UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

JUN 29 1992

Report Nos.: 50-369/92-16 and 50-370/92-16

Licensee: Duke Power Company
P. O. Box 1007
Charlotte, NC 28201-1007

Docket Nos.: 50-369 and 50-370 License Nos.: NPF-9 and NPF-17

Facility Name: McGuire 1 and 2

Inspection Conducted: June 8-12, 1992

Inspectors: D W Jones 6/19/92
D. W. Jones Date Signed

N. G. McNeill for 6/26/92
N. G. McNeill Date Signed

Approved by: J R Decker 6/26/92
T. R. Decker, Chief Date Signed
Radiological Effluents and Chemistry
Section
Radiological Protection and Emergency
Preparedness Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of environmental monitoring, radiological effluents, meteorological instrumentation, and confirmatory measurements.

Results:

In the areas inspected, violations or deviations were not identified.

The licensee's radiological environmental monitoring program was effectively implemented and an effective quality assurance program had been maintained for analysis of environmental samples (Paragraphs 2, 3, and 4).

The licensee had implemented and maintained an effective program to monitor and control liquid and gaseous radioactive effluents. The projected offsite doses resulting from those effluents were well with in the limits specified in the FSAR, 10 CFR 50 Appendix I, and 40 CFR 190 (Paragraph 5).

The meteorological monitoring instrumentation had been maintained in an operable status and the meteorological monitoring program had been effectively implemented (Paragraph 6).

The licensee demonstrated adequate capability to quantify radionuclide concentrations in various matrices normally encountered in nuclear power plant operations (Paragraph 7).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

R. Baker, Scientist, Chemistry
*M. Bridges, General Supervisor, Chemistry
*B. Byrum, Supervising Scientist, Radiation Protection
C. Carpenter, Scientist, Chemistry
J. Drew, Specialist, Radiation Protection
*L. Epps, Supervisor, Radiation Protection
*J. Foster, Radiation Protection Manager
J. Gabbert, Scientist, Chemistry
*L. Kunka, Nuclear Production Engineer, Compliance
*T. McConnell, Station Manager
*T. McMeekin, Vice President
*R. Michael, Manager, Chemistry
S. Mooneyhan, General Supervisor, Radiation Protection
J. Pope, Associate Scientist, Radiation Protection
*R. Sharpe, Manager, Regulatory Compliance

Other licensee employees contacted included engineers, technicians, operators, and office personnel.

Nuclear Regulatory Commission

T. Cooper, Resident Inspector
*K. Van Doorn, Senior Resident Inspector

*Attended exit interview on October 10, 1991.

2. Radiological Environmental Monitoring (84750)

Technical Specification (TS) 6.8.4 g required the licensee to establish, implement, and maintain a program to monitor the radiation and radionuclides in the environs of the plant as described in Chapter 16 of the Final Safety Analysis Report (FSAR). The sampling locations, types of samples or measurements, sampling frequency, types and frequency of sample analysis, reporting levels, and analytical lower limits of detection (LLDs) were specified in FSAR Section 16.11-13. TS 6.9.1.6 and FSAR Section 16.11-16.1 delineated the requirements for submitting, the submittal dates, and the content of the Annual Radiological Environmental Operating Reports. The reports were required to be submitted prior to May 1 of each year and to provide an assessment of the observed impact on the environment resulting from plant operations during the previous calendar year.

The inspector reviewed the licensee's 1991 Annual Radiological Environmental Operating Report and discussed its contents with the licensee. The report included the following: a summary description of the program, maps indicating sampling locations, summary results of analyses of radiological environmental samples and of environmental radiation measurements, discussion of deviations from the required sampling plan and analyses which did not achieve the required LLD, a summary and discussion of the results for each exposure pathway, analysis of trends and comparisons with previous years and preoperational studies, and an assessment of the impact on the environment resulting from plant operations. The report also included the results of the Land Use Census required by TS 6.8.4 g and FSAR Section 16.11-14, and the results of the Interlaboratory Comparison Program required by TS 6.8.4 g and FSAR Section 16.11-15. The licensee's evaluation of the 1991 environmental monitoring program data produced the following observations which were documented in the report.

- Dose estimates calculated from the environmental monitoring program data were in good agreement with dose estimates calculated from effluent release data and were a small percentage of the regulatory limits.

- Direct gamma radiation exposure, as measured by thermoluminescent dosimeters (TLDs), did not significantly differ from exposure rates observed during previous years of plant operation or during preoperational studies.

- No airborne radioactivity was detected at any of the air sampling locations during 1991.

- Tritium was the only manmade radionuclide detected in drinking water and surface water samples. The measured concentrations were a small percentage of the specified reporting levels but increasing trends were indicated.

- No manmade radionuclides were detected in milk samples collected during 1991.

- An increasing trend in Cs-137 concentration was indicated at one shoreline sediment sampling location but the concentration was a small percentage of the specified reporting level.

- The concentrations of the radionuclides Mn-54, Co-58, Co-60, Cs-134, and Cs-137 detected in fish samples was not significantly different from the concentrations found during previous years of plant operation or during preoperational studies.

- The specified lower limits of detection (LLDs) for environmental measurement systems were achieved.

- No specified reporting levels for radioactivity in the environment were exceeded.

- During 1991 there were 30 deviations from the specified sampling plan due to equipment malfunctions and natural disasters (forest fires).

- The licensee implemented a program improvement, through the use of the Global Positioning Satellite System, to more accurately determine the distance and direction of each sampling location from the reactors.

- The contribution to the radioactivity in the environment resulting from plant operations was slight.

Based on the above reviews and discussions, it was concluded the licensee's radiological environmental monitoring program was effectively implemented.

No violations or deviations were identified.

3. Environmental Monitoring Quality Assurance Program (84750)

TS 6.8.4 g and FSAR Section 16.11-15 required the licensee to participate in an interlaboratory comparison program and to include a summary of the program results in the Annual Radiological Environmental Operating Report. The licensee's report for 1991 provided a summary of the results from the licensee's participation in the Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck) Program. The report also included descriptions of the various types of samples analyzed and the analyses performed, and an evaluation of the analytical results. A total of 37 samples were analyzed and statistical evaluation of the program data indicated that the EPA control limit had been exceeded for one sample. The licensee investigated the indication that the measurement system may have been out of control but no assignable cause was found. Analyses of subsequent crosscheck samples performed on that system were within control limits.

Based on the licensee's overall performance in the EPA crosscheck program it was concluded that an effective quality assurance program had been maintained for analysis of environmental samples.

No violations or deviations were identified.

4. State Radiological Environmental Monitoring (84750)

The State of North Carolina Division of Radiation Protection (NCDRP), by contract with the NRC, independently monitors the concentrations of radioactivity in the environs of the licensee's facility and provides an annual report of the results from the monitoring program. The inspector reviewed the NCDRP's report for 1991 and discussed its content with the licensee. No anomalies were noted between the NCDRP's program data and the licensee's program data. The range of radioactivity concentrations and general trends observed by the NCDRP were comparable to the licensee's data.

5. Semiannual Radioactive Effluent Release Reports (84750)

FSAR Section 16.11-16.2 described the reporting schedule and content requirements for the Semiannual Radioactive Effluent Release Reports. The reports were required to be submitted within 60 days after January 1 and July 1 of each year covering the operation of the facility during the previous six months. Summaries of the quantities of radioactive liquid and gaseous effluents released from the facility and an assessment of the radiation doses due to those releases were required to be included in the reports.

The effluent data presented in Table 1 below were compiled from the licensee's effluent release reports for the years 1990 and 1991. The inspector reviewed those reports and discussed their content and the data presented in Table 1 with the licensee. The inspector noted a general decrease in the activity released in both liquid and gaseous effluents during 1991 as compared to 1990. The total body dose resulting from the liquid effluents also decreased but the air and organ doses resulting from the gaseous effluents slightly increased. The licensee attributed the decrease in activity released in liquid effluents to improved liquid radwaste processing technology such as the use of carbon filters to reduce cobalt concentrations and the use of demineralizer resins specifically adept at removing cesium. The licensee also indicated that an aggressive leak control program had contributed to reducing the activity in both liquid and gaseous effluents. By locating and repairing leaks the amount of contaminated water required to be processed and released was reduced. Also the amount of activity escaping from the contaminated water into the air in the containment and auxiliary buildings was reduced. The apparent anomaly between the decrease in activity released and an increased dose for gaseous effluents was discussed with the licensee General Office personnel who prepared the effluent reports. The licensee indicated that the 1991 doses were calculated with release-weighted real-time

Table 1

Effluent Release Summary for McGuire Units 1 and 2

Activity Released (curies)

Liquid Effluents	1990	1991
Fission and Activation Products	4.00	2.08
Tritium	916	878
Dissolved and Entrained Gases	1.95	0.462
Gaseous Effluents		
Fission and Activation Gases	1038	898
Iodines	2.74E-3	2.58E-3
Particulates	8.46E-4	8.20E-4
Tritium	50	64.6

Annual Doses

Liquid Effluents	1990		1991	
	Unit 1	Unit 2	Unit 1	Unit 2
Total Body Dose (mrem)	0.148	0.148	0.133	0.133
(Limit: 3 mrem/unit)				
Percent of Limit	4.93	4.93	4.43	4.43
Gaseous Effluents				
Air Doses due to Noble Gases (mrad)				
Gamma	0.235	0.235	0.433	0.433
Beta	0.595	0.595	1.03	1.03
(Limits: Gamma-10mrad/unit, Beta-20mrad/unit)				
Percent of Limit				
Gamma	2.35	2.35	4.33	4.33
Beta	2.98	2.98	5.15	5.15
Maximum Organ Doses due to Radioiodine, Tritium, and Particulates (mrem)	0.102	0.102	0.145	0.145
(Limit: 15 mrem/unit)				
Percent of Limit	0.68	0.68	0.97	0.97

meteorology data rather than constant annual average dispersion coefficients and that the new calculation method should yield more accurate dose estimates.

The effluent reports indicated that there were no effluent monitors inoperable for more than 30 days during 1991 and only one during 1990. The reports also indicated that there were 3 unplanned releases during 1990 and 3 during 1991. No release limits were exceeded during those events.

As indicated in Table 1, the annual total body doses from liquid effluents were less than 5 percent of their limits. The air doses from gaseous effluents were less than 6 percent of their limits and the organ doses from gaseous effluents were less than 1 percent of their limits.

Based on the above reviews and discussions, it was concluded that the licensee had implemented and maintained an effective program to monitor and control liquid and gaseous radioactive effluents. The projected offsite doses resulting from those effluents were well within the limits specified in the FSAR, 10 CFR 50 Appendix I, and 40 CFR 190.

6. Meteorological Monitoring Program (84750)

TS 3/4.3.3.4 described the operational and surveillance requirements for the meteorological monitoring instrumentation. The licensee was required to demonstrate that the instrumentation was operable by the performance of daily channel checks and semiannual channel calibrations.

The inspector reviewed the procedures listed below and determined that they included provisions for performing the required surveillances.

PT/1/A/4600/03B	"Daily Surveillance Items"
IP/0/B/3260/01	"Teledyne Geotech Series 21 Wind Direction Module Channel Calibration Procedure"
IP/0/B/3260/03	"Teledyne Geotech Series 40 Wind Speed Module Channel Calibration"
IP/0/B/3260/19	"Channel Calibration Procedure for the Teledyne Platinum RTD T/ΔT System"

The inspector reviewed records of calibrations performed during March 1991, September 1991, and March 1992 by the above IP procedures and determined that the instrumentation had been calibrated at the required frequency. The inspector also reviewed records of daily surveillances performed on June 1-5, 1992, and determined that the daily channel checks had been performed. The inspector visited the control room and determined that the meteorological monitoring instrumentation was then currently operable.

Based on the above reviews and observations, it was concluded that the meteorological monitoring instrumentation had been maintained in an operable status and that the meteorological monitoring program had been effectively implemented.

No violations or deviations were identified.

7. Confirmatory Measurements (84750)

10 CFR 20.201 (b) required the licensee to perform surveys as necessary to evaluate the extent of radiation hazards.

In an effort to evaluate the licensee's analytical capabilities, samples of reactor coolant, liquid radwaste, and waste gas were collected and analyzed for radionuclide concentrations by the licensee and the NRC Region II mobile laboratory. The licensee was also provided with a spiked particulate filter and a spiked charcoal cartridge for analysis. Each of the above samples were analyzed by the licensee's four gamma spectroscopic systems except for the waste gas sample which was analyzed on three of the licensee's systems. One of the systems was taken out of service, due to a problem with the amplifier, after the waste gas sample was collected. The licensee's results were compared to the results obtained by the mobile laboratory. The purpose of these measurement comparisons was to verify the licensee's capability to accurately detect and identify gamma emitting radionuclides and to quantify their concentrations. Attachment 1 provides a comparison of the licensee's results to the NRC's results for each sample. Attachment 2 provides the criteria for assessing the agreement between the analytical results. As indicated in Attachment 1, the results were in agreement for all 30 comparisons.

The inspector reviewed the procedures listed below and determined that they were adequate for the types of samples collected for this inspection. The inspector also accompanied the licensee during the collection of the reactor coolant and waste gas samples and determined that the procedures were followed.

OP/2/B/6200/11 "Primary Nuclear Sampling System"
CP/0/B/8600/01 "Chemistry Procedure for Sampling the Radwaste and Boron Recycle System"
0P/2/B/6200/45 "Radwaste Procedure for Waste Gas Decay Tank Sampling"

Based on the above comparisons, it was concluded that the licensee had demonstrated adequate capability to quantify radionuclide concentrations in various matrices normally encountered in nuclear power plant operations.

No violations or deviations were identified.

8. Exit Interview

The inspection scope and results were summarized on June 11, 1992, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the results listed above. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

ATTACHMENT 1

COMPARISON OF NRC AND MCGUIRE ANALYTICAL RESULTS
June 8-12, 1992

Reactor Coolant

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #1					
CO-58	2.59E-03	2.68E-03 +- 9.37E-05	29	0.97	Agreement
CO-60	1.25E-04	1.24E-04 +- 7.36E-06	17	1.01	Agreement
CR-51	4.83E-04	4.42E-04 +- 6.47E-05	7	1.09	Agreement
FE-59	2.60E-04	2.45E-04 +- 1.40E-05	18	1.06	Agreement
MN-54	1.48E-04	1.58E-04 +- 7.99E-06	20	0.94	Agreement
Detector #2					
CO-58	2.51E-03	2.68E-03 +- 9.37E-05	29	0.94	Agreement
CO-60	1.30E-04	1.24E-04 +- 7.36E-06	17	1.05	Agreement
CR-51	4.58E-04	4.42E-04 +- 6.47E-05	7	1.04	Agreement
FE-59	2.47E-04	2.45E-04 +- 1.40E-05	18	1.01	Agreement
MN-54	1.49E-04	1.58E-04 +- 7.99E-06	20	0.94	Agreement
Detector #3					
CO-58	2.53E-03	2.68E-03 +- 9.37E-05	29	0.94	Agreement
CO-60	1.21E-04	1.24E-04 +- 7.36E-06	17	0.98	Agreement
CR-51	5.00E-04	4.42E-04 +- 6.47E-05	7	1.13	Agreement
FE-59	2.32E-04	2.45E-04 +- 1.40E-05	18	0.95	Agreement
MN-54	1.41E-04	1.58E-04 +- 7.99E-06	20	0.89	Agreement
Detector #4					
CO-58	2.55E-03	2.68E-03 +- 9.37E-05	29	0.95	Agreement
CO-60	1.29E-04	1.24E-04 +- 7.36E-06	17	1.04	Agreement
CR-51	4.07E-04	4.42E-04 +- 6.47E-05	7	0.92	Agreement
FE-59	2.56E-04	2.45E-04 +- 1.40E-05	18	1.04	Agreement
MN-54	1.45E-04	1.58E-04 +- 7.99E-06	20	0.92	Agreement

Liquid Radwaste (Floor Drain Storage Tank)

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #1					
AG-110M	1.08E-05	1.05E-05 +- 6.35E-07	17	1.03	Agreement
CO-57	2.58E-06	2.89E-06 +- 3.67E-07	8	0.89	Agreement
CO-58	3.54E-04	3.69E-04 +- 1.22E-05	30	0.96	Agreement
CO-60	3.86E-04	4.18E-04 +- 1.33E-05	31	0.92	Agreement
CS-134	1.73E-05	1.66E-05 +- 1.19E-06	14	1.04	Agreement
CS-137	3.33E-05	3.39E-05 +- 1.71E-06	20	0.98	Agreement
MN-54	6.64E-05	7.21E-05 +- 2.45E-06	29	0.92	Agreement
NB-95	2.79E-05	3.10E-05 +- 1.32E-06	23	0.90	Agreement
SB-125	2.73E-05	3.03E-05 +- 2.12E-06	14	0.90	Agreement
ZR-95	1.31E-05	1.34E-05 +- 1.17E-06	11	0.98	Agreement
Detector #2					
AG-110M	1.24E-05	1.05E-05 +- 6.35E-07	17	1.18	Agreement
CO-57	2.51E-06	2.89E-06 +- 3.67E-07	8	0.87	Agreement
CO-58	3.72E-04	3.69E-04 +- 1.22E-05	30	1.01	Agreement
CO-60	4.06E-04	4.18E-04 +- 1.33E-05	31	0.97	Agreement
CS-134	1.47E-05	1.66E-05 +- 1.19E-06	14	0.89	Agreement
CS-137	3.56E-05	3.39E-05 +- 1.71E-06	20	1.05	Agreement
MN-54	7.09E-05	7.21E-05 +- 2.45E-06	29	0.98	Agreement
NB-95	3.12E-05	3.10E-05 +- 1.32E-06	23	1.01	Agreement
SB-125	3.12E-05	3.03E-05 +- 2.12E-06	14	1.03	Agreement
ZR-95	1.29E-05	1.34E-05 +- 1.17E-06	11	0.96	Agreement
Detector #3					
AG-110M	1.21E-05	1.05E-05 +- 6.35E-07	17	1.15	Agreement
CO-57	2.38E-06	2.89E-06 +- 3.67E-07	8	0.82	Agreement
CO-58	3.72E-04	3.69E-04 +- 1.22E-05	30	1.01	Agreement
CO-60	4.02E-04	4.18E-04 +- 1.33E-05	31	0.96	Agreement
CS-134	1.58E-05	1.66E-05 +- 1.19E-06	14	0.95	Agreement
CS-137	3.49E-05	3.39E-05 +- 1.71E-06	20	1.03	Agreement
MN-54	6.86E-05	7.21E-05 +- 2.45E-06	29	0.95	Agreement
NB-95	3.26E-05	3.10E-05 +- 1.32E-06	23	1.05	Agreement
SB-125	3.35E-05	3.03E-05 +- 2.12E-06	14	1.11	Agreement
ZR-95	1.36E-05	1.34E-05 +- 1.17E-06	11	1.01	Agreement

Liquid Radwaste (continued)

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #4					
AG-110M	1.26E-05	1.05E-05 +- 6.35E-07	17	1.20	Agreement
CO-57	1.98E-06	2.89E-06 +- 3.67E-07	8	0.69	Agreement
CO-58	3.68E-04	3.69E-04 +- 1.22E-05	30	1.00	Agreement
CO-60	3.96E-04	4.18E-04 +- 1.33E-05	31	0.95	Agreement
CS-134	1.42E-05	1.66E-05 +- 1.19E-06	14	0.86	Agreement
CS-137	3.62E-05	3.39E-05 +- 1.71E-06	20	1.07	Agreement
MN-54	6.70E-05	7.21E-05 +- 2.45E-06	29	0.93	Agreement
NB-95	2.99E-05	3.10E-05 +- 1.32E-06	23	0.96	Agreement
SB-125	2.71E-05	3.03E-05 +- 2.12E-06	14	0.89	Agreement
ZR-95	1.40E-05	1.34E-05 +- 1.17E-06	11	1.04	Agreement

Waste Gas (Decay Tank A)

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #1 out of service on June 11, 1992.					
Detector #2					
KR-85	4.10E-03	5.49E-03 +- 5.11E-04	11	0.75	Agreement
XE-133	6.55E-04	7.71E-04 +- 2.46E-05	31	0.85	Agreement
Detector #3					
KR-85	4.07E-03	5.49E-03 +- 5.11E-04	11	0.74	Agreement
XE-133	6.41E-04	7.71E-04 +- 2.46E-05	31	0.83	Agreement
Detector #4					
KR-85	4.49E-03	5.49E-03 +- 5.11E-04	11	0.82	Agreement
XE-133	6.47E-04	7.71E-04 +- 2.46E-05	31	0.84	Agreement

Particulate Filter, NRC spike

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #1					
CD-109	7.49E-02	9.19E-02 +- 3.19E-03	29	0.82	Agreement
CE-139	1.04E-03	1.02E-03 +- 5.84E-05	17	1.02	Agreement
CO-57	2.31E-03	2.38E-03 +- 9.13E-05	26	0.97	Agreement
CO-60	2.53E-02	2.43E-02 +- 8.76E-04	28	1.04	Agreement
CS-137	2.30E-02	2.29E-02 +- 1.04E-03	22	1.00	Agreement
SN-113	2.61E-03	3.09E-03 +- 2.24E-04	14	0.84	Agreement
SR-85	5.91E-04	4.96E-04 +- 9.61E-05	5	1.19	Agreement
Detector #2					
CD-109	7.65E-02	9.19E-02 +- 3.19E-03	29	0.83	Agreement
CE-139	1.04E-03	1.02E-03 +- 5.84E-05	17	1.02	Agreement
CO-57	2.22E-03	2.38E-03 +- 9.13E-05	26	0.93	Agreement
CO-60	2.49E-02	2.43E-02 +- 8.76E-04	28	1.02	Agreement
CS-137	2.32E-02	2.29E-02 +- 1.04E-03	22	1.01	Agreement
SN-113	2.54E-03	3.09E-03 +- 2.24E-04	14	0.82	Agreement
SR-85	4.75E-04	4.96E-04 +- 9.61E-05	5	0.96	Agreement
Detector #3					
CD-109	7.48E-02	9.19E-02 +- 3.19E-03	29	0.81	Agreement
CE-139	1.06E-03	1.02E-03 +- 5.84E-05	17	1.04	Agreement
CO-57	2.31E-03	2.38E-03 +- 9.13E-05	26	0.97	Agreement
CO-60	2.44E-02	2.43E-02 +- 8.76E-04	28	1.00	Agreement
CS-137	2.27E-02	2.29E-02 +- 1.04E-03	22	0.99	Agreement
SN-113	2.43E-03	3.09E-03 +- 2.24E-04	14	0.79	Agreement
SR-85	5.47E-04	4.96E-04 +- 9.61E-05	5	1.10	Agreement
Detector #4					
CD-109	7.18E-02	9.19E-02 +- 3.19E-03	29	0.78	Agreement
CE-139	1.06E-03	1.02E-03 +- 5.84E-05	17	1.04	Agreement
CO-57	2.20E-03	2.38E-03 +- 9.13E-05	26	0.92	Agreement
CO-60	2.42E-02	2.43E-02 +- 8.76E-04	28	1.00	Agreement
CS-137	2.28E-02	2.29E-02 +- 1.04E-03	22	1.00	Agreement
SN-113	2.49E-03	3.09E-03 +- 2.24E-04	14	0.80	Agreement
SR-85	6.61E-04	4.96E-04 +- 9.61E-05	5	1.33	Agreement

Charcoal Cartridge, NRC spike (CP 100)

Nuclide	Licensee Value	NRC Value & Error	Resolution	Ratio	Comparison
Detector #1					
CD-109	3.07E-01	4.04E-01 +- 1.15E-02	35	0.76	Agreement
CE-139	2.19E-03	2.02E-03 +- 1.13E-04	18	1.08	Agreement
CO-57	5.45E-03	5.66E-03 +- 1.92E-04	29	0.96	Agreement
CO-60	4.19E-02	4.44E-02 +- 1.54E-03	29	0.94	Agreement
CS-137	4.51E-02	4.67E-02 +- 2.06E-03	23	0.97	Agreement
SN-113	2.47E-03	2.99E-03 +- 2.38E-04	13	0.83	Agreement
Detector #2					
CD-109	3.28E-01	4.04E-01 +- 1.15E-02	35	0.81	Agreeme
CE-139	2.11E-03	2.02E-03 +- 1.13E-04	18	1.04	Agreement
CO-57	5.33E-03	5.66E-03 +- 1.92E-04	29	0.94	Agreement
CO-60	4.29E-02	4.44E-02 +- 1.54E-03	29	0.97	Agreement
CS-137	4.62E-02	4.67E-02 +- 2.06E-03	23	0.99	Agreement
SN-113	2.37E-03	2.99E-03 +- 2.38E-04	13	0.79	Agreement
Detector #3					
CD-109	3.32E-01	4.04E-01 +- 1.15E-02	35	0.82	Agreement
CE-139	2.11E-03	2.02E-03 +- 1.13E-04	18	1.04	Agreement
CO-57	5.41E-03	5.66E-03 +- 1.92E-04	29	0.96	Agreement
CO-60	4.36E-02	4.44E-02 +- 1.54E-03	29	0.98	Agreement
CS-137	4.84E-02	4.67E-02 +- 2.06E-03	23	1.04	Agreement
SN-113	2.49E-03	2.99E-03 +- 2.38E-04	13	0.83	Agreement
etector #4					
CD-109	3.25E-01	4.04E-01 +- 1.15E-02	35	0.80	Agreement
CE-139	2.06E-03	2.02E-03 +- 1.13E-04	18	1.02	Agreement
CO-57	5.38E-03	5.66E-03 +- 1.92E-04	29	0.95	Agreement
CO-60	4.30E-02	4.44E-02 +- 1.54E-03	29	0.97	Agreement
CS-137	4.84E-02	4.67E-02 +- 2.06E-03	23	1.04	Agreement
SN-113	2.69E-03	2.99E-03 +- 2.38E-04	13	0.90	Agreement

ATTACHMENT 2

CRITERIA FOR COMPARISONS OF ANALYTICAL MEASUREMENTS

This attachment provides criteria for the comparison of results of analytical radioactivity measurements. These criteria are based on empirical relationships which combine prior experience in comparing radioactivity analyses, the measurement of the statistically random process of radioactive emission, and the accuracy needs of this program.

In these criteria, the "Comparison Ratio Limits"[1] denoting agreement or disagreement between licensee and NRC results are variable. This variability is a function of the ratio of the NRC's analytical value relative to its associated statistical and analytical uncertainty, referred to in this program as "Resolution"[2].

For comparison purposes, a ratio between the licensee's analytical value and the NRC's analytical value is computed for each radionuclide present in a given sample. The computed ratios are then evaluated for agreement or disagreement based on "Resolution." The corresponding values for "Resolution" and the "Comparison Ratio Limits" are listed in the Table below. Ratio values which are either above or below the "Comparison Ratio Limits" are considered to be in disagreement, while ratio values within or encompassed by the "Comparison Ratio Limits" are considered to be in agreement.

TABLE

NRC Confirmatory Measurements Acceptance Criteria
Resolution vs. Comparison Ratio Limits

Resolution	Comparison Ratio Limits for Agreement
<4	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

[1]Comparison Ratio = $\frac{\text{Licensee Value}}{\text{NRC Reference Value}}$

[2]Resolution = $\frac{\text{NRC Reference Value}}{\text{Associated Uncertainty}}$