

COMPREHENSIVE ENVIRONMENTAL ASSESSMENT AND RESPONSE PROGRAM

Rocky Flats Plant

Phase II - Remedial Investigation

Work Plan for Medium Priority Sites

QUALITY ASSURANCE/QUALITY CONTROL PLAN

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ATTACHMENT 1

**INSTALLATION GENERIC MONITORING PLAN
QUALITY ASSURANCE/QUALITY CONTROL PLAN**

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QUALITY ASSURANCE/QUALITY CONTROL PLAN

1 INTRODUCTION

CEARP Phase 2 consists of CEARP Phase 2a, Monitoring Plan, and CEARP Phase 2b, Site Characterization (Remedial Investigation). This Quality Assurance/Quality Control (QA/QC) Plan is one component of the Monitoring Plan for Rocky Flats Plant. The Monitoring Plan typically consists of five parts: Synopsis, Sampling Plan, Technical Data Management Plan, Health and Safety Plan, and Quality Assurance/Quality Control Plan. Because of the Compliance Agreement made by the State of Colorado, Environmental Protection Agency, and the DOE, this Monitoring Plan also includes a Feasibility Study Plan. The Synopsis provides a discussion of the current situation and serves as an introduction to the other plans.

CEARP uses a three-tiered approach in preparing the monitoring plans: the CEARP Generic Monitoring Plan (CGMP) (DOE, 1986b), the Installation Generic Monitoring Plan (IGMP), and the Site-Specific Monitoring Plans (SSMPs). The CGMP Quality Assurance/Quality Control (QA/QC) Plan provides the generic guidelines and procedures that will be employed during CEARP Phase 2 site characterization (remedial investigation) to ensure the reliability of data collected at CEARP sites. It is intended to establish a general quality assurance/quality control policy and to provide the framework for more specific quality assurance/quality control requirements to be employed at each installation and at each site. This IGMP Quality Assurance/Quality Control Plan provides installation generic information and procedures, whereas the SSMPs will provide site-specific detail regarding locations, types and number of samples.

This IGMP is the Comprehensive Source and Plume Characterization Plan required by the Compliance Agreement. Therefore, the acronym used to refer to this plan is IGMP/CSPCP.

According to DOE policy, DOE activities shall maintain programs of quality assurance (DOE Order 5700 6B). In the area of environmental protection, quality assurance plans must be integrated with the DOE implementation of CERCLA (DOE Order 5480 14).

CEARP Phase 2b site characterizations (remedial investigations) will be implemented using procedures to assure that the precision, accuracy, completeness, and representativeness of data are known and documented. At a minimum, this will include adherence to the CEARP CGMP, IGMP/CSPCP, and SSMP Quality Assurance/Quality Control Plans, and may include preparation of written Quality Assurance/Quality Control Plans covering each aspect of the project performed.

This IGMP/CSPCP Quality Assurance/Quality Control Plan presents the organization, objectives, functional activities, and specific quality assurance and quality control activities associated with the CEARP Phase 2b site characterizations (remedial investigations) at Rocky Flats Plant. The Quality Assurance/Quality Control Plan is designed to achieve specific data quality goals for CEARP Phase 2b site characterizations (remedial investigations). Appendix A includes the quality assurance protocols for all laboratory services to be provided under CEARP Phase 2b site characterizations (remedial investigations).

A brief description of the CEARP Phase 2b site characterization (remedial investigation) and background can be found in the Synopsis. For a more in-depth background description, see the CEARP Phase 1 report.

2 PROJECT ORGANIZATION AND RESPONSIBILITY

Project organization and responsibility are divided among DOE, Los Alamos National Laboratory, and Rockwell International as described below. Los Alamos National Laboratory has the primary responsibility to implement CEARP under the guidance of DOE-Albuquerque Operations Office. However, operational responsibilities have been assigned to Rockwell International at Rocky Flats Plant for the site characterizations (remedial investigations). The DOE-Rocky Flats Plant Area Office is responsible for the function of the Rocky Flats Plant. Because of this responsibility, the DOE-Rocky Flats Plant Area Office will provide additional guidance to its contractor, Rockwell International, in implementation of the CEARP Phase 2b site characterizations (remedial investigations).

Project organization is shown in Figure 2.1. The responsibilities of the various personnel can be divided into operational, laboratory, and quality assurance responsibilities, as follows:

2.1 OPERATIONAL RESPONSIBILITIES

Assistant Secretary for the Environment The DOE Assistant Secretary for the Environment appoints Headquarters investigation boards and establishes the scope of Headquarters investigations (DOE Order 5484.1). DOE-wide Environmental Surveys and Audits originate from the Assistant Secretary.

Environmental Surveys and Audits Headquarters Environmental Survey Teams have been directed to conduct one-time environmental surveys and sampling of DOE facilities. These surveys are independent of CEARP activities at Rocky Flats Plant, but data from survey team sampling will be utilized in the CEARP characteri-

zation of Rocky Flats Plant A Headquarters environmental survey team visited the Rocky Flats Plant site in 1986 The results of the survey will be used as an internal management tool by the Secretary and Undersecretary of DOE

Audits are a function of the Office of the Assistant Secretary for the Environment Audit teams provide quality control for the implementation of environmental monitoring at DOE facilities Although independent of CEARP, audit teams complement CEARP activities by providing additional quality assurance

DOE-Albuquerque Operations Office Environmental Programs Branch The DOE-Albuquerque Operations Office, Environmental Programs Branch, is responsible for overseeing all environmental programs within DOE-Albuquerque Operations and conducting special assessments such as CEARP

DOE-Rocky Flats Area Office The DOE Rocky Flats Area Office is responsible for the missions of the Rocky Flats Plant, including environmental protection The DOE Rocky Flats Area Office oversees the integration of Rocky Flats Plant resources with CEARP activities at Rocky Flats Plant

Rockwell International Rockwell International, as prime contractor to DOE, provides support to DOE in accomplishing the mission of Rocky Flats Plant, including environmental protection Rockwell International will perform the CEARP Phase 2b site characterizations (remedial investigations) at Rocky Flats Plant

Los Alamos National Laboratory Los Alamos National Laboratory manages the CEARP program, providing direction, oversight and review, and preparing final reports

2 2 ANALYTICAL LABORATORY RESPONSIBILITIES

Analytical laboratory responsibilities include performing analytical services, and providing quality assurance. Rockwell International will perform the CEARP Phase 2b site characterizations (remedial investigations) at Rocky Flats Plant. This IGMP/CSPCP provides guidance for quality assurance programs to be implemented by

- field laboratory operations
- analytical laboratories
- geotechnical laboratories
- radiological laboratories

2 3 QA RESPONSIBILITY

Quality assurance responsibilities are to monitor and review the procedures used to perform all aspects of site characterizations (remedial investigations), including data collection, analytical services, data analysis, and report preparations. Primary responsibility for project quality rests with the Rockwell International CEARP Manager. Ultimate responsibility for project quality rests with DOE.

3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall quality assurance objective is to develop and implement procedures for field sampling, field testing, chain of custody, laboratory analysis, and reporting that will assure quality as specified in DOE orders governing quality assurance and environmental protection. Specific procedures to be used for sampling, chain-of-custody, audits, preventive maintenance, and corrective actions are described in other sections of this IGMP Quality Assurance/Quality Control Plan. The purpose of this section is to define quality assurance goals for accuracy, precision and sensitivity of analysis, and completeness, representativeness, and comparability of measurement data from all analytical laboratories. Quality assurance objectives for field measurements are also discussed.

For some field activities, samples will not be collected, but measurements will be taken where quality assurance concerns are appropriate (e.g., field measurements of pH, temperature, and elevations). The primary quality assurance objective in activities where samples are not collected is to obtain reproducible measurements to a degree of accuracy consistent with their intended use and to document measurement procedures.

3.1 REGULATORY AND LEGAL REQUIREMENTS

Data used to evaluate compliance with the National Interim Primary Drinking Water Standards, State of Colorado water-quality standards, or water-quality criteria for agricultural or industrial use will have method detection limits as specified by the analytical method used, as appropriate.

3.2 LEVEL OF QUALITY ASSURANCE EFFORT

Field duplicates, field blanks, and trip blanks will be taken and submitted to the analytical laboratories to provide a means to assess data quality resulting from field sampling. Duplicate samples will be analyzed to check for sampling reproducibility. Field and trip blanks will be analyzed to check for procedural contamination and/or ambient site conditions that are causing sample contamination. Trip blanks will be analyzed to check for contamination during packaging and shipment. Because volatile organic compounds are a class of contaminants most likely to be introduced to the sample by the sample container, there will be one trip blank per batch of samples designated for volatile organic compound analysis (shipping container). There will be one duplicate and one field blank for every 10 investigative samples collected. For laboratory organic analysis, matrix spikes and matrix spike duplicates will be used. The general level of quality assurance effort for organic analysis will be one matrix spike and one matrix spike duplicate prepared for every 20 samples of similar concentration and/or similar sample matrix, whichever is greater. In addition to field check samples, water samples of known concentration traceable to either EPA or NBS standards will be prepared for inorganic and radiological analyses. The general level of quality assurance effort for inorganic analyses will be one duplicate known sample and one duplicate field sample for every 10 investigative samples to check analytical reproducibility.

Soil samples selected for geotechnical testing will include one field duplicate for each 20 analyses being performed, if possible, but will not include blanks.

The groundwater, surface water, and soil samples collected at Rocky Flats Plant during CEARP Phase 2 will be analyzed using the analytical methods specified in Tables 3 1, 3 2, 3 3, and 3 4. The level of laboratory quality assurance effort will correspond to the procedures outlined in Appendix A.

3 3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSES

The fundamental quality assurance objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the quality control acceptance criteria of the analytical protocols. Sensitivities required for analyses of radionuclides, organics, metals, and other inorganic compounds, in both aqueous and solid matrices will be the detection limits shown in Tables 3 1, 3 2, 3 3, 3 4, 3 5, and 3 6. Achieving these detection limits depends on the sample matrix. Highly contaminated samples requiring dilution will have detection limits higher than those detected.

The geotechnical and field data will be considered accurate if the quality assurance criteria with respect to equipment, solutions, and calculations are met, and if adherence to appropriate methods can be documented during a systems audit.

3 4 COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The laboratories will provide data meeting quality control acceptance criteria as described in Appendix A. Laboratories will provide completely valid data (IGMP/CSPCP QA/QC Plan, Section 8), the reasons for any variances from 100 percent completeness will be documented in writing.

3 5 FIELD MEASUREMENTS

Measurement data will be generated in many field activities. These activities may include, but are not limited to, the following

- using geophysical surveys
- documenting time and weather conditions
- locating and determining the elevation of sampling stations
- measuring pH, conductivity, dissolved oxygen, and temperature of water samples
- qualitative organic vapor screening of solid samples using a photoionization detector (PID) or an organic vapor analyzer (OVA)
- measuring water levels in a borehole or well
- standard penetration testing
- calculating pumping rates
- verifying well-development and presampling purge volumes
- performing hydraulic conductivity tests

The general quality assurance objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of the data through the documented use of standardized procedures. Procedures for performing these activities and standardized formats for documenting them are presented in the CGMP and IGMP/CSPCP Sampling Plans. These procedures may be incorporated by reference (EPA methods) or included as appendices. Standardized formats for documenting data collection are included in the Technical Data Management Plan.

Table 3 1 Analysis Plan for Aqueous Samples*

Analyte	Method	Detection Limit	Sample Container	Sample Volume	Preservations	Holding Time (days)	Reporting Units
HSL Volatile	Ref 1	X ³	40 ml vial (2) w/teflon lined silicone rubber septum	40 ml	Cold, 4°C	14	ug/L
HSL Base/Neutral/Acid ¹	Ref 2	X ³	Amber G, 1L	1 L	Cold, 4°C	7/40 ⁷	ug/L
HSL Pesticide/PCB	Ref 3	X ³	Amber G, 1L	1 L	Cold, 4°C	7/40	ug/L
HSL Inorganic ²	Ref 4 EPA-200-7 ^B	X ³	P, G, 1L	1 L	pH<2, w/HNO ₃	180	ug/L
Cyanide	Ref 5 EPA-335 ^A	X ³	P, G, 1L	0.5 L	pH>11, w/NaOH	14	ug/L
pH ⁴	EPA 150 ¹ ^B	0.1 pH unit	P, G	N/A	None	Field Meas	pH unit
Sp Conductivity ⁴	EPA 120 ¹ ^B	1	P, G	N/A	None	Field Meas	umho/cm
Temperature ⁴	EPA 170 ¹ ^B	0.1	P, G	N/A	None	Field Meas	°C
Diss Oxygen ⁴	EPA 360 ¹ ^B	0.5	G	N/A	None	Field Meas	mg/l
TDS	EPA 160 ^B	5	P, G 1L	0.1 L	Cold 4°C	7	mg/l
TSS	EPA 160 ^B	10	P, G 1L	0.1 L	Cold 4°C	7	mg/l
Total Phosphate	EPA 365 ⁴ ^B	0.01	P, G 1L	1 L	Cold 4°C, pH<2 w/H ₂ SO ₄	28	mg/l

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Table 3.1 (Continued)

Analyte	Method	Detection Limit	Sample Container	Sample Volume	Preservations	Holding Time (days)	Reporting Units
Chloride, Sulfate	EPA 352.2 ⁶ 375.2 ⁶	5	P, G, 1L	1 L	Cold 4°C ⁹	28	mg/l
Carbonate/Bicarbonate ⁵	S M 403 ⁶	10	P, G, 1L	1 L	Cold 4°C ⁹	14	mg/l
Nitrate	EPA 300.0 ⁶	5	P, G, 1L	1 L	Cold 4°C ⁹	2	mg/l
Hexavalent Chromium	S M 3128 ⁶	0.01	P, G, 1L	1 L	Cold 4°C ⁹	1	mg/l

¹ The HSL Base/Neutral/Acid fractions analytical parameters are the HSL semivolatiles

² Includes Cesium, Molybdenum, Strontium which are non HSL metals

³ See Tables 3.5 and 3.6

⁴ Field Measurements

⁵ These are reported as carbonate and bicarbonate alkalinity

⁶ Standard Methods for Examination of Water and Wastewater, 15th Edition

⁷ 7 days to extraction, analysis within 40 days of extraction

⁸ Methods for Chemical Analysis of Water and Wastes, 1983, EPA 600/4-79-020

⁹ All samples with the exception of VOA's will be filtered within 4 hours of sample collection, and preservatives added to the filtrate as specified. All samples will be kept at 4°C until delivered to the laboratory

¹⁰ The SAMP Sampling Plans will define the actual suite of parameters to be analyzed for specific samples

Method References

8240 Test Methods for Evaluating Solid Waste "Office of Solid Waste and Emergency Response, Washington DC 20460" *Review November 1986*

Ref 1 Method 625 "Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water," EPA 600/4-82-057 plus additions, 1984

8270 " "

Ref 2 Method 625 "Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water," EPA 600/4-82-057 plus additions, 1984

8050 " "

Ref 3 Method 608 "Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water," EPA 600/4-82-057 plus additions, 1984

Ref 4 Method 6010 " "

Ref 5 Method 9010 " "

Table 3 2 Analysis Plan for Soil/Sediment/Waste Samples*

Analyte	Method	Detection Limit	Sample Container	Sample Volume	Preservations	Holding Time (days)	Reporting Units
HSL Volatile	Ref 2	X ²	40 ml vial (2) w/teflon lined silicon rubber septa	5	Cold, 4°C	14	ug/kg
HSL Base/Neutral/Acid	Ref 3	X ²	Amber G, 1 l	10 30	Cold, 4°C	7/40 ³	ug/kg
HSL Pesticide/PCB	Ref 4	X ²	Amber G, 1 L	10 30	Cold, 4°C	7/40 ³	ug/kg
HSL Inorganic ¹	Ref 5	X ²	P G, 1 L	200	Cold, 4°C	180	mg/kg
Reactivity	Ref 6	Ref 8	Amber G		Cold 4°C	N/A	ug/l
EP Toxicity	Ref 7	Ref 9	Amber G	100 g	Cold 4°C	N/A	ug/l in leachate
Chloride	EPA 300 0 ⁵	60 ug/g ⁶	G, 1 L	20	Cold, 4°C	N/A	mg/kg
Sulfate	EPA 300 0 ⁵	60 ug/g ⁶	G, 1 L	20	Cold, 4°C	N/A	mg/kg
Nitrate	EPA 300 0 ⁵	60 ug/g ⁶	G, 1 L	20	Cold, 4°C	N/A	mg/kg
Cyanide	Ref 1	X ²	G, 1 L	200	Cold, 4°C	14	mg/kg
Hexavalent Chromium	S M 312B ⁷	1 ug/g ⁶	G, 1 L	100	Cold 4°C	1	mg/kg

*10 days from receipt to reporting
4 days from receipt to reporting*

¹Includes Cesium, Molybdenum, and Strontium which are non HSL metals
²See Tables 3 5 and 3 6
³Extract within 7 days, analysis within 40 days of extraction
⁴Reported as dry weight, % moisture reported separately
⁵Soil/Sediments will be leached with Laboratory Reagent Water (20 g soil to 50 ml water) and water extract analyzed using referenced procedure
 Methods for Chemical Analysis of Water and Wastes 1983, EPA 600/4 79 020

Table 3 2 (Continued)

6 these are estimated detection limits

7 Soil/sediment will be leached with Laboratory Reagent Water (5 g soil and 100 ml of water) by shaking for 2 hours, and the water extract filtered and subsequently analyzed. This is in accordance with method 3128 in Standard Methods for Examination of Water and Wastewater, 15th Edition

*The SSWP Sampling Plans will define the actual suite of parameters to be analyzed for specific samples

Method References

- Ref 1 Method 9010 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*
- Ref 2 Method 8240 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*
- Ref 3 Method 8270 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*
- Ref 4 Method 8080 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*
- Ref 5 Method 6010 or 7000 Series Methods "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460 *Revised April 1984⁶*
- Ref 6 Method 9010, 9030 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*
- Ref 7 Method 1310 "Test Methods for Evaluating Solid Wastes," Office of Solid Waste and Emergency Response, Washington, DC 20460, Revised April 1984⁶ *November 6*

Table 3.3 Analysis Plan for Radiological Analysis for Aqueous Samples

Analyte	Method*	Detection Limit**	Sample Container	Sample Volume	Preservations	Holding Time (days)	Reporting Units
Gross alpha/beta	1,2,3,4,6,7,8,9	Gross α = 2pCi/L	P, 1 gal	0.2 L	HNO ₃ to pH <2	180	pCi/L
Tritium	1,2,3,8	4.0 pCi/L	G, 100 ml	0.008 L	No preservation	NA	pCi/L
Pu 239	10,11	0.3 pCi/L	P, 1 gal	1.000 L	HNO ₃ to pH <2	180	pCi/L
Am 241	11,12	0.4 pCi/L	P, 1 gal	1.000 L	HNO ₃ to pH <2	180	pCi/L
Isotopic U	1,3,4,7,8,9	U 233 + 234 = 0.6 pCi/L U 238 = 0.6 pCi/L	P, 1 gal	0.500 L	HNO ₃ to pH <2	180	pCi/L
Sr 90	1,3,4,8	1 pCi/L	P, 1 gal	1.000 L	HNO ₃ to pH <2	180	pCi/L

*See Attachment 1

**See Attachment 2

ATTACHMENT I

Method References

- 1 US Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No EMSL-LY-0539-1, Las Vegas NV, US Environmental Protection Agency
- 2 American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985 Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, DC, Am Public Health Association
- 3 US Environmental Protection Agency, 1976 Interim Radiochemical Methodology for Drinking Water, Report No EPA-600/4-75-008 Cincinnati US Environmental Protection Agency
- 4 Harley, J H, ed, 1975, HASL Procedures Manual, HASL-300, Washington, DC US Energy Research and Development Administration
- 5 Misaqi, Fazielleh L, Monitoring Radon-222 Content of Mine Waters Informational Report 1026, US Department of Interior, Mining Enforcement and Safety Administration, Denver, CO, 1975
- 6 "Radioassay Procedures for Environmental Samples," 1967, USDHEW, Section 7 2 3
- 7 "Handbook of Analytical Procedures," USAEC, Grand Junction Lab 1970, page 196
- 8 "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, US Environmental Protection Agency, Cincinnati, Ohio 45268
- 9 "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," USGS Book 5, Chapter A5, 1977
- 10 "Acid Dissolution Method for the Analysis of Plutonium in Soil" EPA-600/7-79-081, March 1979, US EPA Environmental Monitoring and Support Laboratory Las Vegas, Nevada, 1979
- 11 "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium and Americium," by E H Essington and B J Drennon, Los Alamos National Laboratory, a private communication
- 12 "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories

ATTACHMENT 2

Lower Limits of Detection

The detection limits presented were calculated using the formula in NRC Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg 21, and follow

$$\text{LLD} = 4.66 \frac{\text{BKG}^{1/2}}{\text{DUR} (2.22) (\text{Eff}) (\text{CR}) (\text{SR}) (e^{-\lambda t}) (\text{Aliq})}$$

Where

- LLD = Lower Limit of Detection in pCi per sample unit
- BKG = Instrument Background in counts per minute (cpm)
- DUR = Duration of sample counting in minutes
- Eff = Counting efficiency in cpm/disintegration per minute (dpm)
- CR = Fractional radiochemical yield
- SR = Fractional radiochemical yield of a known solution
- x = The radioactive decay constant for the particular radionuclide
- t = the elapsed time between sample collection and counting

In that LLD is a function of many variables including sample matrix, sample volume, and other factors, the limits presented are only intended as guides to order-of-magnitude sensitivities and, in practice, can easily change by a factor of two or more even for the conditions specified

Table 3.4 Analysis Plan for Radiological Analysis for Soils/Sediments

Analyte	Method*	Detection Limit**	Sample Container	Sample Size (g)	Preservations	Holding Time (days)	Reporting Units
Gross alpha/beta	1,2,3,4,6,7,8,9	Gross a = 4 pCi/g Gross b = 10 pCi/g	6, 1 L	0.1	MA	MA	pCi/g
Pu 239	10,11	0.3 pCi/g	6, 1 L	1	MA	MA	pCi/g
Am 241	11,12	0.3 pCi/g	6, 1 L	1	MA	MA	pCi/g
Isotopic U	1,3,4,7,8,9	U 233 + 234 = 0.3 pCi/g U 238 = 0.3 pCi/g	6, 1 L	1	MA	MA	pCi/g
Sr 90	1,3,4,8	1 pCi/g	6, 1 L	1	MA	MA	pCi/g

*See Attachment 1

**See Attachment 2

ATTACHMENT I

Method References

- 1 US Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No EMSL-LY-0539-1, Las Vegas NV, US Environmental Protection Agency
- 2 American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985 Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am Public Health Association
- 3 US Environmental Protection Agency, 1976 Interim Radiochemical Methodology for Drinking Water, Report No EPA-600/4-75-008 Cincinnati U.S Environmental Protection Agency
- 4 Harley, J H, ed, 1975, HASL Procedures Manual, HASL-300, Washington, D.C. US Energy Research and Development Administration
- 5 Misaqi, Fazlilleh L, Monitoring Radon-222 Content of Mine Waters Informational Report 1026, US Department of Interior, Mining Enforcement and Safety Administration, Denver, CO, 1975
- 6 "Radioassay Procedures for Environmental Samples," 1967, USDHEW, Section 7 2 3
- 7 "Handbook of Analytical Procedures," USAEC, Grand Junction Lab 1970, page 196
- 8 "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, US Environmental Protection Agency, Cincinnati, Ohio 45268
- 9 "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," USGS Book 5, Chapter A5, 1977
- 10 "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, US EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979
- 11 "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium and Americium," by E H Essington and B J Drennon, Los Alamos National Laboratory, a private communication
- 12 "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories

ATTACHMENT 2

Lower Limits of Detection

The detection limits presented were calculated using the formula in NRC Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg 21, and follow

$$LLD = 4.66 \frac{BKG}{DUR}^{1/2} (2.22) (Eff) (CR) (SR) (e^{-\lambda t}) (Aliq),$$

Where

- LLD = Lower Limit of Detection in pCi per sample unit
- BKG = Instrument Background in counts per minute (cpm)
- DUR = Duration of sample counting in minutes
- Eff = Counting efficiency in cpm/disintegration per minute (dpm)
- CR = Fractional radiochemical yield
- SR = Fractional radiochemical yield of a known solution
- λ = The radioactive decay constant for the particular radionuclide
- t = the elapsed time between sample collection and counting

In that LLD is a function of many variables including sample matrix, sample volume, and other factors, the limits presented are only intended as guides to order-of-magnitude sensitivities and, in practice, can easily change by a factor of two or more even for the conditions specified.

Table 3 5 Hazardous Substance List (HSL) and Contract Required
Detection Limits (CRDL)**

Volatiles	CAS Number	Detection Limits*	
		Low Water ^a ug/L	Low Soil/Sediment ^b ug/Kg
1 Chloromethane	74-87-3	10	10
2 Bromomethane	74-83-9	10	10
3 Vinyl Chloride	75-01-4	10	10
4 Chloroethane	75-00-3	10	10
5 Methylene Chloride	75-09-2	6	5
6 Acetone	67-64-1	10	10
7 Carbon Disulfide	75-15-01	5	5
8 1,1-Dichloroethene	75-35-4	5	5
9 1,1-Dichloroethane	75-35-3	5	5
10 trans-1,2-Dichloroethene	156-60-5	5	5
11 Chloroform	67-66-3	5	5
12 1,2-Dichloroethane	107-06-2	5	5
13 2-Butanone	78-93-3	10	10
14 1,1,1-Trichloroethane	71-55-6	5	5
15 Carbon Tetrachloride	56-23-5	5	5
16 Vinyl Acetate	108-05-4	10	10
17 Bromodichloromethane	75-27-4	5	5
18 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19 1,2-Dichloropropane	78-87-5	5	5
20 trans-1,3-Dichloropropene	100061-02-6	5	5
21 Trichloroethene	79-01-6	5	5
22 Dibromochloromethane	124-48-1	5	5
23 1,1,2-Trichloroethane	79-00-5	5	5
24 Benzene	71-43-2	5	5
25 cis-1,3-Dichloropropene	10061-01-5	5	5
26 2-Chloroethyl Vinyl Ether	110-75-8	10	10
27 Bromoform	75-25-2	5	5
28 2-Hexanone	591-78-6	10	10
29 4-Methyl-2-pentanone	108-10-1	10	10
30 Tetrachloroethene	127-18-4	5	5
31 Toluene	108-88-3	5	5
32 Chlorobenzene	108-90-7	5	5
33 Ethyl Benzene	100-41-4	5	5
34 Styrene	100-42-5	5	5
35 Total Xylenes	100-42-5	5	5

Table 3 5 -(Continued)

Semi-Volatiles	CAS Number	Detection Limits*	
		Low Water ^c ug/L	Low Soil/Sediment ^d ug/Kg
36 N-Nitrosodimethylamine	62-75-9	10	330
37 Phenol	108-95-2	10	330
38 Aniline	62-53-3	10	330
39 bis(2-Chloroethyl) ether	111-44-4	10	330
40 2-Chlorophenol	95-57-8	10	330
41 1,3-Dichlorobenzene	541-73-1	10	330
42 1,4-Dichlorobenzene	106-46-7	10	330
43 Benzyl Alcohol	100-51-6	10	330
44 1,2-Dichlorobenzene	95-50-1	10	330
45 2-Methylphenol	95-48-7	10	330
46 bis(2-Chloroisopropyl ether	39638-32-9	10	330
47 4-Methylphenol	106-44-5	10	330
48 N-Nitroso-Dipropylamine	621-64-7	10	330
49 Hexachloroethane	67-72-1	10	330
50 Nitrobenzene	98-95-3	10	330
51 Isophorone	78-59-1	10	330
52 2-Nitrophenol	88-75-5	10	330
53 2,4-Dimethylphenol	105-67-9	10	330
54 Benzoic Acid	65-85-0	50	1600
55 bis(2-Chloroethoxy) methane	111-91-1	10	330
56 2,4-Dichlorophenol	120-83-2	10	330
57 1,2,4-Trichlorobenzene	120-82-1	10	330
58 Naphthalene	91-20-1	10	330
59 4-Chloroaniline	106-47-8	10	330
60 Hexachlorobutadiene	87-68-3	10	330
61 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
62 2-Methylnaphthalene	91-57-6	10	330
63 Hexachlorocyclopentadiene	77-47-4	10	330
64 2,4,6-Trichlorophenol	88-06-2	10	330
65 2,4,5-Trichlorophenol	95-95-4	50	1600
66 2-Chloronaphthalene	91-58-7	10	330
67 2-Nitroaniline	88-74-4	50	1600
68 Dimethyl Phthalate	131-11-3	10	330
69 Acenaphthylene	208-96-8	10	330
70 3-Nitroaniline	99-09-2	50	1600

Table 3 5 (Continued)

Semi-Volatiles	CAS Number	Detection Limits*	
		Low Water ^c ug/L	Low Soil/Sediment ^d ug/Kg
71 Acenaphthene	83-32-9	10	330
72 2,4-Dinitrophenol	51-28-5	50	1600
73 4-Nitrophenol	100-02-7	50	1600
74 Dibenzofuran	132-64-9	10	330
75 2,4-Dinitrotoluene	121-14-2	10	330
76 2,6-Dinitrotoluene	606-20-2	10	330
77 Diethylphthalate	84-66-2	10	330
78 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
79 Fluorene	86-73-7	10	330
80 4-Nitroaniline	100-01-6	50	1600
81 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
82 N-nitrosodiphenylamine	86-30-6	10	330
83 4-Bromophenyl Phenyl ether	101-55-3	10	330
84 Hexachlorobenzene	118-74-1	10	330
85 Pentachlorophenol	87-86-5	50	1600
86 Phenanthrene	85-01-8	10	330
87 Anthracene	120-12-7	10	330
88 Di-n-butylphthalate	84-74-2	10	330
89 Fluoranthene	206-44-0	10	330
90 Benzidine	92-87-5	50	1600
91 Pyrene	129-00-0	10	330
92 Butyl Benzyl Phthalate	85-68-7	10	330
93 3,3'-Dichlorobenzidine	91-94-1	20	660
94 Benzo(a)anthracene	56-55-3	10	330
95 bis(2-ethylhexyl) phthalate	117-81-7	10	330
96 Chrysene	218-01-9	10	330
97 Di-n-octyl Phthalate	117-84-0	10	330
98 Benzo(b)fluoranthene	205-99-2	10	330
99 Benzo(k)fluoranthene	207-08-9	10	330
100 Benzo(a)pyrene	50-32-8	10	330
101 Indeno(1,2,3-cd)pyrene	193-39-5	10	330
102 Dibenz(a,h)anthracene	53-70-3	10	330
103 Benzo(g,h,i)perylene	191-24-2	10	330

Table 3 5 (Continued)

Pesticides	CAS Number	Detection Limits ^a	
		Low Water ^b ug/L	Low Soil/Sediment ^c ug/Kg
104 alpha-BHC	319-84-6	0 05	8 0
105 beta-BHC	319-85-7	0 05	8 0
106 delta-BHC	319-86-8	0 05	8 0
107 gamma-BHC (Lindane)	58-89-9	0 05	8 0
108 Heptachlor	76-44-8	0 05	8 0
109 Aldrin	309-00-2	0 05	8 0
110 Heptachlor Epoxide	1024-57-3	0 05	8 0
111 Endosulfan I	959-98-8	0 05	8 0
112 Dieldrin	60-57-1	0 10	16 0
113 4,4'-DOE	72-55-9	0 10	16 0
114 Endrin	72-20-8	0 10	16 0
115 Endosulfan II	33213-65-9	0 10	16 0
116 4,4'-DDD	72-54-8	0 10	16 0
117 Endrin Aldehyde	7421-93-4	0 10	16 0
118 Endosulfan Sulfate	1031-07-8	0 10	16 0
119 4,4'-DDT	50-29-3	0 10	16 0
120 Endrin Ketone	53494-70-5	0 10	16 0
121 Methoxychlor	72-43-5	0 5	8 0 0
122 Chlordane	57-74-9	0 5	8 0 0
123 Toxaphene	8001-35-2	1 0	16 0 0
124 AROCLOR-1016	12674-11-2	0 5	8 0 0
125 AROCLOR-1221	11104-28-2	0 5	8 0 0
126 AROCLOR-1232	11141-16-5	0 5	8 0 0
127 AROCLOR-1242	53469-21-9	0 5	8 0 0
128 AROCLOR-1248	12672-29-6	0 5	8 0 0
129 AROCLOR-1254	11097-69-1	1 0	16 0 0
130 AROCLOR-1260	11096-82-5	1 0	16 0 0

^aMedium Water Contract Required Detection Limits (CRDL) for Volatile HSL
Compounds are 100 times the individual Low Water CRDL

^bMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Volatile
HSL Compounds are 100 times the individual Low Soil/Sediment CRDL

^cMedium Water Contract Required Detection Limits (CRDL) for Semi-Volatile HSL
Compounds are 100 times the individual Low Water CRDL

^dMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Semi-
Volatile HSL Compounds are 60 times the individual Low Soil/Sediment CRDL

Table 3 5 (Continued)

- ^eMedium Water Contract Required Detection Limits (CRDL) for Pesticide HSL
Compounds are 100 times the individual Low Water CRDL
- ^fMedium Soil/Sediment Contract Required Detection Limits (CRDL) for Pesticide
HSL compounds are 60 times the individual Low Soil/Sediment CRDL

*Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

**These are the EPA detection limits under the Contract Laboratory Program. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

**Table 36 Elements Determined by Inductively Coupled
Plasma Emission or Atomic Absorption Spectroscopy**

<u>Element</u>	<u>Contract Required Detection Level^{1,2} (ug/L)</u>
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cesium	200
Molybdenum	40
Strontium	200
Cyanide	10

Note: Detection limits in soil/sediment are numerically equivalent to those listed above with concentration units of mg/kg

¹Higher detection levels may also be used in the following circumstances

If the sample concentration exceeds two times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the contract required detection limit. This is illustrated in the example below

Table 36 (Continued)

For lead

Method in use - ICP

Instrument Detection Limit (IDL) = 40

Sample Concentration = 85

Contract Required Detection Limit (CRDL) = 5

The value of 85 may be reported even though instrument detection limit is greater than required detection level. The instrument or method detection limit must be documented.

²These CRDL are the instrument detection limits obtained in pure water met using the procedure in Exhibit E. The detection limits for samples may be considerably higher depending on the sample matrix.

4 SAMPLING PROCEDURES

Procedures for collecting samples and for performing all related field activities are described in detail in Appendix A of the IGMP/CSPCP Sampling Plan. Adherence to these procedures will be confirmed by the CEARP Quality Assurance Officers (Rockwell International and subcontractor) by quality assurance audits.

5 SAMPLE CUSTODY

CEARP field custody procedures are described in Section 7.2 of the IGMP/CSPCP Sampling Plan Laboratory custody procedures for the analytical laboratories are described in Appendix A

6 CALIBRATION PROCEDURES AND FREQUENCY

Standard commercial calibration procedures will be used by the analytical laboratories, as specified in Appendix A

Calibration of equipment used to perform geotechnical testing will be in accordance with that specified in the ASTM Method D 422-63 for hydrometer and sieve analyses (Annual Book of ASTM Standards, Volume 04 08, 1984) The equipment calibrations, including those for ovens, thermometers and balances, shall be done at a minimum of every six months and prior to large scale testing

Field instruments will be calibrated according to procedures presented in Appendixes A and B of the IGMP/CSPCP Sampling Plan A calibration log book will be assigned to each field instrument, and all calibrations will be documented in the log books

7 ANALYTICAL PROCEDURES

Laboratory analyses will follow methods described in Tables 3 1, 3 2, 3 3, and
3 4 Deviation from those methods, if required, will be presented in the SSMPs

8 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical laboratories will provide results to the Rockwell International CEARP Manager, the Subcontractor Project Manager, and Quality Assurance Officers. These data will include results and documentation for blanks and duplicates, matrix spikes, and forms summarizing analytical precision and accuracy.

Analytical data, including quality control sample analysis, will be entered into the technical data base. The analyses will be grouped into lots, with quality control samples associated with a particular lot. The analyses of quality control samples will be compared to theoretical known concentrations of those samples. If analyses do not meet acceptance criteria, the analytical laboratory may be asked to re-analyze the samples for parameters which do not exceed holding times. Analyses which cannot meet acceptance criteria, will be labelled as unacceptable. All parameter-specific values for a lot in which the quality control analyses did not meet acceptance criteria, will be removed from the technical data base.

Acceptance criteria for analyses of parameters for quality control samples (knowns) will be based on the theoretical known value furnished by the laboratory that prepared the sample. The theoretical known value is stated as a range of values. The analysis of the sample must be within the stated range of the theoretical known, plus or minus 10% of the range. An exception is analyses at or near the limit of detection. If the lower limit of the range of the theoretical known value is less than twice the limit of detection, an acceptable analysis includes the range from the limit of detection to the upper limit of the theoretical range, plus 10%.

Analytical reports from a field laboratory, if used, and the geotechnical laboratory will include all raw data, documentation of reduction methods, and related quality assurance/quality control data. These data will be assessed by verification of reduction results and confirmation of compliance with quality assurance/quality control requirements.

Raw data from field measurements and sample collection activities used in project reports will be appropriately identified. Where data have been reduced or summarized, the method of reduction will be documented.

The Quality Assurance Officers will review results of Quality Control-acceptance evaluations and will document acceptance or non-acceptance of data. The Quality Assurance Officers will maintain records of quality control-acceptance tests. These records will be subject to independent audit, which may include Los Alamos National Laboratory.

9 INTERNAL QUALITY CONTROL PROCEDURES

Internal quality control procedures for the laboratory are those specified in Appendix A. These specifications include types of audits required (e.g., sample spikes, surrogate spikes, reference samples, controls, and blanks), frequency of audits, compounds to be used for sample spikes and surrogate spikes, and quality control acceptance criteria for audits.

The quality control checks and acceptance for data from a field laboratory, if used, and the geotechnical laboratory are described above in Sections 3.2 and 3.3. Quality control procedures for field measurements (pH, conductivity, and temperature) are limited to checking the reproducibility of the measurement in the field by obtaining multiple readings and/or by calibrating the instruments (where appropriate). Quality control of field sampling will involve collecting field duplicates and blanks.

10 PERFORMANCE AND SYSTEMS AUDITS

For each activity where samples are collected, a performance audit investigating conformance with quality control procedures will be conducted (Appendix A) at the discretion of the Rockwell International CEARP manager, Subcontractor Project Manager, and Quality Assurance Officers. This audit will be scheduled to allow oversight of as many different field activities as possible. This audit will be performed by the Quality Assurance Officers or their designees. A written report of the results of this audit, along with a notice of nonconformity (if necessary), will be submitted to the following individuals:

- Rockwell International CEARP Manager
- Subcontractor Project Manager
- Subcontractor Site Manager

At least one systems audit will be performed during the project. The audit will verify that a system of quality control measures, procedures, reviews, and approvals was established for all activities and is being used by project personnel. It will also verify that the system for project documentation is being used and that all quality control records, along with required quality control reviews, approvals, and activity records are being maintained. A standard checklist for systems audits will be used. The systems audit will be conducted by the Quality Assurance Officers and/or Los Alamos National Laboratory. A final report will be prepared which summarizes any deviations from approved methods and their impacts on the project results.

After consultation with the CEARP Manager (and Subcontractor Project Manager), the Quality Assurance Officers may schedule systems audits of the participating laboratories. At a minimum, the systems audit would include inspection of labo-

ratory notebooks, control sheets, logsheets, computer files, and equipment calibration and maintenance records. If scheduled, system audits will be executed by individuals identified in Section 2.3 of this document.

Performance and systems audits of analytical laboratories will be scheduled and executed by the laboratory Quality Assurance Officers. Performance audits are conducted at least semiannually.

11 PREVENTIVE MAINTENANCE

This section applies solely to field equipment. Preventive maintenance will be addressed by checks of equipment prior to initiation of field operations, to allow time for replacement of malfunctioning equipment. The Subcontractor Site Manager will be responsible for implementing and documenting these procedures on a weekly basis during the period of use.

12 LABORATORY DATA ASSESSMENT PROCEDURES

Analytical data from laboratories is assessed for accuracy, precision and completeness by the laboratory Quality Assurance Officers, using standard procedures

Assessment of data generated by analytical laboratories is initiated and continued at three administrative levels. The bench chemist directly responsible for the test knows current operating acceptance limits. He/she can directly accept or reject generated data and consult with his/her immediate supervisor for any corrective action. Once the bench chemist has reported the data as acceptable, he/she initials the report sheet. Any out-of-control results are flagged and a note is made as to why the results were reported.

The chief chemist receives the data sheets and reviews the quality control data that accompanied the sample run. After checking the reported data for completeness and quality control results, the chief chemist either initials the report sheet or sends it back to the bench chemist for rerunning of samples. The Quality Control Coordinator reviews data forwarded to him/her as acceptable by the chief chemist. Any remaining out-of-control results that, in the opinion of the Quality Control Coordinator, do not necessitate rerunning of the sample, are flagged, and a memo is written to the data user regarding utility of the data. Data generated from all analyses are given a final review by the laboratory Quality Assurance Officers.

13 CORRECTIVE ACTION PROCEDURES

The Quality Assurance Officers and their audit teams will prepare a report describing the results of the performance and/or system audits. If unacceptable conditions (e.g., failure to have/use procedures), unacceptable data, nonconformity with the quality control procedures, or a deficiency are identified, the Quality Assurance Officers will notify the Rockwell International CEARP Manager of the results of the audit in writing. They will also state if the nonconformity is of significance for the program and recommend appropriate corrective actions. The Rockwell International CEARP Manager will be responsible for ensuring that corrective is developed and initiated and that, if necessary, special expertise not normally available to the project team is made available. The subcontractor will be responsible for carrying out corrective actions. The subcontractor will also ensure that additional work is not performed until the nonconformity is corrected. Corrective action may include

- reanalyzing the samples if holding time permits,
- resampling and reanalyzing,
- evaluating and amending the sampling and analytical procedures, and
- accepting the data and acknowledging its level of uncertainty

The Rockwell International CEARP Manager will be responsible for ensuring that corrective action was taken, and that it adequately addressed the nonconformity.

After corrective action is taken, the Quality Assurance Officer responsible for the audit will document its completion in a written report. The report will indicate any identified findings, corrective action taken, follow-up action, and final

recommendations The report will be sent to the Rockwell International CEARP Manager Project staff will be responsible for initiating reports on suspected nonconformities in field activities and deliverables or documents

14 QUALITY ASSURANCE REPORTS

The Rockwell International CEARP Manager will rely on written reports/memoranda documenting data assessment activities, performance and systems audits, nonconformity notices, corrective action reports, and quality assurance notices to enforce quality assurance requirements. The Los Alamos National Laboratory will be issued a written quality assurance report at the end of each stage of site characterization (remedial investigation) by the Rockwell International CEARP Manager.

Records will be maintained to provide evidence of quality assurance activities. Proper maintenance of quality assurance records is essential to provide support for evidential proceedings and to assure overall quality of the investigation. A quality assurance records index will be started at the beginning of the project. All information received from outside sources or developed during the project will be retained by the project team. Upon termination of an individual task or work assignment, working files will be processed for storage as quality assurance records. Upon termination of the project, complete documentation records (for example, chromatograms, spectra, and calibration records) will be archived as required by DOE Order 1324.2A (Records Deposition). The Rockwell International CEARP Manager and the Los Alamos National Laboratory Quality Assurance Officer will be responsible for ensuring that the Quality Assurance records are being properly stored and that they can be retrieved.

15 REFERENCES

DOE 1986b "Comprehensive Environmental Assessment and Response Program Phase 1 Draft Installation Assessment Rocky Flats Plant," US Department of Energy unnumbered draft report, April 1986

APPENDIX A
QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

1 LABORATORY QA/QC PROGRAM

This appendix to the quality assurance/quality control plan describes the organization and procedures used to produce reliable analytical data. These procedures are applicable to performing chemical, radiological, and geotechnical analyses on waste or environmental samples as appropriate.

The ultimate responsibility for the generation of reliable laboratory data rests with the laboratory management. Laboratory management is vested with the authority to establish those policies and procedures to ensure that only data of the highest attainable caliber are produced. Laboratory management, as well as the laboratory Quality Assurance/Quality Control Officer are responsible for the implementation of the established policies and procedures.

Laboratory management has the following responsibilities:

- direct implementation of the quality assurance program,
- ensure that their personnel are adequately trained to perform analyses,
- ensure that equipment and instrumentation under their control are calibrated and functioning properly, and
- review and perform subsequent corrective action on internal and external audits.

The Quality Assurance/Quality Control Officer has the following responsibilities:

- on-going review of individual quality assurance procedures,
- providing assistance in the development and implementation of specific quality assurance plans for special analytical programs,

- coordination of internal and external quality assurance audits,
- coordination of quality assurance training,
- review of special project plans for consistency with organizational requirements and advising laboratory management of inconsistencies,
- overall coordination of the laboratories' quality assurance program manual,
- assist in coordination between field and laboratory, and
- responsible for QA/QC record filing system

12 SAMPLE MANAGEMENT

On notification of the sampling and analyses effort, the laboratory will create a file to maintain records associated with the activity. In addition to administrative information, requests for sample containers, preservatives, and required analyses will be included in the file.

Sample bottles will be prepared by the laboratory and made available to the sampling team. The bottles will be prepared according to the analysis plan procedures and will include sample preservatives appropriate to the analytes and matrices of concern. Addition of preservatives to sample shall be recorded on chain-of-custody forms.

Samples received at the laboratories will be inspected for integrity, and any field documentation will be reviewed for accuracy and completeness.

Chain-of-custody and sample integrity problems will be noted and recorded on the chain-of-custody forms during sample log-in. Chain-of-custody forms and deficiency notices will be maintained in the file. Any deficiencies will be brought to the

attention of the Rockwell International CEARP Manager who will advise the laboratory on the desired disposition of the samples

Each sample that is received by the laboratory will be assigned a unique sequential sample number which will identify the sample in the laboratory's internal tracking system. References to a sample in any communication will include the assigned sample number.

Samples will be stored in a locked refrigerator at 4°C. The temperature of the storage refrigerators will be monitored and recorded daily by the sample custodian. Sample fractions and extracts will also be stored under these same conditions.

1.3 ANALYTICAL SYSTEMS

1.3.1 Instrument Maintenance

Instruments will be maintained in accordance with manufacturers' specifications. More frequent maintenance may be dictated dependent on operational performance. Instrument logs will be maintained to document the date, type, and reason for any maintenance performed.

Contracts on major instruments with manufacturers and service agencies may be used to provide routine preventive maintenance and to ensure rapid response to emergency repair service.

1 3 2 Instrument Calibration

Before any instrument is used, it will be calibrated using known reference materials. All sample measurements will be made within the calibrated range of the instrument. A record of calibration will be kept in an equipment log.

1 3 3 Personnel Training

Prior to conducting analyses on an independent basis, analysts will be trained by experienced personnel in the complete performance of the analytical method. Analysts may require training at instrument manufacturers' training courses. The analyst will be required to independently generate data on several method and/or matrix spikes to demonstrate proficiency in that analytical method. The type of data to be generated will be dependent on the analytical method to be performed. Results of this "certification" will be reviewed by laboratory management for adequacy.

Method blanks and method spikes will be required in every lot of samples analyzed, thus performance on a day-to-day basis can be monitored. Laboratory management and the Laboratory Quality Assurance/Quality Control Officer are responsible for ensuring that samples are analyzed by only competent analysts.

1 4 ANALYTICAL METHODS

1 4 1 Gas Chromatography/Mass Spectroscopy

Mass spectrometers will be tuned on a daily basis to manufacturer's specifications with FC-43. In addition, once per shift (8 hours) these instruments will be

tuned with decafluorotriphenylphosphine (DFTPP) or 4-bromo-fluorobenzene (BFB) for semi-volatiles or volatiles, respectively. Ion abundance will be within the window dictated by the requirements of the specific protocols. Once an instrument has been tuned, initial calibration curves for analytes (appropriate to the analyses to be performed) will be generated for at least three solutions containing known concentrations of authentic standards of compounds of concern.

The calibration curve will bracket the anticipated working range of analyses.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

During each operating shift, a midpoint calibration standard will be analyzed to verify that the instrument responses are still within the initial calibration determinations. The calibration check compounds will be those analytes used in the EPA contract laboratory program's multicomponent analyses (e.g., priority pollutants and hazardous substances list) with the exception that benzene will be used in place of vinyl chloride (volatiles) and di-n-octyl phthalate will be deleted from the semi-volatile list.

The response factor drift will be calculated and recorded. If significant (>30%) response factor drift is observed, appropriate corrective action will be taken to restore confidence in the instrumental measurements.

All GC/MS analyses will include analyses of a method blank, a method spike, and a method spike duplicate in each lot of samples. In addition, appropriate surrogate compounds specified in EPA methods will be spiked into each sample.

Recoveries from method spikes and surrogate compounds will be calculated and recorded on control charts to maintain a history of system performance

Duplicate samples will be analyzed for analytical lots of twenty (20) or more samples

Audit samples will be analyzed periodically to compare and verify laboratory performance against standards prepared by outside sources

1.4.2 Gas Chromatography and High Performance Liquid Chromatography

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

Working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentrations must be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A midpoint calibration check standard will be analyzed each operating shift (8 hours) to confirm the validity of the initial calibration curve. The check standard must be within twenty (20) percent of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory. The method spikes will be examined to determine both precision and accuracy.

Accuracy will be measured by the percent recovery of the spikes, precision will be measured by the reproducibility of method spikes.

1.4.3 Atomic Absorption Spectrophotometry

Atomic absorption spectrophotometers will be calibrated prior to each day of use.

Calibration standards will be prepared from appropriate reference materials, and working calibration standards will be prepared fresh weekly. The working standards will include a blank and a minimum of five concentrations to cover the anticipated range of measurement.

Duplicate injections will be made for each concentration. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation co-

efficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes and blanks will be in aqueous media. Method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory and will be introduced at a frequency of one per analytical lot or five (5) percent of the samples, whichever is more. The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range of 75-125 percent to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within twenty (20) percent in order to be considered acceptable.

1.4.4 Spectrophotometric Methods

Spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from reference materials appropriate to the analyses being performed, and working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of "known" versus "found" concentration will be at

least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to the analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

At least one method blank and two method spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method spikes will be at a concentration of approximately five (5) times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

Accuracy will be measured by the percent recovery of the spikes. The recovery must be in an acceptable range (based on EPA data for the method of interest) in order to be considered acceptable. Precision will be measured by the reproducibility of both method spikes.

Results must agree within acceptable limits (based on EPA data) in order to be considered acceptable.

1.5 REFERENCE MATERIALS

Whenever possible, primary reference materials will be obtained from the National Bureau of Standards (NBS) or the US Environmental Protection Agency (EPA). In absence of available reference materials from these organizations, other reliable sources may be sought. Reference materials will be used for instrument calibrations, quality control spikes, and/or performance evaluations. Secondary reference material

may be used for these functions provided that they are traceable to an NBS standard or have been to an NBS standard within the laboratory

16 REAGENTS

Laboratory reagents will be of a quality to minimize or eliminate background concentrations of the analyte to be measured. Reagents must also not contain other contaminants that will interfere with the analyte of concern.

17 CORRECTIVE ACTIONS

When an analytical system is deemed to be questionable or out-of-control at any level of review, corrective action will be taken. If possible, the cause of the out-of-control situation will be determined, and efforts will be made to bring the system back into control. Demonstration of the restoration of a reliable analytical system will normally be accomplished by generating satisfactory calibration and/or quality control sample data. The major consideration in performing corrective action will be to ensure that only reliable data are reported from the laboratory. The Rockwell International CEARP Manager will be informed of the problem and all corrective actions taken.

18 DATA MANAGEMENT

18.1 Data Collection

All data will be recorded in laboratory notebooks. Laboratory notebooks will contain

- Date and time of processing

- Sample numbers
- Project
- Analyses or operation performed
- Calibration data
- Quality control samples included
- Concentrations/dilutions required
- Instrument readings
- Special observations
- Analyst's signature

Copies of laboratory notebooks will be provided to the Rockwell International CEARP Manager on request

182 Data Reduction

Data reduction will be performed by the individual analysts. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (extractions, dilutions, and concentrations) involved.

For those methods utilizing a calibration curve, sample responses will be applied to the linear regression line to obtain an initial raw result which will be factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained, to minimize rounding errors, and results will not normally be expressed in more than two (2) significant figures.

Copies of all raw data and the calculations used to generate the final results will be retained in the laboratory file to allow reconstruction of the data reduction process at a later date. Copies of these records will be provided to the Rockwell International CEARP Manager on request.

183 Data Review

System reviews will be performed at all levels. The individual analyst will review the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews will be performed prior to submission of data to the laboratory management.

Laboratory management will review data for consistency and validity to determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated. In addition, laboratory management will recalculate selected results to verify the calculation procedure. Any abnormalities will be brought to the attention of the Rockwell International CEARP Manager.

The Quality Assurance Officer will independently conduct a complete review of results from randomly selected samples to determine if laboratory and program quality assurance/quality control requirements have been met. Deviations from requirements will be reported to the laboratory management and Rockwell International CEARP Manager for resolution.

Non-routine audits may be performed.

184 Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blanks data. In addition, special analytical problems, and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) significant figures.

Data will be reported in units commonly used for the analyses performed. Concentrations in liquids will be expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semi-solid matrices will be expressed in terms of weight per unit weight of sample (e.g., micrograms per grams).

Reported detection limits will be those specified by the analytical method.

185 Data Archiving

The laboratory will maintain on file all of the raw data (including calibration data), laboratory notebooks, and other pertinent documentation. This file will be maintained at the laboratory for a period of time consistent with Rocky Flats Plant's requirements. At the end of that time frame, all these records will be given to Rocky Flats Plant.

2 PERFORMANCE AND SYSTEM AUDITS

Quality assurance audits will be conducted. System audits will be conducted at random, unscheduled intervals at least annually.

Audits will be planned, organized, and clearly defined before they are initiated. Auditors will identify nonconformances or deficiencies. These will be reported and documented so that corrective actions can be initiated through appropriate channels. Corrective actions will be followed up with a compliance review. A report on each audit will be sent to the Rockwell International CEARP Manager.

2.1 FIELD AUDITS

Unannounced field audits, investigating conformance with QA/QC procedures, will be performed. A typical checklist for this type of audit is shown in Table A-1. A written report on the results of this audit will be submitted to the Rockwell International CEARP Manager.

2.2 CORRECTIVE ACTION

After each audit, auditors will identify nonconformances in a written nonconformance notice and initiate corrective action through the Rockwell International CEARP Manager. The nonconformance notice will describe any nonconforming conditions and set a date for response and corrective action(s). The Subcontractor Project Manager will prepare a written proposal for corrective action for review and approval by the Rockwell International CEARP Manager. When approved, the pro-

posed corrective action(s) will be implemented Follow-up review will be performed by the auditor to confirm that the corrective actions have been implemented

Table A 1 Field Audit

Project _____ Site Manager _____
 Site Location _____ Field Team Leader _____
 Auditor _____ Date _____

<u>Audit Question</u>	<u>Yes</u>	<u>No</u>	<u>Comment/Documentation</u>
1 Was a site-specific sampling and analytical plan followed?			
2 Was a field team leader appointed?			
3 Was the site health and safety coordinator present?			
4 Were field team members familiar with the sampling plan?			
5 Was a briefing held offsite, before any site work was begun, to acquaint personnel with sampling equipment and assign field responsibilities?			
6 Was the daily briefing and safety check conducted?			
7 Was a completed "Site Personnel Protection and Safety Evaluation Form" read and signed by all visitors and personnel entering the site?			
8 Was a field notebook assigned to the field team leader?			
9 Were entries made in the field notebook?			
10 Were sampling stations located correctly?			
11 Did the number and location of samples collected follow the site-specific sampling plan?			

Table A 1 (Continued)

Project _____ Site Manager _____
 Site Location _____ Field Team Leader _____
 Auditor _____ Date _____

Audit Question Yes No Comment/Documentation

- 21 Have any procedures been revised?
- 22 Are revisions to procedures adequately documented?
- 23 Was the document log for chain-of-custody records and other sample traffic control forms maintained?
- 24 Have any accountable documents been lost?
- 25 Did drilling and well construction follow procedures outlined in the sampling plan?
- 26 Were the activities being conducted compatible with the environmental conditions?