11169-22

EPA QUALITY ASSURANCE OFFICER'S HANDBOOK

Volume I

Quality Control Samples
Performance Evaluations
Technical Assistance

QAMS-006/81

Quality Assurance Management Staff
Office of Monitoring Systems and Quality Assurance
U. S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

INTRODUCTION

This directory of services, materials, and performance evaluations, available from the two Environmental Monitoring Systems Laboratories (EMSLs), located in Las Vegas, Nevada, and Research Triangle Park, North Carolina, and the one Environmental Monitoring and Support Laboratory (also EMSL), located in Cincinnati, Ohio, is offered by the Quality Assurance Management Staff (QAMS) in response to many requests from regional and program office Quality Assurance (QA Officers. Its purpose is to place under one cover information regarding availability of materials and technical assistance from the ORD/EMSL facilities. These materials are made available to authorized laboratories free of charge, although there may be restrictions in some instances on how these samples are used and how results of analyses are reported. The names of principal contacts for these QA materials and services are included to facilitate the flow of information; where telephone numbers are not provided for the principals, it is requested that inquiries be made through correspondence.

This compendium is provided in a loose-leaf format so that pages can easily be replaced as information is added, deleted, or otherwise revised. Our intent is to revise this document as circumstances require. QAMS welcomes comments and suggestions for enhancing the utility of this publication.

EMSL - CINCINNATI
26 W. St. Clair Street
Cincinnati, Ohio 45268
Director: Robert L. Booth

WATER AND WASTEWATER ANALYSIS

EMSL-CI provides seven major quality assurance support programs:

(I) Quality Control Sample Program

(II) The EPA Repository for Toxic and Hazardous Materials

(III) Surrogates and Internal Standards

(IV) Performance Evaluation Studies.

(V) Special Studies

(VI) Alternate Test Procedures

(VII) Development of Monitoring Methods and Standards

The details follow:

I. QUALITY CONTROL SAMPLE PROGRAM

Quality Control (QC) samples are furnished without charge to interested governmental, industrial, commercial, and private laboratories for use as secondary checks on their within-laboratory quality control programs. The samples are intended as independent measures of technique and performance, not as replacement for the standards, replicates, or spike samples run routinely as part of the laboratory's own QC program.

There is no certification or other formal evaluative function resulting from the use of QC samples. No reports are prepared and there is no requirement for use of specific methodology in these QC analyses. The Quality Control Sample Program now covers water quality, drinking water, and the priority pollutant parameters shown in Tables C-1, C-2, and C-3.

II. THE EPA REPOSITORY FOR TOXIC AND HAZARDOUS MATERIALS

EMSL-Cincinnati has established the EPA Repository for Toxic and Hazardous Materials to provide a continuing source of calibration materials, standards and reference compounds needed by EPA. Initially, the Repository will provide the Priority Pollutants, but will be expanded soon to cover all trace organics of interest to the Agency. For example, personnel are being added to support the broader needs of the Hazardous Wastes Program. Also, EMSL-CI will acquire a gas chromatograph/mass spectrometry (GC/MS) library of approximately 2000 trace organic compounds which have been characterized and stored in a

computer data base as part of a contract administered by the Health Effects Research Laboratory - Cincinnati. Because a number of the toxic or hazardous compounds are increasingly difficult to obtain as manufacturing and commercial uses are restricted, the Repository has been given the staff, equipment and facilities needed to purify and upgrade chemicals, and to perform complex chemical syntheses for unattainable compounds.

Table C-1

QUALITY CONTROL SAMPLES FOR WATER QUALITY ANALYSES

DEMAND ANALYSES - BOD, COD, TOC

MINERAL/PHYSICAL ANALYSES - sodium, potassium, calcium, magnesium, pH, sulfate, chloride, fluoride, alkalinity/acidity, total hardness, total dissolved solids, and specific conductance

NUTRIENTS - nitrate-N, ammonia-N, Kjeldahl-N, orthophosphate, and total-P

TRACE METALS - aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, and zinc

TRACE METALS - antimony, thallium, and silver

CYANIDE

TOTAL NON-FILTERABLE, FILTERABLE, AND TOTAL VOLATILE RESIDUE

LINEAR ALKYLATE SULFONATE - LAS, the anionic surfactant standard/MBAS Test

CHLOROPHYLL - Spectrophotometric and Fluorometric analyses

MUNICIPAL DIGESTED SLUDGE - 26 inorganic and general organic parameters

OIL AND GREASE

PETROLEUM HYDROCARBONS - two crude oils, No. 2 fuel oil, and Bunker C (API Reference Oils for characterization analyses)

PHENOL (4AAP Method)

PESTICIDES - aldrin, dieldrin, DDT, DDE, DDD, heptachlor, chlordane

POLYCHLORINATED BIPHENYLS - Aroclor 1254 and 1016

VOLATILE ORGANIC - six to nine compounds, including THM's

Table C-2

QUALITY CONTROL SAMPLES FOR DRINKING WATER ANALYSES

NITRATE/FLUORIDE

HERBICIDES - 2,4-D, 2,4,5-TP

TURBIDITY

RESIDUAL-FREE CHLORINE

TRIHALOMETHANES

TRACE METALS - arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver

PESTICIDES - endrin, lindane, methoxychlor, toxaphene

Table C-3

QUALITY CONTROL SAMPLES FOR PRIORITY POLLUTANTS, CATEGORIES (No. Compounds/Category)

Available by 12/80	Available by 12/81
Phthalate Esters (6)	Acrolein, Acrylonitrile
Haloethers (7)	Nitrobenzenes/Isophorone (4)
Chlorinated Hydrocarbons (9)	Nitrosamines (3)
Benzidines (3)	Phenols (specific) (11)
Polynuclear Aromatics (16)	
Pesticides/PCBs (25)	
Purgeables (26)	
Trace Metals (15)	

To establish qualitative identification and determine purity, Repository compounds are qualitatively and quantitatively measured by at least two independent methodologies by the Repository staff and subsequently verified by at least two referee laboratories. Significant differences are resolved before release of a compound.

Three grades of materials will be established:

(1) Quality Assurance Standards (QAS) $\geq$ 99 percent purity

(2) Quality Assurance Reagents (QAR) 95-98 percent purity

(3) Quality Assurance Technical Materials (QAT) < 95 percent purity

The Repository will move as many compounds as possible from the QAT and QAR categories into the QAS category by use of purification techniques. Multicomponent materials, such as polychlorinated biphenyls (PCB's) and toxaphene, will be categorized as QAR or QAT and will not be purified further. A list of the first Repository materials to be distributed in January 1981 is given in Table C-1.

Table C-4

REPOSITORY MATERIALS TO BE DISTRIBUTED IN JANUARY 1981

Concentrations are 5,000 ug of OAS-pure compound per mL of methanol solvent unless otherwise noted.

E001 Acenaphthene	E004 Benzene (10,000 ug/mL)
E006 Chlorobenzene (10,000 ug/mL)	E007 1,2,4-Trichlorobenzene
E018 2-Chloronaphthalene	E020 p-Chloro-m-cresol
E023 1,2-Dichlorobenzene	E025 1,4-Dichlorobenzene
E037 Fluoranthene	E053 Naphthalene
E054 Nitrobenzene	E058 4,6-Dinitro-o-cresol
E059 N-Nitrosodimethylamine	E060 N-Nitrosodiphenylamine
E061 N-Nitroso-di-n-propylamine	E064 bis(2-Ethyl hexyl) phthalate
E066 Di-n-butyl phthalate	E068 Diethyl phthalate
E069 Dimethyl phthalate	E078 Fluorene
E079 Phenanthrene	E084 Toluene (10,000 ug/mL)
E104 PCB-Aroclor 1242 (OAT)	E107 PCB-Aroclor 1232 (OAT)
E109 PCB-Aroclor 1260 (OAT)	E110 PCB-Aroclor 1016 (OAT)
E022 2-Chlorophenol	E063 Phenol
E111 Toxaphene (OAT)	

III. SURROGATE COMPOUNDS AND INTERNAL STANDARDS

Since the first step in regulation for specific parameters is to establish the analytical methodology, EMSL-Cincinnati is now incorporating quality control requirements for calibration standards, internal standards, surrogates, and quality control check samples into the methodology. This assures that quality control and data quality are addressed. Examples of some of the surrogate compounds and internal standards that are being considered for inclusion in the methodology are shown in the following tables. Those available now are shown with an asterisk (*). The others are in preparation.

Table C-5

METHOD 624

d_5-ethyl benzene
*d_5-benzene
*d_8-toluene
*fluorobenzene
1,4-difluorobenzene
pentafluorobenzene
d_{10}-ethylbenzene
*4-bromofluorobenzene
bromochloromethane
2-bromo-1-chloropropane
1,4-dichlorobutane
d_4-1,2-dichloroethane
d_2-1.1.2.2-tetrachloroethane
d_6-2,2-dichloropropane

Table C-6

METHOD 625

*2-fluorophenol
*pentafluorophenol
d_5-phenol
d_4-2-nitrophenol
*1-fluoronaphthalene
4,4'-dibromo-octafluorobiphenyl
*4-fluoroaniline
decafluorobiphenyl
d_8-naphthalene
d_5-nitrobenzene
d_{10}-fluorene
d_{12}-chrysene
d_4-di-n-butyl-phthalate

IV. PERFORMANCE EVALUATION STUDIES

Performance Evaluation Studies have the primary purpose of regularly evaluating performance of laboratories as required by EPA mandates or by program request. One or two sample concentrates for each parameter group of interest are sent to participating laboratories for spiking into a labortory-pure water, and analyses within a set time interval. Performance is judged from analyses in a laboratory-pure water rather than wastewaters in order to remove variable sample matrix interference from the evaluations.

The performance evaluation studies presently available for EPA laboratories, EPA extramural projects, and the State and local agencies follow, with the approximate periods during which samples may be requested are shown in Tables C-7 and C-8.

Table C-7

WATER SUPPLY STUDIES FOR DRINKING WATER CERIFICATION PROGRAM

Parameters - all MCL Parameters:

Trace Metals - Ag, As, Ba, Cd, Cr, Pb, Hg, Se
Nitrate/Fluoride
Lindane, Endrin, Methoxychlor, Toxaphene
2,4-D, 2,4,5-TP
Chloroform, Bromoform, Bromodichloromethane,
Chlorodibromomethane
Residual-Free Chlorine, Turbidity

Study No.	Sample Request Period
WSOO8	1/81 - 6/81
WSOO9	7/81 - 12/81
WSO10	1/82 - 6/82

Table C-8

WATER POLLUTION STUDIES

Parameters:

Minerals - pH, alkalinity/acidity, T-hardness, TDS, Sodium
Potassium, Calcium, Magnesium, Chloride, Fluoride,
Sulfate
Nutrients - Ammonia-N, Nitrate-N, Kjeldahl-N, Orthophosphate,
Total-P
Demands - BOD, TOC, COD
Trace Metals - Al, As, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, V,
Se, Zn, Sb, Ti, Ag
Halogenated Purgeables (11)
PCB's - 1016 and 1254
Pesticides - Aldrin, Dieldrin, DDT, DDE, DDD, Heptachlor,
Chlordane, Cyanide

Study No.	Sample Request Period
WP007	3/81 - 8/81
WP008	9/81 - 2/82
WP009	3/81 - 8/82

V. SPECIAL STUDIES

Priority Pollutant Categories for GC analyses - 12 categories available. Priority Pollutants for GC/MS Analyses (as Volatile and Semi-Volatile Compounds).

Additional information concerning quality control samples, toxic and hazardous materials respository, and surrogate compounds and internal standards may be obtained from:

John Winter, Chief
Quality Assurance Branch

VI. ALTERNATE TEST PROCEDURES

In addition to these services and materials, EMSL-Cincinnati also provides direct support by administering the Alternate Test Procedure Program in both the National Pollutant Discharge Elimination System and the National Interim Primary Drinking Water Regulations. All alternate test procedures intended for limited use applications that are considered for approval at the state and regional level are forwarded to EMSL-Cincinnati for technical review and consistency with previous actions. Recommendations are provided to the requesting region and appropriate program office. Applications for nationwide approval are submitted directly to the Director of EMSL-Cincinnati for technical review and appropriate administrative actions to result in publication in the Federal Register.

Information regarding alternate test procedures may be obtained from:

Larry Lobring
Acting QA Officer

VII. DEVELOPMENT OF MONITORING METHODS AND STANDARDS

Indirect support is also provided by developing standardized analytical test procedures to identify and measure pollutants and quality characteristics, both chemical and biological, in drinking water, ambient receiving waters, and effluents. EMSL-Cincinnati also develops quality assurance manuals for use in water pollution measurements.

Information regarding the development of new monitoring methods and standards may be obtained from the Director, Robert L. Booth.

EMSL-Las Vegas
P.O. Box 15027
Las Vegas, Nevada 89114
Contact: [illegible]

RADIOACTIVITY AND HAZARDOUS WATER ANALYSIS

[illegible] known amounts of one or more radionuclides which are prepared and [illegible] [illegible] upon request. [illegible] [illegible] analyses and return their data to the [illegible] Division for statistical analysis and comparison with known values as well as analytical values obtained by other participating [illegible]. A report is returned to each participant. The program [illegible] laboratory to document the precision and accuracy of [illegible] data, identify instrumental and procedural problems, and [illegible] performance with that of other laboratories.

[illegible] making environmental radiation measurements should have an internal quality control program in operation to ensure [illegible] instrumentation is calibrated and functioning, and that [illegible] [illegible] properly. [illegible] continual monitoring of instrumentation, the plotting of [illegible] charts, frequent analysis of replicate samples [illegible] and the regular measurement of samples to which known [illegible]

I. TYPES OF ENVIRONMENTAL SAMPLES DISTRIBUTED

The current laboratory intercomparison studies program includes the analysis of a variety of media containing various levels of radioactivity. These include

Water: Water containing several different mixtures of radio-[illegible] Study. For example:

- Four-liter samples for the analysis of gross alpha and gross beta activity are sent bimonthly to participating laboratories.
- Four-liter samples containing chromium-51, zinc-65, cobalt-[illegible], ruthenium-106, cesium-134, and cesium-137 are distributed bimonthly for analysis of gamma emitters.
- Fifty-milliliter samples for tritium analysis are distributed on a bimonthly basis.
- Four-liter samples containing plutonium-239 are [illegible] laboratories twice per year.
- [illegible]-liter samples containing iodine-131 are distributed [illegible] times per year.
- [illegible] samples containing radium-226 and radium-228 [illegible] distributed four times per year.
- Four-liter samples containing strontium-89 and strontium-[illegible] distributed three times per year.
- [illegible] containing [illegible] are distributed semiannually.
- Four-liter samples containing uranium-238 are distributed twice per year.

Milk: four-liter milk samples containing [illegible] are distributed quarterly.

Air: Two-inch-diameter air filters are distributed quarterly for gross alpha, gross beta, cesium-137, and strontium-90 analyses. Three air filters are sent to each laboratory.

Vegetation: Four-liter food slurry samples containing strontium-90, strontium-90, [illegible] cesium-137, [illegible] are distributed three times per year. Three samples are sent to each laboratory.

Drinking: Fifty-milliliter urine samples containing tritium are distributed quarterly.

Sample type, approximate activity levels, type of analysis, and other pertinent information concerning the intercomparison samples are summarized in Table 1-1. The distribution schedule is outlined in Table 1-2. Information pertinent to laboratory precision for the various analytical procedures is presented in Table 1-3.

Table 1-1

SUMMARY OF [illegible] RADIOLOGICAL [illegible]

Sample	Analysis	Activity of isotope	Quantity supplied	Frequency	Distribution	Time for analysis & report
Milk	^{89}Sr, ^{90}Sr, ^{131}I, ^{137}Cs, ^{140}Ba, I	[illegible] pCi/liter	~4 liters	[illegible]	quarterly	10 weeks
Water						
Gross	Gross α,β	~1 - pCi/liter	~4 liters	[illegible]	semimonthly	6 weeks
Gamma	^{60}Co, ^{106}Ru, ^{134}Cs, ^{131}I, ^{137}Cs, ^{51}Cr, [illegible]	<500 pCi/liter	~4 liters	0.5[illegible]	bimonthly	6 weeks
^{3}H	^{3}H	<2,500 pCi/liter	~50 ml	[illegible]	bimonthly	4 weeks
^{239}Pu*	^{239}Pu	<10 pCi/liter	~4 liters	0.5[illegible]	semiannually	6 weeks
Radium	^{226}Ra, ^{228}Ra	<20 pCi/liter	~4 liters	0.5[illegible]	quarterly	8 weeks
Strontium	^{89}Sr, ^{90}Sr	<50 pCi/liter	~4 liters	0.5[illegible]	triannually	10 weeks
Blind	Any combination of above radionuclides	<200 pCi/liter	~4 liters	0.5[illegible]	semiannually	10 weeks
^{131}I	^{131}I	<3 pCi/liter	~4 liters	[illegible]	triannually	6 weeks
Uranium	Total uranium	<50 pCi/liter	~4 liters	0.5[illegible]	triannually	6 weeks
Air filter	Gross α, β, ^{90}Sr, ^{137}Cs	[illegible] pCi/sample	3 - 2" diameter air filters	[illegible]	quarterly	10 weeks
Diet	^{89}Sr, ^{90}Sr, ^{131}I, ^{137}Cs, ^{140}Ba, [illegible]	[illegible] pCi/kg	2 - 4-liter samples	[illegible]	triannually	10 weeks
Urine	^{3}H	[illegible] pCi/liter	~50 ml	[illegible]	quarterly	[illegible]

*Laboratories are required to have the [illegible] licenses before [illegible]

Date: [illegible]
Page [illegible] of [illegible]

Table 1-2

LABORATORY INTERCOMPARISON STUDIES DISTRIBUTION SCHEDULE

(Numbers indicate week of the month)

Month	Water									Milk	Food	Urine	Air filter
	γ	^{131}I	Gross α, β	^{3}H	^{226}Ra ^{228}Ra	^{239}Pu	^{89}Sr ^{90}Sr	^{235}U	others	Sr, I	Sr, ?	^{3}H	Gross α, β ^{137}Cs, ^{90}Sr
October	1			2					3	4			
November			1								1		
December		1		2	1							2	4
January			1			2	1			4			
February	1			2				3					
March			1		2						1	3	4
April		1		2					3	4			
May			1				1						
June	1			2	1							2	4
July			1			2				4	1		
August		1		2				3					
September			1				1					3	4

[illegible] sample [illegible] Support [illegible] Certification [illegible]

Table L-4

RATIOS OF ACTIVITY MEASUREMENTS PERFORMED UNDER THE EPA TRACEABILITY PROGRAM WITH NBS, JANUARY 1974 TO JANUARY 1980

	Nuclide	EPA Value / NBS Value
Direct Traceability:		
Samples submitted to NBS by the EMSL-LV	^{3}H	0.996
	^{51}Cr	0.985
	^{54}Mn	0.997
	^{60}Co	1.006
	^{65}Zn	0.994
	^{89}Sr	0.989
	^{89}Sr	0.966
	^{89}Sr	0.977
	^{90}Sr	1.014
	^{131}I	0.977
Indirect Traceability:		
NBS-prepared samples sent to the EMSL-LV	^{14}C	1.004
	^{45}Ca	1.049
	^{46}Sc	0.995
	^{51}Cr	1.015
	^{59}Fe	0.996
	^{57}Co	1.027

CONTENTS

Table L-4 (Continued)

Nuclide	EPA Value / NBS Value
Indirect Traceability (Continued):	
NBS-prepared samples sent to the EMSL-LV	
^{58}Co	0.980
^{60}Co	1.001
^{63}Ni	0.989
^{75}Se	0.919
^{89}Sr	0.997
^{90}Sr	1.008
^{99}Mo	0.968
^{109}Cd	0.970
^{110m}Ag	1.018
^{134}Cs	1.013
^{137}Cs	0.981
^{140}Ba	0.979
^{141}Ce	1.080
^{147}Pm	1.008
^{152}Eu	0.959
^{203}Hg	1.024
^{203}Hg	1.017
^{203}Pb	1.171
^{228}Th	0.970
^{238}Pu	1.000
^{239}Pu	0.986
^{241}Am	0.995

IV. AQUEOUS CALIBRATED SAMPLES

The inventory of calibrated samples consists of a number of calibrated radionuclide solutions (Table L-5). Except for Iodine-131, every effort is made to maintain this inventory so that samples can be shipped in a timely manner. Iodine-131 is prepared bimonthly and distributed to requestors on record. While the types of calibrated samples in the inventory vary during the year, every effort is made to keep the calibrated solution samples listed in Table L-2 in stock and available for distribution at any time.

Throughout the year, the additional radionuclide solutions listed in Table L-6 are calibrated and made available for distribution. The Quality Assurance Division will obtain, calibrate, and distribute any of these radionuclides, as time and resources permit, after ten or more requests have been received. The user is reminded, however, that these solutions are prepared as time permits, and as the Division is able to maintain the above inventory.

On occasion, a few selected radionuclide solutions not listed in Table L-6 are calibrated. Letters will be sent to previous requestors of low-level radionuclide solutions to efficiently allocate the distribution of these solutions.

Table L-5

CALIBRATED RADIONUCLIDE SAMPLES KEPT IN INVENTORY

Isotope	Type Emission	Half-Life	Major Gamma Peak (MeV)	Gamma Abundance	dpm/cc
^{3}H	β−	12.35 y	—	—	10,000
^{14}C	β−	5730 y	—	—	10,000
^{54}Mn	γ	312.5 d	0.835	99.978	40,000
^{57}Co	γ	270.9 d	0.122	85.6	30,000
^{60}Co	β−,γ	5.271 y	1.333	100	40,000
^{63}Ni	β−	92 y	—	—	10,000
^{65}Zn	β−,γ	244.1 d	1.115	50.75	160,000
^{89}Sr	β−	50.6 d	—	—	160,000
^{90}Sr	β−	28 y	—	—	10,000
^{106}Ru	β−,γ	369 d	0.512	20.6	160,000
^{109}Cd	γ	453 d	0.088	3.72	≈0.2 μCi/g
^{110m}Ag	β−,γ	250.8 d	0.658	94.6	80,000
^{125}Sb	β−,γ	2.77 d	0.428	29.6	320,000
^{131}I	β−,γ	8.04 d	0.364	81.2	≈0.4 μCi/g
^{133}Ba	γ	10.5 y	0.356	62.4	160,000
^{134}Cs	β−,γ	2.062 y	0.605	97.6	40,000
^{137}Cs	β−,γ	30.17 d	0.662	85.0	20,000
^{144}Ce	β−,γ	284.3 d	0.134	10.8	320,000
^{226}Ra	α	1600 y	—	—	10,000
^{228}Ra	β−	5.75 y	—	—	30,000
^{230}Th	α	7.7×10^{4} y	—	—	10,000

Table L-5 (Continued)

Isotope	Type Emission	Half-Life	Major Gamma Peak (MeV)	Gamma Abundance	dpm/g*
^{232}Th	α	1.4×10^{10} y	—	—	10,000
^{232}U	α	72 y	—	—	25,000
^{238}U	α	4.5×10^{9} y	—	—	2,500
^{239}Pu	α	2.4×10^{4} y	—	—	5,000
^{241}Pu	β−	14.4 y	—	—	10,000
^{241}Am	α	433 y	—	—	10,000

*Approximate activity (dpm/g) of the isotope on the date calibrated.

†Prepared and calibrated by the National Bureau of Standards.

Table L-6

CALIBRATED RADIONUCLIDE SAMPLES SUPPLIED AS NEEDED

Isotope	Type Emission	Half-Life	Major Gamma Peak (MeV)	Gamma Abundance	dpm/g*
^{7}Be	γ	53.3 d	0.477	10.3	640,000
^{22}Na	β^+,γ	2.602 y	0.511	180.58	20,000
^{46}Sc	β^-,γ	82.80 d	1.120	100	160,000
^{51}Cr	γ	27.704 d	0.320	9.80	= 0.2 μCi/g
^{56}Co	β^+,γ	77.3 d	0.847	99.974	160,000
^{58}Co	β^+,γ	70.8 d	0.811	99.45	160,000
^{59}Fe	β^-,γ	44.6 d	1.099	56.1	320,000
^{75}Se	γ	120 d	0.265	59.5	320,000
^{85}Sr	γ	64.85 d	0.514	98.0	160,000
^{88}Y	β^+,γ	107 d	1.836	99.35	160,000
^{95}Zr	β^-,γ	63.98 d	0.757	54.3	320,000
^{103}Ru	γ	39.35 d	0.497	86.4	320,000
^{124}Sb	β^-,γ	60.20 d	0.603	97.9	160,000
^{139}Ce	γ	137.65 d	0.165	80.0	160,000
^{141}Ce	β^-,γ	32.50 d	0.145	48.0	320,000
^{203}Hg	β^-,γ	46.59 d	0.279	81.5	160,000
^{207}Bi	γ	38 y	0.570	97.8	20,000

*Approximate activity (dpm/g) of the isotope on the date calibrated.

V. SPECIAL REFERENCE MATERIALS

Calibrated soil samples for use as reference materials are also available. These samples have been dried, ground to pass a 170-mesh or a 200-mesh screen, and carefully blended. Reports of calibration accompany the samples. The samples are packaged in glass containers which contain approximately 10 grams (g) of soil. Soils available are:

1. Standard Pitchblende

Principal radionuclides and approximate activity - ^{238}U : 253 pCi/g
^{235}U : 12 pCi/g

Principal daughter products - ^{210}Pb, ^{210}Po, ^{234}U, ^{230}Th, ^{231}Pa, ^{226}Ra, ^{227}Ac, ^{227}Th, ^{214}Pb

2. Diluted Pitchblende

This is approximately a 10:1 dilution of the standard pitchblende diluted with low-activity soil.

3. Standard Monazite Ore

Principal radionuclides and approximate activity – ^{232}Th : 1.54 nCi/g
^{228}Th : 1.54 nCi/g

4. Diluted Monazite Ore

This is approximately a 10:1 dilution of standard monazite diluted with low-activity soil.

5. Uranium Mill Tailings (1)

Climax sand tailings

Principal radionuclides and approximate activity – ^{230}Th : 257 pCi/g
^{226}Ra : 344 pCi/g
^{210}Pb : 300 pCi/g

6. Uranium Mill Tailings (2)

A composite mixture from 16 different uranium mills

Principal radionuclides and approximate activity – ^{230}Th : 311 pCi/g
^{226}Ra : 501 pCi/g
^{210}Pb : 433 pCi/g

7. Diluted Uranium Mill Tailings

A 7:1 dilution of the Climax sand tailings with low-activity soil.

The three materials listed below were prepared for the EPA by the NBS. Material Number 8 is unspiked. Supplemental information concerning the techniques used to characterize the radium-226 and radium-228 concentrations is supplied with the report of calibration prepared by the NBS. Mancos shale and fly ash are supplied in 100-gram aliquots.

8. Mancos Shale

Principal radionuclides

and approximate activity – ^{226}Ra : 3.4 dpm/g

^{228}Ra : 2.9 dpm/g

9. Fly Ash

Principal radionuclides

and approximate activity – ^{226}Ra : 7.8 dpm/g

^{228}Ra : 5.7 dpm/g

Mixed Nuclide Standard [illegible]

[illegible] of seven radionuclides in an aqueous [illegible] [illegible] and calibrated by the National [illegible] [illegible]. This material is available in 5-ml [illegible] aliquots sealed in a glass ampul. Another mixed nuclide standard [illegible] [illegible] listed below.

[illegible] radionuclide

^{3}H	14,000 dpm/g
^{90}Sr	67 dpm/g
^{134}Cs	60 dpm/g
[illegible]	53 dpm/g
^{228}Ra	44 dpm/g
^{234}U	73 dpm/g
[illegible]	[illegible] dpm/g

[illegible] of concerned with environmental [illegible] [illegible] eligible to [illegible] [illegible] as described. There is no cost to participating laboratories for this service. A laboratory may elect to receive [illegible] frequent basis than indicated on the distribution

participant in the laboratory intercomparison studies
shall be one of the forms included at the end of this docu-
ment and shall be sent to:

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Quality Assurance Division
Attn:

Questions concerning the above programs may be di-
rected to:

Radioactive Standards:

Lauren Thompson 702-798-2141
FTS 595-2141

702-798-2674
FTS 595-2674

Waste Standards:

702-798-2143
FTS 595-2143

Intercomparison Studies:

702-798-2134
FTS 595-2134

Performance Audit Studies:

Paul Koska 702-798-2671
FTS 595-2671

[illegible] Section of Radiochemistry Laboratories:

Burt Whittaker — 702-798-2233
FTS 595-2233

[illegible] Evaluation of Laboratories Analyzing Hazardous Wastes:

[illegible] — 702-798-2143
FTS 595-2143

New Analytical Methods:

[illegible] Graham — 702-798-2233
FTS 595-2233

Hazardous Waste Methods Validation and Equivalency:

David Hemphill — 702-798-2114
FTS 595-2114

[illegible] production-site evaluations of laboratories analyzing [illegible] drinking water or analyzing hazardous wastes, and also offers consultation and assistance on radiation and hazardous [illegible] and quality assurance procedures.

EMSL - RESEARCH TRIANGLE PARK
Mail Drop 75
Research Triangle Park, North Carolina 27711
Director: Thomas R. Hauser

AIR MEDIA ANALYSIS

The audit materials shown are intended for performance audits of [illegible] stationary source measurement systems.

1. Performance Audit Materials Available

   a. Compressed Gas Cylinders

   b. Sodium Arsenite Samples

   c. Flow Measurement Devices

Table R-1

PERFORMANCE AUDIT MATERIALS AVAILABLE AS COMPRESSED GAS CYLINDERS

Type	Concentration Range	Audit Purpose
[illegible]	Several levels from 50 to 1500 ppm	CEMS[1]
[illegible]	Several levels from 50 to 10,000 ppm	CEMS
[illegible]	3 levels from 3 to 8 percent	CEMS
Oxygen	3 levels from 1 to 8 percent	CEMS
[illegible]	3 levels from 50 to 50 ppm	CAM[2]
[illegible]	Several levels from 25 to 100 ppm	CAM
[illegible]	Several levels from 1 to 10 ppm	CAM
[illegible]	2 ppm methane with propane ranging from 0.5 to 6 ppm	CAM
Benzene	Several levels from 8 to 300 ppm	GCA[3]
[illegible]	Several levels from 5 to 20,000 ppm	GCA
[illegible]	Several levels from 1000 to 8000 ppm of methane, and 200 to 700 ppm of ethane	GCA
[illegible]	Several levels from 5 to 700 ppm	GCA
[illegible]	Several levels from 5 to 700 ppm	GCA
[illegible]	Several levels from 5 to 700 ppm	GCA
[illegible]	Several levels from 5 to 700 ppm	GCA

Table R-1 (Continued)

Gas	Concentration Range	Audit Purpose
Vinyl Chloride	Several levels from 5 to 40 ppm	GCA
Hydrogen Sulfide	Several levels from 7 to 650 ppm	GCA
m-Xylene	Several levels from 8 to 600 ppm	GCA
Chloroform	Several levels from 5 to 700 ppm	GCA
Perchloroethylene	Several levels from 5 to 700 ppm	GCA
Hexane	Several levels from 30 to 3000 ppm	GCA
Methyl Mercaptan	Several levels from 5 to 10 ppm	GCA
Trichloroethylene	Several levels from 10 to 600 ppm	GCA
Vinylidene Chloride (1,1-Ethylene Dichloride)	Several levels from 10 to 600 ppm	GCA
1,2-Dichloroethane (1,2-Ethylene Dichloride)	Several levels from 10 to 600 ppm	GCA
Propylene Dichloride	Several levels from 7 to 680 ppm	GCA
1,2-Dibromo ethylene	Several levels from 10 to 600 ppm	GCA
Acrylonitrile	Several levels from 5 to 700 ppm	GCA
Ethylamine	Several levels from 10 to 50 ppm	GCA
P-dichlorobenzene	Several levels from 10 to 20 ppm	GCA
Cyclohexanone	Several levels from 10 to 20 ppm	GCA
Methyl Isobutyl Ketone	Several levels from 10 to 100 ppm	GCA

---

[1] Continuous emission monitoring systems
[2] Continuous air monitors
[3] Gas chromatographic analysis of source test samples

Table R-2

PERFORMANCE AUDIT MATERIALS AVAILABLE AS STATIC AND FILTER SAMPLES

Type	Description and Audit Purpose
Ambient SO_2 Samples	Freeze-dried mixtures of sodium sulfite and potassium tetrachloromercurate (TCM) in 5-ml glass vials; sets of five vials/ampules containing 4 to 64 µg SO_2 equivalent each. Simulate ambient level of 10 to 200 µg/m^3 SO_2. Use to audit EPA reference and equivalent methods (manual methods).
Ambient NO_2 Samples	Aqueous sodium nitrite glass; sets of five ampules, which when mixed with absorbing reagent, simulate ambient samples from 0.12 to 0.87 µg/ml (40 to 200 µg/m^3 NO_2). Use to audit EPA equivalent methods (manual methods).
Ambient Lead Samples	Lead nitrate deposited on 1/2" x 8" glass fiber filter strips. Samples simulate collected concentrations from 0.1 to 15 µg/m^3 of lead. Nine levels are available. Use to audit EPA reference method.

Table R-2 (Continued)

Type	Description and Audit Purpose
Ambient Sulfate-Nitrate Samples.	Sodium sulfate and potassium nitrate deposited on 1/2" x 8" glass-fiber filter strips. Samples simulate collected concentrations from 0.6 to 40 $\mu g/m^3$ of sulfate, and from 0.8 to 15 $\mu g/m^3$ of nitrate. Nine levels are available.
Ambient Arsenic Samples	Arsenious oxide deposited on 1/2" x 8" glass-fiber filter strips. Samples simulate collected concentrations from 0.02 to 1.0 $\mu g/m^3$ of arsenic. Nine levels are available.
Source NO_x Samples	Aqueous potassium nitrate that simulate a source emission concentration of 150- to 900-mg NO_2/dscm. Samples are furnished as a set of five different concentrations. Use to audit EPA Reference Method 7.
Source SO_2 Samples	Dilute sulfuric acid that simulate a source emission concentration of 200- to 2500-mg SO_2/dscm. Samples are furnished as a set of five different concentrations. Use to audit EPA Reference Methods 6 and 8.

Table R-3

PERFORMANCE AUDIT MATERIAL AVAILABLE AS FLOW MEASUREMENT DEVICE

Type	Description and Audit Purpose
Ambient Hi-Vol Flow Device	Reference consists of a set of resistance plates to simulate various filter loading conditions used to confirm flow calibration for the measurement of Total Suspended Particulates in air by the High-Volume (Hi-Vol) method. Use to audit flow rate of EPA reference method. Units may periodically be unavailable due to survey commitments.

II. QA TECHNICAL SERVICES AVAILABLE

A Standards Laboratory has been established at EMSL/RTP. The Standards Laboratory offers calibration, standardization and certification of client-owned sample material. There is no charge for this service. Where applicable, certifications are referenced directly to NBS Standard Reference Materials. The following services are offered:

A. Verification of compressed gas standards used for calibration, span checks or audits of air quality analyzers (NO, NO_2, SO_2, CO, CO_2, CH_4, and some hydrocarbons).

B. Verification of permeation tube rates (gravimetric or direct comparison with SRM). The service to calibrate permeation tubes must necessarily be limited to not over four tubes of any one type per year. The customer will specify the temperature at which calibration is needed. Standardized conditions are to be preferred.

Additional information and audit materials for the above programs may be obtained from the following:

Static and Filter Samples, Hi-Vol, and Organic Compressed Gases

CONTACT: Robert L. Lampe
Quality Assurance Division (MD-77)
Environmental Monitoring Systems Laboratory
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711
Telephone: FTS: 629-4531
Commercial: (919) 541-4531

Technical Services and Inorganic Compressed Gases

CONTACT: Berne I. Bennett
Quality Assurance Division (MD-77)
Environmental Monitoring Systems Laboratory
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711
Telephone: FTS: 629-2366
Commercial: (919) 541-2366

EMSL-RTP has also established audit schedules for ambient air and stationary sources. The schedules are shown in Table R-4 and R-5, respectively, along with respective individuals to contact for information.

Table R-4

AMBIENT AIR 1981 AUDIT SCHEDULE

January 5	-	Pb
February 2	-	SO_4 NO_3
March 2	-	CO
March 30	-	SO_2 bubbler
May 4	-	Hi-Vol
June 1	-	NO_2 bubbler
June 1	-	SO_2 - continuous
June 29	-	Pb
August 3	-	SO_4 - NO_3
August 31	-	CO
October 5	-	SO_2 bubbler
November 30	-	NO_2 bubbler

CONTACT:
Robert L. Lampe
Quality Assurance Division (MD-77)
Environmental Monitoring Systems Laboratory
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711
Telephone: FTS: 629-4531
Commercial: (919) 541-4531

Table R-5

SOURCE 1981 AUDIT DATES

Method 5	DGM	3/81
		9/81
Method 6	SO_2	2/81
		8/81
Method 7	NO_x	4/81
		10/81
Coal	S, BTU ASH, H_2O	3/81

CONTACT:

Robert G. Fuerst
Quality Assurance Division (MD-77)
Environmental Monitoring Systems Laboratory
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711
Telephone: FTS: 629-2573
Commercial: (919) 541-2573