CONFIRMATORY MEASUREMENTS PROGRAM

I. Introduction

The following information has been compiled for the information of
licensees in NRC Region III to assist in developing a more uniform
basis of laboratory comparisons in the conduct of the NRC Confirm-
atory Measurements Program.

II. NRC Reference Laboratory Analysis

The following counting times and instrumentation are generally used
by the NRC Reference Laboratory:

Media	Analysis	Instrumentation	Count Time*
Liquid	Gross Beta	Proportional	20 minutes
	H-3	Liquid scintillation	10 minutes
	Sr-90, total Sr	Proportional	20 minutes
	Gamma Spec	GeLi	60 minutes
Gas	Gamma Spec	GeLi	60 minutes
Particulate filter	Gamma Spec	GeLi	60 minutes
Charcoal Adsorber	Gamma Spec	GeLi	60 minutes

*or 20,000 counts.

III. Limits for Detectability

The reported NRC reference laboratory results are reviewed to deter-
mine if the results are above specific limits for detectability (LD).
Values below the LD are not used for comparison purposes. These LD
values are as follows:

1. Liquid and Gas

   Specific radionuclide concentrations of 10% of their MPC in
   10 CFR 20, Table II, Column B, of more restrictive value of
   soluble or insoluble limit.

2. Particulate Filter and Charcoal Adsorber

   Specific radionuclide activity present on filter (µCi/sample)
   at the following levels:

Isotope	LD	Isotope	LD
Cr-51	1×10^{-4}	Mo-99	5×10^{-5}
Mn-54	1.5×10^{-5}	I-131	2×10^{-5}
Co-57	2×10^{-5}	Cs-134	2×10^{-5}
Co-58	1.5×10^{-5}	Cs-137	2×10^{-5}
Co-60	3×10^{-5}	Ba-140	2×10^{-5}
Fe-59	3×10^{-5}	La-140	4×10^{-5}
Zn-65	3×10^{-5}	Ce-141	2×10^{-5}
Sr-89	1×10^{-5}	Ce-144	1×10^{-4}
Sr-90	2×10^{-5}	ZrNb-95	4×10^{-5}

IV. Decay Correction

NRC reference laboratory samples are counted approximately ten (10) days from sample collection.

Gross beta analysis is performed by both licensee and NRC reference laboratory on liquid samples at a pre-specified date approximately three (3) weeks from sample collection.

Gas samples should be retained by licensees for recounting two (2) to six (6) days after sample collection. Experience has shown that Xe-135 will mask Xe-133m and Kr-85 identification and quantification.

La-140 is presently not decay corrected to time of sampling by the NRC reference laboratory. Comparisons with La-140 are presently made for information purposes only.

V. Acceptance Criteria

Attachment 1 - "Criteria for Comparing Analytical Measurements" is utilized to determine whether results are in the agreement, disagreement, possible agreement, or no comparison category. For all NRC reference laboratory results above the LD, comparisons which are in 'agreement' or 'possible agreement' are considered acceptable, while 'disagreement' or 'not reported by licensee' are considered unacceptable.

VI. Reporting of Results

Results from the licensee's analytical measurements are to be received by NRC IE:III within 45 days of sample collection.

VII. Reports

Information on the NRC reference laboratory's and licensee's results are analyzed by the NRC Computer Data Analysis System. The completed report, example in Table I, is submitted to the licensee by the inspector during the exit interview of the Confirmatory Measurements Inspection.

As seen in Table I, results are provided for each sample by isotope. The respective parameters are:

1. NRC reference laboratory result and error (uncertainty).

2. Licensee result and error (uncertainty).

3. NRC and Licensee results and errors are reported in units of:

    $\mu Ci/cc$ for gas samples
    $\mu Ci/ml$ for liquid samples
    $\mu Ci/sample$ for particulate filters and charcoal adsorbers

4. Z Value

    This parameter was utilized in 1973 as part of the statistical comparison test criteria. The Z value is included for those licensees desiring additional statistical information about the reported values.

    $$Z \text{ value} = (X_1 - X_2)/(\sigma_1^2 + \sigma_2^2)^{\frac{1}{2}}$$

    where X_1 = NRC value
    X_2 = Licensee value
    σ_1 = NRC error
    σ_2 = Licensee error

5. PCT

    The percentage parameter was utilized in 1973 as part of the statistical comparison test criteria. Percentage (PCT) is included for those licensees desiring additional statistical information.

    $$PCT = (100) (X_1 - X_2)/X_1$$

6. RAT

    The ratio (RAT) is defined in Attachment 1 as:

    $$RAT = \overline{X}_2/\overline{X}_1$$

7. RES

    The resolution (RES) is defined in Attachment 1 as:

    $$RES = \overline{X}_1/\sigma_1$$

8. T

    The test result (T) is defined in Table 1 as:

    A = Agreement
    P = Possible Agreement
    N = No Comparison
    D = Disagreement

Attachments:
1. Attachment 1, Criteria for
   Comparing Analytical
   Measurements
2. Table 1, Confirmatory
   Measurements Program

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment 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 judgment limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated one sigma uncertainty. As that ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement should be considered acceptable as the resolution decreases. The values in the ratio criteria may be rounded to fewer significant figures to maintain statistical consistency with the number of significant figures reported by the NRC Reference Laboratory, unless such rounding will result in a narrowed category of acceptance. The acceptance category reported will be the narrowest into which the ratio fits for the resolution being used.

RESOLUTION	RATIO = LICENSEE VALUE/NRC REFERENCE VALUE		
	Agreement	Possible Agreement "A"	Possible Agreement "B"
<3	No Comparison	No Comparison	No Comparison
≥3 and <4	0.4 - 2.5	0.3 - 3.0	No Comparison
≥4 and <8	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
≥8 and <16	0.6 - 1.67	0.5 - 2.0	0.4 - 2.5
≥16 and <50	0.75 - 1.33	0.6 - 1.67	0.5 - 2.0
≥50 and <200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.67
≥200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is greater than 250 keV.

Tritium analyses of liquid samples.

"B" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is less than 250 keV.

Sr-89 and Sr-90 determinations.

Gross beta, where samples are counted on the same date using the same reference nuclide.

TABLE 1

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM

FACILITY:

FOR THE 3 QUARTER OF 1974

SAMPLE	ISOTOPE	---NRC--- RESULT	ERROR	RESULT	---LICENSEE--- RESULT	ERROR	Z VALUE	---NRC/LICENSEE--- PCT	RATIO	R-S	T
R SOLIDS	SR 89	2.7E-02	1.4E-03	6.9E-02	7.0E-04	2.6E+01	1.9E+02	2.2E+00	1.9E+01	R
	SR 90	3.0E-03	1.2E-04	8.1E-04	1.1E-04	1.4E+01	7.3E+01	2.7E-01	2.9E+01	R
L WASTE	I 131	6.7E-05	2.0E-06	6.1E-05	4.0E-06	1.3E+00	9.0E+00	9.1E-01	3.4E+01	A
	LA 140	7.7E-06	3.0E-07	2.1E-05	2.0E-06	6.6E+00	1.7E+02	2.7E+00	2.9E+01	A
	BA 140	1.7E-05	3.0E-06	2.0E-05	2.0E-06	8.3E-01	1.2E+01	1.2E+00	5.7E+01	A
	CS 134	4.4E-06	5.0E-07	3.9E-05	3.0E-05	1.5E+00	1.1E+01	8.9E+00	1.4E+01	A
	CS 137	8.3E-05	7.0E-07	6.4E-06	5.0E-06	2.8E+00	1.7E+01	8.3E-01	1.2E+02	A
	CO 60	7.2E-05	4.0E-06	6.7E-05	4.0E-06	3.7E+00	2.1E+01	7.7E-01	9.3E+01	A
	NB 95	2.1E-04	6.0E-06	1.8E-04	8.0E-06	6.0E+00	1.6E+01	8.4E-01	5.9E+01	A
	H 3	2.5E-03	1.0E-05	2.2E-03	2.0E-04	1.5E+01	1.2E+01	8.3E-01	2.0E+02	A
DEC GAS	XE 133	1.3E-01	6.0E-03	1.0E-01	3.0E-02	7.0E+00	4.5E+01	2.2E+00	2.2E+01	A
	XE 133.	9.1E-03	4.0E-04	4.0E-03	1.0E-03	9.3E-02	1.1E+00	9.3E-01	2.9E+01	A
	XE 135	2.5E-01	6.0E-02	3.7E-01	5.0E-02	1.4E+10	4.9E+01	1.2E+00	6.2E+00	A
	XE 133	1.3E-01	6.0E-03	1.9E-01	3.0E-02	2.0E+00	2.6E+01	1.5E+00	2.2E+01	A
	XE 133A	9.1E-02	4.0E-04	8.0E-03	1.0E-03	1.0E+00	1.2E+01	9.1E-01	2.2E+01	A
	XE 135	2.5E-01	4.0E-02	3.7E-01	6.0E-02	1.4E+00	4.8E+01	1.5E+00	4.2E+00	A
P FILTER	I 131	1.6E-04	3.0E-05	2.3E-04	3.0E-05	1.6E+00	4.4E+01	1.4E+00	5.4E+00	A
C FILTER	I 131	1.8E-01	1.0E-03	1.5E-01	2.0E-02	1.5E+00	1.2E+01	8.3E-01	1.8E+02	A

T TEST RESULTS:
A=AGREEMENT
R=DISAGREEMENT
B=POSSIBLE AGREEMENT
N=NO COMPARISON

SAMPLE COPY