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

SEP 0 8 1988

Report Nos.: 50-413/88-26 and 50-414/88-25

Licensee: Duke Power Company
422 South Church Street
Charlotte, NC 28242

Docket Nos.: 50-413 and 50-414 License Nos.: NPF-35 and NPF-52

Facility Name: Catawba 1 and 2

Inspection Conducted: August 1-5, 1988

Inspectors: for S. S. Adamovitz — 9/2/88 Date Signed

H. Bermudez — 9/2/88 Date Signed

Accompanying Personnel: T. Volk

Approved by: J. B. Kahle, Section Chief — 9/2/88 Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This routine, unannounced inspection was conducted in the areas of quality assurance and confirmatory measurements for in-plant radiochemical analysis.

Results: The inspectors noted significant improvements concerning count room activities as compared to the previous confirmatory measurements inspection conducted during December 1985. The inspectors concluded that the count room quality assurance program was adequate to ensure accurate and reliable analytical results. In the areas inspected, no violations or deviations were identified.

REPORT DETAILS

1. Licensee Employees

D. Bain, Chemistry Supervisor
*M. Cote, Compliance Specialist
S. Hamilton, Health Physics Technician
*J. Isaacson, Staff Scientist
B. Kimwray, Health Physics Shift Supervisor
G. Mode, Health Physics General Supervisor
*T. Owen, Station Manager
*R. Wardell, Superintendent Technical Services
B. Wilson, Chemistry Specialist
*C. Wray, Health Physics Supervisor, Count Room/Environmental

Other licensee employees contacted during this inspection included technicians and administrative personnel.

NRC Resident Inspectors

*M. Lesser
K. Vandoorn

*Attended exit interview

2. Quality Assurance - Radioactivity Measurements (84725)

The inspectors evaluated the licensee's Counting Room Quality Assurance Program against recommendations provided in Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," issued in February 1978.

a. Organizational Structure, Responsibilities and Personnel

The inspectors reviewed selected job descriptions, position analyses and position guides which described lines of authority, personnel duties and required qualifications regarding the counting of radioactive samples and the interpretation of results. By review of qualification records of selected personnel along the organizational structure, the inspectors determined that there was an adequate match between job requirements and the personnel filling respective positions.

b. Operating Procedures

The inspectors reviewed procedures which covered the following areas: counting room equipment startup and maintenance, sample preparation, operation and calibration of the alpha/beta and gamma spectrometry systems, and cross-check programs. The procedures delineated, among

other areas, routine maintenance requirements, performance and background checks, calibration requirements, acceptance criteria and follow-up actions for results outside acceptable limits.

c. Records

The inspectors reviewed quality control records for laboratory counting systems dealing with efficiency checks, background checks, efficiency calibrations, verification of computer programs, cross-check programs, sample history and audits. The inspectors determined that the licensee's capability to track and control a sample in its progress through the sequence of monitoring processes was adequate.

d. Quality Control in the Radioanalytical Laboratory

The inspectors verified that the licensee's radionuclide standards used to determine counting efficiencies were traceable to the National Bureau of Standards. Also, the standards were of the same form/geometry, or close approximations, to the unknown samples that were routinely counted.

The licensee performs intra- and inter-laboratory analyses of radioactive samples. During intra-laboratory comparisons, the licensee counts the same sample in all available systems to determine consistency within the systems. During inter-laboratory comparisons, the licensee's General Office provides samples obtained from a vendor with activities unknown to counting room personnel. Analyses of these samples provide means to detect errors that might not be detected by intra-laboratory measurements alone.

No violations or deviations were identified.

3. Audits and Reviews (84725)

Technical Specification (TS) 6.5.2.9 states that audits of unit activities shall be performed under the cognizance of the Nuclear Safety Review Board (NSRB) encompassing: the conformance of unit operation to provisions contained within the TSs and applicable license conditions at least once per 12 months; and the performance of activities required by the Quality Assurance Program to meet the criteria of Regulatory Guide 4.15, December 1977, at least once per 12 months. The inspectors reviewed the following audits and responses:

a. Catawba Nuclear Station Radioanalysis Program Review by the System Health Physics Unit of Nuclear Technical Services conducted June 23-26, 1987.

b. QA Audit NP-88-07 (CN) Health Physics, Environmental, OLCM Activities, conducted March 28 - April 27, 1988.

c. Departmental Audit NP-87-06 (CN) Health Physics and Environmental Group Activities, conducted March 30 - April 29, 1987.

The inspectors noted that the audits of laboratory activities utilized Regulatory Guide 4.15 as a reference and basis for checklists. Problem areas identified by the audits were tracked and response due dates were established.

No violations or deviations were identified.

4. Counting Facilities and Instrumentation (84725)

The inspectors toured the count room and discussed systems operation and maintenance with licensee representatives. One radioisotopic count room was utilized for all in-plant health physics and chemistry samples. The station's Health Physics group was responsible for the operation of the count room and also participated in selected sample collection. Instrumentation included five Tennelec Geiger counters for determining beta/gamma activities in plant smears; two Tennelec alpha/beta proportional counters for smear counting; two Beckman liquid scintillation counters for determining tritium concentrations in liquid samples; and six intrinsic germanium (IG) detectors for gamma isotopic analyses. The licensee had acquired two new IG detectors and a Nuclear Data Genie multichannel analyzer (MCA)/terminal during 1987. These systems were in the process of being calibrated and phased into routine use. The other four Ortec IG detectors were to be eventually connected to the Nuclear Data Genie MCA/terminal.

The inspectors reviewed a series of records concerning instrument performance checks, calibrations, and cross-check results. The gamma spectroscopy systems were calibrated annually for all geometries. Counted standard activities were compared to certificate values and efficiencies were not changed if counted results were within 10% of certificate values. Gaseous calibrations were accomplished by utilizing a gaseous standard for energy efficiencies at less than 514 KeV and a solid standard for higher energy efficiencies. Daily performance checks for the gamma systems included source checks using a Cs-137 standard and a background determination. The alpha-beta proportional counters utilized Th-230 and TC-99 for daily source checks. Voltage plateaus, efficiency calibrations, and cross talk determinations were performed quarterly or when operating parameters had changed. The licensee used Am-241 and Cs-134 standards for the efficiency and voltage plateau calibrations. The inspectors noted that all efficiency data records, calibration source certificates and daily performance checks were easily accessible and well organized.

The count room participated in a cross-check program where vendor-supplied spiked samples of different geometries were analyzed quarterly to determine instrument accuracy. The licensee also performed weekly checks by counting one in-plant sample on all detectors and comparing the results.

No violations or deviations were identified

5. Confirmatory Measurements (84725)

During the inspection, reactor coolant and selected liquid and gaseous samples were sampled by the licensee and analyzed for isotopic concentrations using the licensee's gamma spectroscopy systems and the NRC Region II mobile laboratory. The purpose of these comparative measurements was to verify the licensee's capability to accurately measure gamma emitting radionuclide concentrations in various plant systems and effluent streams. Comparisons were made utilizing the licensee's Ortec (3 out of 4 operational) and Genie (2 out of 2 operational) gamma spectroscopy systems. Sample types and counting geometries included the following: reactor coolant system (RCS) sample 100 ml bottle; liquid waste tank - 1500 ml liquid Marinelli; containment gas - 1260cc Marinelli; and waste gas decay tank - 14cc gas vial. Spiked charcoal cartridge and particulate filter samples were provided in lieu of licensee samples which did not have sufficient activity for comparisons.

Comparisons of licensee and NRC results are listed in Attachment 1 with the acceptance criteria listed in Attachment 2. Results were in agreement for all compared radionuclides in the liquid waste tank sample, the charcoal cartridge, the particulate filter and the containment gas sample. The reactor coolant sample showed agreement for all isotopes with the exception of Xe-133 on Ortec #1. In reviewing the data for this sample, the inspectors noted that the ratio of licensee/NRC values for Xe-133 varied from 0.57 to 1.62 among detectors. However, Xe-133 ratios for the liquid waste sample did not show the same variance among detectors, and licensee/NRC ratios ranged from 0.99 to 1.17. Based on this information the inspectors concluded that the difference in Xe-133 activity for the reactor coolant sample was due to the gaseous Xe-133 diffusion through the sample, changing the calibration geometry.

For the 14cc gas vial from the waste gas decay tank, isotopic xenon results were in disagreement for all detectors with the exception of Ortec #2. The inspectors noted that although both the NRC and the licensee utilized a 14cc gas vial, the shapes were different. The licensee's vial was tall and thin as compared to the NRC's; also the NRC's vial had a thicker base. Due to split sampling difficulties, both laboratories opted to count the licensee's sample vial. The results showed a disagreement (reported in Attachment 1). When the disagreements were found, the licensee attempted to collect a second sample and provide a split for the licensee's and NRC's vials. However, disagreements still existed. After reviewing the licensee's calibration methodology, the NRC inspectors determined that the gaseous calibrations had been performed correctly. The disagreements were attributed to geometry differences and/or transfer difficulties during sample preparations.

The inspectors observed the sampling of the waste gas decay tank, the liquid waste tank, and the reactor coolant system (RCS). In sampling the reactor coolant system in the "NM" laboratory, the inspectors noted that

the technician had to raise the fume hood window above the maximum level indicated in order to manipulate some of the controls. The inspectors discussed this with licensee personnel who agreed to investigate the matter. This matter will be followed as an inspector followup item (IFI), IFI 50-413, 414/88-26-01.

No violations or deviations were identified.

6. Exit Interview

The inspection scope and results were summarized on August 5, 1988, with those persons indicated in Paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report.

ATTACHMENT 1

RESULTS OF CONFIRMATORY MEASUREMENTS AT CATAWBA NUCLEAR PLANT - AUGUST 1-15, 1988

SAMPLE (Geometry)	ISOTOPE	CONCENTRATION (uCI/UNIT) LICENSEE	NRC	RESOLUTION	LICENSEE/NRC	COMPARISON
1. Reactor Coolant Sample (100 ml Bottle)						
a. Ortec #1 SN26-P-1671A	Na-24	?.88 E-3	4.58 ± 0.22 E-3	21	0.85	Agreement
	Xe-133	2.23 E-3	3.93 ± 0.30 E-3	13	0.57	Disagreement
	Xe-135	2.62 E-3	2.26 ± 0.18 E-3	12	1.16	Agreement
	I-132	3.56 E-3	3.27 ± 0.23 E-3	14	1.09	Agreement
	I-133	2.23 E-3	2.33 ± 0.12 E-3	19	0.96	Agreement
	I-135	4.12 E-3	4.88 ± 0.54 E-3	9	0.84	Agreement
b. Ortec #2 SN24-P-94VC	Na-24	4.82 E-3	4.58 ± 0.22 E-3	21	1.05	Agreement
	Xe-133	6.36 E-3	3.93 ± 0.30 E-3	13	1.62	Agreement
	Xe-135	3.41 E-3	2.26 ± 0.18 E-3	12	1.51	Agreement
	I-132	4.10 E-3	3.27 ± 0.23 E-3	14	1.25	Agreement
	I-133	2.23 E-3	2.33 ± 0.12 E-3	19	0.96	Agreement
	I-135	4.76 E-3	4.88 ± 0.54 E-3	9	0.98	Agreement
c. Ortec #3 SN24-P-92VC	Na-24	4.08 E-3	4.58 ± 0.22 E-3	21	0.89	Agreement
	Xe-133	4.76 E-3	3.93 ± 0.30 E-3	13	1.21	Agreement
	Xe-135	2.77 E-3	2.26 ± 0.18 E-3	12	1.22	Agreement
	I-132	3.82 E-3	3.27 ± 0.23 E-3	14	1.17	Agreement
	I-133	2.18 E-3	2.33 ± 0.12 E-3	19	0.94	Agreement
	I-135	4.77 E-3	4.86 ± 0.54 E-3	9	0.98	Agreement
d. Genie #3 SN26-P-K01A	Na-24	4.68 E-3	4.58 ± 0.22 E-3	21	1.02	Agreement
	Xe-133	3.40 E-3	3.93 ± 0.30 E-3	13	0.86	Agreement
	Xe-135	2.11 E-3	2.26 ± 0.18 E-3	12	0.93	Agreement
	I-132	3.47 E-3	3.27 ± 0.23 E-3	14	1.06	Agreement
	I-133	2.54 E-3	2.33 ± 0.12 E-3	19	1.09	Agreement
	I-135	4.22 E-3	4.88 ± 0.54 E-3	9	0.86	Agreement
e. Genie #4 SN27-K-080	Na-24	4.84 E-3	4.58 ± 0.22 E-3	21	1.06	Agreement
	Xe-133	2.43 E-3	3.93 ± 0.30 E-3	13	0.62	Agreement
	Xe-135	2.21 E-3	2.26 ± 0.18 E-3	12	0.98	Agreement
	I-132	3.62 E-3	3.27 ± 0.23 E-3	14	1.11	Agreement
	I-133	2.43 E-3	2.33 ± 0.12 E-3	19	1.04	Agreement
	I-135	4.18 E-3	4.88 ± 0.54 E-3	9	0.86	Agreement

SAMPLE (Geometry)	ISOTOPE	CONCENTRATION (uCi/UNIT) LICENSEE	NRC	RESOLUTION	LICENSEE/NRC	COMPARISON
2. Liquid Waste Tank (1500 ml Liquid Marinelli)						
a. Ortec #1	Xe-133	2.83 E-5	2.64 ± 0.09 E-5	29	1.07	Agreement
	Xe-135	8.59 E-6	8.66 ± 0.27 E-6	32	0.99	Agreement
	Mn-54	2.08 E-5	2.12 ± 0.05 E-5	42	0.98	Agreement
	Co-58	2.30 E-5	2.36 ± 0.05 E-5	47	0.97	Agreement
	Co-60	1.04 E-5	9.39 ± 0.41 E-6	23	1.11	Agreement
	I-131	1.19 E-5	1.13 ± 0.04 E-5		1.05	Agreement
	I-133	2.84 E-6	3.08 ± 0.40 E-6		0.92	Agreement
	Cs-134	1.87 E-5	2.16 ± 0.05 E-5	43	0.86	Agreement
	Cs-137	3.14 E-5	3.55 ± 0.06 E-5	59	0.88	Agreement
b. Ortec #2	Xe-133	2.62 E-5	2.64 ± 0.09 E-5	29	0.99	Agreement
	Xe-135	7.90 E-6	8.66 ± 0.27 E-6	32	0.91	Agreement
	Mn-54	2.13 E-5	2.12 ± 0.05 E-5	42	1.00	Agreement
	Co-58	2.38 E-5	2.36 ± 0.05 E-5	47	1.01	Agreement
	Co-60	9.55 E-6	9.39 ± 0.41 E-6	23	1.02	Agreement
	I-131	1.11 E-5	1.13 ± 0.04 E-5	28	0.98	Agreement
	I-133	3.51 E-6	3.08 ± 0.40 E-6	8	1.14	Agreement
	Cs-134	2.04 E-5	2.16 ± 0.05 E-5	43	0.94	Agreement
	Cs-137	3.29 E-5	3.55 ± 0.06 E-5	59	0.93	Agreement
c. Ortec #3	Xe-133	3.09 E-5	2.64 ± 0.09 E-5	29	1.09	Agreement
	Xe-135	8.49 E-6	8.66 ± 0.27 E-6	32	0.98	Agreement
	Mn-54	2.11 E-5	2.12 ± 0.05 E-5	42	1.00	Agreement
	Co-58	2.44 E-5	2.36 ± 0.05 E-5	47	1.03	Agreement
	Co-60	1.02 E-5	9.39 ± 0.41 E-6	23	1.09	Agreement
	I-131	1.26 E-5	1.13 ± 0.04 E-5	28	1.12	Agreement
	I-133	3.32 E-6	3.08 ± 0.40 E-6	8	1.08	Agreement
	Cs-134	2.08 E-5	2.16 ± 0.05 E-5	43	0.96	Agreement
	Cs-137	3.23 E-5	3.55 ± 0.06 E-5	59	0.91	Agreement
d. Genie #3	Xe-133	3.09 E-5	2.64 ± 0.09 E-5	29	1.17	Agreement
	Xe-135	8.12 E-6	8.66 ± 0.27 E-6	32	0.94	Agreement
	Mn-54	2.20 E-5	2.12 ± 0.05 E-5	42	1.04	Agreement
	Co-58	2.58 E-5	2.35 ± 0.05 E-5	47	1.09	Agreement
	Co-60	9.95 E-6	9.39 ± 0.41 E-6	23	1.06	Agreement
	I-131	1.17 E-5	1.13 ± 0.04 E-5	28	1.04	Agreement
	I-133	3.19 E-6	3.08 ± 0.40 E-6	8	1.04	Agreement
	Cs-134	2.04 E-5	2.16 ± 0.05 E-5	43	0.94	Agreement
	Cs-137	3.42 E-5	3.55 ± 0.06 E-5	59	0.96	Agreement
e. Genie #4	Xe-133	2.92 E-5	2.64 ± 0.09 E-5	29	1.11	Agreement
	Xe-135	8.22 E-6	8.66 ± 0.27 E-6	32	0.95	Agreement
	Mn-54	2.19 E-5	2.12 ± 0.05 E-5	42	1.03	Agreement
	Co-58	2.45 E-5	2.36 ± 0.05 E-5	47	1.04	Agreement
	Co-60	1.07 E-5	9.39 ± 0.41 E-6	23	1.14	Agreement
	I-131	1.23 E-5	1.13 ± 0.04 E-5	28	1.09	Agreement
	I-133	3.41 E-6	3.08 ± 0.40 E-6	8	1.	Agreement
	Cs-134	2.08 E-5	2.16 ± 0.05 E-5	43	0.96	Agreement
	Cs-137	3.32 E-5	3.55 ± 0.06 E-5	59	0.94	Agreement

SAMPLE (Geometry)	ISOTOPE	CONCENTRATION (uCi/UNIT) LICENSEE	CONCENTRATION (uCi/UNIT) NRC	RESOLUTION	LICENSEE/NRC	COMPARISON
3. Containment Gas (1260 cc Marinelli)						
a. Ortec #1	Ar-41	3.83 E-6	3.40 ± 0.33 E-6	10	1.12	Agreement
	Xe-133	7.91 E-5	7.75 ± 0.06 E-5	129	1.02	Agreement
	Xe-135	1.50 E-6	1.82 ± 0.07 E-6	26	0.82	Agreement
b. Ortec #3	Ar-41	3.97 E-6	3.40 ± 0.33 E-6	10	1.17	Agreement
	Xe-133	8.69 E-5	7.75 ± 0.06 E-5	129	1.12	Agreement
	Xe-135	1.68 E-6	1.82 ± 0.07 E-6	26	0.92	Agreement
c. Genie #3	Ar-41	3.91 E-6	3.40 ± 0.33 E-6	10	1.15	Agreement
	Xe-133	8.37 E-5	7.75 ± 0.06 E-5	129	1.08	Agreement
	Xe-135	1.57 E-6	1.82 ± 0.07 E-6	26	0.86	Agreement
Waste Gas Decay Tank A (14cc Gas Vial)						
a. Ortec #1	Kr-85M	3.69 E-3	3.30 ± 0.09 E-3	37	1.12	Agreement
	Kr-88	5.32 E-3	3.54 ± 0.24 E-3	15	1.50	Agreement
	Xe-133M	1.29 E-2	9.59 ± 0.43 E-3	22	1.34	Disagreement
	Xe-133	7.70 E-1	5.98 ± 0.01 E-1	>200	1.29	Disagreement
	Xe-135	3.86 E-2	3.03 ± 0.02 E-2	152	1.27	Disagreement
b. Ortec #2	Kr-85M	3.66 E-3	3.30 ± 0.09 E-3	37	1.11	Agreement
	Kr-88	4.71 E-3	3.54 ± 0.24 E-3	15	1.33	Agreement
	Xe-133M	1.22 E-2	9.59 ± 0.43 E-3	22	1.27	Agreement
	Xe-133	6.76 E-1	5.98 ± 0.01 E-1	>200	1.13	Agreement
	Xe-135	3.67 E-2	3.03 ± 0.02 E-2	152	1.22	Agreement
c. Ortec #3	Kr-85M	3.78 E-3	3.30 ± 0.09 E-3	37	1.14	Agreement
	Kr-88	5.18 E-3	3.54 ± 0.24 E-3	15	1.46	Agreement
	Xe-133M	1.22 E-2	9.59 ± 0.43 E-3	22	1.27	Agreement
	Xe-133	7.68 E-1	5.98 ± 0.01 E-1	>200	1.28	Disagreement
	Xe-135	3.94 E-2	3.03 ± 0.02 E-2	152	1.30	Disagreement
d. Genie #3	Kr-85M	3.52 E-3	3.30 ± 0.09 E-3	37	1.07	Agreement
	Kr-88	3.83 E-3	3.54 ± 0.24 E-3	15	1.08	Agreement
	Xe-133M	1.09 E-2	9.59 ± 0.43 E-3	22	1.14	Agreement
	Xe-133	7.45 E-1	5.98 ± 0.01 E-1	>200	1.24	Disagreement
	Xe-135	3.43 E-2	3.03 ± 0.02 E-2	152	1.13	Agreement
5. Spiked Charcoal Cartridge						
a. Ortec #1	Co-60	4.36 E-2	4.63 ± 0.07 E-2	66	0.95	Agreement
	Cd-109	1.08 E-0	1.10 ± 0.01 E-0	110	0.98	Agreement
	Sr-113	1.79 E-2	1.89 ± 0.03 E-2	63	0.95	Agreement
	Ce-139	1.01 E-2	1.15 ± 0.02 E-2	57	0.88	Agreement
	Hg-203	4.21 E-3	3.90 ± 0.16 E-3	24	1.08	Agreement
	Co-57	1.72 E-2	1.88 ± 0.02 E-2	94	0.91	Agreement
	Y-88	2.83 E-2	3.13 ± 0.06 E-2	52	0.90	Agreement
	Cs-137	4.13 E-2	4.49 ± 0.05 E-2	90	0.92	Agreement

SAMPLE (Geometry)	ISOTOPE	CONCENTRATION (uCi/UNIT) LICENSEE	NRC	RESOLUTION	LICENSEE/NRC	COMPARISON
b. Ortec #2	Co-60	4.31 E-2	4.63 ± 0.07 E-2	66	0.93	Agreement
	Cd-109	1.09 E-0	1.10 ± 0.01 E-0	110	0.99	Agreement
	Sr-113	1.86 E-2	1.89 ± 0.03 E-2	63	0.98	Agreement
	Ce-139	1.03 E-2	1.15 ± 0.02 E-2	57	0.90	Agreement
	Hg-203	4.1 E-3	3.90 ± 0.16 E-3	24	1.06	Agreement
	Co-57	1.75 E-2	1.88 ± 0.02 E-2	94	0.93	Agreement
	Y-88	2.94 E-2	3.13 ± 0.06 E-2	52	0.94	Agreement
	Cs-137	4.42 E-2	4.49 ± 0.05 E-2	90	0.98	Agreement
c. Ortec #3	Co-60	4.15 E-2	4.63 ± 0.07 E-2	66	0.90	Agreement
	Cd-109	1.10 E-0	1.10 ± 0.01 E-0	110	1.00	Agreement
	Sr-113	1.79 E-2	1.89 ± 0.03 E-2	63	0.95	Agreement
	Ce-139	1.04 E-2	1.15 ± 0.02 E-2	57	0.90	Agreement
	Hg-203	4.08 E-3	3.90 ± 0.16 E-3	24	1.05	Agreement
	Co-57	1.62 E-2	1.88 ± 0.02 E-2	94	0.86	Agreement
	Y-88	2.94 E-2	3.13 ± 0.06 E-2	52	0.94	Agreement
	Cs-137	4.26 E-2	4.49 ± 0.05 E-2	90	0.95	Agreement
d. Genie #3	Co-60	4.27 E-2	4.63 ± 0.07 E-2	66	0.92	Agreement
	Cd-109	1.06 E-0	1.10 ± 0.01 E-0	110	0.96	Agreement
	Sr-113	1.72 E-2	1.89 ± 0.03 E-2	63	0.91	Agreement
	Ce-139	9.88 E-3	1.15 ± 0.02 E-2	57	0.86	Agreement
	Hg-203	3.67 E-3	3.90 ± 0.16 E-3	24	0.94	Agreement
	Co-57	1.71 E-2	1.88 ± 0.02 E-2	94	0.91	Agreement
	Y-88	2.70 E-2	3.13 ± 0.06 E-2	52	0.86	Agreement
	Cs-137	4.46 E-2	4.49 ± 0.05 E-2	90	0.99	Agreement
e. Genie #4	Co-60	4.17 E-2	4.63 ± 0.07 E-2	66	0.90	Agreement
	Cd-109	1.05 E-0	1.10 ± 0.01 E-0	110	0.95	Agreement
	Sr-113	1.73 E-2	1.89 ± 0.03 E-2	63	0.92	Agreement
	Ce-139	9.86 E-3	1.15 ± 0.02 E-2	57	0.86	Agreement
	Hg-203	3.74 E-3	3.90 ± 0.16 E-3	24	0.96	Agreement
	Co-57	1.67 E-2	1.88 ± 0.02 E-2	94	0.89	Agreement
	Y-88	2.74 E-2	3.13 ± 0.06 E-2	52	0.88	Agreement
	Cs-137	4.41 E-2	4.49 ± 0.05 E-2	90	0.98	Agreement
6. Spiked Particulate Filter (NRC Spike)						
a. Ortec #1	Co-60	4.15 E-2	4.29 ± 0.06 E-2	72	0.97	Agreement
	Sr-85	2.18 E-3	2.03 ± 0.17 E-3	12	1.07	Agreement
	Cd-109	1.61 E-1	1.59 ± 0.03 E-1	53	1.01	Agreement
	Sn-113	7.27 E-3	7.15 ± 0.24 E-3	30	1.02	Agreement
	Ce-139	2.66 E-3	2.63 ± 0.09 E-3	29	1.01	Agreement
	Co-57	4.46 E-3	4.34 ± 0.09 E-3	48	1.03	Agreement
	Y-88	1.33 E-2	1.34 ± 0.04 E-2	34	0.99	Agreement
	Cs-137	4.10 E-2	4.05 ± 0.05 E-2	81	1.01	Agreement

SAMPLE (Geometry)	ISOTOPE	CONCENTRATION (uCi/UNIT) LICENSEE	NRC	RESOLUTION	LICENSEE/NRC	COMPARISON
b. Ortec #2	Co-60	4.46 E-2	4.29 ± 0.06 E-2	72	1.04	Agreement
	Sr-85	2.47 E-3	2.03 ± 0.17 E-3	12	1.22	Agreement
	Cd-109	1.68 E-1	1.59 ± 0.03 E-1	53	1.06	Agreement
	Sn-113	8.23 E-3	7.15 ± 0.24 E-3	30	1.15	Agreement
	Ce-139	2.83 E-3	2.63 ± 0.09 E-3	29	1.08	Agreement
	Co-57	4.89 E-3	4.34 ± 0.09 E-3	48	1.13	Agreement
	Y-88	1.42 E-2	1.34 ± 0.04 E-2	34	1.06	Agreement
	Cs-137	4.44 E-2	4.05 ± 0.05 E-2	81	1.10	Agreement
c. Ortec #3	Co-60	4.34 E-2	4.29 ± 0.06 E-2	72	1.02	Agreement
	Sr-85	2.41 E-3	2.03 ± 0.17 E-3	12	1.19	Agreement
	Cd-109	1.76 E-1	1.59 ± 0.03 E-1	53	1.11	Agreement
	Sn-113	7.82 E-3	7.15 ± 0.24 E-3	30	1.09	Agreement
	Ce-139	2.88 E-3	2.63 ± 0.09 E-3	29	1.10	Agreement
	Co-57	4.65 E-3	4.34 ± 0.09 E-3	48	1.07	Agreement
	Y-88	1.42 E-2	1.34 ± 0.04 E-2	34	1.06	Agreement
	Cs-137	4.38 E-2	4.05 ± 0.05 E-2	81	1.08	Agreement
d. Genie #3	Co-60	4.11 E-2	4.29 ± 0.06 E-2	72	0.96	Agreement
	Sr-85	2.19 E-3	2.03 ± 0.17 E-3	12	1.08	Agreement
	Cd-109	1.58 E-1	1.59 ± 0.03 E-1	53	0.99	Agreement
	Sn-113	7.07 E-3	7.15 ± 0.24 E-3	30	0.99	Agreement
	Ce-139	2.51 E-3	2.63 ± 0.09 E-3	29	0.95	Agreement
	Co-57	5.60 E-3	4.34 ± 0.09 E-3	48	1.15	Agreement
	Y-88	1.23 E-2	1.34 ± 0.04 E-2	34	0.92	Agreement
	Cs-137	4.13 E-2	4.05 ± 0.05 E-2	81	1.02	Agreement
e. Genie #4	Co-60	4.38 E-2	4.29 ± 0.06 E-2	72	1.02	Agreement
	Sr-85	2.32 E-3	2.03 ± 0.17 E-3	12	1.14	Agreement
	Cd-109	1.67 E-1	1.59 ± 0.03 E-1	53	1.05	Agreement
	Sn-113	7.35 E-3	7.15 ± 0.24 E-3	30	1.03	Agreement
	Ce-139	2.73 E-3	2.63 ± 0.09 E-3	29	1.04	Agreement
	Co-57	4.62 E-3	4.34 ± 0.09 E-3	48	1.06	Agreement
	Y-88	1.33 E-2	1.34 ± 0.04 E-2	34	0.99	Agreement
	Cs-137	4.40 E-2	4.05 ± 0.05 E-2	81	1.09	Agreement

ATTACHMENT 2

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This enclosure provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgement limits denoting agreement or disagreement between licensee and NRC results are variable. This variability is a function of the NRC's value relative to its associated uncertainty, referred to in this program as "Resolution"[1] increases, the range of acceptable differences between the NRC and licensee values should be more restrictive. Conversely, poorer agreement between NRC and licensee values must be considered acceptable as the resolution decreases.

For comparison purposes, a ratio[2] of the licensee value to the NRC value for each individual nuclide is computed. This ratio is then evaluated for agreement based on the calculated resolution. The corresponding resolution and calculated ratios which denote agreement are listed in Table 1 below. Values outside of the agreement ratio for a selected nuclide are considered in disagreement.

[1]Resolution = $\frac{\text{NRC Reference Value for a Particular Nuclide}}{\text{Associated Uncertainty for the Value}}$

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

TABLE 1

CONFIRMATORY MEASUREMENTS ACCEPTANCE CRITERIA
RESOLUTION VS. COMPARISON RATIO

<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