route test equipment (e.g., hoses) to the fill line for pressure testing of the CW pipe.

The CW piping installed in this EC will be hydrostatically pressure tested in accordance with the requirements of ASME B31.1. A threaded connection with threaded pipe cap is provided at the end of the fill and vent lines to allow for the attachment of test equipment and proper venting of the pipe respectively. The approximate volume of fluid required for hydrostatic pressure testing is 21,350 gallons and was determined in the work planning instructions of this EC. Blind flanges are installed at the end of the CW pipe to allow for hydrostatic pressure testing. A 2" line is attached to the blind flange at the end of 16" OD line 0CW112AG to allow for draining of the CW piping after pressure testing is complete. Globe valves 0CW260A and 0CW260B will remain closed during pressure testing.

After pressure testing of the CW piping is complete, the water within the CW piping that was used for testing will be drained, collected, and disposed of.

An orifice plate and nozzle diffuser will be installed at the end of 16" OD CW lines 0CW112AA through 0CW112AG. The orientation and size of the orifice plates and nozzle diffusers is provided on Drawing M-900, Sheet 13C and Vendor Drawing TTS-35180 respectively included with this EC package. A gasket will be installed between the orifice plate and a slip-on flange connection at seven locations in order to provide a mechanical seal between the metal surfaces. According to the Tideflex Technologies Series 35/35-1 check valve Installation, Operation, and Maintenance Manual included in Tab 3 of this EC package, no gasket is required to be installed between the orifice plate and the nozzle diffuser flange.

As mentioned in Section 4.1.21, the valve positions associated with 0CW260A/B and 0CW152A/B will be changed to direct CW blowdown flow through the new nozzle diffusers. The position of valves 0CW260A/B can be changed by manually adjusting the valve handwheel extension located above floor elevation 555'-4" within the enclosure over the modified instrument pit. The position of valves 0CW152A/B can be changed by manually adjusting the valve handwheel located above floor elevation 543'-6" in the existing outfall structure. Existing operating procedures will be revised in support of this EC to provide the steps required for manually adjusting the 18" globe valves located within the instrument pit and outfall structure. Additional adjustments of the globe valves hand wheels for 0CW260A/B may be required during startup of the CW Blowdown System to ensure adequate backpressure upstream of the valves to keep the vacuum breakers seated during normal operation.

4.1.26 Walkdowns

An Installer's Walkdown is required to validate the design details presented in this EC. As a result of the walkdown, any changes to the EC drawings or documents will be processed as a planned revision to the EC.

4.1.28 Requirements for Handling, Storage, Cleaning, and Shipping

Protective coatings will be applied to the buried and submerged CW system piping and fittings installed in this EC. The protective coatings act as a barrier to prevent corrosion of the external surfaces of the buried carbon steel piping. If the coating is damaged, that portion of the pipe could be more susceptible to corrosion. The protective coatings will be applied to the piping surfaces both in the shop and in the field. Care shall be taken while handling, transporting, and installing the coated piping to ensure the protective coating is not damaged. In the case that the coating is damaged during installation, see AWWA C210 and AWWA C213 for direction on repair as directed in the WPI.

In addition, the backfilling operation should be carefully controlled to prevent damage to the exterior pipe coating applied to the CW piping. Special precautions during the backfilling operation are provided in the work planning instructions of this EC.

The Tideflex Technologies Series 35/35-1 check valve Installation, Operation, and Maintenance Manual includes considerations for storage of the nozzle diffusers and is included in Tab 3 of this EC package.

4.1.30 Industrial Safety Requirements

The existing and modified instrument pit structure is a confined space. Appropriate safety precautions for confined space entry must be followed during installation of the EC and considered in procedures that require entry into the confined space. In addition, the work area in the instrument pit around the piping and valves is restricted. However, there is adequate lighting and access to the fill and vent valves during pressure testing conducted in this EC.

Steel grating may be removed in the instrument pit extension at elevation 555'-4" to allow for the routing of test equipment (e.g., hoses, valves, pumps, etc.) associated with the hydrostatic pressure testing of the CW piping installed in his EC. The removal of grating may pose a fall hazard for workers. Compensatory measures may be required to ensure the safety of workers in and around the removed portions of grating.

A portion of the installation work implemented in this EC will take place in cofferdam located in the Kankakee River. The installation contractor is responsible for the preparation and implementation of safety procedures for the cofferdam work.

4.1.33 Mechanical System Requirements

The CW system piping installed in this EC is designed to Piping Design Table (PDT) 100BB and has a design pressure of 110 psig and a design temperature of 100°F which is consistent with the existing CW system requirements.

The required bolt torque values for fastening the blind flanges to the end of the CW piping for pressure testing are different then the bolt torque values for attachment of the nozzle diffusers to the end of the CW piping after pressure testing is complete. The bolt torque required for fastening the blind flanges for pressure testing has been specified in the work planning instructions for this EC and is in accordance with Exelon procedure MA-MW-736-600 Attachment 2 for 1"-8 T.P.I. stainless steel bolts. The required bolt torque values for attachment of the nozzle diffusers to the end of the CW piping is in accordance with the values provided in the installation, operation, and maintenance manual submitted by the vendor Tideflex Technologies. In accordance with Exelon procedure MA-MW-736-600 Section 3.2.5, the bolt torque values specified by a vendor shall take precedence over the torque values provided in the Exelon procedure. Therefore, the recommended torque values provided by Tideflex Technologies will be utilized for attachment of the nozzle diffusers to the end of the CW blowdown piping. These torque values have been specified in the work planning instructions of this EC.

As listed on Vendor Drawing TTS-35180 included with this EC, the nozzle diffusers are sized for a maximum back pressure of 27.5 feet. According to the nozzle diffuser vendor, a backpressure in excess of the rated pressure can invert the sleeve and cause nozzle diffuser failure. The maximum backpressure is based on the difference of the Kankakee River 100 year floor elevation (553'-0") and the pipe centerline elevation (525'-6"). The pipe centerline elevation at the concrete spillway location is provided on Drawing M-900, Sheet 13C included with this EC package. The 100 year flood elevation obtained from drawing M-900 Sheet 5 is 550-6". However, an updated 100 year flood elevation was obtained from the Flood Insurance Rate Map (FIRM) map number 17197C0560 E for Will County, Illinois effective September 6, 1995, provided by the Federal Emergency Management Agency. Therefore, the elevation obtained from the FIRM map (553'-0") is used as a conservative value to determine the maximum backpressure.

In accordance with Procedure NSWP-M-05 (Pressure Testing) and the requirements in ASME B31.1 Code, the hydrostatic test pressure is 1.5 times the system design pressure (110 psig) which equals 165 psig. However, given the elevation difference from the pipe centerline at the high point (elevation 546'-0", From Drawing M-900, Sht. 13A) and the low point (elevation 525'-6", From Drawing M-900, Sheet 13C) the pressure at the low point in the CW Blowdown System piping is calculated as follows:

Hydrostatic Test Pressure: 165 psig

Elevation difference: 546.0 ft – 525.5 ft = 20.5 ft

Conversion from ft water to psi: 0.433 ft water/psi (From Crane Technical Paper 410, Flow of Fluids Through Valves, Fittings, and Pipe, Page B-11)

20.5 ft x 0.433 ft water/psi ≈ 8.9 psig

Corrected hydrostatic Test Pressure: 165 + 8.9 ≈ 174 psig

A half coupling will be welded to a blind flange which is temporary installed at the end of 16" OD line 0CW112AG for pressure testing. A drain line is installed to this half coupling to allow for draining of the CW piping after pressure testing is complete. The fillet weld for the attachment of the half coupling to the blind flange is specified as 5/16" and is conservatively designed to withstand an applied pressure of 200 psig which is greater than the hydrostatic test pressure at this location (approximately 174 psig). In addition, the pressure rating of a 16" blind flange shown on Sketch SK-M-375873 used for pressure testing (150# Class, ASTM A105) of the CW Blowdown System pipe for temperatures -20 to 100 °F is 285 psig (Reference ASME B16.5-2009).

This EC will temporarily bolt blind flanges to the end of the CW piping at seven locations to provide pipe closure for pressure testing of the CW piping installed in this EC. After pressure testing is complete, the blind flanges will be removed and the nozzle diffusers will be bolted to the end of the CW system piping. The nozzle diffuser flange connections cannot be checked for leakage since the diffusers are open at one end and will be submerged beneath the Kankakee River during normal operation of the CW blowdown system. If leakage were to occur at the flanged nozzle diffuser connections installed at the end of lines 0CW112AA through 0CW112AG, the water would discharge into the Kankakee River just upstream of the intended discharge path through the nozzle diffusers.

Revisions to Calculations BRW-02-0152-M (Circulating Water Blowdown Hydraulic Analysis) and BRW-06-0073-M (Hydraulic Transient Analysis of the Circulating Water Blowdown Piping) were provided in EC 375871 in order to model the alternate CW Blowdown System flow path through the nozzle diffusers. Calculation BRW-02-0152-M specified that restriction orifice plates are required to be installed at the discharge of the CW Blowdown System piping into the Kankakee River in order to balance the flow passing through each nozzle diffuser to within 10% of each other and to help maintain a pressure above vapor pressure at the discharge of the 18" globe valves (EPNs: 0CW260A/B). The orifice diameters will vary based on the diffuser location and generally decrease in diameter towards the end of the concrete spillway. The orifice diameters are listed in a table on Drawing M-900, Sheet 13C included with this EC package.

Calculation BRW-06-0174-M, Revision 1 (Orifice Sizing for CW Blowdown Lines) is issued in support of this EC to calculate the minimum required orifice plate thickness to ensure deformation of the orifice does not occur. The orifice plate thickness is shown on Drawing M-900, Sheet 13C included with this EC package.

As mentioned in Section 4.1.21 and 4.1.24, the positions of globe valves 0CW260A/B and 0CW152A/B will be changed in order to direct CW blowdown flow through the new nozzle diffusers installed in this EC. Existing operational and mechanical line-up procedures will require update based on the aforementioned changes to the globe valve positions as well as the changes to the operation of the CW blowdown system. The mechanical procedures that require update have been identified in Section 4.1.21 of the DCS.

A stagnant section of piping could exist in lines 0CWC2A-30", 0CWC2BA/B-24", and 0CWC2CA/B-18" located downstream of the 30" lateral fitting and upstream of globe valves 0CW152A/B between the instrument pit and outfall structures.

For the scenario mentioned above, the potential for accelerated corrosion exists due to the stagnant water conditions in the CW Blowdown System piping caused by Microbiologically Induced Corrosion (MIC). Generally, there are higher risks for MIC when untreated natural waters (i.e., pond, lake, river water) are in contact with steel components. Action Request (AR #: 01098301) has been assigned to track actions to mitigate corrosion in portions of 0CWC2A-30" and 0CWC2A/B-18" downstream of the 30" lateral fitting inside of the instrument pit.

A portion of lines 0CWC2CA-18" and 0CWC2CB-18" located within the outfall structure upstream of globe valves 0CW152A/B will be heat traced along with valves 0CW152A/B to prevent the water in the CW piping from freezing. Insulation is required to be installed on the portion of the CW piping that is heat traced. The insulation requirements have been specified in Section 4.1.13 of the DCS. The basis for the selection of the heat trace cables is discussed in Section 4.1.35 of the DCS.

4.1.35 Electrical Requirements

This EC provides the design for the installation of the Electrical Heat Tracing System for the exposed (inside the outfall structure) portions (0CWC2CA & 0CWC2CB) of the 18" diameter pipes, which ties in to the existing Circulating Water (CW) blow-down header (line 0CWC2A-30") in the blow down instrument pit located upstream of the Outfall Structure. Portions of the 18" exposed piping inside the outfall structure separated by globe valves will not be heat traced. Water will be present on these portions (following the globe valves) of the pipe only during continuous flow. Therefore these portions of the piping will not require heat tracing.

Two sections (CWC2A-18" & 0CWC2B-18") of the pipe (prior to globe valves) inside the outfall structure will require heat tracing to prevent them from freezing since these sections of pipe may contain stagnant water. 120 VAC power for the heat tracing will be provided from Regular Lighting Cabinet (RLC) # 130C (which is added by EC 375871), Circuits #9 & #11. Heat tracing for pipe section 0CWC2A-18" will be powered form RLC #130C, Circuit #9 and heat tracing section 0CWC2B-18" will be powered form RLC #130C, Circuit #11.

A new power connection box with LED indication and a new thermostat will be installed in each section of the pipe to be heat traced. The heat trace, power connection box, and thermostat will be connected as indicated on drawing 20E-0-4030HT12

Design Condition & Pipe Heat Loss – Water Piping

Location	Above Ground (Inside outfall structure)
Maintain Temperature (TM)	40°F
Maximum Temperature (TMax)	103°F
Min. Ambient Temp (TA)	- 10°F
Pipe Diameter & Material	18" – Carbon Steel
Length of Pipe to be Heat Traced	approximately 8'
Thermal Insulation & Thickness	1.5 inch (ASTM C547)
Supply Voltage	120V

Temperature differential:

ΔT = TM - TA
= 40°F – (- 10°F)
ΔT = 50°F

Pipe Heat Loss:

From Table 1, for 18" diameter pipe with 1.5 inch insulation and ΔT = 50°F, the pipe heat loss (QB) will be obtained from Table 1 (pipe Heat Loss (watts per foot))

QB = 12.9 W/ft @ TM = 40°F

Insulation Type:

Multiplying the base heat loss of the pipe (QB) from above by the insulation compensation factor (f) from the bottom of Table 1 to get the actual heat loss per foot of pipe (QT).

QT = QB x f
= 12.9 x 1
= 12.9 watts/ft @ 40°F

Heating Cable:

From Tyco Table 4a – (Thermal Output Ratings for QTVR Heating Cables on insulated Metal Pipes) 15QTVR1-CT cable is selected for heat tracing. From the Table 4a, it is clear that the 15QTVR1-CT provides more than 15 watts/ft. Therefore, single layer of tracing of this cable type is adequate for this service.

Length of the heating cable required for each section of the piping:

Piping: 8 ft of pipe = 8 ft

There is one globe valve. From Tyco Table for amount of heating cable required for each valve for a 18" diameter pipe is 9.4 ft of heating cable.

For one valve 18" = 9.4 ft

There is one support shoe on each section of the pipe to be heat traced. Additional heat is required for each support shoe.

Heat Required

$Q_{SUPPORT} = 0.7L \times (T_M - T_A)$, where L = support length (ft) – considering 1'
This formula is based on a 0.25" steel welded shoe partially shielded from winds.
Heat loss from supports: 1 x (1 x 0.7 x 50) = 35 watts x 10% safety factor = 40 watts
Heating cable power output is 15W/ft.

Additional heating cable required for support:

40/15 = 2.7 ft or approximately 3'
Total heating cable = 8 + 9.4 +3 = 20.4 feet
Total power require = (20.4 feet x 15) = 306 watts
Therefore, continuous current will be less than 3 amps at 120V.

Circuit Breaker Selection:

Total heating cable circuit length is 20.4 feet. From Table 7, the maximum heating cable length allowed for 15QTVR powered at 120 volts with a -0°F startup temperature on a 15A circuit breaker is 60 feet and on a 20A breaker, 80 feet. Selecting a 15A circuit breaker as the total length will be less than 21'. This is lowest size breaker shown on Tyco Table 7.

Ground-fault protection:

If the heating cable is improperly installed or physically damaged to the point that water contacts the bus wires, sustained arcing or fire could result. If arcing does occur, the fault current may be too low to trip conventional circuit breaker. A 15A Ground Fault Interrupting (GFI) type circuit breaker is selected for these services.

Feed Cable:

A #10 AWG feed cable is selected for each section of the heat tracing for the circulating water pipes tie-in sections. NEC Table 310.16 shows that in raceway at 900C the current carrying capacity of 3/C, 10 AWG cable is 40A at an ambient temperature of 300C. NEC Table also shows a temperature correction factor of 0.82 for an ambient temperature of 400C. Therefore, the current carrying capacity at an ambient temperature of 400C for a 3/C, #10 AWG cable is (40 x 0.82) 32.8A.

Since the current carrying capacity of 3/C, #10 AWG is higher feed breaker trip rating (15A) therefore, the feed breaker will protect the cable.

4.1.38 Civil/Structural Requirements

A geotechnical investigation was performed by Patrick Engineering, Inc. in October 2008 to evaluate the subsoil conditions along the approximate location of the CW branch blowdown pipe and the diffuser header in the river. Three (3) land borings and four (4) river borings were drilled. A final report documenting the results of the geotechnical investigation was subsequently issued by Patrick in December of 2008. In the land borings, the depth to the bedrock varied from about 7.2 feet to 16 feet. The subsoil consisted of sandy silt fill, sand/gravel fill, silty sand, gravel, and organic silt. The Standard Penetration Test (SPT) blow counts (N) varied from 5 to >50 blows/ft. The groundwater table was encountered four (4) to six (6) feet below grade. The bedrock is a moderately weathered shale with the Rock Quality Designation (RQD) values varying from 35 percent to 73 percent. In three of the river borings, brown sandy gravel was encountered above the shale bedrock in thickness that varied from 1.3 feet to 3.6 feet. In one boring, shale bedrock was encountered at the river bottom with no gravel overlying the rock. RQD of the rock cores obtained in the river varied from 16 to 86 percent. The unconfined compressive strength of the core samples varied from 240 to 2775 psi. Based on the buried pipe profiles shown on Drawing M-900, Sheet 13C, the minimum ground cover to the top of the CW piping will be 3'-3" which is adequate to prevent freezing of any stagnant water in the CW blowdown piping.

Based on a survey drawing prepared by Atwell-Hicks, the existing land elevation between the Outfall Structure and the top of the east river bank is relatively constant (varying between 544 feet to 541 feet). At the time of the survey, the water elevation in the Kankakee River was approximately 536 feet. The river bottom elevation was also obtained at several locations across the river. The lowest river bottom elevation at approximately 527 feet.

The reinforced concrete spillway which encases the end of the CW blowdown line in the river bed and provides a ramp opposite the river nozzle diffusers to direct the blowdown discharge into the Kankakee River flow is detailed on Drawing S-308, Sheet 3 included with this EC package. The qualification of the spillway structure is provided in Calculation 2.4.1-BRW-09-0073-S, Revision 0 issued in support of this EC package. Minor revision 0A is issued in support of this EC package and concludes that the concrete spillway structure is adequate based on the diffuser spacing changing from 11' to 7' apart.

4.1.40 Personnel Requirements and Limitations

For personnel requirements and limitations, see section 4 of the Work Package Instructions titled, "Special Installation Sequencing and Considerations."

4.1.42 Interfacing Department Review

Interfacing department impacts are addressed in the applicable CC-AA-102, Attachment 10 forms included with this EC.

4.1.45 Single Point Vulnerability (SPV) Review

In accordance with CC-AA-102, the following questions were addressed:

Does the configuration change add any unnecessary challenges associated with the operation of the system?

No. This EC provides the Phase 3 scope of work for the completion of the CW blowdown river diffuser project. CW blowdown flow will be directed through the nozzle diffusers which discharge directly into the Kankakee River.

Orifice plates of varying diameters will be installed between the CW pipe to nozzle diffuser flange connections. The orifice plates are installed based on the results of the hydraulic analysis of the new CW blowdown river diffuser pipe routing for the purpose of balancing the flow to within 10% of each other and to help maintain a pressure above vapor pressure at the discharge of the 18" globe valves (EPNs: 0CW260A/B).

A protective coating will be applied to the CW piping installed in this EC in order to mitigate corrosion on the external surface of the CW piping. Stainless steel fasteners and orifice plates are specified in this EC to offer corrosion protection of the submerged components. Dissimilar metal corrosion may occur due to the connection of the stainless steel fasteners to the carbon steel CW flanges. However, this corrosion would not be localized, but rather will be spread out over the area of the carbon steel (anode). The area of the carbon steel (anode) is significantly greater then the area of the stainless steel (cathode). Therefore, the accelerated corrosion due to the galvanic action will be significantly minimized due to the area of the anode in relation to that of the cathode. The gasket material specified in this EC will electrically insulate the stainless steel orifice to carbon steel CW flange connection and will prevent stray currents which could cause galvanic corrosion of the carbon steel flange and potentially lead to the galvanic corrosion of the metal.

According to the nozzle diffuser vendor, a backpressure in excess of the rated pressure can invert the nozzle sleeve and cause nozzle diffuser failure. The nozzle diffusers have been sized for a maximum backpressure of 27.5 feet which is based on the difference in the 100 year flood elevation (553'-0") and the pipe centerline (525'-6"). The 100 year flood elevation was obtained from an Flood Insurance Rate Map (FIRM) map number 17197C0560 E for Will County, Illinois effective September 6, 1995 provided by the Federal Emergency Management Agency in lieu of the elevations shown on M-900, Sheet 5 which will result in a conservatively larger elevation difference. The pipe centerline at the concrete spillway location is provided on Drawing M-900, Sheet 13C included with this EC package.

A portion of 18" OD lines 0CWC2CA/B upstream of valves 0CW152A/B located in the outfall structure will be heat traced along with valves 0CW152A/B to prevent water in the CW system piping from freezing.

Does the configuration change modify existing or require the development of new operating procedures, maintenance or system testing activities such that these procedures or activities could result in an unnecessary risk of losing the system function?

No. Existing procedures will require revision based on changes to the CW system manual valve line-ups as well as the changes to the operation of the CW blowdown system. The procedures will be modified to allow for CW blowdown flow to be directed through seven CW nozzle diffusers installed in this EC. The 18" globe valves 0CW260A/B installed in EC 375871 will be throttled to ensure there is adequate backpressure to keep the vacuum breakers seated during normal operation.

Could the configuration change lead to a plant SCRAM or Derate?

No. See disposition for the previous two questions.

Do any proposed Instrument & Control (I&C) setting changes or dynamic compensation changes introduce a single point of vulnerability?

No, there are no I&C setting changes in this EC.

Can the fault tolerance of the system be adversely affected by any I&C setting changes so as to introduce a new single point of vulnerability?

No, disposition is the same as the previous question.

Would other I&C related changes that would cause an effective gain change to a control system adversely affect the fault tolerance so as to introduce a new single point of vulnerability?

No, disposition is the same as the previous two questions.

Conclusion:

A single point vulnerability (SPV) review has been performed for the configuration change. The purpose for the review was to identify all events that can result in unplanned reactor SCRAMs in a proactive manner, with the intent of taking action to prevent such events. No relevant events were identified.

50.59 Screening Questions (Check correct response and provide separate written response providing the basis for the answer to each question) (See Section 5 of the Resource Manual (RM) for additional guidance):

1. Does the proposed Activity involve a change to an SSC that adversely affects an UFSAR described design function? (See Section 5.2.2.1 of the RM)

☐ Yes ☒ No

The Braidwood Station is proposing to implement an activity to install an alternate Circulating Water System (CW) blowdown flow path that will direct the blowdown flow to a new multi-port diffuser for discharging CW directly into the Kankakee River. New piping will tie-in to the existing CW blowdown header (line 0CWC2A-30") in the instrument pit located upstream of the outfall structure and will be routed underground to the Kankakee River. A multi-port diffuser will be installed in a concrete spillway in the river bed at the end of the new bypass line to discharge CW below the water surface directly into the river flow. The diffuser will consist of seven discharge points, each equipped with a flow balancing orifice, that will improve the mixing of liquid releases into the Kankakee River, eliminate background noise levels and organic foam, and enable an improved alternative release strategy. Studies have concluded that use of the aforementioned multi-port diffuser will significantly improve discharge dilution over the existing configuration which consists of two 18" discharge lines feeding a flume that discharges above the surface of the Kankakee River. The discharge configuration described above will be implemented as a preferred alternative to the existing discharge configuration as the primary method of CW blowdown. This activity will be segregated into three (3) separate Engineering Changes (EC), as indicated below, to allow for a phased installation approach. Phase 1 and Phase 2 when considered as stand-alone activities screened-in as commercial change activities that had operational boundaries that ensured that the proposed activities could not adversely impact a system, structure, or component as described in the UFSAR. The Phase 3 activities cannot be screened-in as a commercial change and requires evaluation per the 50.59 process. Phase 3, in-conjunction with the completed Phase 1 and Phase 2 activities will combine to implement modifications and additions to procedures that affect how the UFSAR described CW blowdown function is controlled. Therefore, all three phases of the proposed EC activities will be addressed by this 50.59 screening.

Phase 1 Activities: EC 375871 will provide the first phase of the work consisting of a tie-in to the existing CW system blowdown 0CWC2A-30" using a 30" x 30" lateral fitting, installation of two parallel 18" CW system lines (0CWE2BA-18" and 0CWE2BB-18") with 18" globe valves (0CW260A and 0CW260B) installed in each line, demolition of a portion of the south wall of the existing instrument pit and extending the east and west pit walls to accommodate the described new piping and valves. A new pre-fabricated metal building will be added to enclose the extended instrument pit. This EC will also install pressure gauges upstream of the new 18" globe valves, will relocate an existing blowdown sample probe (and associated equipment), and will provide a new sample tie-in, composite sampler and provisions for taking grab samples. Power will be supplied to the new instrument pit building for lighting, receptacles, composite sampler power feed, heat tracing for sample lines, and future tie-in for heat tracing existing piping lines 0CWC2CA-18" and 0CWC2CB-18" (See Phase 3, EC 375873 activities). The non-safety related power feed will be supplied from existing lighting cabinet 1LL30JA located in the River Screen House via two spare cables (1CW582 and 1CW583) through a new 5kVA 120/240Vac single phase transformer and new power distribution panel located in the outfall structure pit.

Phase 2 Activities: EC 375872 will provide the second phase of the installation work that consists of routing the CW blowdown piping from the piping termination points in the first phase of installation work, located just outside of the instrument pit extension, to a location near the Kankakee River bank. Fill and vent lines will be added to both 18" branch lines to allow for pressure testing. The two 18" branch lines (0CWE2BA-18" and 0CWE2BB-18") installed in Phase 1 EC (375871) will converge back to a single 30" line outside of the instrument pit extension and will be routed underground approximately 380 feet to a location near the Kankakee River bank. The two 18" globe valves installed in Phase 2 will remain closed following pressure testing. The pipe will terminate near the river bank pending the third phase of installation work which will be provided in EC 375873.

Phase 3 Activities: EC 375873 will provide the third and final phase of the installation. This EC will continue the routing of the 30" line, installed in Phase 2, into a branch header provided with seven 16" diameter branch lines each equipped with a restriction orifice and diffuser nozzle which will discharge below the surface of the Kankakee River. A concrete spillway will be installed beneath the new diffuser nozzles and supply piping in order to prevent potential erosion of the river bottom. The 18" globe valves, 0CW260A and 0CW260B, installed in Phase 1 will be opened to direct CW blowdown through the newly added diffuser piping branch and existing.

DRP 13-057 will be processed to modify UFSAR Section 2.4.1.1 "Site and Facilities" to describe the additional method of CW blowdown discharge via the added diffuser spillway in addition to the flume. In addition, Section 2.4.8.1 "Pipelines" will be revised to differentiate between the maximum blowdown flowrate during normal operation and the maximum permissible blowdown flowrate allowed by the Braidwood National Pollutant Discharge Elimination System (NPDES) permit. DRP 13-057 will also correct a typographical error identified in UFSAR Section 2.4.11.5 relative to thermal mixing zone compliance with Illinois Pollution Control Board regulations. The aforementioned UFSAR changes are needed to describe an improved diverse method of CW blowdown discharge into the Kankakee River. None of these changes adversely affect the function of the CW blowdown system as described below in the UFSAR.

The CW System functions to provide heat rejection for the steam cycle by continuous circulation of cooling water through the main condenser and a cooling pond utilized to dissipate waste heat. Water chemistry, including dissolved solids concentration, in the cooling pond is controlled by continuous makeup from and blowdown to the Kankakee River (UFSAR Section 10.4.5). Effluent from the Liquid Radwaste System (after appropriate processing and monitoring) may be discharged to the environment via the CW blowdown line. Wastes from the Turbine Building floor drain tanks and Turbine Building Fire and Oil sump (via the Waste Treatment System), and discharge from the Condensate Polisher sump is discharged into the cooling pond at the CW discharge canal, where it mixes with circulating water prior to release to the Kankakee River via the CW blowdown line. In addition, temporary groundwater remediation activities, including collection of contaminated water from the Exelon Pond and surrounding groundwater is pumped into the CW blowdown line for release to the environment (UFSAR Section 11.2.3).

As identified in UFSAR Table 3.2-1, CW blowdown is considered a part of the Raw Water system and is considered a Safety Category II (non-safety related), Quality Group D, Non-IE (electrical classification) system. The CW system does not perform any safety function and is not required for safe shutdown of the plant and is not credited in any accident analyses.

This activity will not alter the safety classification or function of the CW system or CW blowdown as described in the UFSAR. This activity will not change any SSCs that would adversely impact the CW system blowdown function to maintain cooling pond water chemistry.

This activity will not alter the CW blowdown system interface with the Liquid Radwaste, Waste Treatment or Condensate Polishing systems and the quantity of liquid wastes that are fed into the CW blowdown system for discharge to the Kankakee River are not altered by this change. UFSAR described methods to monitor and isolate effluent discharge to the CW blowdown system are not altered by this activity. This activity will not change expected liquid radwaste annual radionuclide releases identified in Table 11.2-1.

The added piping, valves, piping appurtenances and instrumentation monitoring devices have the same safety classification as the existing CW blowdown piping components and are constructed to the same codes and standards as the original blowdown piping system.

A section of added instrumentation and isolated sections of the previous blowdown piping that normally contain water and are subjected to cold temperatures will be heat traced to preserve pressure integrity and prevent freezing damage. Power for the heat tracings, lighting, receptacles and the composite sampler equipment will be supplied from existing non-safety related River Screen House lighting cabinet 1LL30JA. This will have no adverse impact on the design of the station's electrical distribution system.

Based on the above description, the proposed activity does not involve a change to an SSC adversely affecting a UFSAR described design function.

2. Does the proposed Activity involve a change to a procedure that adversely affects how UFSAR described SSC design functions are performed or controlled? (See Section 5.2.2.2 of the RM)

☐ Yes ☒ No

This activity will add new CW blowdown control valves and process controls for the new diverse (and preferred) CW blowdown flowpath to the added diffuser spillway. Station operating procedures will need to be revised to reflect the addition of these added components and associated valve lineups during system operation. Specifically, the added CW blowdown valves 0CW260A/B which will be placed in a normally open position (in conjunction with EC 375873) in addition to changing the position of existing blowdown valves 0CW152A/B from normally "open" to normally "closed". The available CW blowdown controls, as described in Section 7.7.1.15 of the UFSAR are not affected by this activity. None of the aforementioned CW blowdown Station procedure changes affect how the UFSAR described CW blowdown function is performed or controlled.

No unwanted system/material interactions are introduced by this change.

This change will not introduce any changes to operator actions to plant accidents and transients as described in the UFSAR.

3. Does the proposed Activity involve an adverse change to an elements of a UFSAR described evaluation methodology, or use of an alternative evaluation methodology, that is used in establishing the design bases or used in the safety analyses? (See Section 5.2.2.3 of the RM).

☐ Yes ☒ No

The system and components being modified are not credited in any UFSAR safety analysis. There is no UFSAR described unique evaluation methodology associated with the CW blowdown system with the exception of the assessment of expected radioactive releases to the Kankakee River (UFSAR Section 11.2.1.3). However, the quantity and types of liquid wastes that are fed into the CW blowdown system for discharge to the Kankakee River are not altered by this change. UFSAR described methods to monitor effluent discharge to the CW blowdown system are not altered by this activity. The affected piping system maintains a Quality Group D, Safety Category II designation as defined in UFSAR Table 3.2-1 and is designed to the codes applicable to this quality group classification. The added piping, valves, electrical components and structures meet the same design codes and standards applicable to the original CW blowdown system components.

The proposed activity does not utilize any changes to methodology used to establish the UFSAR described design basis as summarized above.

4. Does the proposed Activity involve a test or experiment not described in the UFSAR, where an SSC utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the UFSAR? (See Section 5.2.2.4 of the RM)

☐ Yes ☒ No

This activity adds piping, valves, controls and supporting structures required to direct CW blowdown flow to a new multi-port diffuser over an added concrete spillway in the Kankakee River. EC supporting analyses have been performed to ensure that the SSCs are not utilized or controlled beyond their design limitations. The only analyses associated with the CW blowdown system described in the UFSAR are the expected radioactive releases to the Kankakee River. However, the quantity and types of liquid wastes that are fed into the CW blowdown system for discharge to the Kankakee River are not altered by this change.

Therefore, this activity does not involve a test or experiment or subject CW blowdown system components in a manner outside their design bounds.

5. Does the proposed Activity require a change to the Technical Specifications or Facility Operating License? (See Section 5.2.2.5 of the RM)

☐ Yes ☒ No

The CW blowdown system and components are not addressed in the Operating License or Technical Specifications. There is no impact from this activity on any component or systems that are covered by these documents. Therefore, there are no changes required.

II. List the documents (e.g., UFSAR, Technical Specifications, other licensing basis, technical, commitments, etc.) reviewed, including sections numbers where relevant information was found (if not identified in the response to each question).

UFSAR Sections

2.1 GEOGRAPHY AND DEMOGRAPHY
2.1.1 Site Location and Description
2.1.1.2 Site Area Map
2.1.1.3 Boundaries for Establishing Effluent Release Limits
2.4 HYDROLOGIC ENGINEERING
2.4.1 Hydrologic Description
2.4.1.1 Site and Facilities
2.4.8 Cooling Water Canals and Reservoirs
2.4.8.1 Pipelines
2.4.11 Low Water Considerations
2.4.11.5 Plant Requirements
2.4.11.6 Heat Sink Dependability Requirements
2.4.13 Groundwater
2.4.13.2.3 Effects of Seepage from Cooling Pond
3.2 CLASSIFICATION OF STRUCTURES, COMPONENTS, AND SYSTEMS
3.2.2 Quality Group Classification
Table 3.2-1 Safety Category and Quality Group Classification for Structures and Components
7.7 CONTROL SYSTEMS NOT REQUIRED FOR SAFETY
7.7.1 Description of Control Systems Not Required for Safety
7.7.1.15 Circulating Water System Controls
9.2 WATER SYSTEMS
9.2.5 Ultimate Heat Sink
9.2.5.2 System Description
10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM
10.4.5 Circulating Water System
11.2 LIQUID WASTE MANAGEMENT SYSTEMS
11.2.1 Design Basis
11.2.1.1 Safety Design Basis
11.2.1.2 Power Generation Design Basis
11.2.1.3 Expected Radioactive Releases
11.2.2 System Description
11.2.2.2.7 Turbine Building Floor Drain
11.2.2.2.8 Turbine Building Fire and Oil Sump
11.2.2.2.9 Condensate Polisher Sump
11.2.2.2.10 Waste Treatment System
11.2.3 Radioactive Releases
11.2.3.1 Release Points
Table 11.2-1 Expected Annual Average Releases of Radionuclides in Liquid Effluents
Table 11.2-2 Parameters Used in the Gale-PWR Computer Program (Original & Uprated)
Table 11.2-4 Comparison of Expected Liquid Effluent Concentrations to 10 CFR 20 Limits
Table 11.2-6 Design-Basis Annual Average and Maximum Waste Stream Flows
11.5 PROCESS AND EFFUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS
11.5.1 Design Bases
11.5.1.1 Design Objectives
11.5.2 System Description
11.5.2.3.7 Turbine Building Fire and Oil Sump
11.5.2.3.8 Condensate Cleanup Area Sumps Discharge

Other Documents:
NPDES Permit No. IL0048321
HydroQual Report EXCO.001, dated August 2, 2007.
HydroQual Report EXCO.003, dated February 13, 2009.
Addendum to February 13, 2009 HydroQual Report EXCO.003, dated May 6, 2010.

III. Select the appropriate conditions:

☒ **If** all questions are answered NO, **then** a 50.59 Evaluation is not required.

☐ **If** question 1, 2, 3, or 4 is answered YES for any portion of an Activity and question 5 is answered NO, **then** a 50.59 Evaluation shall be performed for the affected portion of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and questions 1 through 4 are answered NO for the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment; however, a 50.59 Evaluation is **not** required for the remaining portions of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and question 1, 2, 3, or 4 is answered YES for any of the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment **and** a 50.59 Evaluation is required for the remaining affected portions of the Activity.

IV. **Screening Signoffs**:

The 10CFR50.59 screening has been approved by the Site's Qualified Screening Process on 8/10/10.

ATTACHMENT 3

Supporting Documentation of
Engineering Change 378192

Description of the Engineering Change (EC):

Revision 002 incorporates vendor drawings that were revised during the Factory Acceptance Test. DCS Sections 4.1.35 and 4.1.36 are revised to add reference to the radiation monitor internal wiring drawings that were issued after Revision 000.

Revision 001 did not revise the Design Considerations Summary.

The liquid contents of the Release Tanks 0WX01T and 0WX26T are monitored by Radiation Monitor 0PR01J in recirculation mode or discharge mode. Presently, this is the only monitor for both tanks. Both tanks are piped to a common header that discharges to Circulating Water (CW) blowdown. On detection of increased radiation in the blowdown effluent stream, Release Tank Discharge Header isolation valves 0WX353 and 0WX896 auto-close to terminate the effluent release. Because of the single monitor design, only one tank at a time can be monitored during a discharge. This prevents the other tank's effluent from being monitored until the previous release is completed. This inefficiency prevents the near continuous discharge of effluent.

To allow one tank to be monitored while the other tank is being discharged, a second radiation monitor skid equivalent to the existing 0PR01J skid is added to the system configuration. The new radiation monitor 0PR90J is located near 0PR01J and the release tanks. Its sample point monitors the discharge of release tank 0WX26T. The original common sample point to 0PR01J is relocated such that it will monitor only tank 0WX01T.

This EC provides the design to incorporate the new radiation monitor. It includes the skid installation, inlet and discharge piping, back flush water and drain, new cables for the 120 VAC power feed and connections into the RM-11 network, re-programming of the RM-11, and the revision of control circuits for the valves 0WX353, 0WX896, 0WX889, and 0WX890. The functionality of the new monitor will be identical to that of 0PR01J. A radiation condition at either monitor will alarm in the Radwaste Control Room Panel 0PL01J and initiate an interlock into the discharge valve control circuits.

The revised Release Tank Discharge Header valve control circuits will allow the discharge of one tank as long as the other tank is isolated during recirculation. If a radiation condition occurs during the recirculation of an isolated tank, the discharge of the other tank will not be interrupted. If a radiation condition occurs during effluent release and discharge into CW blowdown, the discharge will be isolated and terminated.

The following items were identified in CC-AA-102, Attachment 1 as requiring consideration for the design of this configuration change:

4.1.4.1 Basic System, Structure, or Component (SSC) Functions

The Radiation Monitoring System provides monitoring, sampling, measurement, indication, and control of radioactivity in those effluent streams which discharge to the environs outside the plant boundaries. The system provides a means to inform Operating personnel of liquid and airborne radiation levels in the plant. The 0PR01J skid is a liquid process radiation monitor in the common discharge path of the release tanks 0WX01T and 0WX26T. It monitors effluent discharges into the station blowdown prior to discharge to the environment and interrupts an effluent discharge on a high radiation condition.

The liquid radwaste effluent radiation monitors are part of the Process and Effluent Radiation Monitoring and Sampling System as described in UFSAR Sections 11.5 and 7.7.1.19. The system function is to provide measurement, indication, and/or control of radioactivity in those streams which could conceivably be contaminated by radioactive substances. The system provides operating personnel with radiological measurements within the plant process systems. The objective of the effluent monitoring system is to sample and monitor each discharge path prior to discharge. UFSAR Table 11.5-2 describes that skid 0PR01J has automatic interlocks in Section 11.5.2.3.1 for Liquid Radwaste Effluent Monitors. The interlocks require that the release tank discharge valves 0WX353 and 0WX896 close on high radiation.

The Release Tanks 0WX01T and 0WX26T are the collection points for the plant liquid drains and waste effluents in the Liquid Radwaste system. After being monitored, the release tanks are individually discharged through a common header into the station blowdown line that discharges to the Kankakee River. Existing Radiation Monitor 0PR01J monitors the common header and upon detection of radioactivity will automatically isolate the discharge flow by closing the release tank discharge isolation valves 0WX353 and 0WX896, which are in parallel discharge paths. Since the existing monitor is in the common discharge path, both tanks are isolated from a discharge when only one of the tanks may have elevated radioactivity in the effluent. A second monitor and revised valve control interlocks will provide operating flexibility for release tank discharges.

4.1.4.2 Safety Classification of Configuration Change

This EC is classified Non-Safety Related. The affected portions of the PR, WX and WM systems are Non-Safety Related. This EC also affects control panel 0PL01J in the Radwaste Control Room in the Aux Building El. 383'. 0PL01J is a non-safety related panel.

4.1.4.3 Seismic Classification of SSC

This EC is classified Seismic Category II (Non-Seismic). The 0PR01J and 0PR90J liquid process radiation monitors and associated monitor piping are classified Seismic Category II (Non-Seismic) and are located in the Unit 1 Turbine Building.

This EC also affects control panel 0PL01J in the Radwaste Control Room in the Aux. Building El 383'. The panel is classified as Seismic Category II (Non Seismic).

4.1.5 Performance Requirements and Design Conditions

The performance requirements and design conditions are defined in UFSAR Section 11.5. The UFSAR invokes Standard ANSI N13.10-1974 "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents". ANSI N13.10-1974 has been re-designated as ANSI N42.18-2004. This standard is the basis of the technical requirements for the new radiation monitor from General Atomics.

Original radiation monitor 0PR01J was procured under Specification L-2827. This spec included ANSI N13.10-1974 for the technical requirements. The new radiation monitor has the same function as 0PR01J; thus the same criteria apply.

Design Criteria from UFSAR 11.5 that is applicable to liquid effluent monitors:

- Monitors are gamma-responsive scintillation detectors to provide maximum sensitivity to a water medium.
- Shielding provided to reduce background and increase sensitivity.
- Monitors are designed to fail in the interlock mode in the event of loss of power, loss of signal, or operate failure.
- Alarms annunciate in the main control room.
- Monitors provide readouts, alarms, and trending in the main control room.
- Monitor components are readily accessible for maintenance.
- Designed for operability within the environmental conditions listed in UFSAR Table 3.11-2. See Section 4.1.14 for details.
- Alarm setpoints are adjustable over the range of the instrument.
- Two independent setpoints are available, one for alarm and one for initiating corrective action.
- UFSAR Section 11.5.2.3.1 "Liquid Radwaste Effluent Monitor" describes that detector 0RE-PR001 monitors effluent from either 30,000-gallon release tank. The release tank discharge valves 0WX353 and 0WX896 close on high radiation. These required features are included in this design change that adds radiation monitor 0PR90J.

The process parameters applicable to 0PR01J according to original procurement Spec L-2827 are:

- Fluid = Water
- Pressure Max./Normal = 50 psig/50psig.
- Flow Range = 1- 9 GPM (per vendor drawing 3582200)
- Temp. Max./Normal = 122 °F /80 °F
- Pipe Sch./Size = Sch. 40S/6"
- Pipe Material = ASTM A312/GR TP304
- Tubing Material = ASTM A213/ GR TP304 (per PDT 359BB)
- Seismic Category = II.
- Quality Group = D.

These parameters are applicable to the new monitor 0PR90J.

These design criteria for the new radiation monitor are included in Specification 29487-BRW0166-01. The specification is the basis of the radiation monitor procurement from General Atomics. The original procurement specification for radiation monitors was L-2827. Specification L-2827 requirements that are applicable to liquid monitors were incorporated in the new specification.

The radiation monitor requires a 120VAC single-phase power source and has a nominal load of 5 amps with a maximum load rating of 10 amps surge (200 msec).

UFSAR Section 11.5 and Table 11.5-2 have been revised (DRP 13-052) to address the new monitor.

4.1.6 Surveillance and Acceptance Testing

The required post-modification testing is specified in accordance with procedure T&RM CC-AA-107-1001 with specific testing identified on form CC-AA-107, Attachment 1 contained in Tab 5 of the EC. A Vendor Factory Acceptance Test (FAT) is required and will be defined by the vendor's procedures. The test will be performed at the General Atomics Facility using radioactive sources as defined by Braidwood Station. The FAT is not part of this EC. Completion and acceptance of the FAT is tracked by Milestone 600 that will be signed by the System Manager.

The radiation monitor must be on a periodic surveillance program to the same frequency and criteria as monitor 0PR01J. Predefine activity PMID 00039329 covers 0PR01J. Procedure 0BWIS RETS 2.1-1 is the 92-day frequency digital channel operational test for 0PR01J. Procedure BWIS RETS 2.1.B-201 is the 18-month surveillance calibration for Liquid Effluent Monitors. Similar predefine activities and surveillance procedures are required for the new radiation monitor 0PR90J. Action Tracking Item ATI #01068985-03 is assigned.

4.1.7 Codes, Standards and Regulatory Requirements

The following are applicable to this design change:

- 10CFR20, Standards for Protection Against Radiation
- Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures and Components installed in Light-Water-Cooled Nuclear Power Plants
- Regulatory Guide 8.8, Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low As Is Reasonably Achievable"
- General Design Criteria 60, Control of Releases of Radioactive Materials to the Environment
- ANSI N42.18-2004 Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents
- ANSI B31.1, 1973 Edition with Summer 1975 Addenda Power Piping Code (Field Erected Piping/Tubing)
- ASME B31.1, 2007 Edition Power Piping Code (Liquid Radiation Monitor)
- Specification 29487-BRW0166-01 Rev. D "Liquid Radiation Monitor"

4.1.9 Affected Design Analyses

The following design analyses and evaluations are issued to support this design change. The affected calculations are listed on the ADL.

Calculations are pending approval. HOLD milestone is created and will be signed off when calculations are approved.

Exelon Calculation ATD-0026, Calculation of Combustible Fire Loads is affected but not revised for this EC. This calculation evaluates the impact of the new combustibles in Turbine Building Fire Zones. The added combustibles are cable insulation in trays. Exelon will revise this calculation based on TODI URS-BRW-10-002 from URS.

Piping Calculation 0PRF90 was created to document the piping and tubing in subsystem 0PRF90.

Two Structural Calculations, 9.15.1-BRW-10-0103-S and 9.2.2-BRW-10-0104-S, evaluate the panel assembly attachments on the block wall and the skid weight on the floor slab loading.

4.1.12 Fire Protection and Appendix R Safe Shutdown Requirements

The B/B Fire Protection Report (FPR) lists the Turbine Building Unit 1 Basement Level, fire zone 8.2-1 and Turbine Building Unit 1 Grade Level, fire zone 8.3.1. The FPR is being revised via FDRP 24-038 to account for changes in the combustible loading attributed to this design change. The added combustibles are cable insulation in cable tray. This activity has no affect on any Safe Shutdown equipment.

The changes in combustible loading are documented on the Fire Protection Program Design Change Impact Evaluation (CC-AA-209, attachment 1) included in Tab 7.

4.1.13 Material Requirements / Material Suitability Requirements

All material and components for the radiation monitor skid are fabricated and furnished by General Atomics to the material requirements of Specification 29487-BRW0166-01.

Valve and piping/tubing material requirements from the applicable PDT are listed on the ECML, CC-AA-103 Att. H, of this EC.

Cables and other critical engineered materials that are not part of the skid are listed on the ECML, CC-AA-103 Att. H in this EC.

4.1.14 Environmental Conditions or Impacts

This design change was reviewed for possible environmental impacts in accordance with EN-AA-103, "Environmental Review". A review of EN-AA-103, Attachment 1, Environmental Review Checklist results in at least one "Yes" answer. Tanks that contain a chemical or fuel (Item 15) are affected since the release tanks 0WX01T and 0WX26T may contain tritiated water. Therefore, a review by Environmental personnel is applicable to this design change. The checklist is included in TAB 8.

The radiation monitors are located at elevation 401'-0" in the Turbine Building. The normal environmental design conditions at this elevation during normal plant operating conditions are as follows: (from B/B UFSAR Table 3.11-2)

- Specifically for 0PR01J and 0PR90J, in the Turbine Building Environment: temperature maximum of 104°F; relative humidity range 70% to 8%; Pressure 0.0" water gage; Radiation maximum integrated exposure 350 rads over 40 years.
- These criteria are bounded by the technical requirements listed in original Procurement Specification L-2827 which was used to define the procurement requirements for the new monitor.

4.1.16 OPEX Review – Operating Experience

The OPEX database was searched using the following keywords: "radiation monitor" and "General Atomics" and "RM-80". While many operating experience reports on radiation monitors were identified in the INPO database, none were in the category of skid design failures.

General Atomics issued a Part 21 notice in 2009 regarding RM-80 firmware anomaly. It was applicable for safety-related applications and annunciator output applications. Firmware had to be replaced. Braidwood AR 992115 documents the evaluation for this issue. Monitor 0PR01J was identified as potentially affected and a testing procedure was done. This condition potentially applies to the new monitor since it has similar outputs as 0PR01J. Testing will verify that the firmware anomaly does not impact the new radiation monitor.

4.1.17 EPIX Data Base Affected

New radiation monitor 0PR90J has the same functionality as monitor 0PR01J. The EPIX data base will be reviewed for radiation monitor applicability and updated as appropriate. ATI #01068985-05 is assigned for tracking.

4.1.19 System Operational Requirements Changes

This design change affects the system operational requirements for release tank recirculation and discharges. The addition of radiation monitor 0PR90J and the relocation of the sample monitoring point for 0PR01J provide system configuration options for the Operating and Chemistry Departments that previously have not existed.

Upon completion of this EC, operations and chemistry will be able to independently monitor the two Liquid Release Tanks while isolated from the discharge path.

When tank 0WX01T is being monitored on recirculation, its discharge isolation valve 0WX889 will be closed. During the recirculation, if high radiation is detected, an alarm notifies Operations. If a release is in progress from opposite tank 0WX26T, the release will not be interrupted since 0WX889 is closed.

Similarly, when tank 0WX26T is being monitored on recirculation, its discharge isolation valve 0WX890 will be closed. During the recirculation, if high radiation is detected, an alarm notifies Operations. If a release is in progress from opposite tank 0WX01T, the release will not be interrupted since 0WX890 is closed.

Only one of the two release pump discharge valves 0WX889 or 0WX890 will be open at any one time by procedural control and interlock design.

The logic for the revised interlocks for release valves 0WX353 and 0WX896 is displayed in logic tables on the schematic diagrams 20E-0-4030WX040 and 20E-0-4030WX179.

During a tank release evolution, if a high radiation condition occurs for the tank being discharged, interlocks will cause the release to be terminated by closure of valves 0WX353 and 0WX896.

Numerous annunciator response procedures and operating procedures must be revised to address that tanks 0WX01T and 0WX26T are monitored separately and to include 0PR90J in the various radiation monitor lineup and sorting list procedures.

4.1.20 Human Factors Requirements

The new radiation monitor 0PR90J will alarm at Radwaste Control Room 0PL01J at a common window with 0PR01J. The window engraving "Release Tank Disch Header Radiation High" is not changed by this EC. The annunciator response procedure BwAR 0PL01J-7-A9 is listed on the ADL and Operating Dept CC-AA-102 Att. 9 for revision to address the new monitor.

The system mimic layout on panel 0PL01J is updated for the revised sample position of 0PR01J and the new 0PR90J.

The new radiation monitor will alarm in the Main Control Room RM-11 computer. The graphic displays must be revised as part of this EC to include the configuration of the new monitor. The vendor is providing software revision services. A Work Order Task is tracking this activity.

4.1.21 Procedure Changes

Operating, Instrument Maintenance, Rad Protection, System Engineering, and Chemistry Department procedures are affected. The procedures are listed on the ADL and on form CC-AA-102, Attachment 9 for each department.

A new calibration TRP (0R-PR090) has been drafted for the new radiation monitor 0PR90J and is included in Tab 8 of this EC. The TRP is based on functional similarity to radiation monitor 0PR01J. As vendor documentation becomes available, the TRP may need to be revised. This is tracked by AT 01068985-06.

4.1.22 Training Requirement Changes

Training Requirements are documented on CC-AA-102, Attachment 9 and Attachment 10E.

4.1.23 System Interface Requirements

The radiation monitor has interfaces with the Demineralized Water System, Liquid Radwaste System, Aux Power System, and the Process Monitoring RM-11 Computer.

The Plant Process Computer (PPC) is not a direct interfacing system; however, the PPC is also affected since the RM-11 data points are inputs to the PPC. With the addition of a new monitor, the PPC requires programming of a new data point.

The following sections 4.1.33, 4.1.35, and 4.1.36 discuss those interfaces in detail.

The Braidwood Simulator is affected and requires program changes to include the new radiation monitor. This is tracked by a Training Work Order listed on Attachment 10E.

4.1.24 Layout

The new radiation monitor location is adjacent to Release Tank 0WX26T in a corner of the tank block wall room Unit 1 Turbine Building El. 401'. The vendor was challenged to provide a skid that does not require rear access due to limited access space in the location. Vendor responded with a more compact skid with front access panels and remote panels that met the space requirements. The design incorporates a remote mounted RM-80 microprocessor and front access junction boxes which allows the skid to be mounted directly against the wall. The detector module is oriented such that it is removable in the north direction where the largest open space exists for maintenance and calibration activities.

4.1.25 RP/ALARA Concerns

The work associated with this engineering change will be performed in a radiologically controlled (RCA) low radiation area in the Turbine Building at floor elevation 401'-0". The release tanks and skids are located inside the hollow block shield wall north of Unit 1 18-line. An ALARA Applicability review was performed using CC-AA-102, Attachment 5. It determined that ALARA considerations should apply to the design and installation. ALARA Design and Installation Reviews have been completed using CC-AA-212-1001, Att. 1 and Att. 2 and are included in Tab 8.

4.1.26 Need for Walkdowns

Designer's Walkdowns were performed at various points during the conceptual and design phases. Form CC-AA-106-1001 Attachment 2 is included in Tab 8.

An Installer's Walkdown shall be performed prior to start of work activities to confirm spare circuit breaker position, spare limit switch contacts, and spare conductors in boxes that were not accessible during Designer's Walkdowns. A Work Order has been created.

4.1.29 Effect on Emergency Plan or Environmental and Discharge Monitoring

This EC introduces no changes to the approved effluent discharge limits and discharge release administrative controls. The addition of the new monitor does not introduce a new or different release path. This EC provides a configuration that separately monitors both of the release tanks upstream of the discharge point into Circulating Water Blowdown.

A revision to the procedure CY-BR-170-301 "Offsite Dose Calculation Manual (ODCM)" is required to include the new monitor 0PR90J in the sections that address monitoring of liquid effluent. The procedure is included in the affected procedure list form CC-AA-102, Attachment 9 for the Chemistry Department.

4.1.30 Industrial Safety Requirements

The radiation monitor skid power feed junction box is grounded in accordance with Nuclear-Electrical Installation Standard N-C-0003 and design drawing 20E-0-3391A.

4.1.33 Mechanical System Characteristics

The new radiation monitor will require new sample lines from release pump (0WX53P) to the inlet of the monitor (0PR90J) and from the radiation monitor outlet to release tank (0WX26T). The new line will be routed between the tanks and along the south wall on 18 and will utilize existing pipe supports shown on M-6005 sheet 1 and new pipe supports shown on sketch PG-2617T-1 drawing detail 1. The new line and associated valves will be of stainless steel construction as specified in PDT 140BB. Remote operated valve 0WX848 will be locked closed as the flow path from the existing monitor (0PR01J) to release tank 0WX26T will no longer be used as the monitoring for tank 0WX26T will be performed by the new radiation monitor, 0PR90J. Piping, tubing, and valves will be installed as depicted on drawings M-48 sheet 1, M-836 sheet 3, and PG-2617T-1.

The sample point for monitor 0PR01J will be relocated upstream of isolation valve 0WX889 as a tapped connection. Relocation upstream of the isolation valve will allow for the individual monitoring of tank 0WX01T at release tank pump 0WX01P. Preliminary design included re-designing a sample probe in a new location. The vendor General Atomics recommended that a sample probe is not required to achieve the necessary process flow; see General Atomics letter AEE:647:001:10 dated March 17, 2010, in EC Tab 8. Therefore, the existing sample probe 0RX-PR001 will be cutoff, capped, abandoned in place and placed on inactive status.

Line 0WX564B-3/4" will tap off of line 0WX454A-6" just upstream of valve 0WX890. New installed piping and tubing will become part of the PR system as it enters the monitor (0PR15B-3/4"), bypasses the monitor (0PR66B-3/4", 0PR74A-3/4"), and exits the monitor (0PR16B-3/4")

Lines will be added for the new radiation monitor for demineralized water flushing (0WMV2B-3/4") and draining (0TEQ2B-1/2"). The monitor will require approximately 3 gpm for system flushing (vendor drawing 03582200 sheet 1).

P&ID M-48 Sheet 1 is being updated to reflect the locked close position of cross tie valve 0WX894 and the locked close position of return valve 0WX848.

P&ID M-48 Sheet 1 is revised with a Record Change to reflect that valve 0WX890 is normally closed and normally de-energized. It has the same configuration as 0WX889.

4.1.35 Electrical Requirements

The skid information cited below is based on preliminary radiation monitor outline diagrams and wiring interconnection diagrams from the vendor, General Atomics. A detailed schematic diagram incorporating the skid and RM-80 internal connection details has not yet been provided by the vendor. Drawing 20E-0-4030PR25 has been reserved as the schematic diagram for 0PR90J. A revision to this EC may be required to incorporate the final drawings. This is tracked by AT 01068985-08.

Revision 002 incorporates the vendor drawings as revised during the Factory Acceptance Test. Reserved Schematic Drawing 20E-0-4030PR25 will not be issued and was removed from the EC in Revision 001. Vendor drawings 03582230 Shts. 1 & 2, 04600231 Sht. 1, and 03582231 Sht. 1 provide the radiation monitor internal wiring connections in lieu of a schematic drawing. Drawing 03582231 Sht. 1 was issued in Revision 001 and has not been changed since Revision 001.

According to vendor drawing 03582200 Sheet 1, the skid has power requirements of single-phase 120 VAC +/- 10%, 5 amp nominal, 10 amp peak surge (200 msec). The skid does not require a pump to achieve sample flow. The skid power demand rating of 5 amp nominal is a load of 600 VA.

The power feed is from the 120/208 VAC distribution panel at MCC 134Y2. This distribution panel is powered from a 22.5KVA, 480-120/208V three-phase distribution transformer. The distribution panel loads shown on MCC Key Diagram 20E-1-4008CL and MCC wiring diagram 20E-1-4796C were evaluated to verify that the transformer has adequate capacity for the load additions. The total connected load on the transformer is less than 18 KVA. If load factors and a panel diversity factor were considered, the actual loading would be less. Thus, there is adequate capacity to feed the new radiation monitor.

The feed cable to the rad monitor skid is #10 AWG which is adequate for the skid load of 5 amps (NEC Table 310.16). The feed cable is protected by a 20 amp circuit breaker as shown on MCC Key Diagram 20E-1-4008CL and MCC wiring diagram 20E-1-4796C.

A Division 12 power source is selected to power the new monitor to be consistent with the power feed to release tank pump 0WX53P and discharge valve 0WX890. (Division 12). The new monitor is associated with pump 0WX53P which is in the flow path of release tank 0WX26T.

The skid is grounded in accordance with N-EIS standard No. N-C-0003 and drawing 20E-0-3391A, utilizing rigid steel conduit bonded to cable tray for a power circuit rated less than 600 amps.

One new cable is routed in control cable trays. SLICE Cable data program evaluated the cable routing and tray loading. No adverse loading conditions were identified by the cable addition.

4.1.36 Instrument and Control Requirements

The skid information cited below is based on preliminary radiation monitor outline diagrams and wiring interconnection diagrams from the vendor, General Atomics. A detailed schematic diagram incorporating the skid and RM-80 internal connection details has not yet been provided by the vendor. Drawing 20E-0-4030PR25 has been reserved as the schematic diagram for 0PR90J. A revision to this EC may be required to incorporate the final drawings. This is tracked by AT 01068985-08.

Revision 002 incorporates the vendor drawings as revised during the Factory Acceptance Test. Reserved Schematic Drawing 20E-0-4030PR25 will not be issued and was removed from the EC in Revision 001. Vendor drawings 03582230 Shts. 1 & 2, 04600231 Sht. 1, and 03582231 Sht. 1 provide the radiation monitor internal wiring connections in lieu of a schematic drawing. Drawing 03582231 Sht. 1 was issued in Revision 001 and has not been changed since Revision 001.

RM-11/RM-80

All plant radiation monitors interconnect into the RM-11 network. 0PR90J is integrated into RM-11 communication Loop 3 and is assigned loop position 3-16. Communication Loop 3 is shown on drawing 20E-0-4705C. It will be electrically positioned between monitors 0PR01J and 2PR27J by revising the existing signal cables between those two monitors and installing new signal cables from 0PR90J to interconnect into the loop. All other monitors in Loop 3 downstream of 0PR90J (existing positions 3-16 through 3-21) will have their loop positions on drawings increased by one (new positions 3-17 through 3-22).

The RM-11 provides the Main Control Room alarm and indications for all plant monitors. Software changes in the RM-11 computer are required. The software must be revised to display the new monitor at operator's consoles and to develop the check and response commands that communicate with the new monitor. Vendor's support to edit the RM-11 "Online Database Builder" is required. 0PR90J is the twenty-second (22nd) monitor in communication loop 3. It will be programmed in the RM-11 as octal address 26, displayed in Grid-1 screens. The octal addresses of other loop 3 monitors will be unchanged; however, the loop positions for "downstream" monitors as shown on drawings are revised to maintain sequential numbering.

The radiation monitor incorporates an RM-80 microprocessor for data acquisition and control, local indication, and develops 4-20 milliamp (ma) analog outputs for the external communication transmit and receive loop that interfaces with the station's RM-11 network. RM-80 includes history filing, continuous self-test, and online diagnostic capability. The alarm and interlock outputs are developed in the RM-80. Setpoints and calibrations are programmed through the RM-80. The RM-80 cabinet for 0PR90J is remotely mounted near the monitor to allow a smaller skid footprint. The skid configuration is shown on General Atomics vendor drawings 03582200 Sheets 1 through 4, and 03582210 Sheets 1 and 2.

The skid includes an RM-23L local Control/Display module for local operator interface, digital display, status indication, and purge and checksource control.

The skid incorporates a flowmeter switch for visual indication of sample flow and for monitoring data in the RM-80.

Valve Control Circuits

The control circuits of Release Tank Discharge Header valves 0WX353 and 0WX896 and Release Pump Discharge valves 0WX889 and 0WX890 are revised to add style AR440AR auxiliary relays. The continuous load rating for the AR440AR relay is 28 VA. The control circuits are each fused at 3 amps. The revised control circuit fuse loading was reviewed using standard E-I&C 10.01. The revised loadings on the fuses are acceptable.

Close limit switch contacts from release pump discharge valves 0WX889 and 0WX890 provide auxiliary relay interlocks in the control circuit logic of release valves 0WX353 and 0WX896. The interlocks are combined with the two radiation monitor high radiation interlocks to develop control circuit logic as described in Section 4.1.19 above.

Close limit switch contacts from release pump discharge valves 0WX889 and 0WX890 provide auxiliary relay permissive interlocks in the opening control circuit of the opposite valve. This is to assure that only one of the valves can be opened at any one time.

Reset pushbutton 0HS-WX648 at 0PL01J is modified with an added contact block to allow reset of the control circuit after a high radiation condition at 0PR90J has been resolved. Existing contacts on the reset pushbutton provide the same reset functions for 0PR01J high radiation condition and for a blowdown low flow condition.

Cyber Security/ Digital Asset

The radiation monitor 0PR90J will be added to the Exelon Critical Digital Asset (CDA) Database "Not in Scope - BRW" group according to CC-AA-215. This is tracked by AT 01068985-02. The new radiation monitor provides a release tank monitoring and control function in the Liquid Radwaste System. It is interconnected into the RM-11 computer network and alarms in the Main Control Room. The RM-11 is only accessible from the Main Control Room which is a Vital area. The new component has a control function to interlock isolation valves in the release discharge path if the monitor has a high radiation condition. The radiation monitor skid is located inside a locked cubicle. Any changes to the skid programming requires authorized personnel access. Therefore, the radiation monitor was determined not to be a CDA. The subject component is non-safety related, non-critical, not Nuclear Significant, and does not affect Continuity of Power. No further cyber security evaluation is required.

The radiation monitor utilizes an RM-80 microprocessor. The software is Version - LIQ169.04. A DTSQA review is required to categorize and register the software. Vendor documentation is required to confirm the software ID. This is tracked by AT 01068985-07.

PPC

The Plant Process Computer (PPC) is also affected since the RM-11 data points are inputs to the PPC. The new PPC point for 0PR90J is labeled RM-11 Monitor point 22, corresponding to octal address 26. The following table shows the Current Mapping and New Mapping for PPC points, as provided and controlled by the Exelon Corporate IT Department.

For reference, RM-11 Point 0PS101 below corresponds to monitor 0PR01J.

Current Mapping

PPC point	RM-11 Point	RM-11 loop	RM-11 Monitor	RM-11 Chan	PPC offset	PPC description
RP0001	0PS101	3	15	1	609	LIQUID RADWASTE EFF
RP0200	0PS101	3	15	1	1433	LIQUID RADWASTE EFF 00-09
RP0201	0PS101	3	15	1	1435	LIQUID RADWASTE EFF 10-19
RP0202	0PS101	3	15	1	1437	LIQUID RADWASTE EFF 20-29
RP0203	0PS101	3	15	1	1439	LIQUID RADWASTE EFF 30-39
RP0204	0PS101	3	15	1	1441	LIQUID RADWASTE EFF 40-49
RP0205	0PS101	3	15	1	1443	LIQUID RADWASTE EFF 50-59
RP0132	2PS127	3	16	1	617	SJAE/GLAND STM EXH - GAS 2
RP0007	0PS106	3	17	1	625	RAD EVAP 0A CONDENSATE RETURN
RP0008	0PS107	3	18	1	633	RAD EVAP 0B CONDENSATE RETURN
RP0009	0PS108	3	19	1	641	RAD EVAP 0C CONDENSATE RETURN
RP0106	2PS102	3	20	1	649	RCFC 2A/2C SX OUTLET
RP0107	2PS103	3	21	1	657	RCFC 2B/2D SX OUTLET

New Mapping- *Italicized (Yellow)* highlighting below indicates required change elements in the PPC.

PPC point	RM-11 Point	RM-11 loop	RM-11 Monitor See Note	RM-11 Chan	PPC offset	PPC description
RP0001	0PS101	3	15	1	609	*LIQUID RADWASTE EFF TANK 0WX01T*
RP0200	0PS101	3	15	1	1433	LIQUID RADWASTE EFF 00-09
RP0201	0PS101	3	15	1	1435	LIQUID RADWASTE EFF 10-19
RP0202	0PS101	3	15	1	1437	LIQUID RADWASTE EFF 20-29
RP0203	0PS101	3	15	1	1439	LIQUID RADWASTE EFF 30-39
RP0204	0PS101	3	15	1	1441	LIQUID RADWASTE EFF 40-49
RP0205	0PS101	3	15	1	1443	LIQUID RADWASTE EFF 50-59
RP0132	2PS127	3	17	1	617	SJAE/GLAND STM EXH - GAS 2
RP0007	0PS106	3	18	1	625	RAD EVAP 0A CONDENSATE RETURN
RP0008	0PS107	3	19	1	633	RAD EVAP 0B CONDENSATE RETURN
RP0009	0PS108	3	20	1	641	RAD EVAP 0C CONDENSATE RETURN
RP0106	2PS102	3	21	1	649	RCFC 2A/2C SX OUTLET
RP0107	2PS103	3	22	1	657	RCFC 2B/2D SX OUTLET
RP0141	****0PS190*	*3*	*16*	*1*	*665*	*LIQUID RADWASTE EFF TANK 0WX26T*

Note: RM-11 Monitor Column is the physical position on the print (20E-0-4705C)

*** Proposed Point ID is consistent with ID mapping of existing radiation monitors. The RM-11 Points are display codes in Annunciator Response Procedures (e.g. BwAR RM-11 Grid-1)

Computer Database Change Request Form IT-AA-101-1502-F-01 has been reviewed and approved by IT and is included in EC Tab 8.

In order for the revised points to display in the HMI and graphics system, the PPC will require a restart that must coincide with the startup of the new monitor. A restart will need to occur on PPC's in both Unit 1 and Unit 2. These will be accomplished by a Work Order task assigned to IT.

4.1.38 Civil/Structural Requirements

The configuration is a Seismic Category II SSC in the Turbine Building. The installation does not require seismic qualification or mounting.

This EC also affects liquid radwaste control panel 0PL01J in the Radwaste Control Room in the Aux Building El. 383'. The panel is classified as Seismic Category II. The EC includes the addition of three auxiliary relays to the panel. By engineering judgment, the weight of the added relays has negligible impact on the structural integrity of the panel.

Calculation 9.2.2-BRW-10-0104-S documents the mounting of the Radiation Monitor skid to the Unit 1 Turbine Building (ref: EL 401'0") reinforced concrete slab. The skid has an approximate weight of 3300 lbs, which is mounted to the floor with anchors and a PL ½" x 2'4-1/2" x 2'4-1/2".

Calculation 9.15.1-BRW-10-0103-S documents the mounting of the Control Panel assembly to the existing masonry block wall. The control panel assembly weighs approximately 250 pounds and is mounted to the hollow masonry block wall adjacent to the Release Tanks in the Unit 1 Turbine Building El. 401' (ref: Col: 18). The control panel assembly consists of two panels and is approximately 42" x 31" overall dimension. It is mounted with 6 thru-wall threaded rods, washers, hex nuts, and a ¼" backing plate on the exterior of the block wall in accordance with drawing 20E-1-3432D01.

4.1.40 Personnel Requirements and Limitations

The vendor General Atomics will provide technical personnel for radiation monitor checkout and startup support at the plant.

4.1.42 Interfacing Departments

This modification will require reviews by several departments at Braidwood Station. The reviews are documented on the CC-AA-102, Attachment 10 forms in PASSPORT.

4.1.44 Conformance to NEIL Requirements

The NEIL Loss Control Standards were reviewed for requirements specific to installing new radiation monitoring components. None were identified.

4.1.45 Single Point Vulnerability (SPV) identified in the Configuration Change

A single point vulnerability (SPV) review has been performed for the configuration change. The purpose of the review was to identify all events that can result in unplanned Reactor Scrams in a proactive manner, with the intent of taking action to prevent such events.

A review has been performed to identify any latent failures in redundant, non-safety related trip circuits that have the potential to cause a reactor scram. None of the systems or system components modified by this EC has the potential to cause a reactor scram. The control circuits for the radiation monitor and associated release isolation valves do not trip nor are interlocked with any SSCs that can cause a reactor scram. Therefore, there are no latent failures in the modified circuits.

50.59 Screening Questions (Check correct response and provide separate written response providing the basis for the answer to each question) (See Section 5 of the Resource Manual (RM) for additional guidance):

1. Does the proposed Activity involve a change to an SSC that adversely affects an UFSAR described design function? (See Section 5.2.2.1 of the RM)

☐ Yes ☒ No

The proposed activity affects the Process and Effluent Radiation Monitoring and Sampling System. It also affects the Non-1E Aux Power (AP), Liquid Radwaste (WX), and Demineralized Water (WM) Systems. The proposed activity does not adversely affect the functions of these systems, as discussed below.

The proposed activity provides for a revised process monitoring capability in the Liquid Effluent Release path from Release Tanks 0WX01T and 0WX26T. The change provides plant operating flexibility for planning and executing the release of liquid effluents.

The Release Tanks 0WX01T and 0WX26T are the point of release to be discharged to the Kankakee River. After being monitored for radioactive contamination, the release tanks are individually discharged through a common header into the station blowdown line that discharges to the Kankakee River. Existing Radiation Monitor 0PR01J monitors the common header and upon detection of radioactivity will automatically isolate the discharge flow by closing the release tank discharge isolation valves 0WX353 and 0WX896. Only one tank is aligned for a discharge at any one time. A second monitor and revised valve control interlocks will provide operating flexibility for release tank discharges.

This activity installs a new liquid radwaste effluent radiation monitor 0PR90J that will monitor only the liquid release tank 0WX26T discharge path. The monitored process point is upstream of the common discharge header. The new monitor isolates tank 0WX26T, if being discharged to the blowdown discharge line, if high radiation is detected in its flowpath. If the tank is only on recirculation while it is isolated from the blowdown discharge line, detection of a high radiation condition will not interrupt an in-progress release from the opposite tank.

This activity also relocates the monitoring point of existing liquid radwaste effluent radiation monitor 0PR01J from the common discharge path of release tanks 0WX01T and 0WX26T to monitor only the discharge from tank 0WX01T. The high radiation interlock of 0PR01J continues to interlock the discharge isolation valves 0WX353 and 0WX896 and will isolate a discharge to blowdown if high radiation is detected in the flowpath. If the tank is only on recirculation while it is isolated from the blowdown discharge line, detection of a high radiation condition will not interrupt an in-progress release to blowdown from the opposite tank.

The sample location for 0PR01J is changed. Relocation of the existing sample probe for 0PR01J (0RX-PR001) was considered. The vendor General Atomics evaluated and determined that a sample probe is not required to achieve the necessary process flow. Therefore, the existing sample probe 0RX-PR001 will be cutoff, capped, abandoned in place and placed on inactive status.

The new monitor 0PR90J is furnished with an RM-80 microprocessor which is integrated into the RM-11 communication loop to provide measurement data to the Control Room operators. There is no change to the communication from 0PR01J's RM-80 to the RM-11.

The control circuits for valves 0WX353, 0WX896, 0WX889, and 0WX890 are revised in the Liquid Radwaste Control Panel 0PL01J to interlock with the new radiation monitor. Valves 0WX353 and 0WX896 are automatic isolation valves in the blowdown path. Their revised control circuits have new close interlocks from valves 0WX889 and 0WX890, the individual tank discharge pump isolation valves, to differentiate if a tank is on recirculation or is being released. If a tank is on recirculation it is isolated from the discharge header and is monitored by its respective radiation monitor. Valves 0WX889 and 0WX890 interlock each other such that only one can be open at a time. Detection of radiation during isolated recirculation results in alarms to the control room RM-11 computer and annunciation at 0PL01J, but does not auto-close the release isolation valves 0WX353 and 0WX896. This allows the opposite tank to continue its monitored discharge. Radiation detection by either monitor during discharge of its respective tank will auto-close the release discharge valves.

These liquid radwaste effluent radiation monitors are part of the Process and Effluent Radiation Monitoring and Sampling System as described in UFSAR Sections 11.5 and 7.7.1.19. The system function is to provide measurement, indication, and/or control of radioactivity in those streams which could conceivably be contaminated by radioactive substances. The system provides operating personnel with radiological measurements within the plant process systems. The objective of the effluent monitoring system is to sample and monitor each discharge path prior to discharge. UFSAR Table 11.5-2 describes that skid 0PR01J has automatic interlocks per Section 11.5.2.3.1 for Liquid Radwaste Effluent Monitors. The interlocks require that the release tank discharge valves 0WX353 and 0WX896 close on high radiation. The addition of new monitor 0PR90J accomplishes the measurement and interlock functions. The revision to 0PR01J interlocks continues to accomplish these functions. 0PR90J is added to the UFSAR as tracked by DRP13-052.

New monitor 0PR90J is furnished by the original supplier of Braidwood's process monitors, General Atomics, to the same technical criteria as monitor 0PR01J. The new monitor will have equivalent performance and measurement parameters as 0PR01J. Thus, it will provide the process monitoring function no differently than 0PR01J.

The capability to monitor liquid effluent discharges from the Liquid Radwaste system release tanks and to isolate radioactive effluents is not changed by this EC activity.

New piping and conduit are designed and installed appropriately in accordance with original Design Criteria for a non-Safety Related application in a non-seismic (Category II) structure.

The new monitor skid is a new load on the Non-1E Aux Power system from the 120/208VAC distribution panel at MCC 134Y2. The load addition is within the rating capability of the MCC distribution panel and does not adversely affect the function of the Non-1E Aux Power system to distribute power to non-safety related loads.

The new monitor skid requires a supply of demineralized water for manual flushing of the skid. The change does not adversely affect the function of the system to supply water for the waste disposal system.

The proposed activity adds combustible material in the form of cable insulation in Turbine Building Fire Zones. The amount of added combustible is small and does not adversely impact the fire protection features for the affected zones. There is no adverse affect on Safe Shutdown systems.

The activity does not affect any design basis limit for fission product barrier because no SSCs are modified that pertain to fuel cladding, the reactor coolant system pressure boundary, or primary containment.

Based on the above, the proposed activity does not involve a change to any SSC that adversely affects a UFSAR described design function, and does not involve a change to any design basis limit for a fission product barrier.

2. Does the proposed Activity involve a change to a procedure that adversely affects how UFSAR described SSC design functions are performed or controlled? (See Section 5.2.2.2 of the RM)

☐ Yes ☒ No

The proposed activity introduces a new liquid effluent radiation monitor which affects Operating, Chemistry, and Maintenance procedures. Operating interface with the control room RM-11 computer network is affected and PR skid lineup procedures are affected. Chemistry Department release control procedures will be affected such that the release tanks are separately monitored. Also, the ODCM is affected to incorporate the new monitor. New Maintenance calibration procedures must be developed unique to the new skid. The procedures are revised to incorporate the new monitor to the same controls and criteria as the existing monitor 0PR01J. The affected procedures are implied in the UFSAR as controls for releases to the environment. The affected procedures will continue to implement the Liquid Radwaste Effluent monitoring functions as described in the UFSAR. Therefore, the proposed activity does not adversely affect how any UFSAR described SSC design functions are performed or controlled.

3. Does the proposed Activity involve an adverse change to an elements of a UFSAR described evaluation methodology, or use of an alternative evaluation methodology, that is used in establishing the design bases or used in the safety analyses? (See Section 5.2.2.3 of the RM).

☐ Yes ☒ No

With the addition of another radiation monitor, the methodology for tank sampling, tank content analysis, or calculation of volume is not changed. The methodology of analysis of the monitor's loading impact on the Turbine Building Structure is not changed.

No calculations, analysis, or other evaluation methodology explicitly or implicitly stated in the UFSAR are adversely affected by the proposed activity.

4. Does the proposed Activity involve a test or experiment not described in the UFSAR, where an SSC utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the UFSAR? (See Section 5.2.2.4 of the RM)

☐ Yes ☒ No

The proposed activity adds a radiation monitor into the Liquid Radwaste system that provides operating flexibility for releasing effluent. The release paths are unchanged by this activity. Tank effluent testing is unchanged.

The required testing associated with this change is post-modification testing of valve interlocks and monitor communication with the RM-11 system in the control room.

Testing/calibration of the new monitor will be to the equivalent criteria as for existing liquid effluent radiation monitors. Post-modification testing of revised valve control circuits and interlocks is performed to prove that high radiation detected in an unisolated release path will auto-close release valves 0WX353 and 0WX896, which is UFSAR criteria. Thus, the proposed activity does not involve a test or experiment not described in the UFSAR, and it does not utilize an SSC outside the reference bounds of the plant design.

5. Does the proposed Activity require a change to the Technical Specifications or Facility Operating License? (See Section 5.2.2.5 of the RM)

☐ Yes ☒ No

This activity adds a new radiation monitor for liquid effluent monitoring as controlled by the ODCM. Tech Spec Section 5.5.1 that describes the Offsite Dose Calculation Manual (ODCM) program is unchanged. Tech Spec Section 5.5.4 that describes the Radioactive Effluent Controls Program is unchanged. This activity does not affect the contents of any release tank and thus does not affect the NPDES Permit. Thus, this activity does not require a change to the Technical Specifications or Operating License.

II. List the documents (e.g., UFSAR, Technical Specifications, other licensing basis, technical, commitments, etc.) reviewed, including sections numbers where relevant information was found (if not identified in the response to each question).

UFSAR Sections

7.7.1.17	Process Radiation Monitoring Instruments and Control
7.7.1.19	Liquid Radwaste System Instruments and Controls
8.3.1.1.1	Auxiliary Power System Non-1E Distribution
9.2.3	Demineralized Water Makeup System
11.5	PROCESS AND EFFLUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS
11.5.2.3.1	Liquid Radwaste Effluent Monitor
Table 3.2-1	Safety Category and Quality Group Classification for Structures and Components
Table 11.5-2	Process Liquid Monitors

Technical Specifications & Bases

Offsite Dose Calculation Manual (ODCM)
NPDES Permit

Technical Requirements Manual (BRW-TRM) Latest Revision in EDMS

3.3.p	Radiation Monitoring Instrumentation
Appendix A	ODCM and Radiological Controls Reports and Program
Appendix D	Radioactive Effluent Controls Program

UFSAR Change Log - Effective UFSAR Changes

Reviewed, not affected. This activity will require a change to the UFSAR Table 11.5-2 and Section 11.5.2.3.1 DRP 13-052 tracks the update.

III. Select the appropriate conditions:

☒ **If** all questions are answered NO, **then** a 50.59 Evaluation is not required.

☐ **If** question 1, 2, 3, or 4 is answered YES for any portion of an Activity and question 5 is answered NO, **then** a 50.59 Evaluation shall be performed for the affected portion of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and questions 1 through 4 are answered NO for the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment; however, a 50.59 Evaluation is **not** required for the remaining portions of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and question 1, 2, 3, or 4 is answered YES for any of the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment **and** a 50.59 Evaluation is required for the remaining affected portions of the Activity.

IV. Screening Signoffs:

The 10CFR50.59 screening has been approved by the Site's Qualified Screening Process on 11/4/10.

ATTACHMENT 4

Supporting Documentation of
Engineering Change 362453

The design attributes addressed in this document are those identified in Attachment 1, "Design Change Attribute Review", of procedure CC-AA-102 and are numbered accordingly.

Background - Blowdown of processed liquid radioactive waste is being re-evaluated to optimize the release process at Braidwood. Recycling processes have been introduced to reduce the volume of processed water to be returned to the river. This reduces the amount of blowdown to the river. Diffusers are being added to the discharge into the river to provide more complete dilution of tritium in the river (EC 375871, EC 375872 and EC 375873). Release to the river through the low-low flow controlled path, via control valve 0WX302, is planned with a blowdown rate of 0.5 gpm to 20 gpm to provide for additional operation flexibility while limiting release flows below procedurally controlled maximum limits. The plant original blowdown system was designed to release and monitor blowdown flows up to 500 gpm based on Release Tank Pump capacity. The current low-low flow release line design, installed under previous revisions of EC 362453, provides a flow rate between 0.5 and 5 gpm. The existing low-low flow regulating equipment must be modified to allow for measurement and control over the new range (0.5 gpm to 20 gpm) of flow rates. In order to control and monitor blowdown at these low-low rates, the current low-low flow blowdown control valve and associated piping will be replaced with a larger (1") valve (including the new actuator) and associated piping. The flow element will be replaced with a larger diameter flow element to allow for more accurate monitoring of the blowdown flow on the 0.5 to 20 gpm range. The existing control components (e.g., flow indicator, recorder, integrator, etc.) will be used with the new valve with the exception that OWX302 control valve limit switches will be replaced. The new valve will have the same operating method and failure position as the existing valve. The indicator, recorder controller, and computer point ranges will be re-scaled for a larger flow range (0 to 30 gpm).

4.1.4.1 Basic System Functions

This equipment forms a control loop that regulates the flow rate of processed primary system letdown after it has been monitored and accepted for release in the WX release tanks (0WX01T and 0WX26T). The flow rate is set manually at the flow controller 0FC-WX001 located in panel 1PA20JB. The flow is measured by 0FE-WX001 and 0FT-WX001 and the difference between the flow and the set point produces a valve position signal. The valve position signal is converted from a current signal to a pressure signal by 0IY-WX001. Currently this signal is connected directly to the valve actuator. Valve 0WX353 provides isolation of flow in this line and automatically closes on high radiation.

4.1.4.2 Configuration Change Safety Classification

The Solid Radwaste Reprocessing and Disposal (WX) System is considered a Safety Category II (Non-Safety Related), Quality Group D system as identified in UFSAR Table 3.2.1. The WX system does not perform any safety related function, is not required for safe shutdown of the plant and is not credited in any accident analysis. Therefore, this EC is classified as Non-Safety Related.

4.1.4.3 Seismic Classification

The WX System is classified as Seismic Category II as identified in UFSAR Table 3.2.1, therefore the associated components will be Seismic Category II components.

4.1.5 Performance Requirements and Design Conditions

Prior to modification EC 362453, Rev. 000, the blowdown release line was designed for a discharge up to 500 gpm. The full flow blowdown valve and flow measuring devices were replaced with a low-low flow control valve and flow measuring devices for a design flow rate of 0.5 to 5 gpm. After implementation of this modification (EC 362453, Rev. 005) the low flow blowdown through the release line will be increased to 0.5 to 20 gpm. The associated instrumentation is being calibrated to read flows in the range of 0 to 30 gpm.

The design conditions are determined by the WX release tank pump head. The design conditions are 75 psig at 120°F.

4.1.6 Surveillance and Acceptance Testing

There are no surveillance tests associated with this non-safety related control valve and associated piping. Form CC-AA-107, Attachment 1 for this EC provides the testing requirements for this modification.

4.1.7 Codes, Standards, and Regulatory Requirements

The codes, standards and regulatory requirements that apply to this work are listed in the Work Planning Instructions (WPI), CC-AA-103, Attachment C for this EC.

The new 50.59 screening BRW-S-2010-43 supersedes Rev. 1 of BRW-S-2007-159 and supplements Rev. 0 of BRW-S-2007-159 performed in the previous revisions

4.1.9 Calculations and Design Analysis

The original 6" WX pipe was analyzed as part of subsystem 1CW14. This analysis was revised to incorporate the piping size changes in EC 362453 Rev. 000. This analysis is being revised as part of EC 362453 Rev. 005. Impacted Design Analysis (031203 Rev. 002B) is identified in the ADL of this EC.

Hydraulic calculation (BRW-10-0030-M) was prepared to document upstream and downstream pressure for flow control valve 0WX302 and the fluid flow velocity in the release path. This calculation is identified in the ADL of this EC. See discussion regarding this analysis in the Revision Summary Notes Topic.

4.1.13 Material Requirements

Equipment and materials associated with this modification are classified as non-safety-related and are included in the ECML for this EC package.

Material requirements are specified in the applicable drawing included in the ADL. The ECML is not a complete list of the required parts. Standard required materials shall be identified, as applicable, during work planning and work package preparation activities.

Material specified for this EC is based on the applicable Piping Design Tables (PDTs) and they are suitable for this application.

4.1.14 Environmental Conditions and Environmental Impacts

This EC has been reviewed in accordance with EN-AA-103 and no environmental condition changes or impacts have been identified. This EC is associated with providing a flow path for releases and does not authorize or control radioactive waste releases.

4.1.15 Environmental Qualification of Equipment

Based on CC-AA-102, Attachment 3, EQ Screening Considerations and Checklist no Environmental qualifications are required.

4.1.16 Operating Experience

Searches of INPO's operating experience and SER/SOER data base was performed in accordance with LS-AA-115 and did not result in anything germane to AOVs used in liquid radwaste systems. The operating experience on AOV's that leaked or failed to operate in critical service were too many to list. However, there was no trend on Fisher Baumann valves globe style valves. Therefore, the results of the industry operating experience review are not applicable to this modification.

4.1.19 Operational Requirement Change

The maximum flow through the alternate low flow release line has changed from 5 gpm to 20 gpm when valve 0WX302 is opened. The scale on the flow controller has been recalibrated to accommodate the increased flow requirement. The flow through the existing low flow line (0WX897) remains unchanged. The releases from the 0WX01T and 0WX26T release tanks are assessed and controlled via procedures BwOP WX-526T1 "Liquid Release Tank 0WX26T Release Form" and BwOP WX-501T1 "Liquid Release Tank 0WX01T Release Form". These procedures limit the maximum effluent discharge rate from the release tanks to 50 gpm. The change in release tank blowdown control valve 0WX302 capacity from 0.5 - >5 gpm to 0.5 - >20 gpm will maintain maximum release rates within established procedural limits. See CC-AA-102 Attachment 9 for procedures that require revisions due to this EC.

4.1.20 Human Factors Requirements

Human interface devices are not replaced or relocated within this change package. The scale of flow indicators, recorders and controllers are revised to maintain the expected flow at the same fraction of full scale as it is prior to the change. Control Room and remote shutdown panels are not affected.

4.1.21 Procedure Changes

Operating procedures requiring revision are listed in CC-AA-102 Attachment 9 and the ADL These procedures define the steps to be taken to release liquids from the Liquid Release Tanks (0WX01T and 0WX26T). The procedures provide release volumes and flow rates that are to be maintained. The flow rates are revised by this EC. This revision of the EC provides for a low flow release path that can control releases at higher flow rates than are currently possible, but does not authorize or control radioactive waste releases, which are controlled in accordance with CY-AA-170-200. The revised ultra low flow releases remains less than the original flow releases (500 gpm) through the same release path.

Operating Procedure BwAR 0PL01J-7-B9, Rev 53 shall be revised to reflect the elimination of the High Flow Path. The recommended set point of the new Ultra Low Flow Path high flow alarm is 22.2 (Ref. 0FSH-WX001).

4.1.22 Additional Training Requirements

Training requirements are identified in CC-AA-102 Attachment 9.

4.1.23 System Interfaces

The alternate low flow liquid release line is part of the WX system. It interfaces with the CW system to provide dilution flow and a path to release fluids to the river. This revision of the EC increases the size of the low flow release line flow control valve (0WX302) to the CW system. The revised flow through the alternate low flow release line is larger than then the current low flow through this release line. It also interfaces with Instrument Air (IA) system. The tubing from the replaced flow element, the air signal to the valve and the instrument air supply to the valve's positioner will be field routed.

4.1.24 Layout and Arrangement Requirements

This revision of the EC replaces the flow control valve, flow element and associated piping with larger components and piping. It also relocates the flow element by approximately 6" south from its current location. The piping and component layout is shown on the physical drawings referenced in the ADL.

4.1.25 Radiation Protection/ALARA

This EC has been screened in accordance with CC-AA-102 Attachment 5. This EC modifies the release line which is a portion of the WX system. Therefore, ALARA is applicable. However, the radiation levels in this line are minimal and the fluid is suitable to release off-site. There is no measurable dose from this line. The flow control equipment is not located in a radiation area. The modification to the minimum flow recirculation line is in the Release Tank Pump Room. The fluid in this line has passed through demineralizers and filters in the WX system and does not contain contamination that could build up as CRUD in the piping.

4.1.26 Walkdowns

A designer's walkdown determined that there is sufficient room in the area to perform the configuration changes required in this revision of the EC.

A walkdown report in accordance with CC-AA-106-1001, Attachment 2 is included in this EC.

4.1.27 Access for Maintenance, Repair, ISI and IST

The flow control valve is covered by the AOV PCM template. There is sufficient room around the flow control valve (0WX302) to connect diagnostic equipment or to disassemble the valve for repair.

4.1.29 Emergency Plan and Environmental Impact

This modification increases the size of the existing control valve and piping used for planned release of processed liquid from the site. The original 4" flow control valve in the 6" size piping (before EC 362453 modification) allowed larger release flow rate (up to 500 gpm) than the revised low flow control valve (current release flow rate up to 5 gpm). This modification will increase the release flow rate to a maximum of 20 gpm. The maximum possible off site release rate is not changed. The liquid is monitored prior to entering the release tank. It is also sampled during the release. This modification does not change any of the monitoring equipment or functions. The discharge rate is under manual control during planned releases. This modification does not affect the offsite release of radiation during postulated accidents. This EC provides for an alternate low flow path and does not control or authorize radioactive waste releases.

4.1.33 Mechanical System Characteristics

EC 362453, Rev. 007 piping is non-ASME and non-safety related, located in Unit 2 Turbine Building. The original piping was computer analyzed in subsystem 1CW14; therefore, the revised piping was also computer analyzed. The design analysis in the ADL for this EC captures the impacted portion of piping in this revision of the EC. This is a moderate energy line in the non-safety related building; no line break analyses are affected. This piping transports water at ambient temperatures and low pressures. There are no significant stress changes to cause fatigue in the pipe. Due to concerns regarding potential transients in the CW blowdown line, this line is analyzed for 1" of displacement at the connection to the CW line for additional conservatism. The pipe in the modified area is also analyzed for acceleration of 0.5 g's in two directions to address potential operational vibratory loads. There are no postulated transients in the WX system. Pipe supports (guides) have been designed to address these potential vibratory loads during operation (Design Analysis 031203, Rev. 002B).

Fouling and corrosion have been considered for this EC. The piping size for this release line is increased in the proximity of the control valve. The flow velocity will remain below 10 fps in these stainless steel lines. Flow Induced Corrosion will not be a concern. The water transported through this line is demineralized water in stainless steel systems. There should be no source of sediment or corrosion products. This EC does not create dead ends that would be susceptible to Micro Induced Corrosion. The lines are stainless steel and are not susceptible to corrosion by demineralized water. The control valve was specified and reviewed to ensure that valve cavitation would not be present to cause pipe erosion. CC-AA-107, Attachment 1 requires an assessment of potential cavitations during testing.

0RX-PR001 Liquid Radwaste Probe supplies Liquid Radwaste Effluent Radiation Monitor/Detector 0RE-PR001. Review of the current PASSPORT Equipment Data for 0RX-PR001 indicates that Parameter "Process Flow Max" provides a range of a max flow of 600 GPM and a min flow of 130 GPM. The minimum flow of 130 GPM will not be met when the flow path provided by this EC is used. Note that Operating procedures BwOP WX-501T1, Rev. 57, and BwOP WX-526T1, Rev. 58 have limited the release flow rate to 50 gpm. IR 1043521 has addressed this condition and concluded that the 0RX-PR001 130 gpm flow rate limitation is deemed unnecessary. Probe 0RX-PR001 is located less than 50 ft away from the discharge of release pumps 0WX01P and 0WX53P. Therefore adequate mixing is generated by the pump impellers and the use of the probe to ensure that the sample to the PR skid is representative based on flow rate requirements is deemed unnecessary. The General Atomic Letter included in the Technical Eval Topic of the EC evaluates mixing based on turbulent flow criteria to address potential flow requirements and need for a sampling probe for the new Radiation Monitor skid that is being installed in accordance with EC 378192. Since turbulent flow conditions are an indication of sufficient flow mixing, the basis for the ability of the radiation monitor skid to receive a representative sample is the fact that the probe is in the proximity and downstream of the release pumps.

It should be noted that a sample probe is not relied upon to provide sufficient flow through the Liquid Radwaste Effluent Radiation Monitor/Detector 0RE-PR001. The system is designed to use pump discharge pressure and the flow control valve to develop a driving head through the rad monitor. Lower release flow will increase this driving head and therefore low sample flows are not anticipated due to low release flow. If low sample flow were to occur (less than 1 gpm in flow indicator 0FIS-PR173, Ref. Test Report Package 0R-PR001) the low flow condition will be detected/alarmed.

The EPN record for 0RX-PR001 will be revised to provide this explanation regarding flow requirements in the "Process Flow Max" parameter notes.

Previous revisions to this EC sized the recirculation line and restricting orifices to maintain a safe minimum flow for the pump when the blowdown of the low flow line was 0 - 5 gpm. This revision increases the maximum flow of blowdown to 20 gpm. No additional changes are required for the recirculation line and restricting orifices due to the increased blowdown flow rate due to the conservative nature of the blowdown flow rate change with regard to the recirculation line. Pump run out for the ultra low flow path is not a concern since the pumps were designed for higher flow rates in excess of 500 gpm.

4.1.35 Electrical Requirements

The existing valve limit switches will be replaced with Topworx Go Switch to provide more sensitive monitoring of the valve position. The existing flexible conduits and cables (reworked under EC 362453 prior to Rev. 005) may be re-used or replaced to reach the replacement switches. The new limit switches are SPDT with a normally open and a normally closed contact. The limit switches include a pigtail with four (4) conductors. Normally open, normally closed, common, and ground. The ground conductor will be terminated to the junction box metal of 1JB118T. The limit switch contacts will be wired to provide the same valve status indication as the existing limit switches. When the valve is fully open, the valve open indicating light will be lit, and the valve closed indicating light will be off. When the valve is fully closed, the valve closed indicating light will be lit, and the valve open indicating light will be off. When the valve is in transition (not fully open or not fully closed) both the open and closed valve indicating lights will be lit.

4.1.36 Instrument and Control Requirements

EC 362453 Rev. 5 changes the control and measurement range of the flow in the release line. The existing control components will remain the same. A new flow element will be installed to accurately measure the increased flow in the larger one inch line from 0 to 30 GPM. The flow element is located such that there is adequate upstream and downstream straight pipe to prevent flow disturbances from affecting the accuracy of the flow reading. See Panel TIMD071 for 0FE-WX001 in Passport for the updated flow element parameters. The differential pressure across the new flow element will change from the existing 0 to 400 in wc to approximately 0 to 100 in wc (Reference, revision summary Notes Topic).

The flow control loop will be recalibrated for a range 0 to 30 gpm. The existing flow transmitter will be recalibrated for a measured differential pressure of 0 to 200 in wc with an output of 0 to 20 mA equivalent to a flow of 0 to 30 gpm. The flow recorder 0FR-WX630 on 0PL01J will be rescaled and calibrated to match the output of the transmitter a full flow of 30 gpm to accommodate the lower design flow. The calibration factor and counts per hour for the linear indicator 0FQ-WX001, and totalizing indicators OFQI-WX001A and B on 0PLO1J will be revised to accurately measure the required counts/minute for the new flow range. The setpoint for analog comparator OFSH-WX001 will be revised to be compatible with the new flow range.

The setpoint voltage for flow controller 0FC-WX001 will remain the same. With the new flow range of 0 to 30 gpm, this will be equivalent to approximately 15 gpm. The scale on computer point F0001A will also be revised to accommodate the new flow rate of 0 to 30 gpm. The control signal from the auto driver OFY-WX001E is 4 – 20 mA. This is the required input range for the positioner on the valve. The control cable that went to the I/P will be extended to connect to the positioner on the valve. The instrument air line required for the positioner shall be field routed from the existing instrument air connection to the new I/P location.

See additional discussion of the I&C considerations in the revision summary Notes Topic.

4.1.38 Civil/Structural

The impacted pipe supports are located in the Unit 2 Turbine Building and are classified as non-safety related and non-seismic, with no Category II over Category I interaction concerns. The impacted piping subsystem, 1CW14, was analyzed for loads from weight plus thermal plus 0.5g Seismic. The load for 0.5g Seismic was included in the piping analysis for conservatism to account for vibration concerns. However, it is not considered as a Design Basis Load (Design Analysis 031203, Rev. 002B). The original support qualifications are documented in Calculation 14.1.12-BRW-07-0009-S.

The stress analysis for EC 362453 Rev. 005 changes did not result in higher loads than the loads utilized for the supports qualification in calculation 14.1.12-BRW-07-0009-S. The support locations and/or support structural members are not changed other than the u-bolts have been replaced to accommodate larger size pipe. This will require additional hole drilled in the structural member. However, this change will not adversely affect the carrying capacity of the supports.

4.1.42 Interfacing Department Review

See PASSPORT milestones and Attributes for Interfacing Department reviews.

4.4 Configuration Control Activities

Configuration Control Activities (if required) are identified in CC-AA-102, Attachment 7.

4.5 Program Impact

Program impact (if required) is identified in CC-AA-102, Attachment 8

50.59 Screening Questions (Check correct response and provide separate written response providing the basis for the answer to each question) (See Section 5 of the Resource Manual (RM) for additional guidance):

1. Does the proposed Activity involve a change to an SSC that adversely affects an UFSAR described design function? (See Section 5.2.2.1 of the RM)

☐ Yes ☒ No

EC 362453 Rev. 005 allows for replacement of the existing ½" size liquid radwaste release tank blowdown control valve, 0WX302, and associated ½" size piping and ½" pipe sized flow element (0FE-WX001) installed in previous revisions of EC 362453 with a 1" size control valve (with actuator and limit switches) and associated 1" size piping and 1" pipe sized flow element to increase blowdown control rate from 0.5 - >5 gpm to 0.5 - >20 gpm. The existing controls components will be used on the new valve, however, the flow indicator, recorder, integrator and computer points are being rescaled and recalibrated to a span of 0 to 30 gpm to envelope the larger flow range and the valve limit switches will be replaced. Pipe support changes will be needed to accommodate the larger/heavier valve. The new valve will have the same operating method and failure position as the replaced valve.

The function of the liquid waste system (WX) to collect, monitor, recycle or release potentially radioactive liquid wastes, as described in UFSAR Section 11.2 " Liquid Waste Management Systems" of the UFSAR is not impacted by this proposed change. Potentially radioactive releases from Release Tanks 0WX01T and 0WX26T will continue to be sampled and monitored and releases controlled to ensure that radioactive releases are within Technical Specification requirements as discussed in Sections 11.2.1.1, 11.2.1.3, 11.2.1.10, 11.2.2.3 and 11.2.3 of the UFSAR. The modified components have been designed in accordance with the original design criteria and the liquid radwaste system continues to be capable of processing maximum expected liquid waste inputs as a result of normal operation, including anticipated abnormal occurrences for Units 1 and 2. UFSAR Table 11.2-4 "Comparison of Expected Liquid Effluent Concentration to10CFR20 Limits (Braidwood) and Table 11.2-5 "Liquid Radwaste System Components and Design Parameters per Station" are not impacted by the changes proposed by EC 362453 Rev. 005. Following implementation of this change, liquid Radwaste System releases will continue to be performed on a batch basis with release rates from the Release Tanks determined by Station Operating procedures including BwOP WX-526T1 and BwOP WX-501T1.

The interface between the WX system and Circulating Water (CW) system which functions to maintain water chemistry by continuous makeup from and blowdown to the Kankakee River is not impacted by this change (UFSAR Section 10.4.5).

The interface between the WX system and Instrument Air (IA) system which functions to provide dry, oil-free compressed air for both nonessential and essential components and instruments as described in UFSAR Section 9.3.1, is not impacted by this activity.

The monitoring of liquid effluents as described in UFSAR Section 11.5.2.3.1 "Liquid Radwaste Effluent Monitor" is not affected by this change.

The function of "Liquid Radwaste System Instruments and Controls", as described in UFSAR Section 7.7.1.19 is not affected by this change.

The changes being implemented by EC 362453 Rev. 005 meet the requirements of Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Power Plants referenced in UFSAR Appendix A1.143.

The supporting of the replacement control valve including the new configuration of associated piping, supports, and components have been evaluated and have been found to be acceptable.

The WX, CW (considered a part of the Raw Water system) and IA systems are considered Safety Category II (non-safety related), Quality Group D systems as identified in UFSAR Table 3.2-1. The WX,CW and IA systems do not perform any safety function and are not required for safe shutdown of the plant and are not credited in any accident analyses.

Based on the above, the proposed activities do not involve a change to an SSC that adversely affects an UFSAR described design function.

2. Does the proposed Activity involve a change to a procedure that adversely affects how UFSAR described SSC design functions are performed or controlled? (See Section 5.2.2.2 of the RM)

☐ Yes ☒ No

The procedures utilized to monitor and control effluent discharge from the release tanks, as described in UFSAR Section 11.2.2.3 "Operating Procedures" are not impacted by the introduction of the revised effluent flow rate capability. Potentially radioactive releases from Release Tanks 0WX01T and 0WX26T will continue to be sampled and monitored and release controlled to ensure that radioactive releases are within acceptable limits in accordance with station procedures. Specifically, Liquid radwaste is governed by a programs and procedures including CY-AA-170-000 "Radioactive Effluent and Environmental Monitoring Programs", CY-AA-170-200 "Radioactive Effluent Controls Program" and CY-BR-170-301 "Offsite Dose Calculation Manual (ODCM)". The releases from the 0WX01T and 0WX26T release tanks are assessed and controlled via BwOP WX-526T1, "Liquid Release Tank 0WX26T Release Form" and BwOP WX-501T1, "Liquid Release Tank 0WX01T Release Form". These procedures limit the maximum effluent discharge rate from the release tanks to 50 gpm. The change in release tank blowdown control valve 0WX302 capacity from 0.5 - >5 gpm to 0.5 - >20 gpm will maintain maximum release rates within established procedural limits.

Therefore, replacement of release tank blowdown control valve 0WX302 and associated components, and the increase in valve flow capacity from 0.5 - >5 gpm to 0.5 - >20 gpm will not change an existing procedure or create a new procedure that adversely affects how UFSAR described SSC design functions are performed or controlled.

3. Does the proposed Activity involve an adverse change to an elements of a UFSAR described evaluation methodology, or use of an alternative evaluation methodology, that is used in establishing the design bases or used in the safety analyses? (See Section 5.2.2.3 of the RM).

☐ Yes ☒ No

The systems and components being modified are not credited in any UFSAR safety analysis. This activity does not change the effluent monitoring process or methodology including the effluent monitoring as described in the UFSAR. This activity involves hardware changes to a release path in order to allow better flexibility and control at low release rates from the 0WX01T and 0WX26T release tanks. The modified system is evaluated in accordance with the original design criteria. The computer program (PIPSYS) utilized to analyze the piping has been documented for use in UFSAR Appendix D.8.1. No new methodology was used in determining the adequacy of the configuration of associated piping, supports, and components. There are no changes to the evaluation methodology of liquid releases as a result of this EC. There are no changes to the performance characteristics or design functions of any SSC that results in adverse changes to an element of a UFSAR described evaluation methodology. The subject activities do not introduce or use an alternative evaluation methodology that is used in establishing the design bases or used in the safety analyses.

4. Does the proposed Activity involve a test or experiment not described in the UFSAR, where an SSC utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the UFSAR? (See Section 5.2.2.4 of the RM)

☐ Yes ☒ No

This activity replaces control valve hardware in the existing flow path from the release tanks to CW blowdown interface. The modified WX system components will be tested in accordance with the requirements of the applicable construction codes and approved procedures to ensure the modified system continues to meet its performance requirements and design functions. The testing requirements associated with this activity does not utilize or control an SSC of the WX system or supporting CW and IA systems in a manner that is outside the reference bounds of the design for the associated SSCs as described in the UFSAR. The design function of the WX system and supporting CW and IA systems is not altered as a result of the subject activities and no experiments are performed.

5. Does the proposed Activity require a change to the Technical Specifications or Facility Operating License? (See Section 5.2.2.5 of the RM)

☐ Yes ☒ No

No changes to the Technical Specifications or Operating License are required.

The effluent line flow rate is not a parameter in the Technical Specifications or Operating License. TS Section 5.5.1 requires that the offsite releases be controlled by the ODCM. TS Section 5.5.4 describes the radioactive effluent controls program. TS Section 5.6 describes effluent report requirements. TRM 5.2 "Procedures and Programs" describes requirements regarding Process Control Programs including: In-Plant Radiation Monitoring, Radiological Environmental Monitoring Program, Radiation Protection Programs and ODCM. None of these aforementioned documents define a specific release tank blowdown flow rate. The releases from the 0WX01T and 0WX26T release tanks will continue to be assessed and controlled via BwOP WX-526T1, "Liquid Release Tank 0WX26T Release Form" and BwOP WX-501T1, "Liquid Release Tank 0WX01T Release Form" to ensure that releases are in compliance with 10CFR20, 10CFR50 and NPDES permit limitations.

II. List the documents (e.g., UFSAR, Technical Specifications, other licensing basis, technical, commitments, etc.) reviewed, including sections numbers where relevant information was found (if not identified in the response to each question).

UFSAR Sections

3.2 CLASSIFICATION OF STRUCTURES, COMPONENTS, AND SYSTEMS
3.2.2 Quality Group Classification
Table 3.2-1 Safety Category and Quality Group Classification for Structures and Component
7.7 CONTROL SYSTEMS NOT REQUIRED FOR SAFETY
7.7.1.19 Liquid Radwaste System Instruments and Controls
9.3 PROCESS AUXILIARIES
9.3.1 Compressed Air Systems
10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM
10.4.5 Circulating Water System
11.2 LIQUID WASTE MANAGEMENT SYSTEMS
11.2.1.1 Safety Design Basis
11.2.1.3 Expected Radioactive Releases
11.2.1.10 Prevention of Uncontrolled Releases
11.2.2.3 Operating Procedures
11.2.3 Radioactive Releases
Table 11.2-4 Comparison of Expected Liquid Effluent Concentrations to 10 CFR 20 Limits
Table 11.2-5 Liquid Radwaste System Components and Design Parameters Per Station
11.5 PROCESS AND EFFUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS
11.5.2.3.1 Liquid Radwaste Effluent Monitor
App A1.143 Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Power Plants"
App D.8 Piping Analysis Programs

Technical Specifications & Bases

5.5.1 Offsite Dose Calculation Manual (ODCM)
5.5.4 Radioactive Effluent Controls Program
5.6 Reporting Requirements

Technical Requirements Manual (BRW-TRM) Latest Revision in EDMS

5.2 Procedures and Programs

Pending UFSAR Change Log

Exelon Procedures

CY-AA-170-000, Radioactive Effluent and Environmental Monitoring Programs
CY-AA-170-200, Radioactive Effluent Controls Program
CY-BR-170-301, Offsite Dose Calculation Manual (ODCM)
BwOP WX-501T1, Liquid Release Tank 0WX01T Release Form
BwOP WX-526T1, Liquid Release Tank 0WX26T Release Form

50.59 Screenings:

BWR-S-2007-159 R/0
BWR-S-2007-159 R/1

III. Select the appropriate conditions:

☒ **If** all questions are answered NO, **then** a 50.59 Evaluation is not required.

☐ **If** question 1, 2, 3, or 4 is answered YES for any portion of an Activity and question 5 is answered NO, **then** a 50.59 Evaluation shall be performed for the affected portion of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and questions 1 through 4 are answered NO for the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment; however, a 50.59 Evaluation is **not** required for the remaining portions of the Activity.

☐ **If** question 5 is answered YES for any portion of an Activity and question 1, 2, 3, or 4 is answered YES for any of the remaining portions of the Activity, **then** a License Amendment is required prior to implementation of the portion of the Activity that requires the amendment **and** a 50.59 Evaluation is required for the remaining affected portions of the Activity.

IV. Screening Signoffs:

The 10CFR50.59 screening has been approved by the Site's Qualified Screening Process on 10/6/11.

ATTACHMENT 5

EVALUATION OF EFFLUENT RELEASE RATES INCORPORATING A PROPOSED RIVER DIFFUSER SYSTEM AT BRAINDWOOD STATION

ChemStaff

Evaluation of the Liquid Effluent Release Practices Incorporating a Proposed River Diffuser System at Braidwood Station

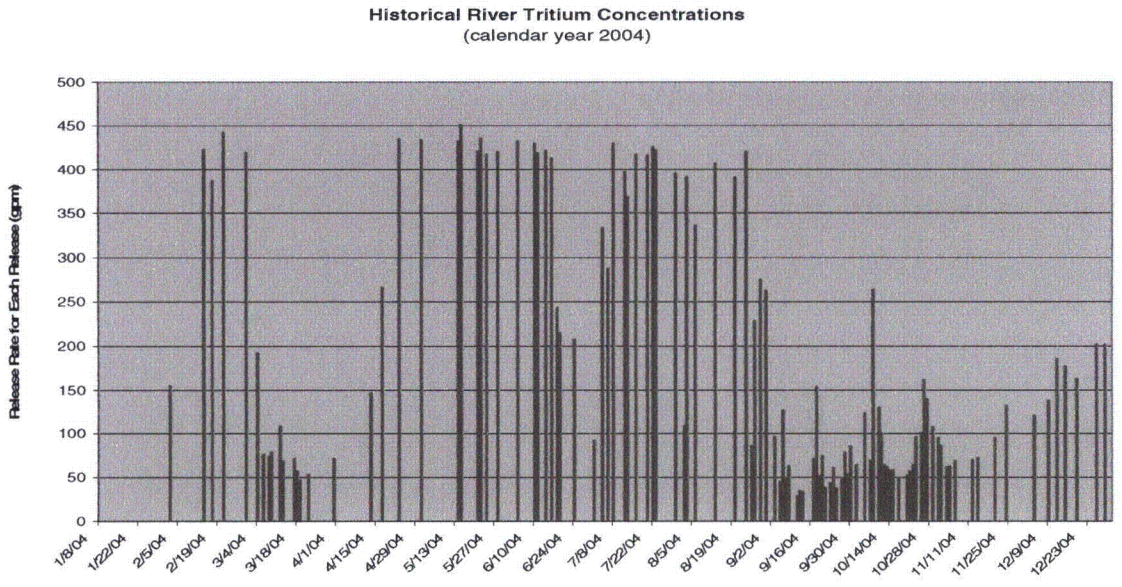
Introduction:

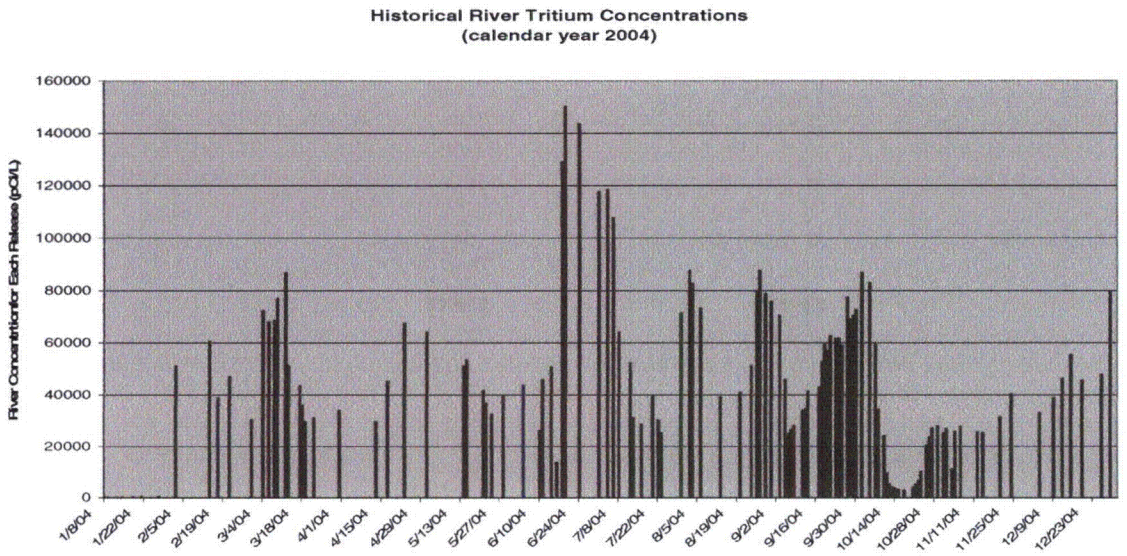
Since tritium cannot be easily separated from water, tritium management requires long range planning and consideration in most liquid effluent optimization decisions. Programmatic extremes such as releasing all plant liquid or zero liquid release without considering all impacts will likely cause unintended consequences. A zero release strategy will eventually result in elevated tritium concentrations in plant systems, requiring potentially extensive personnel monitoring programs. In addition, evaporative losses will result in increased tritium releases via gaseous pathways. Tritium releases as water vapor via gaseous pathways have a high probability of deposition on site or near the site boundary.

The station produces approximately 2000 to 2400 Curies of tritium on an annual average. This report uses tritium mass balance and a tritium management models to project how program changes might affect long-term in-plant and liquid effluent tritium levels and is based on a typical dual outage calendar year to demonstrate seasonal and operational effects. The liquid effluent program is governed by guidance found in the Braidwood Station Offsite Dose Calculation Manual. The Offsite Dose Calculation Manual (ODCM) presents a discussion of the following:

- The basic concepts applied in calculating offsite doses from nuclear plant effluents.
- The regulations and requirements for the ODCM and related programs.
- The methodology and parameters for the offsite dose calculations used by the nuclear power stations to assess impact on the environment and compliance with regulations.

It has been a past station practice to release liquid effluent at a rate ranging from 50 gallons per minute up to 450 gallons per minute which was allowed by plant design. Releases had been completed typically in two to six hours to a side-stream discharge design at the Kankakee River. This design is able to achieve only approximately 25% mixing with total river flow which resulted in a short duration plume with instantaneous tritium concentration down stream calculated to range from 103 to 150,233 pCi/L.





This evaluation will assess the plants ability to release liquid effluents at a rate that will yield the target tritium concentrations, calculate the amount of tritium that will be released by meeting these target concentrations, and calculate the overall tritium balance within the plant as a result of meeting the target tritium concentrations. The goal is to determine the ideal target river concentration and the resulting effects on the current operational practices including recycle and feed and bleed, as well as the effect on proposed disposal options including solidification and offsite disposal.

The proposed river diffusion system in combination with the ultra-low flow release tank regulator 362453 installed in 2007 would significantly alter the station's liquid effluent release practice by achieving greater river flow mixing and regulated low flow release rates. The practice would effectively regulate liquid effluent release rates based on maintaining a constant river concentration well under Federal limits at all times thereby minimizing impacts down stream of the station.

The basis for river dilution characteristics is from the Tritium Dilution Analysis Report (EXCE003) prepared by HydroQual Environmental Engineers and Scientists in February 2009. This effort was to determine allowable tritium discharge concentrations from the Exelon Braidwood Nuclear facility that meet downstream tritium targets at the Wilmington Dam of 200, 400, 600, 800 and 1,000 pCi/L. Three alternative discharge scenarios were assessed which included 3-port submerged diffuser, 5-port submerged diffuser, and 7-port submerged diffuser.

Summary:

The goal of this evaluation was to evaluate liquid effluent release rates controlled to maintain down stream river concentrations at specific target values well below federal limits at all times and the resulting impact to the overall tritium balance in the plant. To maintain a balance between total liquid effluent volume and total tritium curies generated, the station has employed or proposed to employ a combination of tritium effluent management options including release, recycle, and solidification/disposal. The results, which are further detailed in this report, indicate that setting an environmentally conscious minimum river tritium concentration goal down stream of the diffuser of approximately 600 pCi/L will achieve the liquid effluent release requirements. The 600 pCi/L down stream river concentration goal remains well below federal limits, allows discontinuation of recycle and Feed and bleed operation, restores the PW system to "clean", allows effective use of RST as a valuable forward thinking asset, and will minimize or eliminate the need for solidification/disposal.

The following table provides a tritium balance summary based on the down stream river targets:

Annual Plant Tritium Balance						
River Concentration Goal	Liquid Effluent		Recycle To PWST		Solidification/ Disposal	
	Volume gallons	Curies	Volume gallons	Curies	Volume gallons	Curies
200 pCi/L	730,000	892	1,009,000	1259	9,000	49
400 pCi/L	1,460,000	1786	277,000	346	12,000	68
600 pCi/L	2,194,000	2860	0	0	0	0
800 pCi/L	2,926,000	3574	0	0	0	0
1000 pCi/L	3,658,000	4468	0	0	0	0

General Discussion:

This report evaluates several aspects of a regulated liquid effluent release program and the resulting concentrations based on the river mixing study performed by HydroQual in February 2009 (EXCO.003). This evaluation works backward from river dilution and concentration data into plant to assess plant operation, practices, and liquid effluent generation rates to determine if target river concentrations can be met.

As requested by Exelon, the target river concentrations at the dam were 200, 400, 600, 800 and 1,000 pCi/L. As per 40 CFR 141.66 (Table A) and subsection 611.330 of Title 35, subtitle F, Chapter I of the Illinois General Assembly Administrative Code, the average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/yr). This relates to an average annual concentration in drinking water of 20,000 pCi/L, which is much greater than the chosen target river concentrations at the dam just upstream from the Wilmington water intake.

Liquid effluent release rates, liquid effluent volume and liquid effluent tritium curie content in the plant were calculated from the river concentration goals. From these values, an assessment was made to determine if the plant could operate in a manner that would allow liquid effluents to meet the river concentration goals. The viable operational practices will be used to develop a water management plan which will manage liquid effluent generation, direct appropriate processing and purification, implement logical movement and storage of liquid effluent, and regulate release of liquid effluents within accepted goals.

Evaluation Assumptions

Parameter	Assumption	Reference
Federal Limit State Limit	20,000 pCi/L	40 CFR 141.66 (Table A) and subsection 611.330 of Title 35, subtitle F, Chapter I of the Illinois General Assembly Administrative Code
Federal LLD	2,000 pCi/L	
Achievable LLD	200 pCi/L	
Average Release Tank Concentration	0.33 uCi/mL	Steady State Release Tank concentration average from 2008
	0.62 uCi/ml	Outage Release Tank concentration average from 2008
Average and Annual Liquid Effluent Generation Rate	2 gpm	
	1,739,200 gallons	Average input to Total generation in Dual Outage Year
	1,939,200 gallons	Total Generation in Dual Outage Year plus One Forced Outage (worst case)
RCS Feed and Bleed	50,000 gallons per unit @ 300 EFPD	w/ H3 >1.5 uCi/ml at RST
Average and Annual River Flows		USGS (1969 – 2008)
Blowdown System Availability	90%	

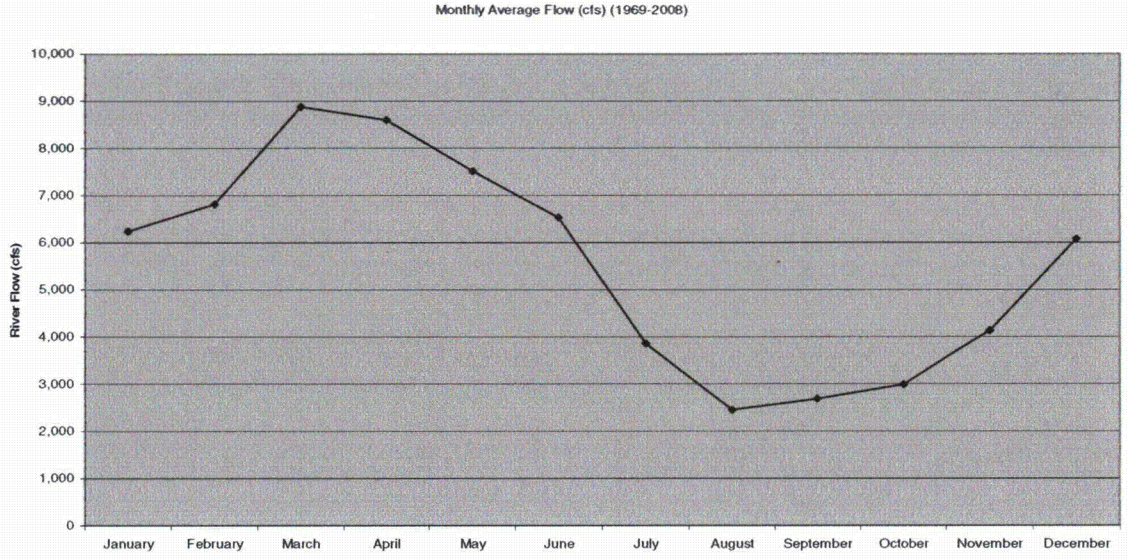
From the HyrdoQual Report, the following baseline data was used to calculate the plant effects of a three, five, and seven port diffuser system over a 200, 400, 600, 800, and 1000 pCi/L range of river tritium concentrations:

Discharge flow – 19,000 gpm			River Concentration at Dam (pCi/L)				
Option: 3-Port Diffuser			200	400	600	800	1000
Months	Monthly Average Flow (cfs) (1969-2008)	Dilution at Dam (B_d)	Allowable Discharge Tritium Concentration, C_e (pCi/L)				
January	6,238	132.9	28,570	53,150	79,720	106,290	132,870
February	6,810	145.0	29,010	58,020	87,030	116,040	145,050
March	8,874	189.0	37,800	75,610	113,410	151,210	189,020
April	8,598	183.1	36,630	73,250	109,880	146,500	183,130
May	7,513	160.0	32,000	64,010	96,010	128,010	160,020
June	6,527	139.0	27,800	55,610	83,410	111,210	139,020
July	3,859	82.2	16,440	32,880	49,320	65,760	82,200
August	2,451	52.2	10,440	20,880	31,320	41,760	52,200
September	2,888	57.2	11,440	22,880	34,320	45,770	57,210
October	2,987	63.6	12,730	25,450	38,180	50,900	63,630
November	4,128	87.9	17,580	35,170	52,750	70,340	87,920
December	6,070	129.3	25,880	51,710	77,570	103,430	129,290
Mean annual average flow (1969-2008)	5,553	118.3	23,680	47,310	70,970	94,630	118,280
Median annual average flow (1969-2008)	5,354	114.0	22,810	45,620	68,420	91,230	114,040

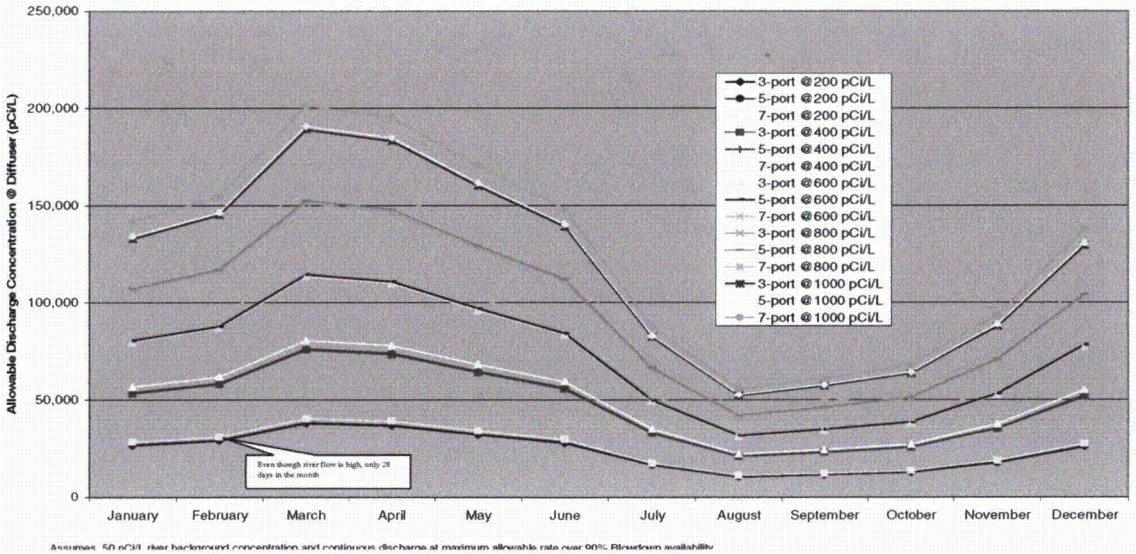
Discharge flow – 19,000 gpm			River Concentration at Dam (pCi/L)				
Option: 5-Port Diffuser			200	400	600	800	1000
Months	Monthly Average Flow (cfs) (1969-2008)	Dilution at Dam (B_d)	Allowable Discharge Tritium Concentration, C_e (pCi/L)				
January	6,238	134.1	28,820	53,650	80,470	107,290	134,110
February	6,810	148.4	29,280	58,560	87,850	117,130	146,410
March	8,874	190.8	38,160	76,320	114,480	152,630	190,790
April	8,598	184.8	36,970	73,940	110,910	147,880	184,850
May	7,513	161.5	32,300	64,610	96,910	129,220	161,520
June	6,527	140.3	28,060	56,130	84,190	112,260	140,320
July	3,859	83.0	16,590	33,190	49,780	66,370	82,970
August	2,451	52.7	10,540	21,080	31,610	42,150	52,690
September	2,888	57.7	11,550	23,100	34,650	46,200	57,740
October	2,987	64.2	12,850	25,690	38,540	51,380	64,230
November	4,128	88.7	17,750	35,500	53,250	71,000	88,750
December	6,070	130.5	26,100	52,200	78,300	104,400	130,500
Mean annual average flow (1969-2008)	5,553	119.4	23,880	47,760	71,640	95,520	119,400
Median annual average flow (1969-2008)	5,354	115.1	23,020	46,040	69,070	92,090	115,110

Discharge flow – 19,000 gpm			River Concentration at Dam (pCi/L)				
Option: 7-Port Diffuser			200	400	600	800	1000
Months	Monthly Average Flow (cfs) (1969-2008)	Dilution at Dam (B_d)	Allowable Discharge Tritium Concentration, C_e (pCi/L)				
January	6,238	141.6	28,320	56,640	84,960	113,280	141,600
February	6,810	154.6	30,920	61,830	92,750	123,660	154,580
March	8,874	201.4	40,290	80,580	120,870	161,150	201,440
April	8,598	195.2	39,030	78,070	117,100	156,130	195,160
May	7,513	170.5	34,110	68,210	102,320	136,430	170,530
June	6,527	148.2	29,630	59,260	88,890	118,520	148,160
July	3,859	87.6	17,520	35,040	52,560	70,080	87,600
August	2,451	55.6	11,130	22,250	33,380	44,500	55,630
September	2,888	61.0	12,190	24,390	36,580	48,770	60,970
October	2,987	67.8	13,560	27,120	40,690	54,250	67,810
November	4,128	93.7	18,740	37,480	56,220	74,960	93,700
December	6,070	137.8	27,560	55,110	82,670	110,230	137,780
Mean annual average flow (1969-2008)	5,553	126.1	25,210	50,420	75,640	100,850	126,060
Median annual average flow (1969-2008)	5,354	121.5	24,310	48,610	72,920	97,230	121,540

The Kankakee River flow data shows consistent trends in total volume every month over the course of a year. River flow data analyzed over a forty time period indicates December through June typically have monthly average flow rates greater than 4000 cfm. July through November is typically less than 4000 cfm. These trends in high flow and low flow are a necessary fundamental in meeting liquid effluent release criteria.



Comparing the three, five, and seven port diffuser systems against the average river flow by month indicates similar effectiveness in the three and five port design. The seven port design however shows significantly greater effectiveness. The tritium concentrations shown below are the concentration at the diffuser required to meet the down stream river target concentrations and in effect would be the concentration of the circulating water system blowdown at the point of exit into the river.



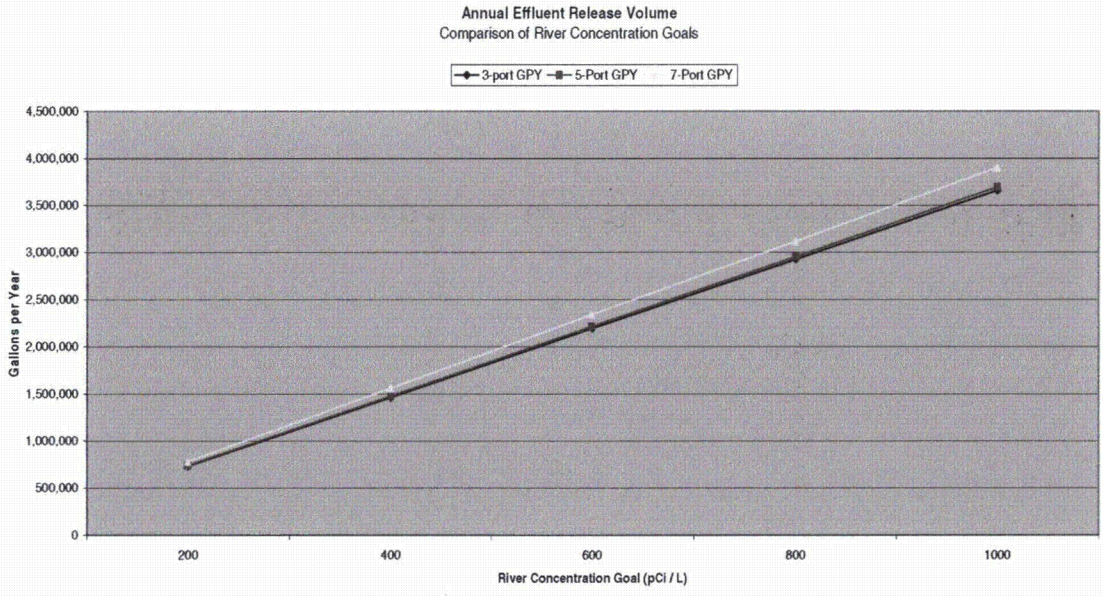
Assumes .50 pCi/L river background concentration and continuous discharge at maximum allowable rate over 90% Blowdown availability

Using an average release tank concentration and calculating the release rate (gpm) to achieve the tritium concentration goal at the diffuser, the annual volume of liquid effluent (gal) attainable can be estimated. Again similar effectiveness in the three and five port design is noted. The seven port design however shows significantly greater effectiveness. Further, this estimation indicates that the 200 and 400 pCi/L downstream river concentration goals do not allow the plant to release all of the anticipated liquid effluent generation. The estimated annual volume generated in a dual outage year would be 1,739,200 gallons and in a worse case dual outage year with one forced outage is 1,939,200 gallons. Releasing the full allowed volume at the 200 and 400 pCi/L down stream river concentration goals would result in an excess liquid effluent volume of approximately 1,009,000 gallons and 277,000 gallons respectively. This volume of low tritium concentration effluent would need to be dispositioned by recycle, surge capacity or solidification/disposal. These cases far exceed current surge capacity, therefore only recycle and solidification/disposal remain as viable options.

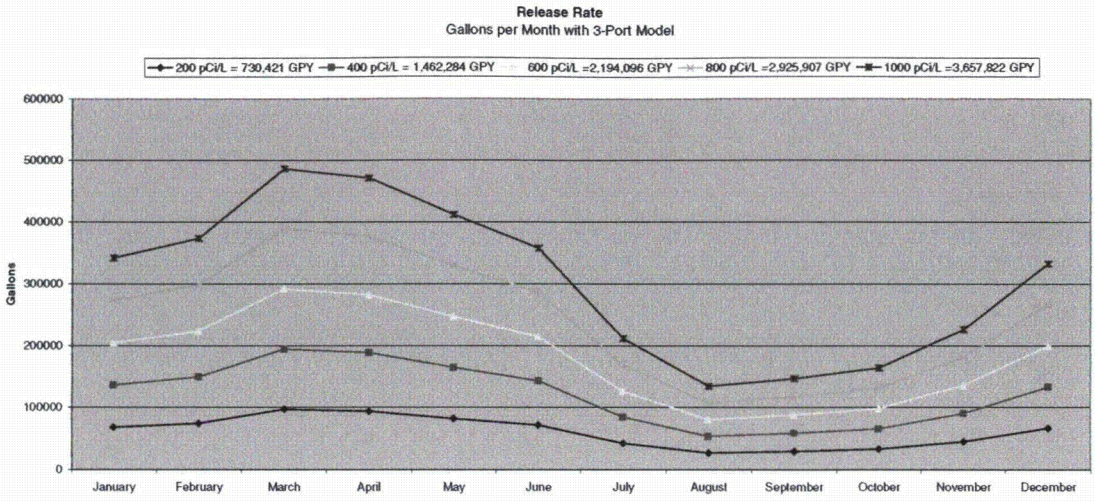
200-400 will require the plant to continue the current recycle operation and the current reactor coolant system feed and bleed for processing to the proposed solidification/disposal facility. Reactor coolant, PW, and spent fuel pool would all continue to increase in nominal tritium concentration until equilibrium is achieved again around 2017.

	Nominal Tritium Concentration prior to 2007	Nominal Tritium Concentration Currently	Nominal Tritium Concentration in 2017 (equilibrium)
Reactor Coolant System	2.0 μCi/ml	2.5 μCi/ml	3.5 μCi/ml
Primary Water	0 μCi/ml	0.24 μCi/ml	1.25 μCi/ml
Spent Fuel Pool	0.1 μCi/ml	0.4 μCi/ml	0.9μCi/ml

The ≥500 pCi/L down stream river concentration goal remains well below federal limits at all times, allows discontinuation of recycle operation, restores PW system to "clean", allows effective use of RST as a valuable forward thinking asset, and will minimize or eliminate the need for solidification/disposal.



A closer examination using only the three port model demonstrates on a month-by-month basis that the 200 pCi/L downstream river concentration goal never meets monthly plant release volume requirements and 400 pCi/L downstream river concentration goal meets the monthly plant release volume requirements in only 6 of 12 months.



These two charts indicate the minimum downstream river concentration goal necessary to meet annual or monthly plant release volume requirements begins at 600 pCi/L. The estimated annual volume generated in a dual outage year would be 1,739,200 gallons and in a worse case dual outage year with one forced outage is 1,939,200 gallons. Releasing the full allowed volume at the ≥600 pCi/L down stream river concentration goals would result in the ability to release all liquid effluents generated plus an additional 455,000 gallons during a dual outage year. A dual outage year with one force outage would result in an excess liquid effluent volume of approximately 255,000 gallons. This volume of low tritium concentration effluent would need to be dispositioned by recycle, surge capacity or solidification/disposal. This volume is within the current surge capacity; therefore surge (via the RST) would be the viable option.

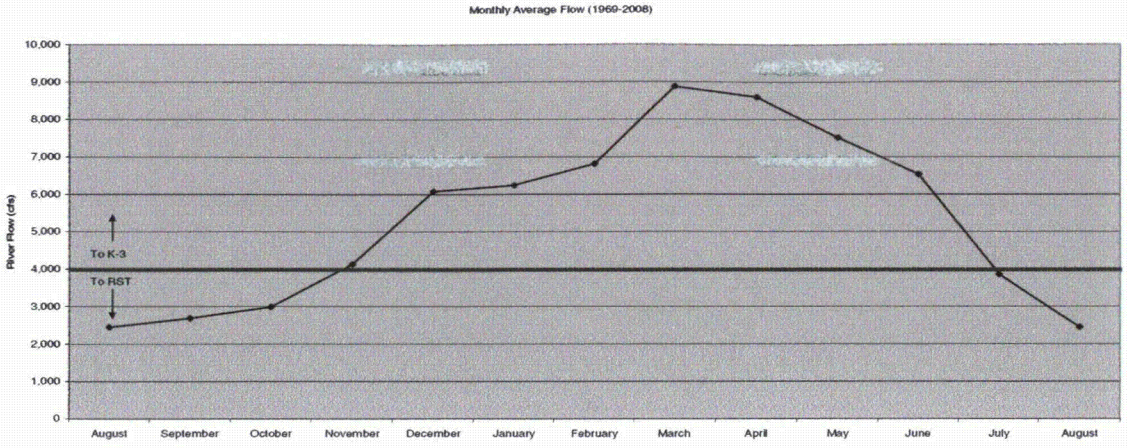
Curies per Month

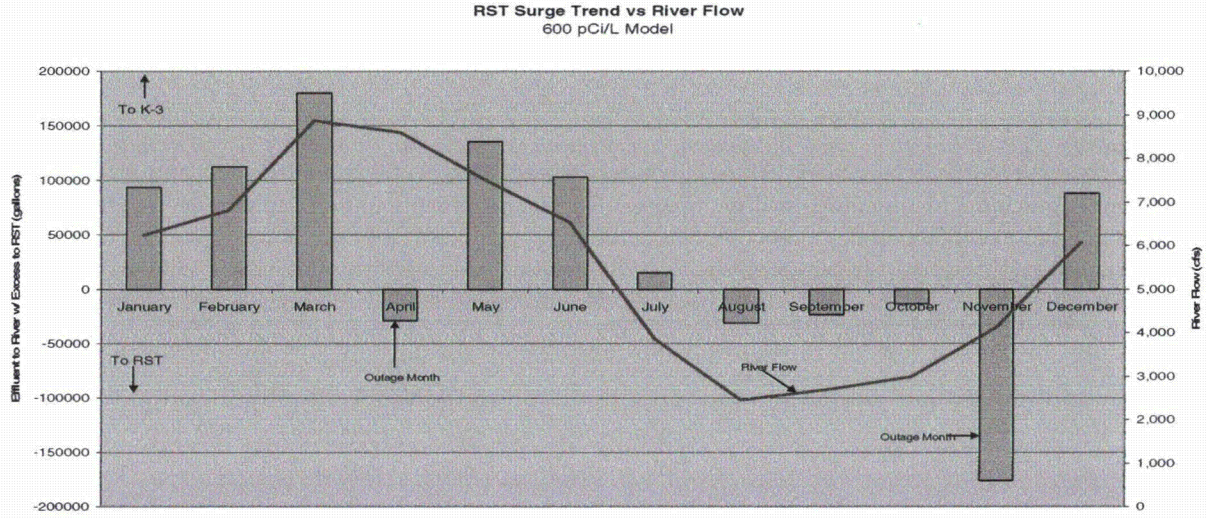
200	400	600	800	1000	pCi/L
85.2	170.5	255.8	341.1	426.4	Jan
84.0	168.1	252.2	336.3	420.5	Feb
121.2	242.6	363.9	485.3	606.7	Mar
113.7	227.4	341.2	455.0	568.8	Apr
102.6	205.3	308.1	410.8	513.6	May
86.2	172.6	259.0	345.4	431.8	Jun
52.6	105.4	158.2	211.0	263.7	Jul
33.4	66.9	100.4	133.9	167.4	Aug
35.4	70.9	106.5	142.1	177.6	Sep
40.7	81.6	122.4	163.3	204.1	Oct
54.5	109.1	163.7	218.4	273.0	Nov
82.9	165.9	248.9	331.9	414.9	Dec
892	1786	2680	3574	4468	

Gallons per Month

200	400	600	800	1000
68278	136697	205090	273483	341902
74558	149232	223907	298581	373255
97184	194511	291811	389111	486437
94173	188436	282724	376987	471276
82255	164651	247022	329392	411789
71444	143029	214588	286148	357733
42202	84520	126838	169156	211474
26758	53631	80504	107378	134251
29332	58779	88227	117700	147147
32652	65395	98163	130905	163673
45137	90415	135667	180945	226197
66450	132990	199556	266121	332687
730,421	1,462,284	2,194,096	2,925,907	3,657,822

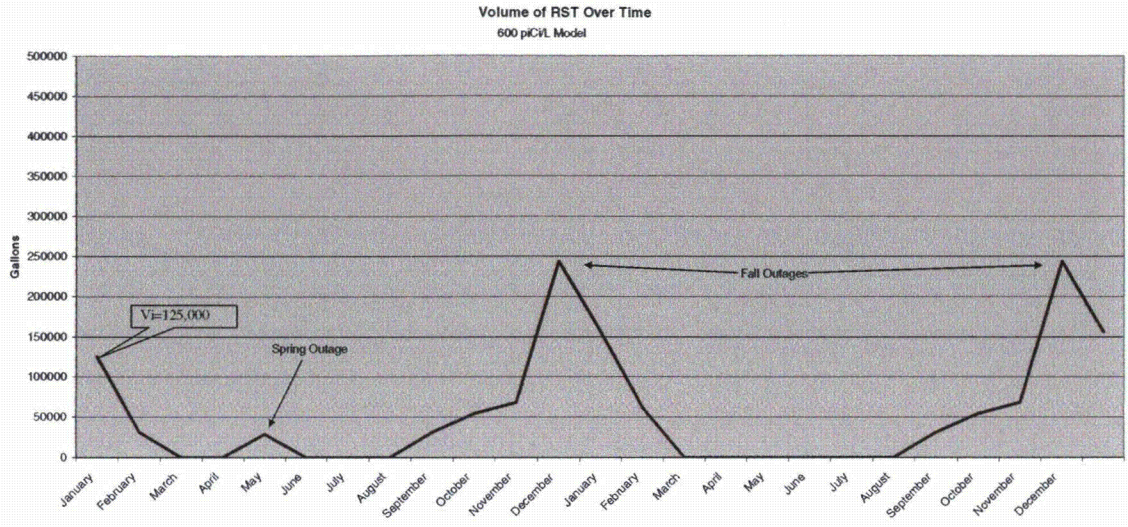
Consequently, comparing annual average river flows to the effect on liquid effluent discharge at ≥600 pCi/L down stream river concentration goal generally indicates that any period where the river flow is greater than 4000 cfs the plant will be able to release all the liquid effluent generated plus some reserve volume. At the periods of the month where the river flow is less than 4000 cfs the plant will not be able to release all the liquid effluent generated and available surge capacity will be required.





The RST was evaluated against this data to determine if adequate surge capacity exists based on the excess liquid release volumes calculated for the low river flow months. The RST has a total capacity of 500,000 gallons. Assuming an initial volume of 125,000 gallons at the beginning of the calendar year, excess discharge volumes above the routine monthly liquid effluent generation could occur due to the higher river flows during the first quarter of the year. These excess releases would reduce the RST to minimal levels until surge capacity is again required due to the higher liquid effluent generation rates incurred by the spring outage. The RST level would be minimized again until the average river flow drops below 4000 cfm. During these months, liquid effluent releases will not keep pace with generation rates and the RST will serve as surge capacity through the summer and the fall outage.

By January of the following year, higher river flows will allow normal release frequencies plus the reduction of the RST volume again to minimal levels over the next few months.



This case is built on a dual outage year to demonstrate the effects of river flow and setting the appropriate minimum down stream concentration goal. In calendar years where no spring outage is planned, the RST surge trend line would remain flat. In calendar years where no fall outage is planned, the RST surge trend line would continue to build at a gradual pace. By January of the following year, higher river flows will allow normal release frequencies plus the reduction of the RST volume again to minimal levels over the next few months.

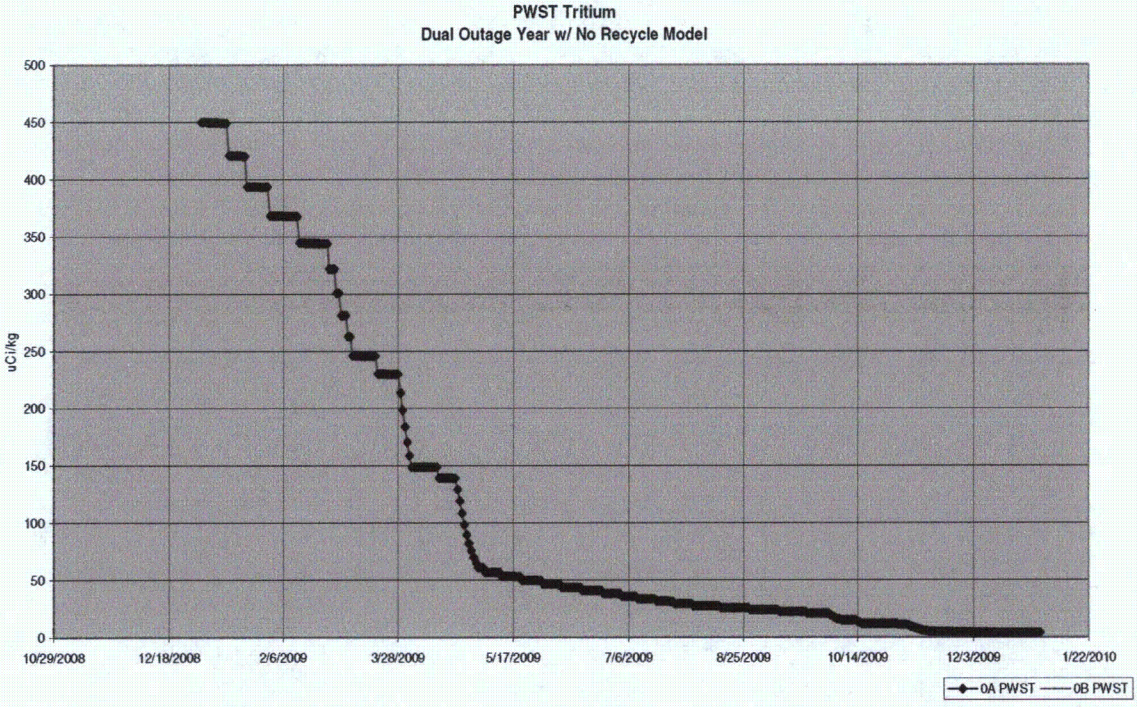
Analysis of the release rate data identified several operational concerns. Release tank release rates at the 200 and 400 pCi/L downstream river concentration goals at all times of the year will not meet the plant resource commitments. Generally, release tank release rates remain so low that a total release (25,000 gallons) would span 4 to 29 days to completion. Significant changes in Operations oversight and implementation would be required to achieve these downstream goals. Surge volume in the RST or waste processing system is inadequate to retain this excess volume of liquid effluent resulting in significant recycle and solidification/disposal. Release tank release rates $\geq$600 pCi/L downstream river concentration goal will meet most operational concerns except during the low river flow periods. As previously discussed, available RST surge capacity is adequate to retain the excess liquid effluent volume in the short term. This is also the case when abnormally low river flows are observed outside of the normal months.

River Goal	200	400	600	800	1000	pCi/L
Jan	1.5	3.1	4.6	6.1	7.7	Release Tank Release Rate (gpm)
Feb	1.7	3.3	5.0	6.7	8.4	
Mar	2.2	4.4	6.5	8.7	10.9	
Apr	2.1	4.2	6.3	8.4	10.6	
May	1.8	3.7	5.5	7.4	9.2	
Jun	1.6	3.2	4.8	6.4	8.0	
Jul	0.9	1.9	2.8	3.8	4.7	
Aug	0.6	1.2	1.8	2.4	3.0	
Sep	0.7	1.3	2.0	2.6	3.3	
Oct	0.7	1.5	2.2	2.9	3.7	
Nov	1.0	2.0	3.0	4.1	5.1	
Dec	1.5	3.0	4.5	6.0	7.5	

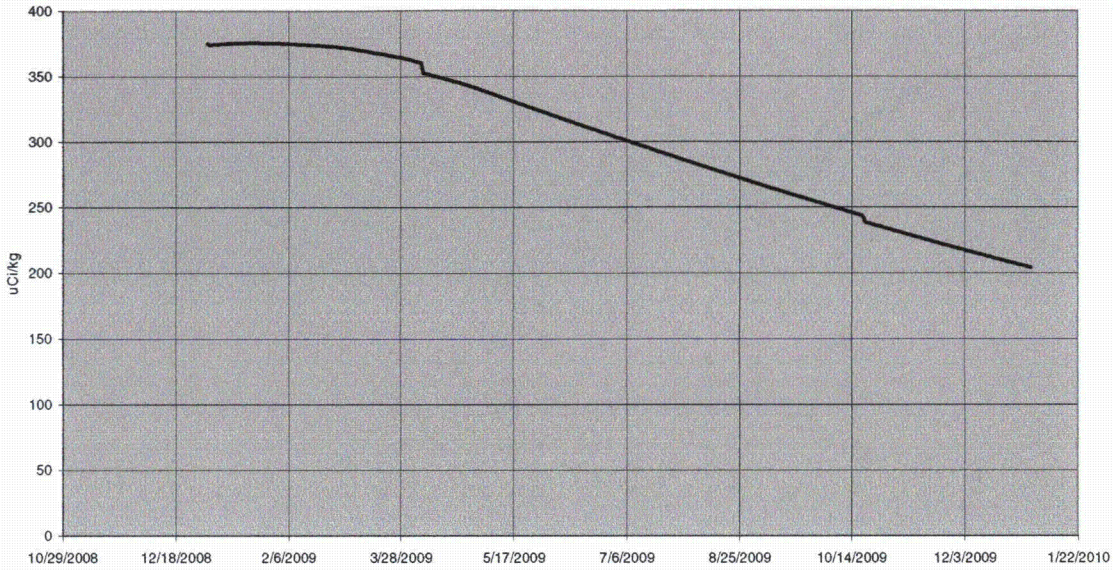
Release Tanks per Month						Days per Release Tank Release				
200	400	600	800	1000	pCi/L	200	400	600	800	1000
3	5	8	11	14	Jan	11.4	5.7	3.8	2.8	2.3
3	6	9	12	15	Feb	10.4	5.2	3.5	2.6	2.1
4	8	12	16	19	Mar	8.0	4.0	2.7	2.0	1.6
4	8	11	15	19	Apr	8.2	4.1	2.7	2.1	1.6
3	7	10	13	16	May	9.4	4.7	3.1	2.4	1.9
3	6	9	11	14	Jun	10.8	5.4	3.6	2.7	2.2
2	3	5	7	8	Jul	18.4	9.2	6.1	4.6	3.7
1	2	3	4	5	Aug	29.0	14.5	9.6	7.2	5.8
1	2	4	5	6	Sep	26.4	13.2	8.8	6.6	5.3
1	3	4	5	7	Oct	23.7	11.9	7.9	5.9	4.7
2	4	5	7	9	Nov	17.2	8.6	5.7	4.3	3.4
3	5	8	11	13	Dec	11.7	5.8	3.9	2.9	2.3

Conclusion:

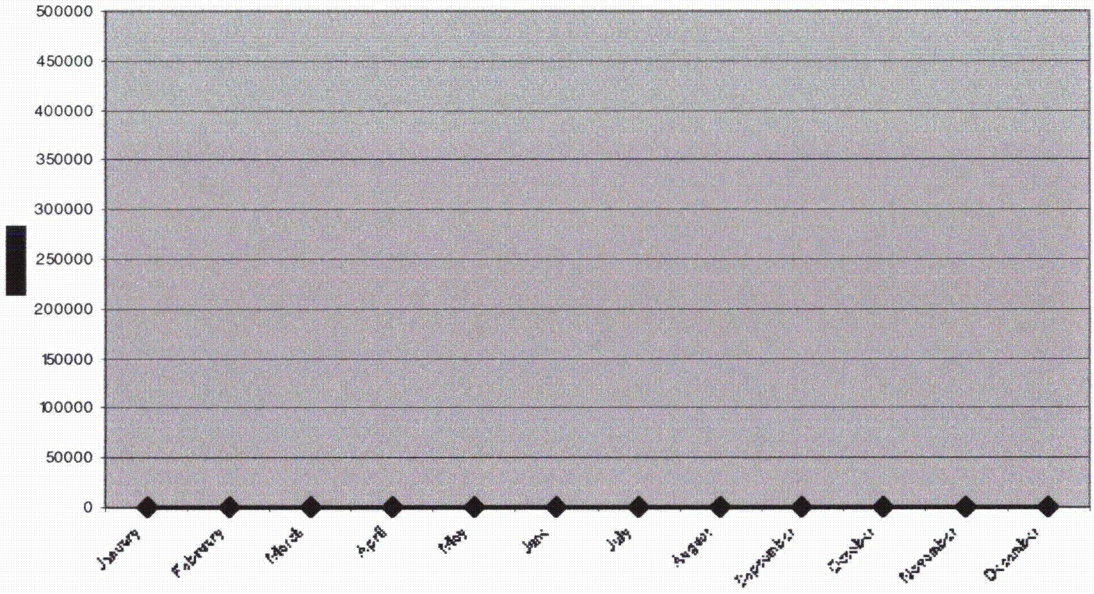
In order to effectively implement the river diffuser system and achieve net zero water balance, net zero tritium balance, net zero recycle, and net zero solidification/disposal a down stream river tritium concentration goal $\geq$600 pCi/L is required.



Spent Fuel Pool Tritium
Dual Outage Year w/ No Recycle Model



Recycle to PWST



ATTACHMENT 6

TELEDYNE BROWN ENGINEERING
SAMPLE RESULTS FOR BD-22 TRITIUM

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

01/24/2012

LIMS #:	L48912
Project ID#:	EX001-3EREMPBRAID-05
Received:	12/28/2011
Delivery Date:	02/01/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L48912-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

2-13-12

Report of Analysis

01/24/12 12:30

L48912

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID:	BD-22	Collect Start:	12/15/2011 15:40	Matrix:	Drinking Water (WD)
Station:	BD-22	Collect Stop:	12/22/2011 15:20	Volume:	
Description:	Wilmington	Receive Date:	12/28/2011	% Moisture:	
LIMS Number:	L48912-1				

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
H-3 (DIST)	2011	-2.68E+01	1.12E+02	1.88E+02	pCi/L		10	ml		01/15/12	60	M	U
I-131 (LOW LVL)	2012	1.06E-01	3.19E-01	6.17E-01	pCi/L		4000	ml	12/22/11 15:20	01/18/12	300	M	U

Comment: 1 Weekly composite-hold for monthly composite

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L48912
L48912 pg3 of 7
WH 2/E

Braidwood Generating Station

Public Water Sample

Sample Collection/Receipt Sheet

EXELON NUCLEAR

1

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	12/15/2011	15:40	12/22/2011	15:20	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by: Jonathan Lee

Date: 12/22/2011 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 12/27/2011 Hold for Quarterly H-3 Composite.

Date: 12/28/11 BD-22

10:53

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5535

Shipping Request

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. Description of items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)

2 gallons BD-22

B. Purpose of Shipment:

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. Comments or Instructions to Vendor:

D. Control Data:

Vendor _____

P.O. No. _____

W.O./Acct. No. _____

Location of material _____

Ship no later than _____

Ship via _____ Collect ☐ Prepaid ☐

No. Pcs./ctns. _____ Cu. Ft. _____

Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express

Date Shipped 12/27/2011

Collect _____ Prepaid _____

FOB point _____

Waybill No. _____

Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

12/28/11 13:14
SR #: SR30013
Client: Exelon

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

Project #: EX001-3EREMPBRAID-05

LIMS #L48912

Initiated By: JSIMMONS
Init Date: 12/28/11 Receive Date: 12/28/11

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

01/24/12 12:30

Work Order: L48912 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPERAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48912-1		H-3 (DIST)					0		01-15-12 06:24	LS7	110	60 M	117	60 M	.203		DW
BD-22				10 ml													
Activity: -2.68E+01	Error:	1.12E+02	MDC:	1.88E+02	pCi/L		L48912-1		H-3 (DIST)								

Raw Data Sheet (rawdata)

01/24/12 12:30

Work Order: L48912 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48912-1		I-131 (LOW LVL)	22-dec-11 15:20	4000 ml			.0211	92.95	01-18-12 16:22	Y1C	114	300 M	282	800 M	.32	.098	BP
BD-22																	
Activity: 1.06E-01		Error: 3.19E-01	MDC: 6.17E-01	pCi/L			L48912-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

01/30/2012

LIMS #:	L48967
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/04/2012
Delivery Date:	02/08/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L48967-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

2-13-12

Report of Analysis

01/30/12 11:07

L48967

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID:	**BD-22**	Collect Start:	12/22/2011 15:20	Matrix:	Drinking Water (WD)
Station:	BD-22	Collect Stop:	12/29/2011 17:20	Volume:	
Description:	Wilmington	Receive Date:	01/04/2012	% Moisture:	
LIMS Number:	L48967-1				

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
H-3 (DIST)	2011	2.83E+02	1.26E+02	1.80E+02	pCi/L		10	ml		01/13/12	60	M	+
I-131 (LOW LVL)	2012	-5.86E-03	3.31E-01	**6.59E-01** 1	pCi/L		5000	ml	12/29/11 17:20	01/26/12	300	M	U

Comment: 1 Weekly composite-hold for monthly composite

* DW NOT GW OR WELL WATER REQUIRING IR FOR VALUE GREATER THAN LLD. 2-13-12

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L 48967

WH21B

Braidwood Generating Station

Public Water Sample

Sample Collection/Receipt Sheet

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	12/22/2011	15:20	12/29/2011	17:20	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by: Jonathan

Date: 12/29/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 01/03/2012 Hold for Quarterly H-3 Composite.

Date: 1/4/12 BD-22

10:00

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5540

Shipping Request

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. **Description of items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)**

Braidwood:
BD-22

B. **Purpose of Shipment:**

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. **Comments or Instructions to Vendor:**

D. **Control Data:**

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 01-03-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

01/04/12 10:46
SR #: SR30067
Client: Exelon

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

Project #: EX001-3EREMPBRAID-05

LIMS #L48967

Initiated By: JSIMMONS
Init Date: 01/04/12 Receive Date: 01/04/12

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

01/30/12 11:07

Work Order: L48967 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48967-1		H-3 (DIST)		10			0		01-13-12 07:56	LS7	201	60 M	120.6	60 M	.214		DW
BD-22				ml													
Activity: 2.83E+02	Error:	1.26E+02	MDC:	1.80E+02	pCi/L		L48967-1		H-3 (DIST)								

Raw Data Sheet (rawdata)

01/30/12 11:07

Work Order: L48967 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48967-1		I-131 (LOW LVL)	29-dec-11 17:20	5000 ml			.0208	91.63	01-26-12 16:36	X4C	145	300 M	388	800 M	.309	.091	BP
BD-22																	
Activity: -5.86E-03	Error:	3.31E-01	MDC:	6.59E-01	pCi/L		L48967-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

02/02/2012

LIMS #:	L49059
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/10/2012
Delivery Date:	02/14/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L49059-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

This report shall not be reproduced or distributed except in its entirety.

2-13-12

Report of Analysis

02/02/12 10:45

L49059

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID: **BD-22** Collect Start: 12/29/2011 17:20 Matrix: Drinking Water (WD)
Station: BD-22 Collect Stop: 01/05/2012 16:00 Volume:
Description: Wilmington Receive Date: 01/10/2012 % Moisture:
LIMS Number: L49059-1

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
H-3 (DIST)	2011	1.56E+02	1.19E+02	**1.78E+02**	pCi/L		10	ml		01/23/12	60	M	U			
I-131 (LOW LVL)	2012	6.62E-02	3.41E-01	**6.42E-01**	pCi/L		4000	ml	01/05/12 16:00	01/31/12	400	M	U			

Comment: 1 Weekly composite-hold for monthly composite

Flag Values
U = *Compound/Analyte not detected (< MDC) or less than 2 sigma*
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L49059
L49059 pg 3 of 7
WH25A

Braidwood Generating Station

Public Water Sample

Sample Collection/Receipt Sheet

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	12/29/2011	17:20	01/05/2012	16:00	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by:

Date: 01/05/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 01/09/2012 Hold for Quarterly H-3 Composite.

Date: BD-22

JMS

1/10/12

10:00

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5556

Shipping Request

L 49059 pg 1 of 7

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. Description of items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)

Braidwood:
BD-22-2 gallons

B. Purpose of Shipment:

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. Comments or Instructions to Vendor:

D. Control Data:

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 01-09-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

01/10/12 10:29

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

SR #: SR30127

Client: Exelon **Project #: EX001-3EREMPBRAID-05** **LIMS #L49059**

Initiated By: JSIMMONS
Init Date: 01/10/12 Receive Date: 01/10/12

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

02/02/12 10:45

Work Order: L49059 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49059-1		H-3 (DIST)					0		01-23-12 22:18	LS7	144	60 M	102.6	60 M	.199		DW
BD-22				10 ml													
Activity: 1.56E+02	Error: 1.19E+02		MDC: 1.78E+02	pCi/L			L49059-1		H-3 (DIST)								

Raw Data Sheet (rawdata)

02/02/12 10:45

Work Order: L49059 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49059-1		I-131 (LOW LVL)	05-jan-12 16:00	4000 ml			.0197	89.14	01-31-12 16:45	Y4C	189	400 M	365	800 M	.289	.107	BP
BD-22																	
Activity: 6.62E-02		Error: 3.41E-01	MDC: 6.42E-01	pCi/L			L49059-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

01/20/2012

LIMS #:	L48995
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/06/2012
Delivery Date:	01/20/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
Dec11 BD-22	L48995-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	GAMMA	EPA 901.1
WD	GR-B	EPA 900.0
WD	H-3 (DIST)	EPA 906.0

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Report of Analysis

01/20/12 10:54

L48995

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID: **Dec11 BD-22** | Collect Start: 12/01/2011 18:40 | Matrix: Drinking Water (WD)
Station: BD-22 | Collect Stop: 12/29/2011 17:20 | Volume: .000E+00
Description: | Receive Date: 01/06/2012 | % Moisture:
LIMS Number: L48995-1

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
GR-B	2008	**3.39E+00**	1.12E+00	1.54E+00	pCi/L		500	ml		01/13/12	100	M	+		
H-3 (DIST)	2011	1.02E+02	1.01E+02	**1.56E+02**	pCi/L		10	ml		01/12/12	60	M	U		
I-131 (LOW LVL)	2012	-3.44E-01	1.86E-01	**3.73E-01**	pCi/L		3500	ml	12/29/11 17:20	01/18/12	500	M	U		
BE-7	2007	5.63E+00	2.36E+01	**3.94E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
K-40	2007	2.04E+01	4.73E+01	**3.66E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		Yes
MN-54	2007	-1.16E+00	2.69E+00	**4.11E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CO-58	2007	-1.39E+00	2.73E+00	**4.08E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
FE-59	2007	6.78E-01	4.80E+00	**8.08E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CO-60	2007	3.43E-01	3.12E+00	**5.16E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
ZN-65	2007	-4.15E+00	6.10E+00	**8.50E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
NB-95	2007	-2.46E-01	2.82E+00	**4.61E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
ZR-95	2007	-9.20E-01	4.94E+00	**7.95E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
RU-103	2007	6.62E-01	4.17E+00	**6.82E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
RU-106	2007	-9.29E+00	2.83E+01	**4.55E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
I-131	2007	-3.56E+00	8.87E+00	**1.38E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CS-134	2007	-3.67E-01	3.12E+00	**4.47E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CS-137	2007	1.03E+00	2.91E+00	**5.11E+00**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
BA-140	2007	5.08E+00	2.23E+01	**3.67E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
LA-140	2007	5.49E+00	6.20E+00	**1.23E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CE-141	2007	9.00E-01	6.65E+00	**1.03E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
CE-144	2007	-1.27E+01	2.74E+01	**3.93E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
RA-226	2007	1.60E+01	8.98E+01	**1.38E+02**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No
TH-232	2007	4.92E+00	1.13E+01	**2.11E+01**	pCi/L		3599.57	ml	12/29/11 17:20	01/12/12	4257	Sec	U		No

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Composite Report **EX001-3EREMPBRAID-05** **12/01/2011** **12/29/2011**

L48995-1 **.000E+00**

Sample#	Station	Done	Matrix	StartCollect	Stop Collect	Volume	Units	Shelf	Percent Comp
L48776-1	BD-22	*	WD	12/01/11 18:40	12/08/11 15:40			WH20D	
L48853-1	BD-22	*	WD	12/08/11 15:40	12/15/11 15:40			WH22C	
L48912-1	BD-22	*	WD	12/15/11 15:40	12/22/11 15:20			WH21C	
L48967-1	BD-22	*	WD	12/22/11 15:20	12/29/11 17:20			WH24B	

Count: 4

Raw Data Sheet (rawdata)

01/20/12 10:54

Work Order: **L48995** Customer: **Exelon**

Analysis: **GR-B** Project: **EX001-3ERSMPBRAID-05**

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48995-1		GR-B		.00E+00			.1559		01-13-12	G2D	254	100	135	100	.316		DW
				500					22:06			M		M			
Decll BD-22				ml													

Activity: 3.39E+00 Error: 1.12E+00 MDC: 1.54E+00 pCi/L **L48995-1** **GR-B**

Raw Data Sheet (rawdata)

01/20/12 10:54

Work Order: L48995 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48995-1		H-3 (DIST)		.00E+00			0		01-12-12	LS8	162	60	127.8	60	.254		DW
				10					20:53			M		M			
Decll BD-22				ml													
Activity: 1.02E+02		Error: 1.01E+02		MDC: 1.56E+02		pCi/L		L48995-1	H-3 (DIST)								

Raw Data Sheet (rawdata)

01/20/12 10:54

Work Order: L48995 Customer: Exelon

Analysis: I-131 Project: EX001-3ERHMPERAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L48995-1		I-131 (LOW LVL)	29-dec-11 17:20	.00E+00 3500 ml			.0204	89.87	01-18-12 16:22	Y3C	167	500 M	372	800 M	.3	.182	BP
Decll BD-22																	
Activity: -3.44E-01 Error: 1.86E-01 MDC: 3.73E-01 pCi/L							L48995-1		I-131 (LOW LVL)								

VAX/VMS Teledyne Brown Eng. Laboratory Gamma Report: 12-JAN-2012 11:33:04.72
TBE01 P-20651A HpGe ********** Aquisition Date/Time: 12-JAN-2012 10:22:00.51

LIMS No., Customer Name, Client ID: L48995-1 WD BRAIDWOOD STATION

Sample ID : 01L48995-1
Sample Type : WD
Quantity : 3.59957E+00 1
Start Channel : 90 Energy Tol : 2.00000
End Channel : 4090 Pk Srch Sens: 5.00000
MDA Constant : 0.00 Library Used: LIBD

Smple Date: 29-DEC-2011 17:20:00.
Geometry : 0135L121508
BKGFILE : 01BG120911MT
Real Time : 0 01:10:57.56
Live time : 0 01:10:56.97

Pk	It	Energy	Area	Bkgnd	FWHM	Channel	%Eff	Cts/Sec	%Err	Fit
1	1	66.49*	35	117	0.97	133.08	4.78E-01	8.15E-03	57.5	8.74E-01
2	1	92.66*	6	116	1.16	185.35	1.28E+00	1.47E-03	336.3	2.00E+00
3	1	141.89*	114	171	6.96	283.67	1.98E+00	2.68E-02	30.6	2.57E+00
4	1	185.57*	6	70	1.02	370.92	1.98E+00	1.39E-03	280.3	1.78E+00
5	1	198.61*	30	94	1.57	396.96	1.95E+00	7.14E-03	64.8	3.03E+00
6	1	238.71*	15	75	1.12	477.05	1.81E+00	3.41E-03	116.1	1.25E+00
7	1	352.28*	17	39	2.38	703.94	1.44E+00	4.08E-03	76.2	4.87E+00
8	1	609.12*	30	14	1.55	1217.21	9.83E-01	7.02E-03	33.4	2.19E+00
9	1	1460.59*	7	10	2.22	2920.16	5.37E-01	1.56E-03	116.0	8.00E-01

Flag: "*" = Peak area was modified by background subtraction

Nuclide Line Activity Report

Nuclide Type: natural

Nuclide	Energy	Area	%Abn	%Eff	Uncorrected pCi/l	Decay Corr pCi/l	2-Sigma %Error
K-40	1460.81	7	10.67*	5.372E-01	2.040E+01	2.040E+01	231.94
RA-226	186.21	6	3.28*	1.984E+00	1.601E+01	1.601E+01	560.65
TH-228	238.63	15	44.60*	1.808E+00	3.179E+00	3.223E+00	232.15
	240.98	------	3.95	1.800E+00	------ Line Not Found		------
U-235	143.76	114	10.50*	1.976E+00	9.685E+01	9.685E+01	61.15
	163.35	------	4.70	2.015E+00	------ Line Not Found		------
	185.71	6	54.00	1.984E+00	9.727E-01	9.727E-01	560.65
	205.31	------	4.70	1.927E+00	------ Line Not Found		------

Flag: "*" = Keyline

Total number of lines in spectrum 9
Number of unidentified lines 5
Number of lines tentatively identified by NID 4 44.44%

Nuclide Type : natural

Nuclide	Hlife	Decay	Uncorrected pCi/l	Decay Corr pCi/l	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
K-40	1.28E+09Y	1.00	2.040E+01	2.040E+01	4.731E+01	231.94	
RA-226	1600.00Y	1.00	1.601E+01	1.601E+01	8.978E+01	560.65	
TH-228	1.91Y	1.01	3.179E+00	3.223E+00	7.482E+00	232.15	
U-235	7.04E+08Y	1.00	9.685E+01	9.685E+01	5.922E+01	61.15	
	Total Activity :		1.364E+02	1.365E+02			
	Grand Total Activity :		1.364E+02	1.365E+02			

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

It	Energy	Area	Bkgnd	FWHM	Channel	Left	Pw	Cts/Sec	%Err	%Eff	Flags
1	66.49	35	117	0.97	133.08	129	8	8.15E-03	****	4.78E-01	
1	92.66	6	116	1.16	185.35	182	9	1.47E-03	****	1.28E+00	
1	198.61	30	94	1.57	396.96	392	10	7.14E-03	****	1.95E+00	
1	352.28	17	39	2.38	703.94	700	9	4.08E-03	****	1.44E+00	
1	609.12	30	14	1.55	1217.21	1212	9	7.02E-03	66.9	9.83E-01	

Flags: "T" = Tentatively associated

Summary of Nuclide Activity

Total number of lines in spectrum	9	
Number of unidentified lines	5	
Number of lines tentatively identified by NID	4	44.44%

Nuclide Type : natural

Nuclide	Hlife	Decay	Wtd Mean Uncorrected pCi/l	Wtd Mean Decay Corr pCi/l	Decay Corr 2-Sigma Error	2-Sigma %Error	Flags
K-40	1.28E+09Y	1.00	2.040E+01	2.040E+01	4.731E+01	231.94	
TH-228	1.91Y	1.01	3.179E+00	3.223E+00	7.482E+00	232.15	
U-235	7.04E+08Y	1.00	9.727E-01	9.727E-01	54.53E-01	560.65	
	Total Activity :		2.455E+01	2.459E+01			

Grand Total Activity : 2.455E+01 2.459E+01

Flags: "K" = Keyline not found "M" = Manually accepted
"E" = Manually edited "A" = Nuclide specific abn. limit

Interference Report

Interfering		Interfered	
Nuclide	Line	Nuclide	Line
U-235	185.71	RA-226	186.21

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/l)	Act error	MDA (pCi/l)	MDA error	Act/MDA
K-40	2.040E+01	4.731E+01	3.664E+01	0.000E+00	0.557
TH-228	3.223E+00	7.482E+00	9.590E+00	0.000E+00	0.336
U-235	9.727E-01	5.453E+00	3.414E+01	0.000E+00	0.028

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/l)	K.L. Ided	Act error	MDA (pCi/l)	MDA error	Act/MDA

BE-7	5.628E+00	2.359E+01	3.939E+01	0.000E+00	0.143
NA-24	-5.753E+05	8.985E+06	1.482E+07	0.000E+00	-0.039
CR-51	-3.161E+01	3.286E+01	4.835E+01	0.000E+00	-0.654
MN-54	-1.156E+00	2.691E+00	4.114E+00	0.000E+00	-0.281
CO-57	5.060E-01	3.122E+00	5.355E+00	0.000E+00	0.094
CO-58	-1.392E+00	2.727E+00	4.079E+00	0.000E+00	-0.341
FE-59	6.780E-01	4.796E+00	8.080E+00	0.000E+00	0.084
CO-60	3.433E-01	3.123E+00	5.164E+00	0.000E+00	0.066
ZN-65	-4.145E+00	6.101E+00	8.504E+00	0.000E+00	-0.487
SE-75	2.305E+00	3.893E+00	6.784E+00	0.000E+00	0.340
SR-85	-9.802E+00	4.493E+00	5.594E+00	0.000E+00	-1.752
Y-88	2.589E+00	3.280E+00	6.362E+00	0.000E+00	0.407
NB-94	1.375E+00	3.312E+00	5.766E+00	0.000E+00	0.238
NB-95	-2.456E-01	2.815E+00	4.606E+00	0.000E+00	-0.053
ZR-95	-9.204E-01	4.942E+00	7.949E+00	0.000E+00	-0.116
MO-99	6.847E+01	5.882E+02	9.976E+02	0.000E+00	0.069
RU-103	6.615E-01	4.170E+00	6.821E+00	0.000E+00	0.097
RU-106	-9.294E+00	2.825E+01	4.547E+01	0.000E+00	-0.204
AG-110m	1.157E+00	2.433E+00	4.371E+00	0.000E+00	0.265
SN-113	1.296E+00	4.071E+00	6.851E+00	0.000E+00	0.189
SB-124	2.053E+00	3.317E+00	5.585E+00	0.000E+00	0.368
SB-125	-3.432E+00	6.961E+00	1.042E+01	0.000E+00	-0.329
TE-129M	-1.015E+01	4.377E+01	6.852E+01	0.000E+00	-0.148
I-131	-3.563E+00	8.865E+00	1.376E+01	0.000E+00	-0.259
TE-132	1.134E+01	4.543E+01	7.712E+01	0.000E+00	0.147
BA-133	2.134E+00	4.342E+00	6.668E+00	0.000E+00	0.320
CS-134	-3.672E-01	3.116E+00	4.466E+00	0.000E+00	-0.082
CS-136	2.955E+00	5.443E+00	9.776E+00	0.000E+00	0.302
CS-137	1.034E+00	2.909E+00	5.112E+00	0.000E+00	0.202
CE-139	-3.673E-01	3.040E+00	5.069E+00	0.000E+00	-0.072
BA-140	5.077E+00	2.225E+01	3.670E+01	0.000E+00	0.138
LA-140	5.485E+00	6.201E+00	1.226E+01	0.000E+00	0.447
CE-141	9.001E-01	6.650E+00	1.031E+01	0.000E+00	0.087
CE-144	-1.271E+01	2.744E+01	3.927E+01	0.000E+00	-0.324
EU-152	-3.734E+00	9.209E+00	1.442E+01	0.000E+00	-0.259
EU-154	-4.904E-01	6.426E+00	1.085E+01	0.000E+00	-0.045
RA-226	1.601E+01	8.978E+01	1.377E+02	0.000E+00	0.116
AC-228	4.943E+00	1.132E+01	2.120E+01	0.000E+00	0.233
TH-232	4.920E+00	1.127E+01	2.111E+01	0.000E+00	0.233
U-238	-1.201E+02	3.410E+02	5.685E+02	0.000E+00	-0.211
AM-241	2.929E+01	4.468E+01	7.584E+01	0.000E+00	0.386

```
A,01L48995-1      ,01/12/2012 11:33,12/29/2011 17:20,   3.600E+00,L48995-1 WD BR
B,01L48995-1      ,LIBD                ,01/12/2012 09:47,0135L121508S
C,K-40    ,YES,   2.040E+01,   4.731E+01,   3.664E+01,,    0.557
C,TH-228  ,YES,   3.223E+00,   7.482E+00,   9.590E+00,,    0.336
C,U-235   ,YES,   9.727E-01,   5.453E+00,   3.414E+01,,    0.028
C,BE-7    ,NO ,   5.628E+00,   2.359E+01,   3.939E+01,,    0.143
C,NA-24   ,NO ,  -5.753E+05,   8.985E+06,   1.482E+07,,   -0.039
C,CR-51   ,NO ,  -3.161E+01,   3.286E+01,   4.835E+01,,   -0.654
C,MN-54   ,NO ,  -1.156E+00,   2.691E+00,   4.114E+00,,   -0.281
C,CO-57   ,NO ,   5.060E-01,   3.122E+00,   5.355E+00,,    0.094
C,CO-58   ,NO ,  -1.392E+00,   2.727E+00,   4.079E+00,,   -0.341
C,FE-59   ,NO ,   6.780E-01,   4.796E+00,   8.080E+00,,    0.084
C,CO-60   ,NO ,   3.433E-01,   3.123E+00,   5.164E+00,,    0.066
C,ZN-65   ,NO ,  -4.145E+00,   6.101E+00,   8.504E+00,,   -0.487
C,SE-75   ,NO ,   2.305E+00,   3.893E+00,   6.784E+00,,    0.340
C,SR-85   ,NO ,  -9.802E+00,   4.493E+00,   5.594E+00,,   -1.752
C,Y-88    ,NO ,   2.589E+00,   3.280E+00,   6.362E+00,,    0.407
C,NB-94   ,NO ,   1.375E+00,   3.312E+00,   5.766E+00,,    0.238
C,NB-95   ,NO ,  -2.456E-01,   2.815E+00,   4.606E+00,,   -0.053
C,ZR-95   ,NO ,  -9.204E-01,   4.942E+00,   7.949E+00,,   -0.116
C,MO-99   ,NO ,   6.847E+01,   5.882E+02,   9.976E+02,,    0.069
C,RU-103  ,NO ,   6.615E-01,   4.170E+00,   6.821E+00,,    0.097
C,RU-106  ,NO ,  -9.294E+00,   2.825E+01,   4.547E+01,,   -0.204
C,AG-110m ,NO ,   1.157E+00,   2.433E+00,   4.371E+00,,    0.265
C,SN-113  ,NO ,   1.296E+00,   4.071E+00,   6.851E+00,,    0.189
C,SB-124  ,NO ,   2.053E+00,   3.317E+00,   5.585E+00,,    0.368
C,SB-125  ,NO ,  -3.432E+00,   6.961E+00,   1.042E+01,,   -0.329
C,TE-129M ,NO ,  -1.015E+01,   4.377E+01,   6.852E+01,,   -0.148
C,I-131   ,NO ,  -3.563E+00,   8.865E+00,   1.376E+01,,   -0.259
C,TE-132  ,NO ,   1.134E+01,   4.543E+01,   7.712E+01,,    0.147
C,BA-133  ,NO ,   2.134E+00,   4.342E+00,   6.668E+00,,    0.320
C,CS-134  ,NO ,  -3.672E-01,   3.116E+00,   4.466E+00,,   -0.082
C,CS-136  ,NO ,   2.955E+00,   5.443E+00,   9.776E+00,,    0.302
C,CS-137  ,NO ,   1.034E+00,   2.909E+00,   5.112E+00,,    0.202
C,CE-139  ,NO ,  -3.673E-01,   3.040E+00,   5.069E+00,,   -0.072
C,BA-140  ,NO ,   5.077E+00,   2.225E+01,   3.670E+01,,    0.138
C,LA-140  ,NO ,   5.485E+00,   6.201E+00,   1.226E+01,,    0.447
C,CE-141  ,NO ,   9.001E-01,   6.650E+00,   1.031E+01,,    0.087
C,CE-144  ,NO ,  -1.271E+01,   2.744E+01,   3.927E+01,,   -0.324
C,EU-152  ,NO ,  -3.734E+00,   9.209E+00,   1.442E+01,,   -0.259
C,EU-154  ,NO ,  -4.904E-01,   6.426E+00,   1.085E+01,,   -0.045
C,RA-226  ,NO ,   1.601E+01,   8.978E+01,   1.377E+02,,    0.116
C,AC-228  ,NO ,   4.943E+00,   1.132E+01,   2.120E+01,,    0.233
C,TH-232  ,NO ,   4.920E+00,   1.127E+01,   2.111E+01,,    0.233
C,U-238   ,NO ,  -1.201E+02,   3.410E+02,   5.685E+02,,   -0.211
C,AM-241  ,NO ,   2.929E+01,   4.468E+01,   7.584E+01,,    0.386
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TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

02/09/2012

LIMS #:	L49145
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/17/2012
Delivery Date:	02/21/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L49145-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

This report shall not be reproduced or distributed except in its entirety.

Report of Analysis

02/09/12 10:11

L49145

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID: **BD-22**
Station: BD-22
Description: Wilmington
LIMS Number: L49145-1

Collect Start: 01/05/2012 16:00
Collect Stop: 01/12/2012 17:00
Receive Date: 01/17/2012

Matrix: Drinking Water (WD)
Volume:
% Moisture:

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
H-3 (DIST)	2011	**2.02E+02**	1.15E+02	1.71E+02	pCi/L		10	ml		01/26/12	60	M	+			
I-131 (LOW LVL)	2012	-3.46E-01	2.32E-01	**4.04E-01**	pCi/L		4000	ml	01/12/12 17:00	02/07/12	800	M	U			

Comment: 1 Weekly composite-hold for monthly composite

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L49145

WH26B

Braidwood Generating Station

Sample Collection/Receipt Sheet

Public Water Sample

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	01/05/2012	16:00	01/12/2012	17:00	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by:

Date: 01/12/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 01/16/2012 Hold for Quarterly H-3 Composite.

Date: 1/17/12 BD-22

10:00

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5574

Shipping Request

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. Description of items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)

Braidwood:
BD-22

B. Purpose of Shipment:

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. Comments or instructions to Vendor:

D. Control Data:

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 01-16-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

01/17/12 14:05

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

SR #: SR30200

Client: Exelon **Project #: EX001-3EREMPBRAID-05** **LIMS #L49145**

Initiated By: JSIMMONS
Init Date: 01/17/12 Receive Date: 01/17/12

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

02/09/12 10:11

Work Order: L49145 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49145-1		H-3 (DIST)					0		01-26-12	LS8	193	60	130.2	60	.234		DW
BD-22				10 ml					22:26			M		M			
Activity:	2.02E+02	Error:	1.15E+02	MDC:	1.71E+02	pCi/L		L49145-1	H-3 (DIST)								

Raw Data Sheet (rawdata)

02/09/12 10:11

Work Order: L49145 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49145-1		I-131 (LOW LVL)	12-jan-12 17:00	4000 ml			.0212	95.93	02-07-12 16:50	Y3C	295	800 M	372	800 M	.3	.109	BP
BD-22																	
Activity: -3.46E-01		Error: 2.32E-01	MDC: **4.04E-01**	pCi/L			L49145-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

02/09/2012

LIMS #:	L49228
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/24/2012
Delivery Date:	02/28/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L49228-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

Report of Analysis

02/09/12 10:12

L49228

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID:	**BD-22**	Collect Start:	01/12/2012 17:00	Matrix:	Drinking Water (WD)
Station:	BD-22	Collect Stop:	01/19/2012 17:40	Volume:	
Description:	Wilmington	Receive Date:	01/24/2012	% Moisture:	
LIMS Number:	L49228-1				

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
H-3 (DIST)	2011	-6.54E+01	9.68E+01	**1.66E+02**	pCi/L		10	ml		02/01/12	60	M	U			
I-131 (LOW LVL)	2012	-3.32E-02	1.24E-01	**2.40E-01**	pCi/L		4000	ml	01/19/12 17:40	02/07/12	400	M	U			H

Comment: 1 Weekly composite-hold for monthly composite

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L49228

WH27D

Braidwood Generating Station

Public Water Sample

Sample Collection/Receipt Sheet

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	01/12/2012	17:00	01/19/2012	17:40	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by:

Date: 01/19/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 01/23/2012 Hold for Quarterly H-3 Composite.

Date: 1/24/12 BD-22

10:00

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5578

Shipping Request

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. Description of Items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)

Braidwood:
BD-22:
5 gallons of well water samples:

B. Purpose of Shipment:

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. Comments or Instructions to Vendor:

D. Control Data:

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 01-23-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

01/25/12 09:04

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

SR #: SR30281

Client: Exelon **Project #: EX001-3EREMPBRAID-05** **LIMS #L49228**

Initiated By: JSIMMONS
Init Date: 01/25/12 Receive Date: 01/24/12

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

02/09/12 10:12

Work Order: L49228 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49228-1		H-3 (DIST)					0		02-01-12 14:54	LS8	104	60 M	124.2	60 M	.235		DW
BD-22				10 ml													
Activity: -6.54E+01	Error:	9.68E+01	MDC:	1.66E+02	pCi/L		L49228-1		H-3 (DIST)								

Raw Data Sheet (rawdata)

02/09/12 10:12

Work Order: L49228 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49228-1	I-131	(LOW LVL)	19-jan-12 17:40	4000 ml			.0275	124.43	02-07-12 16:50	YIB	166	400 M	349	800 M	.294	.197	BP
BD-22																	
Activity: -3.32E-02	Error:	1.24E-01	MDC:	2.40E-01	pCi/L		L49228-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

02/16/2012

LIMS #:	L49281
Project ID#:	EX001-3EREMPBRAID-05
Received:	01/31/2012
Delivery Date:	03/06/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L49281-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

This report shall not be reproduced or distributed except in its entirety.

Report of Analysis

02/16/12 08:48

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

L49281

Braidwood Station

EX001-3EREMPBRAID-05

Sample ID: **BD-22**
Station: BD-22
Description: Wilmington
LIMS Number: L49281-1

Collect Start: 01/19/2012 17:40
Collect Stop: 01/26/2012 17:00
Receive Date: 01/31/2012

Matrix: Drinking Water (WD)
Volume:
% Moisture:

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
H-3 (DIST)	2011	7.51E+01	1.04E+02	**1.64E+02**	pCi/L		10	ml		02/09/12	60	M	U
I-131 (LOW LVL)	2012	-1.43E-02	3.06E-01	**5.41E-01**	pCi/L		4000	ml	01/26/12 17:00	02/14/12	150	M	U

Comment: 1 Weekly composite-hold for monthly composite

223 of 238

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L49281
WH28B

Braidwood Generating Station

Public Water Sample

Sample Collection/Receipt Sheet

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	01/19/2012	17:40	01/26/2012	17:00	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: fedEx

Received by: Jonathan

Date: 01/26/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 01/30/2012 Hold for Quarterly H-3 Composite.

Date: 1/31/12 BD-22

John

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5588 L49281 4 of 7

Shipping Request

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. Description of items (include, Quantity, Model No., Type, Serial No., and Gov't Property No.)

Braidwood:
2 gallons : BD-22

B. Purpose of Shipment:

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. Comments or instructions to Vendor:

D. Control Data:

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 01-30-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

Project #: EX001-3EREMPBRAID-05 **LIMS #L49281**

Initiated By: JSIMMONS
Init Date: 01/31/12 Receive Date: 01/31/12

Notification of Variance

Person Notified: Contacted By:
Notify Date:
Notify Method:
Notify Comment:

Client Response

Person Responding:
Response Date:
Response Method:
Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

02/16/12 08:48

Work Order: L49281 Customer: Exelon

Analysis: H-3 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49281-1		H-3 (DIST)					0		02-09-12 20:39	LS8	151	60 M	126.6	60 M	.24		DW
BD-22				10 ml													
Activity: 7.51E+01	Error:	1.04E+02	MDC:	1.64E+02	pCi/L		L49281-1		H-3 (DIST)								

Raw Data Sheet (rawdata)

02/16/12 08:48

Work Order: **L49281** Customer: **Exelon**

Analysis: **I-131** Project: **EX001-3EREMPBRAID-05**

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49281-1		I-131 (LOW LVL)	26-Jan-12 17:00	4000 ml			.021	95.02	02-14-12 17:00	Y1D	65	150 M	88	200 M	.283	.195	BP
BD-22																	
Activity: -1.43E-02		Error: 3.06E-01	MDC: **5.41E-01**	pCi/L			L49281-1		I-131 (LOW LVL)								

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

Eric Cieszkiewicz
Braidwood Station
Exelon Generation Company LLC
35100 South Rte 53, Suite 84
Braceville, IL 60407-9619

Report of Analysis/Certificate of Conformance

02/28/2012

LIMS #:	L49356
Project ID#:	EX001-3EREMPBRAID-05
Received:	02/07/2012
Delivery Date:	03/13/2012
P.O.#:	01000298 REL.#00018
Release #:	
SDG#:	

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Mark Yust for KEITH JETER
Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
BD-22	L49356-1	BD-22

Method Reference Numbers

Matrix	Analysis	Method Reference
WD	H-3 (DIST)	EPA 906.0

This report shall not be reproduced or distributed except in its entirety.

Report of Analysis

02/28/12 11:06

L49356

Braidwood Station

EX001-3EREMPBRAID-05

TELEDYNE BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID:	**BD-22**	Collect Start:	01/26/2012 17:00	Matrix:	Drinking Water (WD)
Station:	BD-22	Collect Stop:	02/02/2012 16:40	Volume:	
Description:	Wilmington	Receive Date:	02/07/2012	% Moisture:	
LIMS Number:	L49356-1				

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
H-3 (DIST)	2011	**2.70E+02**	1.34E+02	1.93E+02	pCi/L		10	ml		02/16/12	60	M	+		
I-131 (LOW LVL)	2012	-1.76E-01	4.24E-01	**7.17E-01**	pCi/L		4000	ml	02/02/12 16:40	02/24/12	200	M	U		

Comment: 1 Weekly composite-hold for monthly composite

Flag Values
U = Compound/Analyte not detected (< MDC) or less than 2 sigma
\+ = Activity concentration exceeds MDC and 2 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 2 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum
Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

L49356

WH30B

Braidwood Generating Station

Sample Collection/Receipt Sheet

1

Public Water Sample

EXELON NUCLEAR

Lab. No.	Client ID	Station Code	Sample Medium	Start date	Start time	Stop date	Stop time	Sample Size	Analysis	Comments
	Wilmington	BD-22	DW	01/26/2012	17:00	02/02/2012	16:40	2 gal.	H-3 (DIST),I-131 (LOW LVL)	Weekly composite-hold for monthly composite

Collected by: A. Lewis

Shipped by: FedEx

Received by: [signature]

Date: 02/02/2012 BD-22 Composite weekly sample for Monthly Composite for Gamma, GR-B

Date: 02/06/2012 Hold for Quarterly H-3 Composite.

Date: 2/7/12 BD-22

1000

Environmental, Inc.
Midwest Laboratory
An Allegheny Technologies Company

SR NO. 5594

Shipping Request

149356 pg 4 of 7

MIDWEST LABORATORY
700 LANDWEHR ROAD • NORTHBROOK, IL 60062-2310 • (847) 564-0700
FAX (847) 564-4517

NOTE!! When returning or replacing this material, please reference S/R No. on all documents.

PART I (To be completed by originator)

A. **Description of Items (Include, Quantity, Model No., Type, Serial No., and Gov't Property No.)**

Braidwood:
BD-22

B. **Purpose of Shipment:**

- ☐ Return for credit-No replacement:
- ☐ Return for rework or replacement at Vendor's expense.
- ☐ Return for rework or replacement at Environmental, Inc's expense.
- ☐ Furnished on Consignment for use on P.O. No. _____
- ☐ Other (explain) _____

C. **Comments or instructions to Vendor:**

D. Control Data:

Vendor _____
P.O. No. _____
W.O./Acct. No. _____
Location of material _____
Ship no later than _____
Ship via _____ Collect ☐ Prepaid ☐
No. Pcs./ctns. _____ Cu. Ft. _____
Weight _____ Est. Val. _____

Part II (To be completed by Shipping Dept.)

Actual method of shipment Federal Express
Date Shipped 02-06-2012
Collect _____ Prepaid _____
FOB point _____
Waybill No. _____
Misc. _____

SHIP TO: TBE

L.B.
ORIGINATOR'S INITIALS

ATTN: _____

02/07/12 10:56

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report

SR #: SR30394

Client: Exelon

Project #: EX001-3EREMPBRAID-05

LIMS #L49356

Initiated By: JSIMMONS
Init Date: 02/07/12 Receive Date: 02/07/12

Notification of Variance

Person Notified: Contacted By:

Notify Date:

Notify Method:

Notify Comment:

Client Response

Person Responding:

Response Date:

Response Method:

Response Comment

	Criteria	Yes	No	NA	Comment
1	Shipping container custody seals present and intact.			NA	
2	Sample container custody seals present and intact.			NA	
3	Sample containers received in good condition	Y			
4	Chain of custody received with samples	Y			
5	All samples listed on chain of custody received	Y			
6	Sample container labels present and legible.	Y			
7	Information on container labels correspond with chain of custody	Y			
8	Sample(s) properly preserved and in appropriate container(s)			NA	
9	Other (Describe)			NA	

Raw Data Sheet (rawdata)

02/28/12 11:06

Work Order: **L49356** Customer: **Exelon**

Analysis: **H-3** Project: **EX001-3SREMPBRAID-05**

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49356-1		H-3 (DIST)					0		02-16-12 23:19	LS7	184	60 M	114	60 M	.194		DW
BD-22				10 ml													

Activity: **2.70E+02** Error: 1.34E+02 MDC: 1.93E+02 pCi/L **L49356-1** **H-3 (DIST)**

Raw Data Sheet (rawdata)

02/28/12 11:06

Work Order: L49356 Customer: Exelon

Analysis: I-131 Project: EX001-3EREMPBRAID-05

Sample ID / Client ID	Run #	Analysis	Reference Date/Time	Volume/ Aliquot	Scavenge Date/Time	Milking Date/Time	Mount Weight	Recovery	Count Date/Time	Detector ID	Total Counts	Sample dt	Bkg Counts	Bkg dt	Eff.	Decay & Ingrowth Factor	Analyst
L49356-1		I-131 (LOW LVL)	02-feb-12 16:40	4000 ml			.0206	93.21	02-24-12 17:08	XIB	116	200 M	129	200 M	.296	.151	BP
BD-22																	
Activity: -1.76E-01	Error:	4.24E-01	MDC:	7.17E-01	pCi/L		L49356-1		I-131 (LOW LVL)								

ATTACHMENT 7

ERRATA CORRECTIONS FROM 2010 REPORT

BRAIDWOOD NUCLEAR POWER STATION
RADIOACTIVE EFFLUENT RELEASE REPORT FOR 2010
UNIT 1 (Docket Number 50-456)

GASEOUS EFFLUENTS
SUPPLEMENTAL RELEASE INFORMATION

A. Batch Release	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	**Total**
1. Total Number of Batch Releases	20	18	20	23	**81**
2. Total Time Period for Batch Releases (minutes)	1,158	984	778	35,138	**38,058**
3. Maximum Time Period for a Batch Release (minutes)	305	414	103	14,400	**N/A**
4. Average Time Period for a Batch Release (minutes)	58	55	39	1,528	**N/A**
5. Minimum Time Period for a Batch Release (minutes)	20	22	21	22	**N/A**
B. Abnormal Releases					
1. Number of Releases	0	0	1	0	**1**
2. Total Activity Released (Ci)	0	0	4.31E-02	0	**0**

ATTACHMENT 8

OFFSITE DOSE CALCULATION MANUAL (ODCM)