

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report No. 50-382/92-20

Operating License No. NPF-38

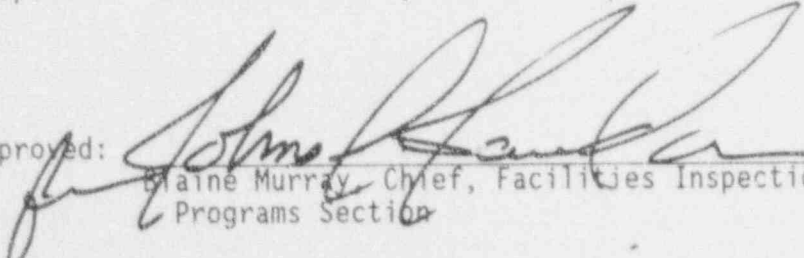
Licensee: Entergy Operations, Inc. (EOI)
P.O. Box B
Killona, Louisiana 70066

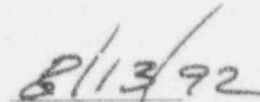
Facility Name: Waterford Steam Electric Station, Unit 3

Inspection At: Waterford-3 Site, Killona, St. Charles Parish, Louisiana

Inspection Conducted: July 27-31, 1992

Inspector: Lorenzo Wilborn, Radiation Specialist

Approved: 
Elaine Murray, Chief, Facilities Inspection
Programs Section


Date

Inspection Summary

Inspection Conducted July 27-31, 1992 (Report 50-382/92-20)

Areas Inspected: Routine, announced inspection of the licensee's radiochemistry and health physics programs relating to the radiological aspects of the confirmatory measurements program.

Results: Within the areas inspected, no violations or deviations were identified. The following is a summary of the inspection findings:

- o The licensee's radiological measurements results were in close agreement with the staff's confirmatory measurements. The radiochemistry counting room results were 98 percent agreement, and the health physics counting room results were 100 percent agreement, which were consistent with the radiochemistry 100 percent agreement and health physics 99 percent agreement achieved during the last NRC inspection of this area in March 1990.
- o The radiochemistry and health physics radiological counting facilities were well maintained.

DETAILS

1. PERSONS CONTACTED

EOI

- *T. R. Leonard, Technical Services Manager
- *A. S. Bergeron, Chemistry Supervisor
- *T. J. Gaudet, Operational Licensing Supervisor
- *D. L. Hoel, Health Physics Supervisor
- *P. M. Kelly, Health Physics Supervisor
- *D. Landeche, Lead Health Physics Supervisor-Operations
- *A. S. Lockhart, Quality Assurance Manager
- D. C. Madere, Chemistry Superintendent
- *S. Ramzy, Radiation Control Supervisor
- *J. A. Ridgel, Radiation Protection Superintendent
- *J. C. Ruffin, Health Physics Technician
- *C. J. Thomas, Licensing Engineer

NRC

- W. F. Smith, Senior Resident Inspector
- *J. L. Dixon, Resident Inspector
- *A. D. Gaines, Radiation Specialist

*Indicates those present during the exit meeting on July 31, 1992.

2. RADIOLOGICAL CONFIRMATORY MEASUREMENTS (84750)

Radiological confirmatory measurements were performed by the licensee on the following samples in the radiochemistry and health physics counting rooms. The inspector performed measurements in the Region IV mobile laboratory onsite. The tritium sample was analyzed in the Region IV office laboratory.

- o WAT-3 air particulate filter sample obtained through the collection of crud from the reactor coolant system.
- o WAT-3 waste liquid sample obtained from Tank "B" - 1 liter Marinelli beaker.
- o WAT-3 reactor coolant system liquid sample - 4 ml in a 20 ml scintillation vial.
- o WAT-3 reactor coolant system gas sample - 23 cc in a 33 cc gas bulb.
- o WAT-3 Scott charcoal cartridge sample.
- o WAT-3 containment atmosphere sample - 1 liter Marinelli beaker.
- o WAT-3 reactor coolant system tritium sample.

The radiological confirmatory measurements consisted of comparing the analysis results of the licensee's radiochemistry and health physics counting rooms and the Region IV mobile laboratory using routine methods and equipment. The Region IV mobile laboratory's measurements are referenced to the National Institute of Standards and Technology by laboratory intercomparisons. The radiological confirmatory measurement comparisons were made only for those nuclides identified by NRC as being present in concentrations greater than 10 percent of the respective isotopic values for liquid and gas concentrations as stated in 10 CFR Part 20, Appendix B, Table II.

The licensee maintained three high-purity germanium detectors in the radiochemistry counting room and three high-purity germanium detectors in the health physics counting room. These detectors are used routinely for isotopic analysis of radioactive samples to demonstrate compliance with technical specifications and regulatory requirements. At the time of the inspection, one detector each in the radiochemistry and health physics counting rooms was out of service. This resulted in the Region IV mobile laboratory comparing measurements with four detectors. The inspector noted that both of these counting rooms were well maintained.

The licensee performed the reactor coolant system tritium analysis on their liquid scintillation counting system in the radiochemistry counting room. The NRC performed the reactor coolant system tritium analysis on a liquid scintillation counting system in the Region IV office laboratory.

The individual sample analyses and comparison of analytical results of the radiological confirmatory measurements are tabulated in Attachment 1. Attachment 3 describes the criteria used to compare the analytical results.

The tabulated results from the four detectors are listed in the following order:

- o Radiochemistry counting room detector No. Cave 1.
- o Radiochemistry counting room detector No. Cave 2.
- o Health Physics counting room detector No. H.
- o Health Physics counting room detector No. O.

The detectors labeled Cave 1 and Cave 2 are primarily used for isotopic analysis of reactor coolant system samples. The detectors labeled H and O are primarily used for isotopic analysis of radioactive waste samples and building atmosphere.

The licensee's radiochemistry counting room gamma isotopic analysis results from the samples listed in Attachment 1 showed 98 percent agreement with the NRC analysis results based on 41 agreement results out of 42 total results compared. The licensee's radiochemistry counting room performance in the area of radiological confirmatory measurements was similar to the 100 percent agreement achieved during the last NRC inspection in this area in March 1990.

The licensee's radiochemistry counting room tritium analysis result of the reactor coolant system sample was in agreement with the NRC analysis result.

The licensee's health physics counting room gamma isotopic analysis results from the samples listed in Attachment 1 showed 100 percent agreement with the NRC analysis results based on 51 agreement results out of 51 total results compared. The licensee's health physics counting room performance in the area of radiological confirmatory measurements demonstrated the same high quality of performance of 99 percent agreement achieved during the last NRC inspection in this area in March 1990.

The licensee performed radiological confirmatory measurements on a quality control liquid certified sample prepared by NRC's reference laboratory, the Department of Energy, Radiological and Environmental Sciences Laboratory in Idaho Falls, Idaho. The licensee's analytical results were compared to the certified sample activities and the results of the comparisons are presented in Attachment 2. The gamma isotopic analysis and the beta isotopic analysis results were in 100 percent agreement.

No violations or deviations were identified.

Conclusion

The radiochemistry and health physics programs associated with radiological confirmatory measurements were conducted effectively. The radiochemistry and health physics radiological counting rooms were functional were well maintained. The licensee's performance in the area of radiological confirmatory measurements was outstanding.

3. EXIT MEETING

The inspector met with the resident inspector and the licensee's representatives denoted in paragraph 1 at the conclusion of the inspection on July 31, 1992, and summarized the scope and findings of the inspection as presented in this report. The licensee did not identify as proprietary any of the materials provided to, or reviewed by, the inspector during the inspection.

ATTACHMENT 1
 RADIOLOGICAL CONFIRMATORY MEASUREMENT RESULTS
 WATERFORD STEAM ELECTRIC STATION, UNIT 3
 NRC INSPECTION REPORT: 50-382/92-20

1. WAT-3 Air Particulate Filter Sample (WF052A) (Standardized: 11:00, CDT, July 28, 1992) Detectors Cave 1, Cave 2, H, and O				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{Sample}$)	NRC Results ($\mu\text{Ci}/\text{Sample}$)	WAT-3/NRC Ratio	Comparison Decision
Cr-51	9.733 \pm 0.240E-2	8.332 \pm 0.174E-2	1.17	Agreement
	9.826 \pm 0.250E-2		1.18	Agreement
	9.925 \pm 0.120E-2		1.19	Agreement
	9.716 \pm 0.121E-2		1.17	Agreement
Mn-54	4.219 \pm 0.235E-3	4.121 \pm 0.140E-2	1.02	Agreement
	4.730 \pm 0.201E-3		1.15	Agreement
	4.595 \pm 0.120E-3		1.12	Agreement
	4.575 \pm 0.133E-3		1.11	Agreement
Co-57	7.868 \pm 0.930E-4	7.003 \pm 0.821E-2	1.12	Agreement ⁺
	8.895 \pm 1.088E-4		1.27	Agreement
	8.379 \pm 0.511E-4		1.20	Agreement
	8.168 \pm 0.487E-4		1.17	Agreement
Co-58	4.608 \pm 0.013E-1	4.088 \pm 0.007E-1	1.13	Agreement
	4.710 \pm 0.011E-1		1.15	Agreement
	4.735 \pm 0.006E-1		1.16	Agreement
	4.828 \pm 0.006E-1		1.18	Agreement

Attachment 1 (cont')

1. (cont')				
Fe-59	$3.579 \pm 0.397E-3$	$3.284 \pm 0.184E-3$	1.09	Agreement
	$4.459 \pm 0.379E-3$		1.36	Disagreement
	$4.037 \pm 0.209E-3$		1.23	Agreement
	$4.091 \pm 0.268E-3$		1.25	Agreement
Co-60	$1.118 \pm 0.032E-2$	$1.016 \pm 0.016E-2$	1.10	Agreement
	$1.196 \pm 0.026E-2$		1.18	Agreement
	$1.134 \pm 0.014E-2$		1.12	Agreement
	$1.139 \pm 0.017E-2$		1.12	Agreement
Nb-95	$3.747 \pm 0.048E-2$	$3.157 \pm 0.025E-2$	1.19	Agreement
	$3.720 \pm 0.039E-2$		1.18	Agreement
	$3.743 \pm 0.020E-2$		1.19	Agreement
	$3.875 \pm 0.024E-2$		1.22	Agreement
Zr-95	$2.646 \pm 0.069E-2$	$2.388 \pm 0.036E-2$	1.11	Agreement
	$2.904 \pm 0.058E-2$		1.22	Agreement
	$2.829 \pm 0.028E-2$		1.18	Agreement
	$2.821 \pm 0.030E-2$		1.18	Agreement
Ru-103	$10.150 \pm 2.984E-4$	$9.778 \pm 1.776E-4$	1.04	Agreement
	$13.270 \pm 3.054E-4$		1.35	Agreement
	$10.420 \pm 1.343E-4$		1.07	Agreement
	$10.080 \pm 1.368E-4$		1.03	Agreement
Sn-113	$4.729 \pm 0.368E-3$	$3.740 \pm 0.201E-3$	1.26	Agreement
	$4.547 \pm 0.299E-3$		1.22	Agreement
	$4.534 \pm 0.173E-3$		1.21	Agreement
	$4.429 \pm 0.165E-3$		1.18	Agreement

Attachment 1 (cont')

1. (cont')				
La-140	$1.851 \pm 0.215E-3$	$1.268 \pm 0.080E-3$	1.46	Agreement
	$2.111 \pm 0.150E-3$		1.66	Agreement
	$1.544 \pm 0.079E-3$		1.22	Agreement
	$1.404 \pm 0.077E-3$		1.11	Agreement

Attachment 1 (cont')

2. WAT-3 Waste Liquid "Tank B" Sample (1000 ml in 1 Liter Marinelli Beaker) (WF053A) (Sampled: 11:00, CDT, July 28, 1992) Detectors H and O				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{Sample}$)	NRC Results ($\mu\text{Ci}/\text{Sample}$)	WAT-3/NRC Ratio	Comparison Decision
Mn-54	1.001 \pm 0.117E-3	1.092 \pm 0.067E-3	0.92	Agreement
	1.024 \pm 0.118E-3		0.94	Agreement
Co-58	4.677 \pm 0.148E-3	4.857 \pm 0.105E-3	0.96	Agreement
	4.550 \pm 0.151E-3		0.94	Agreement
Co-60	8.165 \pm 0.202E-3	8.200 \pm 0.143E-3	1.00	Agreement
	7.745 \pm 0.218E-3		0.94	Agreement
Nb-95	2.053 \pm 0.123E-3	2.217 \pm 0.082E-3	0.93	Agreement
	2.002 \pm 0.127E-3		0.90	Agreement
Zr-95	0.925 \pm 0.169E-3	1.045 \pm 0.122E-3	0.89	Agreement
	0.908 \pm 0.130E-3		0.87	Agreement
Ag-110M	10.540 \pm 1.999E-4	7.318 \pm 0.879E-4	1.44	Agreement
	9.636 \pm 1.877E-4		1.32	Agreement
Sn-113	-----	2.288 \pm 0.792E-4	----	-----
	1.988 \pm 0.786E-4		0.87	Agreement
Sb-125	7.192 \pm 0.372E-3	6.764 \pm 0.202E-3	1.06	Agreement
	6.993 \pm 0.302E-3		1.03	Agreement

Attachment 1 (cont')

2. (cont')				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{Sample}$)	NRC Results ($\mu\text{Ci}/\text{Sample}$)	WAT-3/NRC Ratio	Comparison Decision
I-131	5.435 \pm 1.057E-4	4.333 \pm 0.531E-4	1.25	Agreement
	5.513 \pm 0.860E-4		1.27	Agreement
Cs-134	6.174 \pm 1.274E-4	6.711 \pm 0.714E-4	0.92	Agreement
	5.807 \pm 0.936E-4		0.87	Agreement
Cs-137	1.258 \pm 0.097E-3	1.211 \pm 0.057E-3	1.04	Agreement
	1.153 \pm 0.090E-3		0.95	Agreement

Attachment 1 (cont')

3. WAT-3 RCS Liquid Sample (4 ml in 20 ml Scintillation Vial) (WF054A) (Sampled: 22:35, CDT, July 28, 1992) Detectors Cave 1 and Cave 2				
<u>Nuclide</u>	<u>WAT-3 Results</u> <u>($\mu\text{Ci}/\text{ml}$)</u>	<u>NRC Results</u> <u>($\mu\text{Ci}/\text{ml}$)</u>	<u>WAT-3/NRC</u> <u>Ratio</u>	<u>Comparison</u> <u>Decision</u>
Na-24	3.028±0.235E-3	3.220±0.085E-3	0.94	Agreement
	2.716±0.172E-3		0.84	Agreement
I-131	3.666±0.293E-3	3.292±0.059E-3	1.11	Agreement
	3.102±0.194E-3		0.94	Agreement
I-132	3.650±0.043E-2	3.607±0.092E-2	1.01	Agreement
	3.934±0.872E-2		1.09	Agreement
I-133	2.763±0.033E-2	3.031±0.014E-2	0.91	Agreement
	2.814±0.028E-2		0.93	Agreement
I-135	4.430±0.151E-2	4.711±0.069E-2	0.94	Agreement
	4.341±0.198E-2		0.92	Agreement
W-187	2.566±0.853E-3	2.574±0.211E-3	1.00	Agreement
	2.213±0.293E-3		0.86	Agreement

Attachment 1 (cont')

3. WAT-3 RCS Liquid Sample (4 ml in 10 ml Scintillation Vial) (WF054A) (Sampled: 22:35, CDT, July 28, 1992) Detectors Cave 1 and Cave 2				
<u>Nuclide</u>	<u>WAT-3 Results</u> ($\mu\text{Ci/ml}$)	<u>NRC Results</u> ($\mu\text{Ci/ml}$)	<u>WAT-3/NRC</u> <u>Ratio</u>	<u>Comparison</u> <u>Decision</u>
Na-24	3.028 \pm 0.235E-3	3.220 \pm 0.085E-3	0.94	Agreement
	2.716 \pm 0.172E-3		0.84	Agreement
I-131	3.666 \pm 0.293E-3	3.292 \pm 0.059E-3	1.11	Agreement
	3.102 \pm 0.094E-3		0.94	Agreement
I-132	3.650 \pm 0.043E-2	3.607 \pm 0.092E-2	1.01	Agreement
	3.934 \pm 0.872E-2		1.09	Agreement
I-133	2.763 \pm 0.033E-2	3.031 \pm 0.014E-2	0.91	Agreement
	2.814 \pm 0.028E-2		0.93	Agreement
I-135	4.430 \pm 0.151E-2	4.711 \pm 0.069E-2	0.94	Agreement
	4.341 \pm 0.198E-2		0.92	Agreement
W-187	2.566 \pm 0.853E-3	2.574 \pm 0.211E-3	1.00	Agreement
	2.213 \pm 0.293E-3		0.86	Agreement

Attachment 1 (cont')

4. WAT-3 RCS Gas Sample (23 cc in 33 cc Gas Bulb, (WF055A) (Sampled: 23:58, CDT, July 28, 1992) Detectors Cave 1 and Cave 2				
<u>Nuclide</u>	<u>WAT-3 Results</u> ($\mu\text{Ci/cc}$)	<u>NRC Results</u> ($\mu\text{Ci/cc}$)	<u>WAT-3/NRC</u> <u>Ratio</u>	<u>Comparison</u> <u>Decision</u>
Kr-85M	1.642 \pm 0.051E-4	1.610 \pm 0.099E-4	1.02	Agreement
	1.712 \pm 0.063E-4		1.06	Agreement
Xe-133M	2.250 \pm 0.448E-4	1.784 \pm 0.186E-4	1.26	Agreement
	1.506 \pm 0.308E-4		0.84	Agreement
Xe-133	6.161 \pm 0.031E-3	5.401 \pm 0.021E-3	1.14	Agreement
	6.251 \pm 0.037E-3		1.16	Agreement
Xe-135	3.329 \pm 0.016E-3	3.085 \pm 0.014	1.08	Agreement
	3.395 \pm 0.016E-3		1.10	Agreement

Attachment 1 (cont')

5. WAT-3 Scott Charcoal Cartridge Sample (WF056A) (Sampled: 11:00, CDT, July 28, 1992) Detectors H and O				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{Sample}$)	NRC Results ($\mu\text{Ci}/\text{Sample}$)	WAT-3/NRC Ratio	Comparison Decision
I-131	$10.310 \pm 0.032\text{E-}2$	$9.760 \pm 0.044\text{E-}2$	1.06	Agreement
	$10.070 \pm 0.034\text{E-}2$		1.03	Agreement
I-133	$1.410 \pm 0.025\text{E-}2$	$1.328 \pm 0.034\text{E-}2$	1.06	Agreement
	$1.363 \pm 0.024\text{E-}2$		1.03	Agreement

Attachment 1 (cont')

6. WAT-3 Containment Atmosphere Sample (1260 cc in 1 Liter Gas Marinelli Beaker) (WF057A) (Sampled: 04:25, CDT, July 29, 1992) Detectors H and O				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{cc}$)	NRC Results ($\mu\text{Ci}/\text{cc}$)	WAT-3/NRC Ratio	Comparison Decision
Xe-133	6.390 \pm 0.137E-6	6.327 \pm 0.104E-6	1.01	Agreement
	6.554 \pm 0.132E-6		1.04	Agreement
Xe-135	1.171 \pm 0.182E-7	1.374 \pm 0.152E-7	0.85	Agreement
	1.267 \pm 0.128E-7		0.92	Agreement

Attachment 1 (cont')

7. WAT-3 RCS Tritium Sample (Sampled: 22:35, CDT, July 28, 1992)				
Nuclide	WAT-3 Results ($\mu\text{Ci}/\text{ml}$)	NRC Results ($\mu\text{Ci}/\text{ml}$)	WAT-3/NRC Ratio	Comparison Decision
H-3	$3.520 \pm 0.025\text{E}-2$	$3.55 \pm 0.035\text{E}-2$	0.99	Agreement

ATTACHMENT 2

1991 QUALITY ASSURANCE LIQUID CAPABILITY TEST SAMPLE RESULTS

WATERFORD STEAM ELECTRIC STATION, UNIT 3

NRC INSPECTION REPORT: 50-382/92-20

Reference Time and Date: 12:00, CDT, October 10, 1991

1. Gamma Isotopic Analyses				
Nuclide	WAT-3 Results ($\mu\text{Ci/ml}$)	NRC Results ($\mu\text{Ci/ml}$)	WAT-3/NRC Ratio	Comparison Decision
Mn-54	9.53 \pm E-6	8.84 \pm 0.24E-6	1.08	Agreement
Co-60	8.85 \pm E-6	7.39 \pm 0.26E-6	1.20	Agreement
Cs-137	1.32 \pm E-5	1.15 \pm 0.04E-5	1.15	Agreement
2. Beta Isotopic Analyses				
Nuclide	WAT-3 Results ($\mu\text{Ci/ml}$)	NRC Results ($\mu\text{Ci/ml}$)	WAT-3/NRC Ratio	Comparison Decision
H-3	1.15 \pm E-4	1.02 \pm 0.03E-4	1.13	Agreement
Sr-89	1.00 \pm 0.10E-4	1.09 \pm 0.03E-4	0.92	Agreement
Sr-90	1.70 \pm 0.10E-4	1.81 \pm 0.05E-5	0.94	Agreement
Fe-55	1.10 \pm 0.10E-5	9.66 \pm 0.29E-6	1.14	Agreement

ATTACHMENT 3

CRITERIA FOR COMPARING RADIOCHEMISTRY ANALYTICAL MEASUREMENTS

The following are the criteria used in comparing the results of capability tests and verification measurements. The criteria are based on an empirical relationship established through prior experience and this program's analytical requirements.

In these criteria, the judgement limits vary in relation to the comparison of the resolution.

$$\text{Resolution} = \frac{\text{NRC VALUE}}{\text{NRC UNCERTAINTY}}$$

$$\text{Ratio} = \frac{\text{LICENSEE VALUE}}{\text{NRC VALUE}}$$

Comparisons are made by first determining the resolution and then reading across the same line to the corresponding ratio. The following table shows the acceptance values.

RESOLUTION	AGREEMENT RATIO
<4	0.40 - 2.50
4 - 7	0.50 - 2.00
8 - 15	0.60 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

The above criteria are applied to the following analyses:

- (1) Gamma Spectrometry
- (2) Tritium in liquid samples
- (3) Iodine on adsorbers
- (4) ⁸⁹Sr and ⁹⁰Sr determinations
- (5) Gross Beta where samples are counted on the same date using the same reference nuclide.