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SITE-WIDE QUALITY ASSURANCE PROJECT PLAN VOLUMES I & II
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VOLUME I

+

VOLUME II

Fernald Environmental Management Project

Site - Wide
QUALITY ASSURANCE PROJECT PLAN

Prepared by

Westinghouse Environmental Management Company of Ohio

for the

United States Department of Energy
Fernald Office

31 October 1991

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NOTICE TO QAPjP REVIEWERS

- THE DOCUMENT IS CONTAINED IN TWO (2) VOLUMES
  - VOLUME I = GLOSSARY AND SECTIONS 1 - 16
  - VOLUME II = APPENDICES A - L

- THE LABORATORY ANALYTICAL METHODS ARE NOT CONTAINED IN THIS QAPjP. THESE METHODS WILL BE MAINTAINED IN A SEPARATE CONTROLLED DOCUMENT ENTITLED "FEMP LABORATORY ANALYTICAL METHODS MANUAL"
  - DRAFT ANALYTICAL METHODS HAVE BEEN GENERATED AND ARE BEING EVALUATED FOR USEABILITY BY THE ANALYTICAL LABS
  - ONCE THESE METHODS HAVE BEEN EVALUATED AND ACCEPTED, THEY WILL BE AVAILABLE FOR EPA REVIEW

- ATTACHED IS A LIST OF CURRENTLY GENERATED ANALYTICAL METHODS WHICH WILL BE INCLUDED IN THE "FEMP LABORATORY ANALYTICAL METHODS MANUAL"

- GENERAL ANALYTICAL METHODS ARE INCLUDED IN APPENDIX L

FEMP LABORATORY ANALYTICAL METHODS

Measurement of Purgeable Organic Compounds in Drinking Water by Capillary Column Gas Chromatography/Mass Spectrometry
Measurement of Purgeable Organic Compounds in Drinking Water by Capillary Column Gas Chromatography
Gas Chromatography/Mass Spectrometry Methods for Analysis of Target Volatile Compounds
Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry
Chlorinated Pesticides/PCBs by Gas Chromatography
Herbicides by Gas Chromatography
Gas Chromatography Purgeable Halocarbons
Metals by Graphite Furnace Atomic Absorption Spectrometry
Metals by Flame Atomic Absorption Spectrometry
Metals by Inductively Coupled Plasma
Mercury Analysis by Cold Vapor Atomic Absorption Spectrometry
Cyanide(Total)
Toxicity Characteristic Leaching Procedure
Corrosivity
Soil pH
Conductivity
Sulfide
Sulfate(Colorimetric, Turbidimetric)
Chloride(Colorimetric, Automated Ferricyanide)
Ammonia and Total Organic Nitrogen
Hexavalent Chromium
Fluoride
Nitrogen, Nitrate-Nitrite(Colorimetric, Automated; Spectrophotometric)
Total Dissolved Solids
Oil and Grease(IR and Gravimetric)
Total Petroleum Hydrocarbons(IR)
Total Phosphorus
Total Recoverable Phenolics(4-AAP)
Total Organic Carbon(Soil and Water)
Alkalinity
Surfactants(MBAS)
Color
Percent Solids(Moisture)
Gross Alpha, Beta Gamma Activity Screening Procedure
Isotopic and Total Uranium in Soil and Air Filters
Isotopic and Total Uranium in Milk
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Alpha-emitting Radium Isotopes in Water
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Isotopic and Total Thorium in Filtered Water
Radiometric Determination of Pb-210 in Soil and Water

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

U.S. DEPARTMENT OF ENERGY
FERNALD OFFICE

SITE - WIDE
QUALITY ASSURANCE PROJECT PLAN

APPROVALS:

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QUALITY ASSURANCE PROJECT PLAN

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GLOSSARY

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ACRONYMS

A	Acid extractables
AA	Atomic Absorption
AEC	Atomic Energy Commission
AEDE	Annual Effective Dose Equivalent
AnaLIS	Analytical Laboratory Information System
ANSI	American National Standards Institutes
ARAR	Applicable or Relevant and Appropriate Requirement
ASI	Advanced Sciences, Inc.
ASL	Analytical Support Level
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AVGRRF	Average Relative Response Factor
BDN	BioDeNitrification
BFB	Bromofluorobenzene
BNA	Base Neutrals Analysis
B/N	Base Neutrals
BNAE	Base-Neutral and Acid Extractable organics
CA	Consent Agreement
CAA	Clean Air Act
CAM	Continuous Air Monitor
CAR	Corrective Action Report
CCB	Calibration Control Blank
CCC	Calibration Check Compounds
CCS	Contract Compliance Screening
CCV	Continuing Calibration Verification
CEC	Cation Exchange Capacity

ACRONYMS (cont.)

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration Factor
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program (U.S. Environmental Protection Agency)
COLIWASA	Composite Liquid Waste Sampler
CRDL	Contract-Required Detection Limit (in the CLP)
CRHT	Contract-Required Holding Time
CRQL	Contract-Required Quantitation Limit (in the CLP)
CRR	Contract-Required Recovery
CTM	Contract Technical Monitor
CVAA	Cold Vapor Atomic Absorption methods for mercury analysis
CWA	Clean Water Act
DBC	DiButylChlorendate
DCAR	Deviation and Corrective Action Report
DCR	Document Change Request
DFTPP	Decafluorotriphenylphosphine
DFQAPjO	Designated FEMP Quality Assurance Project Organization
DI	DeIonized (water)
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQ	Data Quality
DQO	Data Quality Objective
DR	Deviation Report
DVP	Data Validation Plan
DVT	Data Validation Team
ECD	Electron Capture Device
EDP	Electronic Data Processing
EPA	U.S. Environmental Protection Agency
EP Tox	Extraction Procedure Toxicity
ERA	Executive Resource Associates, Inc.

ACRONYMS (cont.)

ERMC	Environmental Restoration Management Contractor
ETS	Effluent Treatment System
FEMP	Fernald Environmental Management Project
FFCA	Federal Facility Compliance Agreement
FID	Flame-Ionization Detector
FMPC	Feed Materials Production Center (Fernald, Ohio)
FO	Fernald Office
FR	Federal Register
FS	Feasibility Study
FSO	Fernald Site Office (Department Of Energy)
FSDCP	Field Sampling/Data Collection Package
FSP	Field Sampling Plan
FTAAS	Flame Technique Atomic Absorption Spectroscopy
GC	Gas Chromatography (or Chromatograph)
GC/EC	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption
GS	General Sump
HMT	Hazardous Materials Table
HSL	Hazardous Substance List
HWMU	Hazardous Waste Management Unit
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma (spectroscopy)
ICS	Interference Check Sample
ICV	Initial Calibration Verification
ID	IDentification
IDL	Instrument Detection Limit
IS	Internal Standards
IR	InfraRed

ACRONYMS (cont.)

IT	International Technology Corporation
LAACC	Large-Area, Activated-Charcoal Collector
LCS	Laboratory Control Samples
LSA	Low Specific Activity
LSC	Laboratory Services Contract
MCL	Maximum Contaminant Level
MDL	Method Detection Limits
MOSA	Methods of Soil Analysis
MS	Mass Spectroscopy (or Spectrometer)
MSA	Method of Standard Additions
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSA	Method of Standard Addition
MTE	Measuring and Testing Equipment
N/A	not applicable
NCP	National Contingency Plan (for Oil and Hazardous Substances Pollution)
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
N/K	not known
NLO	National Lead of Ohio, Inc.
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Units
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OJT	On-the-Job Training
ORO	Oak Ridge Operations (or Office)
OSHA	Occupational Safety and Health Administration (or Act)

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ACRONYMS (cont.)

OU	Operable Unit
PCB	PolyChlorinated Biphenyls
PE	Performance Evaluation
PIC	Pressurized Ionization Chamber
PID	Photo-Ionization Detector
PVC	PolyVinyl Chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Program Plan
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RAM	RadioActive Material
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDL	Radiation Detection Limits
REMP	Radiological Environmental Monitoring Program
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RIC	Reconstructed Ion Chromatograph
ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factor
RRT	Relative Retention Time
RSD	Relative Standard Deviation
RSE	Removal Site Evaluation
RvA	Removal Action

ACRONYMS (cont.)

SA	Spike Added
SARA	Superfund Amendments and Reauthorization Act
SAS	Sample Analysis Selection (or Summary)
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	System Performance Check Compound
SR	Sample Result
SRPD	Self-Reading Pocket Dosimeter
SSR	Spike Sample Result
SVOA	Semi-Volatile Organic Analysis (or Analytes)
SWMU	Solid Waste Management Unit
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TLD	ThermoLuminescent Dosimeter
TOC	Total Organic Carbon
TOX	Total Organic Halogens (or Halides)
TQM	Total Quality Management
TSCA	Toxic Substance Control Act
UST	Underground Storage Tank
UV/VIS	UltraViolet/Visible Spectrum
VOA	Volatile Organic Analysis (or Analytes)
VOC	Volatile Organic Compound
WEMCO	Westinghouse Environmental Management Company of Ohio
WTP	Water Treatment Plant
XRFS	X-Ray Fluorescence

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ACRONYMS (cont.)

%D	Percent Difference
%RSD	Percent Relative Standard Deviation

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ABBREVIATIONS

cc	cubic centimeter
cm	centimeter
cpm	counts per minute
dpm	disintegrations per minute
Eh	redox potential
ft	foot or feet
in.	inch or inches
kg	kilogram
m	meter
Ma	milliampere
min	minute
msl	(feet above) mean sea level
mg/L	milligram per liter
mL	milliliter
mrem/h	millirem per hour
mV	millivolt
m/z	Ratio of mass (m) to charge (z) of ions measured by GC/MS
μmhos/cm	micromhos per centimeter
μg	microgram
μg/L	microgram per liter
nCi	nanocuries
pCi/L	picocuries per liter
ppt	parts per trillion
Ra-226	radium-226
Rn-222	radon-222

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Accuracy. The closeness of a measured value to the accepted true value.

Administrative Record. Official repository for information documenting progress of programs and projects aimed at remediation of FEMP. Contents of the administrative record are determined by DOE and are accessible to the public.

Analytical Batch. A group of twenty or less FEMP samples analyzed as a group, relative to instrument calibration checks, quality control samples, etc.

Analytical Support Level. Level of defined quality assurance/quality control parameters to assure data are satisfactory for their intended use.

Aquifer. A geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring

Capillary water. Water held as a film around soil particles and in tiny spaces between particles in the unsaturated zone. Surface tension is the adhesive force that holds capillary water in the soil.

CERCLA-covered. Programs or projects at FEMP that generate data or perform functions required by the CERCLA program to fulfill requirements of the NCP or consent agreement.

CERCLA-driven. Items or activities at FEMP required by the NCP or the Consent Agreement.

Channel. Bed where a natural stream of water runs; a long gutter, groove, or furrow

Confined Aquifer. An aquifer that is overlain by a confining bed. The confining bed has a significantly lower hydraulic conductivity than the aquifer.

Consent Agreement. A written agreement entered into by the U.S. Department of Energy and the U.S. Environmental Protection Agency in April 1990 and as amended September 1991 that specifies actions to be taken at FEMP, including defining Operable Units (OU); conducting Removal Actions (RA), Remedial Investigations (RI), and Feasibilty Studies (FS); preparing Records of Decision (ROD); and implementing Remedial Design (RD) and Remedial Actions (RA). The goal of the consent agreement is remediation of FEMP.

Contaminant. Any physical, chemical, biological, or radiological substance or matter that has an adverse affect on air, soil, or water.

TERMINOLOGY (cont.)

Contractor. Organization contracted directly to DOE to function in a specific capacity at FEMP and reports to DOE or to a designee of DOE. Contractors currently include the prime contractor, the RI/FS contractor, and the RD/RA contractor.

Designated FEMP Quality Assurance Project Organization (DFQAPjO). The quality assurance organization of a DOE prime contractor or a DOE quality assurance group, the responsibility of which it is to oversee QA functions of prime contractors and subcontractors on site.

Designee. Individual designated to perform a function in place of the defined responsible individual. The designation of authority to a designee must be documented in the project record and must include the scope and length of time the designation is in effect.

Electro-Fishing. A fresh-water fish sampling method that uses a pulsating direct current electro-shocker between 300 and 30,000 ohms to stun fish for collection

Feasibility Study. See Remedial Investigation/Feasibility Study.

Fluid. Any material or substance that flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state

FEMP. The DOE Fernald Environmental Management Project, formerly a uranium processing plant named Feed Materials Production Center (FMPC). Consists of a 1050 acre site and potentially affected off-site areas.

FEMP Program or Project Manager. FEMP individual (usually an employee of a direct or prime contractor to DOE) responsible for execution and completion of a program or project.

FEMP Program or Project Contact. FEMP individual designated to maintain program/ project liaison with laboratory or other subcontractor personnel during the course of a program/project.

Formation. A body of consolidated or unconsolidated rock characterized by a degree of lithologic homogeneity that is prevailingly, but not necessarily tabular and is mappable on the earth surface or traceable in the subsurface

Formation Fluid. Fluid present in a formation under natural conditions as opposed to introduced fluids, such as drilling mud

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TERMINOLOGY (cont.)

Fully Penetrating Well. A well drilled to the bottom of an aquifer, constructed in such a way that it withdraws water from the entire thickness of the aquifer

Gaining Stream. A stream or section of stream, the flow of which is being increased by inflow of ground water (that is, effluent with respect to ground water). The hydraulic head of the stream surface has a lower potential than the surrounding ground-water environment, so ground water is discharged to the stream.

Ground Water. (1) The supply of fresh water under the earth's surface that forms a natural reservoir. (2) Water at or above atmospheric pressure which is below the land surface in the zone of saturation. (3) Water in a saturated zone or stratum beneath the surface of land or water.

Gully or Rill. Miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage. A rill is of lesser depth and can be smoothed over by ordinary tillage.

Hazardous Substance. Any material that poses a threat to human health and/or the environment as defined in 40 CFR 300.5. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or if otherwise emitted to the environment.

Hazardous Waste. Any waste or combination of wastes that pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable or persistent in nature, or they can be biologically magnified, or they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects. Also a waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid or that may cause or contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, taking into account the toxicity of such waste, its persistence and degradability in nature, its potential for accumulation or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other organisms. [ed. Hazardous wastes as defined here as those wastes listed by EPA or meeting characteristics specified by EPA in their criteria pursuant to the Resource Conservation Recovery Act (RCRA). Disposal treatment or storage of hazardous wastes can only take place in a site or facility issued a permit by EPA or a state.]

TERMINOLOGY (cont.)

Hydraulic Conductivity. A coefficient of proportionality describing the rate at which water can move through a permeable medium. The density and kinematic viscosity of the water must be considered in determining hydraulic conductivity.

Laboratory Project Manager. Individual employed by a laboratory who is responsible for overseeing the analysis and reporting of all samples from FEMP for a particular program or project. Also responsible for day-to-day liaison with the FEMP program/project contact.

Leachate. Liquid that has percolated through solid waste and dissolved soluble components. Any liquid including any suspended components in the liquid that has percolated through or drained from waste materials.

Losing Stream. A stream or section of stream that is influent with respect to ground water (i.e., there is a net loss of stream water to the ground-water system). The hydraulic head of the stream surface has a greater potential than the surrounding ground-water environment, so the stream water contributes recharge to the aquifer.

Monitoring Well. A well installed in a selected location and screened at a specific depth to allow monitoring of chemical and hydraulic parameters.

Open-Channel Flow. Flow with a free surface within definable, continuous-channel boundaries. Flow in a stream, river, or unconfined flow in a conduit.

Overland Flow. Water flowing on the land surface without the ordinary constraint of definable, continuous channel boundaries. Most commonly refers to the flow resulting when rainfall rates exceed surface infiltration rates. This is also called rainfall-excess overland flow. May also include flood flows, also termed channel-excess flows. One characteristic of overland flow is that it is ephemeral.

Partially Penetrating Well. A well constructed in such a way that it draws water directly from a fractional part of the total thickness of the aquifer. The fractional part may be located at the top or the bottom or anywhere in between the aquifer.

Performance Audit or Surveillance. Spot checks of program implementation to determine conformance to specified requirements.

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TERMINOLOGY (cont.)

Piezometer. A bored, drilled or driven shaft or a dug hole with a depth greater than the largest surface width; a shaft or pit dug or bored into the earth, generally cylindrically, and often walled with bricks or tubing to prevent earth from caving in with its main purpose being to monitor ground water elevation or pressure; or a nonpumping well used to measure the elevation of the water table or potentiometric surface.

Ponding. Standing water on soils in closed depressions. The water can be removed only through percolation or evapotranspiration.

Precision. A measure of the repeatability of an analysis or measurement. Measurements that are repeatable within small limits are said to be precise.

Process Wastewater. Any water that, during manufacturing or processing, comes into direct contact with or results from the production of or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Program. In the context of this QAPjP, a defined set of ongoing activities, such as routine monitoring, that will be continued in basically the same format for an indeterminate length of time (e.g., the CERCLA Program, Environmental Compliance Monitoring Ground-Water Program, and Environmental Monitoring Program). Programs are subject to the same substantive requirements regarding sampling and analysis as projects. However, the converse may not be true. Therefore, whenever the term project is used in this QAPjP, it also refers to programs.

Program or Project-Specific Plans. Scoping documents required for any program or project. All programs or project-specific plans for FEMP sampling and analysis activities should include elements defined in Section 6 of the QAPjP. Examples of program and project-specific plans include work plans, field sampling plans, health and safety plans, and standard operating procedures.

Project. In the context of this QAPjP, a defined set of activities pursued towards a defined final conclusion. Examples of projects at FEMP include the remedial investigation/ feasibility studies for each operable unit, removal site evaluations, and removal actions. A project may be included within a program.

Recharge. A process, natural or artificial, by which water is added to the saturated zone of an aquifer. A recharge area is where water reaches the ground water by surface infiltration.

Recharge Area. An area in which there are downward components of hydraulic head in the aquifer. Infiltration moves downward into deeper parts of an aquifer in a recharge area.

TERMINOLOGY (cont.)

Record of Decision (ROD). A public document that explains which cleanup alternatives will be used at a National-Priorities-List site. The ROD is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments and community concerns.

Redox Potential. Potential for oxidation and reduction of elements in water. A measure of aqueous electron concentration controlled by reactions involving elements present in more than one oxidation state.

Remedial Action. Those actions consistent with permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment.

Remedial Design. A phase of remedial action that follows the remedial investigation/ feasibility study and includes development of engineering drawings and specifications for a site cleanup.

Remedial Investigation/Feasibility Study (RI/FS). Consists of two distinct but related studies usually performed concurrently. The remedial investigation is intended to gather data necessary to determine the types and extent of contamination at a superfund site and assess risk to human health and the environment posed by identified contamination. The feasibility study identifies and screens cleanup alternatives and produces a detailed analysis of the technology and costs of remedial alternatives.

Removal Action. Short term, immediate actions taken to address releases of hazardous substances that require expedited response.

Removal Site Evaluation. A study conducted to determine whether a site poses an imminent or potential hazard to human health and the environment requiring initiation of a removal action.

Rill. See Gully.

Runoff. (1) Precipitation discharged into stream channels from an area. Surface runoff is water that flows off the surface of the land without sinking into the soil. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water. (U.S. Soil Conservation Service) (2) Any rain water, leachate, or other liquid that drains overland from any part of a facility.

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TERMINOLOGY (cont.)

Sampling Round. Collection of samples from one or more locations for a specific project during a specified time period for a similar purpose.

Saturated Zone. The zone in which the voids in the rock or soil are filled with water at a pressure greater than atmospheric. The water table is the top of the saturated zone in an unconfined aquifer.

Seep. An area where water oozes from the earth. A surface expression of the water table. A small spring with little or no discernable flow.

Significant Condition Adverse to Quality. A condition, if left uncorrected, could significantly impact the quality of a measurement or program.

Site. (1) "...refers to FMPC and all areas where hazardous or radioactive substances, pollutants, or contaminants have been deposited, stored, disposed of, placed, or otherwise come to be located." (Federal Facility Compliance Agreement, Attachment I, p.1, July 18, 1986) (2) "...shall include all areas within the property boundary of FMPC and any other areas that received or potentially received released hazardous substances, pollutants, contaminants, or hazardous constituents. The term shall have the same meaning as 'facility' as defined by Section 101(9) of CERCLA, 42 U.S.C. §9601(9)." (Consent Agreement, April 9, 1990)

Spring. Where water flows without artificial aid from the subsurface to the surface. A surface expression of the water table.

Standard. (noun) In context of equipment calibration, something set up and established by authority as a rule for the measurement of a parameter (e.g. concentration, length, temperature, mass). (adj) A regularly and widely used method (e.g. standard operating procedure), material (e.g. standard gauge), or calculation (e.g. standard deviation).

Stream. Any body of flowing water or other fluid.

Subcontractor. Organization that performs a service for FEMP while contracted to a prime contractor of the Department of Energy and that reports to the prime contractor.

Surface Water. Water that is open to the atmosphere and subject to surface runoff

System Audit or Audit. An in-depth review of an entire program, including an evaluation of the associated quality assurance program and procedures, effectiveness of their implementation, and review of associated documentation.

TERMINOLOGY (cont.)

Teflon. A fluorocarbon plastic manufactured by the DuPont Corporation. In this document, teflon refers to any fluorocarbon plastic.

Tremie Line Method of Grouting. A method of inserting grout into a borehole to ensure that there are no void spaces. A hose or pipe is inserted into a borehole to within five feet of the bottom of the opening. Grout is pumped through the hose or pipe. As the borehole fills, the tremie line is retracted at approximately the same rate as the hole is filling.

Unconfined Aquifer. An aquifer in which there are no confining beds between the zone of saturation and the surface. There will be a water table in an unconfined aquifer. Water-table aquifer is a synonym.

Unsaturated Zone. The zone between the land surface and the water table. It includes the root zone, intermediate zone, and capillary fringe. The pore spaces contain water at less than atmospheric pressure, as well as air and other gases. Saturated bodies, such as perched groundwater, may exist in the unsaturated zone.

Water Table. The surface in an unconfined aquifer or confining bed at which the pore water pressure is atmospheric. It can be measured by installing shallow wells extending a few feet into the zone of saturation and then measuring the water level in those wells.

Well. (1) A hydraulic structure which, when properly designed and constructed, permits the economic withdrawal of water from a water-bearing formation. (2) A bored, drilled or driven shaft, or a dug hole with a depth greater than the largest surface dimension (hole is deeper than it is wide). (3) Any shaft or pit dug or bored into the earth, generally of a cylindrical form and often walled with bricks or tubing to prevent the earth from caving in.

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Section 1

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Section 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

The EPA requires that all environmental monitoring and measurement programs mandated or supported by EPA contain a centrally managed Quality Assurance (QA) program. Parties generating data under this program are responsible for implementing procedures that ensure the precision, accuracy, completeness, and representativeness of generated data and documentation thereof (U.S. Environmental Protection Agency, 1991).

FEMP, as a Superfund-designated site, is on the National Priorities List (NPL) for environmental cleanup as mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This Quality Assurance Project Plan (QAPjP) has been developed to direct environmental sampling and analysis to support ultimate remediation of the site. To this end, ongoing and future environmental projects at FEMP shall adhere to the Quality Assurance/Quality Control (QA/QC) requirements specified herein. The following projects are included in FEMP activities.

- Remedial Investigations/Feasibility Studies (RI/FS) - Consists of two distinct but related studies usually performed concurrently. During the remedial investigation, data is gathered to determine types and extent of contamination at a Superfund site and to assess risk to human health and the environment posed by identified contamination. The feasibility study results in identification of cleanup requirements and a detailed analysis of the technology and costs of remedial alternatives.

- Removal Site Evaluations (RSE) - Assessment of the need for a removal action required by ongoing or threatened release of contaminants that may adversely impact public health or the environment without immediate response

- Removal Actions (RvA) - Short-term immediate actions taken to address releases of hazardous substances that require an expedited response

- Remedial Design (RD) - Engineering phase that follows the record of decision when technical drawings and specifications are developed for subsequent remedial action at an NPL site

- Remedial Actions (RA) - Construction or implementation phase that follows remedial design of selected cleanup alternative at an NPL site

Other programs and activities at FEMP requiring collection and analysis of samples include the following.

- Resource Conservation and Recovery Act (RCRA)
- Clean Air Act (CAA)
- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- National Environmental Policy Act (NEPA)
- Toxic Substances Control Act (TSCA)
- Radiological Environmental Monitoring Program (REMP)
- Underground Storage Tank (UST)
- Routine environmental surveillance required by U.S. Department of Energy (DOE) orders
- Construction

The QAPjP is designed to ensure that work performed for environmental programs and supporting activities at FEMP are of adequate quality to fulfill project-specific Data Quality Objectives (DQO). The organization, objectives, functional activities, and specific QA and Quality Control (QC) activities associated with the CERCLA program at FEMP are presented. Basic requirements for sampling, sample handling and storage, chain-of-custody records, and laboratory and field analyses are specified. Data generated are intended to fulfill defined needs of DOE, EPA, the Ohio Environmental Protection Agency (OEPA), and the public. DQOs and requirements for meeting and verifying DQOs are included as part of this document.

Sampling efforts implemented under this plan are designed to accomplish the following.

- Assess environmental conditions in air, soil, ground water, and surface water
- Aid in identifying areas requiring remediation
- Determine the variability in the entire measurement process along with sources and magnitude of variation in results generated

- Provide a means of determining whether a sampling program meets DQOs
- Identify areas requiring remedial action

This document is a revision of the QAPjP prepared for the FEMP RI/FS that fulfills requirements of the Federal Facilities Consent Agreement (FFCA) entered into by DOE and EPA in 1986 (U.S. Department of Energy, 1988). Inclusion of FEMP on the NPL in 1989 necessitated implementation of a new agreement between DOE and EPA, so the two parties entered into a consent agreement in April 1990. As a result, a subsequent decision was made to modify the RI/FS QAPjP to include all site programs generating environmental data and to ensure useability of data for the FEMP CERCLA program.

This QAPjP has been prepared by DOE and its FEMP contractors to integrate CERCLA requirements into applicable sampling activities at FEMP. This is consistent with EPA recommendations to consolidate QA requirements and to consolidate documents whenever possible (U.S. Environmental Protection Agency 1989a).

QA/QC procedures are in accordance with applicable professional technical standards, regulatory requirements, regulations, guidelines, and specific project goals and requirements. The following documents were considered in the development of this QAPjP.

- DOE Order 5700.6B and 5700.6C, Quality Assurance (U.S. Department of Energy, 1986 and 1991)
- Quality Assurance/Quality Control Guidance for Removal Activities (U.S. Environmental Protection Agency, 1990)
- Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) Under CERCLA (U.S. Environmental Protection Agency, 1988)
- Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (U.S. Environmental Protection Agency, 1983)
- Superfund Remedial Design and Remedial Action (RD/RA) Guidance (U.S. Environmental Protection Agency, 1986)
- Model Quality Assurance Project Plan, Region V, Office of Superfund (U.S. Environmental Protection Agency, 1991)
- Content Requirements for Quality Assurance Project Plan (U.S. Environmental Protection Agency, Region V, Chicago, Illinois, Cheng-Wen Tsai (1989a)

- Final Standard - Quality Assurance Project Plan Content Document, U.S. Environmental Protection Agency, Region V (1989b)

Revisions in response to evolving program needs are an integral part of a successful program as new programs will be implemented at FEMP later; therefore, this QAPjP provides for document changes. The QAPjP is intended to be a living document, meeting current site needs while retaining the flexibility to respond to advances in analytical methods, field techniques, operating procedures, and changes in the mission of FEMP. Techniques and procedures are appropriately referenced and, as improvements are proposed and accepted, change requests will be drafted and distributed for comment or approval. References to EPA guidance documents, journal articles, textbooks, and FMPC/FEMP contractor methods and guidlines are an integral part of this document. Referenced documents are available to users and reviewers as public documents or upon request to the DOE Fernald Office. Referenced DOE orders are available through the FEMP library.

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Section 2

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Section 2

BACKGROUND AND INTENDED DATA USE

FEMP is owned by the U.S. Government and was formerly a uranium processing facility known as the Feed Materials Production Center (FMPC). The Westinghouse Environmental Management Company of Ohio (WEMCO) is currently the prime contractor to DOE at FEMP.

2.1 SETTING AND SITE HISTORY

2.1.1 Setting

FEMP is located in a rural area of southwestern Ohio approximately 18 miles northwest of downtown Cincinnati, Ohio, and 8 miles southwest of Hamilton, Ohio. The site is comprised of 1,050 acres bounded by State Highway 126 to the north, Willey Road to the south, Paddys Run Road and the Chesapeake and Ohio Railroad to the west, and a power transmission line right-of-way to the east (U.S. Department of Energy, 1988). The plant area occupies approximately 136 acres in the center of the DOE property. The villages of Fernald, New Baltimore, Ross, New Haven, and Shandon are located within a few miles of the plant (Figure A-1) (U.S. Department of Energy, 1990a).

Ground elevations at FEMP range from a high of approximately 700 feet above mean sea level (msl) along the northern boundary to approximately 550 feet msl where Paddys Run leaves the property near the southwest corner. Natural surface runoff at the plant is generally east to west into Paddys Run, which flows south to the Great Miami River. Runoff from the northeast corner of FEMP drains into a small, intermittent tributary of the Great Miami River. Surface runoff within most of the former plant production area is captured in a storm-sewer system that discharges to a storm-water retention basin. After solids have been allowed to settle out of the collected runoff, water from the basin is discharged along with plant waste water to the Great Miami River through an effluent line permitted under the National Pollutant Discharge Elimination System (NPDES) provisions of the Clean Water Act (U.S. Department of Energy, 1990a).

Before construction of the storm-water retention basin, storm flows in excess of the capacity of the main effluent line were discharged to the storm-water outfall ditch. These runoff events are suspected of contributing significant amounts of contaminants from the main plant area to the surface water system (U.S.Department of Energy, 1990a).

Directly underlying most of FEMP are glacial drift deposits (also referred to as glacial overburden) ranging from zero to approximately 50 feet in thickness. The drift is composed primarily of poorly sorted, clay-rich till, with various interbedded glaciofluvial (glacial stream), lacustrine (lake), and loess (wind blown) deposits of lenticular geometry (U.S. Department of Energy, 1990a).

Underlying the glacial drift are extensive valley-fill outwash deposits of medium- to well-sorted sands and gravels averaging about 150 feet in thickness under FEMP. The outwash overlies well-indurated shale and limestone bedrock. The outwash under the plant is separated into an upper and lower unit by a clay-rich lacustrine deposit, locally referred to as blue clay, which ranges from zero to about 20 feet in thickness (U.S. Department of Energy, 1990a).

In the area around FEMP, the portion of the Great Miami River not affected by the Southwest Ohio Water Company collector wells is a discharge area under normal hydrologic conditions. The lower portion of Paddys Run between New Haven Road and the Great Miami River is a gaining stream during part of the year and a losing stream at other times. Paddys Run is also a gaining stream where its bed is on the clay-rich glacial overburden (north of the K-65 area), as evidenced by small seeps and springs along its banks and tributaries.

The Great Miami River is a losing stream where drawdown induced through pumping of SOWC collector wells reduces the aquifer head below the stream level. Paddys Run is a losing stream between the K-65 area and approximately New Haven Road and loses flow to the aquifer along other stretches at other times of the year.

Ground water is present in perched aquifers composed of coarser, better-sorted lenses within the glacial drift and in coarse fill below buildings and along utility lines. Ground-water flow within the drift is discontinuous and may be subject to extreme seasonal fluctuation. The upper 20 to 30 feet within the outwash is unsaturated; and the remainder forms the Great Miami Aquifer, which has been designated a sole-source aquifer by the EPA. Under the plant area, the Great Miami Aquifer is separated into an upper and lower unit by the blue clay. The upper portion is unconfined and receives recharge from Paddys Run (a losing stream) and the storm-water outfall ditch, as well as the overlying drift. The lower portion is semi-confined and, probably, is primarily recharged by leakage through the blue clay (U.S. Department of Energy, 1990a).

Ground-water users in the area surrounding FEMP draw primarily from the Great Miami Aquifer. The most significant usage is by the Southern Ohio Water Company, which operates a series of radial collector wells east of FEMP. Ground-water is also used at the plant for process and sanitary purposes. Other ground-water users include production facilities to the south of FEMP, residents around the plant, and various other private and commercial users (U.S. Department of Energy, 1990a).

Contaminants including radionuclides, trace metals, and volatile organic compounds have been confirmed in perched saturated zones within the glacial drift. Ongoing removal actions (pump and treat) are being conducted at FEMP to remedy the worst of the contamination. Contaminants including radionuclides and volatile organic compounds associated with FEMP have also been detected in the Great Miami Aquifer. Much of the aquifer contamination is associated with surface water from Paddys Run and the storm-water outfall ditch (i.e., losing streams).

2.1.2 Production History

The U.S. Atomic Energy Commission, predecessor to DOE, began construction of FMPC in 1951 and operations in 1952. Operations consisted of foundry and other processes to convert natural uranium ore concentrates and recoverable, recyclable residues into uranium metal and compounds. The primary function of the plant was production of metallic uranium fuel cores and uranium compounds for use in U.S. defense programs.

In addition to the primary uranium products, small amounts of thorium were produced. The site currently serves as the thorium repository for DOE, where a variety of thorium materials are stored in long-term storage facilities. During the 1950s, pitchblende ores containing uranium, radium-226, and daughter products were processed at FMPC.

A variety of chemicals (e.g., nitric acid, anhydrous hydrogen fluoride, magnesium metal, metal cleaning solvents, coolants, and lubricating oils) were used in the production processes.

As a result of these operations, various types of liquid and solid matrix wastes were generated. These wastes can be broadly categorized as hazardous and non-hazardous wastes, radioactive wastes, and mixed wastes (hazardous wastes with radioactive material).

Many solid and liquid wastes were stored or disposed of on-site. Radium-bearing wastes from pitchblende processing were stored in two concrete silos in a waste storage area northwest of the main plant area (Figure A-2). Metal oxide wastes were stored in a third silo. A fourth silo was constructed, but remains unused. Uranium metal production wastes were placed in pits in the waste storage area, and a sanitary landfill was operated on site to dispose of solid waste. Construction debris was disposed of on site separately from the waste storage area, as was fly ash from the boiler plant.

Releases of contaminants from FEMP to environmental media have been noted during past investigations (U.S. Department of Energy, 1990a). These releases include runoff to the storm-water outfall ditch and Paddys Run; discharges of uranium to the Great Miami River; and releases and spills of uranium-bearing materials, solvents, and other material to soils on the plant property. Media affected include perched ground water (radionuclides and volatile organic materials), ground water in the Great Miami Aquifer (radionuclides and volatile organic compounds), surface water and sediments in Paddys Run and the Great Miami River

(radionuclides), and, possibly, aquatic and terrestrial biota. In addition, it is suspected that air emissions contributed to both on-site and off-site deposition of radionuclides. More detailed descriptions of site history and previous investigations are included in DOE documents (e.g., 1988 and 1990a).

2.2 REGULATORY ISSUES

2.2.1 Federal Facilities Compliance Agreement

DOE Oak Ridge Operations (ORO) entered into a Federal Facilities Compliance Agreement (FFCA) with EPA pertaining to FMPC on 18 July 1986 pursuant to Executive Order 12088 [43 Federal Register (FR) 47707], which set forth compliance with existing environmental statutes and implementing regulations. Key elements of the FFCA include bringing the site into compliance with the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA) and initiating a Site Remedial Investigation/Feasibility Study (RI/FS).

2.2.2 Consent Agreement

FMPC was added to the National Priorities List (NPL) in 1989. A Consent Agreement was negotiated and entered into in April 1990 between DOE and EPA outlining activities and schedules to be performed in order to remedy the site condition. This agreement was revised in September 1991. Key elements of this agreement include incorporating the FFCA as an attachment, recognizing that significant previous work was conducted, grouping the site into five Operable Units (OU) for characterization and remediation, and setting a schedule for activities from completion of the RI/FS for each OU through signing of a Record of Decision (ROD).

OUs are groupings of sites suspected of past releases of contaminants to the environment based on the similarity of use, process, proximity to other sites, or type of potential contaminant. Defined OUs requiring characterization and remediation at FEMP are described in the Consent Agreement as follows.

- OU-1 - Waste pit area
- OU-2 - Other waste units
- OU-3 - Production area
- OU-4 - Silos 1 through 4
- OU-5 - Environmental media

A sixth OU, the comprehensive site-wide operable unit, is identified in the September 1991 revision of the Consent Agreement. This OU is defined as the site-wide evaluation of remedial response actions to ensure that those actions are protective of human health and the environment. A remedial investigation/risk assessment report and a Proposed Plan and Record of Decision (PP/ROD) shall be completed if no additional action is necessary to achieve protectiveness. If necessary, a Site-Wide Feasibility and PP/ROD will be prepared to address additional concerns.

Approximately 480,000 cubic yards of waste material were disposed of in units comprising OU-1. The bulk of the solid waste was disposed of in pits 3 (245,000 cubic yards), 4 (57,6000 cubic yards), and 5 (101,000 cubic yards). In addition, approximately 3,700 cubic yards of water are in pit 5 (748,000 gallons) and 7,700 cubic yards of water are in the clearwell (1,550,000 gallons) (U.S. Department of Energy, 1991a).

OU-2 consists of the sanitary landfill (approximately 18,000 cubic yards of waste), the south lime sludge pond (approximately 11,500 cubic yards), the north lime sludge pond (about 5,000 cubic yards), the inactive fly ash disposal area (approximately 50,000 cubic yards), the active fly ash pile (approximately 38,000 cubic yards), and Southfield (approximately 125,000 cubic yards of construction rubble) (U.S. Department of Energy, 1991b).

The former production area and additional suspect areas comprise OU-3. There are currently ten suspect areas being addressed.

- Area within the east buffer zone
- Clearwell to manhole 175 pipeline
- Fire training area
- Flagpole area near the old administration building site
- Sewage treatment plant/incinerator area
- K-65 slurry line
- Main effluent line
- Rubble mound west of the K-65 silos
- Rubble mound south of the K-65 slurry line
- Rubble area in the northeast corner of the pit area

Four quadrants were defined within the former production area in order to logistically focus the investigations. These are described as follows along with their main components and include a number of drummed waste storage areas.

- Southeast Quadrant - Plants 4, 5, 6, 7; the main electrical substation; and the site garage
- Southwest Quadrant - Plants 2, 3, and 8, general sump, pilot plant, and laboratory
- Northwest Quadrant - Plant 1 and the drum storage pad
- Northeast Quadrant - Plant 9, Decontamination and Decommissioning (D&D) facility, maintenance building, boiler plant, tank farm, and metal scrap pile (U.S. Department of Energy, 1990b)

OU-4 was defined as those special facilities with waste characteristics requiring the potential application of singular technologies to effect final remediation. Specifically, OU-4 consists of the K-65 silos (silos 1 and 2), the metal oxide silos (3 and 4), piping and tanks below the silos, and the earthen embankment that provides structural support to silos 1 and 2. Wastes in silos 1 and 2 include about 11,200 kilograms of uranium and 1.6 to 3.7 kilograms of radium. Silo 3 may contain about 18,000 kilograms of uranium and an unknown mass of thorium and radium. Available evidence suggests that silo 4 was never used for waste storage (U.S. Department of Energy, 1990c).

Environmental media that represent potential pathways or environmental receptors affecting FEMP are included in OU-5. These consist of surface water and sediments in the Great Miami River, Paddys Run, and the storm-water outfall ditch; ground water not included in other OUs; soils outside other OUs; flora and fauna; and ambient air.

2.2.3 Remedial Investigation and Feasibility Studies

RI/FSs are conducted in order to collect the data necessary for EPA and DOE to choose remedial actions sufficiently protective to mitigate excessive risks to human health and the environment from FEMP (U.S. Department of Energy, 1990d). RI/FSs for each of the OUs are currently underway. These activities include determining the nature, extent, and threat of past releases and conducting baseline risk assessments, evaluation of remedial alternatives, and detailed evaluation of preferred alternatives.

2.2.4 Contaminants of Concern

The primary potential contaminants of concern associated with each OU are as follows.

- OU-1 - radionuclides, trace metals, and volatile organic compounds

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- OU-2 - radionuclides and trace metals
- OU-3 - radionuclides, trace metals, volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, acids, and fuel and lubricating oils
- OU-4 - radionuclides and trace metals
- OU-5 - radionuclides, volatile organic compounds

Approximately 5.3 million kilograms of uranium; 80,000 kilograms of thorium; and an unknown quantity of asbestos, barium, fluoride, magnesium, and various other organic (tetrachloroethane, 2-butanone, acetone, methylene chloride, PCBs) and inorganic (arsenic, cobalt, copper, silver, vanadium) constituents are present in OU-1. Based on the transport characteristics, volume, and toxicity, uranium is the primary contaminant of concern (U.S. Department of Energy, 1991a).

Primary contaminants of concern for OU-2 include uranium and cadmium from the sanitary landfill and fly ash piles; uranium and thorium at the lime sludge ponds; and uranium, thorium, and cadmium in the Southfield. Various other organic and inorganic materials have been detected in source materials from these areas, but current data indicate that these constituents have not migrated from the source area.

OU-3 contaminants of concern include uranium, thorium, radium, technetium, magnesium, manganese, molybdenum, selenium, vanadium, and various volatile organic compounds, all of which have been identified in perched ground water. In addition, numerous other trace metals; asbestos; PCBs and other organic materials; and inorganic ions such as nitrate, sulfate, and fluoride have a high potential for being present based on FMPC history. However, uranium is by far the predominant contaminant within OU-3 (U.S. Department of Energy, 1990b).

Within OU-4, uranium and radon are the primary contaminants of concern. Radium and thorium also have a high possibility of occurrence in environmental media (U.S. Department of Energy, 1990c).

Because OU-5 is not a source area, contaminants of concern therein must be extrapolated from other sources. Contamination of ground water with uranium has been identified in the waste pit, production area, the southern boundary of FEMP, and along Paddys Run Road. Volatile-organic-compound contamination has been confirmed below the waste pits and along Paddys Run Road. However, the volatile-organic-compound contamination along Paddys Run Road is suspected to be from a source other than FMPC (U.S. Department of Energy, 1990d).

Additional contaminants of concern may be identified during the ongoing RI/FSs. Those identified contaminants will be addressed during site investigation or remediation individually or through the use of indicator chemicals (U.S. Environmental Protection Agency, 1989).

2.2.5 Other Regulatory Issues

In addition to compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), FEMP shall also comply with other regulatory requirements including DOE Orders, RCRA, Clean Air Act (CAA), CWA, National Pollutant Discharge Elimination System (NPDES), the Safe Drinking Water Act (SDWA), National Environmental Policy Act (NEPA), Toxic Substances Control Act (TSCA), and Underground Storage Tank (UST) requirements of the Ohio State Fire Marshall. It is the intent of FEMP to meet or exceed the substantive requirements of each of these regulations.

DOE entered into a consent decree with the State of Ohio on 2 December 1988 that outlined specific actions to characterize and manage hazardous waste and to protect waters of the State in accordance with RCRA and CWA, respectively. This decree arose in response to allegations by the State that DOE and National Lead of Ohio violated various provisions of both state and federal laws and regulations. Amendments to the consent decree were proposed in December 1990 specifying additional actions to comply with RCRA.

The 28 June 1991 Revision 2 of the RCRA Part A Permit Application identified 47 Hazardous Waste Management Units (HWMU) at FEMP. FEMP will continue to operate seven of the HWMU under the RCRA Part B application submitted in October 1991. One of the HWMUs, the barium chloride salt treatment facility, has been closed. The remaining 38 HWMUs will be closed in accordance with closure plans currently under review or the schedules provided by FEMP to the Ohio Environmental Protection Agency (OEPA) 27 August 1991.

Individual HWMU closure plans will specify sampling and analysis necessary to evaluate potential contamination of the surrounding environment resulting from hazardous waste management activities. Seven of the HWMUs to be closed are land-based units (surface impoundments, landfills, and land treatment units) that are subject to RCRA ground-water monitoring requirements. The other HWMUs, which are not defined as land-based, will not be subject to ground-water monitoring requirements unless it is determined that contaminants have been released that could result in ground-water contamination.

Wastes generated at FEMP are subject to waste determination and characterization. These evaluations are based on a combination of process knowledge and sampling and analysis. RCRA hazardous waste characterizations and determinations will follow the current FEMP Waste Analysis Plan as required by Ohio Administrative Code (OAC) 3745-54-13.

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Stack monitoring is conducted under CAA. Because no production is currently occurring at FEMP, laboratory hoods and the boiler plant are the main areas affected by these regulations.

Water discharges from FEMP to the Great Miami River through the main plant effluent line, including collected storm water runoff, fall under CWA. Discharges shall be maintained within limits specified in the site NPDES permit. Contributing outfalls shall meet their own requirements to ensure that the final composite stream remains within limits.

Because of the population size served by the plant potable water system, monitoring for coliform bacteria and various other constituents defined by SDWA shall be performed on a routine basis.

As part of the environmental restoration of FEMP, USTs are being removed and remediation performed as necessary. These activities are required by the Ohio State Fire Marshall and include reports of findings and conclusions.

2.3 INTENDED USE OF ACQUIRED DATA

The intended use of acquired data is to assess the nature of the site and the degree and extent of potential problems resulting from past activities, evaluate the potential hazard to human health and the environment, evaluate remedial actions, choose and implement preferred remedial actions, and monitor plume migration and the effectiveness of remedial actions. Data partially fulfilling these requirements have been collected in previous and ongoing studies. Use of these data and identification and collection of additional data needs will fulfill the intent of the Consent Agreement and the stated site remediation objectives of DOE.

2.4 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) are qualitative and quantitative statements that specify the quality of the data required to support decision making. Because they are based on the end uses of the data to be collected, different uses may require different levels of data quality. There are five analytical levels that define the various data uses and the Quality Assurance/Quality Control (QA/QC) methods required to achieve the desired level of quality. These levels are analogous to the 1987 EPA-defined DQO levels 1 through 5 (U.S. Environmental Protection Agency, 1987). However, because radionuclides comprise a large proportion of the analyses supporting FEMP programs and projects and because these radionuclide analyses have been used and verified by DOE and DOE contractors for many years, it is appropriate to address these measurements as standard. Therefore, in order to maintain consistency in definition of DQO levels and to avoid confusion between EPA and DOE/EPA programs, DQO levels at FEMP will be referred to as Analytical Support Levels

(ASL) A through E. QA/QC requirements for ASLs are provided in Table A-1. End data users prescribe ASLs for data to develop DQOs (Appendix C). Analytical methods for use at each ASL are defined in Appendix L, and data validation requirements are in Appendix D. Following are detailed definitions of the A through E levels of quality.

- ASL A (Qualitative Field Analysis) - Provides the most rapid (real time) results. ASL A is often used for health and safety monitoring at the site, preliminary comparison to Applicable or Relevant and Appropriate Requirements (ARAR), initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on site through the use of Photo- or Flame- Ionization Detectors (PID or FID), pH, conductivity, alpha and beta-gamma friskers, or radiological wipe samples. Analogous to EPA DQO level 1.

  Example: Field screening for alpha, beta, and gamma radiation conducted with portable field equipment provides real time qualitative analysis of the presence or absence of radioactive isotopes.

  Example: Field screening for chemical gases in the well bore of ground-water monotoring wells requires the use of PIDs. This detector provides real time qualitative analyses of the presence of organic compounds (e.g., benzene, toluene).

- ASL B (Semi-Quantitative/Quantitive and Qualitative Analyses) - Provides more quality control checks than ASL A and results may be qualitative, semi-quantitative, or quantitative. Can be used to provide rapid turn around results. Analyses will be performed according to the FEMP-specified analytical protocols, and each project-specific plan will contain defined QA/QC, data reporting, and validation requirements. Methods may range from more sophisticated screening techniques to fully defined methods similar to ASL C or D with reduced QA/QC sample frequency and data reporting requirements to provide more rapid turn around times for radiological and nonradiological parameters. ASL B methods also include standard methods such as EPA 500 series drinking water that have well defined QA/QC requirements that may be different than requirements for ASLs C and D. The QA/QC requirements for an ASL B method are dependent on intended data use and are described in the project-specific plan.

  Example: Measurement of gross alpha and beta radioactivity in water in compliance with the Safe Drinking Water Act provides data on water quality.

  Example: The determination of volatile halogenated organic compounds (e.g., chloroform) in water by purge and trap gas chromatography without second-column confirmation, with a limited suite of field and laboratory QA/QC samples and a minimal data package.

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- ASL C (Quantitative With Fully Defined QA/QC) - Provides data generated with full QA/QC checks of the types and frequencies specified for ASL D according to FEMP-specified analytical protocols for radiological and nonradiological parameters. The analytical methods are identical to ASL D for QA/QC sample analysis and method performance criteria; however, the data package does not contain raw instrument output but does include summaries of QA/QC sample results. ASL C may be used when analyses require a rigid, well defined protocol, but where other information is available, so that a complete raw data package validation effort is not required.

  Example: Analysis of total uranium by the fluorimetric method with a full set of QA/QC samples per batch with analytical results reported from the laboratory provides quantitative data.

  Example: Determination of volatile organic compounds in soil or water by purge-and-trap gas chromatograph/mass spectrometry with a full complement of field and laboratory QA/QC samples as specified for level D. A summary data package will be provided including QA/QC sample performance without raw instrument data. A limited level of data validation will be required because only summary forms need review.

- ASL D (Confirmational With Complete QA/QC and Reporting) - Provides data generated with a full complement of QA/QC checks of specified types and frequencies according to FEMP-specified analytical protocols for radiological and non-radiological parameters. The data package will include raw instrument output for validation of ASL D data and may be used to confirm data gathered at ASLs B and C and when full validation of raw data is required. Possible uses include risk assessment and evaluation of remedial alternatives.

  Example: The determination of volatile organic compounds in soil or water by purge-and-trap gas chromatography, mass spectrometry with a full complement of field and laboratory QA/QC samples. A complete raw data package will be provided and validated for the analyses.

  Example: The analysis of total uranium by the fluorimetric method, with a full set of QA/QC samples per bach with analytical results and the full raw data package reported from the laboratory provides fully validatable quantitative data.

- ASL E (Non-Standard) - Analyses by non-standard protocols that often require method development or adaptation (e.g. when exacting detection limits or analyses of an unusual chemical compound are required). ASL E is usually similar to ASL D data; however, analyses performed outside the accepted requirements, whether

because of interferences or procedures (e.g., modified geotechnical analyses), are considered ASL E. Analogous to EPA DQO level 5.

Example: Analysis of total uranium by the fluorimetric method modified to account for unusual matrix interference, with a full set of QA/QC samples per batch with analytical results and the full raw data package reported form the laboratory provides fully validatable quantitative data by a non-standard method.

Example: Determination of organic compounds (e.g. benz(a)anthracene) in drinking water by special method on-column injection, gas chromatograph/ mass spectrometer with a full suite of field and laboratory quality control samples. Summary data forms will be delivered pursuant to FEMP method guidelines. The methods for each analyte will be FEMP methods with prescribed level and frequency of field and laboratory quality control samples.

The useability of data is determined by DQO requirements. ASL A data are considered as "good" as level D data if in compliance with DQOs. In many cases, higher level data may be used in lieu of lower level data.

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Section 3

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Section 3

PROJECT ORGANIZATION AND RESPONSIBIITIES

Lead agency responsibilities under the National Contingency Plan (NCP) for Oil and Hazardous Substances Pollution at the FEMP lie with DOE Fernald Office (FO). Under a 1990 consent agreement entered into by DOE with EPA, DOE agreed to identify, characterize, and remediate environmental contamination at and originating from FEMP.

Total Quality Management (TQM) principles are incorporated in environmental activities at the site to ensure that the right action is performed right the first time. One aspect of TQM is to evaluate the likely impact of an action before it is instituted. TQM encourages cooperation between personnel and agencies in a controlled solution of environmental problems and delegates responsibility for the quality of a task to the individuals performing the task.

TQM at FEMP is performed by teams with regulatory oversight by DOE, the DOE prime contractor, and subcontractor personnel and resources. Six main factors, other than technical requirements, shall be addressed in sampling and analysis program/project scoping. A list of the factors in order of importance follows.

- **FEMP personnel protection** - FEMP is committed to a "Total Safety Attitude." Methods for performing work will minimize the probability of an accident and keep hazard exposure to an acceptable level. Exposure to potentially harmful conditions or materials shall be kept As Low As Reasonably Achievable (ALARA).

- **Protection of the general public and the environment** - The Total Safety Attitude is extended to the protection of the general public. All activities at the site shall be performed with due consideration to protection of human health and the environment.

- **Meeting Data Quality Objectives (DQO)** - The objectives of data collection activities shall be defined prior to initiation of those activities. Data be collected in a manner consistent with DQOs and documentation will allow an evaluation by DOE, EPA, or a third party to confirm that DQOs are met.

- **Waste minimization** - Activities shall be scoped to prevent unnecessary generation of waste materials, including due consideration of sample location selection, sample collection methods, parameters to be analyzed, use of screening analyses where applicable, and prudent use of materials. Generated wastes shall be handled in an environmentally sound manner.

- **Timeliness** - Every attempt shall be made to meet schedule commitments and perform activities in a manner that produces useable data within a reasonable time frame.

- **Cost effectiveness** - Activities shall be performed in a manner that produces the most useable information per expended capital.

3.1 ORGANIZATION

Activities aimed at remediation of the environment at FEMP are conducted by DOE and regulated by EPA and the Ohio Environmental Protection Agency (OEPA). Responsibilities of each group are defined in the consent agreement, the Federal Facility Compliance Agreement (FFCA), the consent decree with OEPA, or in various other agreements between DOE and regulatory agencies and are shown in Figure A-3.

3.2 AUTHORITY AND RESPONSIBILITY

3.2.1 U.S. Environmental Protection Agency

The EPA Remedial Project Manager (RPM) is responsible for day-to-day oversight, review of documents, and interactions with FEMP personnel. The RPM is also responsible for distributing deliverables to appropriate reviewers within EPA and transmitting and resolving comments with DOE. Additional responsibilities are outlined in the consent agreement. The EPA administrator is ultimately responsible for resolution of disputes as specified in the consent agreement.

3.2.2 Ohio Environmental Protection Agency

OEPA has review and comment responsibility for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents as stated in the consent agreement. In addition, OEPA has jurisdiction over Resource Conservation and Recovery Act (RCRA) activities at FEMP.

3.2.3 U.S. Department of Energy

DOE FO is responsible for day-to-day site management, programmatic decisions, interpretation of DOE orders, interaction with regulatory agencies, meeting milestones, and transmitting deliverables. The hierarchy within DOE FO includes a site manager and deputy, a manager of environmental affairs, RPM for the Remedial Investigation/Feasibility Study (RI/FS), and managers for each operable unit.

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The DOE FO site manager reports directly to DOE headquarters in Washington, D.C. Procedures for site operations are outlined at headquarters level through DOE orders and guidance and are interpreted and implemented at the FO level.

3.2.4 Contractors

FEMP is a Government-Owned/Contractor-Operated facility, thus contractors to DOE are an essential ingredient of a successful site operation. The Prime Operating Contractor is responsible for day-to-day operation of the site, including operation of all facilities, services, and utilities.

The Remedial Investigation/Feasibility Study (RI/FS) contractor to DOE is responsible for day-to-day execution of the FEMP RI/FS program. The RI/FS contractor performs data-collection and interpretation activities pertaining to RI/FS, evaluation of remedial alternatives, and is responsible for initial preparation of RI, FS, and various other reports specified in the 1990 consent agreement.

The Remedial Design (RD) contractor to DOE is responsible for designing the preferred remedial alternatives chosen in the Records of Decision for the various operable units.

A Contract Technical Monitor (CTM) has been assigned by DOE to the FEMP prime operating contractor. CTM duties shall consist of reviewing contracts and specifications between the FEMP prime contractor and other contractors to ensure compliance with the Quality Assurance Project Plan (QAPjP) and other site regulations.

Each DOE contractor at FEMP has an internal management structure defined in contractor-specific documents. Also, there may be several levels of subcontractors to the contractors to provide services in any area. However, completion and quality of subcontracted work is the direct contractual responsibility of the respective contractor.

3.2.5 Subcontractor Requirements

Contractors and subcontractors are required to adhere to applicable site procedures, policies, and the site QAPjP. This requirement shall be included in all contracts between contractor and subcontractor. Provisions shall be made to update subcontracts that predate this requirement to be consistent with new subcontracts. Failure of a subcontractor to comply with requirements of the QAPjP or other contractual requirements may be viewed as a breach of contract and grounds for contract termination.

Subcontractor analytical laboratories performing sample analyses covered by this QAPjP shall perform the work in accordance with the requirements specified herein. Exceptions shall be approved by DOE. Compliance shall be determined during surveillances and audits described in Section 12.

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3.2.5.1 Procurement of Subcontractors. Each contractor shall use a documented system for procuring subcontractors. When required by the consent agreement (e.g., adding a subcontractor laboratory to the approved list), EPA shall be notified prior to employing new subcontractors for CERCLA-driven activities.

3.2.5.2 Analytical Laboratory Subcontractors. Procurement of laboratory subcontractors for analyzing environmental samples shall be strictly controlled. Only laboratories that have a demonstrated capability to provide the level of data quality required for a program or project shall be employed. Analytical laboratory performance requirements are listed in Appendix E. The current laboratory list is included in Appendix H. Minimum elements of analytical services procurement shall include the following.

- Demonstrated ability to perform the analyses required at a specified capacity
- Ability to handle the types of material to be analyzed including all applicable licenses and permits
- Implementation of required quality elements verified through an on-site pre-award audit conducted by FEMP
- Successful analysis of Performance Evaluation (PE) samples
- Verification of continuing satisfactory performance through audits by FEMP and PE sample analysis
- FEMP notification to EPA of intent to use a laboratory
- Upon EPA request, provision of audit and PE data
- Opportunity for EPA to perform their own audit of the laboratory

PE samples may be provided by FEMP or may be part of an ongoing program such as the EPA Contract Laboratory Program (CLP). FEMP-supplied PE samples shall be traceable to standards purchased from EPA and the National Institute of Standards and Technology (NIST) or equivalent.

Work conducted by a laboratory between time of FEMP notification to EPA and EPA approval shall be conducted "at risk" based on the outcome of the EPA evaluation. Therefore, only laboratories with a demonstrated capability to perform the analyses requested at a consistently high level shall be retained. DOE will prepare a list of approved laboratories that documents the following information for each laboratory.

- The laboratory project manager designated for FEMP work

- Types of analyses the laboratory is approved to perform
- Types of samples the laboratory is qualified to handle
- Capacity or available equipment of the laboratory

Changes to the list, such as additions or deletions of laboratories, shall be based on designated FEMP Quality Assurance (QA) audits and analysis of PE samples. If a subcontractor owns more than one laboratory, only those on the approved list may perform FEMP work.

3.3 QUALITY ASSURANCE MANAGEMENT

DOE FO has overall responsibility for QA activities at FEMP, and may delegate all or part of this responsibility to contractor QA staff [Designated FEMP QA Project Organization DFQAPjP)].

The DFQAPjO is independent of direct job involvement and day-to-day operations and has direct access to DOE FO management to resolve any QA dispute. The organization is responsible for conducting audits and surveillances to verify that the QA program is implemented in compliance with site-wide and project-specific requirements, DOE orders and guidance, and EPA regulations. The organization is also responsible for verifying corrective actions.

The DFQAPjO organization is also responsible for auditing compliance with training procedures and for review and signature approval of plans, procedures, drafts, and final documents.

The manager of each program/project is also responsible for QA within the scope of the program/project. An individual may be designated the QA officer for a program/project and be responsible for training, conducting audits and surveillances, data validation, and verifying adherence to requirements.

Review and approval of this site-wide QAPjP is the responsibility of EPA Region V. Requests to modify the QAPjP or other EPA-approved documents shall be transmitted by DOE to the EPA RPM, who is responsible for distributing change requests to appropriate personnel for review.

Section 4

SECTION 4

QUALITY ASSURANCE OBJECTIVES

The overall Quality Assurance (QA) objective is to provide results that are technically and legally defensible in a court of law. The purpose of this section is to present specific objectives for the level of the quality control effort; the accuracy, precision, and sensitivity of analytical data; and the completeness, representativeness, and comparability of data. Data Quality Objectives (DQO) are defined for samples collected in accordance with guidelines in Appendix C to specified Analytical Support Levels (ASLs).

Details for attaining QA objectives for environmental sampling and analysis programs at FEMP are described herein. These include field quality assurance samples; analytical quality control samples; training requirements; records administration; document control; and requirements for completeness, representativeness, comparability, precision, accuracy, and sensitivity.

Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, surveillances/audits, preventive maintenance of field equipment, and corrective actions are described in other sections.

Responsibility for overall direction and implementation of the QA program rests with the Designated FEMP QA Project Organization (DFQAPjO) (Section 3) as does maintenance of the QA program and verification of program implementation through audits and surveillances.

4.1 LEVEL OF QUALITY CONTROL

Data generated shall be of known quality and in compliance with DQOs. Data shall be traceable, technically and legally defensible, and have definable characteristics.

Traceability is a legal requirement that provides a documented trail beginning with requirements for data and ending with effective use of the data. Traceable elements include defined data quality objectives, documentation of collection and measurement techniques used, sample and data custody, and original and final data used to support decisions.

Legal defensibility requires that data generated be scientifically defendable (i.e., accurate, precise, and representative). In addition, complete files of generated data and supporting documentation sufficient to support litigation are required.

Fundamental mechanisms employed to achieve established quality goals can be categorized as prevention, quality assessment, and correction and include the following.

- Prevention of errors by planning, documented training to instructions and procedures, and careful selection and training of skilled, qualified personnel
- Quality assessment through a program of audits and surveillances to supplement continual informal review
- Correction of process to prevent recurring conditions adverse to quality

This QAPjP has been prepared to ensure attainment of these goals. It describes the QA program to be implemented and the Quality Control (QC) procedures to be followed by DOE and its contractors during the course of remediation of FEMP. The QAPjP also describes the project organization structure and specifies the procedures, documentation requirements, sample custody requirements, acceptance criteria, and audit and corrective action provisions to ensure that operations and activities meet the intent of regulatory requirements.

4.1.1 Type and Frequency of Field Quality Assurance Samples

Field QA samples include the following.

- Trip blanks
- Field blanks
- Equipment rinsate samples
- Preservative blanks
- Container blanks
- Duplicate samples
- Split samples
- Spiked samples
- Materials blanks (e.g., cleaning solutions)

Collection of field QA samples is based on Data Quality Objectives (DQO), and requirements and justification for collection of field QA samples shall be documented in project-specific plans. Tables A-1 and A-2 summarize requirements for field QA samples including

frequencies. The rationale for selection of specific field QA samples and minimum requirements for use follow.

- Trip blank analyses are used to determine whether conditions encountered during sample container shipment and handling have affected sample quality. Trip blanks are prepared by the sample coordinator or container supplier and transported to the field with other sample containers. A trip blank is prepared by pouring organic-free or de-ionized water into a forty-milliliter (mL), or larger, Volatile Organic Analysis (VOA) bottle and sealing it with a teflon-lined septum lid. Trip blanks are required whenever ASL C or D samples are collected for VOAs and may be specified for analyses to ASLs B and E. Definitions of ASLs are provided in Section 2. In addition to VOA samples, trip blanks may be specified for other parameters if technically justified.

NOTE

A sampling "round" constitutes collection of samples from one or more locations for a specific project during a specified time period for a similar purpose.

- Field blank analyses are used to determine whether the sample collection process or conditions at the collection site have affected sample quality. Field blanks are prepared by the sampling team at the sample location by pouring organic-free or de-ionized water into appropriate containers for each constituent analyte. Field blanks are specified for ASLs C, D, and E, and some B analyses.

- Equipment rinsate sample analyses are used to determine effectiveness of decontamination procedures. Rinsate samples are prepared by the sampling team at the decontamination site. A final rinse from the decontamination process is collected in appropriate containers, one for each constituent analyte. In addition to the sampling frequencies specified in Table A-1, when visibly contaminated equipment is cleaned, a sample is collected. Rinsate samples are specified when cross-contamination caused by improperly cleaned equipment is a concern and may be appropriate for ASLs A through E analyses. Rinsate samples are specified for ASLs C and D.

- Preservative blank analyses are used to determine the quality of sample preservatives. Preservative blanks are prepared by a sample coordinator or field sampling team in a controlled environment by pouring organic-free or de-ionized water into an appropriate sample container along with the preservative specified in Section 6. Preservative blanks may be specified for ASLs B, C, D, and E analyses.

- Container blank analyses are used to determine quality and integrity of containers used in matrix sampling. Container blanks are prepared by sampling coordinator or field sampling personnel in a controlled environment. Unpreserved sample containers are submitted to the laboratory, where an extract from the container is prepared and analyzed for parameters of interest. Container suppliers provide QA information on batches of pre-cleaned containers if requested. In some cases, additional container blanks may be necessary. Container blanks may be necessary when unsealed containers are used, container custody seals and associated documentation is not available, or locally cleaned containers are used. Use of container blanks is appropriate for ASLs B, C, D, and E analyses. Container blank usage is described in detail in the sample handling paragraphs of Section 6.

- Duplicate sample analyses are used to determine precision of analytical laboratory performance and sample collection techniques. Duplicate samples are prepared by field sampling teams at sampling location by evenly distributing sample media between two or more sets of containers. Each duplicate sample is assigned a unique identification number and sent to the same laboratory as the analyses samples. If duplicate samples are required for a non-fluid matrix, the compositing method or rationale for assuming homogeneity of the matrix shall be presented in project-specific plans. Duplicate samples are appropriate for ASLs A through E and required for ASLs C and D.

- Split sample analyses are used to determine accuracy of analytical laboratory and field sample handling practices. Split samples are prepared by field sampling teams at sampling location by evenly distributing sample media between two or more sets of sample containers. The split samples is assigned the same number as the actual sample and sent to a separate laboratory for analyses. When a non-fluid matrix split sample is collected, the compositing procedure or justification for assuming homogeneity of the matrix shall be presented in the work plan. Split samples are most commonly used for ASLs C, D, and E.

- Performance evaluation samples are used to determine precision and accuracy of analytical laboratory performance. Theses are prepared in a laboratory environment and transported to the sampling site for numbering and shipment to the laboratory with the remaining field samples. If required, performance evaluation samples are included one every sixty days or at least once per project, more frequently if appropriate, or when accuracy of a particular laboratory is in question. Intended use of performance evaluation sample analytical data shall be stated in the project-specific plan, and quantitative requirements for accuracy by chosen analytical method shall be justified. Performance evaluation samples may be specified for ASLs B through E.

- Materials blanks are samples of material used in construction, decontamination, or other activity (e.g., drilling fluids, annular sealants, cleaning solutions) that are

retained for quality control purposes in case unexpected contaminants are detected in related media. A material blank shall be collected in a controlled environment from each solution or mixture of materials (e.g., cleaning solutions and drilling fluids) that have the potential to introduce contamination not otherwise present in the media being sampled. These samples will be clearly marked as retained samples and placed in an archive for future analysis if an anomalous contamination is identified upon review of sample analysis. Material blanks may be analyzed at any ASL.

4.1.2 Type and Frequency of Analytical Quality Control Samples

Following are descriptions of various types of QC samples that shall be analyzed for all applicable analytical methods. The types of QC samples required for a specific method are specified in Section 9 or Appendix L and are based on ASLs. Internal QC checks are specified in Section 10. Analytical QC samples appropriate for ASL B analyses shall be described in project-specific plans.

Frequency of QC sample collection may be increased but shall not be less stringent than specified in Table A-1 unless so specified in a project-specific plan. An analytical batch is defined as 20 samples.

- Laboratory Control Samples (LCS), such as reference standards, may be certified reference material or a control matrix spike with analytes representative of target analytes. LCS results shall be compared to established control limits for accuracy and bias to determine useability of data. LCSs are not performed for organic analytes.

- A method blank (e.g., reagent blanks, preparation blank) is a volume of the analyzed matrix to which reagents used in sample processing are added in the same volumes or proportions required by the method. Method blanks are submitted to the full analytical procedure and used to assess background contamination levels in the laboratory. Guidelines shall be established for acceptance or rejection of analytical data based on the level of contamination in the blank.

- A matrix spike is an aliquot of a sample spiked with a known amount of target analytes. Matrix spikes shall be analyzed when commercially available, certifiable standards exist appropriate to the method used if quantity of sample permits. (Examples of methods not requiring matrix spikes include pH and flash point.) For determination of trace metals by atomic absorption and inductively coupled plasma methods, post-digestion (analytical spikes) shall be analyzed for every sample injection to assess matrix interference.

- Matrix duplicate/replicate or matrix spike duplicates are used to assess the matrix effect on method precision. A matrix duplicate/replicate is an intralaboratory split and spiked sample used in organic analyses.

- Surrogate spikes are used to assess matrix interferences in individual organic samples. A surrogate is an organic compound not normally found in the environment that is similar to target analytes in chemical composition and behavior relative to the method. A surrogate is added to each analytical and QC sample (organics only) prior to analysis. Surrogate spikes can also be used for radionuclide samples.

- Blind and double blind QC samples are used for long term assessment of accuracy and precision of the analysis or operator. Blind samples are submitted so the analyst knows it is a QC sample. Double blind samples are submitted so the analyst is not aware it is a QC sample. Types of blind and double blind QC samples include LCSs, spikes, and duplicates/replicates. Some types of these QC samples are included in requirements for certain methods at frequencies specified in Table A-1 or the project-specific plan. If additional types or frequencies of these QC samples are required they will be specified in the project-specific plan.

- Intercomparison study samples are supplied by an external source to a series of laboratories. Results are evaluated against the expected value and against results from other participating laboratories. If available, a FEMP laboratory shall participate in at least one study for analytes it is contractually permitted to analyze.

4.2 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analyses is to meet QC acceptance criteria of analytical protocols. The accuracy and precision objective for each major measurement parameter for FEMP are pertinent to laboratory methods. Specific information on accuracy, precision, and sensitivity is presented in Section 14 and Appendix L.

Standard Operating Procedures (SOP) shall be written for laboratory analyses and shall include required accuracy, precision, and sensitivity of the analyses. SOPs for field equipment to measure pH, conductivity, redox potential (Eh), temperature, dissolved oxygen, and alkalinity are outlined in Section 6. Accuracy and precision requirements for field screening analyses are also provided in Section 6.

4.2.1 Analytical Precision

To determine precision of an analytical method, instrument, or laboratory analysis, a routine program of duplicate or replicate analysis shall be established. Results of these analyses are used to calculate Relative Percent Difference (RPD). The RPD for duplicate, matrix spike duplicates, or replicates is defined as 100 times the absolute difference of each data set, divided as the average of the data set (Section 14). The data set RPD may be used to generate precision control charts for organic and inorganic laboratories.

Statistical range analysis is used to calculate the expected mean range and control limits for a replicate or duplicate result and assess whether the result is "in control." A range analysis result that lies within three standard deviations of the mean is considered in control. Range analysis results greater than three standard deviations from the mean are considered to be out of control. Range analysis may be used to determine the precision or reproducibility of radiological data.

4.2.2 Laboratory Accuracy

To determine accuracy of a chemical method or a chemical laboratory analyst, analytical results of method blanks, matrix spike/matrix spike duplicate, field blanks, and container blanks shall be assessed along with a periodic program of sample spiking. The results of sample spiking are used to calculate percent recovery, which is the quality control indicator for accuracy. Percent recovery is defined as 100 times the observed spike sample result or concentration minus observed sample result or concentration divided by amount of spike added to the sample. Percent recovery of matrix spikes is used to generate accuracy control charts. Percent recovery is calculated from the equation in Section 14.

Laboratory accuracy is determined by calculating the expected precision for a known value (either a reference standard sample or a matrix sample) and assessing the divergence of the recovered sample result from the known value in terms of statistical control. Statistical control bounds are defined as the mean (known) value $\pm$ 3 standard deviations (σ). Results outside $\pm 3\sigma$ are considered out-of-control.

4.2.3 Sensitivity of Analysis

The QA objective with respect to sensitivity is the achievement of specified method detection limits and quantitation limits. These limits depend on instrument sensitivity and matrix effects associated with the analysis. Therefore, it is important to monitor and take into account sensitivity to ensure data quality.

Analytical methods are described in Appendix L, including descriptions of the sensitivity of the analyses. Instrument sensitivity is monitored by the analysis of method blanks, calibration check samples, and laboratory control samples.

4.3 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

- <u>Completeness</u> - Completeness can be defined by the percentage of total useable points from the set of total data points collected, analyzed, and available. A formula for estimating completeness is presented in Section 14. Data points may not be useable if sample holding times were exceeded, quality control criteria were not met, and

sample re-analysis is not possible or if sample bottles were damaged during shipment to the laboratory. Completeness is expected to be a least 90 percent for this project.

Example: Fifty soil samples are collected and analyzed. After data validation, forty four data points are determined to be valid. Completeness is estimated as (44/50) x 100 = 88 percent.

- Representativeness - Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at sampling points, or an environmental condition. Representativeness is a qualitative parameter based on professional judgement that reflects the design of the sampling program, Standard Operating Procedures (SOP), and whether sampling locations are selected properly and a sufficient number of samples are collected.

  For FEMP, representativeness is addressed through selection of appropriate sample locations and design of adequate procedures. The goal is to obtain samples representative of the specific matrix (solids, liquids, and air) such that sampling performance can be evaluated. Representativeness is assessed by analysis of field duplicate samples.

  Example: The objective is to obtain data that is representative of the worst case releases from an outfall. The sampling program includes sampling at times when outfall contaminant concentrations are expected to be highest.

- **Comparability** - Comparability is a qualitative parameter that expresses the degree of confidence that data are equivalent for a specific parameter or group of parameters. The ability to compare data sets is particularly critical when a set of data for a specific parameter is applied to an action level or other criterion.

  Example: If the quantitation limits for site ground water quality data exceed background concentration data, the data sets are not comparable.

4.4 TRAINING, RECORDS ADMINISTRATION, AND DOCUMENT CONTROL

The QAPjP presents a number of elements for achieving the QA objectives described in the subsections 4.1, 4.2, and 4.3. These elements include the following.

- Field activity requirements (Section 5)
- Sampling requirements (Section 6)
- Sample custody (Section 7)

- Calibration procedures and frequency (Section 8)
- Analytical procedures (Section 9)
- Internal quality control checks (Section 10)
- Data reduction, validation, and reporting (Section 11)
- Performance and system audits (Section 12)
- Preventive maintenance (Section 13)
- Specific routine procedures to assess data precision, accuracy, and completeness (Section 14)
- Corrective actions (Section 15)
- Quality assurance reports to management (Section 16)

FEMP has established three additional QA elements that are important to achieving QA objectives: training, records administration, and document control. These additional elements are described in paras. 4.4.1, 4.4.2, and 4.4.3.

4.4.1 Training

FEMP contractors and subcontractors shall ensure that personnel have appropriate education, training, and experience to perform an assigned task. Requirements for types of training, frequency, and curricula are specified in DOE orders, project-specific plans, and by FEMP policy. Personnel qualifications and training needs shall be identified and documented. Training shall be performed in accordance with formally planned, executed, and documented training activities.

4.4.1.1 <u>Requirements</u> The following site and job-specific training is required as specified by FEMP for specific activities.

<u>Site Training</u> - Site-level training requirements involve a broad range of activities and are determined by the nature and location of the work or task. Site-level training shall include the following as appropriate.

- General site orientation
- General occupational safety and health orientation

- Nuclear criticality
- Radiation safety
- Respirator
- Resource Conservation and Recovery Act (RCRA)
- Fire extinguisher use
- Occupational Safety and Health Administration (OSHA) in accordance with 29 CFR 1910.120
- Quality assurance requirements
- Energy control awareness
- Change control awareness

Job-Specific Training - Job-specific training shall be conducted for personnel who are scheduled to perform certain designated tasks. These tasks may include, but are not limited to, the following.

- Nondestructive examination and inspection
- Environmental sampling
- Field and analytical sample analysis
- Data analysis
- Sample packaging and shipping
- Conducting surveillances and audits
- Installing boreholes, wells, and piezometers
- Implementing change proposals
- Conducting field tests
- Change control

4.4.1.2 **Implementation.** The FEMP prime contractor is responsible for verifying that required site training at FEMP is administered (Section 3), including ensuring that subcontractor personnel are trained. Instructors shall be technically qualified by experience or training to present the topic of instruction. As appropriate, the trainee shall be required to pass a written and/or hands-on examination regarding the training subject. Training shall be completed before an individual may perform sampling or support activities. Job-specific training is the responsibility of the organization conducting the work (including contractors and subcontractors). The organization shall verify the individual's education and experience to ensure that the assigned task is within his/her realm of capability and provide documentation of experience for project files.

Before an untrained individual is allowed to perform an unfamiliar task, the following requirements shall be completed as a minimum.

- Read the standard operating procedure for the task or duty and understand it sufficiently to pass a written test if required.
- Observe the task being done by a trained and qualified worker.
- Perform the task under supervision of a trained and qualified individual until completion of formal training.

4.4.1.3 **Documentation.** Training shall be conducted in accordance with approved lesson plans and shall include testing and on-the-job training as appropriate. Personnel training documentation shall include the following as a minimum.

- Name of trainee
- Name of trainer
- Training subject
- Training dates
- Training results (pass or fail)
- Required frequency of training
- Educational and job experience requirements
- On-the-job training received

4.4.2 Records Administration

Records may be stored in on-site, laboratory, and off-site office project or program record files. A records management system in accordance with the requirements of this section shall be established at record-keeping locations that cover preparation, control, and retention of project-related records. Record control shall include receipt from sources, transmittals, and transfer to storage. Retention shall include receipt at storage areas, indexing and filing, storage and maintenance, and retrieval.

4.4.2.1 <u>Record Preparation</u>. Hard-copy records shall be legible, accurate, and complete; indexed to permit quick and accurate identification of items or activities to which they apply; and authenticated by preparer's signature and completion date. Electronic records [e.g., magnetic diskettes, magnetic tapes, Compact Disks Read Only Memory (CDROM)] shall be stored in duplicate. Each diskette, tape, or other data medium shall be identified by a unique identifier. A hard-copy index of contents shall be maintained in project files.

When appropriate, corrections may be made to records by authorized personnel (e.g., originating personnel/organization, QA personnel). Corrections shall be made by drawing a single line through the incorrect information on hard copies, making the correct entry, and initialing and dating the revised entry. Electronic files in the archives shall be write-protected. If changes to an electronic file are required, both the original and the back-up copies shall be replaced entirely.

4.4.2.2 <u>Record Control</u>. Program and project records are controlled as follows.

<u>Incoming Records</u> - Project-related correspondence, data, sketches, logs, authorizations, or other information.

1. The FEMP manager or designee marks original with receipt date.

2. The FEMP manager or designee determines who will review the materials and routes copies of the material to that person.

3. As soon as practical, incoming correspondence originals are placed in the project/program files.

4. If the correspondence is required by project personnel for reference, a copy shall be marked as such and is routed accordingly.

5. Quality-related correspondence is routed to the DFQAPjO.

6. Communications relative to FEMP that are initiated by third parties (e.g., media, interested individuals, and groups) is referred directly to designated DOE representatives without comment unless otherwise directed by the DOE site manager.

Outgoing Records - Externally (i.e., external to the specific program or project) transmitted correspondence, reports, drawings, and sketches.

NOTE

As a minimum, correspondence is signed by the originator and, if joint signatures are desirable, appropriate managers. QA correspondence is signed by a representative of the DFQAPjO. Correspondence issued by DOE contains appropriate DOE signatures.

1. Outgoing records are reviewed, approved, and signed prior to transmittal as required.

2. Routing information is attached to office copy of project correspondence.

3. Records transmitted between the site and remote offices or locations are protected from damage and loss during transfer (e.g., by copying prior to shipment and hand carrying).

4. Transmittal letters are numbered and traceable, and copies of attachments are filed with transmittal letters unless otherwise indicated. Each FEMP contractor and subcontractor shall have a system for numbering transmittal letters.

4.4.2.3 Records Retention. Following receipt of information from external sources and issuance of reports, associated records shall be filed as required in the central files including records generated by subcontractors. Files shall also include correspondence, data, and references supporting entries into the administrative record; supporting documentation for CERCLA-driven programs; and supporting documentation for CERCLA-covered programs. Records shall be identified as to source and date of receipt. Documents exempt from the Freedom of Information Act (e.g., personal dosimetry, urinalysis, and medical records) are specifically excluded from these requirements. Each FEMP contractor and subcontractor shall maintain central files as appropriate.

Records Facility - Files shall be located in an area that, at a minimum, provides the following.

- Suitable environment to prevent record deterioration, damage, and loss
- Controlled access

- Steel file cabinets
- Protection against excess moisture and temperature extremes
- A record review area if practical

Records Handling - Files and records contained in the program or project files shall be maintained by designated personnel who are responsible for the following.

- Review of incoming records for completeness as specified in para. 4.4.2.2 prior to filing
- Indexing
- Filing in labeled folders or binders as applicable
- Maintaining sign-out sheet

Records Index - A numbered index for each project file shall be prepared and maintained in the project records storage area. The index shall list individual file numbers and identify records therein.

4.4.2.4 Off-Site Office Project Files. Record storage off-site (e.g., at analytical laboratories) shall be as secure as and similar to the on-site file. Upon completion of the project phase, off-site files shall be transferred to and integrated with on-site files.

Laboratories shall maintain record systems for documents pertinent to testing performance that provide record control and retention similar to that outlined in paras. 4.4.2.2 and 4.4.2.3 for on-site office files.

4.4.2.5 Final Disposition. Upon completion of the project phase, the original or certified copies of data and records shall be transferred to DOE if a written request is received from DOE. With approval from DOE, laboratory data files and records may be microfilmed for archive storage at any time during a project.

If requested to transfer original files to DOE, laboratories may retain copies of project data and records for their files.

4.4.3 Document Control

Documents and drawings shall be prepared, reviewed, approved, revised, and distributed in accordance with the requirements of this section. Documents and drawings that are controlled shall be identified as such and updated. Uncontrolled documents and drawings are

issued once and not updated. Document listings shall be maintained by each FEMP contractor and subcontractor for quality-related documents, project-specific documents and drawings, computer graphics, maps, and other controlled documents.

4.4.3.1 Preparation, Review, and Approval of Documents and Drawings. Prior to implementation or use, documents and drawings shall be reviewed and approved by signature and date. Documents and drawings requiring DOE approval shall be reviewed and approved by designated personnel before submittal to DOE. Copies of documents or drawings released for any purpose before they have gone through the complete review and approval process shall be dated and marked "PRELIMINARY" for drawings and "DRAFT" for documents.

Each FEMP contractor and subcontractor shall have a documented process for preparation, review, and approval of documents and drawings under their cognizance. This process shall include the following.

- Standardized document and drawing format
- Identification of required reviewers
- Review process including documented resolution of reviewer comments
- Procedure for obtaining required approvals and authorization to issue
- Periodic review

FEMP site-wide documents shall be approved by each affected FEMP contractor.

4.4.3.2 Initiating Changes to Documents and Drawings. Changes to approved plans and procedures are likely to be necessary during the course of project performance as a result of new information or events that occur. Review and approval of changes to documents shall be in accordance with requirements of the original document. Organizations approving the original document shall also approve changes. Changes to previously approved documents and drawings shall be approved before the change is implemented. Each FEMP contractor and subcontractor shall have a written procedure for initiating changes to documents and drawings under their responsibility.

Revisions shall be submitted for review/approval with approval sheets as appropriate. Review/approval of other documents, if not documented on reissued approval title sheets, shall be documented in another manner [e.g., associated Document Change Request (DCR) approval signature blocks] to attest to review and approval in accordance with requirements of the original document.

A document change request shall be completed for changes to the FEMP site-wide QAPjP.

Document Change Requests - A DCR (Figure B-1) is the only means of initiating a change or revision to the FEMP site-wide QAPjP. Review and approval of DCRs shall be in accordance with the requirements of the original document before they are implemented. DCRs that involve changes to analytical laboratory activities shall be reviewed by applicable laboratory organizations. At a minimum, the FEMP manager, DFQAPjO, and FEMP laboratory manager (for laboratory changes) shall review the DCR.

Oral approval may be requested from other signers when necessary. If the other signers orally approve and consent for the DCR to be signed for them, the FEMP manager or DFQAPjO manager may sign their own name in the other person's signature space and write "for" before the person's title below the signature space.

DCR Procedure - The DCR (Figure B-1) shall be completed in the following manner.

1. The originator completes the DCR through the CONTENT OF CHANGE section and forwards it to the designated FEMP prime contractor organization for evaluation.

2. The designated FEMP prime contractor organization manager reviews the DCR and resolves any disagreements with originator.

3. Upon concurrence, the designated FEMP prime contractor organization manager assigns a request number and enters it in REQUEST NO. space.

4. The designated FEMP prime contractor organization manager enters pertinent information in the DCR status and tracking log, which will show the DCR number, originator, request date, subject matter, affected document and section numbers, approval date from each signer, date of distribution to each document holder, and issue date of revised document pages.

5. The designated FEMP prime contractor organization manager makes copies of the DCR and forwards them to applicable FEMP contractor organizations with a request for review and comments.

NOTE

If a receiver refuses to sign the DCR, that person communicates to the FEMP prime contractor the reasons for not signing; and the project manager coordinates resolution of the disagreement. If a decision is made not to proceed with the DCR, the designated FEMP prime contractor organization manager notifies the originator and those who signed the DCR. An appropriate entry to this effect is made in the DCR log.

6. The designated FEMP prime contractor organization receives signed DCRs from reviewers and records dates in DCR status and tracking log.

NOTE

The effective date of change and issuance of the DCR is dependent on DOE completing the section of the DCR specifying EPA notification, EPA approval, or immediate implementation.

7. The designated FEMP prime contractor organization manager forwards signed DCR to DOE Fernald Office (FO) for signature and transmittal to EPA for signature.

NOTE

EPA signature is required for EPA-approved documents (consent agreement primary documents). EPA approval is not required for non-EPA-approved documents (consent agreement secondary documents). The EPA is advised of modification to documents that received EPA comments.

8. The designated FEMP prime contractor organization manager coordinates resolution of external FEMP comments and obtains required internal FEMP approvals.

9. The designated FEMP prime contractor organization manager issues DCR to holders of controlled copies of the QAPjP upon completion of FEMP external approval process.

10. The changes described in the DCR are implemented by the applicable organization on the date specified in the EFFECTIVE DATE space.

4.4.3.3 Revision of Documents and Drawings. Documents may be revised by either (1) a complete revision where the entire text is replaced or (2) a limited revision where only affected pages are replaced. The document table of contents shall be revised when affected by either a limited or complete revision. Each FEMP contractor and subcontractor shall have a written procedure for revising documents and drawings under their cognizance.

Revision Level for QAPjP - Complete revisions (when the entire document is re-issued) of the QAPjP shall be indicated by a sequential number (i.e., Revision 1, 2, 3) and a date on the cover and title page as well as each page of the document.

A limited revision (when only a few pages are changed, added, or deleted) shall have the current revision number with a decimal number indicating the change (i.e., Revision 1.1,

1.2, 1.3) and the new date only on the changed or added pages and the table of contents if affected. Revised information shall be indicated by physical notation on the page. Page numbers will be the same as the original page immediately preceding the new page with a decimal number added (i.e., Page 1.1 of 10, 1.2 of 10, 1.3 of 10)

Drawings, Computer Graphics, and Maps - Revisions shall, as a minimum, be denoted by displaying a consecutive revision number, revision date, and review/approval signatures in the appropriate manner. Distribution shall be made to users who require current information to perform their work.

4.4.3.4 Distribution. Controlled documents and drawings shall be distributed to personnel as the need is identified. The FEMP prime contractor is responsible for controlled distribution of the QAPjP. Each FEMP contractor and subcontractor is responsible for controlled distribution of documents under their responsibility. Delegation of distribution activities shall be documented.

Distributed documents shall be identified by a copy control number unique to each recipient. Each organization responsible for controlled distribution shall maintain a distribution list containing name of document, control number, and copy holder name and mailing address. If controlled documents and drawings become obsolete or are no longer needed, instructions for their disposal shall be issued to copy holders. An uncontrolled issue of a document shall be so identified on the copy in a conspicuous manner.

NOTE

It may not be practical to identify drawings, graphics and maps with a copy control number. If not, they shall be identified in some other manner.

Distribution of DCRs - Distribution of document/drawing revisions and addenda shall be made to original-issue copy holders in the same manner. The transmittal of revisions/ addenda shall include instructions for revision inclusion and disposition of superseded material. Each limited revision (para. 4.4.3.3) shall be transmitted by a revision log sheet that lists revised pages for that revision. The log sheet shall be filed in front of the revised document section. A record of document transmitted, recipient, and transmittal date shall be maintained.

Incorporation of Changes - Each controlled document copyholder who receives an approved DCR shall insert it in the QAPjP until revised document pages incorporating the DCR changes are received. Upon receipt of changed pages, they shall be incorporated in the QAPjP and the DCR shall be removed.

Section 5

Section 5

FIELD ACTIVITIES

Policies and guidelines for geophysical surveys; drilling, construction, development, and abandonment of monitoring wells; aquifer testing; field decontamination; and documentation of these activities are provided in this section. Methods are contained in Appendix J. Additional methods may be submitted to provide detailed information on applicable field work. Procedures will be documented in project-specific plans as a supplement to the QAPjP. Each field procedure shall specify reasons or uses for the activity, methods to be used, applicable material specifications, and documentation requirements specific to that activity.

Minimum requirements for field activities in this section and in Appendix J shall be incorporated into project-specific plans by reference to this QAPjP. Surveillances and audits (Section 12) shall be conducted in accordance with the requirements of this QAPjP and with project-specific requirements.

Information obtained from site exploration activities shall be recorded. Required documentation of field investigations and testing include a daily log of project activities including applicable subsurface logs, test data forms, piezometer/well installation forms, field collection forms, photographs taken, and chain-of-custody records. Requirements for documentation of specific sampling activities are in Section 6. Requirements for chain-of custody records are in Section 7.

5.1 DAILY LOGS

Field personnel shall keep a daily log of project activities. It shall be a written record of activities and measurements conducted in the field by a team on a given date and may include daily field activity logs, boring logs, well-construction logs, media-specific sampling logs, photographs, and sketches. The log shall be in a bound book with sequentially number pages or on individual, sequentially numbered loose log forms as specified by the project-specific plan. Daily log entry requirements are specified in Appendix J.

Activity-specific logs (e.g., subsurface boring logs, water sampling logs, sediment sampling logs) shall be generated to document conditions as specified in Section 6 and Appendix K and are considered part of the daily log. Copies of daily log forms shall be sent by field personnel to the FEMP manager or representative and others as required at least weekly.

NOTE

Information in activity-specific logs shall not be duplicative but rather supportive of other required documentation.

Originals of field records shall be maintained in the project central file. During performance of the field program, copies of field records shall be maintained by the FEMP manager or representative. These copies will provide adequate documentation of work activities if originals are destroyed, lost, or stolen.

5.2 FIELD ACTIVITY POLICIES

Policies for the following field activities are discussed in the paragraphs indicated. Procedures are provided in Appendix J.

- Drilling (para. 5.2.1)
- Monitoring Well/Piezometer Design, Installation, and Abandonment (para. 5.2.2)
- Monitoring Well Development (para. 5.2.3)
- Monitoring Well Maintenance (5.2.4)
- Geophysical Surveys (para. 5.2.5)
- Aquifer/Permeability Testing (para. 5.2.6)
- Decontamination (para. 5.2.7)
- Field Radiological Contamination Surveys (para. 5.2.8)

5.2.1 Drilling

The nature, arrangement, thickness, and extent of subsurface strata can be determined by implementing a well-designed drilling program. Number, location, and depth of borings and type of sampling and testing required are dependent on intended use of the data generated.

The type of drilling method selected for a particular project at FEMP depends on intended use of the borehole and samples collected. Descriptions of various drilling methods are presented in Driscoll (1986) and Aller, et.al. (1989). Drilling methods that might be considered for use at FEMP include cable tool, hollow-stem auger, drive casing, spin casing, direct mud rotary, air rotary with casing driver, air rotary with a swing-out under-reaming

bit and casing advancer, and reverse-air or mud rotary. Ability to acquire data of sufficient quality for intended use and personnel health and safety are the primary factors considered when choosing a drilling method. The justification for choosing a particular drilling method shall be clearly presented in project-specific plans.

Historically, boreholes for monitoring well installation at FMPC were drilled using cable-tool or hollow-stem auger methods. Good samples can be collected with both these methods. However, the cable tool method is slow relative to other available methods, and the hollow-stem auger method is not applicable to deep drilling or drilling through consolidated material or large boulders.

Drilling operations shall be conducted so as to minimize introduction of contaminants into the environment or spreading of contaminants between zones. Surface casing shall be set when a potentially contaminated zone is drilled prior to reaching the target zone. When drilling through areas where near-surface contamination is indicated through past use or during screening of samples while drilling, surface casings shall be grouted in place and made a part of the permanent installation. In outlying areas not suspected of being contaminated, large diameter temporary casings shall be advanced as necessary for bore-hole control.

Consistent with FEMP policy of waste minimization, the chosen drilling method shall require the least possible fluids and generate the least possible cuttings and other waste.

The source of water for drilling operations at FEMP will be the plant potable water system. The quality of any other water source used will be documented.

Additives used in drilling fluids shall be approved by the FEMP manager prior to use. Before an additive is approved, a sample shall be analyzed for parameters of interest and the results reviewed for potential impact on the objectives of the data-collection program. Use of additives is discouraged.

Dug sumps for containment of drilling fluid are prohibited except where absolutely necessary and shall have prior approval by necessary regulatory agencies. Above-ground mud pits, drums, or plastic-lined structures are normally used for containment of drilling fluids and cuttings.

Drilling equipment shall be decontaminated before each use as specified in Appendix J to prevent contamination of the borehole and after each use to prevent off-site transport of contaminants.

A qualified geologist, hydrogeologist, or geological engineer is responsible for operations at each drilling site and shall be on hand when the borehole is being advanced. This person is also responsible for logging activities at the site including, but not limited to, drilling and sampling activities, footage drilled, materials used, sample descriptions, well installation

activities, and any unusual occurrences. Subsurface boring logs shall be generated for each boring.

The FEMP manager is ultimately responsible for securing permits required by state, local, or on-site authorities, which includes ensuring that underground and above ground utilities are identified and do not pose a danger to drilling operations. Copies of permits and other appropriate documentation shall be posted on site when drilling operations are conducted.

5.2.2 Monitoring Well/Piezometer Design, Installation, and Abandonment

Monitoring wells and piezometers have been installed at FEMP. Existing monitoring well locations and depths were selected to allow monitoring of chemical and hydraulic properties. They were primarily constructed according to procedures in the EPA-approved RI/FS QAPjP (U.S. Department of Energy, 1988) and included borehole installation by the cable-tool method, four-inch diameter, 316-stainless-steel casing and screen, annular seal of bentonite grout, and locking protective casing. Piezometers at FEMP are also used to monitor chemical and hydraulic properties. However these wells were installed by a method (e.g., hollow-stem auger) or constructed of a material (e.g., PVC) other than that approved in the RI/FS QAPjP. QA/QC controls such as decontamination of well materials and drilling equipment, containment of cuttings, and documentation of contruction were maintained throughout the installation of these piezometers. Therefore analysis of samples collected from piezometers at FEMP are considered capable of yielding quantitative data at ASLs C and D for constituents not affected by well materials.

A four-digit numbering system is used to identify monitoring wells and piezometers at FEMP. The first digit refers to the hydrogeologic zone and the last three digits refer to location. Wells in the 1000-series are screened within the glacial drift. Those in the 2000-series are screened across the water table in the regional aquifer (Great Miami Aquifer) and those in the 3000-series within the regional aquifer immediately above the clay interbed when present and at a comparable depth when this layer is absent. The 4000-series wells are the deepest and are screened at the base of the regional aquifer.

To ensure quality control of monitoring well/piezometer design, installation, and successful completion of field drilling investigations for obtaining hydrogeological and future water quality information, applicable requirement in Appendix J shall be followed.

Installation and use of dedicated ground-water sampling equipment is encouraged when either of the following conditions exist.

- High concentrations of contaminants are present at a well site, making handling and decontamination of sampling equipment a problem
- Well accessibility is a problem

Equipment that may be dedicated to a sampling location are specified in Appendix J.

Improperly abandoned wells may serve as a pathway for pollutants from one zone to migrate to another. Proper well abandonment is a necessary part of maintaining a credible monitoring program. The objectives of proper well abandonment include the following.

- Eliminate physical hazards
- Prevent ground-water contamination
- Conserve aquifer yield and hydrostatic head
- Prevent intermixing of subsurface water (Aller and others 1989)
- Comply with reasonable property owner requests

Factors to be considered in well abandonment and procedures for abandoning a well are provided in Appendix J.

5.2.3 Monitoring Well Development

Monitoring wells must be properly developed to yield accurate aquifer test results and ground-water samples representative of aquifer conditions. A qualified geologist, hydrogeologist, or geological engineer shall be present during well development activities and is responsible for documenting aspects of the process. Procedures for developing monitoring wells are provided in Appendix J.

5.2.4 Monitoring Well Maintenance

A regular inspection program for FEMP monitoring wells shall be developed. Maintenance will be performed on a case-by-case basis pursuant to the results of the inspection program. Requirements for maintenance are provided in Appendix J.

It is important to maintain ground water monitoring wells in order to extend the life of the wells and to provide representative levels and samples of the ground water surrounding the wells. The following aspects of well maintenance shall be addressed.

- Well evaluation
- Redevelopment

- Maintenance check lists
- Well head protection

Well maintenance activities shall be the responsibility of the FEMP prime contractor. Also, the prime contractor shall conduct a maintenance survey of ground water monitoring wells, evaluating well maintenance concerns such as water quality, structural integrity, and well-head protection.

For clarity, the term "well" shall include ground water sampling points such as four-inch diameter monitor wells, above-ground and surface-finished piezometers, and former production wells.

Well maintenance activities shall comply with applicable regulatory and site requirements.

Existing ground water monitoring wells shall be evaluated to assess whether the status will allow for collection of representative ground water samples. The assessment process is detailed in Appendix J.

Maintenance Procedures are provided in Appendix J.

Prior to performing maintenance activity at a designated location, subcontractors shall submit to FEMP for approval a work plan in a standard format specified in the contract statement of work for ground water programs. Details of this plan are specified in Appendix J.

5.2.5 Geophysical Surveys

Understanding of the subsurface hydrogeologic and geochemical conditions at FEMP can be enhanced by geophysical surveys. Specific techniques used are dependent upon DQOs. Minimum QA/QC measures to be employed for borehole logging and surface surveys are discussed in the following paragraphs.

5.2.5.1 <u>Borehole Geophysical Logging</u>. Borehole geophysical methods are used to acquire information about subsurface geological characteristics including formation breaks, thickness of individual beds, porosity, nature of borehole and formation fluids, identification of high-permeability zones, depth of penetration of drilling fluids, and borehole size. Some commonly used geophysical methods include spontaneous potential, resistivity, natural gamma, neutron density, and calipers. Certain methods (e.g. neutron density) require use of a radioactive source, which requires special handling methods.

Basic requirements for performing and documenting subsurface geophysical logging activities are presented in Appendix J. Suites of logs to be generated are dependent on the geologic environment, borehole fluids, information desired, borehole size, and resolution. A number

of excellent references exist on the use of borehole geophysics including Dresser Atlas Division (1975), Schlumberger (1972), and Sengel (1981).

The project-specific plan shall specify the logging subcontractor, suite of logs to be run and boreholes to be logged, tool size, borehole preparation, special source material handling requirements, document formats, resolution desired, logging speed, and frequency of quality control runs. A minimum of one quality control duplicate run shall be made with each tool used on each logging project. The FEMP manager shall be responsible for verifying that necessary permits and operator licenses or certifications are acquired and current.

5.2.5.2 Surface Geophysical Surveys. Surface geophysical methods provide subsurface information without the need for excavation of surface materials. Surface geophysical methods commonly used in environmental investigations include seismic refraction and seismic reflection, gravimetric surveys, electrical resistivity, ground-penetrating radar, ground conductivity, magnetometry, and metal detectors. Information provided includes delineation of contaminant plumes, identification of high permeability zones, location of disposal areas, location of subsurface anomolies, and identification of subsurface utilities.

Surface geophysics may be used for a variety of purposes including screening of an area for possible contamination, locating potential disposal areas, identifying subsurface excavation or boring sites, locating abandoned wells, and characterizing the local geology. Surface geophysical methods are subject to a number of interferences including buildings, metal fences, power lines, subsurface utility lines, and natural variations in mineralogy.

The nature of the designated site and the information desired should be evaluated before choosing a surface geophysical method. The field of surface geophysics is currently in a state of development with new methods and advances on established methods geared towards the environmental industry becoming commonplace.

An expert on surface geophysics should be consulted during the scoping phase of the project if use of this tool is anticipated. A number of excellent references are available on the use of surface geophysics including Costello (1980); Micham, Levy, and Lee (1984); Mooney (1981); and Zohdy, Eaton, and Mabey (1974).

Requirements for performing and documenting surface geophysical surveys are presented in Appendix J. Project-specific plans shall specify the geophysical method and instruments to be used, grid spacing, speed at which survey is to be conducted, information desired, and frequency of duplicating lines for quality control purposes. A minimum of five percent of the total linear distance of the survey will be duplicated. Provisions for verifying interpretations through use of borings or excavations shall be included.

Project-specific log forms shall be maintained. Information required on the forms is specified in Appendix J.

Operators shall be trained in use of equipment, and training shall be documented in project files as specified in Section 4. Instruments shall be operated as specified in manufacturer instructions. If these instructions are not used, a complete description of variations along with justification in the project-specific plan shall be provided or the situation shall be presented as a variance as specified in Section 15.

5.2.6 Aquifer/Permeability Testing

This paragraph defines requirements and provides guidelines for hydraulic tests to characterize certain properties of hydrogeologic units (i.e., hydraulic conductivity, transmissivity, and storage coefficient). A decision to conduct an aquifer test for each project shall be made in accordance with guidelines in the project/program-specific plan. Determining test type, location, and objectives for each project is also specified in the project-specific plan. Methods for testing aquifer/permeability are provided in Appendix J. Equipment used in the test shall be based on approximations of properties of interest from previous drilling and testing data.

Tests shall be designed and managed by a hydrogeologist with demonstrated experience in conducting the specified test in a similar environment. Data obtained during field hydraulic tests may include the following.

- Static water level
- Pumping well water discharge rate or volume of water displaced
- Drawdown or pressure versus time data for pumping and monitoring wells
- Water temperature, pH, and specific conductance
- Test interval

Hydraulic conductivity (K) is a measure of the capacity of a hydrogeologic unit to conduct water through a given cross-sectional area under saturated conditions. The greater the value of hydraulic conductivity, the greater the capacity of the unit to conduct water. The transmissivity (T) of an aquifer is defined as the ability of the aquifer to transmit water through its entire thickness and is equal to hydraulic conductivity (K) times the saturated thickness of the aquifer (b). Transmissivity is equal to integration of hydraulic conductivity over depth Z or $T = \int K(Z)dz$.

Specific yield is the ratio of volume of water drained by gravity per unit volume of porous media under atmospheric pressure. The storage coefficient of an aquifer is the volume of water in storage released from an aquifer column of unit cross section under a unit decline of

head. In confined aquifers, water released from storage is the result of aquifer compression and water expansion in response to pressure differentials introduced during pumping.

5.2.6.1 Slug Tests. Slug tests are a quick and inexpensive method of estimating the hydraulic conductivity or transmissivity near the screened zone of the well.

Analysis of slug test data is based on a modification of well-known ground water flow equations (Theis (1935) equation or subsequent modifications). Several authors have presented analytical solutions for analysis of slug test data. Most solutions require a semi-logarithmic plot of data collected: dimensionless head (logarithmic scale) or residual head (logarithmic scale) versus time (arithmetic scale).

Hvorslev (1951) was one of the first researchers to publish techniques of analysis of either constant or slug (falling head) tests in near-surface saturated soils. Cooper, et.al. (1967) and Papadopoulos, et.al. (1973) developed a set of type curves for analyzing slug test data, particularly for tests run in materials that are confined (under artesian pressure). Bouwer and Rice (1976) and Bouwer (1978) developed a technique for analyzing slug test data collected from completely or partially penetrating wells in unconfined aquifers.

Pressurized slug test methods have been developed for testing extremely low conductivity (10^{-8} cm/sec or lower) materials (Bredehoeft and Papadopoulos 1980). The advantage of the pressurized slug technique is reduction of time required to perform a test in tight formations. This method involves creating an instantaneous pressure surcharge on drawdown in the test zone, then closing a valve in the well. Based on rate of decay of the pressure slug and geometry of the test zone, transmissivity, hydraulic conductivity, and storage coefficient may be calculated.

5.2.6.2 Aquifer Pumping Tests. Aquifer pumping tests, commonly referred to as pump tests, are used to determine hydraulic properties of water-bearing zones. Pump tests influence a larger area and provide results that are often more representative of the overall aquifer characteristics than slug tests.

Aquifer characteristics that may be obtained from pumping tests include hydraulic conductivity (K), transmissivity (T), and specific yield (S_y) for unconfined aquifers and the storage coefficient (S) for confined aquifers.

Equipment, personnel, and time commitments needed to conduct pumping tests are greater than those required for slug tests. Briefly, a pumping test consists of pumping one well and recording the drawdown in the pumping well and in other nearby observation wells.

There are several types of pumping tests, the most common being the constant-rate discharge test (Todd 1980). Variable-rate tests are also employed under some conditions. Although analysis is more complicated, any sort of temporal variations in flow rate can be accounted

for by assuming the law of superposition holds true, usually a valid assumption. The most widely used variable-rate tests are the step-drawdown test, the constant-head test, and the air-lift pump test (Kruseman and DeRidder, 1976).

Another useful technique is injection testing. Injection tests, both constant and variable rate, are analytically identical to pumping tests except for consideration of flow into, rather than a withdrawal from, an aquifer. Data quality are similar.

Injection tests are commonly used in the petroleum industry (Earlougher 1977) and numerous applications exist in environmental investigations. Water sampling for geochemical characterization of an aquifer shall be conducted prior to application of this technique. Injection water shall be free of suspended solids and of equal or higher quality than ground water at the test site. Injection tests require special regulatory permission, which shall be obtained prior to scoping the test.

One major advantage of injection tests is that contaminated ground water is not removed from the formation and, thus, is not a disposal or safety problem. A potential disadvantage of the injection test is that, in certain cases, the injection well may have to withstand some induced hydraulic pressure. The injection rate shall be kept low enough to prevent raising the water level above the top of the well casing to prevent leakage of injected fluid on the ground surface.

Sources that provide additional information on constant-rate pumping tests are presented in para. 5.3. Driscoll in Ground Water and Wells (1986) presents many suggestions on how to perform the test. Todd in Ground Water Hydrology (1980) and other references, such as Kruseman and DeRidder (1976), provide analytical techniques and example problems of pumping tests conducted under different geologic conditions.

Design of the test well is an important consideration in aquifer testing. In some cases, an existing well may be pumped. When conditions permit, a well can be designed and constructed specifically for the test. Under ideal circumstances, the test well is screened throughout the thickness of the aquifer to be tested (a fully penetrating well) using a standard well screen with openings sized to the aquifer material. However, under some circumstances, a partially penetrating well screened in a specific portion of the aquifer may be preferable. The well should be filter-packed in unconsolidated, fine-grained aquifers to prevent sand production. The well should be correctly sealed from overlying and underlying units that are not to be directly pumped and so that leakage down the well annulus cannot occur. Such leakage can interfere with data interpretation. The completed test well should be developed so that influences related to drilling and well construction are minimized. Proper development of the well may prevent unexpected variations in the pumping rate during the test that can lead to inconsistent drawdown data. Standard well construction techniques are discussed in Driscoll (1986).

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The location and number of observation wells depend on several factors including the following.

- Whether the designated aquifer is confined or unconfined
- Thickness of the aquifer
- Inferred anisotropy of the aquifer
- Location of screened interval of pumping well relative to total aquifer thickness
- Location of aquifer boundaries and whether positive (lake or stream) or negative (impermeable boundaries)
- Logistic and economic considerations

Any number of observation wells may be considered. A number of guidelines for location of observation wells are presented in the Ground Water Manual (U.S. Department of Interior 1981) and Kruseman and DeRidder (1976). The layout of the observation wells shall be included in pumping test plans.

As a general rule for tests performed in both confined and unconfined aquifers, observation wells are screened or completed in a substantial portion of the aquifer thickness in approximately the median depth of the test zone. In some cases, special tests require that observation wells be selectively completed in several depth zones in order to accurately determine aquifer characteristics such as anisotropy and vertical hydraulic conductivity.

Selection of location for an observation well/piezometer relative to the pumped well is partially dependent on whether the aquifer is confined. The location of observation wells generally depends on the following four aquifer conditions.

- For most aquifers with fully penetrating pumped wells, observation wells are located at a distance estimated by using the Theis formulation (Theis 1935). Use of this formulation is described by Walton (1970). Assumed aquifer parameters are used to determine a location that will give the amount of drawdown required for proper analysis.
- For thin confined aquifers with fully penetrating wells, the nearest observation well is located at least 25 feet from the pumped well and, for unconfined aquifers, observation wells are generally located 15 to 100 feet from the pumped well.
- In thick isotropic aquifers with a partially penetrating pumped well, observation wells are located one and one-half to two times the aquifer thickness from the pumped well.

- For thick anisotropic aquifers with a partially penetrating well, observation wells are located at a minimum distance from the pumped well equal to twice the thickness of the aquifer times the square root of the ratio of the horizontal to the vertical hydraulic conductivity.

Duration of the test is determined by project needs and aquifer response. One test for determining adequacy of data is when log-time versus drawdown for the most distant observation well begins to plot as a straight line on semi-log graph paper. There are several exceptions to this simple rule of thumb, so criteria for termination of the test shall be defined in the project-specific plan.

Numerous techniques of analysis have been developed to evaluate water level data collected from constant-discharge aquifer pumping tests. Many of the analyses use the graphical curve-matching technique, which involves matching of theoretical type curves to plot of log drawdown versus log time from observation wells. Other analyses rely on other graphical techniques such as application of a straight line to plots of drawdown versus log time. Verified aquifer test analysis software is available and should be considered for use.

Theis (1935) developed a theoretical formula that related lowering of the potentiometric level in an aquifer caused by constant withdrawal of water from the aquifer. This classic formulation has been widely used to predict water level response in aquifers resulting from specified pumping stresses. Several authors have described the use of this formula in estimating transmissivity and storage coefficient from aquifer test data: Lohman (1972), Walton (1970), Todd (1980), and Freeze and Cherry (1979). In brief, the method involves superimposing the Theis solution (or "type" curve) on a log-log plot of drawdown versus time data from a test well. Data from the "match point" are used to solve two algebraic equations that give the value of transmissivity (T) and storativity (S) (or storage coefficient). Hydraulic conductivity (K) may be computed by dividing T by the aquifer thickness (b). The same aquifer parameters can also be determined from a semi-log plot of drawdown versus time for either the pumped well or observation wells. Analytical data in Cooper and Jacob (1946), when plotted as described, compares with Theis's T, S, and K values.

Knowledge of area hydrogeology and type of aquifer conditions is essential for correct analysis of test data. For example, bounded aquifers produce straight-line trends by the Cooper and Jacob (1946) method that may yield apparent transmissivity values that are too low.

Since the development of the Theis equation, several other formulas have been published that attempt to describe response of certain aquifers to a constant pumping stress. Hantush (1956) developed a formula and a corresponding set of type curves for an aquifer overlain and/or underlain by a confining bed that has significant storage and experiences vertical flow when the adjacent aquifer is pumped. Hydraulic characteristics of the confining unit can be calculated using the set of Hantush type curves.

Another commonly used set of type curves developed by Boulton (1954, 1963) may apply when the tested aquifer is unconfined and exhibits a phenomenon known as delayed yield, which is a result of drainage retardation caused by capillary tension. Nueman (1972, 1975) also developed a set of type curves for the response of unconfined aquifers to pumping, but he used different assumptions concerning the physical processes in effect. In practice, Nueman and Boulton curves have been shown to give similar results.

5.2.7 Decontamination Procedures

Equipment must be decontaminated for the following reasons.

- Prevent transfer of contaminants from equipment to sampled media
- Limit cross-contamination between sampling points
- Protect worker health and safety

Decontamination procedures in Appendix J are designed to accomplish these objectives without affecting the integrity of the collected samples. Generation of hazardous waste and excessive volumes of waste solutions are discouraged. Use of improperly decontaminated equipment is prohibited. Non-dedicated sampling equipment shall be cleaned between each use and each sampling point except as described in Appendix K. Dedicated equipment shall be cleaned as necessary.

Cleaning procedures shall be adhered to by field personnel. Variations from procedure shall have prior approval of the FEMP manager and QA officer. The reason for variation and its nature and the subsequent procedure used shall be described in detail on the daily field log and recorded on sampling logs of samples affected.

Equipment shall be decontaminated at a central decontamination area where a water source and a means of containing decontamination solutions is readily available. If decontamination must be conducted in the field, the circumstances dictating this action shall be documented either in a project-specific plan or in the daily field log.

Requirements for decontamination materials are based on those specified in the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, April 1, 1986b (Region IV SOP) of the U.S. Environmental Protection Agency, Region IV. A similar guidance document is not available for Region V (Craig Thomas, U.S. Environmental Protection Agency, Region V Environmental Sciences Division Laboratory, telephone conversation, January 3, 1991). Variations from use of specified materials shall be noted on the daily field log and the samples potentially affected shall be indicated.

5.2.8 Field Radiological Contamination Surveys

Radiological contamination surveys at FEMP are conducted to determine personnel protection requirements, monitor for or detect releases of radioactive materials, and screen samples for laboratory analyses for gross characterization of areas or materials for the presence of radiological contaminants. These include the site-wide field surveys conducted during the RI/FS.

Surveys are conducted in accordance with DOE Orders 5400.5 and 5480.11 in support of activities such as decontamination and decommissioning of facilities and equipment, construction, and release detection activities. Radiological contamination surveys in support of CERCLA activities include health and safety monitoring in the field and screening of samples to determine need for laboratory analysis, for laboratory licensing requirements, and to determine shipping and packaging requirements.

Field radiological contamination surveys are conducted in the field to characterize an area, a facility, or equipment for contamination. Requirements for these surveys follow. Requirements for health and safety contamination surveys are included in FEMP Health and Safety Department procedures. Requirements for screening of samples are included in Section 6 and Appendix K.

Contamination survey techniques at FEMP shall be based on standard nuclear industry techniques combined with process knowledge of potential contaminants at the site. Field radiological contamination surveys may include loose alpha and beta/gamma surveys and fixed alpha and beta/gamma surveys.

Loose contamination is defined as radiological contamination, including soils and sediments, that can readily be removed from a surface by collecting a smear sample. Surveys are performed for area characterization, to determine level of personnel protection required, to ensure that vehicles and packages meet Department of Transportation (DOT) requirements (Section 6) and to identify free releases.

Fixed contamination is defined as radioactive contamination that has become part of the structure being surveyed at conditions prevailing at the time of survey. Fixed contamination cannot be measured with smear samples; it must be measured directly from the material of interest.

Total contamination of a material or structure is defined as the sum of loose and fixed contamination. Direct survey techniques are used to measure the amount of total activity on various surfaces.

Scoping requirements for radiological contamination surveys include the following.

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- Regulatory driver or other reason for conducting survey
- Types of radiation expected
- Types of measurement equipment plus calibration and operating requirements
- Types of samples to be collected (e.g., smears, surface soil, sediment)

Scoping requirements shall be documented in project-specific plans.

5.3 REFERENCES

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Section 6

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Section 6

SAMPLING REQUIREMENTS

Sampling programs and projects at FEMP are based on project objectives coupled with a review and evaluation of existing data for the site vicinity. Sampling programs/projects may include collecting the following samples.

- Aqueous Samples (Subsection 6.2)
- Solid Matrix Environmental Samples (Subsection 6.3)
- Gaseous Matrix Samples (Subsection 6.4)
- Biological Samples (Subsection 6.5)
- Miscellaneous Samples (Subsection 6.6)

Subsection 6.7 outline requirements for field storage and shipment of samples.

Procedures for the sampling activities at FEMP that generate data used for the CERCLA program are provided in Appendix K. Additional procedures may be submitted to provide detailed information on applicable sampling activities.

Minimum requirements for sampling activities in this section and in Appendix K shall be incorporated into project-specific standard operating procedures. Requirements may be incorporated into project-specific plans by reference to this QAPjP. Surveillances and audits (Section 12) shall be conducted in accordance with requirements of this QAPjP and with project-specific requirements.

Requirements contained in this document may be incorporated by reference to other documents. However, requirements above and beyond those included in this QAPjP shall be described along with appropriate programmatic and background information required for the specific program or project.

6.1 PROJECT-SPECIFIC PLANS

Project-specific plans shall be developed as required for each program or project performed at FEMP that includes sampling and analysis. These plans include details applicable to the

specific project for which they are written and shall be in a form that can be used on a day-to-day basis by project personnel.

6.1.1 Plan Requirements

The following items shall be addressed when developing the project-specific plans.

- Regulatory driver (or other reason for sampling) and Data Quality Objectives (DQO)
- Anticipated uses for analytical data
- Probable sources, environmental fate, potential transport routes, and contaminants of concern
- Summary of previous monitoring
- Method of determining sampling locations (including background) and justification
- Location and number of monitoring stations to be sampled including background stations
- Media to be sampled and variation in space and time
- Frequency of sampling
- Suspected and known hazards
- Methods for collecting samples
- Number of samples to be collected and reason
- Quality assurance samples
- Volume of samples to be collected and reference
- Additional quality control checks
- Type and kind of analyses to be performed in the field and reason
- Methods of preservation, storage, and shipment
- Procedures for and precautions during sampling with reference

- Type and kind of laboratory analyses
- Forms to be used and requirements for tracking field activities
- Sample tracking (chain of custody) procedures
- Decontamination procedures

The plans shall ensure that collected samples are representative of the media sampled. The number of samples specified to be collected shall be sufficient to achieve project-specific DQOs, which shall be documented in the project-specific plans.

DQOs are quantitative and qualitative statements that specify the quality of data required to support decision making (U.S. Environmental Protection Agency, 1987). The intended use of the data is the driving consideration in the formulation of DQOs. Screening-type data [Analytical Support Levels (ASL) A and B] are used most often at FEMP. However, parameter-specific data (ASLs C, D, and E) are necessary for many types of risk assessment, characterization, and treatability analyses. ASLs are discussed in more detail in Section 2.

EPA guidance on preparation of DQOs has been used to develop a process for defining DQOs for various programs/projects at FEMP. An outline of this process and DQOs for ongoing programs and projects at FEMP are provided in Appendix C. Support documentation for DQOs becomes part of project files.

6.1.2 Preparation and Implementation of Project-Specific Plans

Project-specific plans shall be approved as specified by individual project requirements. The following guidelines shall be applied to preparation of project-specific plans.

- Define project-specific DQOs based on intended use of the data and the ASL.
- Develop rationale for sample collection that will achieve DQOs.
- Determine and describe sample collection locations.
- Define overall scope of the study including sampling procedures, equipment, sample handling requirements, and shipping procedures.
- Determine and describe potential hazards presented by the type of sample collection activities and identify the safety precautions and practices outlined in the FEMP site-wide Health and Safety Plan or in the project-specific addenda to the site Health and Safety Plan.

- Determine and identify equipment and materials necessary to perform required sampling activities and field analyses.

- Specify calibration requirements for field equipment, which shall be in accordance with the National Institute of Standards and Technology (NIST) or the American Society for Testing and Materials (ASTM) if available. Otherwise specify manufacturers instructions and calibration procedures or provide specific variations in the project-specific plan in accordance with Section 8.

- Specify appropriate documentation of calibration performance.

- Identify appropriate field collection sampling reports pertinent to the particular sampling activity.

- Determine and specify appropriate sample labeling requirements that will include, at a minimum, an identification of the project, sample number, sampling date and time, parameters to be analyzed, preservatives to be added, and sampler's initials as specified in Section 7.

- Identify complete chain-of-custody documentation to accompany samples sent to a laboratory for analysis from the time of collection to final disposition. (See Section 7 for chain-of-custody requirements.)

- Specify decontamination procedures for sampling activities in accordance with decontamination requirements in Section 5.

- Specify preservation and storage requirements for samples as required in Appendix K.

- Specify sample packaging and shipping requirements in accordance with Appendix K.

- If a technology or method not previously used at FEMP will be implemented during a project, include the following in the work/sampling plan.

  - Reason technology or method was chosen

  - References or other data confirming that the technology or method is sufficient to support data needs

  - If the technology/method replaces one previously used, state reason for the change and initiate a document change request as specified in Section 4.

  - If the technology/method replaces one previously used, describe a means for comparing results of the old and new technology/method.

- Procedure for implementation of the technology/method and include procedure in the QAPjP after EPA approval.

- Define data validation requirements for ASLs B and E data.

- Specify QA/QC samples to be collected and protocols to be followed.

Sampling locations may be selected on the basis of judgemental, random, or systematic sampling. Judgemental samples may be collected for any purpose as long as the purpose is documented in detail in the project-specific plan (U.S. Environmental Protection Agency, 1989a). Geostatistical methods for systematic and random sample location and quantity selection are documented in references such as EPA (1989a), Davis (1973), Gibbons (1990), Gilbert (1987), Westat Research, Inc. (1989), and Krumbein and Graybill (1965). Rationale for sample location and quantity shall be described in the project-specific plan, and support documentation shall be maintained in project files. A combination of professional judgement and random or systematic sampling is normally used.

Sample collection forms shall be completed for activities and are considered part of the daily log (Section 5). Specific information about sampling location and collection shall be recorded on the forms as well as the following minimum information.

- Project identifiers

- Sample location

- Description of the sampling points (e.g., east bank of Miami River 500 feet upstream of confluence with Paddys Run)

- Sampling date or dates

- Start and finish time of sampling activity and sample collection times

- Weather conditions including significant changes during the activity

- Sample numbers

- Description of sample containers (e.g., three 40 mL-glass vials)

- Parameters to be analyzed

- Preservation methods including refrigeration

- Field measurements including replicate measurements

- Visual description of samples
- Unusual occurrences (e.g., "semi-volatile sample could not be collected because of insufficient recovery of well" or "truck passed while sampling stirring up significant volume of dust upwind of sample collection site")
- Sampling team members
- Types and identification numbers of equipment used

Matrix-specific requirements are described in individual sampling sections.

6.2 COLLECTION OF AQUEOUS SAMPLES

Aqueous samples include natural and waste waters. Ground water and surface water are defined for the purpose of this document as natural waters. Water collected after use or in storm sewers are considered waste waters. Specific matrices sampled at FEMP are ground water from monitoring wells, piezometers, and private wells; surface water from the Great Miami River, Paddys Run, other natural above-ground-water bodies, and the storm-water outfall ditch; waste water from manholes, the sewage treatment plant, and any other point in the plant waste-water system; and other waste water, specifically water collected in the storm-water retention basins prior to discharge.

Samples shall be collected for analytical parameters in order of stability. The order of sample collection is provide in Appendix K.

6.2.1 Field Analytical Procedures for Natural Water Samples

Temperature, pH, and specific conductance shall be measured in the field and documented on ground- and surface-water sample collection forms. Determinations shall be performed either in the well or on unpreserved samples. Surface water measurements may be collected directly from the surface-water body. Ground-water field measurements may also be taken in situ (downhole) to avoid changes that might occur if the sample is removed from the well.

Procedures for measurements of temperature, pH, specific conductance, dissolved oxygen, alkalinity, and redox potential (Eh) are provided in Appendix K.

6.2.2 Ground-Water Sampling

Ground-water sampling is currently being conducted at FEMP for the following programs/projects.

- CERCLA Remedial Investigation/Feasibility Study (RI/FS) under the Consent Agreement
- Resource Conservation and Recovery Act (RCRA) Environmental Compliance Ground-Water Monitoring
- Radiological Environmental Monitoring
- Safe Drinking Water Act

The scope of the CERCLA RI/FS ground-water sampling program is defined in the RI/FS Work Plan as amended (U.S. Department of Energy, 1988, and amendments). Requirements of the Environmental Compliance Ground-Water Monitoring program are included in the group procedures and RCRA Ground-Water Quality Assessment Program Plan (Westinghouse Materials Company of Ohio, 1991). Radiological Environmental Monitoring Progran (REMP) requirements are defined in DOE Order 5400.1 and in REMP procedures.

Other activities that may require ground-water sampling at FEMP include, but are not limited to, Removal Actions (RvA), Removal Site Evaluations (RSE), Remedial Design (RD), UST compliance activities, and Solid Waste Management Unit (SWMU) characterization (RCRA Facility Investigations) and RCRA closure of hazardous waste management units.

6.2.2.1 <u>Water Level Measurements</u>. Ground-water elevation data are used to monitor aquifer storage, estimate rate and direction of ground-water movement, define recharge/discharge relationships relative to surrounding features, estimate baseflow to streams, and calculate the volume of water in a borehole or well. Procedures for collecting water-level data from wells including water-level measurements prior to sampling are provided in Appendix K.

6.2.2.2 <u>General Ground-Water Sampling Requirements</u>. The primary technical consideration in ground-water sampling is to obtain a representative sample of the ground-water body at the well location. Additionally, ground-water sampling at FEMP must meet certain requirements in order for subsequent data to be used by the CERCLA Program. To ensure that these objectives are achieved, the following guidelines and techniques shall be the minimum requirements during sample withdrawal. Additional requirements specific to a program or project may be included in project-specific plans.

Procedures for collecting ground-water samples are provided in Appendix K.

6.2.2.3 Parameter-Specific Sampling Procedures. Ground-water samples are collected from monitoring wells and piezometers for Volatile Organic Compounds (VOCs), acid and base-neutral extractable compounds, total and dissolved metals, general chemistry, and radionuclide parameters in accordance with procedures provided in Appendix K.

6.2.2.4 Sampling Ground-Water from Private and Other Production Wells. Private water wells near FEMP have been sampled as part of FEMP programs, including REMP and RI/FS. DOE has authorized sampling of private wells by FEMP personnel when requested, and they may be sampled during a routine program or project or at request of the property owner. Data collected from private wells may be qualified for certain uses.

Specific procedures for collecting water samples from private or other production wells are included in individual project plans. Other procedures are provided in Appendix K.

6.2.3 Surface Water Sampling

Surface-water sampling is currently being conducted at FEMP with samples from Paddys Run and the Great Miami River being collected routinely in accordance with National Pollutant Discharge Elimination System (NPDES) requirements as part of routine monitoring. Samples have also been collected in support of RI/FS.

Procedures and practices are described in Appendix K for collection of water samples from streams, ponds, lakes, rivers, springs, and seeps. Two different techniques are used for collecting surface water samples: grab sampling and composite sampling.

6.2.4 Waste-Water Sampling

Waste-water sampling is regulated by the Ohio Environmental Protection Agency (OEPA) under the Clean Water Act (CWA). As such, data are collected in accordance with permit-specific requirements. Samples are also collected for DOE environmental monitoring purposes and to fulfill requirements of the 1986 Federal Facility Compliance Agreement.

6.2.4.1 Purpose of Data Collection Activity. NPDES is a statutory requirement under Title IV, Section 402, of the Clean Water Act. Regulatory authority is provided under 40 CFR 122. This system requires that point source discharges into the nations waterways have a permit that stipulates allowed limits for certain pollutants entering a particular body of water. The Feed Materials Production Center (FMPC) was issued an NPDES permit renewal (number 1I000004*BD) on 12 February 1990 that expires on 9 February 1995. The permit covers two outfalls to receiving streams and five internal monitoring points located throughout FEMP. It covers process-related waste water, storm water, and sanitary waste water. The permit is based on both technology-based and water-quality-based limitations

depending on water-quality goals of OEPA and the best available technology for treating waste waters specific to an industry. Permitted discharges are as follows.

- 1I000004001: manhole 175; effluent to the Great Miami River
- 1I000004002: spillway from the storm-water retention basin to Paddys Run
- 1I000004601: sewage treatment plant effluent after disinfection
- 1I000004602: general sump effluent to manhole 175
- 1I000004604: storm sewer lift station effluent to manhole 175
- 1I000004605: effluent from biodenitrification effluent treatment system to manhole 175
- 1I000004606: storm-water retention basin pump station effluent to manhole 175

NPDES determines compliance with permit limits through a self monitoring program. This self-monitoring program consists of sampling waste water, analyzing it for regulated parameters, and reporting results in a monthly Discharge Monitoring Report (DMR), which is the end use of the data as far as FEMP is concerned. However, OEPA collects these data plus data from other facilities discharging into waters of the state and uses it to track and regulate water quality in Ohio.

In addition to NPDES requirements, FEMP routinely monitors waste-water discharges on a per-work-shift basis. These data become part of the waste-water treatment plant records. Uranium data are reported monthly to EPA as required under the Federal Facility Compliance Agreement (FFCA) attachment to the Consent Agreement.

DQOs for ongoing waste-water sampling are included in Appendix C.

FEMP has an ongoing program of sampling, analyzing, and reporting as required by its NPDES permit, the FFCA, and DOE. A sampling schedule is developed by Environmental Compliance for the year to ensure that, over the course of a year, the reported data provide an accurate picture of the volume and nature of waste-water flow in the permitted discharges.

The Utilities Section is responsible for sample collection and for operation and maintenance of monitoring equipment such as continuous pH monitors and flow meters. The section is also responsible for operation of automatic samplers and for ensuring that proper techniques are used for grab sample collection when an automatic sampler is not or cannot be used.

Samples are collected as prescribed by procedures in accordance with the schedule. This includes preservation and security until the samples are delivered to the FEMP Analytical Section. Sampling and analysis requirements are regulated pursuant to 40 CFR 136. The FEMP permit defines the applicable regulation as that version of 40 CFR in effect on the effective date of the permit, which is the 1 July 1989 version.

The FEMP Analytical Section is responsible for disseminating samples to appropriate laboratories while maintaining specified sample custody and preservation requirements. Ultimately the department is responsible for analysis of samples including proper use and calibration of analytical equipment and implementation and verification of documented Quality Assurance/Quality Control (QA/QC) requirements.

6.2.4.2 <u>Field Procedures</u>. The NPDES permit requires effluent to be monitored continuously for pH at every permitted location except the general sump and for flow whenever a discharge occurs at each location. Meters are in place to fulfill bothe of these permit requirements. Procedures for collecting flow meter information for each of the NPDES outfalls that require reporting of total daily flow are provided in Appendix K.

An NPDES sampling plan has been developed and is on file with OEPA. The plan identifies samples to be collected weekly under NPDES and contains information relative to location, type of container, number and volume of samples, type of analysis, preservation method, and lab destination.

The basic requirements for NPDES sampling are specified in Appendix K.

Control, duplicate, recycle, and spiked samples are delivered on a regular basis and tested along with regular analytes. The Sample and Data Management Section is responsible for ensuring that QC samples are prepared, delivered regularly, and documented.

FEMP participates in a quality assurance program under the authority of Section 308 (a) of the Clean Water Act. Periodically, samples of the same type of constituents that are normally tested are sent to FEMP for analysis. Analyses are performed and findings reported to EPA or their designated contractor in accordance with instructions provided with these samples. The results are then compared to the true values to determine accuracy of FEMP laboratory analyses.

6.2.4.3 <u>Additional Sources of Information</u>. 40 CFR 136 governs sampling procedures. FEMP Standard Operating Procedures are implemented for waste-water sampling and analysis and are available upon request from DOE FO. References of importance are as follows.

- *Manual of Sampling, Analytical, and Reporting Procedures for Wastewaters* (revised 1976), OEPA

- *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association

- *Annual Book of Standards*, Part 23, "Water; Atmospheric Analysis," American Society for Testing Materials (ASTM)

A list of acceptable reference material for laboratory analyses is included in 40 CFR 136. The primary references used at FEMP are "Methods for Chemical Analysis of Water & Wastes," U.S. EPA 600/4-79-020 (1983) and "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association, 1985). Analysis procedures used in FEMP laboratories for testing waste water are developed from specific methods in these references. The method reference for each analyte is identified in Appendix K.

6.3 SOLID MATRIX ENVIRONMENTAL SAMPLES

6.3.1 Surface Soil Sampling

Surface soil samples are collected prior to excavation in order to characterize the soil for presence of hazardous or radioactive constituents by FEMP as part of routine monitoring. Surface soil samples have also been collected as part of the RI/FS. Procedures for collecting surface soil samples are provided in Appendix K.

6.3.2 Sediment Sampling

Sediments are materials that have been transported from their place of origin by fluid action and redeposited. Stream sediments are of most interest at FEMP. Sediment sampling in Paddys Run and the Great Miami River is conducted for routine characterization. Sediments have also been analyzed as part of the RI/FS.

Specific sampling stations are documented in project-specific plans. Procedures for collecting sediment samples are provided in Appendix K.

6.3.3 Subsurface Soil Sampling

Subsurface soil samples have been collected as part of preliminary studies and for the RI/FS. Additional subsurface soil samples will probably be collected as part of long-term monitoring and for Remedial Design/Remedial Action (RD/RA) purposes.

Methods for collecting and screening subsurface soil samples for radioactive contamination and to provide instructions for determining which samples should be analyzed for radiological parameters are provided in Appendix K. The methods describe the technique for screening subsurface soils for intermediate and high-energy gamma-ray emitters. The

screening level is chosen for instrument gross count rates that exceed the background count rate by three standard deviations when the sample is counted in a low-background area. Screening may be performed with gamma sensitive instrumentation capable of detecting the desired level of contamination. An example of such instrumentation is a portable multi-channel analyzer with associated sodium iodide detector.

Screening shall be performed using field instruments specified in project-specific plans.

6.3.4 Drum Sampling

Drums are commonly used to store RCRA, non-RCRA, and mixed wastes at FEMP. Drum samples have been and continue to be collected to determine whether material is RCRA waste. If it is RCRA waste, additional sampling is completed to evaluate treatment/disposal options.

Project-specific plans describe objectives for drum sampling, representative drum selection criteria, analytical testing requirements, statistical analyses for drum sample testing (e.g., confidence levels), and disposal plans.

6.3.4.1 RCRA Waste Determinations. This section of the QAPjP is based on information supplied in the FEMP Waste Analysis Plan, which was prepared in accordance with the requirements of Ohio Administrative Code (OAC) 3745 and 40 Code of Federal Regulations (CFR) 264, 268, and 270.

FEMP is operating under a proposed amended consent decree between DOE, the State of Ohio, and the Westinghouse Environmental Management Company of Ohio (WEMCO). The parties to the consent decree have agreed to a schedule for RCRA characterization of waste materials stored on site. Wastes have been divided into two groups based on the following definitions.

- Backlogged Waste - Waste generated and inventoried on or before 30 June 1990
- Newly Identified Backlog Waste - Waste generated prior to 30 June 1990 but not inventoried until after 30 June 1990
- Newly Generated Waste - Waste generated after 30 June 1990

RCRA characterizations are being completed according to the schedule agreed upon in the proposed amended consent decree. A quarterly report is submitted to OEPA that identifies all hazardous waste streams characterized under the consent decree.

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6.3.4.2 Chemical and Physical Analysis. The information presented in this section is used to accomplish the following.

- Characterize hazardous and chemical properties of each waste stream and assign applicable hazardous waste codes
- Ensure proper handling and storage of waste
- Evaluate pre-acceptance conditions for receipt of waste from on- and off-site sources
- Determine applicable land disposal restriction information for each hazardous waste stream

Four generic categories of waste constitute the majority of hazardous waste presently generated at FEMP. Examples of these categories follow.

- Closure and CERCLA Wastes - Soil samples, drill cuttings, well development waters, decontamination waters, sampling and decontamination equipment, personnel protective gear, contaminated soils and ground water, contaminated facilities (e.g., demolition material, process equipment)
- Maintenance and Construction Wastes - Scrap metals, wires, wood, and other construction debris and rubble; excavated soils; waste hydraulic and lubricating oils; cleaning solvents; boiler residues; floor sweepings; used rubber parts and products; paints and painting equipment; and off-specification commercial products
- Underground Storage Tank Removals
- Miscellaneous Activities wastes, disposable equipment, and personnel protective gear.

The hazardous waste determination procedure, which relies on process knowledge supplemented by analytical data, is described in Appendix K.

The first step of the FEMP waste determination procedure is evaluation of the accuracy of process knowledge and whether it is sufficient and conclusive enough to make the waste determination.

When process knowledge is deficient, either more information is requested or a request for waste stream sampling and analysis is processed as described in Appendix K. After completion of sampling and analysis, results are evaluated and RCRA waste codes are assigned as warranted.

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For each waste stream, a table is prepared that lists the waste stream name, physical state, hazardous waste codes, the basis for the hazard listing, waste source, land ban status, and FEMP material and source code. This table is submitted to OEPA quarterly to update the ongoing waste determination process which is taking place at FEMP under the terms of the proposed amended consent decree.

6.3.4.3 Containerized Waste. Hazardous waste is stored at FEMP in containers such as 55-gallon steel and polyethylene drums and 85-gallon steel overpack drums, but is not necessarily limited to these types of containers. These containers may be constructed of carbon steel, stainless steel, polyethylene-lined carbon and stainless steel, and polyethylene, but materials are not necessarily limited these materials.

Prior to placing waste in a container, compatibility of the material with the container is verified by comparing analytical data or process knowledge to compatibility information for the container. Most of the waste generated at FEMP is compatible with carbon steel or stainless steel containers.

Containerized wastes are stored in designated hazardous waste storage areas at FEMP. Two categories of waste characterization data are used to determine the appropriate storage area.

- Physical state and presence of free liquids
- Chemical constituency and compatibility

Presence or absence of liquids is determined by a visual inspection of the waste or application of process knowledge.

Chemical constituents within each waste are determined to ensure that wastes stored in a unit are compatible with each other and with the construction of the unit. To ensure that incompatible wastes are not stored together, a Reactivity Group Code (RGC) is assigned to each waste stream.

6.3.4.4 Additional Requirements for Ignitable, Reactive, and Incompatible Wastes. Ignitable wastes are identified through process knowledge or by use of the Pensky-Martens closed-cup test (EPA Method Number 1010) to determine the flashpoint of the waste.

A small quantity of reactive wastes have been generated and stored at FEMP. Reactive wastes are stored in areas that are compatible with the material stored and are separated from incompatible wastes. Each waste stream is assigned a reactivity group code based on the process knowledge and analytical data provided for each waste stream on the material evaluation form. Reactivity group codes are also assigned to storage units at FEMP so that only compatible wastes are stored within each unit or containment system.

In addition, FEMP takes additional precautions to ensure proper management of ignitable, reactive, and incompatible wastes through personnel training and establishment of various waste management procedures. Personnel who are required to handle or manage hazardous waste are trained to perform their tasks in a safe manner.

This training is supported by internal procedures that specify separation of ignitable, reactive, and incompatible wastes and protect them from sources of ignition and reaction.

6.3.4.5 Waste Categorization. Because of the large number of drums at FEMP, representative samples are taken from selected drums containing waste from a particular stream. The drums are then categorized based on waste charateristics as follows.

- Backlog Waste - RCRA, non-RCRA, and mixed waste that has been stored on-site for a long period of time. Selection of drums from a backlog lot is based on process knowledge, waste stream type, and random sampling techniques that ensure representative samples. Drum sampling protocols are specified in project-specific sampling plans.

- Newly Generated RCRA Waste - Waste streams currently being generated on site that fall under RCRA jurisdiction. These streams are sampled at a frequency that ensures availability of accurate, current data for timely disposition of the waste. Sampling strategy depends on the rate of waste production and inherent stream variability. Drums are sampled before being transported to a warehouse to limit drum handling.

NOTE

Composite sampling of large waste streams may be specified to reduce analytical effort.

- Newly Generated Non-RCRA Waste - Waste currently being generated on site that is not covered under requirements for RCRA waste streams and have little potential of becoming RCRA-covered waste are determined by internal record keeping based on process knowledge and analysis. These sampling requirements vary widely and are defined in project-specific plans.

Basic requirements for drum sampling are provided in Appendix K.

6.4 GASEOUS MATRIX SAMPLES

Air sampling conducted at FEMP includes stack sampling for compliance with the CAA, radon sampling as part of the REMP, general area air sampling for radiological health and safety monitoring, and monitoring for specific organic and inorganic contaminants while

conducting field activities. Data may be used for modeling contaminant transport, determining compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP), determining exposure levels, and determining respiratory protection requirements.

6.4.1 Clean Air Act Monitoring

Stack sampling is done at FEMP to measure radionuclide emissions. Stacks with a potential for delivering a dose of 0.1 mrem in one year to any individual shall be monitored and inspected at least weekly as specified in the Clean Air Act, 40 CFR 61 and DOE 5400.5.

Stack sampling methods are provided in Appendix K.

6.4.2 Radon Sampling

Various federal regulations (40 CFR 61 and 192) impose limits on the emission of radon gas from a variety of sources either owned or operated by DOE. Measurement of radon flux density using a passive charcoal collector is often the method of choice for determining radon emissions from these sources. Details of this measurement method are given in 40 CFR 61. Method 115 also references an EPA document authored by Hartley and Freeman, which describes the Large-Area, Activated-Charcoal Collector (LAACC) in detail and gives general field methods for its use.

Sampling frequency and locations are specified in project-specific plans.

Radon sampling methods are provided in Appendix K.

These methods provide instructions for collection of samples to determine long-term radon-222 (Rn-222) concentrations in air under ambient outdoor conditions as described in H. W. Alter and R. L. Fleisher (1981) "Passive Integrating Radon Monitor for Environmental Monitoring," Health Physics, Volume 40, p. 693 and Terradex Corporation, "Instruction for Track-Etch[R] Type F Radon Detectors," Walnut Creek, California.

As radon and radon progeny decay, the resulting alpha particles produce radiation-damage tracks in thin plastic films exposed to air. The film detector is mounted inside the bottom of a plastic shield and a special filter is installed over the mouth of the cup to filter out radon daughters as well as dust and dirt, so that only radon gas enters the cup. Detectors are chemically treated after exposure to make tracks visible. The number of tracks in a specified area is directly proportional to the integrated alpha exposure from decay of radon to which detector was exposed. The detection range is from 0.2 to 20,000 pCi/1-month for outdoor measurements.

The methods include collecting samples of ambient air and soil gas. Two basic types of sampling are used in radon measurements: gas bag samples and soil gas samples (radon flux). Gas bags provide integrated samples of ambient radon in air while soil gas accumulators provide samples of radon in emanated soil gas. Instantaneous air samples may be collected using an evacuated SC-6 scintillation cell.

Sampling procedures are in accordance with DOE Order 5480.1, 10 CFR 20, and U.S. EPA standards 40 CFR 192.

6.4.3 General Area Air Samples

Routine air sampling is performed to measure levels of airborne radioactive material in order to properly characterize areas in accordance with DOE Order 5480.11 and to establish a basis for determining respiratory protection requirements. Sampling is accomplished as specified in procedures in Appendix K.

Continuous Air Monitors (CAM) are used to provide real-time air monitoring as required by DOE Order 5480.11. There are several different types of CAMs in use at the site and each must be operated in accordance with applicable documented procedures. These instruments are generally used as warning devices and do not normally produce data useable by the FEMP CERCLA group. However, instruments equipped with strip charts may be used for tracking ambient airborne levels of radioactive contaminants.

6.4.4 Monitoring for Organic and Inorganic Contaminants in the Field

The purpose of air monitoring is to screen samples for organic analysis in the field and to protect worker health and safety from organic and inorganic contaminants. Procedures for monitoring are provided in Appendix K.

6.4.5 DOE-Required Air Monitoring for Off-Site Exposure.

The goal of air sampling at a site is to characterize air-related contaminant exposures. At a minimum, sampling results shall be adequate for predictive short-term and long-term modeling. When long-term inhalation exposures are required, sample results shall be representative of the long-term exposure points. This requires an air sampling program of sufficient temporal scale to encompass the range of meteorological and climatic conditions potentially affecting emissions and of sufficient spatial scale to characterize associated air concentrations at potential exposure points.

Potential exists for exposure to air particulates from past and present releases, both directly from the facility and from resuspension of materials following deposition. The particulate constituent of concern is primarily uranium. Therefore, particulate air sampling is an

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important part of the environmental surveillance program at FEMP in order to comply with applicable dose limits.

Besides exposure to particulates, there is potential for exposure from radon. Radon shall be monitored to assess status of emissions.

Selection of the type of air monitoring depends on the emission sources to be investigated as well as the exposure routes to be evaluated. For example, if dust inhalation is an exposure pathway of concern, the monitoring equipment shall be able to collect respirable dust samples.

Air sampler locations are based on DOE requirements, public concern, control location, and special studies. Justification of additional monitoring stations or omission of existing stations shall be documented. In general, indicator locations should not be placed in valleys, near structures that would affect measurements, in areas of different geology, or in areas where altitude differs significantly (150 meters). At least one control air monitoring station shall be maintained and monitored at the same frequency as the indicator stations.

Selection of a particular type of track-etch radon detector shall be based on effectiveness and cost.

Frequency of air sample exchange shall allow time for a sufficient volume of air to pass through the sampler so that the required sensitivity can be reached. Frequency also depends on the required speed of data retrieval and shall be determined on a site-specific basis. Determining factors shall be documented in environmental surveillance files (DOE/EH-0173T, Summary 5v). Site-specific meteorological conditions shall be obtained or recorded during the air sampling program with sufficient detail and quality assurance to substantiate air sampling results. These data can be used to determine sampling locations and frequencies. Meteorological characteristics are necessary input for air transport and flow modeling.

Meteorologic monitoring shall be completed to assess potential off-site impacts for releases of airborne contamination. Assessments may be completed for actual or projected releases (including accidental). Necessary data will be obtained from on-site instrumentation.

Types of instruments being considered for use include wind speed, wind direction, ambient and dewpoint temperature, precipitation, and barometric pressure measuring devices. Sensors used and on-site measurement locations will be determined based on a project-specific work plan and DQOs. Procedures for collecting samples are also provided in Appendix K.

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6.5 BIOLOGICAL SAMPLING

Biological sampling is conducted at FEMP to evaluate radiological parameters (e.g., uranium) in selected flora and fauna. Prior biological sampling was completed at the site for the RI/FS. Additionally, Miami University completed a biological and ecological sampling and analysis study. (These documents are available to the public and provide a detailed discussion of biological activities completed during these studies.) Following is a description of ongoing biological sampling and key elements for a plan for future studies.

6.5.1 Ongoing Sampling

Ongoing biological sampling at FEMP is conducted for milk, fish, produce, game, meat, and grass. Methods for collecting samples of milk, fish, soil and grass, and farm and garden produce are provided in project-specific plans and in Appendix K.

6.5.2 Biological Study Plan

The purpose of a study needs to be defined prior to preparation of a plan. Biological studies may be implemented to assess the following

- Difference between biological parameters at a site relative to a control area
- Detect biological (flora/fauna) contamination
- Quantify risks to human health from contamination in the food chain

General elements of a plan shall include the following.

- Identification of target compounds
- Field sampling plan development
- Field sampling procedures
- Laboratory testing

These elements are described in the following paragraphs.

6.5.2.1 <u>Target Compound Identification</u>. Target compounds are on-site contaminants of concern that are studied to assess effects of site contamination on flora and fauna. A list of these compounds is compiled based on a review of soil, sediment, ground water, surface water, and air test data relative to Applicable or Relevant and Appropriate Requirements (ARAR) and ambient water quality criteria. Detailed methodology for comparison is

presented in the EPA Risk Assessment Guidance Manual (U.S. Environmental Protection Agency, 1989c).

6.5.2.2 **Field Sampling Plan Development.** There are two primary steps required when developing a field sampling plan.

First, background data are reviewed to understand physical/chemical properties of target compounds and their migration routes (e.g., air, water). Existing studies relative to biological/ecological surveys of the immediate vicinity of the study area are examined to evaluate permissible collection techniques for flora and fauna.

The second step consists of a preliminary field survey by qualified biologists or similar individuals to collect preliminary data regarding flora and fauna in the study area. This information is obtained by mapping vegetation, animals observed, tracks, burrows, and aquatic habitats. Photographic documentation shall be compiled to support survey findings.

Information gained during these two steps allows identification of specific issues of concern and establishment of project goals. Now the plan can be written to provide guidance for accomplishing the project using the best methodologies to achieve established goals.

6.5.2.3 **Field Sampling Procedures.** FEMP and the surrounding area consist of terrestrial and aquatic habitats. Numerous field methods exist for collecting and assessing effects of contamination on flora and fauna within these habitats and vary widely depending upon the study purpose. For example, stressed vegetation can be assessed using color infrared aerial photography for a broad analysis or by physical collection and observation of vegetation for a more localized scale. Consequently specific methodologies will be addressed in the plan. Procedures for sample processing and handling will also be described in the plan.

6.5.2.4 **Laboratory Testing.** Two types of testing are commonly used to evaluate the effects of hazardous substances on flora and fauna: bioassay (or toxicity tests) and analytical laboratory chemical tests.

In general, bioassay tests consist of using living organisms and subjecting them to site-specific chemical conditions (e.g., waste water) to compare before and after conditions. Analytical laboratory chemical tests consist of analyzing plant or animal tissue for target compounds. Procedures for tissue analysis, for the most part, shall be adapted from current EPA procedures for examination of solid waste.

Neither bioassay or analytical laboratory chemical test methods for biological samples are approved by the EPA. Test methodologies will be specified in project-specific plans.

6.6 MISCELLANEOUS SAMPLES

A variety of media samples are collected at FEMP to characterize radiological, chemical, and metal contaminants to determine handling and disposal requirements. Samples are non-biased and collection processes are similar for each ASL A through E. Other sampling conducted for health and safety monitoring and personnel exposure calculations are covered in detail in health and safety plans and procedures and are not discussed in detail here.

6.6.1 Sample Requests and Collection Requirements

Sampling operations of on-site media (soil, water, sediment, construction rubble, waste streams) shall be performed based on a written request for media sampling from responsible project managers, engineers, and supervisory personnel to the appropriate sample collection organization. The request for media sampling is usually generated as a result of the following types of activities.

- Pre-/post-construction and demolition projects
- Remedial activities
- Characterization of on-site programs
- Renovation projects
- Site emergency response activities
- Support of site regulatory programs
- Support of site remediation programs
- On-site routine environmental media sampling
- RCRA characterization of drummed wastes

The sample request shall contain, as a minimum, the following information.

- Project name
- Requestor's name
- Purpose (objective) of sampling
- Media type

- Sample locations and justification for selected locations
- Regulatory drivers
- Analytical parameters
- Requested completion date
- Notifications required
- Analytical support level
- Appropriate approvals

Based on project knowledge and regulatory guidance, specific parameters for analysis shall be determined.

Media samples shall be collected at sample point locations identified in project-specific plans. Each sample shall be placed in appropriate sample containers as identified in project-specific plans and labeled as specified in Section 7.

6.6.2 Sample Collection Requirements

Methodologies used to collect solid debris samples from construction, renovation, and demolition (paint chip, wood, concrete, and dust) for radiological and chemical analyses are provided in Appendix K.

6.6.3 Asbestos-Containing Building Materials

The majority of FEMP buildings were constructed prior to 1970 when Asbestos-Containing Building Materials (ACBM) were commonly used in the contruction industry. Asbestos was used for items such as pipe insulation, duct work, and outer building coverings. Prior to remodeling, renovation, and demolition, samples of potential ACBM shall be collected. Results will be used to determine if ACBM is present, whether ACBM will be removed or fixed in place, health and safety requirements, and disposal and handling requirements.

6.6.4 Worker Protection and Area Classification

The following paragraphs are for information only. Data gathered from the samples discussed are for personnel monitoring. Samples are obtained in accordance with written procedures and access is controlled as appropriate.

6.6.4.1 Personal Radiological Contamination Survey. Radiological contamination surveys at FEMP are conducted to determine personnel protection requirements in accordance with DOE Order 5480.11. The regulatory driver or other reason for sampling and knowledge of types of radiation emitted by contaminants most likely to be encountered shall be considered when scoping radiological contaminant surveys. Material and equipment shall be capable of providing the type and quality of data required to fulfill DQOs.

Personnel radiological contamination surveys are generally self surveys. Instruments and extent of the survey depend on monitoring location and type of contaminant most likely to be present. Personnel radiological contamination surveys include frisking with hand-held instruments and monitoring with automated equipment. Data are recorded only when contamination is found or when personnel injury is involved.

A frisking survey is used when contamination limits of interest are readily detected by available instruments. Depending on the situation, personnel are required to survey either their hands and feet or their whole body. These requirements are spelled out in applicable site procedures.

Methods for use of automated contamination monitoring equipment are dependent on the type of instrument. Actual usage instructions are described in applicable procedures and taught in FEMP radiation worker training. This type of instrumentation is configured to automatically alarm at contamination exceeding administrative levels.

6.6.4.2 Radiation Survey Techniques. Radiation surveys measure intensity and type of radiation field emitted from radioactive material. These surveys differ from radioactive contamination surveys in that dose or exposure rates in area of interest are measured rather than amount of radioactive material present. This information is used to determine worker safety requirements, shielding requirements, area classification, and radioactive shipment classification. Area radiation surveys are performed with portable instruments and stationary detectors.

Information required prior to performing radiation surveys is similar to that required for radiological contaminant surveys and includès a regulatory driver or other reason for the survey and knowledge of contaminants most likely to be present.

Stationary area radiation detectors are used to detect relatively high radiation fields and serve to indicate possible criticality accidents. These instruments are maintained as specified by FEMP procedures and are not expected to generate data for the FEMP CERCLA program.

The internal dosimetry program has been developed to comply with requirements of DOE Order 5480.11. Results of the internal dosimetry are not expected to be used to support ROD. Basic requirements for these programs are included for information purposes only. Additional details may be obtained upon request to DOE FO.

Any worker who has the potential of receiving an internal exposure of 100 mrem Annual Effective Dose Equivalent (AEDE) shall be monitored for internal contamination. Monitoring methods used to evaluate internal exposure are designed for each potential exposure condition and may include urine sampling, in vivo measurements, and/or fecal sampling.

The FEMP prime contractor is currently responsible for administering the internal dosimetry program. Detailed program procedures are documented in Standard Operating Procedures (SOP). A brief description of these procedures follows.

- Routine Urinalysis - The routine urinalysis program is the largest part of the internal dosimetry program and includes workers with a potential for receiving greater than 100 mrem AEDE from exposure to compounds of uranium. Workers submit monthly urine samples for analysis at the FEMP bioassay laboratory, which uses a fluorometric fusion technique. Assuming a worker is exposed to two percent enriched Class W uranium, a detection limit for uranium of 0.005 mg/L allows assessment of doses less than 100 mrem AEDE. In addition to monthly samples, workers are required to submit baseline, incident, annual, and termination urine samples.

- In Vivo Monitoring - A routine in vivo monitoring program has been implemented for radiation workers. A worker who possesses a ThermoLuminescent Dosimeter (TLD) is scheduled for an annual in vivo examination designed to detect uranium or thorium deposited in the lungs. The detection limit for the lung exam is dependent upon the individual's anthropometric characteristics, which, for an average sized person at the 95 percent confidence interval for a 1200-second exam, is approximately 2.5 nanocuries (nCi) for U-238, 0.18 nCi for U-235, and 1.0 nCi for Th-232. In addition to the annual exam, radiation workers undergo an in vivo exam when hired and upon termination.

- Special Internal Dosimetry Programs - Special monitoring programs are developed on a case-by-case basis and are included in project-specific procedures and Health and Safety plans. Examples of special monitoring projects are the K-65 silo sampling and the thorium overpack projects.

  The frequency and extent of special sampling are determined based on available data from expected source term and potential for exposure to the workers involved in an operation. When mixtures of radionuclides are present, the dose from all radionuclides in the mixture as well as daughter-product activity are considered. The required detection limit for a particular analysis is calculated based on these considerations.

External dosimetry programs are in place to monitor environmental and external personnel radiation exposure. Whole-body and individual organ exposures to beta and gamma radiation are calculated based on dosimetry results. TLDs are used to measure whole-body, extremity,

and environmental exposures. Self-Reading Pocket Dosimeters (SRPD) are used to monitor worker exposure on a real-time basis. The external dosimetry program is currently run by the prime contractor at FEMP. SOPs for specific parts of the program are available upon request from DOE.

- Thermoluminescent Dosimeters - TLDs may be used to monitor whole-body and environmental exposures or may be extremity TLDs, such as ring badges to monitor exposure to the most exposed body part. TLD badges can be used to differentiate between the types and amounts of radiation to which they were exposed and also to determine whether the badge was exposed to a criticality event. Following are basic requirements for TLD use at FEMP.

  - Personnel entering a radiologically controlled area at FEMP shall wear a personal TLD.

  - Additional personal TLD use may be required by the Radiological Safety Group for purposes such as job-dose tracking.

  - Extremity TLDs capable of detecting exposures greater than 30 mrem may be required by radiological safety when a dose to the extremities is a prime concern.

  - Whole body TLDs shall be capable of detecting exposures greater than five mrem.

- Self-Reading Pocket Dosimeters - SRPDs continuously monitor exposures on a real-time basis. They are specified when work is conducted in areas where the possibility of acquiring a large dose in a short period of time exists. SRPDs shall be zeroed before each use and shall be capable of detecting doses to $\pm$ 10 percent of actual value.

6.6.4.3 Medical Services. The Medical Service Department provides services to plant personnel that include, but are not limited to, entry, annual and special assessments, emergency medical services, drug screening (Westinghouse and Department of Energy), and medical surveillance.

The department is staffed by trained professionals and equipped to handle daily activities and critical medical emergencies. Except for drug screening, human specimens (blood, urine and fecal) are analyzed on-site. Rarely are human specimens sent to an off-site laboratory; but, if this is necessary, the specimens are packaged, marked, and shipped according to applicable laboratory and U.S. postal requirements.

As specified by the National Institute on Drug Abuse (NIDA), drug screening specimens are handled in accordance with strict chain-of-custody protocols. The NIDA-approved laboratory is responsible for specimen pick-up and disposal.

Human specimens are handled, stored, transported and disposed of in such a manner as to protect specimen integrity, medical care workers, and the general public and in accordance with Federal, State, and local laws. Standard operating procedures are maintained in the Medical Department to provide guidance to personnel on specimen handling.

6.7 FIELD STORAGE AND SHIPMENT OF SAMPLES

Samples collected in response to the various programs onsite shall be classified by personnel identified in the project-specific plan prior to shipment as either environmental or hazardous substances samples. In general, environmental samples include the following.

- Drinking water
- Natural waters
- Sediment
- Background/control soils
- Treated municipal and industrial waste-water effluent
- Biological specimens or samples not expected to be contaminated with high levels of hazardous materials.

Shipment of samples designated as environmental samples are not regulated by the U. S. Department of Transportation (DOT). However, these samples shall be transported in a manner to preserve their integrity; and, if there is any doubt as to the sample classification, it is considered a hazardous substance and shipped accordingly.

DOT has regulatory responsibility for the safety of hazardous materials transported offsite by any means. Regulations for packaging, marking, labeling, and shipping of hazardous substances are promulgated by DOT and described in 49 CFR 171 through 177.

RadioActive Materials (RAM) samples are, by definition, hazardous and are subject to specific stringent regulations governing their transportation. RAM transportation is regulated by DOT under the Transportation Safety Act of 1974.

Samples collected from process waste-water streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may need to be shipped as hazardous material.

The Nuclear Regulatory Commission (NRC) is responsible for governing transportation of RAM. Specifically included in NRC responsibilities is approval of certain types of packages (type B and fissile). DOE Orders require shipment compliance with applicable DOT and NRC rules or provision of equivalent safety to the public.

Chain-of-custody requirements are discussed in Section 7.

6.7.1 Field Storage

In the field, samples shall be kept cool and away from direct sunlight. As soon as samples requiring refrigeration are collected, filtered as necessary, and preserved, they shall be stored in chests packed with artificial icing material to maintain a temperature range of two to six degrees Centigrade. Field personnel are responsible for ensuring that sample container lids are secure before storing them in the ice chest. Samples are promptly shipped to the laboratory in accordance with chain-of-custody requirements in Section 7 so that holding times are not exceeded. Samples shipped off site shall be shipped to ensure that laboratory receipt is within 24 hours of time of shipment.

Samples are transported, not only in a manner designed to protect the integrity of the sample, but also to prevent detrimental effects from the potentially hazardous nature of the samples. Sample containers and shipping containers shall be custody sealed as specified in Section 7.

Special precautions, procedures, and secondary containment areas within laboratories are necessary when samples classified other than environmental are received. If there is any doubt as to the classification of a sample, it is considered hazardous and handled and shipped accordingly.

6.7.2 Sample Container Preparation

Sample bottles may be purchased pre-cleaned in accordance with EPA specifications with appropriate supplier documentation. VOA vials are purchased pre-cleaned.

Glass containers for other organic analyses may be purchased pre-cleaned or washed in a controlled environment with a nonphosphate detergent, rinsed with tap water, rinsed with methanol, rinsed with de-ionized water, and allowed to air dry.

Plastic containers for metals analyses are washed with a nonphosphate detergent, rinsed with tap water and de-ionized water, and then rinsed with dilute nitric acid. Plastic containers for other general chemistry and radiological procedures are washed with a nonphosphate

detergent and rinsed with tap water and de-ionized water. Container blanks shall be run on containers as specified in Section 4.

Sample bottles are prepared in the sample coordination area with premeasured amounts of appropriate chemical preservatives if requested and shipped to the field.

6.7.3 Sample Preservation

Methods of preservation are relatively limited and intended to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing. Some samples collected to support treatability analyses may require special on-site storage conditions (e.g., non-freezing, special refrigeration.

Recommended preservatives for various constituents are given in Appendix K. These choices are based on the accompanying references and on information supplied by various quality assurance coordinators. As more data become available, recommended holding times will be adjusted to reflect the new information.

Samples shipped by common carrier or through the United States Postal Service shall be in compliance with DOT Hazardous Materials Regulations [49 CFR 172 (1991)]. The person sending such material is responsible for ensuring this compliance.

The Office of Hazardous Materials, Materials Transportation Bureau, DOT, has determined that hazardous materials regulations do not apply to sample preservatives that do not exceed the following concentrations (U.S. Environmental Protection Agency, 1986b).

- HCl in water solutions at concentrations of 0.4 percent by weight or less
- $HgCl_2$ in water solutions at concentrations of .0004 percent by weight or less (pH about 1.96 or greater)
- HNO_3 in water solutions at concentrations of 0.15 percent by weight or less (pH about 1.62 or greater)
- H_2SO_4 in water solutions at concentrations of 0.35 percent by weight or less (pH about 1.15 or greater)
- NaOH in water solutions at concentrations of 0.080 percent by weight or less (pH about 12.30 or greater)
- H_3PO_4 in water solutions at concentrations yielding a pH range between 2 and 4

6.7.4 Sample Classification

6.7.4.1 <u>RCRA and CERCLA Initial Sampling Programs</u>. RCRA and CERCLA programs that require initial sampling of unknown substances specify that samples be shipped in accordance with hazardous materials regulations if process knowledge suggests presence of a substance classified as hazardous.

If process knowledge does not indicate presence of a hazardous substance or if initial tests are for spectrum testing for hazard identification, the samples may be shipped as environmental samples.

6.7.4.2 <u>Routine Sampling</u>. For programs that require routine sampling, a comparison of past test results are made to the requirements of 49 CFR (1991) to establish the sample classification as environmental or hazardous for shipping purposes.

6.7.4.3 <u>Classification of Samples as Hazardous or Non-Hazardous Substances</u>. Process knowledge, previous sampling results, and field test (i.e., pH) results are used to decide whether a sample should be handled as an environmental or hazardous substance. If it is decided that the sample can be classified as environmental or, if it meets the "reportable quantity" or the "exception for small quantities" definitions [49 CFR 173 (1991)] definition, the samples may be shipped in accordance with the FSP for sample integrity and chain-of-custody requirements. However, if it is decided that the sample may contain radionuclides, it must be transported as specified in para. 6.7.8.

Detailed requirements for handling, packaging, labeling, and transportation of samples are provided in the program-specific FSP.

6.7.5 Environmental Samples

Samples collected and designated as environmental samples as specified in the FSP shall be shipped to maintain sample integrity and chain-of-custody requirements. However, if a hazardous material preservative is added to a sample, the amount of preservative shall not exceed the limit specified in Appendix K. If it does, the sample must be reclassified as a hazardous material under US/DOT Hazardous Materials Tables, 49 CFR 172 (1991), and the sample must be shipped accordingly as a corrosive substance.

Shipment of nitric acid is forbidden on passenger aircraft unless packaged in accordance with 49 CFR 173 (1991).

When samples are dispatched to the laboratory for analysis, separate chain-of-custody and request-for-analysis records shall accompany each set of samples. Procedures for processing sample sets for shipment are provided in Appendix K.

6.7.6 Hazardous Substance Samples

6.7.6.1 Known, Suspected, or Routine Hazardous Substance Samples. If a sample contains a known or a suspected substance listed in the Hazardous Materials Table [49 CFR 172 (1991)] or meets the definition of a hazardous substance but not the exceptions for small quantities criteria, the sample shall be handled, packaged, marked and labeled, and shipped as specified for that material. A hazardous substance, for shipping purposes, is a material, including its mixtures and solutions, that meets the following criteria.

- Listed in appendix to 49 CFR 172 (1991)
- Exhibits hazardous characteristics (e.g., flash point)
- In a quantity in one package that equals or exceeds the reportable quantity listed in appendix to 49 CFR 172 (1991)

This definition does not apply to petroleum products that are lubricants or fuels.

6.7.6.2 Exceptions-for-Small-Quantities Criteria. The criteria for this substance category covers flammable liquids; flammable solids; oxidizers; organic peroxides; corrosive materials; poison B and ORM A, B, C; and radioactive materials that are normally classified as hazardous. However, if they are present in known or suspected quantities that are less than the following limits, a hazardous classification is not required, and they are not subject to the requirements of 49 CFR 173 (1991). However the substance-specific guidelines of 49 CFR 173 (1991) do apply. Maximum limits for inner receptacle quantities to meet exceptions-for-small-quantities critera are as follows.

- Thirty milliliters for liquids other than poisons
- Thirty grams for solids other than poisons
- One gram for materials classed poison B or subject to poison-inhalation-hazard criteria for shipping documents as described in 49 CFR 172 (1991)
- Activity level less than that specified in 49 CFR 173 (1991) as appropriate for packages containing radioactive material

6.7.6.3 Exemptions for Treatability Studies. If an off-site treatability study is planned, the Federal Treatability Study Sample Exception Rule (40 CFR 261) shall be used to collect,

store, and transport samples to an off-site laboratory or testing facility provided that the following conditions exist.

- The generator or sample collector uses no more than 1000 kg of any nonacute hazardous waste; 1 kg of acute hazardous waste; or 250 kg of soils, water, or debris contaminated with acute hazardous waste per waste stream per treatment process. However if additional sample is required, the regional administrator or state director may, on a case-by-case basis, grant requests for waste stream limits up to an additional 500 kg of nonacute hazardous waste; 1 kg of acute hazardous waste; and 250 kg of soils, water, or debris contaminated with acute hazardous waste.

- The quantity of each sample shipment does not exceed these quantity limitations.

- The sample is packaged so that it will not leak, spill, or vaporize from its packaging during shipment, and the transportation of each sample shipment complies with regulations for shipping hazardous material as specified in Appendix K.

- The sample is shipped to a laboratory or testing facility that is exempt under 40 CFR 261 or that has an appropriate RCRA permit or interim status.

- The generator or sample collector maintains copies of shipping documents, the contract with the facility conducting the treatability study, and records showing compliance with shipping limits for three years after completion of the treatability study.

- The generator provides the above documentation in its biennial report.

The Federal Treatability Study Sample Exemption Rule is only applicable in states that do not have final authorization (i.e., USEPA authorization to manage NPL Sites) or in authorized states that have revised their program to adopt the equivalent regulations under state law. Thus, the states through which these materials pass and the location of the off-site treatability laboratory or testing-facility need to be evaluated relative to the regulations prior to selection/implementation of the study (U.S. Environmental Protection Agency, 1989d).

6.7.7 Packing and Transporting Hazardous Waste Samples

Procedures for handling, packaging, labeling, and shipping hazardous substance samples are provided in Appendix K.

6.7.8 Radioactive Samples

6.7.8.1 <u>Screening Samples for Total Radioactivity</u>. Laboratories shall be licensed to handle radioactive samples. Licensing requirements may be based on the total mass or

activity of specific radioactive isotopes or on activity by type of radiation. Possession of appropriate valid licenses is a requirement of the FEMP laboratory approval process.

Samples suspected of containing radioactive materials shall be screened prior to being accepted for analysis at an off-site laboratory. Samples that contain radioactivity that exceed the limits of a laboratory license shall not be accepted. Screening may be conducted at the off-site laboratory, meeting the reuirements of the specific laboratory license, or may be conducted at the FEMP analytical laboratory prior to shipment using the method for radiometric screening to determining total radioactivity in various matrices (Appendix K).

6.7.8.2 **Transporting Radioactive Samples.** In general, most samples collected at FEMP are classified as radioactive for transport purposes. Certain samples may fall into categories for which special packaging and shipping restrictions are mandated.

Regulations impose limits on the total radioactivity (i.e., specific activity times the weight of the package) contained within a package of radioactive material. With respect to type A packages, the limits are expressed as two quantities, A1 and A2, which refer to the maximum permissible activity for radionuclides in special form and normal form radioactive materials, respectively. The samples from FEMP fall into the latter category so the A2 value sets the activity limits for packages of samples. In those cases where contaminated material shipments are designated "Low Specific Activity" (LSA) or "limited quantity," some fraction of the A2 value will normally apply.

Appendix K provides A1 and A2 values cited in 49 CFR 173 (1991) for radionuclides of the uranium decay series. Values for radionuclides not listed in the regulations (e.g., lead-214, bismuth-214, polonium-214) have been assigned in accordance with specifications in 49 CFR 173 (1991).

Determination of permissible quantities for samples of contaminated waste from FEMP is more complicated than simple reference to the A2 values because such material contains a mixture of radionuclides. For such mixtures, two rules apply. A mixture of radionuclides from a single decay chain is considered to be a single radionuclide if the following criteria apply: (1) the parent and daughters are present in their naturally occurring proportions (e.g., in secular equilibrium), (2) no daughter has a half-life longer than 10 days, and (3) no daughter has a half-life longer than the parent radionuclide. For such a mixture, the A2 quantity to be applied is that of the parent radionuclide [49 CFR 173 (1991)].

For those mixtures in which the identity and activity of radionuclides is known, the permissible quantity for each radionuclide must be such that the following equation is true.

$$F_1 + F_2 + \ldots + F_k \ldots F_n \leq 1$$

Where F_k is the ratio of the total activity of the kth radionuclide to its A1 or A2 quantity [49 CFR 173 (1991)].

6.7.9 Low-Specific-Activity Materials

LSA materials include uranium and thorium ores, physical and chemical concentrates of these ores (e.g., yellow cake), unradiated natural or depleted uranium or thorium, nonradioactive material externally contaminated with radioactivity that is not readily dispersible, and material in which the radioactivity is essentially uniformly distributed and does not exceed certain prescribed concentration limits. These limits for radionuclides of the uranium decay series, beginning with thorium-230, are provided in Appendix K. In general, these concentrations will not be exceeded in FEMP samples.

Details for shipping LSA materials are described in 49 CFR 173 (1991). The chief advantage of shipping under the LSA category arises when the shipment is consigned "Exclusive Use," that is, under the supervision or direction of a single consignor from point of origin to final destination [49 CFR 173 (1991)]. When packaged shipments of LSA materials are consigned as "Exclusive Use", the shipment is exempt from specification packaging, labeling, and marking. Requirements for these shipments are provided in Appendix K.

6.7.10 Limited Quantities of Radioactive Material

Limited quantity shipments of radioactive material shall meet requirements specified in 49 CFR 173 (1991). If activity per package does not exceed 10^{-3} A2 quantity of the radionuclide, it shall be exempt from specification packaging and from the associated shipping paper, marking, and labeling requirements. Requirements that apply are listed in Appendix K.

6.7.11 General Requirements for Packaging Radioactive Materials

The type of packaging for a radioactive material shipment depends upon general and specific requirements for the shipping category (type A or type B) in 49 CFR 173 (1991). Unless otherwise specified, shipments of radioactive materials shall comply with requirements listed in Appendix K for types A and B packages.

6.7.12 Marking and Labeling Radioactive Samples

Requirements for marking and labelling packages containing radioactive material are provided in Appendix K.

General requirements for shipping documentation and radioactive requirements for shipping papers are specified in 49 CFR 172 (1991). Appendix K lists these requirements.

6.7.13 Radiation and Contamination Control

Measurements of radiation level (dose rate) and of nonfixed (removable) radioactive contamination shall be conducted on radioactive-material shipments to control exposure to radioactivity. The radiation level is the radiation-dose-equivalent rate expressed in millirem per hour (mrem/h) as specified in 49 CFR 173 (1991). Appendix K provides permissible radiation levels for the shipping categories of limited quantity packages, LSA packages, and other packages.

Maximum permissible limits for removable radioactive contamination allowed on a package are specified in 49 CFR 173 (1991) and are summarized in Appendix K.

6.7.14 Transportation of Samples on Public Highways

FEMP contractors and subcontractors that transport samples classified as a hazardous substance over public highways shall comply with applicable Federal and State of Ohio regulations pertaining to transportation of hazardous materials. The only exception to this requirement is if a shipment of radioactive materials is made under DOE auspices and is escorted by personnel specially designated by or under the authority of DOE for the purpose of national security and is exempt from the regulations in 49 CFR 170 through 189 (1991).

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Section 7

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Section 7

SAMPLE CUSTODY

Sample custody procedures and documentation at FEMP are conducted in accordance with guidance presented in the EPA Region V Model Superfund Quality Assurance Project Plan (U.S. Environmental Protection Agency, 1991). It is the stated EPA Region V Policy to follow the EPA Region V sample custody or chain of custody protocols described in "NEIC Policies and Procedures", EPA-330/9-78-DDI-R, Revised June 1985. Custody requirements are addressed in three parts: sample custody and handling in the field, custody during laboratory receipt and analysis, and evidence files.

A sample or evidence file is considered in the custody of a person if one of the following are met.

- the person has physical possession of the sample or file
- the sample or file is in view of the person, after being in possession
- the sample or file is placed in a secured location by the custody holder
- the sample or file is in a designated secure area.

Environmental samples at Analytical Support Levels (ASL) C and D require complete chain-of-custody documentation. ASLs B and E samples shipped to off-site facilities also require complete chain-of-custody documentation. ASLs B and E analyses performed at FEMP require the completion of field documentation, and transfer and laboratory documentation as appropriate.

Sample packaging and shipment requirements are summarized in Section 6. Fulfilling those requirements in addition to the custody requirements in this section provides documentation of sample custody from the time of sample collection to final disposition.

7.1 FIELD PROCEDURES

The FEMP project manager is responsible for implementation of sample custody procedures. The designated FEMP quality assurance project organization is responsible for verifying that sample custody procedures are implemented and followed.

The leader of a sampling team is personally responsible for care and custody of samples collected until they are transferred to a transporter or an analytical or processing facility. The number of persons having sample custody should be minimized as much as possible.

Sample containers shall be labeled with a sample number corresponding to a known location and event as specified in para. 7.1.3. Sample tags or labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions.

Sample tags and labels shall be in two identical parts. After the sample has been collected and label information has been completed, one part of the label shall be removed from the container and placed in project files.

The FEMP project manager or designee will review all activities to determine whether proper custody procedures were followed and decide if additional samples are required.

7.1.1 Sample Tracking and Control Documentation

Sample custody shall be documented from time of collection through analysis and, if analyzed at an off-site laboratory, the final disposition of the sample shall be documented. The following records shall be maintained in the chain-of-custody process for sample tracking and control.

- Field log (bound book) with sequentially numbered pages or sequentially printed and numbered daily field activity log forms
- Sample identification and labeling
- Sample chain-of-custody record, including a record of all custody transfers
- Laboratory request for analysis

The first two items shall be completed for all samples regardless of ASL. The last two items are required for all samples shipped offsite, or for samples analyzed onsite by a party other than the sample collector. The sample chain-of-custody record and laboratory request for analysis may be consolidated into one form or separate forms may be used as long as required information is available.

7.1.2 Daily Logs

Field log or daily activity field log forms will provide the means of recording data collecting activities performed. As such, entries shall describe activities sufficiently so that the sampling team could re-construct a particular situation without reliance on memory.

Field logbooks shall be bound, field survey books or notebooks with sequentially numbered pages, preferably with water-resistant paper (standard engineering field book). Logbooks will be assigned to field personnel, but will be stored in a secure area when not in use. Each log shall be uniquely identified by a program/project-specific control number with pages sequentially numbered.

Use of daily log forms was approved by EPA for the Remedial Investigation/Feasibility Study (RI/FS) program (U.S. Department of Energy, 1988), and similar forms are used by various other programs at FEMP. Each form shall be sequentially printed and numbered and logged into the data management system (Appendix F). Requirements for daily log entries at FEMP are provided in Section 5.

7.1.3 Sample Identification and Labeling

Samples shall be adequately marked for identification from the time of collection and packaging through final disposition. Marking is generally on a tag or label attached to the sample container (jar, bottle) but the sample may be directly labelled, if applicable. Sample identification shall include the following information as applicable.

- Project identifier
- Sample number
- Date and time of sample collection
- Sample type (e.g., ground water, surface water, soil, sediment)
- Parameters to be analyzed
- Initials of individuals collecting sample
- Sample preservative, if used

An established sample numbering system shall be used for identifying samples according to project, location, and type. Each environmental media sampling point shall be identified using the state planar coordinate system. Numbering systems shall be consistent with the RI/FS Sampling Plan, Volume 1, Introduction (U.S. Department of Energy, 1988), or as specified in project-specific plans or in established routine sampling program procedures.

7.1.4 Request for Analysis

A request for analysis (as defined in project-specific plans) shall be prepared to indicate the testing or analyses program required for the collected samples. Requests for analysis shall

be confirmed prior to sample collection. The request for analysis shall be hand-carried or telefaxed to a FEMP approved analytical laboratory (Appendix H) prior to sample collection for information on required laboratory capacity needs. The laboratory project manager or representative shall sign the copy and transmit it by telefax to the FEMP contact, committing laboratory resources to proper, on-time completion of requested analyses. Failure of the laboratory project manager to respond within one working day shall be interpreted as a lack of capacity, and other arrangements shall be made for sample analysis. Other properly documented communications with subcontractor laboratory personnel may substitute for this procedure if defined in a project-specific plan.

When the laboratory initially contacted cannot perform the analysis, an alternate FEMP-audited and approved subcontractor laboratory shall be chosen by the FEMP contact. The request-for-analysis process shall be repeated. Implementation of this process eliminates capacity problems and excessive sample turnaround times with subcontractor laboratories. Record the following information from the request-for-analysis process.

- Project name and number
- Number of samples
- Date samples shipped
- Required report date and turnaround times for testing or analysis
- Contact (with telephone number) for receipt of analytical report and invoices
- Sample identification numbers
- Sample media
- Sample volume collected and preservatives used
- Types of analyses required

Information on the request for analysis shall be consistent with that on sample labels and chain-of-custody records. When a discrepancy exists, the laboratory project manager or representative shall notify the FEMP project contact immediately. The written discrepancy resolution shall be transmitted from the FEMP project contact to the laboratory within one working day of notification by the laboratory.

7.1.5 Chain-of-Custody Record

The chain-of custody record includes all documentation used to establish the location and custodian of a sample at any time from collection through final disposition.

Samples for which custody is transferred shall be accompanied by a completed chain-of-custody form, which may include carrier waybills and internal laboratory custody forms. The sample shall be identified by number on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples.

A chain-of-custody record shall be initiated in the field and accompany each group of samples through shipment to the laboratory. Every sample container in a shipment shall be identifiable on accompanying chain-of-custody record. Each time custody changes, the new custodian shall immediately sign the record and indicate date and time of transfer. The chain-of-custody record shall include the following information.

- Sample number
- Sampling location
- Type and amount of samples collected
- Date and time of sample collection
- Description of containers used
- Names of persons responsible for sample collection
- Date and time of custody transfers
- Name of analytical laboratory
- Number of applicable request for analysis
- Signatures of persons relinquishing and accepting sample custody
- Sample condition on receipt at laboratory
- Final disposition of samples
- Other information deemed essential to ensure complete documentation of sample custody and control.

When samples are personally transported to the laboratory, the original chain-of-custody record is kept by the person delivering the samples and relinquished upon sample acceptance by the laboratory. Samples and accompanying documentation shall be verified complete before the laboratory acceptance of sample custody from the sampling team.

Samples shipped off-site shall be properly packaged for shipment (Section 6) and dispatched to appropriate laboratory for analysis, with a separate signed custody record enclosed in a watertight container (e.g. a zipperlock plastic bag) in each sample shipment. Shipping containers shall be secured with strapping tape and/or FEMP custody seals and locked if appropriate. In this way, access to the container can be gained only by breaking the seal.

If samples are sent by common carrier, a bill of lading (waybill) should be used. Receipts of bills of lading shall be retained as part of permanent documentation. If sent by mail, package shall be certified with a return receipt requested indicating who may accept the receipt and that person's location. Commercial carriers are not required to sign custody form as long as forms are sealed inside the sample container and the custody seals remain intact. The person relinquishing custody shall document this by signing and dating the form prior to sealing it in the container. Documents such as chain-of-custody transfer records and commercial carrier waybills are considered part of the chain-of-custody record. Copies of the waybill are filed with copies of the chain-of-custody record as part of the record.

Laboratory sample receipt procedures are discussed in para. 7.2.1.

Copies of chain-of-custody records shall be maintained by the laboratory in the project file. Working project files shall meet the requirements described in Section 4 or outlined in project-specific plans.

Chain-of-custody records are signed by a designated representative of the laboratory and the signed original FEMP chain-of-custody records are submitted to the FEMP project contact upon final sample disposal or return of samples to FEMP.

7.2 ANALYTICAL LABORATORY

7.2.1 Laboratory Sample Receipt

Within eight hours of sample receipt by a laboratory, the laboratory project manager or representative shall examine the shipment as follows.

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NOTE

The laboratory project manager or representative shall notify the FEMP project contact or representative by telephone immediately and within twenty-four hours in writing (by telefax if necessary) of discrepancies noted during sample receipt. The laboratory project manager may telefax the chain-of-custody record with the problem indicated on it. The FEMP contact shall advise laboratory of disposition to be made of samples within twenty-four hours of notification by telephone or telefax followed in writing. A deviation report shall be required for these discrepancies and observations as specified in Section 15.

1. Examine custody seals of shipping containers for breakage and tampering. Open shipping containers and examine custody seals on sample containers. Record condition of custody seals on chain-of-custody record or program equivalent.

NOTE

If sample containers arrive with an incorrect chain-of-custody record, proceed as specified in step 10. If there is no chain-of-custody record, proceed as specified in step 11.

2. Measure temperature of shipping containers containing samples requiring refrigeration with a calibrated, standard laboratory thermometer and record temperature on the chain-of-custody record. Document samples that are outside the temperature range of two to six degrees Centigrade on chain-of-custody records and notify FEMP project contact. Store samples until directions for disposition are received.

3. When a sample is removed from the shipping container, check sample identification on sample container against that listed on chain-of-custody record and request for analysis. When discrepancies exist, record that on chain-of-custody record and sign and date the notation. Notify FEMP project contact immediately, and store sample until a resolution is received from FEMP project contact.

NOTE

Numbers shall be assigned sequentially as samples are coded in.

4. Assign a unique laboratory tracking number to each sample and affix a label with the number onto each sample container if the FEMP sample number is not used for internal laboratory tracking purposes. Log sample receipt information, including

holding times, test assignments, and anticipated reporting date, into laboratory information management system. If sample holding time has been exceeded or cannot be met, notify FEMP project contact.

5. Process samples through laboratory for analysis based upon designated priorities.

6. Sign and date chain-of-custody record and attach waybill to it. Verify waybill number against that on chain-of-custody record.

7. If the chain-of-custody record does not arrive with the laboratory shipment, notify FEMP project contact, and store samples until a resolution is received.

8. Store samples as required in laboratory facility.

9. Enter samples in laboratory tracking system with the following information.

   - Project identification number
   - Sample numbers
   - Type of samples
   - Date received in the laboratory

10. If samples arrive with an incorrect chain-of-custody record, proceed as follows.

    a. If the chain-of-custody record is incomplete or incorrect, contact FEMP contact by telephone or telefax and explain the discrepancies followed by written documentation to be included in program/project file.

NOTE

Documentation of the discrepancy and its resolution by FEMP manager along with appropriate signatures shall be amendments to the chain-of-custody record.

    b. If information on the chain-of-custody record cannot be corrected by the FEMP project contact or by field personnel, remove samples from the analysis program.

11. Notify laboratory manager or group leaders of sample arrival.

NOTE

A copy of the chain-of-custody record shall be submitted to analyzing laboratory and maintained in project files. Another copy of the chain-of-custody record shall be maintained in FEMP project files. The original chain-of-custody form shall be returned to FEMP after samples have been consumed or disposed of by the laboratory or returned to FEMP with samples.

12. Compare contents of shipping containers to samples documented on chain-of-custody record. When there is a commercial carrier waybill number, verify with the FEMP contact that the number is identical to that recorded on the field custodian's copy of the chain-of-custody record. Indicate discrepancies on record and notify the FEMP project contact.

13. Record damage to samples on chain-of-custody record and set samples aside. Maintain preservation requirements if possible. Notify the FEMP contact with an estimate of the damage and the cause. Determine whether damaged samples can be used based on their intended purpose (DQO). Store the samples until disposition notice is received from FEMP contact.

7.2.2 Storage

Samples shall be stored as prescribed by applicable regulatory and/or method requirements. Samples requiring refrigeration shall be stored in secured, temperature-monitored refrigerators monitored by designated sample custodians. Internal chain-of-custody forms shall be generated for internal control, which shall be signed and dated upon relinquishing the sample to storage.

7.2.3 Initiation of Testing Program

As stated in para. 7.1.4, a request for analysis shall be submitted prior to sampling and a duplicate sent with samples when they are shipped to the laboratory. When the request for analysis is not sent with the sample shipment, sample management personnel shall immediately notify the responsible FEMP project contact for definition of the analysis program.

The laboratory manager and assigned personnel are responsible for assigning priorities to samples to ensure that holding times are not exceeded during the time needed to process the samples through the laboratory work stream.

7.2.4 Sample Disposal

Because of liabilities that can be incurred through improper disposal of samples, it is essential to track the final disposition of each sample. Therefore, the chain-of-custody record for the sample is completed with the final disposition of the sample. Analysis will confirm if the sample contains non-hazardous or hazardous waste or non-radioactive or radioactive material (in accordance with DOT and CERCLA definitions). Non-hazardous and non-radioactive samples shall be disposed of in accordance with standard laboratory practices or returned to FEMP.

When environmental samples are held for re-analysis, proper environmental control and holding time shall be observed. When re-analysis is not anticipated, but samples must be held for a specific time, environmental conditions for storage will not be observed.

When hazardous waste samples are held for re-analysis, they shall be stored according to their hazard classification under Resource Conservation and Recovery Act (RCRA), defined environmental conditions, and holding times.

When radiological samples are held for re-analysis or for a specific time, they will be stored in accordance with DOE regulations, individual laboratory licensing requirements and environmental conditions.

When mixed waste samples are held for re-analysis or for a specific time, they shall be stored in accordance with DOE regulations, their hazard classification under RCRA, and environmental conditions.

Special arrangements may be necessary for samples maintained longer than six months.

Returned hazardous waste and radiologically contaminated samples shall be transported to FEMP in accordance with 49 CFR 171 through 177 (Section 6). Record disposition on the chain-of-custody record and file results.

FEMP shall maintain a sample disposal log defining methods for disposal of FEMP-generated samples. Contracting laboratories shall provide information identifying sample disposal methods to FEMP. Following are examples of sample disposition.

- Consumed in analysis
- Returned to FEMP
- Stored

- Non-hazardous/non-radioactive-contaminated samples disposed of in accordance with standard laboratory disposal practices

- Hazardous waste/radiological-contaminated samples disposed in accordance with standard laboratory disposal practices

A record of disposal methods of samples analyzed at FEMP shall be documented as part of the chain-of-custody record.

7.3 EVIDENCE FILES

Evidence files for analytical data are maintained at FEMP and contain relevant records, reports, correspondence, logs, field logs, original laboratory data packages, pictures, subcontractor reports, chain-of-custody records, and data review reports. Evidence files are in custody of the appropriate program/project manager responsible for generating the data and are kept in a locked, secure storage area.

Data generated by subcontractors for FEMP are the property of DOE and shall be maintained under contract at the facility where it was generated. No files shall be discarded without prior written consent of FEMP project manager. If a storage, security, or other problem is discovered at the facility, files shall be transferred to FEMP.

7.4 REFERENCES

U.S. Department of Energy. 1988. Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald Ohio, Work Plan, Revision 3. Prepared by Advanced Sciences, Inc. for DOE Oak Ridge Operations, March 31, 1988.

U.S. Environmental Protection Agency. 1991. Region V Model Superfund Quality Assurance Project Plan. Chicago, Illinois, May 1991.

Westinghouse Environmental Management Co. of Ohio. 1989. Chain of Custody for Environmental Samples. Procedure AnL-01-0049, September 5, 1989.

Westinghouse Environmental Management Co. of Ohio. 1991. Packaging, On-Site Movement, and Off-Site Shipment of Material. Procedure FMPC-0314, December 31,1991.

Section 8

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Section 8

CALIBRATION PROCEDURES AND FREQUENCY

Measuring and test equipment used in the field and the laboratory shall be controlled by a formal calibration plan. The plan shall designate equipment of the proper type, range, accuracy, and precision to provide data compatible with the required Analytical Support Level (ASL) (Section 2) as defined by the Data Quality Objectives (Appendix C). Calibration of measuring and test equipment will be performed internally using reference standards obtained from external agencies or manufacturers (e.g., EPA-certified primary standards, standards traceable to the National Institute of Technology (NIST), or the best quality materials available).

8.1 RESPONSIBILITIES

The responsibility for laboratory instrument or equipment calibration rests with the applicable Laboratory Manager, whether on-site or a subcontractor.

Individual Laboratory Analysts are responsible for performing analytical procedures and recording data in accordance with accepted methods. Field equipment calibration is the responsibility of the assigned FEMP manager or designee.

8.2 CALIBRATION PROCEDURES

The following requirements shall be addressed in all calibration procedures for measuring and test equipment. Documented and approved procedures for calibrating measuring and testing equipment shall be used. Where available, accepted procedures published by ASTM, EPA, or those provided by manufacturers in equipment manuals shall be used. Source of the procedure shall be referenced and implementation shall be documented.

Unique identification numbers shall be assigned to calibrated equipment using either the manufacturer serial number, a calibration system identification number, or other unique identifier. Calibration stickers containing the date of calibration shall be attached to equipment and an entry shall be made in a calibration log so the due date of the next calibration can be easily determined.

Users of calibrated instruments are responsible for inspecting calibration status prior to using equipment and documenting the inspection in the daily log as applicable.

Measuring and testing equipment shall be calibrated at prescribed intervals in accordance with the appropriate protocol in Appendices I and J and/or as part of operational use. Calibration frequency shall be based on the following.

- Type of equipment
- Inherent stability
- Manufacturer recommendations
- Values given in national standards
- Intended use
- Instrument response to spot checks with standards
- Instrument response time
- Experience

Equipment shall be calibrated using reference standards with known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants. If national standards do not exist, reference and document the basis for calibration.

Equipment that fails calibration or becomes inoperable during use shall be tagged and removed from service. Repair and recalibrate such equipment to the acceptance criteria specified in the procedure as applicable. Equipment that cannot be repaired shall be permanently removed from the program and replaced as necessary.

Records shall be prepared and maintained for each piece of calibrated measurement and test equipment to indicate that established calibration procedures have been followed. Records for field equipment shall be retained in the project files. Records for laboratory equipment shall be maintained by the laboratory.

8.3 FIELD MEASUREMENT AND TEST EQUIPMENT FOR ASLs A AND B

The responsible FEMP manager or designee shall maintain a list of all field measurement and test equipment used for the collection of project data. The list shall include a description and manufacturer of each piece of measurement and test equipment, unique identifier, required calibration frequency, and number and title of applicable calibration procedure. The project manager or designee shall validate the list for adequacy and review the calibration

procedures periodically to assure proper use as required by the appropriate ASL (Section 2). Procedures for field equipment calibration are found in Appendix I.

8.4 ANALYTICAL LABORATORY INSTRUMENTATION AND EQUIPMENT FOR ASLs B, C, D, AND E

Method-specific calibration protocols are specified in Appendix L.

8.4.1 Calibration Schedules

Laboratory equipment requiring calibration schedules are as follows.

- Ovens and refrigerators
- Automatic/Manual pipettors
- Thermometers
- Laboratory balances

Examples of laboratory instruments requiring calibration schedules include the following.

- Liquid scintillation counting systems
- Alpha spectrometer systems
- Alpha/beta counting systems
- Germanium spectroscopy systems
- Alpha scintillation counting instruments
- Gas Chromatograph/mass Spectrometer (GC/MS)
- UV/VIS Spectrophotometer
- Thermal Mass Spectrometry
- Gas Chromatography Electron Capture (GC/ECD)
- Gas Chromatography Flame Ionization (GC/FID)

- High Performance Liquid Chromatography with UV
- Inductively Coupled Plasma Spectroscopy (ICP)
- Flame Technique Atomic Absorption Spectroscopy (FTAS)
- Graphite Furnace Atomic Absorption Spectroscopy (GFAA)
- Cold Vapor Methods for Mercury Analysis (CVAA)
- Infrared Spectrometry (IR)
- Thermal Mass Spectrometry
- Manual/Semi-Automated Spectrophotometry

8.4.2 Calibration Records

Laboratory calibration records shall include the following information.

- Type, manufacturer, and unique identification number of equipment
- Calibration frequency and acceptable tolerances
- Identification of calibration procedures employed
- Calibration dates, results, and any problems encountered during calibration
- Identification of personnel/organizations performing calibrations
- Certification or statement of calibration provided by manufacturer or external agency
- Statement of calibration acceptance or failure

8.4.3 Calibration Protocols

Laboratory instruments shall be calibrated in accordance with ASL B, C, and D as applicable. These protocols are included in Appendix J, Calibration Protocols for Analytical Laboratory Instruments.

8.5 ADDITIONAL SOURCES OF INFORMATION

40CFR Parts 136/261, Office of the Federal Register National Archives and Records Administration; July 1, 1990

EG&G Rocky Flats. 1988a. Cesium-137 in Water or Soil by Beta Activity. L-6116-D, Rocky Flats "L" Procedure, Rocky Flats Plant, Golden, Colorado.

EG&G Rocky Flats. 1988b. Gross Alpha and Beta Activity in Water or Soil. L-6114-E, Rocky Flats "L" Procedure, Rocky Flats Plant, Golden, Colorado

EG&G Rocky Flats. 1988c. Radioactive Strontium Analysis in Water or Soil by Carbonate Precipitation. L-6122-E, Rocky Flats "L" Procedure, Rocky Flats Plant, Golden, Colorado

EG&G Rocky Flats. 1990. General Radiochemistry and Routine Analytical Services Protocol (GRRASP), Scope of Work. Environmental Restoration Program, Rocky Flats Plant, Golden, Colorado.

Kanipe, L.B. 1977. Handbook for Analytical Quality Control in Radioanalytical Laboratories. US EPA-600/7-77-088

U.S. Environmental Protection Agency. 1973. Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions, No. R4-73-014.

U.S. Environmental Protection Agency. 1976. Interim Radiological Methodology for Drinking Water. No. EPA-600/4-75-008, Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1979. Radiochemical Analytical Procedures for Analysis of Environmental Samples, No. EMSL-LV-0539-17, Las Vegas, Nevada.

U.S. Environmental Protection Agency. 1980. Prescribed Procedures for Measurement of Radioactivity in Drinking Water. No. EPA-600/4-80-032, Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1983. Methods for Chemical Analysis of Water and Wastes, US EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio; March 1983

U.S. Environmental Protection Agency. 1984. Eastern Environmental Radiation Facility Radiochemistry Procedures Manual. No. 520/5-84-006.

U.S. Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; US EPA SW-846; Office of Water and Waste Management, Washington D.C.; 3rd Edition, November 1986

U.S. Environmental Protection Agency. 1988a. Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses. Data Review Work Group; February 1, 1988

U.S. Environmental Protection Agency. 1988b. Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. Data Review Work Group; July 1, 1988

U.S. Environmental Protection Agency. 1990a. Contract Laboratory Program Statement of Work for Organic Analysis, Document Number ILM01.0 Including Revisions IOLM01.1 (March, 1990)

U.S. Environmental Protection Agency. 1990b. Contract Laboratory Program Statement of Work for Inorganic Analysis, Document Number OLM01.0 Including Revisions OLM01.1 (December, 1990)

Section 9

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Section 9

ANALYTICAL PROCEDURES

This section describes the analytical procedures required for FEMP activities.

9.1 ANALYTICAL SUPPORT LEVELS

ASLs, defined in Section 2, are confidence levels placed upon field and laboratory data according to the indended use as defined in the Data Quality Objectives (DQO). In order to maintain consistency in definition of DQO levels and to avoid confusion between EPA and DOE/EPA programs, DQO levels at FEMP will be referred to as Analytical Support Levels (ASL) A through E.

Useability of data is determined by DQO requirements. ASL A data are considered as "good" as level D data if the data comply with DQOs. DQOs for ongoing FEMP activities are provided in Appendix C.

9.2 CHEMICAL ANALYSIS

EPA approved methods shall be used as the FEMP method source for analyses for which such methods exist. Where EPA methods do not exist, verified methods shall be submitted to EPA for approval. Table A-3 indicates the analytical and preparation methods used as sources for FEMP methods.

FEMP methods defined for ASL B, C, and D analyses are presented in Appendix L and will be used for analysis of constituents on the Hazardous Substance List (HSL), the Target Compound List (TCL), and RCRA Appendix IX. Also included in Appendix L are SW-846 derived methods for determining non-HSL/TCL organics and inorganics, Toxicity Characteristic Leaching Procedures (TCLP), Polychlorinated Biphenyls (PCB), insecticides, and herbicides. Determination of physical properties not found in SW-846 shall be made in accordance with American Society for Testing and Materials (ASTM) procedures when available. Dioxins and furans shall be analyzed by EPA Method 8280.

9.3 RADIOLOGICAL ANALYSIS

Radiological sample preparation and analysis methods for determining the following analytes are specified in Appendix L. Total uranium and total thorium may also be analyzed by non-radiological means.

- Gross alpha, beta, and gamma activity
- Uranium (isotopic and natural)
- Total uranium (234, 235, 236, and 238)
- Thorium (isotopic, 230, 232) activity
- Total thorium
- Radium (isotopic, 226, 228)
- Lead 210 activity

9.4 ADDITIONAL SOURCES OF INFORMATION

Additional sources of information relative to analytical methods are presented in Section 8.

Section 10

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Section 10

INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

Internal Quality Control (QC) checks are performed to verify the quality of measurements of field and laboratory investigations and associated tasks. Required frequencies for internal QC checks are specified in Table A-1.

10.1 QUALITY CONTROL CHECKS AND PROCEDURES

QC operations that are performed to satisfy analytical requirements for Analytical Support Levels (ASL) are defined in specific methods provided in Appendix L.

10.2 INORGANIC QUALITY CONTROL

The purpose of this section is to provide an example of QC requirements and to summarize minimum requirements for inorganic analysis at ASLs C and D. QC requirements for analyses at other ASLs shall be specified in project-specific plans. Description of field and laboratory QA/QC samples are defined in Section 4. The following QC operations shall be performed for analysis of samples for inorganic parameters using ASLs C and D methods specified in Appendix L.

- Preparation (method) blank
- Inductively Coupled Plasma (ICP) interference check sample
- ICP serial dilution
- Matrix spike analysis
- Duplicate sample analysis
- Analytical (instrumental spike) graphite furnace
- Method of Standard Additions (MSA)
- Laboratory Control Samples (LCS)

10.2.1 Preparation (Method) Blank

At least one preparation (method) blank shall be analyzed during an analytical run. The preparation blank consists of de-ionized water processed through the entire sample preparation procedure. The preparation blank is used to ascertain whether sample concentrations reflect contamination in the following manner.

- If the absolute value of the concentration of the blank is less than the FEMP-Required Detection Limit (RDL), no correction of the sample result is performed.

- If any analyte concentration is present in the preparation blank above the RDL, the lowest concentration for that analyte in any of the associated samples shall be ten times the concentration of that in the blank. Otherwise, all samples associated with that blank with a concentration of less than ten times the amount present in the preparation blank shall be redigested and re-analyzed. Under no circumstances is the sample concentration to be corrected for the blank value.

- If the concentration of the blank is below the negative RDL, all samples reported below ten times the RDL associated with that blank shall be redigested and re-analyzed.

10.2.2 ICP Interference Check Sample Analysis

To verify interelement and background correction factors, an ICP Interference Check Sample (ICS) shall be run. The ICS consists of two solutions: solution A (ICS-A) and solution AB (ICS-AB). Solution A consists of interferents, and solution AB consists of analytes mixed with the interferents. The ICS run consists of running both solutions consecutively (with A first) at every wavelength used for analysis. The results of the ICS shall fall within the limits of $\pm$ 20 percent. If not, terminate the analysis, correct the problem, recalibrate the instrument, and re-analyze samples analyzed since the last ICS meeting requirements. The amount of analyte and interferent is given in the statement of work.

10.2.3 ICP Serial Dilution Analysis

Prior to reporting concentration data for analyte elements, the laboratory shall analyze and report results of the ICP serial dilution analysis. If the analyte in the sample is sufficiently high [at least a factor of fifty above the Instrument Detection Limit (IDL) in the original sample], results of a five-fold dilution of the sample should agree within 10 percent of the original determination after correction for dilution. If results do not agree within 10 percent, a chemical or physical interferent shall be suspected, and the data for affected analytes in the samples received associated with that serial dilution shall be flagged "E".

10.2.4 Matrix Spike/Matrix Spike Duplicate Analysis

The spiked sample is designed to provide information about the effect of the sample matrix on the digestion and measurement methodology. The spike is added before digestion and prior to any distillation steps [i.e., spetrophotometer cyanide (CN)]. Samples identified as field blanks may not be used for the matrix spike sample. The amount of analyte to be spiked is given in the statement of work. If two analytical methods are used to obtain the reported values for the same element, spike samples shall be run by each method used. If spike recovery is not within 75 to 125 percent recovery, the analyte is flagged "N" and an instrumental spike shall be run on the sample for that element if the method used is Atomic Absorption (AA), ICP, or CN (see individual methods). The 75 to 125 percent criteria does not apply to silver or to samples that have an analyte concentration in excess of four times spike concentration and shall be reported unflagged. The equation for determining spike recovery is given in Section 14.

10.2.5 Duplicate Sample Analysis

Samples identified as field blanks may not be used for duplicate analysis. If two analytical methods are used for the same element, duplicate analyses shall be run by each method used. Relative Percent Difference (RPD) is calculated based on results of the duplicate analyses using the equation in Appendix L.

10.2.6 Graphite Furnace Analysis

Graphite furnace analyses shall require that all samples, spikes, standards, and blanks have duplicate injections performed. Instrumental spikes shall be performed on all samples except matrix spikes, calibration verifications, and calibration blanks. Instrumental spikes shall be at two times RDL. Analysis shall proceed as specified in the applicable method in Appendix L. For concentrations greater than RDL, duplicate injections shall agree within 20 percent or they shall be repeated. If the repeat injection does not agree within 20 percent, flag the data with an "M". The "M" flag applies to the instrumental spike also. If the preparation blank analytical spike recovery is not within 85 to 115 percent, the spiking solution shall be verified by respiking and rerunning the blank once. If the recovery is still out, correct the problem and re-analyze analytical samples associated with that blank. An analytical spike is not required on the predigestion spike.

The following spiking scheme shall determine how the furnace analyte is quantified.

1. If spike recovery is less than 40 percent, the sample shall be diluted and rerun with another spike. Dilute sample by a factor of 5 to 10 and re-analyze. If, after dilution, the spike result is still less than 40 percent, report data and flag with an "E."

2. If spike recovery is greater than or equal to 40 percent and sample absorbance is less than 50 percent of the spike absorbance, report results of the IDL. If spike recovery is less than 85 or greater than 115 percent, flag data "W."

3. If the sample absorbance is greater than 50 percent of spike absorbance and spike recovery is between 85 and 115 percent recovery, report results of the IDL.

4. If sample absorbance is greater than or equal to 50 percent of spike and spike recovery is less than 85 percent or greater than 115 percent, the sample shall be run by the MSA.

10.2.7 Method of Standard Additions

The MSA shall be performed if criteria specified in Appendix L are met. The following additional requirements shall be met when performing the MSA.

- Data from the MSA shall be within calibration range.
- The sample and three spikes shall be analyzed consecutively. Only single injections are required.
- Spikes shall be prepared such that spike 1 is approximately 50 percent of sample absorbance; spike 2 is approximately 100 percent of sample absorbance; and spike 3 is approximately 150 percent of sample absorbance.
- MSAs shall be identified in the raw data documentation. Reported values obtained from MSA shall be flagged "S" if the correlation coefficient is 0.995 or above.
- If the correlation coefficient is less than 0.995, the analysis shall be repeated once. If still out, use the run with the best MSA and flag data "+."
- The LCS for graphite furnace analysis shall not be analyzed by MSA.

10.2.8 Laboratory Control Samples

LCS may be obtained from the EPA or from companies having certified reference standards or they may be prepared from NIST standards. If the percent recovery of the LCS does not fall between 80 and 120 percent (except for antimony and silver) the analysis shall be terminated, the problem corrected, and the samples associated with that LCS for that analyte shall be redigested and re-analyzed. For cyanide analysis, the distilled mid-range calibration standard may be used as the aqueous LCS. An LCS is not required for mercury. Concentration of an analyte in the LCS by graphite furnace shall not be quantified by MSA.

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10.3 ORGANIC QUALITY CONTROL

This subsection summarizes QC requirements described in Appendix L. For ASLs B, C, D, and E, laboratory quality control procedures shall ensure that required analyses, QC sample checks, and verification of results are performed and that acceptability of results is known and verifiable.

QC requirements for ASLs B and E analyses shall be specified in project-specific plans. The following QC requirements shall be met to ensure a level of certainty for ASLs C and D data.

- Perform method blank analysis.
- Perform surrogate spike analysis.
- Perform matrix/matrix spike analysis.
- Validate pesticide/PCB analytical results.
- Establish retention-time windows.
- Determine linear range.
- Evaluate breakdown of Endrin and 4,4'-DDT.
- Evaluate retention-time shift for DiButylChlorendate (DBC).

10.3.1 Preparation (Method) Blank Analysis

A method blank is a volume of de-ionized water or a purified solid matrix (when available) processed through the entire analytical sequence of extraction, concentration, and analysis. Method blank volume or weight shall be approximately equal to the sample volumes or weights being processed. Blanks are subject to the following criteria.

- The method blank for volatiles shall contain no more than five times the Required Quantitation Limit (RQL) of common laboratory contaminants. These contaminants are methylene chloride, acetone, and toluene.
- The method blank for semivolatiles shall contain no more than five times the RQL for common phthalate esters.
- For other compounds, the method blank shall contain less than the RQL of any single compound.

If the blank fails any one of these criteria, samples processed with that blank shall be reprocessed and re-analyzed.

10.3.2 Surrogate Spike Analysis

Surrogate standard determinations are performed on standards, samples, and blanks. Samples and blanks are fortified with surrogate compounds prior to purging or extraction in order to monitor preparation and analysis of samples.

Surrogate spike recovery shall be evaluated for acceptance by determining whether concentration (measured as a percent recovery) falls inside contract required recovery limits.

- Method Blank Surrogate Recovery - The laboratory shall take corrective action if analysis of the preparation blank yields either of the following results.

  - One surrogate compound is outside required limits for volatiles.

  - One semivolatile surrogate is outside required limits.

  Corrective action shall include checking calculations, internal standard and surrogate spiking solutions, and instrument performance. If these checks do not locate the problem, re-injection and repurging of volatiles or re-extraction and re-analysis of semivolatiles is required.

- Sample Surrogate Spike Recovery - The laboratory shall take corrective action if any of the following occur.

  - Recovery of one surrogate compound is outside required recovery limits.

  - Recovery of one surrogate in either the base neutral or acid extract is below ten percent.

  - Recovery of two compounds in either the base neutral or acid extract is outside recovery limits.

  Corrective action shall include checking calculations, internal standards and surrogate spiking solutions, and instrument performance. If these checks do not locate the problem, samples shall be repurged and re-analyzed for volatiles or re-extracted and re-analyzed for semivolatiles.

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10.3.3 Matrix Spike/Matrix Spike Duplicate Analysis

Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries are calculated using the equation given in Section 14.

RPDs are generated using the equation given in Section 14.

Compounds used for spiking and their advisory limits for recovery are given in the applicable FEMP method in Appendix L.

10.3.4 Pesticide/PCB Requirements

The following minimum QC requirements shall be met for validation of pesticide/PCB analytical results.

- Preparation blanks shall be prepared as required and shall meet contaminant requirements.
- MS/MSD shall be performed as described.
- Standards, samples, blanks, and MS/MSD shall be fortified with DBC surrogate.

10.3.5 Retention-Time Windows

Before performing a sample analysis, the laboratory shall establish retention-time windows for pesticide/PCB compounds under the constraint that retention-time windows shall be under proper oven temperature and flow rate to ensure that 4,4'-DDT has a retention time greater than 12 minutes. Retention-time windows are generated as follows.

1. Each time a new column is installed, make three injections of single-component pesticide mixtures, multi-response pesticides, and PCBs throughout a seventy-two-hour period. Response shall be approximately half-scale. These injections shall be made at roughly equal intervals during the sequence (i.e, beginning, middle, and end).

2. Verify retention-time shift for DBC in each standard. The shift shall be less than 0.3 percent for capillary columns. If this criterion is not met, continue injecting replicate standards to meet the criterion.

3. Calculate standard deviation of the three absolute retention times for each single component pesticide using equation in the statement of work. For multi-response peaks or PCBs, choose one major peak from the envelope and calculate standard deviation of the three absolute retention times for that peak.

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4. Standard deviations performed in step 3 shall be used to determine windows for subsequent twelve-hour sequences. Apply $\pm$ 3 times standard deviations in step 3 to retention times of pesticide/PCB compounds determined in the first analysis of any given twelve-hour sequence. This range defines windows for the remainder of the sequence. The absolute retention time of the first analysis of a particular compound is the center of the retention-time window.

5. If retention for a particular pesticide/PCB is less than 0.01 minutes, use the following as windows: $\pm$ 0.75 percent of initial retention time for compound for capillary compounds.

10.3.6 Linear Range

Linear range is determined through analysis of three standards of each pesticide at three different concentrations, one of which shall be near, but above, the RQL and the other two at concentrations that define the working range of the instrument. These standards shall be injected consecutively at beginning of the sequence.

Using responses of the three injections, calculate calibration factors for each compound using equation in the statement of work. The RPD of calibration factors shall be less than or equal to 10 percent for aldrin, endrin, 4,4'-DDT, and DBC. If only DDT exceeds 10 percent, it shall be plotted on a standard curve.

Linear range requirements for confirmation Gas Chromatography (GC) analysis are $\leq$ 10 percent RSD for initial evaluation mixes, and then $\leq$ 15 percent RSD for alternating standards if quantitation is performed. If only confirmation is performed, alternating standards shall be $\leq$ 20 percent RSD.

10.3.7 Breakdown of Endrin and 4,4'-DDT

Evaluation of the chromatogram of the analysis of Eval Mix B for the appearance of peaks in addition to the four main peaks indicates that either endrin or 4,4'-DDT is degrading. This degradation is calculated using equation in the statement of work. The breakdown for either compound shall be $\leq$ 20 percent for analysis to continue. If endrin and DDT peaks coelute (OV-1 column or equivalent), a total breakdown is calculated using equation in the statement of work. The combined breakdown shall not exceed 20 percent for analysis to continue.

10.3.8 Dibutylchlorendate Shift

When the preceding steps have been satisfactorily completed, samples shall be analyzed in the sequence specified in the applicable method (Appendix L). Retention-time shift for DBC shall be evaluated for each sample. The retention time shift shall be less than two percent difference for packed columns between initial standard analysis and any sample or standard

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subsequently analyzed during the 72-hour sequence. The percent difference for wide bore capillary columns shall be less than 1.5 percent and less than 0.3 percent for narrow bore capillary columns. Retention-time shifts that do not meet the criteria for percent difference shall be flagged "*" on Form 8E.

10.4 RADIOLOGICAL SAMPLE ANALYSIS QUALITY CONTROL

Radiological sample analysis QC for ASLs B, C, D, and E shall ensure that required analyses, QC sample checks, and verification of results are performed and that acceptability of results is known and verifiable. QC requirements for radiological analyses are provided in Appendix D.

10.4.1 Duplicate Sample Analysis

Results of these analyses shall be used to determine method precision, which shall be recorded on radiological analysis quality control sample forms and control charts as the "normalized range" for parameters tested as specified in Sections 4 and 14.

10.4.2 Matrix Spike/Matrix Spike Duplicate Analyses

When required (Table A-1), at least one sample from each batch shall be an aliquot of actual sample spiked prior to analysis with parameters of interest to determine percent bias. Results of these analyses shall be recorded on radiological analysis quality control sample forms and control charts as the "normalized deviation" for parameters tested as specified in Section 4.

10.4.3 Laboratory Control Sample

When required (Table A-1), at least one sample consisting of a low-level control (less than or equal to 20 times IDL) and at least one sample consisting of a high-level control (greater than 20 and less than or equal to 200 times IDL) shall be analyzed by the laboratory for each batch.

10.4.4 Method and Field Blank Analyses

Method blanks shall consist of a quantity of distilled or de-ionized water appropriate to the analysis.

Field blanks shall be prepared by sample collection teams as specified in Section 4. Field blanks accompany the samples through collection and shipment to the laboratory and are stored with samples. Field blanks are analyzed to monitor for possible sample contamination during collection, shipment, and storage.

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10.5 FIELD QUALITY CONTROL

Field activities and QC are the responsibility of the assigned manager. Prior to initiating field work, the manager shall discuss the scope of work, contractual and regulatory requirements, and applicable QA/QC procedures with assigned personnel. At the request of the manager, this may be done by the QA officer or senior members of the project staff.

Once in the field, personnel are responsible for all daily QC activities. Included in this responsibility shall be the supervision of subcontractors.

10.5.1 Performance Documentation

Performance documentation includes documentation and procedures for sample collection activities and are listed in Sections 5, 6, and 7.

10.5.2 Validation of Field Data

Field data shall be formally validated as specified in Appendix D.

Section 11

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Section 11

DATA REDUCTION, VALIDATION, AND REPORTING

The following procedures shall be used by FEMP personnel, the FEMP laboratory, and all subcontractor laboratories for data reduction, validation, and reporting as appropriate for each Analytical Support Level (ASL) (Section 2). Numerical analysis, including manual calculations, mapping, and computer modeling shall be documented and subjected to quality control and peer review. Records of numerical analyses shall be legible and complete enough to permit reconstruction of work by a qualified individual other than the originator. The Data Validation Plan is described in Appendix D. The Data Management Plan is presented in Appendix F.

11.1 DATA REDUCTION

Data reduction is the process of converting raw data to a useable format and it begins with the processing of data and continues through review and reporting of analytical results (Figure A-4). Data reduction can be performed by the analyst who obtained the data or by another analyst. Data review begins with the laboratory manager or designee, who verifies that data reduction has been correctly performed. In general, data shall be reduced in one of the following ways.

- Manual computation of results directly on the data sheet or on attached calculation pages
- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer

11.1.1 Responsibilities

The laboratory project manager shall be responsible for generation of the certificate of analysis and case narratives for data packages as developed for ASL D analyses and summary data sheets for ASL B and C analyses. Generation of a certificate of analysis or summary data sheets for ASL E analyses shall be specified in the laboratory request for analysis described in Section 7.

The individual analyst shall verify completion of appropriate data forms to ensure completeness and correctness of data acquisition and reduction.

11.1.2 Data Reduction Procedures

Analysis-specific calculations and statistical methods are dependent on the ASL of the reduced data methods are provided in Appendix L, which references appropriate regulatory requirements that include the calculations and methods shown.

Raw instrumental data shall be reduced to the final data package and certificate of analysis when required by the ASL in accordance with the following steps.

1. Data shall be generated for a particular sample using a specific analytical instrument. For a sample tested for several analytes, the reduction process is performed for each analyte unless several analytes can be identified at the same time [e.g., metals by Inductively Coupled Plasma (ICP)].

2. For a particular group of analytes (e.g. metals), raw data generated for a particular sample shall be gathered. For example, raw data from ICP, graphite furnace, flame atomic absorption, and cold vapor analyses for a particular sample are used to generate results sheets for all analytes.

3. Results sheets shall be gathered from all sections (metals, wet chemistry, gas chromatography, gas chromatography/mass spectometry, and radiometrics) and forwarded to the laboratory project manager or designee, who will compile them to generate certificates of analysis.

4. Records management shall be in accordance with guidelines set forth in Section 3 and Appendix F.

11.2 DATA VALIDATION

Data validation begins with the analyst and continues until data are validated as detailed in the Data Validation Plan (Appendix D). The plan is applicable to data collected under this QAPjP. Data collected prior to implementaion of this QAPjP shall be considered historical data, and its validation and use will be handled on a project-specific basis as outlined in subsection 11.4

11.2.1 Responsibilities

The laboratory project manager or designee shall periodically review computer and manual data reduction results and inspect laboratory notebooks and data sheets to ensure close adherence to the specified analytical protocols.

11.2.2 Data Validation for ASL A

Field data generated in accordance with project-specific plans shall consist primarily of the following.

- Radiological screening data
- Temperature
- pH
- Specific conductance
- Soil boring advancement data
- Monitoring well installation and development data
- Geophysical logging data
- Soil classification data

The validation process is described in Appendix D. Fulfillment of requirements in this QAPjP are considered sufficient to document that proper procedures were followed during field investigations.

11.2.3 Data Validation for ASLs B, C, D, and E

Data validation procedures are provided in Appendix D. Criteria used to verify data and identify outliers are given in Section 14 to assess data precision, accuracy, and completeness.

The laboratory shall maintain a complete documentation package for samples (Appendix E).

11.3 DATA REPORTING

A certificate of analysis and summary sheets are generated by the analytical laboratory in accordance with the ASL of the sample. The sheets contain information about analytical tests performed, date and condition of sample received, results, methodology, and quality of data reported.

Electronic data transfer information is generated from a certificate of analysis (Appendix F). Data entered shall be verified for accuracy by a person other than the one responsible for entering the data.

The FEMP project manager or designee shall be responsible for checking and approving the final presentation of reported data. This step ensures that the report meets project-specific requirements.

11.4 VALIDATION OF HISTORICAL DATA

Data collected prior to site-wide implementation of this QAPjP shall be considered historical data. These data may include, but are not limited to, data collected under the RI/FS QAPjP including the RI/FS data validation plan (U.S. Department of Energy, 1988a) and the RI/FS Data Management Plan (U.S. Department of Energy 1988b), RCRA interim status monitoring, NPDES-related waste-water monitoring, and routine environmental monitoring for radionuclides.

Some historical data were not gathered under an approved QAPjP or full QA/QC documentation may not be available for all samples and procedures. However, these may be "good" data for some uses and should not be automatically discounted prior to evaluation.

To validate and assess useability of historical data, the following general approach shall be used.

- Available analytical results, including supporting QA/QC analysis results, data packages, supporting field records, including chain-of-custody documentation, and associated audit and surveillance reports shall be gathered.

- Copies of analytical protocols and performance criteria used to perform analyses, including quality assurance project plans and data validation plans in effect at the time of data generation, shall be obtained if availble.

- Results for samples and QA/QC analyses shall be compared to protocol and method performance criteria in effect at the time data were generated or to data validation criteria of this QAPjP if no such protocols are readily available.

- Field records, audit and surveillance reports, and training records for personnel performing sampling and analysis shall be reviewed.

- The data set may be assigned a level of useability that specifies uses the data are suitable for based on the level of performance achieved and the quality of the supporting data package.

- If sufficient supporting QA/QC documentation is not available or if the raw data package is not available, a data set may be assigned a more restrictive level of useability than it was originally intended for, or it may be classified as unuseable.

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Validation procedures for historical data shall be included in the project-specific plan, and a summary report of data validation shall be prepared. The report shall discuss validation findings and assigned useability of the historical data.

11.5 REFERENCES

U.S. Department of Energy. 1988a. Quality Assurance Project Plan, Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald Ohio. Prepared by Advanced Sciences, Inc., for DOE Oak Ridge Operations, March 1988.

U.S. Department of Energy. 1988b. Data Management Plan, Remedial Investigation and Feasibility Study, Feed Materials Production Center, Fernald Ohio. Prepared by Advanced Sciences, Inc., for DOE Oak Ridge Operations, March 1988.

Section 12

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Section 12

PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of field and laboratory activities shall be conducted to verify that sampling and analysis are performed in accordance with procedures established in the FEMP QAPjP. Performance audits are spot checks of program implementation and, at FEMP, are referred to as surveillances. System audits are in-depth reviews of an entire program and are referred to as audits at FEMP.

To verify compliance with the site-wide Quality Assurance Project Plan (QAPjP) and project-specific requirements, the FEMP manager and Designated FEMP Quality Assurance Project Organization (DFQAPjO) are responsible for scheduling and conducting QA audits and surveillances.

Audits shall, as a minimum, consist of evaluation of the QA program and procedures, effectiveness of their implementation, and review of associated project documentation. Audits shall cover applicable laboratory activities, field operations and documentation, and final reports. Auditing shall be performed in accordance with DFQAPjO procedures and applicable project-specific plans.

Surveillances shall, as a minimum, consist of monitoring/observing ongoing project activity and work areas to verify item and activity conformance to specified requirements. Audits and surveillances shall be scheduled, planned, and documented.

Potential subcontractor laboratories shall be audited by DFQAPjO (Section 3 and Appendix E). Contracted laboratories shall be audited on an annual basis at a minimum and may only perform services for FEMP in the areas audited at the audited facility. Audit team documentation specifying that performance in areas related to analysis of FEMP samples within pre-established specifications is required before a laboratory may handle samples from FEMP.

Subcontractor internal audits are performed in accordance with established laboratory manuals and specific attachments as amended by contract with FEMP, which are included as part of the project record. System audits are performed to evaluate components of the measurement systems to determine their proper selection and use. Performance audits are conducted periodically to determine accuracy of the total measurement system or component parts thereof.

12.1 AUDIT/SURVEILLANCE PERSONNEL

Project and laboratory audits are performed and managed by qualified personnel working under a qualified lead auditor. Technical specialists may be assigned to the audit team at the discretion of the lead auditor.

Project surveillances are performed by the FEMP manager or DFQAPjO surveillance personnel. Surveillance personnel shall be qualified by education or experience to perform the surveillance and technically knowledgeable about the activity being monitored/observed.

Qualifications of personnel conducting audits and surveillances shall be documented as part of the project record. Audits and surveillances shall be performed by personnel who are independent of activities being audited or surveilled.

12.2 AUDITS (SYSTEM AUDITS)

12.2.1 Pre-Audit Activities

Pre-audit activities consist of definition of audit purpose, scheduling, identification of subject and scope, selection of audit team and lead auditor, development of audit plan and checklists, and notification of organization to be audited.

Audits shall be scheduled to provide coverage and coordination with ongoing activities and at a frequency commensurate with the status and importance of the activity. Schedules may be revised as necessary and may be supplemented by additional audits as necessary.

As with scheduling, when determining activities to be audited, consideration shall be given to ensure adequate coverage of pertinent activities. Definition of the scope of each audit shall consider the activity status and importance of required validity/acceptability of its product and supporting documentation (e.g., records, reports).

Plans for each audit shall be developed by the lead auditor, assisted as required by team members. Plans shall identify audit scope, applicable requirements, auditing personnel, activities to be audited, organizations to be audited, schedule, and checklist items.

Checklists shall be designed to accomplish review of necessary items and to document results of the audit and shall be used during the audit.

The audited group or organization shall be formally notified in advance of the scheduled audit. The notification, as a minimum, shall include the audit date and length, associated meetings, and auditing organization. It shall also identify the auditors, audit subject, and intended scope.

12.2.2 Audit Conduct

Audits shall be conducted in accordance with written checklists. If portions of the proposed scope as identified in the checklist are not addressed during the audit, this will be discussed at the closeout meeting and documentation will be recorded in the audit report.

Pre- and post-audit meetings between auditors and audited organization management and personnel shall be held in order to review the purpose and scope of the audit, establish personnel contacts, and present audit results.

During an audit and at completion, auditors shall discuss results and findings with individuals audited. It is not necessary to cite as items requiring corrective action minor administrative findings that can be resolved to the auditors' satisfaction during the audit. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project, regardless of when they are resolved, shall be recorded on checklists and included in audit reports.

12.2.3 Post-Audit Activities

Upon completion of an audit, auditors shall prepare and submit a formal report to the U.S. Department of Energy (DOE), management of the audited organization, and the responsible FEMP organization. This report shall serve to notify management of audit results. The report may also be sent to other project managers, individuals contacted during the audit, and the management of applicable FEMP subcontractors. The report shall be prepared as soon as possible after the audit (within 30 days) and contain the following as applicable.

- Dates of audit
- Identification of participants
- Identification of activities audited
- Audit results
- Description of items requiring corrective action and, if possible, the means of correction
- Directions for audit response in writing

Completion of required corrective actions shall be verified by auditors by written communication, re-audit, or other appropriate means. After verification and acceptance of corrective actions, an audit closure report shall be issued by the lead auditor or designee to the same individuals receiving the audit report.

12.3 SURVEILLANCES (PERFORMANCE AUDITS)

12.3.1 Pre-Surveillance Activities

Surveillances (performance audits) are scheduled by selecting project activities based on the program schedule. Scheduling may occur on a daily or weekly basis in order to provide adequate activity coverage in response to project task assignments. Actual date and time of a surveillance is coordinated with applicable project personnel by surveillance personnel.

Activity procedures or surveillance checklists are prepared by surveillance personnel if applicable.

12.3.2 Surveillance Conduct

Personnel conducting surveillances shall follow applicable procedure/surveillance checklists and observe activities as they are being performed. Surveillance personnel shall document in-process observations of activities as they occur and evaluate conformance with specified requirements. Surveillance personnel may communicate directly with project personnel during conduct of the surveillance to expedite corrective actions.

12.3.3 Post-Surveillance Activities

Surveillance personnel shall prepare a report documenting surveillance results. Observations identified during the surveillance that do not constitute a nonconformance require a response by the cognizant manager or designee on the surveillance report. Nonconformances identified during the surveillance shall constitute cause to initiate a deviation report (Figure B-2) and corrective action report (Figure B-3) (Section 15). Deviation report and corrective action report numbers shall be identified and documented in the surveillance report. The surveillance report, when completed and approved, shall be distributed to applicable project personnel.

Surveillances will be considered closed when all observations, deviation reports, and corrective action reports have been answered, corrective actions implemented and verified, and no further action associated with the surveillance is required.

It is the project manager's responsibility to ensure that all corrective action required by audit or surveillance reports is implemented and completed on schedule. If required, DOE or the DFQAPjO is authorized to stop work until corrective actions have been implemented.

Section 13

Section 13

PREVENTIVE MAINTENANCE

Preventive maintenance is an organized program of actions taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. An adequate preventive maintenance program increases reliability of a measurement system. The following factors are addressed in the FEMP preventive maintenance program.

- Instruments, equipment, and parts thereof that are subject to wear, deterioration, or other change in operational characteristics in the absence of routine maintenance
- Spare parts necessary to minimize down time
- Optimum frequency of maintenance

Analytical laboratories approved for analysis of FEMP samples are required to have Standard Operating Procedures (SOP) for preventive maintenance of each measurement system (including analytical instruments) and necessary support equipment (e.g., refrigerators, ovens). Maintenance activities shall be documented in logs.

The implementation of a preventive maintenance program is dependent upon specific instruments and equipment used within a laboratory or field program. This section does not attempt specific instrument or equipment requirements but, rather, sets minimum guidelines for maintenance practices. The field projects and laboratories shall implement a preventive maintenance program that complies with the guidelines presented in this section. Preventive maintenance requirements may be documented in SOPs, project-specific plans, or in separate preventive maintenance documents.

The laboratory manager is responsible for preparation and documentation of the laboratory program. Specific individuals within the laboratories shall be responsible for implementation of the program and quality assurance personnel shall be responsible for review of activities to verify compliance.

For field projects, the project manager or designee is responsible for preparation, implementation, and documentation of the program. DOE and the Designated FEMP QA Project Organization (DFQAPjPO) shall approve the field program and review its implementation to verify compliance.

Preventive maintenance programs shall include the following at a minimum.

- List of instruments and equipment that require preventive maintenance
- Frequency of maintenance (generally stated in terms of daily, weekly, monthly) considering manufacturer recommendations (which shall be documented in the form of operating manuals) and experience with the particular piece of equipment
- Spare parts list and an up-to-date inventory of spare parts for each instrument or piece of equipment necessary to preclude long down time
- Service contracts as necessary
- Items to be checked or serviced during maintenance and directions for performing maintenance

Preventive maintenance activities shall be performed in accordance with approved SOPs or other requirements for each type of equipment or instrument. These activities shall be documented in individual instrument files, which shall include the following.

- Spare parts inventory and use
- External service contracts if applicable
- Records of periodic maintenance performed

Records of maintenance shall be documented in maintenance logs maintained with the instrument or at an instrument storage and service area.

Section 14

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Section 14

SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

14.1 FIELD DATA

Field data shall be assessed by the data user for accuracy, precision, and completeness taking into account overall project objectives, background data points, and field Quality Assurance (QA) samples as defined in Section 4. Requirements for field documentation are included in Section 5, 6, and 7. If additional requirements are required for a specific project, they shall be defined in project-specific plans.

14.2 ANALYTICAL LABORATORY

Analysts, in consultation with the laboratory project manager or designee, are responsible for evaluating recoveries of surrogates and matrix spikes and ensure precision of duplicates. Control limits are defined as the mean $\pm$ 3 standard deviations (σ). Warning limits are defined as the mean $\pm$ 2σ.

Those recoveries and/or Relative Percent Differences (RPD) that are determined to be "out-of-control" by control chart criteria will be evaluated using all information pertinent to the recoveries/RPDs in question. Pertinent information includes, but is not limited to, preparation blanks, laboratory control samples, any matrix interferences present, concentration of the spiking compound present in the original sample, homogeneity of the sample, and the matrix of the sample.

Assessment of data precision and accuracy, aside from verification to control charts, is an integral part of the laboratory data verification process.

After data have been generated by an analyst or instrument, they shall be submitted to a qualified peer (another analyst, group supervisor or equivalent) for review. This initial review is for transcription errors, calculation errors, holding times, and a check for completeness, which shall include the following elements.

- Required samples and analyses have been processed
- Complete records exist for each analyte and associated quality control (QC) samples

- Specified procedures have been implemented
- Electronic data packages shall be checked for completeness.

A secondary review is conducted by the Laboratory Group Supervisor or equivalent, laboratory project manager or Laboratory Quality Control personnel or equivalent.

A tertiary review is a QA function that is performed on a minimum of five percent of analytical data. This QA review includes technical and editorial QA reviews.

All data shall be reviewed by laboratory project manager or designee for accuracy, precision, and completeness prior to transmittal to the data requestor.

14.3 PRECISION

To determine precision of the method, a routine program of duplicate analyses shall be performed (Section 4). The results of the duplicate analyses are used to calculate the RPD, which is the governing QC parameter for precision.

$$\text{RPD } \% = 100 * \frac{(D_1 - D_2)}{\left(\frac{(D_1 + D_2)}{2}\right)}$$

Where:

D_1 = the larger of the two observed values

D_2 = the smaller of the two observed values

14.4 ACCURACY

Accuracy shall be estimated based on results of laboratory control sample (LCS) analyses or matrix spike recoveries (Section 4). Accuracy is expressed in terms of percent recovery as expressed in the following formulas.

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For LCS

$$\text{Percent Recovery} = 100 * \left(\frac{\text{measured value}}{\text{true value}}\right)$$

For matrix spikes

$$\text{Percent Recovery} = 100 * \left(\frac{C_i - C_o}{C_t}\right)$$

Where:

C_o = value of unspiked aliquot

C_i = value of spiked aliquot

C_t = value of spike added

14.5 COMPLETENESS

Completeness shall be reported as the percentage of all measurements made with results judged to be valid following FEMP data validation (Appendix D). The following formula will be used to estimate completeness.

$$C = 100 * \left(\frac{V}{T}\right)$$

Where:

C = percent completeness

V = number of measurements judged valid

T = total number of measurements

14.6 METHOD DETECTION LIMITS

Method Detection Limits (MDLs) represent the minimum concentration of a substance that can be measured and reported (with 99% confidence) at a value above zero. The MDL will be determined by the following.

- Instrument detection limit
- Appropriate dilution/concentration factors dictated by sample preparation methods used
- Extract/digestate dilutions necessary to adjust analyte concentrations to calibration range of the respective instrument
- Analytical method (e.g., CLP, 40 CFR 136 methods)

14.7 ADDITIONAL SOURCES OF INFORMATION

American Public Health Association. 1985. Standard Methods for the Examination of Water and Wastewater. Sixteenth Edition, New York, New York.

U.S. Environmental Protection Agency. 1973. Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions. EPA R4-73-014.

U.S. Environmental Protection Agency. 1976. Interim Radiological Methodology for Drinking Water. EPA-600/4-75-008, Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1979. Radiochemical Analytical Procedures for Analysis of Environmental Samples. EMSL-LV-0539-17, Las Vegas, Nevada.

U.S. Environmental Protection Agency. 1980. Prescribed Procedures for Measurement of Radioactivity in Drinking Water. EPA-600/4-80-032, Cincinnati, Ohio.

U.S. Environmental Protection Agency. 1984. Eastern Environmental Radiation Facility Radiochemistry Procedures Manual. EPA 520/5-84-006.

U.S. Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste. SW-846, Third Edition.

Section 15

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Section 15

CORRECTIVE ACTIONS

Corrective action may be required for two classes of problems: (1) analytical and equipment and (2) noncompliance. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

A formal corrective action shall be determined and implemented when a noncompliance problem is identified (usually during audits). The person who identifies the problem shall be responsible for notifying the FEMP project manager. If the problem is analytical in nature, this information shall be promptly communicated to the EPA. Parties notified of the problem will also be notified of the implementation of corrective actions.

Analytical and equipment problems are referred to as deviations at FEMP. A system to report and evaluate deviations and to implement and verify corrective actions is established in response to DOE requirements. This system is currently used for environmental surveillances (performance audits), audits (system audits), and other activities where deviations are identified. Subcontractors shall either participate in the FEMP system, which is described in this section and Section 12 or implement a system that meets all of the substantive requirements of the FEMP system.

15.1 DEVIATIONS

A deviation is a deficiency in characteristics, documentation, or procedures or a departure from a specified requirement that renders the quality of an item, datum, or activity unacceptable or indeterminate. Variances defined in para. 15.4 are not deviations. A deviation can be a condition in which characteristics of an item or service do not conform to prescribed limits:

- A required document is not available or is inadequate,
- A regulatory requirement was violated,
- A procedure does not yield the desired results, or
- An unapproved variation from project-specific plans occurred.

Deviations may occur at any point in a program or project. The following personnel may identify deviations.

- Project Staff - During performance of field investigation and testing, supervision of subcontractors, performance of field inspection, and preparation and verification of numerical analyses

- Laboratory Staff - During preparation for and performance of laboratory testing, audits, calibration of equipment, sample receipt, and quality control activities

- Quality Assurance Staff - During audits, surveillances, and other Quality Assurance (QA) activities

Every person conducting work related to FEMP is responsible for notifying the Designated FEMP QA Project Organization (DFQAPjO) of potential deviations by completing sections 1 and 2 of a Deviation Report (DR) (Figure B-2).

The DFQAPjO is responsible for determining whether a deviation actually occurred and, if so, whether a "Significant Condition Adverse to Quality" exists. If appropriate, the DFQAPjO shall ensure that no additional work that is dependent on the nonconforming activity is performed until corrective actions are completed (U.S. Environmental Protection Agency, 1991).

15.1.1 Deviation Reporting

Deviations at FEMP shall be reported and processed as follows.

1. When a condition defined as a deviation is observed, the initiator shall document the violated requirement and provide a description of the deviation that includes the following, as applicable.

    - Dates and times of occurrence
    - Identification of persons involved
    - Project activity being performed
    - Equipment involved
    - Source of requirement that was violated

- Probable adverse impact of deviation on quality or completeness of project data

- Effect of deviation on work already performed

2. The initiator shall sign and date the report and forward it to the DFQAPjO organization for evaluation.

3. Upon receipt of the report, the QA organization evaluator shall determine whether a significant condition adverse to quality exists. If so, a Corrective Action Report (CAR) (Figure B-3) shall be issued and the responsible project manager contacted for an explanation of the deviation and the planned disposition.

4. The project manager shall provide the specified information including the following to the QA evaluator.

   - Reason for the deviation

   - Its impact on the project

   - Corrective actions required to mitigate the impact

   - Steps that will be implemented to prevent a recurrence

NOTE

If the deviation is outside the evaluator's field of technical expertise, it is his/her responsibility to ensure that appropriate technical review is obtained.

5. The QA evaluator shall determine whether the response, corrective action, and actions to prevent recurrence are adequate and shall notify applicable persons.

6. The QA evaluator shall complete the CAR and if necessary, arrange for retraining applicable personnel.

7. If all items are found to be satisfactory, the initiator shall notify the responsible project manager.

8. If the response is in some way deficient, the initiator shall notify the project manager and document the deficiency.

9. Steps 2 through 5 shall be repeated, the DR and CAR shall be revised to indicate the deficiency, and it shall be returned to the responsible project manager.

10. The initiator shall send copies of reports to managers whose projects may be affected by the outcome.

15.1.2 Subcontractor Laboratory Deviations

1. Document deviations identified during subcontractor laboratory operations as specified in laboratory procedures approved by the laboratory-specific contract with FEMP or as DRs identified during FEMP-conducted audits.

2. The FEMP laboratory QA coordinator shall maintain a log of laboratory deviations and their closures.

3. Incorporate DRs or their equivalent as part of the sample documentation if a sample is potentially affected by the deviation.

4. The laboratory manager shall send copies of documents that identify CARs generated during laboratory activities in support of FEMP together with corrective action measures to the FEMP contact for review and concurrence prior to DR closure.

15.2 CORRECTIVE ACTION

Corrective action measures are required to rectify identified conditions that render the quality of process or activity unacceptable or indeterminate. The need for such measures may be identified during the following activities.

- Performance and system audits
- Interlaboratory/interfield comparison studies
- Deviation reporting
- Surveillances and QA program audits

The need for corrective action is based on predetermined limits of acceptability. Corrective actions for field measurements may include the following (U.S. Environmental Protection Agency, 1991).

- Repeat the measurement to check the error

- Check for proper adjustments for ambient conditions such as temperature
- Check batteries
- Check calibration
- Re-calibrate
- Replace instrument or measurement devices
- Stop work if necessary
- Resample
- Revise procedures

Any nonconformance (deviation) with established quality control procedures in this QAPjP shall be identified and corrected in accordance with the QAPjP.

Corrective action measures shall be completed in an expeditious manner and verified as adequate as soon as practicable. Corrective action completion and verification activities shall be documented.

15.2.1 On-Site Corrective Actions

Perform and verify corrective action for deviations as follows.

1. Upon receipt of a DR (Figure B-2) and CAR (Figure B-3) or equivalent, take appropriate action to initiate and complete the correction no later than the scheduled date. If the scheduled date cannot be met, notify the initiator prior to that date.

2. When corrective action is accomplished, complete the prescribed section of the CAR and describe the remedies.

3. Sign and date the applicable sections of the CAR.

NOTE

Completion of corrective actions for nonconformances shall be verified by the evaluator or designee. Following verification that actions are satisfactory, the evaluator will sign the original CAR and submit it for entry into the permanent site files.

15.2.2 Off-Site Laboratory Corrective Actions

The subcontractor laboratory project manager is responsible for verifying completed corrective actions, logging completion date, and notifying the FEMP contact in writing of all deviations that could affect FEMP. The FEMP manager is responsible for ensuring that the effect of all corrective actions are considered in data evaluation.

15.3 EVALUATION OF RECURRING DEVIATIONS

As each DR or equivalent is received, the designated FEMP performance assessment organization determines if it describes a recurring deviation. For each recurring deviation, an evaluation to determine the root cause and actions required to prevent further recurrences is performed. The evaluation and results are documented as described in the DFQAPjO Quality Assurance Plan.

The FEMP performance assessment organization notifies project managers of recurring nonconformances that can impact results of their work and indicates that corrective action shall be taken.

15.4 VARIANCES

A variance is a pre-approved action performed in a manner differing from the requirements of an approved procedure or drawing with the impact on the quality of work performed evaluated and documented beforehand. Variances are not deviations. Variances shall be approved by the FEMP manager and the DFQAPjO before they are implemented.

Variances do not result in revisions to project-specific documents and are a means of accomplishing on-the-spot changes in the implementation of project-specific procedures when the change is necessary for work to proceed. The variance is a one-time change approved only for the specific activity described in the variance documentation.

Variance requests are processed as follows.

1. The person identifying the need for the variance describes the variance in writing including the reason for the variance, the potential impact on the program, and, if appropriate, alternatives to the variance.

2. The variance request is distributed to be reviewed by the DFQAPjO, the project manager or designee, and all others involved in creating and approving the original requirement. The request shall include the intended time and date of variance implementation and the time allotted for comments and resolution.

3. Each reviewer shall either approve or disapprove the document. If approved, the approvers shall sign and date (including time approval was granted) the request.

4. If disapproved, the requestor shall evaluate whether a revision to the requested variance is appropriate and proceed as in steps 1 and 2.

5. When approvals have been obtained, the change described on the variance request may be implemented. Under no conditions will unapproved variances be implemented.

NOTE

> In cases where time is of the essence, oral variance approval may be requested from the DFQAPjO, and the FEMP manager as long as written documentation of approval and the time, date, and location that oral approval was granted is included in official project documentation. Written documentation shall be completed and filed within one week after oral approval is granted.

6. The approved variance request is provided to the project manager for appropriate distribution and inclusion in the project files.

The FEMP manager is responsible for maintaining a log of each issued variance request including date initiated, date approved or denied, the responsible individual, the implementation date and location, and the affected document and section.

A FEMP change proposal request will be completed as required.

Section 16

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Section 16

QUALITY ASSURANCE REPORTS TO MANAGEMENT

16.1 CONSENT AGREEMENT MONTHLY REPORTS

FEMP is required by the 1990 Consent Agreement to submit monthly reports to the U.S. EPA summarizing activities of the past month and projected activities. These reports are intended to keep EPA personnel up to date on activities at FEMP. Milestones shall be indicated and whether they are met documented. If a milestone is not met, the reason it was not met and a new schedule for completion shall be included in the monthly report. Significant problems and steps taken towards resolution shall also be recorded.

16.2 SUMMARY REPORTS OF QUALITY ASSURANCE ACTIVITIES

The designated FEMP quality assurance project organization shall apprise project management of performance of measurement systems, data quality, results of quality assessment activities, and, if applicable, repetitive and significant quality assurance problems through routine distribution of surveillance and audit reports (Section 12), deviation reports, corrective action reports (Section 15), and weekly and monthly activity reports. Records of quality assurance activities within the project shall become part of the project record.

Variance requests and incorporation (Section 15) are the responsibility of the FEMP manager as well as assessment of the affect the variance will have on final project results. Those effects shall be reported on a timely basis to other potentially affected parties.

16.3 LABORATORY MANAGEMENT REPORTS

Laboratory managers and Quality Control (QC) coordinators, or equivalent, shall provide periodic quality reports to FEMP managers as required for specific projects including the following as a minimum.

- Assessment of measurement data accuracy and precision
- Results of performance and system audits of laboratory activities

- Laboratory inter-comparison study of proficiency of sample results (e.g., QC checks for effectiveness)

- Significant quality problems and their resolutions

Data quality shall be assessed in terms of precision, accuracy, representativeness, and method and matrix detection limits. Whether QA objectives are met is recorded; and, if they are not, an explanation of problems, why they were not resolved, and limitations on data use shall be included.

16.4 FINAL PROJECT REPORTS

The final report for each phase of a program or project, including remedial investigation and feasibility studies reports, shall include a separate QA section that summarizes data quality information collected during the project. A brief description of QA elements implemented within the project, surveillances and audits, significant audit and surveillance findings (findings that could affect data interpretation), and implemented corrective actions shall also be provided. Limitations on data use shall be identified by data users based on results of data validation and specific project requirements. A summary of the applicability of QA elements to data quality objectives and achieved data quality shall be included.

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Site - Wide
QUALITY ASSURANCE PROJECT PLAN

Prepared by

Westinghouse Environmental Management Company of Ohio

for the

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Fernald Office

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APPENDIX A

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APPENDIX A

FIGURES AND TABLES

This appendix contains the figures and tables referenced in this QAPjP. Figures are in Section A.1 and tables are in Section A.2.

A.1 FIGURES

Figure A-1. Regional Setting of the Fernald Environmental Monitoring Project (FEMP)

Figure A-2. Major Features of FEMP

Figure A-3. FEMP Management Structure

Figure A-4. Data Reduction Process Summary

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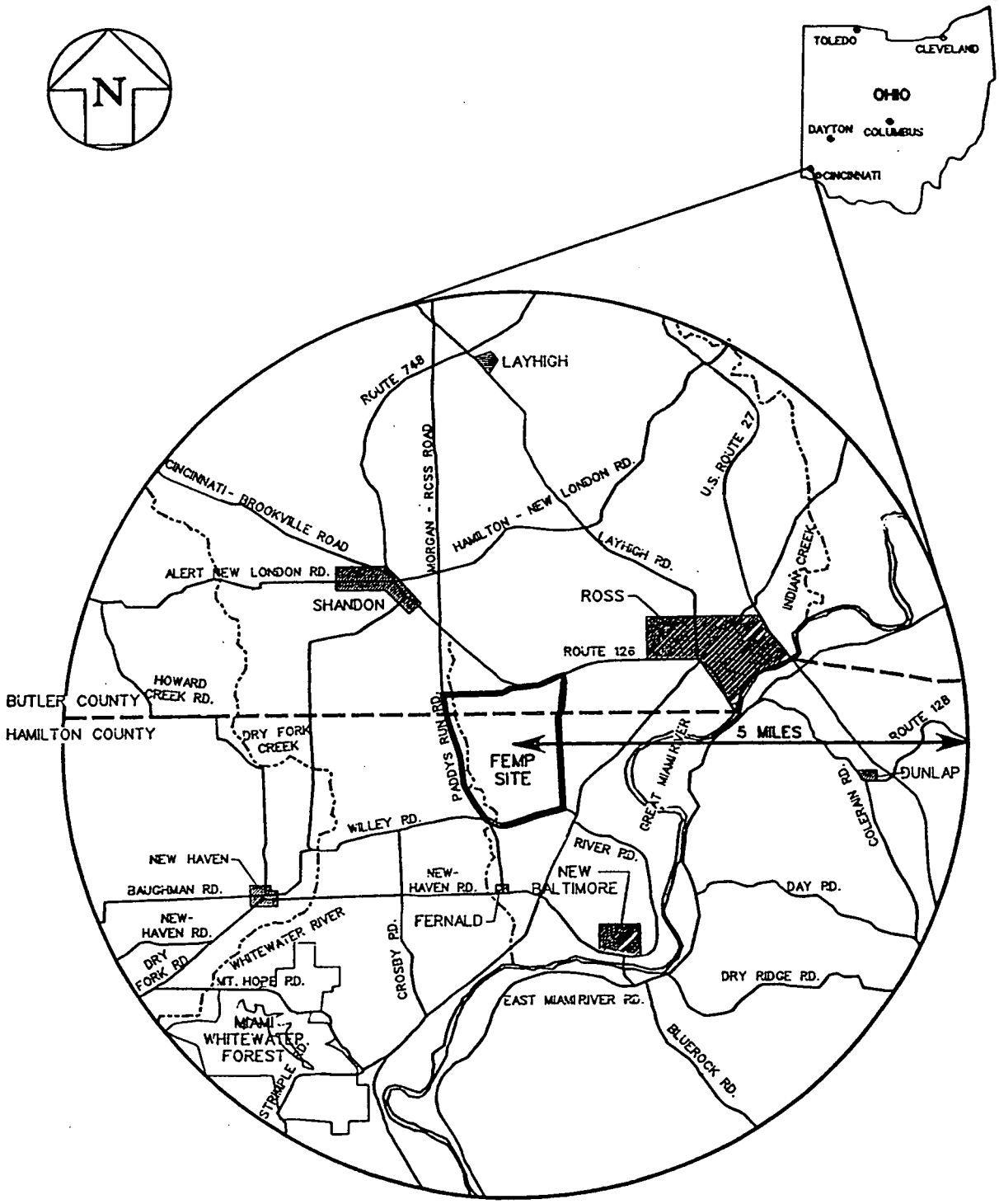

Figure A-1. Regional Setting of the Fernald Environmental Monitoring Project

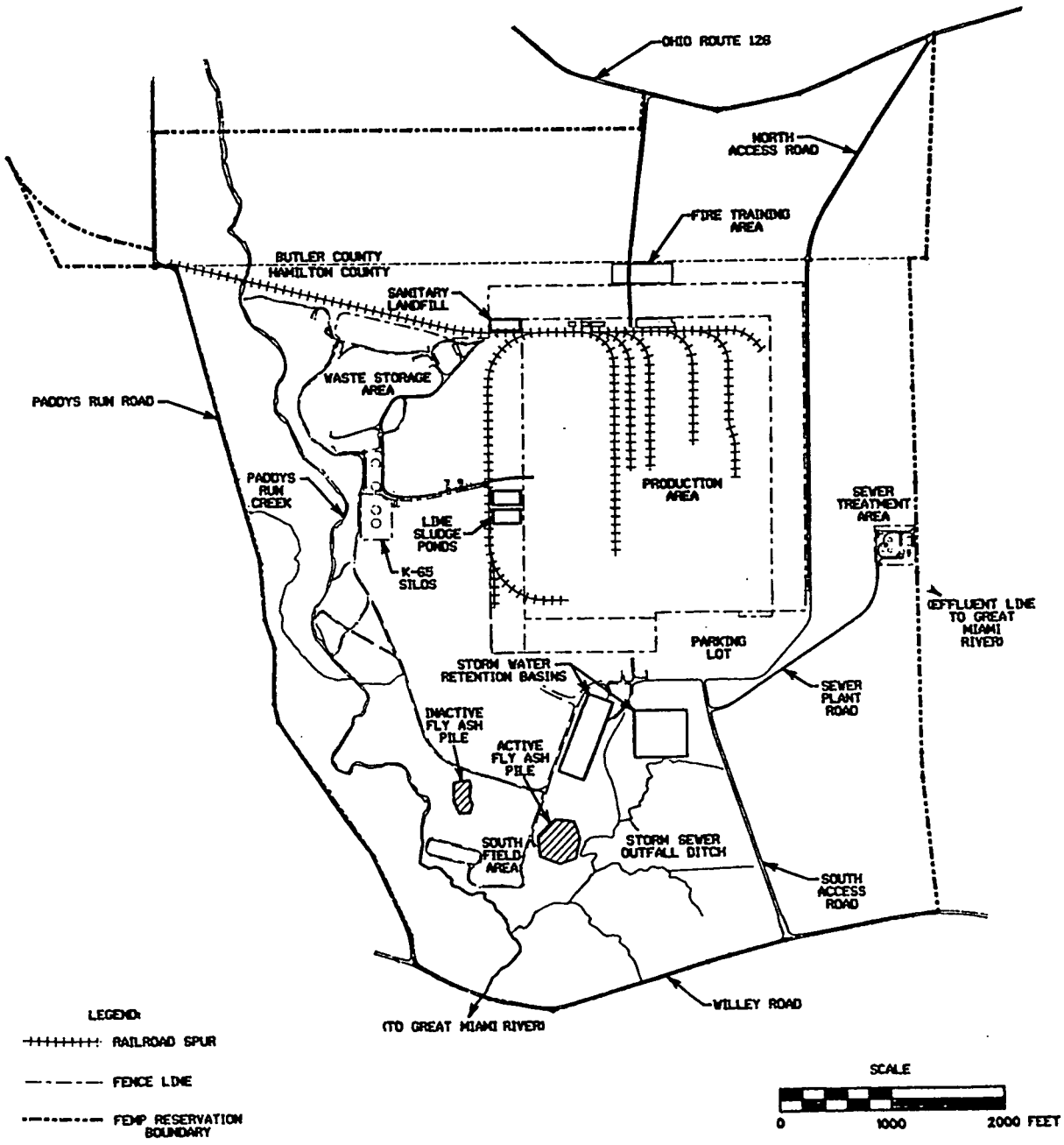

Figure A-2. Major Features of FEMP

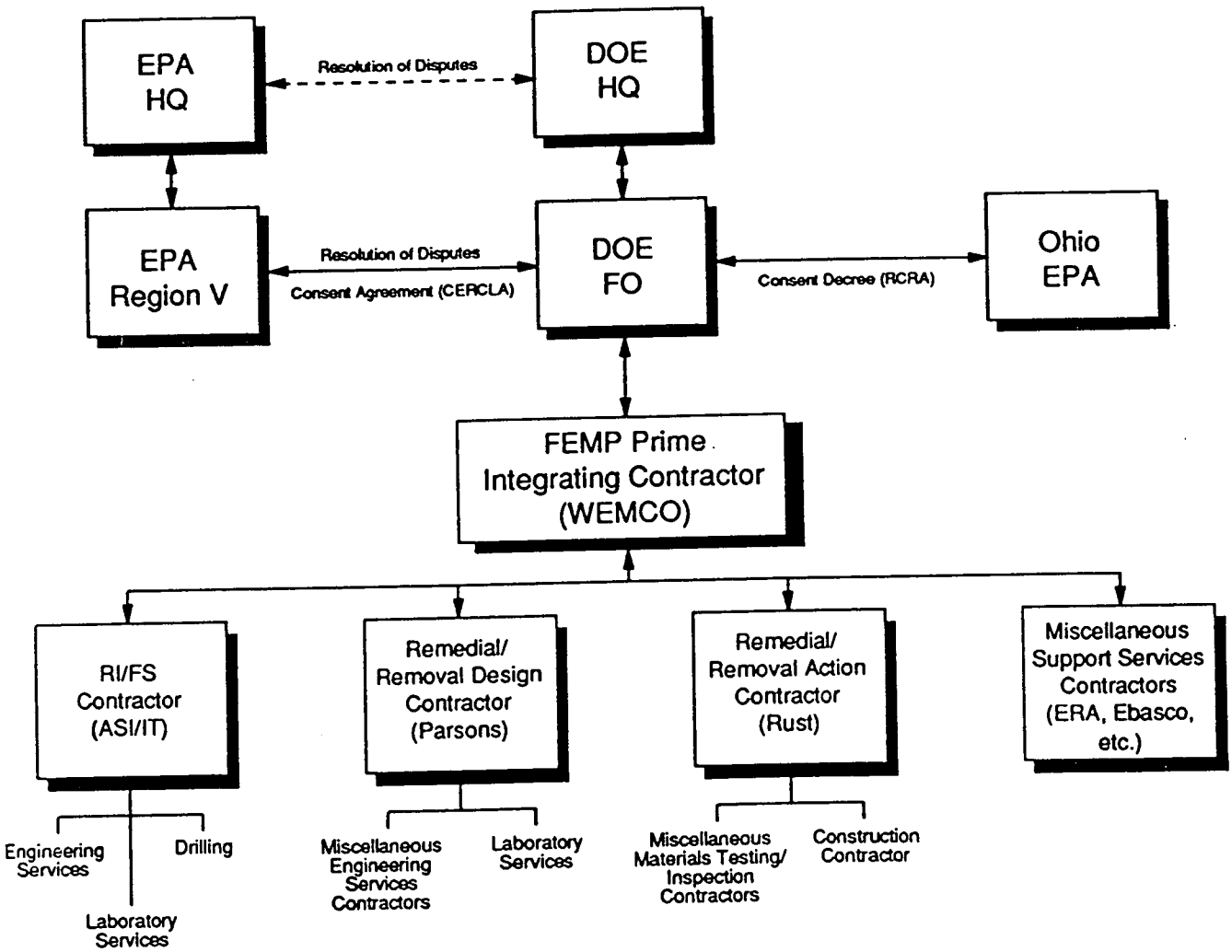

Figure A-3. FEMP Management Structure

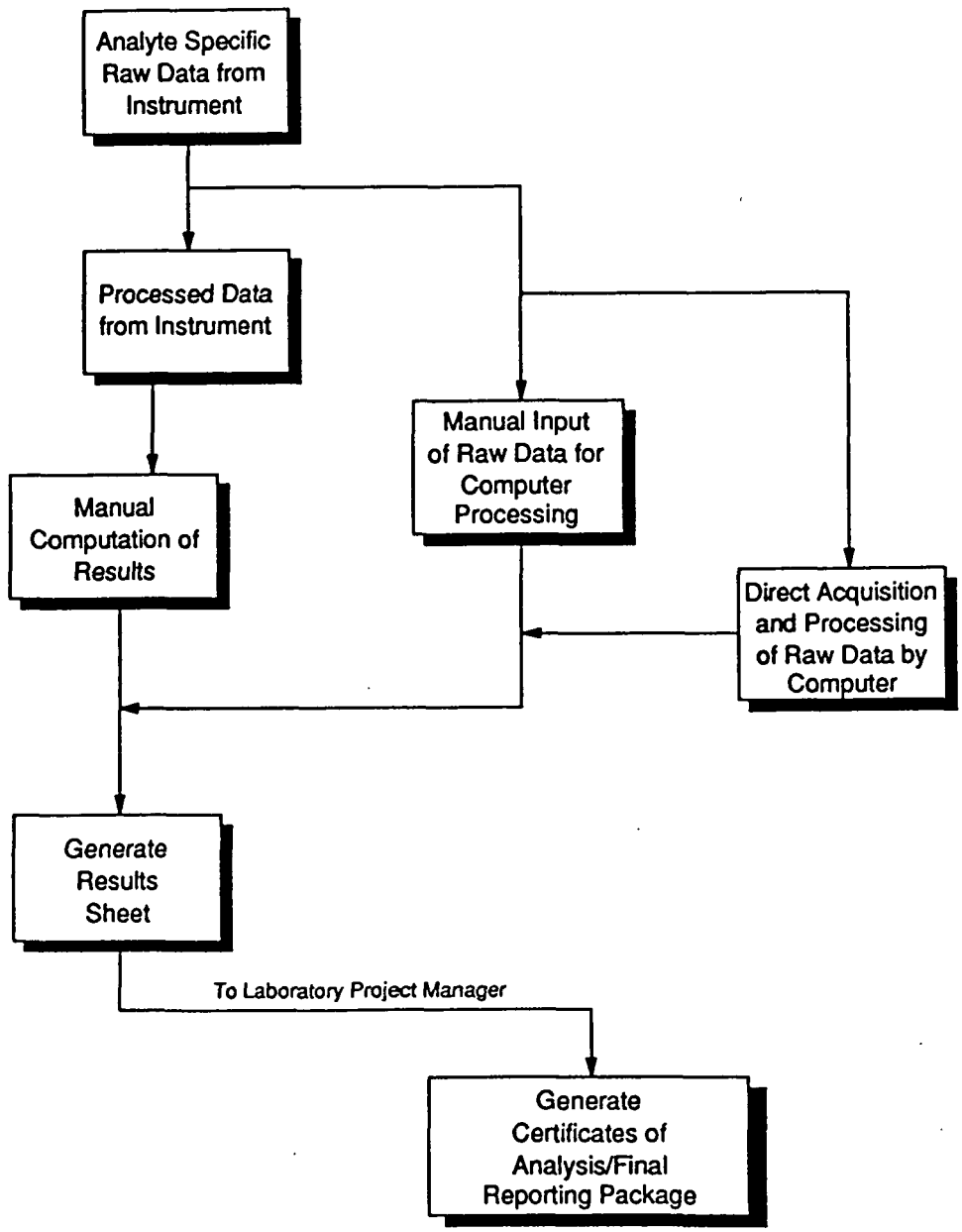

Figure A-4. Data Reduction Process Summary

A.2 TABLES

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TABLE A-1 COMPARISON OF ASL METHODS BY ANALYTICAL CATEGORIES

TABLE A-2. USE OF FIELD QUALITY ASSURANCE SAMPLES ASL C AND D

TABLE A-3. SOURCE OF FEMP-DEFINED METHODS

TABLE A-1. COMPARISON OF ASL METHODS BY ANALYTICAL CATEGORIES

ASL	A	B	C	D	E
Inorganic					
Field Blanks	N/A	A/S	1/20 Samples or SR		
Rinsates Blanks	N/A	A/S	1/20 Samples or SR		
Field Duplicates	N/A	A/S	1/20 Samples or SR		
Preservative Blanks	N/A	A/S	1/Set Containers		
Container Blanks	N/A	A/S	1/Sampling Period		
Laboratory Control Samples	N/A	A/S	1/Batch Samples		
Method Blanks	N/A	A/S	1/Batch Samples		
Continuing/Initial Cal. Blanks	N/A	A/S	1/10 Samples or 2Hrs		
Matrix Spikes	N/A	A/S	1/Batch Samples		
Duplicate.Sample Analysis	N/A	A/S	1/Batch Samples		
Interference Check Samples (ICP)	N/A	A/S	2/8 Hour Shift		
Dilution Check Samples (ICP)	N/A	A/S	1/Batch Samples		
Holding Times (Metals)	N/A	180 days			
Holding Times (Mercury)	N/A	28 days			
Holding Times (Cyanide)	N/A	14 days			
Initial Calibration (AA)	N/A	1 Blank 3 Standards			
Initial Calibration (ICP)	N/A	N/A	1 Blank 1 Standards		
Initial Calibration (Mercury)	N/A	N/A	1 Blank 4 Standards		
Initial Calibration (Cyanide)	N/A	N/A	1 Blank 3 Standards		
Continuing Calibration	N/A	1 Point Calibration			
Reporting Package	N/A	2	2	3	A/S
Organic					
Field Blanks	N/A	A/S	1/20 Samples or SR		
Equipment Rinsates	N/A	A/S	1/20 Samples or SR		
Field Duplicates	N/A	A/S	1/20 Samples or SR		
Trip Blanks (VOA)	N/A	A/S	1/Shipping Container		
Preservative Blanks	N/A	A/S	1/Set Containers		
Container Blanks	N/A	A/S	1/Sampling Period		
Method (Reagent) Blanks	N/A	A/S	1/Batch Samples		
Matrix Spikes	N/A	A/S	1/Batch Samples		
Matrix Duplicates	N/A	A/S	1/Batch Samples		
Surrogates	N/A	A/S	Present in Every Run		
Holding Times (VOA)	N/A	14 Days			
Holding Times (BNA/Pesticides- Water)	N/A	7 Days			
Holding Times (BNA/Pesticides - Soil)	N/A	7 Days			
DFTPP and BFB Performance Results	N/A	Daily			

TABLE A-1. COMPARISON OF ASL METHODS BY ANALYTICAL CATEGORIES (cont.) 2375

ASL	A	B	C	D	E
Organic (cont.)					
Initial Calibration (VOA/BNA)	1/6mos		5 Point Calibration		
Initial Calibration (Pesticides)	N/A		3 Point Calibration		
Continuing Calibration	Daily		1 Point calibration		
Reporting Package	1	2	2	3	A/S
Radiologic					
Field Blanks	N/A	A/S	1/20 Samples or SR		TBD
Equipment Rinsates	N/A	A/S	1/20 Samples or SR		TBD
Field Duplicates	N/A	A/S	1/20 Samples or SR		TBD
Trip Blanks	N/A	A/S	1/Shipping Cont.		TBD
Preservative Blanks	N/A	A/S	1/Set Containers		TBD
Container Blanks	N/A	A/S	1/Sampling Period		TBD
Matrix Spikes	N/A	A/S	1/Batch Samples		TBD
Duplicate Samples	N/A	A/S	1/Batch Samples		TBD
Initial Calibration	1/6mos	A/S	A/S	A/S	TBD
Continuing Calibration	Daily	A/S	A/S	A/S	TBD
Reporting Package	1	2	2	3	TBD
Biological					
Holding Times	N/A	A/S	TBD	TBD	A/S
Duplicate Samples	N/A	A/S	TBD	TBD	A/S
Initial & Continuing Calibration	A/S	A/S	TBD	TBD	A/S
Duplicate Analysis	N/A	A/S	TBD	TBD	A/S
Reporting Package	1	2	2	3	A/S
Geotechnical					
Holding Times	N/A	A/S	TBD	TBD	A/S
Duplicate Samples	N/A	A/S	TBD	TBD	A/S
Initial & Continuing Calibration	A/S	A/S	TBD	TBD	A/S
Duplicate Analysis	N/A	A/S	TBD	TBD	A/S
Reporting Package	1	2	2	3	A/S

TABLE A-1. COMPARISON OF ASL METHODS BY ANALYTICAL CATEGORIES (cont.)

Notes

A/S = As Specified in Method

N/A = Not Applicable

TBD = To Be Determined

1/20 Sample or SR = 1 Control Sample per 20 Samples or one per Sampling Round, whichever is more frequent

Sampling Period = Group of samples of similar matrix type (Soil, Water) and concentration (Low, Medium) or for each sample delivery group.

Batch Samples = Group of samples run per matrix or Group of samples of same matrix per day

Reporting Package Levels are:

1 = Field Data Package
2 = Field Data Package + Laboratory Results
3 = Field Data Package + Full Laboratory Documentation

Field Data Package consists of:

1. Complete daily log
2. Chain-of-custody record
3. Data validation forms

Full Laboratory Documentation consists of:

1. The results of sample analyses
2. The methods of analysis
3. The detection limits of analysis
4. For large numbers of samples per report, a master list of laboratory tracking I.D. numbers correlated with field sample I.D. numbers to correlate QA samples to sample analysis batch
5. Sample collection date
6. Sample received date
7. Sample preparation/extraction date
8. Sample analysis date
9. Copy of the chain-of-custody form signed by the laboratory sample custodian
10. A narrative summary identifying any QA or sample problems encountered, required sample manipulations (dilutions), and the corrective action taken
11. Full CLP and CLP equivalent deliverables

TABLE A-2. USE OF FIELD QUALITY ASSURANCE SAMPLES, ASLs C AND D

Quality Assurance Sample	Water	Soil/Sediment	Biological
Trip Blank	VOA, radon	VOA, radon	VOA, radon
Field Blank	All	All	N/A
Equipment Rinsate Sample	All	All	A/S
Container Blank	A/S	A/S	A/S
Preservative Blank	A/S	A/S	A/S
Duplicate Sample	All	All	N/A
Split Sample	A/S	A/S	N/A
Spiked Sample	A/S	A/S	N/A
Material Blank	A/S	A/S	N/A

Notes

VOA = Volatile Organic Analysis
All = All parameters analyzed in a controlled environment
A/S = As specified in project specific plans. If these samples are specified, they will be analyzed for all analytes of concern to that project.
N/A = Not Applicable

TABLE A-3. SOURCE OF FEMP-DEFINED METHODS

Parameter	NPDES	RCRA	CLP
Physical Properties			
pH	150.1[1]	9040[1]	---
	----	9041	---
	----	9045[2]	---
Inorganics Non-metallics			
Chloride	325.2	9251	---
	325.3*	9252*	---
Cyanide	335.3	9012	---
	335.2	9010	353.2CLPM
Fluoride	340.2	----	---
Nitrogen-NH_3	350.2	----	---
Nitrogen-TKN	351.3	----	---
Nitrogen-NO_3	353.2	9200	---
Nitrogen-NO_2	353.2	----	---
Orthophosphate	365.1	----	---
Orthophosphate	365.3*	----	---
Total Phosphorus	365.1	----	---
Total Phosphorus	365.3*	----	---
Sulfate	375.2	9036	---
Sulfide	376.1	9030	---
Ion Chromatography	300.0[3]	----	---
Organic			
Organic Carbon	415.2	9060	---
Organic Halogens	----	9020	---
Phenolics (Tl)	420.2	9066	---
	420.1*	9065*	---
Metals			
Aluminum	200.7	6010	200.7CLPM
Antimony	200.7	6010	200.7CLPM
Arsenic	206.2	7060	206.2CLPM
Barium	200.7	6010	200.7CLPM
Beryllium	200.7	6010	200.7CLPM

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TABLE A-3. SOURCE OF FEMP-DEFINED METHODS (cont.)

Parameter	NPDES	RCRA	CLP
Metals (cont.)			
Boron	200.7	6010	---
Cadmium	200.7	6010	200.7CLPM
Calcium	200.7	6010	200.7CLPM
Chromium	200.7	6010	200.7CLPM
Chromium^{6+}	218.4	7197	---
Cobalt	200.7	6010	200.7CLPM
Copper	200.7	6010	200.7CLPM
Iron	200.7	6010	200.7CLPM
Lead	239.2	7421	239.2CLPM
Lithium	200.7	6010	---
Magnesium	200.7	6010	200.7CLPM
Manganese	200.7	6010	200.7CLPM
Mercury	245.1[1]	7470[1]	245.1CLPM
	245.5[2]	7471[2]	---
Molybdenum	200.7	6010	---
Nickel	200.7	6010	200.7CLPM
Potassium	258.1	7610	258.1CLPM
Selenium	270.2	7740	270.2CLPM
Silver	200.7	6010	200.7CLPM
Sodium	200.7	6010	200.7CLPM
Thallium	279.2	7841	279.2CLPM
Vanadium	200.7	6010	200.7CLPM
Zinc	200.7	6010	200.7CLPM
Characteristics			
Corrosivity	-----	1110	---
Reactivity(CN)	-----	7.3.3.2**	---
Reactivity(S^{2-})	-----	7.3.4.1**	---
EP Toxicity	-----	1310	---
TCLP	-----	----***	---
Organics			
Volatiles	624	8240	624CLP
Semivolatiles	625	8270	625CLP
Pesticides	608	8080	608CLP
Dioxins/ Dibenzofurans	613	8280	-----

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TABLE A-3. SOURCE OF FEMP-DEFINED METHODS (cont.)

Miscellaneous Methods	ASTM Method	Other Method
Ash Content	D-482, D-3174-82	
Atterberg Limits	D-4318	
BTU Content	D-240-76, D-2015-85	
Density		EM 1110-2-1906
Grain-Size Distribution	D-422	
Harvard Miniture Proctor		Oregon State Highway Department OSHD Test Method 104-71
Modified Proctor	D-1557	
Moisture Content	D-2216	
One-Dimensional Consolidation	D-2435	
Relative Density	D-2453, D-2454	
Soil Classification	D-2487	
Specific Gravity	D-854, C-127	
Standard Proctor	D-698	
Sulfur Content	-----	
Triaxial Shear	D-4767	EM 1110-2-1906
Unconfined Compressive Strength	D-2166	
Viscosity	D-445	

1 - Method for aqueous samples
2 - Method for soils/sediments
3 - Anions included in Ion Chromatography include: Br^-, Cl^-, F^-, I^- and SO_4^{2-}.

• Alternate method for use as a secondary
** Section reference (no method number)
*** 40 CFR Part 268, Appendix I

APPENDIX B

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APPENDIX B

FORMS

This appendix contains the forms referred to throughout this QAPjP. The following forms may be found herein.

Figure B-1. Document Change Request

Figure B-2. Deviation Report

Figure B-3. Corrective Action Report

FEMP QAPjP
DOCUMENT CHANGE REQUEST

This form is used to initiate permanent change to controlled distribution project-specific procedures.

REQUEST #: _____

Issue Date: _____

Page ___ of ___

Do not write in this block

REQUESTOR: _____ PHONE #: _____ REQUESTED DATE: _____

DCR TITLE: _____ SECTION/PAGE #: _____ REV. DATE: _____

CHANGE JUSTIFICATION:

CONTENT OF CHANGE:

IMPLEMENTATION DATE:

☐ EFFECTIVE DATE: _____

☐ OTHER: _____

REQUIRED APPROVALS:

FEMP PROGRAM/PROJECT MGR - ASI	DATE	OTHERS AS REQUIRED	DATE
QA OFFICER - ASI	DATE		
FEMP PROGRAM/PROJECT MGR - PARSONS	DATE	OTHERS AS REQUIRED	DATE
QA OFFICER - PARSONS	DATE		
FEMP PROGRAM/PROJECT MGR - WEMCO	DATE	DOE COTR	DATE
QA OFFICER - WEMCO	DATE		

TO BE COMPLETED BY DOE

A. Prior EPA notification required?	☐ YES	☐ NO
B. Prior EPA approval required?	☐ YES	☐ NO
C. Immediate Implementation?	☐ YES	☐ NO

QA OFFICER - DOE _____ DATE

Figure B-1. Document Change Request

DR NO.:	DEVIATION REPORT	REVISION:

1 Date of Discovery: _____ Responsible Organization: _____

Responsible Organization Representative: _____

Activity: _____ Location: _____

2 Requirements: _____

Deviation: _____

Verbally Notified Management: _____ (DATE) Prepared By: _____ Date: _____

Is Corrective Action Report Required? ☐ YES ☐ NO Provide Disposition by: _____

Evaluator: _____ Date: _____

3 Is Deviation Reportable Under OR? ☐ *Yes (UOR No. _____) ☐ No

**If yes, proceed in accordance with PR-FMPC-4006 and close this DR.*

Disposition: ☐ Accept-As-Is ☐ Rework ☐ Repair ☐ Reject ☐ Other

Accept-As-Is/Repair Justification: _____

Scheduled Completion Date: _____

Responsible Organization's Representative: _____ Date: _____

4 Evaluation of Disposition:

Evaluator: _____ Date: _____

6 Verification of Disposition Action Completion:

Evaluator: _____ Date: _____

Figure B-2. Deviation Report

CAR NO.:	CORRECTIVE ACTION REPORT	REVISION:

1 Date of Discovery: _____ Responsible Organization: _____
Responsible Organization Representative: _____
Activity: _____ Location: _____

2 Requirements: _____

Deviation: _____

Verbally Notified Management: _____ Evaluator: _____ Date: _____

Provide Disposition by: _____ Evaluating Manager: _____ Date: _____

3 Response to the Request for Corrective Action:

Is Deviation Reportable Under OR? ☐ *Yes (OR No. ____) ☐ No
*If yes, proceed in accordance with PR-FMPC-4006 and close this CAR.

A. Reason for the Deviation (Root Cause): _____

B. Action Taken/Proposed to Investigate and Correct Similar Work: _____

C. Action Taken to Prevent Recurrence: _____

D. Date(s) Action(s) will be Complete: _____

Responsible Organization's Representative: _____ Date: _____

4 Evaluation of Corrective Action Response:

Evaluator: _____ Date: _____

Evaluating Manager: _____ Date: _____

5 Verification of Corrective Action Completion:

Evaluator: _____ Date: _____

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Figure B-3. Corrective Action Report

APPENDIX C

APPENDIX C

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APPENDIX C

DATA QUALITY OBJECTIVES

This appendix contains guidelines for completing the DQO logic flow and DQO summary form. Also included in Attachment 1 is an example logic flow and resulting DQO summary form. Attachment 2 contains the Data Quality Objectives (DQO) for FEMP.

GUIDANCE FOR COMPLETING THE DATA QUALITY OBJECTIVE (DQO) SUMMARY FORM

C.1 INTRODUCTION

DOE Orders, environmental regulations, the Federal Facilities Compliance Agreement (FFCA), Ohio Environmental Protection Agency (OEPA) Director's Findings and Orders (DFO), and the EPA and DOE Consent Agreements all require sampling and analysis by specific methods, procedures, and analytes for FEMP environmental media. All sampling and analysis programs at FEMP ultimately contribute towards fulfillment of the site mission - restoration of the environment. Samples collected should provide data for one of the following purposes:

- Identification of potential contamination (e.g. routine monitoring programs, air and water permit verification, investigation of suspect source areas, sampling of decommissioned equipment and materials)
- Confirmation of contamination (e.g. biased sampling of spill areas, collection of samples from areas targeted during screening investigations, sampling of suspected asbestos containing materials)
- Characterization of contamination (e.g. delineation of source areas or plumes by random, biased, or combination methods; sampling of containerized waste)
- Evaluation of remedial alternatives (e.g. treatability studies)
- Monitoring of response actions (e.g. monitoring during removal actions, confirmatory sampling to determine effectiveness of a response action)

Data quality objectives (DQOs) are a scoping tool intended to ensure that data collected fulfill one of the purposes stated above. A logical set of decisions are generated which determine whether collection of samples is necessary, the types of samples to collect, the sample location and number, and the confidence level so that the data will fulfill the requirements. Decisions should fill existing data gaps and be based on intended data use. All steps of the process should be completed in sequence, and appropriately documented. The DQO summary form shall be included in the project-specific plan.

Using EPA's DQO guidance (U.S. Environmental Protection Agency, 1987), an FEMP specific DQO Summary Form was generated. Analytical and sampling requirements of those regulations, Orders and Agreements are summarized within the nine sections of the DQO Summary Form (Figure C-1).

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This guidance is intended to assist in the development of DQOs through the use of a structured logic flow process culminating in the generation of a DQO summary form. The sections of the DQO Summary Form and the queries from the Logic Flow Process are explained in detail, beginning with the DQO Logic Flow Process.

C.2 DQO LOGIC FLOW PROCESS

The logic flow process presents the rationale for deciding what data are necessary, what quality and type of data are required, how the data will be technically and legally defensible, and how risk is comprehended and minimized to insure total quality throughout the remediation process.

The logic flow will help to identify areas of concern, the selection of equipment, quality assurance requirements and analytical support levels. The logic statement is considered part of the DQO, as a supporting document and is kept on file. This logic flow process consists of the following seven (7) steps: statement of the problem; identification of a decision that addresses the problem; identification of inputs that affect the decision; specification of the domain of the decision; development of logic statement; establishment of constraints on uncertainty; and optimization of design for obtaining data. These steps as defined by Neptune (1990) are presented below.

C.2.1 Statement of Problem

This section is a discussion or statement of the area of concern. It is a complete description of what is known or expected at the area of concern, including potential pathway scenarios. Items to be addressed shall include, as appropriate, but are not limited to:

1. How was the area of concern used historically?

2. Description of any emergency remedial response or removal actions that were taken in the area.

3. What are the known and suspected sources of contamination?

4. What concentrations of known and suspected contaminants have been measured at the area?

5. What are the available Applicable or Relevant and Appropriate Requirements (ARARS) for the known and suspected contaminants in the area to be sampled?

6. By what route(s) might contaminants migrate offsite?

7. What populations, if any, are potentially exposed to known and suspected contaminants?

8. Describe the source(s) of the information used to define the problem.

C.2.2 Identification of a Decision That Addresses the Problem

This section describes a decision that addresses the concern including a list of alternative actions that address the problem in addition to the decided action. Items to be addressed shall include, as appropriate, but are not limited to:

1. What is the list of alternative actions that might be taken to address the potential problem?

2. What is the decision that will be the focus of this sampling?

C.2.3 Identification of Inputs That Affect the Decision

This section discusses the items that could affect the decision, or questions that must be answered prior to making the decision. This section should also include specification of how criteria for decision making will be established and the determination of relevance of social and political factors. Items to address shall include, as appropriate, but are not limited to:

1. Will environmental data or other factors (e.g. political or social considerations) drive the decision?

2. What questions about the environment must be answered to make the decision?

3. Will action levels (decision criteria for determining a problem exists) for contaminants of potential concern in the area be determined by risk-based calculations, reference doses (RfDs), or ARARS?

C.2.4 Specification of the Domain of the Decision

This section is a discussion or statement addressing the domain of the decision. This section addresses the boundaries from which data will be collected and the smallest area for which a separate decision will apply. Items to be addressed include, as appropriate, but are not limited to:

1. What are the receptor populations for which preliminary action levels will be calculated?

2. What are the anticipated or known receptor population activity patterns associated with current and future land use?

3. What is the smallest area over which one could reasonably assume receptor population might limit their activities during the period when exposure is possible?

4. Is a scale of resolution smaller than an exposure unit of interest (e.g. a survey design capable of detecting and locating "hot spots" of a given dimension)?

5. Does site operating or disposal historical information allow estimation of the size (area, volume) or footprint of a hot spot of potential contamination?

6. If detecting "hot spots" is a concern, what is the maximum size of a hot spot?

7. When will data be collected and what time frame will it represent?

C.2.5 Development of Logic Statement

The logic statement discusses how data will be used, including how the it will be summarized and compared to the decision criteria. This section contains if/then statements concerning the data. Items to be addressed shall include, as appropriate, but are not limited to:

1. How will data collected at this site be summarized for use in answering the main question (restoration of the environment at FEMP)?

2.* If ARARS are used, what are the thresholds of potential concern?

3.* If risk based criteria are used, what is the acceptable concentration levels for each contaminant of interest?

   a. How will acceptable risk levels be apportioned among site-related contaminants of potential concern?

   b. How will target daily intakes be apportioned among exposure routes?

   c. What site-related contaminants of concern, if any, will drive the survey design?

   d. What are the most important exposure routes for receptors at this site?

   e. What are the most reasonable contact routes (i.e., ingestion, inhalation, dermal contact etc.) for receptors in each exposure pathway of potential concern?

f. What is the estimated absorbed fraction of each site-related contaminant of potential concern for each important exposure route?

g. What are the most reasonable exposure frequencies and durations for receptors of concern at this site?

h. What are the most applicable slope factors (SF) or RfDs (e.g., toxicity values) for site-related contaminants of potential concern?

i. What incremental risk level will be deemed acceptable for site-related contaminants of potential concern?

4.* Based on reasonable exposure assumptions, what concentration(s) of each site-related contaminant of potential concern correspond to the risk level(s) deemed acceptable for this sampling site?

5. Clarify the initial key question incorporating, the specific domain and decision criteria.

6. Create logic statement(s) in if/then terms that explains what actions will be taken and under what circumstances.

* To be addressed by the risk assessors, as appropriate.

C.2.6 Establish Constraints on Uncertainty

This section discusses constraints on uncertainty. Qualitative and quantitative statements of an acceptable level of uncertainty in the outcome of the logic statement based on environmental data should be stated. Items to address shall include as appropriate, but are not limited to:

1. What are potential consequences of incorrectly deciding the site is not a problem (false negative decision error)?

2. What are the potential consequences of incorrectly deciding the site is a problem (false positives decision error)?

3. For each potential consequence determine the level of qualitative discomfort resulting from the error.

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C.2.7 Optimize Design for Obtaining Data

This section addresses how to optimize data collecting by identifying the lowest cost survey that is expected to achieve the desired constraints on uncertainty. Items to address shall include, as appropriate, but are not limited to:

1. What are the estimated variabilities and distributions of site-related contaminants of potential concern?

2. Based on existing estimates of variabilities and distributions of contaminants of potential concern and relative costs of proposed sampling and analysis options, what is the lowest cost sampling and analysis plan that will achieve the desired data and constraints on uncertainty (i.e. how many samples will be collected, how will sampling points be identified or chosen, and what is the sampling method)?

C.2.8 Summary

Using the information of the logic flow, state the Analytical Support Levels (ASLs) required and briefly explain the rationale. ASLs are specified based on the intended use of the data. In addition, identify the analytes, quality control and quality assurance samples require to support the ASL level identified. The summary information is to be listed on the bottom of the logic flow document.

C.3 DATA QUALITY OBJECTIVE FORM

The DQO Summary Form's nine (9) sections are explained. Each section and section element is explained as it appears on the Summary Form (attached). The DQO summary form is to be completed using the information and logic flow statements developed during the logic flow process.

C.3.1 Section 1

C.3.1.1 Section 1A.

Task/Description - A concise description of the task is identified (e.g. "RCRA Groundwater Sampling").

OU# - This acronym stands for Operable Unit Number. The operable unit where the sampling will occur is identified in this space. See section 2 of this QAPjP for a description of the OUs.

3.1.2 Section 1B.

Project Phase - The work phase for which the data will be used is to be identified. More than one phase may be circled since data generated by a sampling and analysis activity may support more than one work phase of the project. If the "Other" is used, an explanation (e.g. RCRA detection monitoring) must be included.

Explanations of the acronyms:

RI = Remedial Investigation
FS = Feasibility Study
RD = Remedial Design
RA = Remedial Action
R_vA = Removal Action

C.3.1.3 Section 1C.

DQO No. - This section identifies the number assigned to this particular DQO. It will be assigned by the designated FEMP prime contractor organization after completion of the form.

DQO Reference No. - This section identifies all other DQOs that are relational to the DQO being prepared.

C.3.2 Section 2

Media Characterization - This section specifies the media being investigated. Only one media will be considered per DQO. If other media are sampled to support a work phase, a separate DQO for that media and sampling activity must be prepared. If "Other" is used, an explanation must be included.

C.3.3 Section 3

Data Use with Analytical Support Level (A-E) - This section identifies data use(s) by activity and the ASLs required during the generation of data. The ASLs are described in Section 2 of this QAPjP. More than one activity or ASL may be indicated. Often more than one ASL will be indicated since various activities are required to generate data, from field measurements to laboratory analysis. Each discrete task requires a separate evaluation of its respective ASL. If "Other" is used, an explanation must be included.
Explanations:

Site Characterization - Characterization of the site to include a determination of the level(s), extent and location of contamination.

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Risk Assessment - Risk assessment data to be used to perform the endangerment assessment or public health evaluation.

Evaluation of Alternatives - Evaluation of Alternatives data will be used to evaluate or screen remedial alternatives.

Engineering Design - Engineering Design data will be used to perform detailed engineering design of the remedial actions for the site.

Monitoring during remediation activities - Data will be used to monitor during remedy implementation or establishing baseline conditions for long term monitoring after site remediation.

C.3.4 Section 4

C.3.4.1 Section 4A.

Regulatory Drivers - Identify all regulatory drivers and ARARs associated with the task.

C.3.4.2 Section 4B.

Objective - Provide a clear, concise statement of why the sampling activity is taking place (e.g. Consent Agreement requirement, RCRA monitoring, waste characterization).

C.3.5 Section 5

Site Information - Identify the necessary information to gain an overview of the site and the relative complexity and extent of the data requirements. Briefly describe the physical setting, dimensions, and current use of the site.

C.3.6 Section 6

C.3.6.1 Section 6A.

Data Types with appropriate Analytical Support Level, Equipment Selection and QAPjP Reference - The data developed from this section establishes the type, degree, extent, and migration characteristics of the contaminants and the required site characteristics.

Explanations:

1-6, Analytical Parameters - Describes the necessary analysis to acquire the data necessary to satisfy task requirements by data quality level and analysis activity.

The list of analytes and "Other" category are completed according to data requirements.

C.3.6.2 Section 6B.

Equipment Selection and QAPjP Reference - ASL A-E with QAPjP Reference - This section identifies the equipment used to analyze the sample parameters and the corresponding reference to that equipment by analytical method in the QAPjP.

C.3.7 Section 7

C.3.7.1 Section 7A.

Sampling Methods - Identify the appropriate sampling method(s) to be used in acquiring the required data in accordance with the task objectives. This refers to the method(s) of determining sample collection location, frequency, and type, not to the physical collection of the sample.

Explanations:

Biased - Sampling of a specific site area, characteristic, or problem factor based upon site knowledge and/or modeling.

Composite - Refers to a mixture of a number of grab samples to represent the average properties of the parameters of concern over the extent of the area sampled.

Environmental - Media sampling of air, water soils, and the biological environment to determine the extent of contamination.

Grab - Refers to discrete samples which are representative of a specific location at a specific point in time.

Grid - Refers to unbiased sampling which provides a representative estimate of the contamination problem over the entire site.

Intrusive - Refers to physically extracting samples from the media being sampled.

Non-intrusive - Refers to obtaining data using methods and equipment that do not require the physical extraction of material from the media being sampled.

Phased - Refers to performing discrete time-phased sampling events and using the information obtained in the previous event to refine the subsequent sampling event.

Source - Refers to sampling of actual contamination source.

C.3.7.2 Section 7B.

Sampling Work Plan Reference - Identifies the appropriate background samples required to satisfy the objective of the task.

C.3.7.3 Section 7C.

Sample Collection Reference - The procedures to be used in obtaining the required samples are to be defined. The requirement of obtaining background samples is to be provided. This section references the appropriate sample collection procedures and methods to insure the integrity and defensibility of the samples required to satisfy the objective of the task.

C.3.8 Section 8

Quality Assurance/Control Samples - Identify the minimum standards for the field quality assurance and laboratory quality control samples. The definitions and use of quality assurance samples are defined in Section 4 of this QAPjP. The required frequencies of quality assurance/quality control samples are specified for each ASL in Table A-1. If the number of samples to be collected is not specified, the frequency is to be defined in the project-specific plan.

C.3.8.1 Section 8A.

Field Quality Control Samples - Identify the quality assurance/quality control samples required for sample integrity and data defensibility to be taken in the field.

C.3.8.2 Section 8B.

Laboratory Quality Control Samples - Identify the quality assurance/quality control samples required for sample integrity and data defensibility to be performed at the analytical laboratory.

C.3.9 Section 9

Other - Provide any other relevant information to the DQO process.

C.4 REFERENCES

Neptune, Dean, 1990. "Streamlining Superfund Soil Studies: Using the Data quality Objectives Process for Scoping", U. S. Environmental Protection Agency.

U. S. Environmental Protection Agency, 1987. "Data Quality Objectives for Remedial Response Activities". Prepared for the USEPA, by CDM Federal Programs Corporation under EPA Contract No. 68-01-6939

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DQO SUMMARY FORM

Revision:
Effective Date:

Page 1 of 3

1.A. Task/Description: OU #: _____

1.B. Project Phase: (Circle the appropriate selection.)

RI FS RD RA R,A OTHER (specify) _____

1.C. DQO No.: ____ DQO Reference No.: _____

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Waste Waste water Surface water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E Evaluation of Alternatives A B C D E Engineering Design A B C D E Monitoring during remediation activities A B C D E
Other A B C D E (Explain) _____

_____

4.A. Drivers:

4.B.Objective:

---

5. Site Information (Description):

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Figure C-1. DQO Summary Form (sheet 1 of 3)

DQO SUMMARY FORM

Revision: **Page 1 of 3**
Effective Date:

1.A. Task/Description: OU #: _____

1.B. Project Phase: (Circle the appropriate selection.)

RI FS RD RA R,A OTHER (specify) _____

1.C. DQO No.: ____ DQO Reference No.: _____

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Waste Waste water Surface water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E Evaluation of Alternatives A B C D E Engineering Design A B C D E Monitoring during remediation activities A B C D E
Other A B C D E (Explain) _____
_____

4.A. Drivers:

4.B. Objective:

---

5. Site Information (Description):

DQO SUMMARY FORM

Revision:
Effective Date:

Page 3 of 3

DQO Number: _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: _____

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: _____

---

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks _
Field Blanks _
Equipment Rinsate Samples _
Preservative Blanks _
Container Blanks _
Duplicate Samples _
Split Samples _
Performance Evaluation Samples _
Other (specify) _ _____

8.B. Laboratory Quality Control Samples:

Method Blank _
Matrix Spike _
Matrix Duplicate/Replicate (Matrix Spike _ Duplicates)
Surrogate Spikes _

Other (specify) _

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Figure C-1. DQO Summary Form (sheet 3 of 3)

ATTACHMENT 1

EXAMPLE COMPLETED DATA QUALITY OBJECTIVES SUMMARY FORM AND LOGIC FLOW PROCESS

DATA QUALITY OBJECTIVE LOGIC FLOW PROCESS

SAMPLING AT RESIDENCES SERVICED BY PRIVATE GROUNDWATER SUPPLY WELLS - METALS

1. STATE THE PROBLEM

DOE Order 5400.1 requires that groundwater that may potentially be affected by DOE operations be:

- Monitored to determine and document the effects of such operations on groundwater quality and quantity and;
- To demonstrate compliance with applicable Federal and State laws and regulations.

DOE Order 5400.1 also provides general guidance for the establishment of environmental monitoring programs including effluent monitoring and environmental surveillance for non-radiological constituents of all media.

CITATION: DOE Order 5400.1, Safe Drinking Water Act (SDWA), the Federal Water Pollution Control Act (FWPCA), as amended by the Clean Water Act (CWA) of 1977, and 40 CFR 141 and 143.

2. IDENTIFY A DECISION THAT ADDRESSES THAT PROBLEM:

Pre-existing property owner wells will be sampled and analyzed to monitor for heavy metals.

3. IDENTIFY INPUTS THAT AFFECT DECISIONS:

The FEMP did not have control over the placement of these wells; they are "pre-existing" property owner wells. Siting requirements and actual placement requirements are not applicable. The number of wells sampled, is primarily dependent on two factors:

- The number of pre-existing property owner wells
- The property owners' desire to participate in the program

The samples are analyzed and the results provide data for early detection of groundwater pollution or contamination or serve as bench marks in other phases of the RI/FS.

Samples results are to be compared to state and federal water quality standards under the SDWA, FWPCA and CWA to monitor for groundwater pollution or contamination.

4. SPECIFY THE DOMAIN OF THE DECISION

Receptor populations: Downstream of the FEMP on the Great Miami River are areas that are sparsely populated and have a few small industries. There are homes located along Route 128. This area is being studied because of the influence of the site operations on Paddys Run Creek and groundwater.

Land use issues: The major land use and economic activities in the area around the FEMP are farming and raising dairy or beef cattle. Other important commercial products from the area include sand and gravel production, and water from the aquifer. Since these activities are located relatively close to the site, the issue of knowing how the FEMP operations effect the environment and the public is a concern.

There are many people in the local area who do not have access to city water and are drinking well water from this aquifer. Community members voice concerns about threats to drinking water with respect to property values, ability to secure first or second mortgages, and long-term health effects of the FEMP on the surrounding population.

Physical description: Under the FEMP is nearly 15 meters of clay-rich glacial drift, that overlie sand and gravel outwash. North of the site, near Route 126, the drift deposits directly overlie the bedrock. South of the site, Paddys Run eroded through the till, exposing the sand and gravel underneath. Groundwater in the sand and gravel aquifer is moving east under the waste pit and production areas.

Not all wells sampled are used for drinking. One is a production well. Ideally, the wells sampled by tap should be located in the vicinity of the plant site, it may also be necessary to determine which, if any, are affected by surface water discharges from the site.

The frequency of analysis is annual or at the request of the DOE.

Offsite measurement locations constitute the same background and locations in nearby communities (within a 15 km radius of the site) and other locations as the radiological pre-existing property owner sampling.

The exceedance of EPA standards in any single well warrants review of whether or not further action is required.

5. DEVELOP A LOGIC STATEMENT

IF well sampling total metals results reflect a significant (beyond what would normally be expected from fluctuations in background parameters) increasing trend, **THEN** further investigation and study is conducted to determine the cause and the relationship, if any, to the FEMP operations.

IF well sampling total metals exceed EPA's primary or secondary regulations for drinking water, **THEN** DOE notifies the pre-existing

property owner of the results and makes decisions on whether further action is appropriate.

6. **ESTABLISH CONSTRAINTS ON UNCERTAINTY:**

Due to potential variability in water sampling results, resampling and reanalysis will be considered to confirm initial sampling results and limit uncertainty based on a single sampling event. This will help to minimize potential adverse consequences should a single exceedance prove to be in error.

RI/FS risk assessments and statistical analysis at the programmatic level will be developed. These activities may be incorporated at the programmatic level in the RI/FS. There is statistical guidance for routine environmental surveillance in Draft 10 CFR 834.

7. **OPTIMIZE DESIGN FOR OBTAINING DATA**

RI/FS risk assessments and statistical analysis at the programmatic level will be developed. These activities may be incorporated at the programmatic level in the RI/FS. There is statistical guidance for routine environmental surveillance in Draft 10 CFR 834.

SUMMARY

Because this data is being obtained for routine surveillance, the data must meet a ASL A for the field measurements and an ASL B for analytical parameters. The field measurements consist of pH, temperature and specific conductance. The samples will be analyzed for total metals (Ag, As, Ba, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Se, and Zn). The following field quality assurance/quality control will be collected: trip blanks, field blanks and duplicate samples. The laboratory will conduct normal quality assurance/quality control checks such as method blanks.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Sampling at Residences Serviced by Private Groundwater Supply Wells-Metals

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental monitoring.

1.C. DQO No.: GW-006 DQO Reference No.: GW-007 & GW-008

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface Water Waste Waste Water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance.

4.A. Drivers: DOE Orders 5400.1 & 5400.5; Draft 10 CFR 834, and 40 CFR 141 and 300

4.B.Objective:

Measure heavy metal contamination at residential taps serviced by private water supply wells.

---

5. Site Information (Description):

The FEMP has potentially contaminated the groundwater around the site. The sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at homeowner taps.

DQO Number: GW-006

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic _
   Metals X
   Cyanide __
   Silica __

3. BTX _
   TPH _
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total Metals: Collected from each sampling location to be analyzed for Ag, As, Ba, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Se, and Zn

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH meter, conductivity meter	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) (Grab) Grid

Intrusive (Non-intrusive) Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS sampling of groundwater

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: GW-006

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

ATTACHMENT 2

DATA QUALITY OBJECTIVES FOR FEMP

The DQO Summary Forms are numbered by media sampled. The following are the abbreviations for the media types:

AR - Air
BL - Biological
GW - Groundwater
MS - Miscellaneous
SD - Sediment
SL - Soil
SW - Surface Water
WS - Waste
WW - Wastewater

DQO NUMBER	DQO TITLE
AR-001	Site Perimeter Radon Sampling
AR-002	Occupational Radiological Air Monitoring
AR-003	Radiological Air Sampling of Stacks
AR-004	Real Time Radon Monitoring - On Site
AR-005	Non-Radiological Occupational Air Sampling
AR-006	Routine Radiological Air Monitoring
BL-001	Fish Sampling - Routine Surveillance
BL-002	Grass Sampling - Routine Surveillance
BL-003	Milk Sampling - Routine Surveillance
BL-004	Meat Sampling - Routine Surveillance
BL-005	Produce Sampling - Routine Surveillance
GW-001	RCRA Groundwater Assessment Sampling
GW-002	Groundwater Sampling - RI/FS
GW-003	Long Term Groundwater Monitoring
GW-004	Monitoring of the FEMP Potable Water Supply
GW-005	Coal Pile Run-off Basin Groundwater Monitoring

DATA QUALITY OBJECTIVES (DQOs) MATRIX

DQO NUMBER	DQO TITLE
GW-006	Sampling at Residences Serviced by Private Groundwater Supply Wells - Metals
GW-007	Sampling at Residences Serviced by Private Groundwater Supply Wells - Radiological
GW-008	Special Request Sampling of Local Property Owner Water Sources
GW-009	CERCLA Removal Site Evaluation - Groundwater
GW-010	CERCLA Groundwater Removal Action - Phase 1
GW-011	CERCLA Groundwater Removal Action - Phase 2
GW-012	CERCLA Groundwater Removal Action - Phase 3
MS-001	Biological Hazards Assessment
MS-002	Radioactive Contamination Surveys for Offsite Release
MS-003	Bulk Sampling of Potential Asbestos Containing Building Materials (ACBMs)
MS-004	Environmental Radiation Dose Measurements
MS-005	Treatability Studies - Generic
SD-001	Routine Sediment Sampling
SD-002	Sediment Sampling - RI/FS
SL-001	Soil Sampling - Firing Range
SL-002	Soil Sampling - RI/FS
SL-003	Soil Sampling - Routine Surveillance
SL-004	Soil Sampling for Disposal
SW-001	Routine Surface Water Sampling of Paddys Run and the Great Miami River
SW-002	Surface Water - RI/FS
WS-001	Sampling of Inactive Flyash Deposits

DATA QUALITY OBJECTIVES (DQOs) MATRIX

DQO NUMBER	DQO TITLE
WS-002	Drummed Waste Characterization
WS-003	Sampling of Construction Materials for Disposal
WS-004	Sampling of Flyash from Active Deposits and Boiler Plant Waste Stream
WW-001	Storm Water Retention/Emergency Spill Containment Basin (SWRB) Sampling
WW-002	NPDES Compliance Sampling

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 1 to 5

Site Perimeter Radon Monitoring

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify) Routine surveillance

1.C. DQO No.: AR-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil
Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE Order 5400.5 Chapter II Section 1 & Chapter IV Section 4; Draft 10 CFR Part 834; 40 CFR 61 Subpart Q and 40 CFR 300.

4.B.Objective:

Monitoring radon concentrations to ensure compliance with permissible standards at FEMP property boundary and to characterize existing conditions.

---

5. Site Information (Description):

Some FEMP waste materials generate radon gas (Radon-222) which may potentially affect offsite public health or the environment. Samples will be taken at the site perimeter and background locations.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: AR-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Radon gas

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Radon Detectors	QAPjP Section: 6
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Collected from Univ. of Cinn. and Brookeville, Ind.

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: AR-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __
Other (specify) __ _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: **OU #:** 1-5

Occupational Radiological Air Monitoring

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Public Health Protection.

1.C. DQO No.: AR-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil
Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Classify work areas and determine respiratory requirements.

4.A. Drivers: DOE Order 5480.11 Section 9g3a and 40 CFR 300

4.B.Objective:

Monitor concentrations of airborne radionuclides to classify work areas and to determine respiratory protection requirements.

---

5. Site Information (Description):

The FEMP has radioactive material that can become airborne. Routine air sampling is regularly performed in work areas.

DQO Number: AR-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Gross alpha and beta gamma measurements

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Low background counting systems	QAPjP Section: 6
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Method: (Circle the appropriate selection.)

Biased Environmental Composite Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: QAPjP Section 6

DQO Number: AR-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __
Other (specify) X Daily Source Check

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Matrix Spike __
Surrogate Spikes __

Other (specify) X Source Check

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 1 to 5

Radiological Air Sampling of Stacks

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Air Quality Assessment

1.C. DQO No.: AR-003 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil
Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Air Monitoring

4.A. Drivers: FEMP Air Discharge Permits; 10 CFR 20.101 to .105, 40 CFR Part 61 Subpart H; DOE Order 5400.5 Chapter II Section 1 & Chapter III; 40 CFR 300 and OAC 3701-38.

4.B. Objective:
Monitor radionuclide emissions (except radon) from stacks and vents to protect public health and the environment.

---

5. Site Information (Description):
The FEMP site contains stacks and vents potentially emitting radionuclides to air. Effluent from stacks which may exceed 0.1 rem per year effective dose equivalent (EDE) to the public are continuously monitored, and those emitting less than 0.1 rem per year are monitored periodically to assure compliance.

Since the FEMP productions are no longer active, this monitoring is only done for laboratory hoods. However future site operations may include cleaning or other operations resulting in stack or vent emissions, and at that time monitoring would be recommenced.

IDS

DQO SUMMARY FORM

DQO Number: AR-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   See Attachment I

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

ATTACHMENT I
ACTIVITY OF RADIONUCLIDES
COMPOSITE SAMPLE

NOTE: Radionuclide release rates are calculated using radionuclide emission factors per total mass of uranium released. For point sources (stacks and vents), radionuclide emission factors in microcuries per kilogram of uranium (uCi/kg U) are developed from composite samples of stack filter analysis solutions for uranium from the FMPC monitored stacks. Below is the list of isotopes that are reported from the composite analysis.

ISOTOPE	
U234	(1)
U235	(1)
U236	(1)
U238	(1)
SR90	(2)
TC99	(3)
RU106	(3)
CS137	(2)
BA137M	(4)
RA226	(2)
RA228	(2)
TH228	(2)
TH230	(2)
TH232	(2)
TH234	(1)
PA234M	(5)
NP237	(2)
PU238	(2)
PU239	(2)
PU240	(2)
PU241	(2)
PU242	(2)

(1) - Mass weighted average of monthly composite samples analyzed at the FMPC.

(2) - Annual composite sample analyzed by an offsite contractor.

(3) - From Table 5 of "Draft Assessment of Radiation Dose and Cancer Risk for Emissions from 1951 through 1984", prepared by IT Corporation, March, 1989.

(4) - Assumed in equilibrium with Cs-137 with same activity level.

(5) - Assumed in equilibrium with Th-234 with same activity level.

DQO Number: AR-003

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) X None

Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __
Other (specify) X Laboratory control samples

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

2375

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 4

Real Time Radon Monitoring - On Site

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify) Concerns with worker exposure

1.C. DQO No.: AR-004 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE Order 5480.11 Section 9g3a & DOE Order 5400.5 Chapter II Section 1 & Chapter IV Section 4; 40 CFR Part 61 Subpart Q; 40 CFR 300 and Draft 10 CFR Part 834.

4.B.Objective:

Monitor concentrations of radon emitted from material stored in K-65 silos and waste pit area. This allows for the appropriate selection of health and safety procedures to protect on-site workers.

---

5. Site Information (Description):

The main source of radon is from the K-65 silos located west of the production area, although the waste pit is also a source of radon. Samples are collected from on site and results are compared to offsite background locations.

245

DQO Number: AR-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Radon gas

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Real Time Radon Monitors	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: A control monitor is stationed approximately 24 km northwest of FEMP.

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: AR-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __
Other (specify) X Monthly source efficiency checks and yearly calibration.

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike __ Duplicates)
Matrix Spike __
Surrogate Spikes __

Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: N/A

Non-Radiological Occupational Air Sampling.

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Health & Safety

1.C. DQO No.: AR-005 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Health & Safety

4.A. Drivers: DOE Orders 5480.4 & 5480.10; OSHA 29 CFR Parts 1910 & 1926; OAC 3704.01.05 and 40 CFR 300

4.B.Objective:

Monitor concentrations of non-radioactive airborne contamination to assure employee occupational exposure is within acceptable limits.

---

5. Site Information (Description):

Previous testing detected potentially hazardous substances (volatiles, metals). Intrusive work (drilling) may result in airborne releases of these substances possibly affecting workers in the area.

DQO Number: AR-005

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals X
   Cyanide __
   Silica X

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Asbestos

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusuve Non-Intrusive Phased Source

Other (specify): Direct Reading Instruments

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Background determined per Activity Specific Health & Safety Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: AR-005

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Surrogate Spikes __

Other (specify) X AIHA Laboratory Accreditation Program for asbestos metals, VOCs, and silica.

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Occupational air sampling results are influenced by the individual using/wearing sampling equipment and weather conditions among other factors.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 1-5

Routine Radiological Air Monitoring

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Enviromental Surveillance

1.C. DQO No.: AR-006 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE Order 5480.5, 40 CFR 300 and Draft 10 CFR 834

4.B.Objective:

Monitor concentrations of airborne radionuclides to ensure applicable standards are met.

---

5. Site Information (Description):

The FEMP has radioactive material that can become airborne. Air sampling is done from on site and off site locations including background stations.

DQO SUMMARY FORM

DQO Number: AR-006

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Gross alpha and beta gamma measurements

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Low background counting systems	QAPjP Section: 6
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Method: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: QAPjP Section 6

DQO Number: AR-006

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) X Source Checks

Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Spike __
Other (specify) X Source Checks

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Fish Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental surveillance

1.C. DQO No.: BL-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE 5400.1, DOE 5400.5, 40 CFR 300 and Draft 10 CFR 834.

4.B.Objective:

Monitoring of uranium concentrations in fish for estimating radiation dose to humans due to fish consumption from the Great Miami River and assessing potential impacts to aquatic habitat.

---

5. Site Information (Description):

Fish are potentially exposed to radionuclides from FEMP discharges (e.g., waste water). Fish sample locations are selected to provide coverage in areas of discharge and to provide background data.

DQO Number: BL-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Samples collected upstream of FEMP outfall to Great Miami River. See Environmental Monitoring Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: BL-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: OU #: 5 & 6

Grass Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental surveillance

1.C. DQO No.: BL-002 DQO Reference No.: SL-003

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE 5400.1, DOE 5400.5, 40 CFR 300 and Draft 10 CFR 834.

4.B.Objective:

Monitor radiological concentrations in grass to assess potential food chain contamination.

---

5. Site Information (Description):

Releases of airborne or water soluble radionuclides potentially occurs from FEMP. These releases may impact the food chain by contaminating soils and subsequently, being uptaken by vegetation (i.e., grass).

DQO Number: BL-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Fluoride

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-Intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Samples collected from Brookville, IN and Westwood, OH. See Environmental Monitoring Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: BL-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performane Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

When selecting grass sampling locations, avoid areas subjected to weathering from wind, precipitation or manmade disturbances (tillage).

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 5 & 6

Milk Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify) Environmental surveillance

1.C. DQO No.: BL-003 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Drivers: DOE 5400.1, DOE 5400.5, 40 CFR 300 and Draft 10 CFR 834.

4.B Objective:

Monitor radionuclide concentrations in milk to assess radiation dose to consumers.

---

5. Site Information (Description):

Releases of airborne or water soluble radionuclides potentially occurs from FEMP. These releases may impact the food chain to include dairy milk.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: BL-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Additional select radionuclides tested annually

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-Intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: A dairy in Indiana used for background conditions. See Environmental Monitoring Plan.

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: BL-003

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples X
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Meat Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental surveillance

1.C. DQO No.: BL-004 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental Surveillance

4.A. Regulatory Driver: DOE 5400.1, DOE 5400.5, 40 CFR 300 and Draft 10 CFR 834.

4.B.Objective:

Monitor radionuclide concentrations in meat to assess radiation dose to consumers.

---

5. Site Information (Description):

Releases of airborne or water soluble radionuclides potentially occurs from FEMP. These releases may impact the food chain to include farm or game animals.

DQO Number: BL-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B		QAPjP Section:
ASL C	Analytical Equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-Intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: BL-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 5 & 6

Produce Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental surveillance

1.C. DQO No.: BL-005 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surfacae water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental Surveillance

4.A. Drivers: DOE 5400.1, DOE 5400.5, 40 CFR 300 and Draft 10 CFR 834.

4.B.Objective:

Monitor radionuclide concentrations in produce to assess radiation dose to consumers.

---

5. Site Information (Description):

Releases of airborne or water soluble radionuclides potentially occurs from FEMP. These releases may impact the food chain to include farm or garden produce (fruits, vegetables).

DQO Number: BL-005

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   PCB __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   TCLP __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Two control locations in Hebron,Kentucky. See Env. Monitoring Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: BL-005

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes __

Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Produce has been determined to potentially lead to a measurable annual dose offsite. As such, critical radionuclides for radiation dosage are tested annually on produce.

2. Estimates of maximum doses to consumers are made using a computer model (AIRDOS).

3. When available, one 500 gram sample of fertilizer used on produce is collected.

4. Soil samples, representative of the farm or garden from which the produce was grown, are also collected.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

RCRA Groundwater Assessment Sampling

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RCA OTHER (specify) RCRA Groundwater Quality Assessment

1.C. DQO No.: GW-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Groundwater Quality Monitoring

4.A. Drivers: 40 CFR Part 265 Subpart F, 40 CFR 300 and Ohio Administrative Code 3745-65

4.B.Objective: Monitor groundwater quality relative to the Hazardous Waste Management Units to determine the presence of hazardous substances in groundwater.

---

5. Site Information (Description):

Area: Waste Pit Area #4.
Depth to Groundwater: Variable
Groundwater use: Domestic and industrial supply in the area
Subsurface stratigraphy (Depth): Glacial overburden (0-50'), Outwash sand and gravel (50-200').
Sensitive receptors: Great Miami sole source aquifer.

DQO Number: GW-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH X
   Oil/Grease __

4. Cations __
   Anions __
   TOX X
   TOC X
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN __
   Pesticides X
   PCB X

6. Other (specify) X
   phenols, sulfate, chloride, fluoride, nitrate, ammonia, phosphorous, alkalinity, TDS, gross alpha & beta

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment defined in GQAPP	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment in GQAPP	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: See GQAPP for Waste Pit #4

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: See GQAPP for Waste Pit #4

DQO Number: GW-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) __ _____

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Matrix Spike X
Surrogate Spikes X
Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data will be used to help determine the rate and extent of contamination, if analytes are detected.

2. Each well installed for this DQO is initially sampled and tested for the RCRA Appendix IX list of parameters.

3. The ASL D data will be done on a confirmational basis of 10 %.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 5

Groundwater Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify)

1.C. DQO No.: GW-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 141; 264 Subpart F; 265; & 300; OAC 3745-64, -81-11, -81-12, -81-15, -81-16, -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Monitor groundwater quality at FEMP to assess areal and vertical extent of contamination resulting from site operations including spills, discharges,etc.

---

5. Site Information (Description):

FEMP has potentially contaminated groundwater around the site. A sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at various depths both on site and offsite.

DQO Number: GW-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX X
   TOC X
   TCLP __
   CEC X
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equip. in RI/FS Sampling Plan	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: See RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: GW-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 5

Long Term Groundwater Monitoring

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Site Monitoring

1.C. DQO No.: GW-003 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Groundwater Monitoring

4.A. Drivers: DOE Order 5400.1, DOE Order 5400.5 Chapter II Section 1.d and 40 CFR 300

4.B.Objective: Long term monitoring is mandated by DOE to assess groundwater quality.

---

5. Site Information (Description):

FEMP has potentially contaminated the groundwater around the site. A sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at various depths both on site and offsite on a long term basis.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: GW-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations X
   Anions X
   TOX X
   TOC X
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   phenols, sulfate, chloride, fluoride, nitrate, ammonia, phosphorous, alkalinity TDS, gross alpha & beta

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Field and analytical equipment	QAPjP Section: 6 & 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS ground water sampling

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-003

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __ _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

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9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

ASL C samples are taken for confirmational purposes.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 3 & 6

Monitoring of the FEMP Potable Water Supply

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Routine Monitoring

1.C. DQO No.: GW-004 DQO Reference No.: N/A

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Quarterly monitoring for total coliform and VOCs.

4.A. Drivers: 40 CFR Parts 141 and 300; and OAC 3745-81-11, -81-12, -81-15, & -81-16.

4.B Objective: To insure that the quality of potable water meets specific baseline requirements in order to protect health and promote welfare and safety.

---

5. Site Information (Description):

Potable water distribution network is served by groundwater from the Great Miami Aquifer.

DQO Number: GW-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total coliform and DPD chlorine residual.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Field and Analytical equipment	QAPjP Section: 6 & 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __
Other (specify) __ _____

Note: See Section 9 Note 4

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Matrix Spike X
Surrogate Spikes X

Other (specify) _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Samples must be collected from a faucet, petcock, or small valve which does not leak or swivel.

2. Within the drinking water distribution system, samples are collected from influent and effluent locations (i.e., before and after treatment.)

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 3 & 5

Coal Pile Run-off Basin Groundwater Monitoring

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Groundwater Quality Assessment

1.C. DQO No.: GW-005 DQO Reference No.: None

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2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface Water Waste Waste water Other (specify) _____

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3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR 141 and 300; OAC 3745-81-11, -81-12, -81-15.

4.B.Objective: Monitor general groundwater characteristics to identify if a release from the coal pile runoff collection basin into the groundwater occurs - part of condition of Permit to Install (PTI)

---

5. Site Information (Description):

A coal pile storage area and associated runoff basin exist onsite. Coal is characteristically high in sulfates and chlorides which may potentially impact underlying groundwater. A sensitive receptor is the Great Miami River Aquifer (EPA designated Sole Source Aquifer). Monitor wells installed adjacent to the Coal Pile Run-off collection basin are used to monitor groundwater quality.

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DQO Number: GW-005

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature __
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Sulfates, chlorides, and total suspended solids (TSS)

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH meter, Conductivity meter	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by GQAPP sampling of groundwater.

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: GW-005

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) __ _____

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Matrix Spike X
Surrogate Spikes X
Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 5 & 6

Sampling at Residences Serviced by Private Groundwater Supply Wells-Metals

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Environmental monitoring.

1.C. DQO No.: GW-006 **DQO Reference No.:** GW-007 & GW-008

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface Water Waste Waste Water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance.

4.A. Drivers: DOE Orders 5400.1 & 5400.5; Draft 10 CFR 834, and 40 CFR 141 and 300

4.B.Objective:

Measure heavy metal contamination at residential taps serviced by private water supply wells.

---

5. Site Information (Description):

The FEMP has potentially contaminated the groundwater around the site. The sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at homeowner taps.

DQO Number: GW-006

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic _
   Metals X
   Cyanide __
   Silica __

3. BTX _
   TPH _
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total Metals: Collected from each sampling location to be analyzed for Ag, As, Ba, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Se, and Zn

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH meter, conductivity meter	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) (Grab) Grid

Intrusive (Non-intrusive) Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS sampling of groundwater

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: GW-006

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Sampling at Residences Serviced by Private Groundwater Supply Wells - Radiological.

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmental Surveillance

1.C. DQO No.: GW-007 DQO Reference No.: GW-006 & GW-008

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Routine Environmental Surveillance.

4.A. Drivers: DOE Order 5400.1, 5400.5, Draft 10 CFR 834 and 40 CFR Parts 141 and 300.

4.B.Objective: Measure uranium concentrations at residential taps serviced by private ground water supply wells.

---

5. Site Information (Description):

FEMP has potentially contaminated the groundwater around the site. A sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at homeowner taps.

DQO Number: GW-007

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH meter, conductivity meter	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) (Grab) Grid

Intrusive (Non-intrusive) Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS sampling of groundwater.

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6.

DQO Number: GW-007

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __
Other (specify) __ _____

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) ___
Matrix Spike __
Surrogate Spikes __
Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: OU #: 5 & 6

Special Request Sampling of Local Property Owner Water Sources.

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Environmental surveillance

1.C. DQO No.: GW-008 DQO Reference No.: GW-006 & GW-007

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other	Property owner water sources, tap, cistern and other sources of water.

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental Surveillance

4.A. Driver: DOE Order 5400.1, 5400.5, 40 CFR 300 and Draft 10 CFR 834

4.B.Objective: Monitor local property owners water quality that may have been affected by FEMP. Special request sampling is not scheduled and usually is performed once per special request location.

---

5. Site Information (Description):

FEMP has potentially contaminated the groundwater around the site. A sensitive receptor is the Great Miami Sole source Aquifer. The aquifer is used as a drinking water source. Groundwater will be sampled at homeowners water source.

DQO Number: GW-008

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   As specified

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH meter, conductivity meter	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) (Grab) Grid

Intrusive (Non-intrusive) Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS sampling

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: GW-008

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 1 to 5

CERCLA Removal Site Evaluation - Groundwater

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: GW-009 DQO Reference No.: GW-010,GW-011 & GW-012

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify)

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 141.11, .12, .15, .16, .50, .51, 264 Subpart F, 264.94 & 300; OAC 3745-64, 3745-81-11, -81-12, -81-15, -81-16, & -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Determine nature and extent of ground water contamination associated with a release of hazardous or radiologic substances. Data used to assist in deciding appropriateness of removal action(s) and/or establishment of baseline conditions for evaluating impact of removal actions on ground water quality.

---

5. Site Information (Description):

Area: Operable Units 1 to 5
Depth to Groundwater: Variable
Groundwater use: Domestic and industrial supply in the area
Subsurface stratigraphy (Depth): Glacial overburden (0-50'), Outwash sand and gravel (50-200').
Sensitive receptors: Great Miami sole source aquifer.

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DQO SUMMARY FORM

DQO Number: GW-009

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Full HSL and other contaminants as defined in RSE Sampling Plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS sampling of groundwater

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-009

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Other (specify) __

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: OU #: 1 to 5

CERCLA Groundwater Removal Action-Phase 1

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: GW-010 DQO Reference No.: GW-009, GW-011, GW-012

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Phase 1 refers to pre-construction and general characterization sampling. These levels are required to determine the extent of actions needed to reduce the threat to public and environment.

4.A. Drivers: 40 CFR Parts 141.11, .12, .15, .16, .50, .51, 264 Subpart F, 264.94 & 300; OAC 3745-64, 3745-81-11, -81-12, -81-15, -81-16, & -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Determine further information on nature and extent of ground water contamination and collect data for evaluating removal action alternatives.

---

5. Site Information (Description):

Area: Operable Units 1 to 5
Depth to Groundwater: Variable
Groundwater use: Domestic and industrial supply in the area
Subsurface stratigraphy (Depth): Glacial overburden (0-50'), Outwash sand and gravel (50-200').
Sensitive receptors: Great Miami sole source aquifer.

DQO Number: GW-010

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   List of test parameters specified in RvA sampling plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Field Equip. defined in RvA Samp. Plan	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: As defined in RvA Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-010

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __ _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

2375

1.A. Task/Description: OU #: 1 to 5

CERCLA Groundwater Removal Action-Phase 2

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify)

1.C. DQO No.: GW-011 DQO Reference No.: GW-009, GW-010, GW-012

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Phase 2 refers to sampling requirements during construction.

4.A. Drivers: 40 CFR Parts 141.11, .12, .15, .16, .50, .51, 264 Subpart F, 264.94 & 300; OAC 3745-64, 3745-81-11, -81-12, -81-15, -81-16 & -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Assure compliance with health & safety plan for protection of workers and the public during the removal action.

---

5. Site Information (Description):

Area: Operable Units 1 to 5
Depth to Groundwater: Variable
Groundwater use: Domestic and industrial supply in the area
Subsurface stratigraphy (Depth): Glacial overburden (0-50'), Outwash sand and gravel (50-200').
Sensitive receptors: Great Miami sole source aquifer.

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DQO Number: GW-011

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Full HSL and other suspected contaminants identified in RSE or phase 1

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: As defined in RvA Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-011

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) __ _____

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Matrix Spike X
Surrogate Spikes X
Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 1 to 5

CERCLA Groundwater Removal Action-Phase 3

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify)

1.C. DQO No.: GW-012 **DQO Reference No.:** GW-009, GW-010, GW-011

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Verification of removal action effectiveness.

4.A. Drivers: 40 CFR Parts 141.11, .12, .15, .16, .50, .51, 264 Subpart F, 264.94 & 300; OAC 3745-64, 3745-81-11, -81-12, -81-15, -81-16 & -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Evaluate effectiveness of removal action by reassessment of nature and extent of ground water contamination, and verification of risk reduction.

---

5. Site Information (Description):

Area: Operable Units 1 to 5
Depth to Groundwater: Variable
Groundwater use: Domestic and industrial supply in the area
Subsurface stratigraphy (Depth): Glacial overburden (0-50'), Outwash sand and gravel (50-200').
Sensitive receptors: Great Miami sole source aquifer.

DQO Number: GW-012

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   List of test parameters specified in RvA Sampling Plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: As defined in RvA Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP section 6

DQO Number: GW-012

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __ _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 3

Biological Hazards Assessment

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Personnel Monitoring

1.C. DQO No.: MS-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface Water	Waste	Waste Water	Other	Depends on biological hazard

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental monitoring

4.A. Drivers: DOE Order 5480.10 and 40 CFR 300

4.B.Objective:

Monitor on-site worker environments to provide places and conditions of employment that are free from or protected against recognized hazards that cause or likely to cause sickness, impaired health and well being or significant discomfort and inefficiency among workers or to those whom they come into contact.

---

5. Site Information (Description):

The FEMP site consists of approximately 2000 employees whom interact on a frequent basis. Biological hazards may result in reduced worker efficiency, increased absentees or other non-productive conditions.

DQO Number: MS-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Varied biological hazards

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Varies depending on hazard	QAPjP Section: N/A
ASL B	Varies depending on hazard	QAPjP Section: N/A
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: MS-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __
Other (specify) X Dependent on hazard

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Duplicate/Replicate (Matrix Spike __ Duplicates)
Matrix Spike __
Surrogate Spikes __

Other (specify) X Dependent on hazard

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 3

Radioactive Contamination Surveys for Offsite Release.

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Contamination survey

1.C. DQO No.: MS-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other	Residue

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Monitoring of equipment, materials, and personnel to be released off-site.

4.A. Drivers: DOE 5400.5 Chapter 2 Section 5c.

4.B. Objective:

Measure levels of radioactive contamination on equipment, materials, and personnel to prevent off-site spread of contamination. Provided levels are sufficiently low, these items are "released" and allowed offsite on an unrestricted basis.

---

5. Site Information (Description):

Equipment, materials, and personnel may become contaminated with radioactive materials. These items must be surveyed prior to release for off site use.

DQO Number: MS-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Alpha, beta & gamma activity

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	GM probe & alpha scintillators Automated Hand and foot monitors & whole body friskers	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

DQO Number: MS-002

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP, section 6

---

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __
Other (specify) X None

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Matrix Spike __
Surrogate Spikes __
Other (specify) X None

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: DRAFT
Effective Date: TBD

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1.A. Task/Description: **OU #:** 3

Bulk Sampling of Potential Asbestos Containing Building Materials (ACBMs)

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Building materials

1.C. DQO No.: MS-003 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface Water	Waste	Waste Water	Other	Potential ACBMs

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental surveillance

4.A. Regulatory Driver: DOE Orders 5480.4 and 5480.10, OSHA 29 CFR 1910.1001 and 29 CFR 1926.58, and EPA 40 CFR 61 (subpart M)and 40 CFR 300

4.B.Objective:

In order to complete a site inventory of locations where asbestos is present, bulk sampling of potential ACBMs is completed. Prior to maintenance work, renovation, and/or removal, the material must be sampled to verify asbestos content. Finally, this DQO is for worker/employee health and safety,and data will be used during renovation or remodelling and future disposition of construction debris.

---

5. Site Information (Description):

The majority of buildings at the FEMP site were constructed prior to 1970 when ACBMs where commonly used in the construction industry. Thus insulation pipes, duct work, outer building coverings, etc are potentially ACBMs.

DQO SUMMARY FORM

Revision: DRAFT
Effective Date: TBD

DQO Number: MS-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Asbestos

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: MS-003

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) ___ _____

Container Blanks X
Duplicate Samples __
Split Samples X
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Spike __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

Other (specify) X Research Triangle Institute quality control samples.

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

ASL C samples are for confirmation of ASL B.

1.A. Task/Description: OU #: 3
Environmental Radiation Dose Measurements

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify) Environmetal dose monitoring

1.C. DQO No.: MS-004 DQO Reference No.: N/A

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other TLDs

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmenatal dose monitoring

4.A. Driver: DOE Order 5480.11

4.B. Objective:

To monitor work areas to determine environmental radiation dose.

---

5. Site Information (Description):

The FEMP has radioactive materials in various work locations. Dur to personnel working in these locations potential radiation exposure is measured.

DQO SUMMARY FORM

Revision:
Effective Date:

DQO Number: MS-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Radiation levels in the work place

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Panasonic TLDs and TLD readers	QAPjP Section: 6
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive (Non-Intrusive) Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: _____

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: MS-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Spike X
Other (specify) __ _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 1-5

Treatability Studies - Generic

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: MS-005 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other	Depends on treatability study

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: Consent Agreement and 40 CFR 300

4.B.Objective:

To conduct treatability studies to evaluate remediation options for the site.

---

5. Site Information (Description):

The FEMP site is currently conducting a RI/FS to remediate the site. The site is divided into 6 Operable Units for remediation purposes. Each Operable unit will have a Record of Decision concerning final remediation.

DQO SUMMARY FORM

DQO Number: MS-005

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Varied dependent on nature of treatability study

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Varies depending on media	QAPjP Section: TBD
ASL B	Varies depending on media	QAPjP Section: TBD
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

(Other) (specify): Varies dependent on media tested

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: TBD

DQO Number: MS-005

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks __
Duplicate Samples __
Split Samples __
Performance Evaluation Samples __
Other (specify) X Dependent on media and test

8.B. Laboratory Quality Control Samples:

Method Blank __
Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Matrix Spike __
Surrogate Spikes __

Other (specify) X Dependent on media and test

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

This DQO is generic for all treatability studies. As the treatability studies are developed, study specific DQOs will be generated.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 5 & 6

Routine Sediment Sampling

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Environmental Surveillance

1.C. DQO No.: SD-001 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental Surveillance

4.A. Drivers: Draft 10 CFR Part 834; 40 CFR 300; DOE Order 5400.5 Chapter II Section 1.a; and DOE Order 5400.1

4.B.Objective:

Collection of sediment samples to evaluate concentrations of radionuclides, and hence, potential impact to children whom ingest affected sediments. Results are also used to assess build-up of radionuclides in surface water sediments.

---

5. Site Information (Description):

An outfall ditch from the Storm Water Retention Basin (SWRB) drains offsite to Paddy's Run. Sediment ingestion is considered a potential mode of exposure to children.

Sediment samples are collected along Paddy's Run both upstream and downstream of its confluence with the outfall ditch. Samples are also collected from the Great Miami River.

DQO Number: SD-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 6 & 9
ASL C	Analytical equipment	QAPjP Section: 6 & 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): Compositing at a given location, is permitted if sufficient sediment quantities are unavailable.

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Several locations north of FEMP boundary along Paddy's Run, and three, upstream of FEMP outfall to Great Miami River. See Environmental Monitoring Plan.

DQO Number: SD-001

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

---

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks X
Duplicate Samples X
Split Samples X
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Obtain water depth and stream flow data at the time of sampling.

2. Characteristics of the sample such as particle size distribution, visual soil description, stream type, ion-exchange, and organic content may also be useful for interpretation of analytical results.

3. ASL C data will be gathered for confirmational purposes at a rate of 10%.

1.A. Task/Description: OU #: 5 & 6

Sediment Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: SD-002 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 261 & 300; 10 CFR Part 20.101 to .105; and DOE Order 5400.5 Chapter II Section 1.a;

4.B.Objective:

Evaluate magnitude and extent of sediment contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

FEMP discharges (e.g., waste water) have potentially contaminated sediments of Paddy's Run and the Great Miami River. [See Site Description for DQO SW-002.

DQO Number: SD-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening Instruments	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Laboratory Instruments	QAPjP Section: 9
ASL D	Laboratory Instruments	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) (Grab) Grid

(Intrusive) Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Specified in RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: SD-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) X Laboratory control samples

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by sediment contamination.

2. Select samples will be tested for grain size analysis using equipment and procedures specified by ASTM.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 2

Soil Sampling - Firing Range

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: SL-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface Water Waste Waste Water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 261 & 300; and OEPA "Closure Plan Review Guidance"

4.B.Objective:

Sample soils from firing range target embankment to evaluate magnitude and extent of lead contamination.

---

5. Site Information (Description):

The firing range has been in use for many years to serve as a target practice area for on-site security guards. The soil embankment behind the range contains numerous lead bullets.

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DQO Number: SL-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals X
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS soil sampling

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: SL-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: OU #: 1 to 5

Soil Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A DTHER (specify)

1.C. DQO No.: SL-002 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other (specify)	

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 261 & 300; and OEPA "Closure Plan Review Guidance"

4.B. Objective:

Evaluate magnitude and extent of soil contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

Discharges or spills from the site have potentially contaminated soils on and off site. These soils may serve as a contamination source to ground water and pose unacceptable risks to human health or the environment. Soil samples will be collected from variable depths.

DQO Number: SL-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Specified in RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: SL-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by soil contamination.

2. Geotechnical testing will be completed following ASTM procedures and specified equipment.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Soil Sampling-Routine Surveillance

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Environmental Surveillance

1.C. DQO No.: SL-003 DQO Reference No.: BL-002 & BL-005

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other (specify) _____	

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Environmental Surveillance

4.A. Drivers: DOE 5400.1, DOE 5400.5 Chapter II Section 1.a, 40 CFR 300 and Draft 10 CFR Part 834.

4.B.Objective:

Monitor radiological concentrations in surficial soil to support ambient air data.

---

5. Site Information (Description):

Releases of airborne or water soluble radionuclides potentially occurs from FEMP. These releases are not considered a significant pathway for potential exposure through soil ingestion. Rather these releases are monitored to assess radiological migration via the air pathway or uptake into plants (e.g., grass).

DQO Number: SL-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) __

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods and Procedures: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Provided by RI/FS soil sampling

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: SL-003

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks __
Field Blanks __
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __ _____

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __

Matrix Spike __

Surrogate Spikes __

Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1.A. Task/Description: OU #: 1 to 5

Soil Sampling for Disposal

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Soil Disposition

1.C. DQO No.: SL-004 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Soil Disposition

4.A. Drivers: Draft 10 CFR 834; 40 CFR Parts 261 and 300; DOE Orders 1430.1A, 1540.2, 5400.1, 5400.3, 5400.5, 5480.19, 5820.2A.

4.B. Objective:

Determine characteristics of soil for on or off site disposition. Characteristics to be evaluated include: hazardous waste, radiologic, and/or hazardous substance list organics/inorganics.

---

5. Site Information (Description):

FEMP has several stockpiles/areas of soil materials with unknown characteristics. Prior to moving these soils, a characterization shall be done to evaluate usage, onsite storage, or offsite disposal.

DQO Number: SL-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic X
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   As specified in sampling plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

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Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: SL-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) X As specified in sampling plan

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

Other (specify) __ _____

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Field and laboratory QA/QC samples are dependent upon analytes (e.g., radiological, characteristics of hazardous waste, etc) and will be specified in project specific sampling plans.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 3, 5 & 6

Routine Surface Water Sampling of Paddys Run and the Great Miami River

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify) Environmental Surveillance

1.C. DQO No.: SW-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface Water	Waste	Waste Water	Other (specify) _____	

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Routine monitoring

4.A. Drivers: FEMP NPDES Permit; Draft 10 CFR Part 834, DOE Order 5400.5 Chapter II Section 1.a; 40 CFR 122.41, .44(a) & (e), 136.1 to .4; 40 CFR 300 OAC 3745-33-04, -33-05; and ORC 6111.04

4.B.Objective: Monitor quality of waste water discharges from FEMP to Paddys Run and the Great Miami River.

---

5. Site Information (Description):

The Great Miami River receives treated stormwater, process water and waste water from FEMP via an outfall and on occasion Paddy's Run. Due to the nature of the site, certain characteristics of the discharges may degrade water quality (e.g., dissolved oxygen). As such, these discharges are monitored to evaluate potential impacts to receiving water bodies.

DQO Number SW-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total suspended solids
   Total dissolved solids

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH, conductivity, diss. oxygen meters	QAPjP Section: 6
ASL B	Spectrophotometer	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite (Environmental) Biased (Grab) Grid

(Intrusive) Non-intrusive Phased Source

(Other) (specify): 24-hour and weekly composites

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Collected from Paddys Run at Route 126, and Great Miami River at Venice Bridge

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: SW-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __
Surrogate Spikes __

Other (specify)

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Surface Water - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify)

1.C. DQO No.: SW-002 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other (specify) _____	

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 122.41, .44, & 300; DOE Order 5400.5 Chapter II Section 1.a; 10 CFR Part 20.101 to .105; OAC 3745-1-07, -1-32 & -33-05; and ORC 6111.04.

4.B.Objective:

Evaluate magnitude and extent of surface water contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

FEMP discharges (e.g., waste water) have potentially contaminated surface waters to include Paddys Run and the Great Miami River. Surface water runoff from FEMP is collected in the Storm Water Retention Basin (SWRB).This water is pumped to a manhole and discharged to the Great Miami River.Also precipitation events of sufficient magnitude may cause overflow of the SWRB into an outfall ditch. This ditch drains to Paddys Run which empties into the River.

DQO Number: SW-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations X
   Anions X
   TOX X
   TOC X
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: One sample collected upstream of plant in Paddy's Run and the Great Miami River.

SDC

DQO Number: SW-002

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

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8. Quality Assurance/Control Samples: (Circle appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by surface water contamination.

2. ASL D samples are confirmational samples.

DQO SUMMARY FORM

2375

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 2

Sampling of Inactive Fly Ash Deposits

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify)

1.C. DQO No.: WS-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Waste Dispositioning

4.A. Drivers: Ohio Administrative Code (OAC) 3745-30; DOE Order 5400.1, 5480.11 & 5820.2A; FEMP Waste Application to Ship Waste to the Nevada Test Site (full radiologic analysis); and 40 CFR Parts 261.4B4 and 300

4.B.Objective:

Assess contamination in inactive flyash deposits to determine on or offsite dispositioning. Also perform radiological survey and/or full radiological analysis depending on metal(s) concentrations.

---

5. Site Information (Description):

Flyash formerly generated from the Boiler Plant was deposited on-site in piles. Flyash is usually high in metals content, and as such, may exceed OEPA standards for a non-toxic classification.

DQO Number: WS-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP X
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Gross alpha and beta/gamma activity for off-site release. Total suspended solids

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Analytical equipment	QAPjP Section: 9
ASL D	Analytical equipment	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: WS-001

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __ _____

Container Blanks X
Duplicate Samples X
Split Samples __
Perfromance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) _____

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Use same extraction procedure for flyash pile samples as for in-plant generation samples.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: **OU #:** 3

Drummed Waste Characteristization

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Waste disposition

1.C. DQO No.: WS-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Waste characterization

4.A. Drivers: 40 CFR Parts 260 Appendix I, 261, 262.34, 264.171, 264.171; 40 CFR 300; Draft 10 CFR 834, DOE Orders: 5400.3, 5700.6B, 5480.19, 5400.1, 5480.11, 5820.2A, 1540.2 & 1430.1A; and OAC 3745-55-70 to -78

4.B Objective:

Assess characteristics of drummed materials to determine storage or disposal requirements for on or offsite disposition.

---

5. Site Information (Description):

Drums are used to store materials at FEMP. Potential materials stored include non-RCRA, RCRA and mixed waste.

DQO Number: WS-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Will be identified sampling plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A		QAPjP Section:
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): Random computer generated

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP, section 6

DQO Number: WS-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluaition Samples X
Other (specify) X Duplicate only for ASL B

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Matrix Spike X
Surrogate Spikes X

Other (specify) X Normal laboratory control samples for ASL B

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

ASL C data is for confirmational purposes.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 1 to 5

Sampling of Construction Materials for Disposal.

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Material Disposition

1.C. DQO No.: WS-003 DQO Reference No.: N/A

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) Mixed construction materials including wood, insulation, roofing, paint, wiring and metal rubble.

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Material Disposition

4.A. Drivers: 40 CFR Part 192 Subparts B & C, 40 CFR 300, 10 CFR Part 61 Subpart C & D, Draft 10 CFR 834; and DOE Orders: 5400.3, 5480.19, 5400.1, 5480.11, 5820.2A Chapters III & IV, 1540.2, 1430.1A

4.B.Objective:

Determine characteristics of construction materials (e.g., debris) for on or off site disposal. Characteristics to be evaluated include: hazardous waste, asbestos, radiologic, and/or hazardous substance list organics/inorganics.

---

5. Site Information (Description):

FEMP has several construction activities on-going. Materials generated for disposal need to be analyzed to determine material disposition (i.e. off-site disposal or on-site storage/reuse.)

DQO Number: WS-003

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Will be identified sampling plan

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section: 9
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP, section 6

DQO Number: WS-003

8. Quality Assurance/Control Samples: (Circle appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) X Duplicates only for ASL B

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike X Duplicates)
Matrix Spike X
Surrogate Spikes X

Other (specify) X Normal laboratory control samples for ASL B

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

Appropriate analytes will be obtained from process knowledge, waste stream characteristics, and offsite disposal facilities' requirements.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 3

Sampling of Flyash from Active Deposits and Boiler Plant Waste Stream

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify) Waste Disposition

1.C. DQO No.: WS-004 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Waste Dispositioning

4.A. Drivers: Ohio Administrative Code (OAC) 3745-30; DOE Order 5400.1, 5480.11 & 5820.2A; FEMP Waste Application to Ship Waste to the Nevada Test Site (full radiologic analysis); 40 CFR Part 261.4B4 and 40 CFR 300

4.B.Objective:

Assess contamination of flyash in active deposits and Boiler Plant waste stream to determine on or offsite dispositioning. Also perform radiological survey and/or full radiological analysis depending on metal(s) concentrations.

---

5. Site Information (Description):

Flyash generated from the Boiler Plant is deposited on-site in active piles. Flyash is usually high in metals content and as such, may exceed OEPA standards for non-toxic classification.

DQO Number: WS-004

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP X
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Gross alpha and beta/gamma activity for off-site release.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening equipment	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C	Analytical equipment	QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): _____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO Number: WS-004

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X
Other (specify) X Samples will vary per ASL

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Matrix Spike X
Surrogate Spikes X

Other (specify) X Samples will vary per ASL

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 3

Storm Water Retention/Emergency Spill Containment Basin (SWRB) Sampling

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify) Routine Monitoring

1.C. DQO No.: WW-001 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) _____

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Waste Water Discharge Monitoring

4.A. Drivers: FEMP NPDES Permit; 40 CFR 122.41, 122.44, & 136.1 to .4; 40 CFR 300 and OAC 3745-33-04 & -33-05.

4.B.Objective: Sampling and analysis of accumulated fluids in the SWRB is completed to assure discharges meet the FEMP NPDES Permit.

---

5. Site Information (Description):

The SWRB is designed to collect stormwater runoff for a 10 year, 24 hour rainfall event. The basin also serves to contain material spills at the site. Accumulated liquids are pumped into MH-175 and are discharged to the Great Miami River. If conditions are such that the SWRB capacity is exceeded, overflow discharges into an outfall ditch which drains to Paddys Run. Paddys Run empties into the River.

DQO Number: WW-001

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals __
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease X

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total Suspended Solids (TSS)

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH Meter and thermometer	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): Oil and grease samples and total suspended solids are composite samples.

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: WW-001

8. Quality Assurance/Control Samples: (Circle appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Sample __

8.B. Laboratory Quality Control Samples:

Method Blank X

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __

Matrix Spike __

Surrogate Spikes __

Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

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1.A. Task/Description: OU #: 3

NPDES Compliance Sampling

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R/A OTHER (specify) Discharge monitoring

1.C. DQO No.: WW-002 DQO Reference No.: N/A

---

2. Media Characterization: (Circle the appropriate selection.)

Air	Biological	Groundwater	Sediment	Soil
Surface water	Waste	Waste water	Other (specify) _____	

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain) Routine monitoring of plant discharges.

4.A. Drivers: FEMP NPDES Permit; 40 CFR Part 122.41, 122.44, 136.1 to .4; and OAC 3745-33-04 & -33-05.

4.B.Objective: Monitor FEMP waste water discharges for contamination to limit loading on the Great Miami River.

---

5. Site Information (Description):

Process waste water from manholes, sumps, treated waste water, and collected storm-water runoff is directed into an outfall leading to the Great Miami River. The NPDES Permit requires testing be completed to meet discharge requirements.

DQO Number: WW-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic __
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease X

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA __
   ABN __
   Pesticides __
   PCB __

6. Other (specify) X
   Total Suspended Solids
   NH, NO, Cr (total), Cr^{+6}
   Ni, Pb, Ag, Cu

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	pH, thermometer & conductivity meters	QAPjP Section: 6
ASL B	Analytical equipment	QAPjP Section: 9
ASL C		QAPjP Section:
ASL D		QAPjP Section:
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased Composite Environmental Grab Grid

Intrusive Non-intrusive Phased Source

Other (specify): Some 24-hour and weekly composites are also required.

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: None

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP section 6

DQO Number: WW-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples __
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X

Matrix Duplicate/Replicate (Matrix Spike Duplicates) __

Matrix Spike __

Surrogate Spikes __

Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

APPENDIX D

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APPENDIX D

DATA VALIDATION PLAN

D.1 INTRODUCTION

The purpose of data validation is to determine if data generated for FEMP activities meets Data Quality Objectives (DQO), as defined in Appendix C of the FEMP Site-Wide Quality Assurance Project Plan (QAPjP) and in project-specific plans (Section 6). Implementing procedures described in this Data Validation Plan (DVP) will allow definitive decisions based on validated data to be made with a known level of confidence.

Data validation procedures generally fall into two categories depending upon whether the data in question are field- or laboratory-generated. Field data validation consists of checking that project-specific plans were followed and activities appropriately documented.

The laboratory data validation process includes assessment of data package completeness and DQO compliance to ensure that data is generated to the specified Analytical Support Level (ASL). ASLs are described in Section 2.

D.1.1 Purpose

The DVP provides procedures to be implemented in a timely, independent, systematic, after-the-fact process that compares a body of data against a set of performance criteria to ensure that data generated for FEMP are adequate for their intended use.

D.1.2 Scope of the Document

This DVP for environmental data collected at FEMP describes the following requirements.

- Technical Approach (para. D.2) - includes the following
  - Checklist development
  - ASLs
  - Field measurements and observations
  - Laboratory analyses

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- Discrepancy/deficiency resolution process
- Qualifier code identification

- Organizational Responsibilities and Functions (Subsection D.3) - includes the following
  - FEMP project manager
  - Data Validation Team (DVT) - composed of field and laboratory data validation personnel
- Data Review and Reporting Requirements (Subsection D.4) - based on the FEMP Remedial Investigation/Feasibility Study (RI/FS) DVP (U.S. Department of Energy, 1991)
- Field Measurements and Observations (para. D.5) - based on RI/FS DVP.
- Volatiles and Semivolatiles Data Validation Procedures (para. D.6) - based on EPA Functional Guidelines for Evaluating Organics Analyses, June 1988
- ASL E Data Validation for Organics (Subsection D.7)
- Pesticides Data Validation Procedures (para. D.8) - based on EPA Functional Guidelines for Evaluating Organics Analyses, June 1988
- Inorganic Data Validation Procedures (para. D.9) - based on EPA Functional Guidelines for Evaluating Inorganics Analyses, June 1988
- Radiological Data Validation Procedures (para. D.10) - based on procedures used at the DOE Rocky Flats plant (EG&G Rocky Flats, 1990)
- Drinking Water Data Validation Procedures (D.11) - based on EPA Method dated December 1988
- Gas Chromatography Organic Procedures (para. D.12) - adapted from EPA SW-846, Third Edition, 1986

D.2 TECHNICAL APPROACH

To ensure that data validation activities are conducted in a cost effective, technically sound, and legally defensible manner, the following technical approach shall be applied.

- Validation activities shall be conducted in accordance with this plan, which addresses the technical, regulatory and QA requirements. A list of documents containing data validation guidance and requirements is provided in Section D.12.

- Checklists and procedures shall be used to perform the data review. Checklists used to validate chemical analyses shall be directly traceable to the appropriate requirements and industry standards (e.g., ANSI, ASTM, ASME).

- Checklists shall be on hardcopy or automated in accordance with the site-wide data management plan (Appendix F). Whenever possible, data validation shall be conducted electronically.

D.2.1 Checklist Development

Data validation checklists shall be developed from the following documents.

- FEMP DQOs (Appendix C)

- Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganic Analysis (U.S. Environmental Protection Agency, 1988a and b)

- Radiochemical and other QA acceptance criteria for non-EPA methods

Review checklists contain many questions and specific guidance on information to be provided for each major measurement parameter. Completion of the checklist will reveal missing data or lack of compliance with criteria that may threaten data integrity.

D.2.1.1 <u>**Field Checklist Development**</u>**.** The field data package shall be available to conduct data validation. Validity of the sample collection process is as important as the analysis. Field data packages shall include, but are not limited to, the following, as appropriate. All are portions of the daily log as defined in Sections 5 and 6.

- Soil boring logs

- Water sampling logs

- Soil/sediment logs

- Chain-of-custody records
- Field instrument calibration records
- Shipping records
- Field logs or daily log forms
- Health and safety logs
- Data sheets for temperature correction adjustments

D.2.1.2 Laboratory Checklist Development. Laboratory data validation criteria are determined by analytical methods and ASLs for the data. Following are some of the criteria.

- Organics
  - Holding times
  - Gas chromatograph/spectrometer tuning
  - Calibration
  - Blanks
  - Surrogate recovery
  - Matrix spike/matrix spike duplicates
  - Field duplicates
  - Internal standards
  - Mass spectra/chromatograms
- Inorganics
  - Holding times
  - Calibration
  - Blanks

- Field duplicates
- Matrix spike/matrix spike duplicates
- Furnace atomic absorption
- Serial dilution analysis
- CRDL standards for Atomic Absorption (AA) and Inductively Coupled Plasma (ICP) spectroscopy
- ICP interference check sample
- Verification of instrument parameters (e.g., detection limits, linear ranges)

- Radiochemical
  - Holding times
  - Calibration verifications
  - Blanks
  - Replicates
  - Relative standard deviation
  - Spikes
  - Percent bias exceeding control limits

D.2.2 Analytical Support Levels

A graded approach shall be applied to determine useability of data generated and extent of the validation effort, based on the following.

- Intended use of the data (level of confidence necessary)
- Sample ASL
- Useability of qualified data

Reporting and deliverable requirements depend upon ASL of the analysis (Section 2).

D.2.3 Data Qualifier Codes

Codes shall be assigned to data to identify the confidence level of identification and quantitation. The qualifiers are taken from the following fundamental guides for organic and inorganic analysis validation.

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis, U.S. Environmental Protection Agency, February 1, 1988a
- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis, U.S. Environmental Protection Agency, July 1, 1988b

For this QAPjP, the following qualifier code letters and definitions are provided.

U Analyte was not detected. Associated numerical value is sample quantitation limit.

J Associated numerical value is an estimated quantity. Data are useable for many purposes.

R Data are unuseable for any purpose (compound may or may not be present). Resampling and re-analysis are necessary for verification.

N Presumptive evidence of material presence

NJ Presumptive evidence of material presence at an estimated quantity

UJ Material analyzed for was not detected. Sample quantitation limit is an estimated quantity.

D.2.4 Sequence of Data Validation Activities

D.2.4.1 **Field Activity Validation.** Following is an outline of the sequence of field data validation activities. Para. D.5 provides complete field data validation procedures.

1. Prior to beginning data validation, ensure that required documentation is available as specified in para. D.5.2.

   - Chain-of-custody record
   - Daily Log as defined in Sections 5 and 6

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NOTE

Field measurements and observations generated in accordance with project-specific work plans are described in detail in Appendices K and L.

2. After sampling is completed, review data in the Field Sampling/Data Collection Package (FSDCP) using the automated field data review process or hardcopy instructions and procedures ensuring that forms specified in project-specific plans and the QAPjP have been completed correctly and that documentation exists for required instrument calibration.

NOTE

This review is sufficient to certify that specified procedures have been followed during the field investigation in accordance with Section 11 and that data meet checklist requirements, thus completing the field data validation process.

3. If checklist requirements are not met, initiate the discrepancy/deficiency resolution process specified in para. D.2.5.

4. Report data validation results to the FEMP manager by hardcopy or electronic data transfer. Provide a hardcopy summary that lists sample numbers, flags discrepant/deficient data samples, and includes copies of data validation deficiency reports less review checklists.

5. Retain copies of completed review checklists in DVT files. Replace original field data forms and records in FEMP files.

D.2.4.2 <u>Laboratory Analysis Validation</u>. Following is an outline of the sequence of laboratoty analysis data validation activities. Para. D.6 provides complete laboratory analysis data validation procedures.

1. Obtain original completed laboratory certificate-of-analysis data packages from the FEMP manager.

2. Review data sets using laboratory analyses review instructions, procedures, and checklists. If laboratory analyses and results meet review requirements, laboratory analysis validation is complete.

3. If laboratory analyses or results do not meet review requirements, see applicable ASL procedure.

4. Report laboratory data review results to the FEMP manager. List sample numbers, flag discrepant/deficient/questionable samples, and include copies of data validation deficiency reports less review checklists.

5. Retain copies of completed review checklists in DVT files. Replace original laboratory documentation in FEMP files.

D.2.5 Discrepancy/Deficiency Resolution Process

The data validation process may raise questions as to the useability of some data because of failure to meet of one or more of the following requirements for data quality.

- Specified work plan
- Specified sample collection/tracking procedures
- Specified field and analytical instrument calibration requirements
- Specified quality control procedures
- Adherence to procedures, requirements, or work plan

If so, the following formal evaluation process shall be conducted to resolve the status of the questionable data.

D.2.5.1 <u>Initiation of Deficiency Report</u>. The DVT shall initiate the process as follows.

1. Document discrepancies/deficiencies by completing the FEMP data validation deficiency report and attaching applicable checklist.

2. Sign and date the deficiency report, ensuring that it is sequentially numbered and logged.

3. Deliver the report to the Designated FEMP QA Project Organization (DFQAPjO).

D.2.5.2 <u>Resolution of Deficiency</u>. A DFQAPjO representative shall determine corrective actions as follows.

1. If the discrepancy/deficiency is associated with field observations and measurements, it shall be assigned to the FEMP project manager or designee to find the missing information, repeat the procedure, or explain the impact of the discrepancy/deficiency on the validity of the data.

2. The FEMP project manager or designee shall incorporate his/her comments on the deficiency report, sign and date it in ink, and return it to the DFQAPjO representative.

3. If the discrepancy/deficiency is associated with laboratory analysis, the DFQAPjO representative shall direct it to the laboratory manager to either find missing information, correct mistakes or omissions, resolve inconsistencies, request re-analysis, or explain impact of the deficiency on the validity of the data.

4. If deficiencies/discrepancies are resolved, the DFQAPjO representative shall initiate appropriate QA/QC system actions, sign and date the data validation deficiency report, and return it to the DVT.

5. The DVT leader shall re-evaluate the application of data qualifiers and verify changes made to the database and return it to the DFQAPjO.

6. The DFQAPjO representative shall transmit the completed deficiency report to the FEMP project manager.

D.2.5.3 **Completion of Deficiency Report.** The deficiency report shall be completed and filed as follows.

1. The FEMP project manager or designee shall indicate concurrence with the data user's recommendation and approval to use the deficient/discrepant data for a specific purpose by signing the data validation deficiency report.

2. The data qualifier assigned to each data sample number shall be entered in the FEMP site-wide relational database.

3. After data qualifiers have been entered in the project database, the approved/signed deficiency report shall be placed in project files.

D.2.6 Data Validation Process Documentation

Documentation of the data validation process shall become part of FEMP files and shall include the following.

- Original project documentation, validation documentation, and reports summarizing or evaluating the validation effort
- DVT reports to the FEMP manager that document progress of the validation process
- Surveillance reports

D.2.7 Validation Process Inspection and Surveillance

The data validation process shall be subject to periodic inspection and surveillance by the QA staff as specified in Section 12 to monitor and document DVT compliance with the DVP and to assess DVT effectiveness.

D.3 ORGANIZATIONAL RESPONSIBILITIES AND FUNCTIONS

The DVT consists of the FEMP project manager or designee, a DFQAPjO representative, and data validation personnel. DVT members have authority to document and transmit review results. The following sections outline the specific functions associated with each organizational responsibility.

D.3.1 FEMP Project Manager

The FEMP project manager is responsible for ensuring that the following requirements are accomplished.

- Plan, assign, direct, coordinate, control, and report DVT activities and results
- Review and sign data validation discrepancy reports

D.3.2 DFQAPjO Representative

The DFQAPjO representative is responsible for accomplishing the following requirements.

- Review data validation procedures for technical adequacy
- Develop checklists and procedures
- Review completed checklists
- Recommend appropriate qualifiers for data
- Review and sign data validation discrepancy reports
- Advise FEMP manager on personnel qualifications and training
- Train DVT validation personnel

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D.3.3 Field Data Validation Personnel

Personnel shall be responsible for performing the following activities in accordance with supervisory guidance and the DVP.

- Review and verify field measurements and observations as specified
- Complete review checklists
- Prepare data validation discrepancy reports
- Prepare reports of data validation results

D.3.4 Laboratory Data Validation Personnel

Personnel shall be responsible for performing the following activities in accordance with supervisory guidance and the DVP.

- Review, verify, and certify laboratory analyses as specified
- Complete review checklists
- Prepare data validation discrepancy reports
- Prepare reports of data validation results

D.4 DATA VALIDATION AND REPORTS

Data validation begins with a review of data generated at FEMP by an analyst who is independent of the data acquisition process or the analytical group leader or equivalent. The review confirms (validates) that data processing was performed as specified. Data review continues through verification that reported analytical results correspond to data acquired and processed. The systems or laboratory project manager performs a final review of the data.

D.4.1 Overview of Data Validation

Following is a discussion of the basic approach to be used for validating data. Specific procedural steps are prescribed in following paragraphs.

- The data package shall include, as applicable, raw data, data sheets, strip charts, computer input/output, calculations, and sources for input parameters such as the Response Factor (RF) and other data listed in Appendix F.

- The independent validator shall review the data package for the following requirements.

  - Appropriateness of equations
  - Correctness of numerical output
  - Numerical correctness of calculations (by repeating numerical computations)
  - Correct interpretation of strip charts

Entries and calculations reviewed by the validator shall be marked in ink with a check mark. If the validator disagrees with any part of the computations, he/she shall draw a single line through the number and place the revised number above or beside it.

The validator shall sign and date in ink all original pages of the data package where corrections were made.

If data have been processed by computer, the validator shall check input entries only. Agreement shall be indicated by a check mark for each line. If the validator disagrees with the input, the number shall be marked through with a line and the corrected entry entered above or beside it.

Raw data that were automatically acquired and processed do not require validation beyond that previously discussed.

D.4.2 Review of Data Validation Reports

Review of data validation reports is required to verify that validated results correspond to processed analytical results reported by the laboratory. This review is performed on data as it is presented for issuance in the report.

After the draft data report is prepared, the results shall be checked against validated data to ensure against transcription errors. The checking procedure is performed by a DVT team menber as follows.

NOTE

A review of printouts such as chromatograms or GC/MS data processing that are included in the data report is not required. If computer printout is used directly as the data report without further transcription, only the input requires review as discussed in para. D.4.1.

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1. Using the draft report, check data entries to ensure that items cited in para. D.4.3 are complete and correct.

2. Place a check mark in ink beside correct entries on the draft report.

NOTE

Do not erase or use white-out.

3. Draw a single line through entries needing correction and write the correct entry beside it in ink.

4. Indicate that corrections were made in the final report by placing a check mark by the correction after comparing the change with the revised copy.

5. Sign and date in ink every page of the draft data report used to verify corrections.

6. Maintain on file draft data reports used to verify corrections as a record to prove that the review occurred.

NOTE

Step 7 is not intended to verify the reported data; rather, it is intended to determine that the report meets project requirements.

7. After completing the data report check, transmit it to the laboratory project manager or designee for final review.

8. After the final review, transmit the final data report to the FEMP project manager for approval to issue.

D.4.3 Data Validation Report Requirements

Data validation reports shall meet the following requirements.

- The final report shall be checked in accordance with data verification requirements of Section D.4.2 and shall be approved by the DVT.

- Data shall be presented in a tabular format whenever possible.

- Each table shall be identified with the project number and name and date of issue of the report.

- Tables shall include the following.
  - Sample IDentification (ID) number used by the laboratory and the sample identification provided to the laboratory if different than the laboratory ID.
  - Analyte parameters, reported values, and units of measurement reported with consistent significant figures for samples
  - Detection limit of the analytical procedure if reported value is less than the detection limit
  - Analytical method used (Appendix L)
  - Results of QC sample analyses including calibration standards
  - Achieved accuracy, precision, and completeness of data when appropriate
  - Footnotes to specific data if required to explain reported values

D.5 FIELD DATA VALIDATION PROCEDURES

Field measurements and observations generated in accordance with project-specific plans will consist primarily of radiological screening data, field temperature, pH, and specific conductance data, and data associated with soil boring advancement, monitoring well installation and development, geophysical logging and soil classification. These data will be validated by a review of the project documentation to check that forms specified in the project-specific plan and QAPjP are complete and that documentation exists for required instrument calibration. This review of documentation is sufficient to certify that proper procedures were followed during the field investigation as specified in Section 10. The DVT shall certify that data reports or forms have been adequately validated.

D.5.1 Purpose

The purpose of the field data validation procedure is to ensure sample collection and documentation is in accordance with project-specific plans and the QAPjP.

D.5.2 Procedures for Data Validation

The following procedures shall be adherred to ensure that FEMP-generated data meets requirements set forth in the QAPjP.

D.5.2.1 Preliminary Procedures.

1. Obtain the Field Sampling/Data Collection Package (FSDCP) (Appendix F), master sample list, QAPjP, and checklist.

NOTE

Only one checklist is required for the data package.

2. Complete header information at top of checklist.

3. Consult the QAPjP to determine the required ASL

4. Using the chain-of-custody records, prepare a master list of samples collected listing samples in column 1 of the master sample list form.

5. Review water or soil sampling log for each sample and verify inclusion of following.

   - A log for each sample
   - Log is completed in ink
   - Information listed on checklist is documented on each sampling log
   - Log is signed and dated

6. Make a check mark on the checklist against each item if it is correct.

7. If an error is detected, correct the error as specified in para. D.4.2, step 3, and initial and date the correction in ink.

8. If information is omitted or a log is missing, obtain the missing information from sampling personnel, verify its accuracy by signature of sampling personnel, and incorporate the information as follows.

   a. Correct omissions by filling in the required information, and initial and date it.

   b. Replace missing logs by filling out a new form indicating that the record was created "after the fact."

9. If errors are identified on sampling logs that cannot be corrected, record this in the comments section of the checklist.

10. Classify data developed from samples collected without acceptable documentation or from sample collections that were not done in accordance with the QAPjP either as "unuseable" or "qualitative," as appropriate.

D.5.2.2 Organizing/Binding Field Records. Field records shall be organized and bound into a plastic cover. Several volumes may be required.

1. Attach sampling logs to the back of their respective chain-of-custody records and arrange in chronological order according to sample collection dates.

2. Assign a number (1, 2, 3, etc.) to each record starting with the one with the earliest sample collection date.

3. Prepare a table of contents for each volume (may be a copy of master sample list).

4. In column 2 of master sample list, indicate, next to the applicable sample ID, the assigned number (step 2) of each sample.

5. Enter the sample collection date in column 4 of the master sample list next to each applicable sample in column 4.

6. Make a photocopy of the master sample list for each analytical method requested plus extra copies for binding with the chain-of-custody records (step 1).

NOTE

For example, if Volatile Organic Compounds (VOC) by EPA method 8240, Base Neutral Acid (BNA) extractable organics by method 8270, total cyanide by method 335.2, and total metals by method 6010 are requested, four copies should be made.

7. Hold these copies to use as work sheets in the next phase of validation, which is the evaluation of data package completeness and compliance with specified holding times.

8. Bind the field record into plastic binders.

D.5.2.3 Count Samples per Matrix and Parameter. Use the master sample list and count the number of samples per matrix and parameter as follows.

1. Count the number of samples that were submitted for each matrix and parameter. Do not include field Quality Control (QC) samples in this count.

2. Count field QC samples separately as follows.

   a. Determine separately the number of field replicates, field blanks, rinsate blanks, and trip blanks submitted.

   b. Determine the percent frequency of each field QC sample per matrix and parameter.

   c. Compare this number to the frequency specified in the QAPjP.

   d. Place a check mark on the checklist for each field QC sample collected and submitted for analysis.

NOTE

Failure to meet frequencies specified in the QAPjP for analysis of field QC samples does not of itself invalidate data; but, in strictly regulated investigations, it may affect useability of the data.

   e. If the sample was not submitted for analysis, place a number in the space provided and footnote the deficiency in the comments section of the checklist.

D.5.2.4 **Field Instrument Calibration Logs.** Ensure that field measuring instruments (pH meters, conductivity meters, FIDs, and PIDs) were calibrated in accordance with manufacturer specifications and consistent with QAPjP requirements as follows.

1. Review field instrument calibration logs and verify that they were properly calibrated prior to use.

2. Indicate this on the checklist.

D.5.3 General Instructions

The following general guidelines shall be applied throughout the data validation process.

- As each document is reviewed, indicate this on the checklist.
- Maintain traceability to each document reviewed.
- Signify completion of the review by reviewer's signature and date on the document reviewed.

- Use the checklist as a guide to ensure that requirements of the QAPjP were implemented at the time the reviewed document was prepared.

- If no deviations are found on a particular document, complete the checklist by indicating same with a check.

- If a discrepancy is found, mark the applicable box on the checklist and enter pertinent comments in the comments section. Documentation of discrepancies will aid in determination of future corrective action.

- Follow applicable instructions, guidelines and procedures referenced in this appendix to other appendices and sections of the QAPjP and the project-specific plan. These references will aid the reviewer in determining the requirements that apply to a particular document and concluding whether a discrepancy actually exists.

- Check recorded field measurements and observations for completeness and accuracy. Ensure that entries have the information required (e.g., the temperature space shall contain a temperature reading, not just a check mark).

- Ensure that spaces are completed as specified in Section 5. There are to be no blank data entry spaces. If the information required is not applicable, "NA" (for not applicable) should be entered in the document. If the information is unknown, "NK" (for not known) should be in the space. If some steps or procedures were not performed as specified, the reason must be stated as completely as possible on the appropriate form or submitted as an attachment thereto.

D.5.3.1 <u>General Validation Checklists</u>. General validation checklists (Figures D-1 through D-5) shall be used for validation of each of the following field measurement and observation data documents.

- Daily field log (Figure D-1)

- Sample collection log (Figure D-2)

- Chain-of-custody record (Figure D-3)

- Requests for analysis (Figure D-4)

- Training documentation, procedures, audits, nonconformance reports, surveillances, variances, and document change control records (Figure D-5)

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D.5.3.2 Specific Validation Checklists. Specific validation checklists (Figures D-6 through D-15) shall be used for validation of each of the following data forms.

- Subsurface soil sampling (Figure D-6)
- Well construction and development Figure D-7)
- Aquifer/permeability tests (Figure D-8)
- Ground water sampling and field analytical data (Figure D-9)
- Surface soils sampling (Figure D-10)
- Surface water and sediment sampling (Figure D-11)
- Radiation measurement (node survey) (Figures D-12)
- Radiation measurement (walk-over survey) (Figures D-13)

D.5.3.3 ASL B Data Validation. ASL B data shall be validated against performance requirements of the method specified in the project-specific plan. QA/QC sample frequency, method performance criteria, and data package deliverables shall be described in the project-specific plan dependent on intended data use. Items such as calibration, blanks, spikes, and other method requirements shall be included in the data validation plan. Data validation may range from minimal checks of method performance to a level very similar to ASL C or D validation with similar evaluation criteria. Figures D-14 through D-17 provide lists of types of information that may be included in ASL B data validation.

D.6 ASL C AND D VOLATILE AND SEMIVOLATILE ORGANIC DATA VALIDATION

This subsection describes data validation procedures for volatile and semi-volatile organic data for ASLs C and D.

Requirements to be checked during data validation are as follows.

- Holding times
- Gas Chromatography/Mass Spectroscopy (GC/MS) tuning
- Calibration (initial and continuing)

- Blanks
- Surrogate recovery
- Matrix Spike/Matrix Spike Duplicate (MS/MSD)
- Internal Standards (IS) performance
- Target Compound List (TCL), Hazardous Substance List (HSL), and RCRA Appendix IX compound identification
- Compound quantitation and reported detection limits including corrections for percent moisture and dilutions
- Tentatively Identified Compounds (TIC)
- System performance
- Overall assessment of data for a case

D.6.1 Holding Times

The data validation objective is to ascertain the validity of data results based on the sample holding time from sample collection to analysis or sample preparation, as applicable.

D.6.1.1 Criteria. The following technical requirements for sample holding times have been established for water and soil matrices.

- Purgeables (volatiles) - Analysis of water and soil/sediment samples shall be completed within fourteen days of validated time of sample collection.
- Extractables (Base/Neutral and Acid) - Both samples and extracts shall be preserved at 4° C. Extraction of water samples by continuous liquid/liquid procedures shall be started within seven days of time of sample collection. Extraction of soil/sediment samples by sonication procedures shall be completed within fourteen days from time of sample collection. Extracts of either water or soil/sediment samples must be analyzed within 40 days following extraction.

NOTE

Separating funnel extraction procedures are not permitted.

D.6.1.2 Evaluation Procedures.

1. Establish actual holding times by comparing sample collection date with dates of analysis and/or extraction on FEMP forms as specified in the Laboratory Services Contract (LSC).

2. If holding times are exceeded, flag positive results as estimated (J) and sample quantitation limits as estimated (UJ) and document that holding times were exceeded.

NOTE

Reviewer may determine that non-detect data are unuseable (R).

3. If holding times are exceeded, either on the first analysis or upon re-analysis, use professional judgment to determine the reliability of the data and the effects of additional storage on sample results.

D.6.2 GC/MS Tuning

Tuning and performance criteria are established to ensure mass resolution, identification and, to some degree, sensitivity.

D.6.2.1 Criteria. The criteria are not sample-specific; conformance is determined using standard materials. Therefore, criteria should be met in all circumstances.

- **DecaFluoroTriPhenylPhosphine (DFTPP)**

m/z	Ion Abundance Criteria
51	30.0 - 80.0% of m/z 198
68	less than 2.0% of m/z 69
69	present
70	less than 2.0% of m/z 69
127	25.0 - 75.0% of m/z 198
197	less than 1.0% of m/z 198
198	base peak, 100% relative abundance

199	5.0 - 9.0% of m/z 198
275	10.0 - 30.0% of m/z 198
365	greater than 0.75% of m/z 198
441	present, but less than m/z 443
442	40.0 - 110.0% of m/z 198
443	15.0 - 24.0% of m/z 442

- **Bromofluorobenzene (BFB)**

m/z	Ion Abundance Criteria
50	8.0 - 40.0% of m/z 95
75	30.0 - 60.0% of m/z 95
95	base peak, 100% relative abundance
96	5.0 - 9.0% of m/z 95
173	less than 2.0% of m/z 174
174	50.0 - 120.0% of m/z 95
175	4.0 - 9.0% of m/z 174
176	93.0 - 101.0% of m/z 174
177	5.0 - 9.0% of m/z 176

D.6.2.2 ASL C and D Data Evaluation Procedures. The following procedures apply to both ASL C and D Data.

1. Verify from the raw data that mass calibration is correct.

2. Compare data presented for each tuning to each mass listing submitted.

3. Ensure the following.

   a. Verify that FEMP forms are present for each 12-hour period samples are analyzed as specified in the LSC.

   b. The laboratory made no transcription errors.

   c. The appropriate number of significant figures has been reported (number of significant figures given for each ion in the ion abundance criteria column.

d. Laboratory made no calculation errors (e.g., the percent mass of m/z 443 relative to the mass of m/z 442 is calculated using the following equation.

$$\text{percent abundance} = \frac{\text{relative abundance of m/z 443}}{\text{relative abundance of m/z 442}} \times 100$$

NOTE

Because DFTPP and BFB spectra are obtained from chromatographic peaks that should be free from coelution problems, background subtraction should be straightforward and designed only to eliminate column bleed or instrument background ions. Background subtraction actions resulting in spectral distortions for the sole purpose of meeting contract specifications are contrary to quality assurance objectives and are therefore unacceptable.

4. If possible, verify that spectra were generated using appropriate background subtraction techniques.

5. If mass calibration is in error, classify associated data as unuseable (R).

D.6.2.3 **Evaluation Procedures for ASL C Data Only.** The following procedures apply only to ASL C data and shall be performed in addition to the procedures in para. D.6.2.2.

1. If mass calibration is in error, classify associated data as unuseable (R).

2. If ion abundance criteria are not met and the data in question are needed on a priority basis, apply professional judgment to determine the extent of data that may be utilized. Use the following guidelines to aid in the application of professional judgment to this topic.

   a. Decafluorotriphenylphosphine (DFTPP) - The most critical factors in the DFTPP criteria are non-instrument-specific requirements that are also not unduly affected by location of the spectrum on the chromatographic profile. The m/z 198/199 and 442/443 ratios are critical. These ratios are based on the natural abundances of carbon 12 and carbon 13 and shall always be met.

   Similarly, m/z 68, 70, 197, and 441 relative abundances indicate the condition of the instrument and the suitability of the resolution adjustment and are very

important. The foregoing abundances relate to adjacent ions and they are relatively insensitive to differences in instrument design and position of the spectrum on the chromatographic profile.

For the ions at m/z 51, 127, and 275, the actual relative abundance is not as critical. For instance, if m/z 275 has 40 percent relative abundance (criteria 10-30 percent) and other criteria are met, the deficiency is minor.

The relative abundance of m/z 365 is an indicator of suitable instrument zero adjustment. If m/z 365 relative abundance is zero, minimum detection limits may be affected. On the other hand, if m/z 365 is present by less than the 0.75 percent minimum abundance criteria, the deficiency is not as serious.

b. Bromofluorobenzene (BFB) - The most important factors to consider are the empirical results that are relatively insensitive to location on the chromatographic profile and the type of instrumentation. Therefore, the critical ion abundance criteria for BFB are the m/z 95/96, the 174/175, the 176/177, and the 174/176 ratios. The relative abundances of m/z 50 and 75 are of lesser importance.

3. In line with the discussion in guideline 2, an expansion of minus 10 percent of the low limit and plus 10 percent of the high limit for selected ions may be appropriate. For example, in DFTPP the m/z 51 ion abundance criteria might be expanded from 30 to 80 percent of m/z 198 to 27 to 88 percent of m/z 198. The complete expanded criteria for DFTPP and BFB are as follows.

- DFTPP expanded criteria

m/z	Ion Abundance Criteria
51	27.0 - 88.0% of m/z 198
68	less than 2.0% of m/z 69
69	present
70	less than 2.0% of m/z 69
127	22.5 - 82.5% of m/z 198
197	less than 1.0% of m/z 198
198	base peak, 100% relative abundance
199	5.0 - 9.0% of m/z 198
275	9.0 - 33.0% of m/z 198
365	greater than 0.74% of m/z 198

441	present, but less than m/z 443
442	36.0 - 121.0% of m/z 198
443	13.5 - 26.4% of m/z 442

- BFB expanded criteria

m/z	Ion Abundance Criteria
50	7.2 - 44.0% of m/z 95
75	27.0 - 72.6% of m/z 95
95	base peak, 100% relative abundance
96	5.0 - 9.0% of m/z 95
173	less than 2% of m/z 174
174	50.0 - 120.0% of m/z 95
175	4.0 - 9.0% of m/z 174
176	93.0 - 101.0% of m/z 174
177	5.0 - 9.0% of m/z 176

- If results fall within these expanded criteria, data may be acceptable

- If results fall outside these expanded criteria, the data are unuseable (R).

- If the reviewer has reason to believe that tuning criteria were achieved using techniques that distorted the spectra, full documentation on tuning quality control shall be obtained. If techniques employed are found to be at variance with accepted practices, the laboratory QA program laboratory may merit evaluation.

- It is at the reviewer's discretion based on professional judgment to flag data associated with times meeting expanded criteria, but not basic criteria. If only one element falls within the expanded criteria, qualification may not be needed. On the other hand, if several date elements are in the expanded windows, associated data may merit an estimated flag (J). The data reviewer is not required to use expanded criteria. The reviewer may still choose to flag data associated with a tune as unuseable (R) if it is appropriate to do so.

D.6.3 Calibration

Compliance requirements for instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration

demonstrates that the instrument is capable of acceptable performance in the beginning, and continuing calibration checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.

D.6.3.1 **Criteria.** Following are initial calibration criteria for volatile and semivolatile fractions.

- Average Relative Response Factors (AVGRRF) for TCL, HSL, and RCRA Appendix IX compounds shall be $\geq$ 0.01.

- Percent Relative Standard Deviations (%RSD) shall be $\leq$ 40 percent.

Following are the continuing calibration criteria for volatile and semivolatile fractions.

- Relative Response Factors (RRF) for TCL, HSL, and RCRA Appendix IX compounds shall be $\geq$ 0.01.

- Percent Difference (%D) shall be $\leq$ 40 percent.

D.6.3.2 **Evaluation Procedures.** Initial calibration procedures are as follows.

1. Evaluate RRF for TCL, HSL, and RCRA Appendix IX compounds and verify the following.

   a. Check and recalculate the RRF and AVGRRF for one or more volatile and semivolatile TCL, HSL, and RCRA Appendix IX compounds and verify that the recalculated values agree with laboratory reported values.

   b. Verify that volatile and semivolatile TCL, HSL, and RCRA Appendix IX compounds have AVGRRF of at least 0.01.

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2. Evaluate %RSD for TCL, HSL, and RCRA Appendix IX compounds and verify the following.

$$\sigma = \text{SQRT}\left(\sum_{i=1}^{n} \frac{(x_i - x)^2}{(n-1)} \right)$$

$$\%RSD = \sigma \times 100 / x$$

σ = Standard deviation of 5 response factors

x = Mean of 5 response factors

a. Check and recalculate the %RSD for one or more TCL, HSL, and RCRA Appendix IX compounds and verify that recalculated value agrees with laboratory reported value.

b. Verify that TCL, HSL, and RCRA Appendix IX compounds (volatile and semivolatile) have a %RSD of $\leq$40 percent.

3. If errors are detected in the calculations of either RRF or %D, perform a more comprehensive recalculation.

4. If a volatile or semivolatile TCL, HSL, or RCRA Appendix IX compound result has an AVGRRF of less than 0.01, proceed as follows.

a. Flag positive results for that compound as estimated (J).

b. Flag non-detects for that compound as unuseable (R).

5. If a volatile or semivolatile TCL, HSL, or RCRA Appendix IX compound has a %RSD of greater than 40 percent, proceed as follows.

a. Flag positive results for that compound as estimated (J).

b. Qualify non-detects using professional judgment.

Continuing calibration procedures are as follows.

1. If a volatile or semivolatile TCL, HSL, or RCRA Appendix IX compound has an RRF of less than 0.01, proceed as follows.

   a. Flag positive results for that compound as estimated (J).

   b. Flag non-detects for that compound as unuseable (R).

2. If a volatile or semivolatile TCL, HSL, or RCRA Appendix IX compound has a %D between initial and continuing calibration of greater than 40 percent, proceed as follows.

   a. Flag positive results for that compound as estimated (J).

   b. Qualify non-detects using professional judgment.

D.6.4 Blanks

Blank analysis results are assessed to determine the existence and magnitude of contamination problems.

D.6.4.1 <u>Criteria</u>. Criteria for evaluation of blanks apply to any blank associated with the samples. If problems with a blank exists, data associated with the case shall be evaluated to determine if there is an inherent variability in the data for the case or if the problem is an isolated occurrence not affecting other data.

No contaminants should be present in the blanks.

D.6.4.2 <u>Evaluation Procedures</u>.

1. Review results of associated blanks and FEMP forms as specified in the LSC and raw data (e.g., chromatogram, reconstructed ion chromatogram, quantitation reports or data system printouts).

NOTE

Reviewer may use the method blank summary to assist in identifying samples associated with each method blank.

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2. Verify that method blank analysis has been reported per matrix, per concentration level for each GC/MS system used to analyze Volatile Organic Analysis (VOA) samples and for each extraction batch for semivolatiles.

NOTE

Action in the case of unsuitable blank results depends on circumstances and origin of the blank. Positive sample results shall not be reported unless the concentration of the compound in the sample exceeds ten times the amount in any blank for the common contaminants listed in step 5 or five times the amount for other compounds. When more than one blank is associated with a given sample, qualification shall be based upon a comparison with the associated blank having the highest concentration of a contaminant. Results shall not be corrected by subtracting a blank value.

3. If a compound is found in a blank but not found in the sample, take no action.

4. Qualify compounds (other than those listed in step 5) detected in the sample and also detected in an associated blank when the sample concentration is less than five times the blank concentration.

5. If concentration of the compound in the sample exceeds ten time the amount in a blank for the following common laboratory contaminants, report a positive result.

- Methylene chloride
- Acetone
- 2-butanone
- Common phthalate esters

NOTE

The blank analyses may not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5x and 10x criteria so that a comparison of the total amount of

contamination is actually made.

Additionally, there may be instances where little or no contamination was present in the associated blanks, but qualification of the sample was deemed necessary. Contamination introduced through dilution water is one example. Although it is not always possible to determine, instances of this can be detected when contaminants are found in the diluted sample result, but are absent in the undiluted sample result. However, if the reviewer determines that the contamination is from a source other than the sample, he/she should qualify the data. In this case, the 5x or 10x rule does not apply; the sample value should be reported as a non-detect.

Following are examples of applying the blank qualification guidelines. Certain circumstances may warrant deviations from these guidelines.

Case 1 Sample result is greater than the contract Required Quantitation Limit (RQL), but is less than the required amount (5x or 10x) from the blank result.

		Rule	
		10x	5x
Blank Results		7	7
RQL	5		5
Sample Results		60	30
Qualified Sample Result		60U	30U

NOTE

In the example for the 10x rule, sample results less than 70 (or 10 x 7) would be qualified as non-detects. In the case of the 5x rule, sample results less than 35 (or 5 x 7) would be qualified as non-detects.

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Case 2 Sample result is less than RQL and also less than the required amount (5x or 10x) from the blank result.

		Rule	
		10x	5x
Blank Result		6	6
RQL	5		5
Sample Result		4J	4J
Qualified Sample Result		5U	5U

NOTE

Data are not reported as 4U because this would be reported as a detection limit below the RQL.

Case 3 Sample result is greater than the required amount (5x or 10x) from the blank result.

	Rule	
	10x	5x
Blank Result	10	10
RQL	5	5
Sample Result	120	60
Qualified Sample Result	120	60

NOTE

For both 10-times and 5 times release, sample results exceeded adjusted blank results of 100 (or 10 x 10) and 50 (or 5 x 10).

6. If gross contamination exists (i.e., saturated peaks by GC/MS), flag affected compounds as unuseable (R) in samples affected because of interference.

7. If inordinate amounts of other TCL, HSL, or RCRA Appendix IX compounds are found at low levels in blanks, record it in the data review comments as it may be indicative of a problem at the laboratory.

8. If TICs are found in both the sample and associated blanks, record this in the data review comments (for the same reason as in step 7).

D.6.5 Surrogate Recovery

Laboratory performance on individual samples is established by means of spiking activities. Samples are spiked with surrogate compounds prior to sample preparation. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects caused by such factors as interferences and high concentrations of analytes. Because the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, review and validation of data based on specific sample results is frequently subjective and demands analytical experience and professional judgement. Accordingly, this paragraph consists primarily of guidelines and, in some cases, several optional approaches are suggested.

D.6.5.1 <u>ASL C Criteria</u>. For ASL C data only, sample and blank surrogate recoveries for volatiles and semivolatiles shall be within limits specified in applicable methods.

D.6.5.2 <u>ASL D Criteria</u>. For ASL D data only, sample and blank surrogate recoveries for volatiles and semivolatiles shall be within limits specified in the applicable FEMP method and the LSC.

D.6.5.3 <u>Evaluation Procedures</u>.

1. Check raw data (i.e., chromatogram, quantitation list) to verify recoveries on the surrogate recovery form.

NOTE

When there are unacceptable surrogate recoveries followed by successful re-analyses, the laboratory is required to report only the successful run.

2. From surrogate recovery forms, determine if any two surrogates within a base/neutral or acid fraction (of one surrogate for the VOA fraction) are out of specification or if any one base/neutral, acid, or VOA surrogate has a recovery of less than 10 percent. If so, re-analyze surrogates that are outside the criteria.

3. From surrogate recovery forms, determine if recoveries are out of specification with no evidence of repurging, re-injection, or re-extraction. If so, the laboratory has failed to perform satisfactorily.

4. Verify that no blanks have surrogates outside the criteria.

5. If there are two or more analyses for a particular fraction, determine which are the best data to report based on the following considerations.

   - Surrogate recovery (marginal versus gross deviation)
   - Holding times
   - Comparison of the values of the TCL, HSL, and RCRA Appendix IX compounds reported in each fraction

6. For surrogate spike recoveries out of specification, proceed as follows.

   a. If at least two surrogates in a base/neutral or acid fraction or one surrogate in the volatile fraction are out of specification, but have recoveries greater than 10 percent, proceed as follows.

      (1) Flag positive results for that fraction as estimated (J).

      (2) Flag negative results for that fraction with the sample quantitation limit as estimated (UJ).

   b. If a surrogate in a fraction shows less than 10 percent recovery, proceed as follows.

      (1) Flag positive results for that fraction as estimated (J).

      (2) Flag negative results for that fraction as unuseable (R).

   c. Do not qualify data with respect to surrogate recovery unless at least two surrogates are out of specification in the base/neutral or acid fraction, one is out of specification in the volatile fraction, or unless recovery of a surrogate is less than 10 percent.

d. In the special case of a blank analysis with surrogates out of specification, give special consideration to the validity of associated sample data and determine whether problems are isolated to the blank alone or if there is a fundamental problem with the analytical process.

NOTE

For example, if one or more samples in the batch show acceptable surrogate recoveries, the blank problem may be considered an isolated occurrence. However, even if this judgment allows some use of the affected data, analytical problems remain, which shall be reported to and corrected by the laboratory.

D.6.6 Matrix Spike/Matrix Spike Duplicate

Matrix Spike/Matrix Spike Duplicate (MS/MSD) data are generated to determine long-term precision and accuracy of the analytical method on various matrices. These data alone cannot be used to evaluate the precision and accuracy of individual samples.

D.6.6.1 Criteria. Spike recoveries and Relative Percent Differences (RPD) between MS/MSD recoveries shall be within advisory limits in FEMP methods (Appendix L).

D.6.6.2 ASL C and D Data Evaluation Procedures. The following procedures are applicable to both ASL C and D data.

1. Inspect data results for the MS/MSD recovery.

2. Verify transcriptions from raw data and verify calculations.

3. Take no action on MS/MSD data alone to qualify an entire case. However, using informed professional judgment and the matrix spike and matrix spike duplicate results in conjunction with other QC criteria, determine the need for some qualification of the data.

D.6.6.3 **ASL D Data Evaluation Procedures.** The following evaluation procedures are applicable only to ASL D data and shall be performed in addition to procedures in para. D.6.6.2.

1. Try to determine the effect of the results of the MS/MSD on associated data with regard to the MS/MSD sample itself as well as specific analytes for samples associated with the MS/MSD.

2. If it can be determined that results of the MS/MSD affect only the spiked sample, limit qualification to this sample alone.

3. If it is determined through the MS/MSD results that a laboratory is having a systematic problem in the analysis of one or more analytes, apply qualification to associated samples.

D.6.7 Field Duplicates

Field duplicate samples may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision; therefore, the results may have more variability than laboratory duplicates, which measure only laboratory performance. It is also expected that solid matrix duplicate results will have a greater variance than water matrices because of difficulties associated with collecting identical samples.

D.6.7.1 **Criteria.** There are no specific review criteria for field duplicate analyses comparability.

D.6.7.2 **Evaluation Procedures.**

1. Identify samples that are field duplicates using FEMP forms specified in the LSC or project-specific plan.

2. Compare results reported for each sample and calculate the RPD.

3. Provide evaluation of field duplicates with the reviewer comments.

D.6.8 Internal Standards Performance

D.6.8.1 Criteria. The following IS performance criteria ensure that GC/MS sensitivity response is stable during every run.

- IS area counts shall not vary by more than a factor of two (-50 percent to +100 percent) from the applicable calibration standard.
- Retention time of the IS shall not vary more than ± 30 seconds from the associated calibration standard.

D.6.8.2 Evaluation Procedures.

1. Check raw data (e.g., chromatograms, quantitation lists) and verify recoveries reported on FEMP forms specified in the LSC.
2. Verify that retention times and IS areas are acceptable.
3. If there are two analyses for a particular fraction, determine which are the best data to report considering the following.
   - Magnitude of the shift
   - Holding times
   - Comparison of the values of TCL, HSL, and RCRA Appendix IX compounds reported in each fraction
4. If an IS area count is outside the range of -50 percent or +100 percent of the associated standard:
   a. Flag positive results for compounds quantitated using that IS as estimated (J) for that sample fraction,
   b. Flag non-detects for compounds quantitated using that IS with the sample quantitation limit classified as estimated (UJ) for that sample fraction, and
5. If an IS retention time varies by more than 30 seconds, examine the chromatographic profile for that sample to determine if false positive or negatives exist.

6. For shifts of a large magnitude, consider partial or total rejection of the data for that sample fraction.

7. If an IS retention time varies by more than 30 seconds, examine the chromatographic profile of the sample to determine if false positives or negatives exist.

8 For shifts of a large magnitude, consider partial or total rejection of the data for that sample fraction.

D.6.9 Compound Identification

The objective of the criteria for GC/MS qualitative analysis is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not present) or a false negative (not reporting a compound that is present).

Identification criteria can be applied much more easily in detecting false positive than false negatives. More information is available because of the requirement for submittal of data supporting positive identifications. Negatives (non-detected compounds), on the other hand, represent an absence of data and are, therefore, much more difficult to assess.

D.6.9.1 Criteria.

- Compound shall be within ± 0.06 Relative Retention Time (RRT) units of the standard RRT.

- Mass spectra of the sample compound and a current laboratory-generated standard shall match according to the following criteria.

  - Ions present in the standard mass spectrum at a relative intensity greater than 10 percent shall be present in the sample spectrum.

  - Relative intensities of ions shall agree within ± 20 percent between the standard and sample spectra. (Example: For an ion with an abundance of 50 percent in the standard spectrum, the corresponding sample ion abundance shall be between 30 and 70 percent.)

  - Ions greater than 10 percent in the sample spectrum but not present in the standard spectrum shall be considered and accounted for.

D.6.9.2 Evaluation Procedures. The following procedures are applicable to both ASL C and D data.

1. Ensure that RRT of reported compounds is within 0.06 RRT units of the reference standard.

2. Check laboratory standard spectra versus sample compound spectra as specified in para. D.9.1.

3. Be aware of situations (e.g., high concentration samples preceding low concentration samples) when sample carry-over is a possibility and use judgement to determine if instrument cross-contamination has affected positive compound identification.

4. Use professional judgement to apply qualitative criteria for GC/MS analyses; and, if it is determined that incorrect identifications were made, flag such data as not detected (U) or unuseable (R).

6. Use professional judgment to qualify data if it is determined that cross-contamination has occurred.

D.6.10 Compound Quantitation and Reported Detection Limits

The data validation objective is to ensure that reported quantitation results and the Required Quantitation Limit (RQL) are accurate.

D.6.10.1 Criteria.

- Compound quantitation as well as the adjustment of the RQL shall be calculated according to the appropriate FEMP method.

- Compound RRF shall be calculated based on IS specified in the FEMP method for that compound.

- Quantitation shall be based on the quantitation ion (m/z) specified in the FEMP method.

- The compound quantitation shall be based on the RRF from the appropriate daily standard.

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D.6.10.2 Evaluation Procedures.

1. For fractions, examine raw data to verify correct calculation of sample results reported by the laboratory.

2. Compare quantitation lists, chromatogram, and sample preparation log sheets to reported positive sample results and quantitation limits.

3. Verify that correct internal standard, quantitation ion, and RRF were used to quantitate the compound.

4. Verify that RQLs have been adjusted to reflect sample dilutions, concentrations, splits, clean-up activities, and dry weight factors that are not accounted for by the method.

5. If discrepancies are found, contact the laboratory to obtain additional information that could resolve differences. If a discrepancy remains unresolved, decide which value is the best value.

NOTE

Under these circumstances, the reviewer may determine qualification of data is warranted.

D.6.11 Tentatively Identified Compounds (ASL D Data Only)

This paragraph concerning TICs is applicable only for ASL D data.

Chromatographic peaks in volatile and semivolatile fraction analyses that are not on target compound lists (TCL, HSL, or RCRA Appendix IX), analytes, surrogates, or internal standards are potential TICs. TICs shall be qualitatively identified by GC/MS library search and the identifications assessed by the data reviewer.

D.6.11.1 Criteria.

- For each sample, the laboratory shall conduct a mass spectral search of the NIST library and report possible identity for the 10 largest VOA fraction peaks and the 20 largest BNA fraction peaks that are not surrogate, IS, TCL, HSL, or RCRA Appendix IX compounds, but have area/height greater than 10 percent of the size of the nearest IS. TIC results shall be reported for each sample.

- Guidelines for tentative identification are as follows.

  - Major ions (greater than 10 percent relative intensity) in the reference spectrum shall be present in the sample spectrum.

  - Relative intensities of major ions shall agree within $\pm$ 20 percent between the sample and the reference spectra.

  - Molecular ions present in the reference spectrum shall be present in the sample spectrum.

  - Ions present in the sample spectrum but not in the reference spectrum shall be reviewed for possible background contamination, interference, or co-elution of additional compounds.

  - Even when these criteria are not met, the data reviewer may report identification if it is correct in the technical judgment of a mass spectral interpretation specialist data reviewer.

  - If, in the data reviewer's judgment, the identification is uncertain or there are extenuating factors affecting compound identifications, the TIC result may be reported as "unknown".

D.6.11.2 Evaluation Procedures.

1. Check raw data to verify that the laboratory has generated a library search for required peaks in the chromatogram (samples and blanks).

2. Examine blank chromatogram to verify that TIC peaks present in samples are not in blanks. When a low-level, non-TCL, non-HSL, or non-Appendix-9 compound that is a common artifact or laboratory contaminant is detected in a sample, check the blank chromatogram for peaks that are less than 10 percent of the IS height, but are present in the blank chromatogram at similar relative retention time.

3. Examine mass spectra in each sample and blank.

4. Because TIC library searches often yield several candidate compounds with a close matching score, consider all reasonable choices.

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5. Be aware of the following common laboratory artifacts/contaminants and their sources that may be present in blanks and not reported as sample TICs.

- Common laboratory contaminants: CO2 (m/e 44), siloxanes (m/e 73), diethyl ether, hexane, certain freons (1,1,2-trichloro-1,2,2-trifluoroethane or fluoro-trichloromethane), phthalates at levels less than 100 ug/l or 4000 ug/kg

- Solvent preservatives: cyclohexene, a methylene chloride preservative, and related by-products including cyclohexanone, cyclohexenone, cyclohexanol, cyclohexenol, chlorocyclohexene, chlorocyclohexanol

- Aldol reaction products of acetone including 4-hydroxy-4-methyl-2-pentanone; 4-methyl-2-penten-2-one; 5,5-dimethyl-2(5H)-furanone

NOTE

A TCL, HSL, or RCRA Appendix IX compound may be identified in the proper analytical fraction by non-target library search procedures, even though it was not found on the quantitation list.

6. If the total area quantitation method was used, request that the laboratory recalculate the result using the proper quantitation ion. In addition, evaluate other sample chromatograms and check library reference retention times on quantitation lists to determine whether the false negative result is an isolated occurrence or data from the entire case is affected.

NOTE

Compounds may be identified in more than one fraction.

7. Verify that quantitation is made from the proper fraction.

8. Flag TIC results as tentatively identified with estimated concentrations (JN).

9. If it is determined that tentative identification of a compound is not acceptable, change the tentative identification to "unknown" or an appropriate identification.

10. If contractually required peaks were not library searched, request these data from the laboratory.

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11. Do not report TIC results that are not sufficiently above the level in the blank. Take into account dilutions and sample size when comparing amounts present in blanks and samples.

12. When a compound is not found in any blanks but is a suspected artifact of a common laboratory contaminant, flag the result as unuseable (R).

NOTE

The reviewer may elect to report similar isomers as a total. (Alkanes may be summarized and reported as total hydrocarbons).

13. When deciding whether a library search result for TIC represents a realistic identification, exercise professional judgement; and if there is more than one reasonable match, report the result as "either compound X or compound Y." If there is a lack of isomer specificity, change the TIC result to a non-specific isomer result (1,3,5-trimethyl benzene to substituted aromatic compound).

NOTE

Other case factors may influence TIC judgments. If a sample TIC match is poor but other samples have TIC with a good library match, similar relative retention time, and the same ions, identification information may be inferred from other sample TIC results. Physical constants, such as boiling point, may be factored into professional judgment of TIC results.

D.6.12 System Performance

During the period following instrument performance QC checks (e.g. blanks, tuning, calibration), changes may occur in the system that degrade data quality. While this degradation would not be directly shown by QC checks until the next required series of analytical QC runs, a thorough review of ongoing data acquisition can yield indicators of instrument performance. Some examples of instrument performance indicators for various factors follow.

- Abrupt, discrete shifts in Reconstructed Ion Chromatograph (RIC) baseline may indicate gain or threshold changes.

- Poor chromatographic performance affects both qualitative and quantitative results. Indications of substandard performance include the following.
  - High RIC background levels or shifts in absolute retention times of internal standards
  - Excessive baseline rise at elevated temperature
  - Extraneous peaks
  - Loss of resolution suggested by factors such as non-resolution of 2,4- and 2,5-dinitrotoluene
  - Peak tailing or peak splitting may result in accurate quantitation

Continued analytical activity with degraded performance suggests lack of attention or professional experience. Using instrument performance indicators, the data reviewer shall decide if the system has degraded to the point of affecting data quality or validity. If data quality may have been affected, data shall be qualified using the reviewer's best professional judgment.

D.6.13 Overall Assessment of Data for a Case

It is appropriate for the data reviewer to make professional judgments and express concerns and comments on the validity of the overall data package for a case. This is particularly true for cases in which there are several QC criteria out of specification. The additive nature of QC factors out of specification is difficult to assess in an objective manner, but the reviewer has a responsibility to inform users concerning data quality and data limitations in order to avoid inappropriate use of data, yet not precluding consideration of the data. The reviewer is greatly assisted if DQOs are provided.

D.7 PESTICIDE, VOLATILE, AND SEMIVOLATILE ORGANIC AND INORGANIC DATA VALIDATION AT ASL E

D.7.1 Organic Data

For ASL E, use the Organic Data Validation Checklist (Figure D-14) for organic data validation and review results of associated data forms and the raw data (chromatograms,

quantitation reports, data system printouts). Check for calculation errors, transcription errors, and equation appropriateness.

D.7.2 Inorganic Data

For ASL E, use the Inorganic Data Validation Checklist (Figure D-15) for organic data validation and review results of associated data forms and raw data (chromatograms, quantitation reports, data system printouts). Check for calculation errors, transcription errors, and equation appropriateness.

D.8 ASLs C AND D PESTICIDES DATA VALIDATION PROCEDURES

This subsection describes general procedures for validation of ASLs C and D Gas Chromatographic (GC) methods (e.g., herbicides, purgeable halocarbond, organo-phosphate pesticides). This procedure lists steps that shall be followed in the validation of any GC method. Specific performance criteria, surrogates, spike compounds, instrument performance requirements, calibration, and standards are provided in the individual methods and shall be used as data validation criteria.

- Holding times (para. D.8.1)
- Instrument performance (para. D.8.2)
- Calibration (initial, analytical sequence, and continuing) (para. D.8.3)
- Blanks (para. D.8.4)
- Surrogate recovery (para. D.8.5)
- Matrix spike/matrix spike duplicate (para. D.8.6)
- Field duplicates (para. D.8.7)
- Compounds identification (para. D.8.8)
- Compound quantitation and reported detection limits (para. D.8.9)
- Overall assessment of data for a case (para. D.8.10)

D.8.1 Holding Times

The objective of holding times data validation is to ascertain the validity of results based on the holding time of the sample from sample receipt to sample analysis or preparation, as applicable.

D.8.1.1 Criteria.

- Extraction of water samples by separatory funnel procedures shall be completed within seven days of sample collection date.
- Extraction of water samples by continuous liquid/liquid extraction procedures shall be started within seven days of sample collection time.
- Extraction of soil/sediment samples by sonication shall be completed within fourteen days of sample collection time.
- Analysis of samples shall be completed within forty days following the start of extraction.

D.8.1.2 Evaluation Procedures for ASLs C and D Data. The following procedures apply to both ASL C and ASL D data. Paragraph D.8.1.3 procedures are applicable to ASL D data only.

1. Establish actual holding time by comparing sample collection date with dates of analysis and extraction on FEMP form specified in the LSC.

NOTE

If there is no indication of preservation, it shall be assumed that sample is unpreserved.

2. Examine sample records to determine if samples were properly preserved.
3. If holding times are exceeded, proceed as follows.
   a. Flag positive results as estimated (J).
   b. Flag sample quantitation limits as estimated (UJ).

c. Document that holding times were exceeded.

4. If holding times are grossly exceeded, either on the first analysis or upon re-analysis, proceed as follows.

   a. Use professional judgment to establish the reliability of the data and the affect of additional storage on sample results.

   b. If it is determined that non-detect data are unuseable, flag the data as (R).

D.8.2 Instrument Performance

Criteria are established to ensure that adequate chromatographic resolution and instrument sensitivity are achieved by the chromatographic system. These criteria are not sample specific. Conformance is determined using standard materials; therefore, the criteria shall be met in all circumstances.

D.8.2.1 **Evaluation Procedures for ASL D Data Only.** The following procedures are applicable to ASL D data only and shall be performed in addition to the procedures in para. D.8.2.5.

1. Check raw data to verify that the following conditions exist.

   a. Retention time windows are reported and pesticide standards are within the established retention-time windows.

   b. Percent breakdown for endrin or DDT does not exceed 20 percent in evaluation standard analyses.

   c. Percent breakdown for combined endrin and DDT does not exceed 30 percent in evaluation standard analyses.

2. Check chromatograms for the following conditions to ensure that standards fall within retention-time windows.

NOTE

Retention-time windows are used in qualitative identification. If standards do not fall within retention-time windows, the associated sample results shall be evaluated. Samples injected after the last in-control standard are potentially affected.

a. For affected sample chromatograms that contain peaks within an expanded window surrounding the expected retention time window of the analyte of interest. If no peaks are present within or close to the retention-time window of deviant target compound, there is usually no effect on data. (Non-detected values can be considered valid.)

b. If the affected sample chromatograms contain peaks that may be of concern (i.e., above the RQL and either close to or within the expected retention-time window of the analyte of interest), two options (c and d) are available to determine the extent of the affect on data.

c. If no additional effort is warranted, flag positive results and quantitation limits as unuseable (R). In the comments, emphasize the possibility of either false negatives or false positives as appropriate.

d. If additional effort is warranted (e.g., if data are needed on a priority basis and if the peaks present may represent a level of concern for that particular analyte), proceed as follows to determine a useable retention-time window for affected samples.

(1) Examine the data package for presence of three or more standards containing the analyte of interest that were run within a 24-hour period during which the sample was analyzed.

(2) If three or more such standards are present, re-evaluate the mean and standard deviation of the retention-time window.

(3) If all standards and matrix spikes fall within the revised window, determine the valid positive or negative sample results using this window.

(4) Record in the comments the additional efforts taken and the resultant impact on data useability.

(5) Include in the support documentation calculations and comparisons generated.

D.8.3 Calibration Data

Compliance requirements for instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning, and continuing calibration checks document maintenance and adjustment of the instrument over specific time periods.

D.8.3.1 **Initial Calibration Criteria for ASLs C and D Data.** The following criteria for initial calibration data is applicable to both ASL C and ASL D data.

- Retention-time windows are established for compounds specified in the method.
- %RSD shall be less than or equal to 20.0 percent for all compounds except the surrogates.
- For surrogates, %RSD shall be less than or equal to 30.0 percent.
- Up to two target compounds, except surrogates, may have %RSD greater than 20.0 percent but less than or equal to 30.0percent.

D.8.3.2 **Continuing Calibration Criteria for ASLs C and D Data.** The following criteria for continuing calibration are applicable to both ASL C and ASL D data.

- RPD shall be less than or equal to 25.0 percent.

D.8.3.3 **Evaluation Procedures for Initial Calibration Data for ASL D Only.** The following procedure shall be performed for initial calibration data for ASL D only. These procedures shall be performed in addition to those in para. D.8.3.4.

1. Inspect standards results and verify agreement with raw GC data (chromatograms and data system printouts).

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2. Check raw data and recalculate some of the calibration factors and %RSD for the calibration concentrations.

3. If errors are detected, perform more comprehensive recalculations.

4. Inspect multicomponent analysis results and verify agreement with raw GC data.

D.8.3.4 **Evaluation Procedures for Initial Calibration Data for ASLs C and D.** The following procedures shall apply to initial calibration data for both ASL C and ASL D.

1. Verify that %RSD for the calibration factor of each analyte is less than or equal to 20 percent for each 12-hour period.

2. If linearity criteria are not met, flag associated quantitative results as estimated (J).

D.8.3.5 **Evaluation Procedure for Continuing Calibration Data for ASL C Only.** The following procedure shall be performed for continuing calibration data for ASL C only and shall be performed prior to and in addition to the procedures in para. D.8.3.7.

1. Verify that RPD is within the criteria specified in para. D.8.3.4.

D.8.3.6 **Evaluation Procedure for Continuing Calibration Data for ASL D Only.** The following procedure shall be performed for continuing calibration data for ASL D only and shall be performed prior to and in addition to the procedures in para. D.8.3.7.

1. Check raw data for quantitation standards to verify percent difference for approximately ten percent of the reported values by recalculation using the following formula.

$$\%D = \frac{R_1 - R_2}{R_1} \times 100$$

Where:

R_1 = Calibration factor from first analysis

R_2 = Calibration factor from subsequent analysis

D.8.3.7 Evaluation Procedure for Continuing Calibration Data for ASLs C and D. The following procedure applies to both ASL C and ASL D data and shall be performed in addition to the procedures in paras. D.8.3.5 and D.8.3.6 as applicable.

1. If percent difference between calibration factors is greater than 25 percent for the quantitated compounds, flag associated positive quantitative results as estimate (J).

D.8.4 Blanks

The purpose for assessing blank analyses results is to determine the existence and magnitude of contamination problems. If problems with a blank exist, data associated with the case shall be evaluated to determine whether there is an inherent variability in the data for the case or if the problem is an isolated occurrence not affecting other data.

D.8.4.1 Criteria. No contaminants shall be present in the blanks.

D.8.4.2 Evaluation Procedure for Blanks Data for ASL D Only. The following procedure is applicable to data for ASL D only and shall be performed in addition to procedures in para. D.8.4.3.

1. Review the results of associated blanks and raw data (chromatograms, quantitation reports or data system printouts).

D.8.4.3 Evaluation Procedure for Blanks Data for ASLs C and D. The following procedures are applicable to data for ASL C and ASL D.

1. Verify that method blank analyses contain less than RQL of target analytes or interfering peaks.

2. Verify that method blank analysis has been reported per matrix, per concentration level, per GC system used to analyze samples and for each extraction batch.

NOTE

When unsuitable blank results occur, action depends on circumstances and origin of the blank. Positive sample results shall not be reported unless compound concentration in sample exceeds five times amount in blank. When more than one blank is associated with a given sample, qualification shall be based upon a comparison with the associated blank having the highest concentration of a contaminant. Results shall not be corrected by subtracting the blank value.

3. If a contaminant is found in the blank but not in the samples, take no action.

4. Qualify target analytes detected in the sample and also detected in an associated blank when the sample concentration is less than five times the blank concentration.

NOTE

The blank analyses may not involve the same weights, volumes or dilution factors as the associated samples. These factors shall be taken into consideration when applying the 5x criteria so that a comparison of the total amount of contamination is made.

Additionally, there may be instances where little or no contamination was present in associated blanks, but qualification of the sample was deemed necessary. Contamination introduced through dilution water is one example. Although it is not always possible to determine, instances of this occurring can be detected when contaminants are found in the diluted sample result, but absent in the undiluted sample result. Because both results are not routinely reported, it may be impossible to verify this source of contamination. However, if the reviewer determines that the contamination is from a source other than the sample, the data shall be qualified. In this case, the 5 times criterion does not apply; the sample value shall be reported as a non-detect.

Examples of applying the blank qualification guidelines follow. Certain circumstances may warrant deviations from these guidelines.

Case 1: Sample result is greater than the RQL, but is less than the required amount (5 times) from the blank result.

	5x
Blank result	1.0
RQL	0.5
Sample result	4.0
Qualified sample result	4.0U

In this case, sample results less than 5.0 (or 5 x 1.0) are qualified as non-detects.

Case 2: Sample result is greater than the required amount (5x) from the blank result.

	5x
Blank result	1.0
RQL	.5
Sample result	6.0
Qualified sample result	6.0

D.8.5 Surrogate Recovery

The quality of laboratory analysis of individual samples is established through spiking activities. Samples are spiked with a surrogate compound prior to sample preparation. Evaluation of the result of surrogate spikes is not necessarily straightforward. The sample itself may produce effects caused by factors such as interferences and high concentrations of analytes. The review and validation of data based on specific sample results is frequently subjective and demands analytical experience and professional judgment because effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems. Accordingly, this paragraph consists primarily of guidelines, in some cases with several optional approaches suggested.

D.8.5.1 Criteria. Sample and blank recoveries of the surrogates shall be within advisory limits of the applicable FEMP method.

D.8.5.2 Evaluation Procedure for Surrogate Recovery Data for ASL C Only. The following procedure applies to surrogate recovery data for ASL C only and shall be performed in addition to the procedures in para. D.8.5.4.

1. Verify that surrogate recoveries are within advisory limits.

D.8.5.3 Evaluation Procedures for Surrogate Recovery Data for ASL D Only. The following procedures apply to surrogate recovery data for ASL D only and shall be performed in addition to the procedures in para. D.8.5.4.

1. Check raw data (i.e., chromatograms, quantitation list) to verify recoveries.

2. If recoveries are not within advisory limits, check raw data for possible interferences which may have affected surrogate recoveries.

D.8.5.4 Evaluation Procedures for Surrogate Recovery Data for ASLs C and D. The following procedures apply to surrogate recovery data for ASL C and ASL D and shall be performed in after the procedures in paras. D.8.5.2 and D.8.5.3.

1. Use the following guidelines if surrogate recoveries are outside advisory windows.

   a. If low recoveries are obtained, flag associated positive results and quantitation limits as estimated (J).

   NOTE

   A high bias may be caused by co-eluting interferences.

   b. If high recoveries are obtained, use professional judgment to determine appropriate action.

   c. If zero surrogate recovery is reported, examine the sample chromatogram to determine if the surrogate may be present, but slightly outside its retention-time window.

   d. If the surrogate is present, in addition to assessing surrogate recovery for quantitative bias, investigate the qualitative validity of the analysis.

   e. If the surrogate is not present, flag negative results as unuseable (R).

D.8.6 Matrix Spike/Matrix Spike Duplicate

MS/MSD data are generated to determine long-term precision and accuracy of the analytical method on various matrices. The data alone cannot be used to evaluate the precision and accuracy of individual samples.

D.8.6.1 Criteria for MS/MSD Data for ASLs C and D. The following criteria apply to MS/MSD data for both ASL C and ASL D.

- Advisory limits are established for spike recovery limits in the appropriate FEMP method and on FEMP forms specified in the LSC.
- Advisory limits are established for RPD between matrix spike and matrix spike duplicate recoveries in the appropriate FEMP method and on FEMP forms specified in the LSC.

D.8.6.2 Evaluation Procedures for MS/MSD Data for ASLs C and D Data. The following procedures are applicable to MS/MSD data for both ASL C and ASL D.

1. Inspect results for the MS/MSD recoveries.
2. Verify transcriptions from raw data.
3. Verify calculations.
4. Take no action on MS/MSD data alone to qualify an entire case, but using informed professional judgment and matrix spike and matrix spike duplicate results in conjunction with other QC criteria, determine the need for qualification of the data.
5. First try to determine the extent of the affects of MS/MSD results on associated data. Make this determination with regard to the MS/MSD sample itself as well as specific analytes for samples associated with MS/MSD.
6. If it can be determined that the results of MS/MSD affect only the sample spiked, limit qualification to the sample alone.
7. If it is determined through the MS/MSD results that a laboratory is having a systematic problem in the analysis of one or more analytes that affects associated samples, the laboratory shall be notified and affected samples qualified.

D.8.7 Field Duplicates

Field duplicate samples may be collected and analyzed to evaluate overall precision. These analyses measure both field and laboratory precision; therefore, the results may have more variability than laboratory duplicates, which measure only laboratory performance. It is also expected that solid matrix duplicate results will have a greater variance than duplicates of water matrices because of difficulties in collecting identical samples.

D.8.7.1 **Criteria.** There are no specific review criteria for field duplicate analyses comparability for either ASL C or ASL D data.

D.8.7.2 **Evaluation Procedures.** The following procedures are applicable to both ASL C and ASL D data.

1. Identify field duplicate samples.

2. Compare results reported for each sample and calculate the RPD.

3. Document field duplicate evaluation in the comments.

D.8.8 Compound Identification

Qualitative criteria for compound identification have been established to minimize the number of erroneous identifications of compounds. An erroneous identification can be either a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present).

D.8.8.1 **Criteria.** The following criteria are applicable to compound identification for both ASL C and ASL D data.

- Retention times of reported compounds shall fall within the calculated retention-time windows for the two chromatographic columns.

- GC/MS confirmation is required if the concentration of a compound exceeds 10 ng/uL in the final sample extract.

D.8.8.2 Evaluation Procedures for ASL D Data Only. The following procedures are applicable to ASL D data only and shall be performed prior to and in addition to the procedures in para. D.8.8.3.

1. Review compound identification results, associated raw data (chromatograms data system printouts).

2. Confirm reported positive detects using appropriate retention times and retention-time windows, and verify that compounds listed as "not detected" are correct.

D.8.8.3 Evaluation Procedures for ASLs C and D Data. The following procedures are applicable to both ASL C and ASL D data.

1. Verify that positive identifications have dissimilar column analysis.

2. If the qualitative criteria for two-column confirmation were not met, consider reported positive detects as non-detects; and, using professional judgment, assign an appropriate quantitation limit based on the following guidance.

   a. If the misidentified peak was sufficiently outside the target pesticide retention-time window, report the RQL.

   b. If identified peak interfers with potential detection of a target peak, consider the reported value and flag it as the estimated quantitation limit (UJ).

D.8.9 Compound Quantitation and Reported Detection Limits

The objective is to ensure that reported quantitation results and RQLs are accurate.

D.8.9.1 Criteria. The following criterion is applicable to both ASL C and ASL D data.

- Compound quantitation, as well as adjustment of the RQL, shall be calculated according to the appropriate FEMP method.

D.8.9.2 Evaluation Procedures for ASL D Data Only. The following procedures are applicable to ASL D data only and shall be performed in addition to the procedure in para. D.8.9.3.

1. Examine raw data to verify correct calculation of sample results reported by the laboratory.

2. Compare quantitation reports, chromatograms, and sample preparation log sheets to reported positive sample results and quantitation limits.

D.8.9.3 **Evaluation Procedures for ASLs C and D Data.** The following procedures are applicable to both ASL C and ASL D data.

1. Verify that RQLs were adjusted to reflect sample dilutions, concentrations, splits, clean-up activities, and dry weight factors that are not accounted for by the method.

2. Flag quantitation limits affected by large, off-scale peaks as unuseable (R).

3. If interference is on-scale, provide an estimated quantitation limit (UJ) for each affected compound.

4. Use professional judgment to decide whether a much larger concentration obtained on one column versus the other indicates the presence of an interfering compound.

5. If an interfering compound is indicated, report the lower of the two values and qualify it as presumptively present at an estimated quantity (NJ), which will necessitate a determination of an estimated concentration on the confirmation column.

6. Document that the presence of interferences has obscured the attempt at a second column confirmation.

D.8.10 Overall Assessment of Data for a Case

The data reviewer shall make professional judgments and express concerns and comments on the validity of the overall data package. This is particularly appropriate when there are several QC criteria out of specification. The additive nature of QC factors out of specification is difficult to assess in an objective manner, but the reviewer has a responsibility to inform users concerning data quality and data limitations in order to assist that user in avoiding inappropriate use of the data, while not precluding consideration of the data. The data reviewer will be greatly assisted in this endeavor if DQOs are provided.

D.9 ASLs C AND D INORGANIC DATA VALIDATION

This section describes the validation procedures for inorganic data for ASLs C and D. Validation procedures for inorganic data for ASL E are provided in subsection D.7. The following requirements shall be checked during data validation.

- Holding times (para. D.9.1)
- Calibration (initial and continuing) (para. D.9.2)
- Blanks (para. D.9.3)
- Inductively Coupled Plasma (ICP) interference check sample (para. D.9.4)
- Laboratory control sample (para. D.9.5)
- Duplicate sample (para. D.9.6)
- Matrix spike sample (para. D.9.7)
- Furnace Atomic Absorption (AA) QC (para. D.9.8)
- ICP serial dilution (para. D.9.9)
- Sample result verification (para. D.9.10)
- Field duplicates (para. D.9.11)
- Overall assessment of data for a case (ASL D data only) (para. D.9.12)

D.9.1 Holding Times

The objective of holding time data validation is to ascertain the validity of results based on the holding time of the sample from sample collection to time of extraction and/or analysis.

D.9.1.1 Criteria. Following are maximum allowable holding times for FEMP samples. To be compliant, the laboratory shall analyze samples within these times.

Analyte	Number of Days Following Sample Collection
Metals other than mercury	180 days; preserved to pH < 2
Mercury	28 days; preserved to pH < 2
Cyanide	14 days; preserved to pH > 12

D.9.1.2 Evaluation Procedure.

1. Establish actual holding times by comparing sample collection date with dates of analysis in raw laboratory data (i.e., digestion logs and instrument run logs).

2. Examine digestion and distillation logs to determine if samples were preserved at the pH specified in para. D.9.1.1.

NOTE

Analyte holding time (days) equals analysis date minus sample collection date.

3. If holding times and preservation requirements are not met, qualify results that are greater than the Instrument Detection Limit (IDL) as estimated (J) and results smaller than IDL as estimated (UJ).

4. If holding times are exceeded, use professional judgement to determine reliability of the data and effects of additional storage on sample results.

NOTE

The expected bias will be low so the reviewer may determine that results smaller than IDL are unuseable (R).

D.9.2 Calibration

Requirements for satisfactory instrument calibration are established to ensure that instruments are capable of producing acceptable quantitative data. Initial calibration demonstrates that an instrument is capable of acceptable performance at the beginning of an analysis run. Continuing calibration verification documents that the initial calibration remains valid.

D.9.2.1 Criteria. The following criteria shall be observed for initial calibration.

- For ICP analysis, a blank and at least one standard shall be used to establish the analytical curve.
- For AA analysis, the following are required.
  - A blank and at least three standards, one of which is at the FEMP RDL, shall be used to establish the analytical curve.

NOTE

The correlation coefficient of 0.995 is a technical criterion and not contractual.

  - The correlation coefficient shall be greater than approximately 0.995.
- For mercury analysis, the following are required.
  - A blank and at least four standards shall be used to establish the analytical curve.
  - The correlation coefficient shall be greater than approximately 0.995.
- For cyanide analysis, the following are required.
  - A blank and at least three standards shall be used to establish the analytical curve.
  - A correlation coefficient greater than approximately 0.995 is required for photometric determination.
- For cyanide analysis at ASL D only, a mid-range standard shall be distilled.

The following criteria shall be observed for Initial and Continuing Calibration Verification (ICV and CCV). Instruments shall be calibrated daily and each time the instrument is set up.

- Analysis results shall fall within the control limits of 90 to 110 %R of the true value for all analytes except mercury and cyanide.
- Analysis results for mercury shall fall within the control limits of 80 to 120 %R.
- Analysis results for cyanide shall fall within the control limits of 85 to 115 %R.

D.9.2.2 Evaluation Procedures for ASLs C and D Calibration Data. The following procedures shall be performed for both ASL C and ASL D calibration data.

1. Verify that the instrument was calibrated daily and each time it was set up using the correct number of standards and blanks.
2. Verify that the correlation coefficient was greater than approximately 0.995.
3. If the minimum number of standards were not used for initial calibration, or, if the instrument was not calibrated daily and each time it was set up, qualify the data as unuseable (R).

NOTE

For critical samples, further evaluation of the calibration curve may be warranted to determine if qualification is necessary.

4. If the correlation coefficient is smaller than 0.995, qualify results greater than IDL as estimated (J) and results smaller than IDL as estimated (UJ).

D.9.2.3 Evaluation Procedures for ASL D Only Calibration Data. The following procedures are applicable to ASL D only calibration data and shall be performed in addition to the procedures in para. D.9.2.2.

1. Check the distillation log and verify that the mid-range cyanide standard was distilled.

2. Recalculate one or more of the ICV and CCV %R per type of analysis (e.g., ICP, GFAA) using the following equation and verify that the recalculated value agrees with the laboratory reported values on FEMP forms specified in the LSC. Because of possible rounding discrepancies, allow results to fall within one percent of contract windows (e.g., 89 to 111 percent).

$$\%R = \frac{\text{Found}}{\text{True}} \times 100$$

Where:

Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution

True = concentration (in ug/L) of each analyte in the ICV or CCV source

3. If the mid-range cyanide standard was not distilled, qualify associated results as estimated (J).

4. If the ICV or CCV %R falls outside the acceptance windows, use professional judgement to qualify associated data; and, if possible, indicate the bias in the review as follows.

   a. For all analytes except cyanide and mercury, use the following guidelines.

      (1) If the ICV or CCV %R falls outside the acceptance windows but within the ranges of 75 to 89 percent or 111 to 125 percent, qualify results greater than IDL as estimated (J).

      (2) If the ICV or CCV %R is within the range of 111 to 125 percent, results smaller than IDL are acceptable.

      (3) If the ICV or CCV %R is 75 to 89 percent, qualify results smaller than IDL as estimated (UJ).

      (4) If the ICV or CCV %R is smaller than 75 percent, qualify positive results as unuseable (R).

b. For all analytes except cyanide, use the following guidelines.

(1) If the ICV or CCV %R is greater than 125 percent, qualify results greater than IDL as unuseable (R).

(2) If the ICV or CCV %R is greater than 125 percent, results smaller than IDL are acceptable.

c. For cyanide, use the following guidelines.

(1) If the ICV or CCV %R falls outside the acceptance windows but within the ranges of 70 to 84 percent or 116 to 130 percent, qualify results greater than IDL as estimated (J).

(2) If the ICV or CCV %R is within the range of 116 to 130 percent, results smaller than IDL are acceptable.

(3) If the ICV or CCV %R is 70 to 84 percent, qualify results smaller than IDL as estimated (UJ).

(4) If the ICV or CCV %R is smaller than 70 percent, qualify positive results as unuseable (R).

(5) If the ICV or CCV %R is greater than 135 percent, qualify results greater than IDL as unuseable (R). Results smaller than IDL are acceptable.

d. For mercury, use the following guidelines.

(1) If the ICV or CCV %R falls outside the acceptance windows but within the ranges of 65 to 79 percent or 121 to 135 percent, qualify results greater than IDL as estimated (J).

(2) If the ICV or CCV %R is within the range of 121 to 135 percent, results smaller than IDL are acceptable.

(3) If the ICV or CCV %R is 65 to 79 percent, qualify results smaller than IDL as estimated (UJ).

(4) If the ICV or CCV %R is smaller than 65 percent mercury, qualify positive results as unuseable (R).

D.9.3 Blanks

The assessment of blank analysis results is to determine the existence and magnitude of sample contamination problems. The criteria for evaluation of blanks applies to all blanks associated with the sample.

If problems with blank data for ASL C exist, associated data shall be evaluated to determine whether there is an inherent variability in the data or if the problem is an isolated occurrence not affecting other data.

If problems with a blank data for ASL D exist, data associated with the case shall be evaluated to determine whether there is an inherent variability in the data for the case or if the problem is an isolated occurrence not affecting other data.

D.9.3.1 <u>Criteria</u>. There shall be no contaminants in the blanks.

D.9.3.2 <u>Evaluation Procedures</u>.

1. Review analytical results as well as the raw data (ICP printouts, strip charts, printer tapes, bench sheets) for blanks and verify that results are reported accurately.

NOTE

If the absolute value of the concentration of the blank contaminant is less than or equal to the RDL, no correction of sample results is performed.

If an analyte concentration in the blank is above the RDL, the lowest concentration of that analyte in the associated samples shall be ten times the blank concentration.

2. If all samples associated with the blank have an analyte concentration less than 10 times the blank concentration and above the RDL, qualify data for these samples as unuseable (R) except for an identified aqueous soil field blank.

3. Do not correct the sample concentration for the blank value.

4. If the concentration of the blank is below the negative RDL, qualify samples reported below ten times the RDL associated with the blank as unuseable (R).

D.9.4 ICP Interference Check Sample

The ICP Interference Check Sample (ICS) verifies the interelement and background correction factors.

D.9.4.1 Criteria.

- An ICS shall be run at the beginning and end of each sample analysis run or a minimum of twice per eight-hour shift, whichever is more frequent.

- Results for the ICS solution AB analysis shall fall within the control limits of $\pm$ 20 percent of the true value.

D.9.4.2 Evaluation Procedures for ASLs C and D Data. The following procedures are applicable to both ASL C and ASL D data for ICP ICS.

1. Check ICS raw data for results with an absolute value greater than IDL for those analytes that are not present in the ICS solution.

2. For samples with concentrations of aluminum, calcium, iron, and magnesium that are comparable to or greater than their respective levels in the interference check sample, proceed as follows.

NOTE

If possible, indicate the bias for the estimated results in the review.

a. If the ICS recovery for an element is greater than 120 percent and the sample results are smaller than IDL, identify the data as acceptable for use.

b. If the ICS recovery for an element is greater than 120 percent and the sample results are greater than IDL, qualify the affected data as estimated (J).

c. If the ICS recovery for an element falls between 50 and 79 percent and the sample results are greater than IDL, qualify the affected data as estimated (J).

d. If sample results are smaller than IDL and the ICS recovery for that analyte falls within the range of 50 to 79 percent, the possibility of false negatives may exist, so qualify the data for these samples as estimated (UJ).

e. If ICS recovery results for an element are less than 50 percent, qualify the data as unuseable (R).

D.9.4.3 **Evaluation Procedures for ASL D Data Only.** The following procedures are applicable to ASL D data only and shall be performed in addition to the steps in para. D.9.4.2.

1. Recalculate from the raw data (ICP printout) one or more of the recoveries using the following equation for %R and verify that the recalculated value agrees with the laboratory-reported value on form IV.

$$\text{ICS } \%R = \frac{\text{Found Solution AB}}{\text{True Solution AB}} \times 100$$

Where:

Found Solution AB = concentration (in ug/L) of each analyte measured in the analysis of solution AB

True Solution AB = concentration (in ug/L) of each analyte in solution AB

2. If results greater than the IDL are observed for elements that are not present in the EPA-provided ICS solution, thus indicating the possibility of a false positive, evaluate the associated sample data for the affected elements.

3. For samples with comparable or higher levels of interferents and with analyte concentrations that approximate those levels found in the ICS (false positive), qualify sample results greater than IDL as estimated (J).

4. If negative results are observed for elements that are not present in the EPA ICS solutions and their absolute value is greater than IDL, thus indicating the possibility of a false negative, and the absolute value of the negative results is greater than IDL, evaluate the associated sample data.

5. For samples with comparable or higher levels of interferents, qualify results for the affected analytes less than IDL as estimated (UJ).

NOTE

In general, the sample data can be accepted if concentrations of aluminum, calcium, iron and magnesium in the sample are found to be less than or equal to their respective concentrations in the ICS.

6. If these elements are present at concentrations greater than the level in the ICS or other elements are present in the sample at more than 10 mg/L, investigate the possibility of other interference effects.

D.9.5 Laboratory Control Sample

The Laboratory Control Sample (LCS) serves as a monitor of the overall performance of the analysis process including sample preparation.

D.9.5.1 Criteria.

- Aqueous LCS results shall fall within the control limits of 80 to 120 %R except for antimony and siver, which have no control limits.

- All solid LCS results shall fall within the control limits.

D.9.5.2 Evaluation Procedures for ASL D Data Only. The following steps apply to ASL D data only and shall be performed in addition to the procedures in para. D.9.5.3.

1. Check raw data (ICP printout, strip charts, bench sheets) to verify reported recoveries.

2. Recalculate one or more of the recoveries (%R) using the following equation.

$$\text{LCS } \%R = \frac{\text{LCS Found}}{\text{LCS True}} \times 100$$

Where:

LCS Found = concentration (in ug/L for aqueous; mg/kg for solid) of each analyte measured in the analysis of LCS solution

LCS True = concentration (in ug/L for aqueous; mg/kg for solid) of each analyte n the LCS source

D.9.5.3 Evaluation Procedures for ASLs C and D Data. The following steps shall be performed for both ASL C and ASL D data.

1. Review data and verify that results fall within the control limits.

2. For aqueous LCSs, proceed as follows.

   a. If the LCS recovery for an analyte falls within the range of 50 to 79 percent or is greater than 120 percent, qualify results greater than IDL as estimated (J).

   b. If results are less than IDL and the LCS recovery is greater than 120 percent, identify the data as acceptable.

   c. If results are less than IDL and the LCS recovery falls within the range of 50 to 79 percent, qualify the data for the affected analytes as estimated (UJ).

   d. If LCS recovery results are less than 50 percent, qualify the data for these samples as unuseable (R).

3. For solids LCSs, proceed as follows.

   a. If the solid LCS recovery for an analyte falls outside the EPA control limits, qualify sample results greater than IDL as estimated (J).

b. If the LCS results exceed the control limits and the sample results are less than IDL, identify the data as acceptable.

c. If LCS results are below the control limits, qualify sample results less than IDL as estimated (UJ).

D.9.6 Duplicate Sample Analysis

Duplicate analyses are indicators of laboratory precision based on each sample matrix.

D.9.6.1 Criteria.

- Samples identified as field blanks cannot be used for duplicate sample analysis.
- A control limit of ± 20 percent for the RPD shall be used for sample values greater than 5X RDL.
- A control limit of ± RDL shall be used for sample values smaller than 5X RDL.

D.9.6.2 Evaluation Procedure for ASL D Data Only. The following step is applicable to ASL D data only and shall be performed in addition to the procedures in para. D.9.6.3.

1. Check raw data and recalculate one or more RPD using the following equation to verify that results have been correctly reported on form VI.

$$PD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where:

S = First sample value (original)

D = Second sample value (duplicate)

D.9.6.3 Evaluation Procedure for ASLs C and D Data. The following steps are applicable to both ASL C and ASL D data.

1. Review and verify that results fall within control limits.

2. If duplicate analysis results for an analyte fall outside appropriate control windows, qualify the results for that analyte in associated samples of the same matrix as estimated (J).

3. If the field blank was used for duplicate analysis, check all other QC data and exercise professional judgement when evaluating the data.

D.9.7 Matrix Spike Sample Analysis

The matrix spike sample analysis provides information about the effect of each sample matrix on the digestion and measurement methodology.

D.9.7.1 Criteria.

- Samples identified as field blanks shall not be used for spiked sample analysis.
- Spike recovery (%R) shall be within 75 to 125 percent; however, spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of four or more.

D.9.7.2 Evaluation Procedures for ASL D Data Only. The following step is applicable to ASL D data only and shall be performed in addition to the procedures in para. D.9.7.3.

1. Check raw data and recalculate one or more %R using the following equation to verify that results were correctly reported.

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

D.9.7.3 **Evaluation Procedures for ASLs C and D Data.** The following steps are applicable to both ASL C and ASL D data.

1. Verify that the field blank was not used for spike analysis.

2. Review and verify that results fall within specified limits.

3. If the spike recovery is greater than 125 percent and the reported sample result is less than IDL, identify the data as acceptable for use.

4. If the spike recovery is greater than 125 percent or less than 75 percent and the sample result is greater than IDL, qualify the data for these samples as estimated (J).

5. If the spike recovery is within the range of 30 to 74 percent and the sample results are less than IDL, qualify the data for these samples as estimated (UJ).

6. If spike recovery results are less than 30 percent and the sample results are less than IDL, qualify the data for these samples as unuseable (R).

7. If the field blank was used for matrix spike analysis, check all other QC data and execise professional judgement when evaluating the data.

NOTE

If the matrix spike recovery does not meet criteria (except for silver), a post digestion spike is required for all methods except furnace, but these data are not used to qualify sample results.

D.9.8 Furnace Atomic Absorption QC

Duplicate injections and furnace post digestion spikes establish the precision and accuracy of individual analytical determinations.

D.9.8.1 **Criteria for ASLs C and D Data.** The following criteria are applicable for both ASL C and ASL D data.

- For sample concentrations greater than RDL, duplicate injections shall agree within ± 20 percent Relative Standard Deviation (RSD) or Coefficient of Variation (CV)). Otherwise, the sample shall be rerun once (at least two additional injections).

- Spike recovery shall be greater than 85 percent and less than 115 percent.

D.9.8.2 **Criteria for ASL C Data Only.** The following criterion is applicable to data for ASL C only and shall be applied in addition to the criteria in para. D.9.8.1.

- The furnace AA scheme shall be as specified in the FEMP method.

D.9.8.3 Evaluation Procedure

1. Check raw data to verify that duplicate injections agree within ± 20 percent of RSD or CV for sample concentrations higher than RDL.

2. Review furnace AA raw data to verify that the furnace AA scheme has been followed.

3. If duplicate injections are outside the ± 20 percent of RSD or CV limits and the sample has not been rerun once as required, qualify the data as estimated (J).

4. If the rerun sample results do not agree within ± 20 percent of RSD or CV limits, qualify the data as estimated (J).

5. If the post digestion spike recovery is less than 40 percent, qualify results higher than IDL as estimated (J).

6. If the post digestion spike recovery is more than 10 percent but less than 40 percent, qualify results less than IDL as estimated (UJ).

7. If the post digestion spike recovery is less than 10 percent, qualify results less than IDL as unuseable (R).

8. If sample absorbance is less than 50 percent of the post digestion spike absorbance, proceed as follows.

   a. If the furnace post digestion spike recovery is not within 85 to 115 percent, qualify sample results higher than IDL as estimated (J).

   b. If the furnace post digestion spike recovery is not within 85 to 115 percent, qualify sample results less than IDL as estimated (UJ).

9. If Method of Standard Additions (MSA) is required but has not been done, qualify data as estimated (J).

10. If any of the samples run by MSA have not been spiked at appropriate levels, qualify data as estimated (J).

11. If the MSA correlation coefficient is less than 0.995, qualify data as estimated (J).

D.9.9 ICP Serial Dilution

The serial dilution determines whether significant physical or chemical interferences exist because of the sample matrix.

D.9.9.1 Criteria.

If the analyte concentration is sufficiently high (concentration in the original sample is minimally a factor of 50 above the IDL), an analysis of a five-fold dilution shall agree within 10 percent of the difference (%D) of the original results.

D.9.9.2 Evaluation Procedure for ASL D Data Only. The following step is applicable to ASL D data only and shall be performed in addition to the procedures in para. D.9.9.3.

1. Check raw data and recalculate the %D using the following equation to verify that the dilution analysis results agree with results reported.

$$\%D = \frac{|I-S|}{I} \times 100$$

Where:

I = Initial sample result

S = Serial dilution result (instrument reading x 5)

D.9.9.3 **Evaluation Procedures for ASLs C and D Data.** The following steps are applicable to both ASL C and ASL D data.

1. Check raw data for evidence of negative interference (i.e., results of the diluted sample are significantly higher than the original sample).

2. When criteria are not met, qualify the associated data as estimated (J).

3. If evidence of negative interference is found, use professional judgement to qualify the data.

D.9.10 Sample Result Verification

The objective is to ensure that the reported quantitation results are accurate.

D.9.10.1 **Criteria.** Analyte quantitation shall be calculated according to the appropriate FEMP method.

D.9.10.2 **Evaluation Procedure for ASL D Data Only.** The following step is applicable to ASL D data only and shall be performed in addition to the procedures in para. D.9.10.3.

1. Examine raw data for anomalies (e.g., baseline shifts, negative absorbance, omissions, legibility).

D.9.10.3 **Evaluation Procedures for ASLs C and D Data.** The following steps are applicable to both ASL C and ASL D data.

1. Examine raw data and verify correct calculation of sample results reported by the laboratory.

2. Compare digestion and distillation logs, instrument printouts, and strip charts to reported sample results.

3. Verify that there are no transcription or reduction errors (e.g., dilutions, percent solids, sample weights) on one or more samples.

4. Verify that results fall within the linear range of the ICP and within the calibrated range for non-ICP parameters.

NOTE

When the laboratory provides both ICP and furnace results for an analyte in a sample and the concentration is greater than ICP IDL, the results can assist in identifying quantitation problems.

5. Verify that sample results are greater than 5X ICP IDL if ICP analysis results are used for arsenic, thallium, selenium, or lead.

6. If discrepancies are found, contact the laboratory to obtain additional information that could resolve differences. If a discrepancy remains unresolved, qualification of the data may be warranted.

D.9.11 Field Duplicates

Field duplicate samples may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision; therefore, the result may have more variability than laboratory duplicates, which measure only laboratory performance. It is also expected that soil duplicate results will have a greater variance than duplicates of water matrices because of difficulties associated with collecting identical field samples.

D.9.11.1 Criteria. There are no review criteria for field duplicate analyses comparability.

D.9.11.2 Evaluation Procedures for ASL C Data Only. The following data validation procedures shall be performed for ASL C data only and shall be performed in addition to the step in para. D.9.11.4.

1. Identify samples that are field duplicates on field sample sheets.

2. Compare results reported for each sample and calculate RPDs if appropriate.

D.9.11.3 Evaluation Procedures for ASL D Data Only. The following validation procedures shall be performed for ASL D data only and shall be performed in addition to the step in para. D.9.11.4.

1. Identify samples that are field duplicates on EPA sample traffic report forms or field sample sheets.

2. Compare results reported for each sample and calculate RPDs if appropriate.

D.9.11.4 Evaluation Procedure for ASLs C and D Data. The following validation procedure shall be performed for both ASL C and ASL D data.

1. Provide evaluation of field duplicates with reviewer comments.

D.9.12 Overall Assessment of Data for a Case

This paragraph is applicable to ASL D data only.

It is appropriate for the data reviewer to make professional judgements and express concerns and comments on the validity of the overall data for a case. This is particularly appropriate when there are several QC criteria out of specification. The additive nature of QC factors out of specification is difficult to assess in an objective manner, but the reviewer has a responsibility to inform the user concerning data quality and data limitations in order to assist that user in avoiding inappropriate use of the data, yet not precluding all consideration of the data. It will be of value to the reviewer if DQOs are provided. The cover form and supplementary documentation shall be included with the review.

D.10 RADIOLOGICAL DATA VALIDATION PROCEDURES FOR ASLs B, C, D, and E

Radiological data validation procedures will in general correspond to chemical validation procedures. Analytical results shall be checked, verifed, marked, flagged, and reported. Holding times, usually based on the half-life of the radionuclides of interest or six months maximum shall be applied. Instrument calibration data, results from QC samples such as blanks and spikes, and QC calculations such as recoveries shall be included and validated for ASLs B, C, D, and E methods.

D.10.1 Radiological Validation of ASL B Data

Analytical results from ASL B methods shall be formally reviewed but will not undergo an intensive validation process because results from these methods are qualitative in nature. The review shall encompass the following.

- Verify sample identification, collection, and receipt and analysis dates with chain of custody
- Compare sample results to reported MDLs

- Verify that LCS results are reasonable (within ± 10 percent of true value)
- Verify that blank results are at least ten times less than sample results

If LCS or blank results do not meet this criteria, results shall be qualified.

D.10.2 Radiological Validation of ASL C Data

As analytical methods are identified or added to ASL C, specific validation procedures shall be established. Generally the radiological analysis laboratory QA program shall ensure that required QC sample analyses and verification of results are performed and that the acceptability of results is known and verifiable. It is expected that sufficient QC information will be supplied in the data package to conduct the validation without further requests for data. However it is also expected that complete instrument calibration information will not be included in ASL C data packages.

D.10.3 Radiological Validation of ASL D Data

Currently radiological analytical methods shall be validated only up to ASL C. When specifications for the ASL D radiological data package are established and accepted, the existing ASL C validation procedure will be modified to incorporate additional criteria.

D.10.4 Radiological Validation of ASL E Data

Data validation is dependent upon the analytical method selected, so the procedure will be established when ASL E analytical methods are identified. As a minimum, criteria for holding times, blanks, calibrations, and recoveries will be addressed.

D.11 DRINKING WATER VALIDATION PROCEDURES AT ASL B

D.11.1 Internal Standard

Internal standards performance criteria ensure that GC/MS sensitivity response is stable during every run. Internal standard error counts shall not vary by more than a factor of two (- 50 percent to + 100 percent) from the associated calibration standard. Retention time of the internal standard shall not vary more than ± 30 seconds from the associated calibration standard. Check raw data to verify recoveries of internal standards and verify retention times. If internal standards are outside windows, a partial or total rejection of data for that sample fraction may be considered.

D.11.2 Surrogate Analyte

Sample and blank surrogate recoveries shall be within specified limits. Check raw data to verify surrogate recovery. If surrogates are outside limits, positive results for that fraction are flagged as estimated (J).

D.11.3 Laboratory Duplicates

Analysis of laboratory duplicates gives a measure of the precision associated with laboratory procedures. Specific criteria for laboratory duplicate analyses comparability are specified in the analysis method. Results for each sample shall be compared and the RPD calculated. If laboratory duplicate samples are outside control limits, they shall be re-analyzed.

D.11.4 Field Duplicates

Analysis of field duplicates gives a measure of precision to sample collection, preservation, and storage as well as to laboratory procedures. Field duplicate samples are collected every sampling period or sample delivery group. There are no specific criteria for field duplicate analyses comparability. Results for each sample shall be compared and the RPD calculated.

D.11.5 Laboratory Reagent Blank

Assessment of blank analysis results identifies existence and magnitude of contamination problems. Contaminants should not be present in blanks. If gross contamination exists in the blank, affected compounds shall be flagged as unuseable (R). If inordinate amounts of target compounds are found at low levels, it may be indicative of a laboratory problem and corrective action shall be taken.

D.11.6 Field Reagent Blank

Reagent water is placed in a sample container in a laboratory and treated as a sample in all respects, including exposure to sampling site conditions, storage, preservation, and analytical procedures. There are no criteria for field reagent blanks; but, if contamination exists, this shall be recorded in data review comments and forwarded to FEMP.

D.11.7 Laboratory Performance Check Solution

A laboratory check solution is made up of one or more compounds and used to evaluate performance of the instrument system. Criteria is established in the specified analysis

method. If the check solution is outside control limits, corrective action such as trouble-shooting instrument and standards preparation shall be taken.

D.11.8 Matrix Spike/Matrix Spike Duplicate

MS/MSD data are generated to determine long-term precision and accuracy of the analytical method on various matrices. Spike recoveries shall be within advisory limits established in the method. If results are outside advisory limits, the results shall be used in conjunction with other QC criteria to establish the need for qualification of the data.

D.11.9 Calibration Standard

VOA analytes and surrogates are expressed as a percentage of true value and shall be 80 to 120 percent and RSD shall be less than 20 percent. The response factor for each analyte and surrogate for continuing calibration shall be within 30 percent of mean value measured in the initial calibration.

Initial calibration for BNA analytes and surrogates shall not exceed 30 percent RSD. The response factor for each analyte and surrogate for continuing calibration shall be within 30 percent of the initial calibration.

Standards and samples shall be analyzed within an eight-hour sequence. If criteria for linearity are not met, flag associated quantitative results as (J).

D.12 GAS CHROMATOGRAPHY PROCEDURES FOR ORGANIC COMPOUNDS

D.12.1 Validation Guidelines for ASL B Data

ASL B data undergo a method-specific validation process. The laboratory, in concert with field laboratory analysts, shall indicate the systematic process to be used for data review in the project-specific plan. Criteria for data evaluation shall be defined prior to sample analysis.

The process shall address data editing, screening, and validation. Data validation shall include checking calibration and blanks to ensure criteria have been met. Review procedures shall include instructions for flagging samples associated with blanks or calibrations that are out of criteria. The laboratory shall use matrix spike data to evaluate and flag routine data accordingly.

D.12.2 Validation Guidelines for ASL C Data

As GC methods are identified or developed for ASL C analyses, corresponding data validation procedures will be developed and implemented. Generally, the GC analysis laboratory QC will perform the required analysis, QC sample checks, and verification of the results and certify that acceptability of results is known and verifiable. Deficiencies in the testing program shall be identified so proper corrective action can be taken.

D.12.3 Validation Guidelines for ASL D Data

The following procedures for ASL D analysis contain basic data validation instructions for several methods. As new methods are identified or developed, corresponding supplemental requirements will be written.

D.12.3.1 <u>Holding Times</u>. Holding time is measured from sample collection to time of sample analysis. Water and soil samples that are to be analyzed for Volatile Organic Compounds (VOC) are preserved and refrigerated and shall be analyzed within fourteen days of sample collection. If holding time is exceeded, proceed as follows.

1. Flag positive results as estimated (J).

2. Flag associated sample quantitation limits as estimated (UJ).

3. Document that holding times were exceeded.

4. If the holding time is grossly exceeded, use best professional judgement as to data reliability. The reviewer may flag associated non-detect data as unuseable (R).

D.12.3.2 <u>Calibration</u>. An external calibration procedure shall be used for quantitation by the laboratory. If the calibration factor is used for sample quantitation, the following criteria shall apply.

- For initial calibration %RSD shall be less than or equal to 20 percent.

- For continuing calibration, %D shall be less than 15 percent.

If the linear regression method is used for sample quantitation, the following criterion shall apply.

- Verification of the calibration curve is required and the correlation coefficient shall be greater than or equal to 0.995.

In the primary analysis, standards are analyzed at the beginning of the twelve- hour period followed by the proper sample/standard sequence. Confirmation analysis requires a mid-level standard at the beginning of the twelve-hour period. The midlevel standard shall be run at the end of the sample/standard sequence but within the twelve-hour period. If calibration criteria are not met, the following steps shall be taken.

1. If criteria for initial calibration are not met, flag associated quantitative results as estimated (J).

2. If criteria for continuing calibration are not met in the primary analysis, flag associated quantitative results as estimated (J).

3. If criteria for continuing calibration are not met in the confirmation analysis, use professional judgement as to data reliability.

4. If proper standards have not been analyzed, use professional judgement as to data reliability.

D.12.3.3 **Blanks.** Blank criteria apply to method, trip, and field blanks. Verify that blanks have been analyzed at the frequency indicated in the project work plan. Do not correct results by subtracting blank values.

If a compound is found in a blank but not in the associated sample, no action is taken. In instances where more than one type blank is associated with a given sample, qualification shall be based upon a comparison with the associated blank having the highest concentration of a contaminant. Differences in weights, volumes, and dilution factors between blanks and associated samples shall be taken into consideration.

D.12.3.4 **Surrogates.** Samples are spiked with the surrogate compounds in the specified FEMP method. The following steps shall be taken to qualify data based on the validtion review.

1. If low recoveries are obtained, flag associated positive results and quantitation limits as estimated (J).

2. If high recoveries are obtained, use professional judgement to determine appropriate action.

3. If zero recovery is reported, examine the sample chromatogram to determine if the surrogate may be present but slightly outside its retention-time window. If this is the case, assess surrogate recovery for quantitative bias and investigate qualitative validity of the analysis.

4. If the surrogate is not present, flag negative results as unuseable (R).

D.12.3.5 **Matrix Spike/Matrix Spike Duplicate.** Control limits shall be specified by the FEMP method. The following criteria cannot be used alone to evaluate precision and accuracy. Flagging is not required.

- If the LCS is within limits, the laboratory is in control and MS/MSDs outside limits on the sample may be caused by matrix effects.

- If the LCS is outside control limits, the laboratory may be out of control and associated samples may require re-analysis. Professional judgement shall be applied to interpretating of results.

D.12.3.6 **Compound Identification.** Retention times of reported compounds shall fall within the calculated window for two chromatographic columns. Second-column confirmation is mandatory. If the qualitative criteria for two-column confirmation is not met, reported positive detects shall be considered nondetects. Professional judgement shall be used to assign an appropriate quantitation limit using the following guidelines.

- If the misidentified peak was sufficiently outside the target compound retention-time window, the RQL can be reported.

- If the misidentified peak poses an interference with potential detection of a target peak, the reported value shall be considered and flagged as the estimated quantitation limit (UJ).

D.12.3.7 **Laboratory Control Samples.** If the Laboratory Control Sample (LCS) exceeds internal QC limits set by the FEMP method for a given sample matrix, data from the associated batch of samples shall be inspected. If no analytical problems are found, data analyzed with the out-of-control point shall be discussed in the QC section of the laboratory report.

If problems are found in the analytical data, samples associated with the batch shall be re-analyzed and data from the re-analysis shall be reported. If holding times are exceeded during re-analysis, both sets of data shall be presented.

If LCS results and matrix spike results are outside method limits, the laboratory shall either reeanalyze the sample within holding times or data shall be flagged unuseable (R).

D.13 REFERENCES

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U.S. Department of Energy. 1988b. Data Management Plan, Volume IV of the FMPC RI/FS Task 2 Report Work Plan Requirements. Prepared by Advanced Sciences, Inc. March 1988.

U.S. Department of Energy. 1988c. Work Plan for Conducting the Site-wide Remedial Investigation and Feasibility Study of the Feed Materials Production Center, FMPC RI/FS Task 2 Report Work Plan Requirements. Prepared by Advanced Sciences, Inc. March 1988.

U.S. Department of Energy. 1988d. Sampling Plan, Volume I of the FMPC RI/FS Task 2 Report Work Plan Requirements. Prepared by Advanced Sciences, Inc. March 1988.

U.S. Department of Energy. 1989. Work Plan Addendum, Production and Additional Suspect Areas. Prepared by Advanced Sciences, Inc. October 1989.

U.S. Environmental Protection Agency. 1983. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80, 1983.

U.S. Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste. SW-846, Third Edition.

U.S. Environmental Protection Agency. 1987. Data Quality Objectives for Remedial Response Activities (Development Process). March 1987.

U.S. Environmental Protection Agency. 1988a. Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis. February 1, 1988.

U.S. Environmental Protection Agency. 1988b. Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis. July 1, 1988.

GENERAL VALIDATION CHECKLIST	TITLE: DAILY FIELD LOG	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Project Name and Number				
Field Activity Subject and Date				
Work Activity				
Unusual Events				
Changes to Plans and Specifications				
Visitor(s) on Site				
Weather Conditions				
Subcontractor Progress				
Communication With Agencies				
Personnel on Site				
Important Phone Calls				
Supervisor Signature and Date				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

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Figure D-1. General Validation Checklist for Field Daily Log

GENERAL VALIDATION CHECKLIST				TITLE: SAMPLE COLLECTION LOG
PROJECT:				
SAMPLE/I.D.:				DATE: Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Unique Sample Number				
Sample Location				
Collector Initials				
Date and Time Sample Collected				
Sample Coordinates				
Sample Identification				
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:

Figure D-2. General Validation Checklist for Sample Collection Log

GENERAL VALIDATION CHECKLIST	TITLE: CHAIN OF CUSTODY	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Project Name/Number				
Laboratory Destination				
Sample Team Members				
Carrier/Waybill Number				
Sample Number				
Sample Location and Description				
Date and Time Collected				
Sample Type				
Container Type				
Disposal Record Number				
Condition on Receipt				
RA Control Number				
C/C Control Number				
Signature(s)				
Original Returned from Laboratory				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

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Figure D-3. General Validation Checklist for Chain of Custody Record

GENERAL VALIDATION CHECKLIST				TITLE: REQUEST FOR ANALYSIS
PROJECT:				
SAMPLE/I.D.:				DATE: Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
R/A Control Number				
C/C Control Number				
Project Name and Number				
Date Samples were Shipped				
Laboratory Destination and Lab Contract				
Unique Sample Number				
Sample Type				
Sample Volume				
Preservative				
Requested Testing Program				
Applicable Special Instruction				
Turnaround Time Indicated				
Possible Hazard ID Indicated				
Original R/A Returned to Laboratory				
Correspondence to Laboratory Report				
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:

Figure D-4. General Validation Checklist for Request for Analysis

GENERAL VALIDATION CHECKLIST				TITLE: TRAINING, PROCEDURES, AUDITS, NONCONFORMANCES, SURVEILLANCES, VARIANCES, DOCUMENT CHANGE CONTROL	
PROJECT:					
SAMPLE/I.D.:				DATE:	Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS	
Procedures approved at the time of data collection, document change requests					
Personnel trained to procedures and document change requests					
Instruments calibrated at the time of collection					
The following items require QA Verification:					
Impact on data by site audits, nonconformances, variances, or surveillances					
Deficient Characteristics flagged for Database					
Any variances that may impact data:					
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:	

Figure D-5. General Validation Checklist for Training, Procedures, Audits, Nonconformances, Surveillances, Variances, and Document Change Control

SPECIFIC VALIDATION CHECKLIST				TITLE: SUBSURFACE SOIL SAMPLING
PROJECT:				
SAMPLE/I.D.:			DATE:	Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Boring Log Complete and Accurate?				
Sample Numbers on Sample Collection Log correspond to Boring Log?				
Calibration Records Log?				
Is the Sample Collection Log Complete and Correct?				
Is the Chain-of-Custody Complete and Correct?				
Is the Request For Analysis Complete and Correct?				
Is the Daily Log Complete and Correct?				
REVIEWED BY: DATE:			CONCURRENCE BY: DATE:	

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Figure D-6. Specific Validation Checklist for Subsurface Soil Sampling Data

SPECIFIC VALIDATION CHECKLIST	TITLE: WELL CONSTRUCTION AND DEVELOPMENT	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Monitoring Well Installation Details Schematic Complete and Correct?				
Piezometer Installation Sheet Complete and Correct?				
Monitoring Well Development Completion Checklist Complete and Correct?				
Monitoring Well Development Form Complete and Correct?				
Piezometer Sensitivity Test Form Complete and Correct?				
Calibration Records Complete?				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

Figure D-7. Specific Validation Checklist for Well Construction and Development Data

SPECIFIC VALIDATION CHECKLIST	AQUIFER/PERMEABILITY TESTING (SLUG TEST)	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
PERMEABILITY TESTING CONDUCTED AND DOCUMENTED AS DESCRIBED IN SECTION. 5 OF QAPjP				
PERMEABILITY TEST DATA FORM COMPLETE AND CORRECT				
DIAGRAM OF EQUIPMENT USED TO CONDUCT TEST				
CALIBRATION DOCUMENTATION SUPPLIED BY VENDOR FOR EQUIPMENT (GAUGES, FLOW METERS, ETC.) COMPLETE				
ARE WATER METER CALIBRATION RECORDS ON FILE AND COMPLETE				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

Figure D-8. Specific Validation Checklist for Aquifer/Permeability Test (Slug Test) Data

SPECIFIC VALIDATION CHECKLIST				TITLE: GROUND WATER SAMPLING AND FIELD ANALYTICAL DATA
PROJECT:				
SAMPLE/I.D.:				DATE: Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
WATER QUALITY COLLECTION REPORT COMPLETE (INCLUDING CALIBRATIONS)				
IS THE CHAIN-OF-CUSTODY COMPLETE AND CORRECT?				
IS THE REQUEST FOR ANALYSIS COMPLETE AND CORRECT?				
IS THE DAILY LOG COMPLETE AND CORRECT?				
TEMPERATURE				
pH				
SPECIFIC CONDUCTANCE				
DISSOLVED OXYGEN				
ALKALINITY				
ALL READINGS RECORDED ON FIELD MEASUREMENT FORM (WATER, QUALITY FIELD COLLECTION REPORT)				
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:

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Figure D-9. Specific Validation Checklist for Ground-Water Sampling and Field Analysis Data

SPECIFIC VALIDATION CHECKLIST				TITLE: SURFACE SOIL SAMPLING	
PROJECT:					
SAMPLE/I.D.:				DATE:	Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS	
Correct Form Used					
Unique Soils Sample Number					
Sample Location					
Collector's Initials					
Collection Date and Time					
Northerly/Easterly Coordinates					
Was the Sample Rinsate					
Sample Depth/Units					
Sample Type					
Definition of Composite					
Sample Media					
Temperature to Cool/Put to 4 °C					
Is the Sample Sequence Correct					
Is the Sample a Sequence or a Blank					
Chain of Custody Complete and Correct					
Daily Log Complete and Correct					
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:	

Figure D-10. Specific Validation Checklist for Surface Soil Sampling Data

SPECIFIC VALIDATION CHECKLIST	TITLE: SURFACE WATER AND SEDIMENT SAMPLING	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Sample Collected in Accordance with Section 6 of QAPjP?				
Sample Collection Log Complete and Correct?				
Chain-of-Custody Complete and Correct?				
Request For Analysis Complete and Correct?				
Daily Log Complete and Correct?				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

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Figure D-11. Specific Validation Checklist for Surface-Water and Sediment Sampling Data

SPECIFIC VALIDATION CHECKLIST				TITLE: RADIATION MEASUREMENT (NODE SURVEY)
PROJECT:				
SAMPLE/I.D.:				DATE: Page __ of __
CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
Correct Form Used				
Sample ID Number(s)				
Location Coordinates				
Date and Time of Sample Collection				
Location Description				
Sampling Team Member Listing				
Description of Weather Conditions				
Instrument and Probe Serial Numbers				
Background Results				
Sample Results				
Instrument Calibration Due Date				
Is there a QA Review of Form?				
Is the Sample Sequence Correct?				
REVIEWED BY: DATE:				CONCURRENCE BY: DATE:

Figure D-12. Specific Validation Checklist for Radiation Measurement (Node Survey)

SPECIFIC VALIDATION CHECKLIST	TITLE: RADIATION MEASUREMENT (WALK OVER SURVEY)	
PROJECT:		
SAMPLE/I.D.:	DATE:	Page __ of __

CHECKLIST ITEMS	YES	NO	N.A.	REMARKS/COMMENTS
CORRECT FORM USED				
SAMPLE ID NUMBER(S)				
GRID AREA LOCATION				
DATE/TIME OF SAMPLE COLLECTION				
LOCATION DESCRIPTION				
LIST OF SAMPLE TEAM MEMBERS				
COUNT TIME/UNIT OF COUNT				
INSTRUMENT AND PROBE/MODEL NO.				
BACKGROUND RESULTS				
SAMPLE RESULTS				
INSTRUMENT CALIBRATION DUE DATE				
IS THERE A QA REVIEW OF FORM?				
IS THE SAMPLE SEQUENCE CORRECT?				

REVIEWED BY: DATE:	CONCURRENCE BY: DATE:

Figure D-12. Specific Validation Checklist for Radiation Measurement (Node Survey)

ORGANIC VALIDATION CHECKLIST FOR ASL B DATA
(sheet 1 of 2)

____Case Narrative

____Quality Control Summary Package
____Surrogate Recovery Summary
____MS/MSD Summary
____Reagent Blank Summary
____GC/MS Tuning and Mass Calibration

____Sample Data Package
____Holding Times
____Organic Analysis Data Sheets
____Reconstructed Ion Chromatograms
____GC/EC Chromatograms
____Quantitation Reports
____Mass Spectral Data
____NIST Mass Spectral Lab Research for TIC

____Standards Data Package
____Current List of Laboratory/Instrument Limits
____Initial Calibration Data for each Instrument
____Continuing Calibration Data for each Instrument
____Pesticide Evaluation Standard Summary
____Pesticide/PCB Standard Summary
____Pesticide/PCB Identification for Positive Results only
____VOA and BNA Standards RICs
____VOA and BNA Standards Quantitation Reports
____Pesticide/PCB Standard Chromatograms and Data System Printouts

____Raw QC Package
____ DFTPP and BFB mass spectra and mass listings
____ Reagent Blank Data
____Organic Analysis Data Sheets
____RIC
____Quantitation Reports
____NIST Library Search TICs
____GC/EC Chromatograms and Data System Printouts
____Mass Spectral Data
____ Matrix Spike/Matrix Spike Duplicate Data
____Organic Analysis Data Sheets
____RIC
____Quantitation Reports
____NIST Library Search TICs
____GC/EC Chromatograms and Data System Printouts
____Mass Spectral Data

Figure D-14. Checklist for Organic Data Validation at ASL B (sheet 1 of 2)

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ORGANIC VALIDATION CHECKLIST FOR ASL B DATA
(sheet 2 of 2)

____ Sample Tracking Package
- ____ Chain-of-Custody Records
- ____ Sample Log-in/Receipt Records
- ____ Preparation/Extraction/Bench Sheets
- ____ Instrument Run Logs

____ Method References

Comments:

Figure D-14. Checklist for Organic Data Validation at ASL B (sheet 2 of 2)

INORGANIC VALIDATION CHECKLIST FOR ASL B DATA

_____ Inorganic Cover Page
_____ Inorganic Analysis Data Sheet
_____ Initial Calibration and Calibration Verification Results
_____ Continuing Calibration Verification Results
_____ Linear Range Analysis and RDL Standard for AA
_____ Blank Analysis Results
_____ ICP Interference Check Sample Results
_____ Spiked Sample Results
_____ Post-digest Spiked Sample Analysis
_____ Duplicate Sample Results
_____ Instrument Detection Limits
_____ Laboratory Control Sample Results
_____ Standard Addition Results
_____ ICP Serial Dilution Results
_____ Holding Times Summary Sheet
_____ ICP Interelement Correction Factors
_____ ICP Linear Ranges
_____ Raw Data
  _____ Samples
  _____ Calibration Standards
  _____ Blanks
  _____ Spikes
  _____ Duplicates
  _____ ICP QC (ICS and Serial Dilution)
  _____ ICS
  _____ Furnace AA
  _____ Mercury Analysis
  _____ Cyanide Analysis
_____ Percent Solids Calculations- Solids only
_____ Sample Prep/Digestion Logs
_____ Chain-of-Custody
_____ Sample Description
_____ Case Narrative
_____ Method References

Comments:

Figure D-15. Checklist for Inorganic Data Validation at ASL B

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ASL B DATA VALIDATION REPORT FORM

PROJECT:	DATE:	ANALYTICAL METHOD: SAMPLE I.D.:

Action Items: _____

_____

_____

_____

_____

Comments: _____

_____

_____

_____

Note: Data Validation Checklist is attached.

_____ _____
Reviewer Signature Date

Figure D-16. Data Validation Report Form for ASL B Analytical Methods

DATA VALIDATION CHECKLIST FOR ASL B GROSS ALPHA AND GROSS BETA IN WATER BY PROPORTIONAL COUNTING

Analysis Results Report

_____ Abnormalities described

_____ Alpha and Beta Results

_____ Calculation Sheets

_____ Sample Identifications

_____ Detector Identification

_____ Analysis (Count) Date and Initials of Analyst

_____ Volumes of Samples Prepared

_____ pH of Samples

_____ Net Weights of Solids Counted

_____ Sample Count Times for Alpha and Beta

_____ Background Count Times for Alpha and Beta

_____ Counts or Count Rates Alpha and Beta Samples and Backgrounds

_____ Alpha and Beta Integrated Efficiency Factors Used for Each Detector

_____ Alpha Amplification Factors Used for Each Detector

Validation Report

_____ Results Marked (on photocopied pages)

_____ Corrected Pages Signed and Dated

_____ Other Observations (e.g., biases or trends observed over the course of the validated samples)

_____ Checklists and Forms

_____ Report Reviewed

_____ Defficiency Report Initiated

Figure D-17. Data Validation Checklist for ASL B Gross Alpha and Gross Beta in Water by Proportional Counting

APPENDIX E

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APPENDIX E

ANALYTICAL LABORATORY PERFORMANCE REQUIREMENTS

E.1 INTRODUCTION

Analytical laboratory performance requirements shall be used as milestones to evaluate the capability of a laboratory to provide specific analytical services to FEMP. The ability to meet these requirements shall be evaluated in a pre-contract-award audit and shall be verified through subsequent audits of laboratory performance and with performance evaluation sample results as specified in para. E.2 and Section 3.

E.1.1 Purpose

This appendix presents performance requirements for laboratories doing analytical work for FEMP. Generally, laboratories shall employ the sample preparation, analysis, and reporting methods specified in the following appendices.

- Appendix D, Data Validation Plan
- Appendix F, Data Management Plan
- Appendix L, Analytical Methods

E.1.2 Scope

This appendix provides general requirements for laboratories performing analysis for FEMP as follows.

- Laboratory Approval Process (subsection E.2)
- Quality Assurance Plan (subsection E.3)
- Equipment Requirements (subsection E.4)
- Sample Receipt and Preparation Requirements (subsection E.5)
- Analysis and Identification of Specific Analytes (subsection E.6)

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- Required Quality Assurance/Quality Control Procedures (subsection E.7)
- Reporting and Deliverables Requirements (subsection E.8)
- FEMP Project Contact (subsection E.9)

E.1.3 FEMP Project Contact

The FEMP project contact and the laboratory project manager shall be identified during the request-for-analysis process described in Section 7. Project correspondence shall be directed through these individuals. The laboratory shall verify capacity prior to committment to accept FEMP samples for analysis.

E.2 LABORATORY APPROVAL PROCESS

The FEMP prime contractor shall maintain a list of analytical laboratories approved for FEMP sample analyses (Appendix H). Laboratories may be added to the FEMP list after meeting the requirements specified in Section 3. The following paragraphs describe these requirements.

E.2.1 Laboratory Capacity

A laboratory shall demonstrate the ability to perform analysis at a specified capacity. Analytical Support Levels (ASL) for sample analyses that a laboratory may perform for FEMP shall be specified. Overall capacity of a laboratory shall be based on equipment and personnel available. The laboratory shall supply references demonstrating successful past performance of analyses similar to those required.

E.2.2 Hazardous Materials Handling Ability, Licenses, and Permits

A laboratory shall be qualified to handle samples containing potentially hazardous materials in a safe, efficient manner. Applicable licenses and permits are required. Additionally, laboratories receiving samples containing radioactive materials shall be licensed by the Nuclear Regulatory Commission. Samples shall not be sent to laboratories if the laboratory is not licensed to handle them in terms of total mass or activity.

E.2.3 Quality Requirements

Implementation of quality requirements shall be verified through an on-site audit conducted by FEMP. The laboratory shall have an acceptable quality assurance plan and shall be bound by applicable requirements of this QAPjP. Laboratories shall be audited prior to

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receiving FEMP samples. The following administrative and technical items shall be addressed during audits.

E.2.3.1 Administrative.

- Documentation of laboratory organizational hierarchy
- Quality assurance program as specified in subsection E.3
- Assignment of responsibility for establishing, maintaining, and verifying an appropriate quality assurance program
- Facility design for mixed waste analytical work meeting EPA requirements
- Tracking system for documents, equipment, parts, and supplies
- Use of current, controlled copies of operating procedures
- Current standards labeled and dated
- Internal chain-of-custody process meeting requirements of Section 7
- Procedures and records for equipment calibration, maintenance, and evaluation
- Facilities for receiving, checking, and storing samples prior to analysis and a routine ensuring preservation requirements
- Tracking system for samples ensuring holding times requirements
- Process for documenting, reporting, and recording nonconforming items or actions, including corrective actions
- Process for records storage that ensures security of records including records tracking system
- System for scheduling and documenting internal audits of the analysis system and its components using checklists and reports and a means of addressing audit findings in a timely manner

E.2.3.2 Technical.

- Analyses performed in accordance with procedural requirements, including calibration and use of proper standards, blanks, and other quality control checks

- Technical expertise and equipment meeting FEMP analytical methods requirements
- Verification and reporting of analytical results as required

E.2.4 Performance Evaluation Samples

Laboratories shall provide documentation of successful analyses of performance evaluation samples prior to approval for FEMP sample analyses. Laboratories that perform ASL D analyses shall document successful analyses of EPA Contract Laboratory Program (CLP) performance evaluation samples or equivalent during the four previous quarters. For analyses at other ASLs, CLP performance evaluation samples or FEMP-supplied performance evaluation samples shall be successfully analyzed and documented using FEMP methods.

E.2.5 Continuing Satisfactory Performance

Quality of laboratory performance shall continue to be evaluated through data validation (Appendix D), audits conducted on an annual basis at a minimum, and performance evaluation sample analysis.

E.2.6 Notification of Intent to Use a Laboratory

After a laboratory has been evaluated and found satisfactory by FEMP, DOE shall notify EPA of its intent to add the laboratory to the approved list in Appendix H with a document change request. FEMP audit and performance evaluation data relevant to the laboratory shall be provided to EPA upon request. EPA may choose to conduct their own audit of the laboratory.

Work performed betweeen initiation of laboratory use and EPA approval of the document change request shall be considered "at risk" pending outcome of the EPA evaluation.

E.3 QUALITY ASSURANCE PLAN

Analytical laboratories shall be required to have an internal quality assurance plan in place that includes the following items. Adherence to the elements of the plan shall be documented in audits.

- Laboratory management structure, including individual responsibilities
- Qualifications of laboratory personnel
- Documentation of training

- Audit procedures, schedule, and log
- Instrument calibration schedule and log
- Internal chain-of-custody procedures meeting Section 7 requirements
- Schedule and log of routine equipment maintenance
- Procedure for documenting and reporting nonconformance to laboratory or project requirements
- Record control system
- Document revision and control system

The FEMP Site-Wide QAPjP shall be a contract-specified attachment to the laboratory-specific Quality Assurance Plan. Compliance with the QAPjP shall be verified through project performance and audits.

E.4 EQUIPMENT REQUIREMENTS

E.4.1 Inorganic Analytes

For inorganic analytes, the laboratory shall have analytical equipment capability to perform analyses by specific FEMP methods. The following equipment is required for certain methods.

- Inductively Coupled Plasma (ICP) emission spectrometer
- Atomic Absorption (AA) spectrometer with graphite furnace and cold vapor

E.4.2 Organic Analytes

For organic analytes, the laboratory shall have analytical equipment capability to perform analyses by specific FEMP methods. The following equipment is required for certain methods.

- Gas chromatograph/mass spectrometer
- Infrared spectrometer
- Gas chromatograph/electron-capture detector

- Gas chromatograph/flame ionization detector
- High performance liquid chromatography

E.4.3 Radiological Analytes

For radiologic analytes, the laboratory shall have analytical equipment capability and capacity to perform FEMP methods. The following equipment is required for certain methods.

- Liquid scintillation counting systems
- Alpha spectrometer systems
- Alpha/beta counting systems
- Germanium spectroscopy systems
- Alpha scintillation counting instruments
- Ultraviolet/visible spectrum

E.5 SAMPLE RECEIPT AND PREPARATION

This subsection outlines general requirements for sample receipt and preparation. Specific procedures for receipt and preparation of samples are found in Section 7 and Appendix L.

E.5.1 Chain of Custody

The laboratory quality assurance plan shall address internal sample handling and custody. The following strategy shall be implemented to ensure that sample custody records are maintained.

- Sample shall remain in one person's possession
- Or sample shall be in that custody holder's view after being in holder's possession
- Or sample was in that holder's possession and placed in a secure, controlled-access storage area by custody holder
- Or sample is in a designated secure area accessible to authorized personnel only

E.5.2 Document Control

Document control ensures that documents for specified sample sets are accounted for after completion of the project. Document control measures shall be specified in the laboratory quality assurance plan, which shall be consistent with this QAPjP. The following document control forms are required.

- Data sheets
- Logs or daily log forms

E.5.3 Standard Operating Procedures

The laboratory shall have written standard procedures for sample receipts, log-in, and storage. These procedures shall be subject to FEMP approval.

E.6 ANALYSIS AND IDENTIFICATION OF SPECIFIC ANALYTES

Samples received in the laboratory shall be prepared and analyzed by methods specified in Appendix L. Required quantitation limits for analyte targets are specified in the method.

E.7 REQUIRED QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The laboratory shall be responsible for performing the QA/QC procedures as specified in Appendices G and D. Procedures specified shall be strictly adhered to by the laboratory. QC samples for laboratory analysis are defined in Section 4. Laboratories are also required to meet specified holding times for all samples accepted.

E.8 REPORTING AND DELIVERABLES REQUIREMENTS

Reporting and deliverables requirements depend upon the specified ASL. ASLs are defined in Section 2. The following paragraphs summarize reporting and deliverables requirements for laboratories.

E.8.1 Inorganic Samples

The following report forms are required for inorganic sample reporting for ASL C data.

- Inorganic analysis data sheet

- RDL standard for AA and ICP
- Blanks
- Spike sample recovery
- Duplicates

Laboratories performing inorganic analyses at ASL D shall comply with the following reporting requirements in addition to the preceding requirements.

- Initial and continuing calibration verification
- ICP interference check sample
- Post-digest spike sample recovery
- Laboratory control sample
- ICP serial dilution
- Analysis run log
- Preparation log

Reporting requirements for ASLs B and E analyses shall be specified during the request-for-analysis process (Section 7).

E.8.2 Organic Samples

The following report forms are required for organic sample reporting at ASL C.

- Organic analyte data sheet
- Surrogate recovery forms
- Matrix Spike/Matrix Spike Duplicate forms
- Method blank summary
- Analyte resolution summary (pesticides only)
- Identification summary for single/multicomponent analytes (pesticides only)

Laboratories performing organic analyses at ASL D shall comply with the following reporting requirements in addition to the preceding requirements.

- Instrument performance check
- Initial calibration data
- Continuing calibration check
- Calibration verification (pesticides only)
- Florisil check (pesticides only)
- Gel permeation chromatography calibration (pesticides only)
- Internal standard error and retention time summary for volatile organic analysis/base neutral analysis

Analysis reporting requirements for ASL B and E data shall be specified during the request-for-analysis process (Section 7).

E.8.3 Radiological Samples

The following report forms are required for radiologic sample reporting at ASL C or D.

- Radiochemical data completeness checklist
- Data assessment summary report form
- Radiochemical analysis results

Reporting requirements for ASL B and E analyses shall be specified during the request-for-analysis process (Section 7).

APPENDIX F

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APPENDIX F

DATA MANAGEMENT PLAN

F.1 INTRODUCTION

This data management plan describes the FEMP data management systems that have been implemented to provide a centralized, consistent, accurate, and flexible data repository for FEMP. The purpose of the plan is to describe each subsystem of the data management system, linkages between subsystems, overall hardware and software environments, and general guidelines for future development of data management systems.

Data generated for the Remedial Investigation and Feasibility Study (RI/FS) are stored on a Flow Gemini-based system meeting requirements of the currently approved FEMP RI/FS Data Management Plan. Data generated for other programs are subject to the requirements of this Data Management Plan.

F.1.1 The Role of Data Management

Environmental data have become a key product of environmental studies, and data that have been collected at FEMP are critically important to analysis and decision making that take place relative to the site. Data management systems are an essential component of FEMP for the following reasons.

F.1.1.1 <u>Large Volume of Data</u>. On large, complex sites like FEMP, the increasing volume of data becomes a management issue. The amount of data collected is vast and is growing rapidly with the number of ongoing characterization and monitoring programs. The volume of data may also increase as new environmental regulations are promulgated. Manual filing and management systems are not adequate for handling the volume of environmental data anticipated for FEMP.

F.1.1.2 <u>Compliance With Regulatory Controls</u>. FEMP data generated in accordance with the RI/FS Work Plan and Quality Assurance Project Plan is historically significant and necessary for the RI/FS process and subsequent records of decision. Data generated in support of other site programs is significant and potentially necessary for removal actions, RCRA closures, and other determinations necessary to ensure compliance with federal and state hazardous waste laws and regulations. The data may also provide supportive information for the RI/FS process. Maintenance of one central computerized data repository helps to ensure that FEMP environmental data are accurately and completely maintained for

the life of the project and appropriate data are accessible for multiple, concurrent compliance efforts.

F.1.1.3 Consistency With Data Quality Objectives. Data collected as part of FEMP shall be consistent with Analytical Support Levels (ASLs) and Data Quality Objectives (DQOs) applicable to the intended use of the data. Data shall be periodically reviewed, and flagged if ASLs or DQOs are not being met. In addition, suitability of data for use in other assessment or compliance activities is determined by the ASLs and DQOs associated with that data. Data useability flags shall be present in the data repository and referenced whenever FEMP environmental data are used. The FEMP environmental data management system allows attachment of data qualifiers to each piece of environmental data, which can be related to ASLs or DQOs. These qualifiers can be used to screen data when retrieval for a particular application is considered.

F.1.1.4 Flexible and Timely Data Queries. FEMP environmental studies require that project data be examined in numerous ways, frequently within a very short time frame. Typically, sets of environmental data that are of interest for examination and preview cannot all be pre-defined at the outset of the project. The FEMP data management system, constructed using relational data management software, can support the ad hoc nature of requests and short time constraints usually involved.

The FEMP environmental data management system was developed to address these needs through its individual modules and its collective integration. The goal is to provide a centralized data repository for a very large quantity of environmental data of known quality that satisfy regulatory requirements and project DQOs and that can support a wide range of ad hoc and routine data requests for assessment and reporting in a timely manner.

F.1.2 Life Cycle of FEMP Environmental Data

Figure F-1 illustrates the general life cycle of a piece of environmental data at FEMP. Guidelines for establishing DQOs, development of sampling plans, data transfer and handling procedures, sample analysis requirements, and data validation procedures are detailed in the Quality Assurance Project Plan (QAPjP). Each of these activities is briefly discussed in the following paragraphs to illustrate overall flow of data within the system. The FEMP data management system modules described in Subsection F.*** were constructed to manage data during each phase of the life cycle.

F.1.2.1 Data Quality Objectives. Data are gathered and analyzed in different ways depending on its intended use. For example, data gathered for ASL D requires much more supporting documentation and QA/QC controls than data gathered for ASL B. Definition of overall data quality objectives is the necessary precursor to any FEMP data collection activity.

F.1.2.2 **Preparation of Sampling Plans.** In a manner consistent with the QAPjP, a project-specific plan shall be developed for proposed FEMP data collection activities. The plan shall define type and number of samples, location of sampling, QA/QC level, appropriate analytical or field methods, a schedule and budget for the sampling effort, sample numbering system, and laboratories for chemical or radiological analyses.

F.1.2.3 **Collection of Samples.** Sample collection shall comply with QAPjP guidelines and DQOs once a sampling plan has been developed and approved. In many cases, field sampling teams collect physical samples (e.g., soil or ground water) and package them for transport to an analytical laboratory. In some cases, field observations such as temperature, pH, and specific conductance are also measured and recorded in the field. In these instances, there is no physical sample sent to the laboratory. Each sample or piece of recorded data is referenced to an on-site or off-site location through a unique coordinate system.

F.1.2.4 **Transfer and Handling of Samples.** Samples collected on-site for laboratory analysis are identified with a unique sample number, packaged for transporting, and then transported to the laboratory in a timely manner. Preservation techniques are documented and, from the time a sample is collected, chain-of-custody records are maintained to identify and document each individual who handles the sample during this process.

F.1.2.5 **Laboratory Analysis and Reporting.** Analysis is performed on each sample at an on-site or off-site analytical laboratory, and the analysis results (along with a large volume of supplementary information regarding analytical techniques, dilutions, and chain-of-custody information) are documented. Laboratory results are produced and transferred in standard hard copy and in electronic formats.

F.1.2.6 **Data Verification and Validation.** During data validation, a set of specified, standardized rules and associated QC measures are applied to the sample results. The validated data are then reviewed by an experienced environmental chemist to determine whether the compliant data are reasonable. In this process, qualifiers assigned to the data by the analytical laboratory are interpreted by the chemist, and a second set of qualifier flags may be added by the chemist to indicate QC requirements not met, other QC parameters that are out of range or not as expected, and how far out the parameters are. These flags allow useability of the data to be determined for any given purpose.

F.1.2.7 **Data Repository.** At this point, the validated data are loaded to the results data repository. This database is the heart of the FEMP environmental data management system and is what most data users are familiar with when they think of the environmental database. The FEMP Data Management System Results Database (DMSRD) supports direct loading of validated data from electronic media as well as manual data entry. The DMSRD is maintained using relational database management software.

F.1.2.8 Data Analysis. Results data are retrieved or accessed to support a wide range of activities including modeling, statistics, mapping and visual display, and summary tabular data listings. Some of the data analyses include an evaluation of existing data and an assessment of its useability for current applications. The results of these assessments may lead to the definition of additional required sampling efforts, which connect this phase of the data life cycle to data requirements and sampling plan phases (Figure F-1).

F.1.2.9 Data Archiving and Storage. Each piece of data in the FEMP environmental DMSRD is linked to the original hard-copy documents produced by the analytical laboratories. These hard copies are kept in permanent storage. In addition, the electronic database is permanently archived in a neutral ASCII file format.

F.2 FEMP ENVIRONMENTAL DATA MANAGEMENT SYSTEMS

A collection of integrated environmental data management systems has been implemented for FEMP to support the range of data-related activities previously outlined. These systems were designed to manage the complete set of sampling, project scheduling, QA/QC, and analytical results data, along with site maps and other spatially oriented data.

Central to the FEMP environmental data management systems is a data repository that stores analytical and field observation results, related QA/QC information, sampling station information, and cross references to original hard copy documents. Each of the other FEMP environmental systems interfaces with this central data repository either by using repository data as input or by serving as a data input point to the repository.

In the FEMP system, data are shared among applications, and redundant storage of a piece of data in more than one location in the data repository is avoided when possible. Figure F-2 shows how the FEMP environmental data management systems are integrated and interrelated.

The following paragraphs contain brief general descriptions of each of the computerized FEMP environmental data management systems illustrated in Figure 2.

F.2.1 Automated Sampling and Analysis Program System

The Automated Sampling and Analysis Program (ASAP) system is used by FEMP as a tool to review the results data and associated qualifiers to help identify data gaps that require

additional sampling, determine the non-routine samples needed, and develop project-specific plans for non-routine sampling. ASAP includes the following subsystems.

- Query and report facilities - Tailored to identify data deficiencies and provide a profile of historical sampling efforts for user-defined locations and time frames

- Detailed logic based on the QAPjP and DQOs - When combined with query and report facilities, produces a recommendation for non-routine sampling activities

- Reporting facilities - Produces chain-of-custody reports, bottle labels, and requests for analysis for non-routine sampling efforts

- Interface to the FACTS system - Transfers data requirements identified for non-routine sampling activities and draws on FACTS ORACLE data tables in assigning unique sample identification numbers to newly required samples

F.2.2 FACTS System

The FACTS (Fernald Analytical Computerized Tracking System) system supports sampling, laboratory analysis, and laboratory analysis reporting activities for FEMP. FACTS includes the following modules.

- Field data tracking system - Used by sampling crews to collect and verify collection of key data fields during sample collection including sample location identifier, collector initials, sample volume requirements, sample preservation, equipment calibration information, sample date and time, and chain-of-custody information

- Laboratory Information Management System (LIMS) - Used in the FEMP laboratory to document analytical results data and generate management reports, hard copy results summary reports, and results data files suitable for direct import into the FEMP data repository database

- Sample tracking system - Used to track the life history of samples through initial planning, sample collection, laboratory analysis, validation, and input to the project data repository database. This system is used to monitor the schedule status of both routine and non-routine sampling activities on an ongoing basis. One of the key functions provided by the sample tracking subsystem within FACTS is the issuance of a unique sample identification number to each analytical sample taken. This identification is used in all other FEMP environmental data systems to cross-reference the results data from the sample.

F.2.3 ORACLE Results Database

The central FEMP environmental data management system is the ORACLE results database. This system serves as the data repository for all analytical results data, related QA/QC information, sampling station descriptors, field observations, and data qualifiers. The DMSRD is comprised of the following subsystems.

- An executive menu - Ties the DMSRD subsystems into a single, easy-to-use system with similar keystroke conventions, screen layouts, error messages, and menu layouts used in each subsystem

- Data entry screens - Facilitates manual data entry of results data

- Data import programs - Facilitates loading of results data received electronically

- Data edit screens - Facilitate modifications to selected fields in the DMSRD, for example, data qualifier fields.

- Standard output reports - For hard copy printouts of results data and associated information in several pre-defined formats. These reports may be generated for subsets of the DMSRD through use of standard queries on the data.

- Ad hoc queries - Facilitates queries on results data through use of the ORACLE Structure Query Language (SQL), which provides a very flexible and powerful means of selecting subsets of data from the DMSRD for further viewing and analysis

- Data views - Allows users to define windows into the DMSRD that combine selected data elements from disparate tables into a view that looks like a single table of data.

- Linkages to external data analysis software packages - Provided in a number of ways. Many easy-to-use third-party software packages are used that directly read ORACLE data tables. Several external data analysis systems use the ORACLE DMSRD directly as a source of input data. A file import/export facility allows copies of results data to be extracted from ORACLE tables into data files that can be input to software packages without being able to read ORACLE tables directly. It is also possible to extract data from the Flow Gemini system through/into the ORACLE database.

- Data security and password protection - Provides via built-in ORACLE functions that allow different levels of data access rights to be assigned to users, ensuring that only selected data center personnel can modify ORACLE results data and only in very clearly defined circumstances

F.2.4 INTERGRAPH ERMA System

The ORACLE DMSRD acts as an electronic file cabinet for FEMP environmental data to facilitate access to these data and to ensure that data are of known quality. ORACLE can be used to analyze results data to a limited extent. The SQL query language, when used by trained personnel, can provide useful data summaries to support data analysis. For more extensive data analysis, external software packages are generally employed. The primary environmental data analysis subsystem in use at FEMP is the Intergraph Environmental Resource Management and Analysis (ERMA) system. Brief descriptions of ERMA data analysis subsystems follow.

- Microstation CAD software - One foundation of the ERMA system. Graphics-related data used by ERMA are stored in Microstation design files. These files can be enhanced in appearance by using standard Microstation CAD menu commands.

- Relational database linkages to ORACLE - Provided by the Intergraph Relational Interface System (RIS) and provides a linkage between ERMA and the ORACLE results data repository. ERMA also maintains its own data structures in ORACLE.

- Statistical analysis capabilities - Provided within ERMA and directly interfaced with the ORACLE DMSRD

- Geographic Information System (GIS) capability - Provided within ERMA using the Intergraph MGE software product and used to facilitate spatially-related queries against the ORACLE DMSRD and to plot results on an appropriate site map.

- Hydrogeologic analysis - Supported in ERMA via direct linkages to software used to generate stratigraphic cross sections, correlation panels, thickness maps, structure maps, and distribution maps. Interfaces are also provided between ERMA and popular commercial contouring packages.

- Modeling - Supported in ERMA via interfaces with popular ground water models such as MODFLOW.

F.3 FEMP SOFTWARE ENVIRONMENT

The core of the FEMP environmental data management systems is the ORACLE relational database management system. FEMP environmental data management systems (except for Flow Gemini) use ORACLE as their means of data storage and retrieval. The following general software characteristics are employed in all FEMP environmental software applications.

F.3.1 Site-Wide ORACLE Database

A site-wide ORACLE database that includes numerous data tables and included data elements is maintained. A data dictionary that describes each ORACLE data table, data elements in each table, keyed data elements, definitions of each data table and each data element, and field characteristics for each data element is also maintained for FEMP. In addition, entity relationship diagrams are maintained that describe relationships among the ORACLE tables.

The site-wide ORACLE database is the data repository for FEMP environmental software modules. It provides a central repository, not only for environmental data, but also for information models that guide functional requirements and design decisions for future software applications developed for FEMP. The central ORACLE database provides a clear and concise definition of FEMP environmental data that can be easily communicated to multiple software application maintenance teams and data users.

The FEMP ORACLE database is normalized to the highest possible degree, except when performance factors on key software applications require addition of redundant data elements to some data tables. This approach minimizes confusion and possibility for error when multiple groups of users access the same data elements in different applications.

F.3.2 Menus

When possible, the ORACLE SQL*Menu software was used to develop executive menus for FEMP environmental software providing users with a similar "look and feel" across applications.

F.3.3 Data Input Standards

An absolute standard for data input modules has not been employed for FEMP environmental software systems. Rather, certain general standards are enforced, recognizing that each specific application may have some unique data input needs requiring some deviation from other applications. The philosophy with data input standards on FEMP environmental systems, then, is to adhere to the following general input standards.

- Software platform - When possible, ORACLE SQL*Forms, Version 3, is used as the software development platform for FEMP environmental software modules.

- Data editing and verification - Pre-defined field "edits" (templates) are used when possible to help screen data for valid entries on input screens.

- Use of pre-defined codes and look-up tables - Look-up tables with pre-defined lists of valid codes are used when possible for coded data elements to help screen data for valid entries by forcing the use of standard codes.

- Required fields and field completeness - To the maximum extent possible, data elements are verified during data input for completeness, and required fields must be entered for a screen entry to be accepted into the database.

- Error messages - The ORACLE SQL*Forms error-message-handling feature is used to provide a clear and concise error message in a consistent fashion on input screens to inform users of input errors.

- Double-key data verification - Manual data entry of analytical results data into the ORACLE DMSRD is accomplished via double-keying of data by separate data entry personnel, with the computer making the comparison between the entries.

F.3.4 Data Output Standards

Data reporting modules implemented in the FEMP environmental data systems are flexible and easy to use. They incorporate standard high-level ORACLE query capabilities including searches, sorts, control breaks, and reformatting. Standard and customized program modules allow for both regular production reports and ad hoc (on demand) reports.

Standardized production reports in the FEMP environmental data systems use pre-defined query forms, are numbered to allow for easy user reference, and may be initiated from system menus. Ad hoc reports use the SQL query capability and the SQR and EASY*SQR third party software packages to generate reports on demand from the FEMP ORACLE data repository.

Other third party software, such as the ORACLE Add-in for Lotus 1-2-3, are also used to extract data from the ORACLE data repository and format ad hoc reports.

F.3.5 Data Interface Standards

Data interface between the separate FEMP environmental software systems is facilitated by sharing the common ORACLE data repository. The ORACLE database provides a seamless interface that does not require a multistep data export/import process to move data from one application system to the next. However, certain basic data interface capabilities between

ORACLE-based systems and stand alone or "orphan" systems, which exist primarily on microcomputers within specific FEMP organizations, are supported in the following manner.

- ASCII file creation - Software tools are provided to produce ASCII data files extracted from the FEMP ORACLE data repository. The delimiter used between fields in these files may be user-defined, and character fields can be enclosed in quotes, dependent on data input requirements of the receiving software.

- Spatial data link - Primary linking fields used for exporting spatial data from the ORACLE DMSRD to external orphan software are the Station ID number, and the location X and Y coordinates.

- Temporal data link - Primary linking fields used for exporting temporal data from the ORACLE DMSRD to external orphan software packages are the sample ID number, date, and time.

F.4 HARDWARE REQUIREMENTS

The hardware environment for new systems development will be compatible with existing site computer equipment. Current base hardware in use at FEMP is a Digital Equipment Corporation VAX cluster comprised of a VAX 8550 and a VAX 6310 running under VAX VMS. Short and long term upgrades include memory upgrades, installation of Multiple Processing Technology (MPX), storage upgrades, and various other peripheral upgrades.

F.4.1 Operating System

The current VAX cluster operates under VAX/VMS version 5.3. All software systems shall be fully compliant with upgrades in the operating system. Short term plans include an upgrade to VAX VMS version 5.4.

F.4.2 Network Support

New system functionality developed shall co-exist successfully with existing network software as well as provide the functional capacity to support future networking software.

F.4.3 Terminal Support

Systems developed will function, at a minimum, in a character-based environment with future migration capabilities to a Graphical User Interface (GUI) form.

F.4.4 Security

Security provisions for systems development conforms to established site security guidelines. The system also considers integration of VAX/VMS security capabilities, as well as other internal system-dependent security. For legal and financial reasons, security of this data is essential. The entire sphere of the data security process is governed by the following major points of interest.

F.4.4.1 Data Access. Personnel connected with the systems are authorized beforehand and given certain and limited access to the data itself. When an employee or contractor is removed from the project, their access rights are withdrawn.

F.4.4.2 Document Procurement. Documents associated with data gathered at the site are restricted from access by the public unless authorized by DOE. When documents are produced concerning data, access restrictions are applied unless waived by DOE.

F.4.4.3 Passwords. Passwords are assigned to each user, data screen, and database and controlled by the database administrator. There are multiple levels of passwording, depending upon the degree of security necessary.

F.5 SOFTWARE DEVELOPMENT STANDARDS

New software developed for FEMP in support of environmental data management activities shall follow a standard structured software development life cycle methodology including the following tasks and deliverables.

- Functional requirements analysis
- Preliminary software design
- Detailed software design
- Testing plans
- Interim production cut-over
- Final production cut-over
- User-level and systems-level documentation
- Ongoing software maintenance plan

In addition, new software modules shall use ORACLE and standard ORACLE development tools for data management, menus, screens, reports, and queries.

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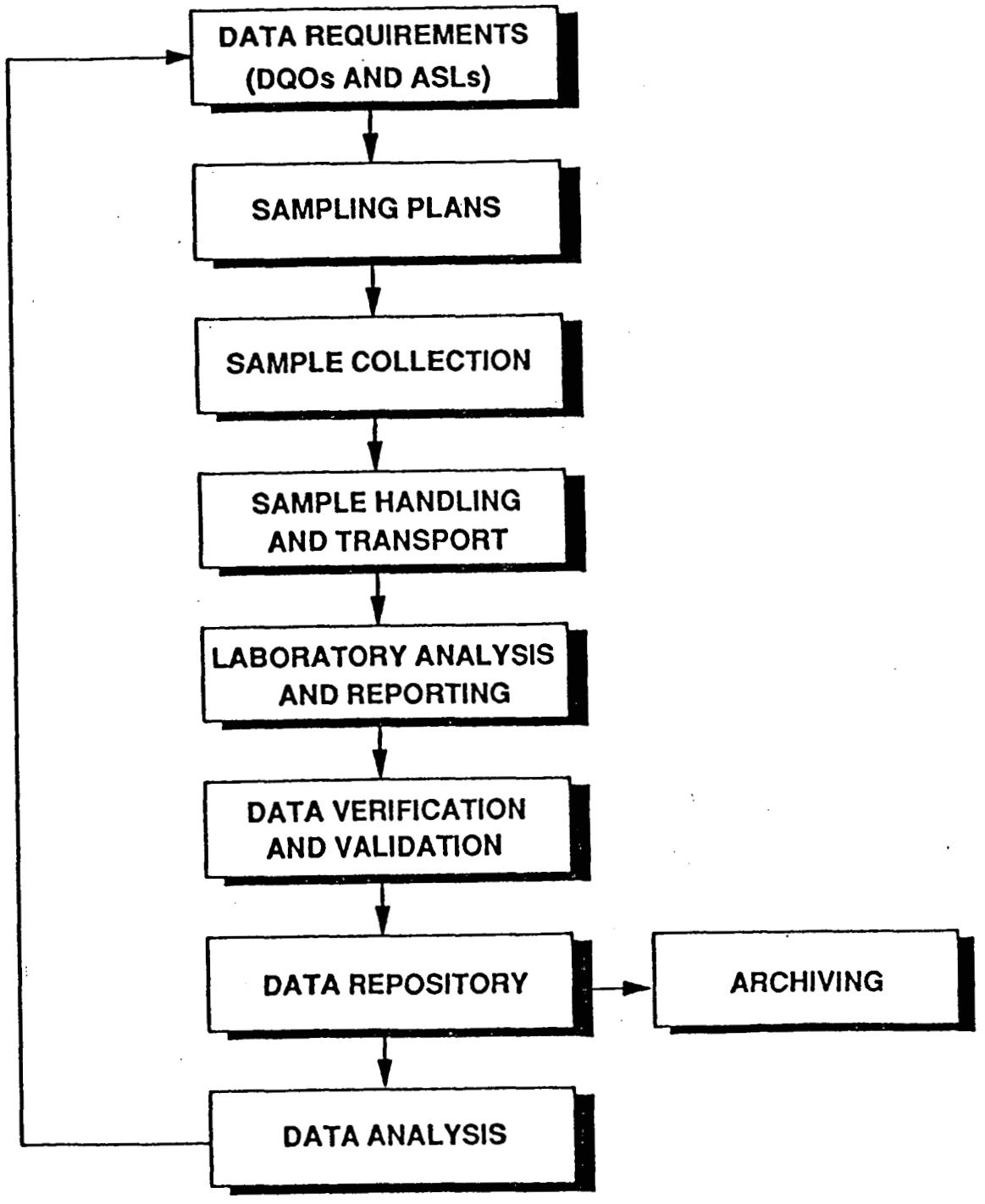

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Figure F-1. FEMP Environmental Data Life Cycle

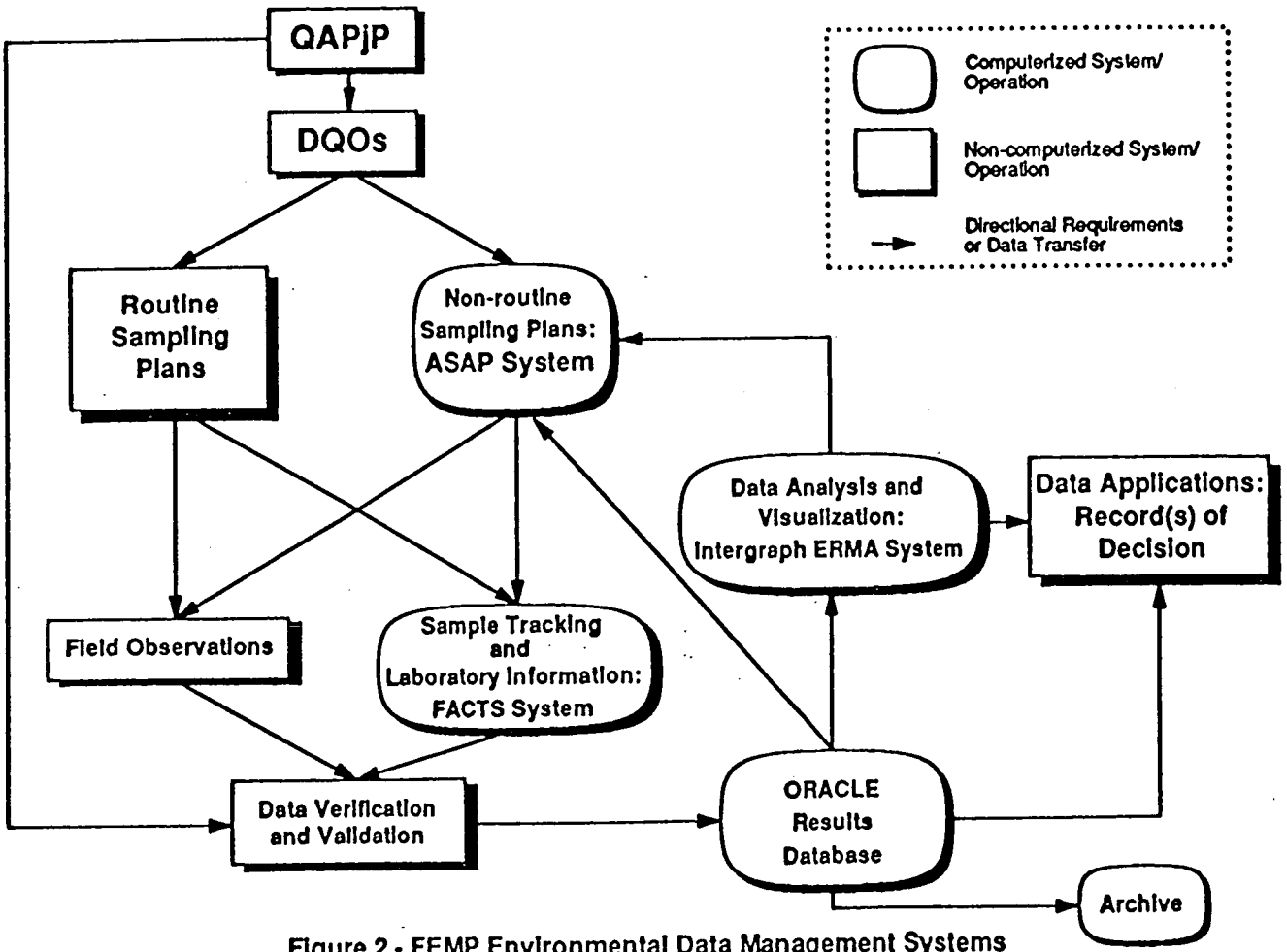

Figure 2 - FEMP Environmental Data Management Systems and their Interrelationships

Figure F-2. Interrelationships of FEMP Environmental Data Management Systems

APPENDIX G

APPENDIX G

(Reserved)

APPENDIX H

APPENDIX H

APPROVED LABORATORIES AND SUPPORT LEVEL CAPABILITIES

H.1 INTRODUCTION

A list of analytical laboratories performing work for FEMP is included in this appendix in Table H-1. Only laboratories meeting the performance requirements specified in Appendix E shall be included on the list. Laboratories included on the list have successfully analyzed performance evaluation samples for the required time period and been audited by FEMP.

FEMP will notify the EPA of its intent to add a laboratory to the list only after the laboratory has demonstrated an ability to fulfill the performance requirements. These laboratories will be considered "proposed for approval." EPA may either accept the FEMP laboratory performance data (thereby indicating approval for use) or may conduct their own audit. Analyses conducted between the time of FEMP approval and EPA audit shall be considered "at risk" until EPA reports results of their audit.

If the laboratory successfully passes the audit, data considered "at risk" shall be accepted. If the laboratory does not pass the audit, data considered "at risk" shall remain "at risk" if corrective actions are pending, or it may be rejected outright.

Maintaining an up-to-date list of laboratories approved for FEMP analyses is the responsibility of the FEMP prime contractor. If a laboratory that has performed work for FEMP is disqualified from performing further work, the period of performance will be included on the list for reference.

H.2 DEFINITIONS

Following are definitions of the columns in Table H-1.

- <u>Laboratory Name</u> - Complete laboratory name with affiliated organizations. Street address (no P.O. box no.), telephone number, and name of laboratory contact shall be kept on file by the FEMP prime contractor.

- <u>Analytical Support Level</u> - Analytical Support Level (ASL) A, B, C, D, or E for which the laboratory is qualified. See Section 2 for ASL definitions.

- **EPA Approved** - Y (yes) indicates that laboratory participates in performance evaluation sample analysis under the EPA Contract Laboratory Program (CLP); n (no) indicates laboratory does not.

- **CLP Contract** - Y (yes) indicates that laboratory currently performs analyses under the EPA CLP.

- **Type of Lab Services** - Type of services laboratory is qualified to perform for FEMP (e.g., example, chemical or radiochemical)

- **Period of Performance** - Interval during which laboratory has been approved to perform type of analysis listed

- **Date Last Audited** - Date (month, year) when laboratory was last audited

- **Auditing Org** - Organization that performed last audit indicated in preceding column. Include a separate line for each auditing organization (e.g., EPA, COE, or private laboratory auditors)

- **Audit Results** - Concerns (major and minor) uncovered in the audit

- **Audit Frequency** - Frequency of audits per year. A minimum of once a year

- **Type of Analyses** - Specific types of analyses laboratory is qualified to perform (e.g., Volatile Organic Analyses (VOA), Base Neutrals Analyses (BNA), inorganics)

- **Remarks** - Comments relating to activities within the laboratory that may affect its ability to perform to its qualifications (e.g., probation periods because of failed audits, current EPA investigations)

Table H-1. LIST OF LABORATORIES APPROVED FOR FEMP ANALYSES

Laboratory Name	Analytical Support level	EPA Approved (y/n)	CLP Contract (y/n)	Type of Lab Services	Period of Performance	Date Last Audited	Auditing Org	Audit Results	Frequency	Type of Analyses
IT Corp Radiological Sciences Lab* Oak Ridge, Tennessee	B,E	Y	N/A	Radiological	1987-Present	1991 2/1991	ASI WEMCO	Pass Pass		Radiological
IT Corp Mixed Waste Lab* Oak Ridge, Tennessee	B,C,D	Y	Y	Chemical	1987-Present	1991	ASI	Pass		
IT Corp Middlebrook Pike Lab* Knoxville, Tennessee	B,D	Y	Y	Chemical	1987-Present	7/88	WEMCO			
IT Corp Export Lab* Pittsburgh, Pennsylvania	B,D	Y	Y	Chemical	1987-Present	8/88	WEMCO			
IT Corp Technology Development Lab** Knoxville, Tennessee	E	N	N	Dioxins Geotechnical	1987-Present	7/88	WEMCO			
IT Corp San Jose Lab** San Jose California	B,C	N	N	Chemical Organo-Phosphorus Pesticides	1989-Present	7/88	WEMCO			
IT Corp Cerritos Lab** Cerritos, California	B,C,D	N	Y	Chemical	1989-Present	9/88	WEMCO			
IT Corp Austin Lab** Austin, Texas	B,C,D	N	Y	Chemical	1989-Present	10/88	WEMCO			

Table H-1. LIST OF LABORATORIES APPROVED FOR FEMP ANALYSES (cont.)

Laboratory Name	Analytical Support level	EPA Approved (y/n)	CLP Contract (y/n)	Type of Lab Services	Period of Performance	Date Last Audited	Auditing Org	Audit Results	Frequency	Type of Analyses
IT Corp Cincinnati Lab** Cincinnati, Ohio	B,C,D	N	Y	Chemical	1980-Present	10/88	WEMCO			
IT Corp St. Louis** 13715 Rider Trail North Earth City, Missouri 63045 (314) 298-8566 IT Contact: Bob White WEMCO Contact: Donna Fisher	B,C	Y	N	Chemical/ Radiochemical	4/30/91-Present	4/30/91	WEMCO	Pass	6 Mos	SW-846 TCLP VOAs TCLP Semi-VOAs (BNAs) TCLP Pesticides/ Herbicides TCLP Metals Total VOAs Radiological Screening
IT Corp Edison Lab** Edison, New Jersey	B,C,D	N	N	Acute & Chronic	1989-Present	None	Schld.			
IT Corp Richland	B,C,E	N	N	Radiological	5/91-Present	5/91	WEMCO	Pass	6 Mos	
Hygeia Waltham, Massachussetts	E	N	N	Asbestos	3/91-Present	3/91	WEMCO	Pass		Asbestos
TMA-Norcal Glendale, California	E	N	N	Radiochemical	1984-1988	1987	WEMCO			
Reed Environmental Covington, Kentucky	E	N	N	Asbestos	1987-3/1991	1989	WEMCO			Asbestos
FEMP Lab** Cincinnati, Ohio	B,E	N	N	Inorganics Radiological	1987-Present	9/1991	WEMCO	Pass		

Table H-1. LIST OF LABORATORIES APPROVED FOR FEMP ANALYSES (cont.)

Laboratory Name	Analytical Support level	EPA Approved (y/n)	CLP Contract (y/n)	Type of Lab Services	Period of Performance	Date Last Audited	Auditing Org	Audit Results	Frequency	Type of Analyses
Chem-Nuclear Lab** 25 Woods Lake Road Greenville, South Carolina 29607 (803) 235-0707 CNLS Contact: Dr. Chuck Reece WEMCO Contact: Donna Fisher	B,C	N	N	Chemical Radio Chemical Physical Testing Treatability Analysis	5/24/91-Present	5/24/91	WEMCO	Pass	6 Mos	SW-846 TCLP VOAs TCLP Semi-VOAs (BNAs) TCLP Pesticides/ Herbicides TCLP Metals Total VOAs Total Uranium Isotopic Uranium Gross Alpha/beta Radiological
TCT - St. Louis** Twin City Testing Corporation 1908 Innerbelt Business Center Drive St. Louis, Missouri 63114-5700 (314) 426-0880 TCT Contact: Fred Grabau WEMCO Contact: Donna Fisher	B,C	N	Y	Chemical	5/2/91-Present	5/2/91	WEMCO	Pass	6 Mos	SW-846 TCLP VOAs TCLP Semi-VOAs (BNAs) TCLP Pesticides/ Herbicides TCLP Metals Total VOAs Total PCBs Total BNAs Total Pesticides/ Herbicides Total Metals
NET Lab** Dayton, Ohio	B,C	N	N	Chemical	1987-Present	5/91	WEMCO ASI		Annual	
EcoTek Lab Services, Inc** 3342 International Park Drive, S.E. Atlanta, Georgia 30316 (404) 244-0827	B,C,D	N	N	Chemical Raiological	12/90-Present	12/90	WEMCO	Pass		VOAs BNAs Pesticides TCLP Metals Gross Alpha/Beta Total Uranium/Thorium

Table H-1. LIST OF LABORATORIES APPROVED FOR FEMP ANALYSES (cont.)

Laboratory Name	Analytical Support level	EPA Approved (y/n)	CLP Contract (y/n)	Type of Lab Services	Period of Performance	Date Last Audited	Auditing Org	Audit Results	Frequency	Type of Analyses
Datachem** Salt Lake City, UT	B,C,D	Y	Y	Radiological/ Chemical	9/91-Present	9/91	ASI	Pass		Organics Inorganics
TMA** Thermo Analytical Inc. Albuquerque, NM 87190-3874 (505) 345-9931	B,C	N	N	Chemical	1991-Present	1991	WEMCO			Metals VOAs Semi-VOAs BNAs CLP Package RCRA TCLP Mixed Waste Explosives PCB's Pesticides
TMA/Eberline Alburquerque, NM	B,C	N	N	Radiological		1991	WEMCO	Pass		Radiochemistry

Note

* List of laboratories approved for RI/FS
** List of laboratories requested for RI/FS

APPENDIX I

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APPENDIX I

FIELD CALIBRATION REQUIREMENTS

I.1 TYPE OF EQUIPMENT

Calibration requirements for the following types of field instrumentation are discussed in this appendix.

- pH meter
- Specific conductance meter
- Dissolved oxygen meter
- Redox Potential
- M-Scope (water level indicator)
- Thermometers
- Photo-ionization detector (HNu, TIP, OVM)
- Flame-ionization detector (OVA)
- Explosimeter
- Pressure transducers

Table I-1 provides a summary of frequency and accuracy requirements for these measuring devices.

I.2 CALIBRATION REFERENCE STANDARDS

Calibration standards represent National Institute of Standards and Technology (NIST) - traceable materials, EPA-certified standards, or the best quality materials available. Calibration certification verifies that measurement equipment is working properly.

I.3 CALIBRATION FREQUENCY

Field instruments shall be calibrated at frequencies specified in FEMP methods.

I.4 CALIBRATION PROCEDURES

I.4.1 pH

Calibrate pH meters in accordance with manufacturer instructions. Meters shall be direct-reading and temperature-compensating and capable of responding within 0.1 pH unit over a temperature range of - 2 to + 40 degrees Centigrade. Response time of the instrument shall not be greater than two minutes (Manigold, et.al., 1982). At a miminum, the following items shall be addressed.

1. Ensure that the electrode is filled with manufacturer-specified solution (usually potassium chloride).

2. Rinse electrode with de-ionized water.

3. Calibrate pH meter at start of each sampling event with a neutral buffer (pH 7.0) and an acidic or basic buffer, depending on expected pH range of sample.

4. Check calibration with a neutral buffer prior to measuring a sample in accordance with manufacturer instructions for calibration.

5. Record date of buffer expiration.

I.4.2 Specific Conductance

Specific conductance meters shall be direct-reading and temperature-compensating. The calibrated accuracy of the measuring system shall be capable of responding within three percent of full scale over a temperature range of -2 to +40 degrees Centigrade, and instrument response time shall be no greater than two minutes (Manigold, et.al., 1982). Two standards that bracket the expected conductivity of the water to be measured (e.g., 100 μmho/cm and 1000 μmho/cm for natural waters) shall be used to check instrument response. Calibrate instrument as follows.

1. Switch on instrument for a power check and calibrate to a known standard as specified in manufacturer instructions.

2. Replace battery when red-line adjustment cannot be accomplished or when meter indicates a low battery.

I.4.3 Dissolved Oxygen

Measuring instrument shall be capable of measuring within 0.2 mg/L over water temperature range of - 2 to + 40 degrees Centigrade with a response time no greater than two minutes (Manigold, et.al., 1982). Calibrate instrument as follows.

1. Calibrate instrument as specified by manufacturer.

2. Perform calibration against water-saturated air.

I.4.4 Redox Potential (Eh)

Calibrate instrument as follows.

1. Turn selector dial on pH/mV meter to BATTERY CHECK. The meter should read in the "battery OK" range. If it does not, charge or replace batteries before using.

2. If battery is charged, turn selector dial to "mV," remove protective cap from redox electrode, and place electrode in ZoBell solution. Meter should read 400 to 450 mv standardized to 25° Centigrade.

3. Record reading.

I.4.5 Water Level Indicator (M-Scope)

Water level indicator tapes, electric or manual, shall be compared to a standard length obtained from NIST on an annual basis.

I.4.6 Thermometers

Working thermometers shall be calibrated annually against a NIST-traceable thermometer. Thermometers with readings differing by ± 1° Centigrade shall be discarded.

I.4.7 Photo-Ionization Detector

Photo-Ionization Detectors (PID) shall be calibrated each day of use. Instrument response shall be checked with each use.

I.4.7.1 <u>PIDs Without Flow Regulators</u>. Calibrate as follows.

1. Fill a sampling bag (of Tedlar or equivalent material) with calibration gas of known concentration.

2. Connect PID probe to sampling bag with flexible tubing.

3. Allow sample bag contents to be drawn into the probe, and check response in parts per million (ppm).

4. Adjust span potentiometer to produce the concentration listed on the span gas cylinder.

5. Allow ion chamber to purge. If instrument reading is zero $\pm$ 0.5 ppm, instrument is calibrated.

6. If the instrument is not calibrated, re-zero and repeat steps 1 through 5.

Probe Potential (eV)	Initial Span Potential Setting	Maximum Acceptance Potential Setting
9.5	5.0	1.0
10.2	9.8	8.5
11.7	5.0	2.0

7. If instrument still is not calibrated, return it for maintenance and recalibration by qualified individuals only.

8. Each responsible organization shall develop a mechanism for documentation of calibration results that include the following information.

- Date inspected
- Name of person who calibrated the instrument
- Instrument number (serial or other ID number)
- Results of calibration (ppm, probe eV, span potentiometer setting)
- Identification of calibration gas (source, type, concentration)

I.4.7.2 PID Canisters With Flow Regulator. Calibrate as follows.

1. Connect sampling hose to regulator outlet and other end of sampling probe of PID.

2. Crack regulator valve.

3. Take reading after 5 to 10 seconds.

4. Perform steps 4 through 8 as specified in para. I.4.7.1.

5. Check response of PID each time instrument power is turned on by placing a felt tip indelible marking pen near the probe and verify that instrument responds positively.

I.4.8 Flame-Ionization Detector

The following steps shall be performed only by qualified service technicians.

I.4.8.1 Primary Calibration.

1. Remove instrument from instrument shell.

2. Turn on ELECTRONICS and ZERO INSTRUMENT on X10 scale. Turn GAS SELECT dial to 300.

3. Turn on PUMP and HYDROGEN, ignite flame, and go to SURVEY MODE.

4. Introduce a methane standard near 100 parts per millon (ppm).

5. Adjust R-32 trimpot on circuit board until meter reads standard.

6. Turn off hydrogen flame, and adjust meter needle to read 40 ppm. Calibrate at each X10) with calibration adjust knob.

7. Switch to X100 scale. Meter should indicate 0.4 on 1-to-10 meter markings (0.4 X 100 = 400 ppm). If reading is off, adjust with the R-33 trimpot.

8. Return to X10 scale, and adjust meter needle to 40 ppm with calibration. Adjust knob, if necessary.

9. At the X10 scale, adjust meter to read 0.4 on 1-to-10 meter markings using calibration adjust. Switch to X1 scale. Meter should read 4 ppm. If reading is off, adjust the R-31 trimpot.

I.4.8.2 Secondary Calibration. Secondary calibration shall be performed by user each day instrument is used.

1. Fill air sampling bag with certified methane calibration gas of known concentration.

2. Connect outlet of air-sampling bag to air-sampling line of FID.

3. Record reading on calibration record.

I.4.8.3 Documentation. Each responsible organization shall develop a documentation system that provides the following calibration information.

- Instrument calibrated (ID or serial number)
- Date of calibration
- Method of calibration
- Results of calibration
- Name of person who calibrated instrument
- Identification of calibration gas (source, type, concentration, lot number)

I.4.9 Explosimeter

Calibration is performed by using a known concentration of combustible gas. (One source is the Mine Safety Appliances Company.). Once gas is introduced into the instrument, adjustments can be made on an internal span control inside exposimeter. If explosimeter cannot be adjusted to read the standard, replace detector filament.

I.4.10 Pressure Transducer

Pressure transducers shall be returned annually to manufacturer for recalibration.

I.4.11 Hand-Held Radiological Survey Instruments

These hand-held instruments are used to screen material and personnel for or gross alpha, beta, or gamma radiation.

I.4.11.1 Preliminary Process.

1. Check instrument to be calibrated with another instrument to ensure there is no residual radioactive contamination.

2. Serialize probe to meter with which it is calibrated.

3. Check reproducibility of instrument with check source.

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NOTE

If instrument does not respond in a similar manner through several trials, electrical malfunction is likely.

I.4.11.2 Calibration.

1. Zero the meter.

2. For electric calibration, pulse with pulse generator at 80 percent and 20 percent of full scale.

3. Set high voltage and run plateau if necessary.

4. Check efficiency with NIST-traceable radiation source.

5. Record data obtained during calibration.

6. If instrument accuracy is outside the limits of 75 to 150 percent of the source, return instrument to manufacturer for repair.

7. Indicate calibration due date on instrument with a sticker.

I.4.11.3 Miscellaneous Instrumentation. Any radiation/contamination detection instrumentation not specifically listed in this document may be used to obtain ASL A and B data provided that the following requirements are met.

1. Instruments are calibrated with vendor-recommended procedures.

2. Radioactive sources used in calibration are traceable to NIST.

3. Instruments are source-checked at least daily.

4. Probes are capable of detecting the type of radiation desired to the levels required.

Table I-1 SUMMARY TABLE OF OPERATIONAL CALIBRATION REQUIREMENTS

Equipment	Calibration frequency	Acceptance Limits
pH meter	Daily: two buffers that are three pH units apart	± 0.1 pH units
Specific Conductance	Daily	3% of full scale over a temperature rance of -2 °C to 40 °C with instrument response time no greater than 2.0 minutes.
Dissolved Oxygen	Daily or before each use	0.2 mg/L over the water temperature range of -2 °C to +40 °C with a response time no greater than 2.0 minutes.
Redox Potential	Daily	200-300 mVolts in ZoBell A Solution
Water Level Indicator	Six months	See FEMP method
Thermometer	One year	± 1 °C
Photo-ionization	Routine Calibration daily Factory Calibration once/year	See Section I.4.8
Flame-Ionization Detector	Routine Calibration daily Factory Calibration once/year	See Section I.4.9
Explosimeter	Daily	The instrument has a tolerance of 40%. For example, a reading of 20% LEL could be as high as 28% or as low as 12%.
Pressure Transducers	Returned to manufacturer yearly for calibration	See FEMP Method.

APPENDIX J

FIELD ACTIVITY METHODS

J.1 PURPOSE

This appendix describes the methodology for field activities that will produce data in compliance with DOE and EPA requirements and meet Data Quality Objectives (DQO) for the FEMP.

J.2 SCOPE

Procedures for the following field activities are provided in this appendix.

- Daily logs (para. J.4.1)
- Drilling (para. J.4.2)
- Monitoring Well/Piezometer Design, Installation, and Abandonment (para. J.4.3)
- Monitoring Well Development (para. J.4.4)
- Geophysical Surveys (para. J.4.5)
- Aquifer/Permeability Testing (para. J.4.6)
- Decontamination (para. J.4.7)
- Well Maintenance (para. J.4.8)

Additional procedures may be submitted to provide detailed information on field work.

J.3 RESPONSIBILITIES

J.3.1 FEMP Project Manager

The FEMP project manager shall be responsible for the safe and prompt completion of project activities and for securing permits required by state, local, or on-site authorities,

which includes ensuring that underground and above ground utilities have been identified and do not pose a danger to drilling operations. Copies of permits and other appropriate documentation shall be posted on site whenever drilling operations are being conducted.

J.3.2 Geologist In Charge

A qualified geologist, hydrogeologist, or geological engineer is responsible for operations at each drilling rig, geophysical survey unit, and for logging activities at the site. This person shall be present whenever a borehole is being advanced and during well development activities. He/she is also responsible for subsurface boring logs that shall be generated for each boring and for complete and accurate generation of a daily log of project activities and for supervising other personnel assigned to the activity.

J.4 PROCEDURES

J.4.1 DAILY LOGS

A daily log is a written record of activities and measurements conducted in the field by a team on a given date and may include daily field activity logs, boring logs, well-construction logs, media-specific sampling logs, photographs, and sketches. The log shall be in a bound book with printed, sequentially numbered pages or on sequentially numbered, printed daily log forms as specified by the project-specific work plan.

J.4.1.1 Daily Log Entries. The following items shall be included in the daily log as applicable.

- Field activity subject
- General work activity
- Unusual events
- Changes to plans and specifications
- Visitors on site
- Time, depth, and identification number of samples
- Chain-of-custody tracking number
- Surveillance observations/findings

- Calibration checks
- Subcontractor progress and specifications
- Communication with regulatory agencies or others
- Weather conditions

J.4.1.2 Types of Field Activities. Daily entries in logs shall include, but not be limited to, the following types of field activities as applicable to the project.

- Footage drilled
- Materials used
- Sample collection start time and completion time
- Samples collected
- Sample description
- Bottom casing depth
- Surveys conducted
- Decontamination activities
- Monitoring well construction
- Aquifer testing
- Special activities
- Well installation activities
- Unusual occurrences

J.4.1.3 Daily Log Completion Methods. The following procedures shall be performed.

1. Record field measurements and comments on applicable forms and complete all lines on the forms as applicable. If the space does not apply or the information is not known, insert an "NA" (not applicable) or "NK" (not known) as appropriate.

2. If steps or procedures were not performed as described in procedures or plans, state reason as completely as possible on form or submit an attachment if necessary.

3. Identify photographs with the project number, date and time taken (using 24-hour time), and a brief description on the back.

4. Place identity-marked photographs in an album in easily retrievable fashion and file.

NOTE

Information in activity-specific logs shall not be duplicative but rather supportive of other required documentation.

5. Generate activity-specific logs (e.g. subsurface boring logs, water sampling logs, sediment sampling logs) to document field conditions as part of the daily log.

J.4.1.4 Filing Requirements.

1. Send photocopies of daily log entries to the FEMP project manager or representative and others as required at least weekly.

2. Maintain originals of field records in the project central file. Keep photocopies of bound books in the central file until book is complete and entered in the file system.

3. During performance of the field program, maintain copies of field records in the FEMP project manager's file.

NOTE

These copies will provide adequate documentation of work activities if originals are destroyed, lost, or stolen.

J.4.2 Drilling Procedures

The number, location, and depth of borings and the type of sampling and testing required are dependent on the intended use of the data. The type of drilling method selected for a particular project at FEMP depends on the intended use of the borehole and samples collected. Ability to acquire data of sufficient quality for intended use and personnel health and safety are the primary factors considered when choosing a drilling method.

Justification for choosing a particular drilling method shall be presented in project-specific plans. Drilling methods that may be selected include, but are not limited to, the following.

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- Cable-tool or hollow-stem auger methods
- Drive casing
- Spin casing
- Direct mud rotary
- Air rotary with casing driver
- Air rotary with a swing-out under-reaming bit and casing advancer
- Reverse-air or mud rotary

Drilling operations shall be conducted as follows.

1. Decontaminate drilling equipment before each use as specified in para. J.4.7 to prevent contamination of the borehole and after each use to prevent off-site transport of contaminants.

NOTE

The chosen drilling method shall reflect the FEMP policy of waste minimization.

2. Make every effort to minimize introduction of contaminants into the environment or spreading of contaminants between zones.

3. Set surface casing when a potentially contaminated zone is drilled prior to reaching the target zone.

4. When drilling through areas where near-surface contamination is indicated through past use or during screening of samples while drilling, grout surface casings in place and make them a part of the permanent installation.

5. In outlying areas not suspected of being contaminated, advance large diameter temporary casings as necessary for bore-hole control.

6. Minimize production of fluids, cuttings, and other waste, using above-ground mud pits, drums, or plastic-lined structures for containment of drilling fluids and cuttings unless otherwise specified in project-specific plans.

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NOTE

The source of water for use in drilling operations at FEMP will be the plant potable water system.

7. Use only an approved source of water during drilling operations.

NOTE

Use of additives in drilling fluids is discouraged except in unusual circumstances.

8. If an additive is to be used, obtain approval of the additive from the FEMP project manager prior to use.

   a. Analyze a sample of the additive for parameters of interest.

   b. Review analysis results for potential impact on objectives of the data-collection program.

J.4.3 Monitoring Well/Piezometer Design, Installation, and Abandonment

To ensure quality control of monitoring well/piezometer design and installation and successful completion of field drilling investigations for obtaining hydrogeological and future water quality information, the following procedures are required.

J.4.3.1 Materials and Installation. Use the following materials for construction of monitoring wells/piezometers.

1. Use 316 stainless-steel well casing with flush-thread joints below the water table for monitoring wells.

NOTE

Use of glues or solvents is prohibited.

2. Use Schedule 40 Polyvinyl Chloride (PVC) or 316 stainless-steel casing with flush-thread joints for piezometers and above the water table in monitoring wells if preferred.

3. Use two- to fifteen-foot sections of commercial wire-wound stainless steel screens with flush-thread joints compatible with the well casing (minimum three square inches open area per foot of screen) for monitoring wells. Determine size of screen

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openings based on effective grain size of monitored zone and filter pack size suggested by Aller (1989).

NOTE

Screen openings shall be capable of holding back between 85 and 100 percent of filter pack materials to allow accurate measurement of hydraulic properties while minimizing turbulence during sample collection activities as well as optimizing capacity to develop the well completely and efficiently.

Slotted or wound PVC screens with flush-thread joints compatible with the well casing may be used in piezometers; however, hydraulic data collected from these piezometers shall be carefully evaluated to determine whether measurements are representative of the aquifer or of well materials.

4. Use well-sorted quartz sand for filter pack material.

NOTE

Selection of filter pack grain size is a function of grain size distribution in the natural formation.

5. Multiply the median formation grain size by a factor of two to arrive at a suitable filter pack grain size (Driscoll 1986).

6. Require a one-quart or one-liter representative sample of each type of proposed filter-pack material from contractor for approval prior to use.

NOTE

Typically, graded sand meeting requirements of ASTM C-33 for fine aggregate (concrete sand) is sufficient.

7. Describe each sample in terms of lithology, grain size distribution, and source (both company from whom purchased and lot number or pit or quarry of origin) and place description in program/project files.

8. Install bentonite pellet seals in the annulus directly above the filter pack in monitoring wells and piezometers screened across the water table. Use pellets 1/4 to 1/2 inch in diameter.

9. Record brand name and lot numbers of bentonite in project files.

10. Use an annular grout consisting of a slurry of high-solids bentonite, such as Volclay, mixed to manufacturer specifications.

11. Reserve a sample of each type, brand, and size of backfill material used during the project for potential analysis of contaminants of interest.

J.4.3.2. Monitoring Well Construction. Proceed as follows to construct monitoring wells after drilling is completed and the borehole has been sufficiently cleaned of cuttings.

1. Place desired length of screen and casing inside temporary casing or hollow-stem augers.

2. Place filter pack in annular space between screen/casing and temporary casing or augers. Make periodic measurements to check uniform placement of filter pack. Record depth to top of filter pack to nearest 0.1 foot.

3. Remove temporary casing gradually because backfill materials are placed in such a manner that the bottom of the temporary casing is kept below the top of the backfill material.

4. Backfill 1000- and 2000-series wells (glacial drift wells and wells screened across water table of the regional aquifer) with a filter pack to a height of two to five feet above the screen. Place a five-foot sodium bentonite pellet plug on top of filter pack, and install a high-solids bentonite grout seal from top of bentonite seal to within 30 inches of ground surface.

5. Backfill the 3000- and 4000-series wells (wells screened approximately in the middle and at the bottom of the regional aquifer) with a filter pack to a height of approximately five feet above the screen and install a high-solids bentonite grout to within 30 inches of ground surface.

6. Place grout material using pumps and tremie line methods.

7. For above ground completions, finish top of well casing with 24 to 30 inches of casing stickup, a vented stainless-steel cap, or an airtight cap and a vent hole not more than six inches from top of casing. Finish ground-flush completions with an airtight cap.

8. File a notch approximately one-half inch deep at top of each well casing, measure elevation of base of notch, and reference each water-level measurement to this elevation.

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9. Install protection around monitoring wells and include the following minimum elements in the protection design.

NOTE

For ground-flush installations, the well cap shall accommodate a lock and the protective cover shall be secured by bolts for ground-flush installations. The cover shall prevent precipitation from entering the protective casing.

a. For above-ground completions, use a five-foot length (minimum 1/4 inch wall thickness) of black iron pipe a minimum of four inches greater in diameter than the well casing as a protective casing, with the well casing within four inches of the top of the protective casing. Drill a drain hole in the oversleeve one foot above the land surface. Fit each protective casing with a hinged cap, hasp, and lock.

b. In ground-flush completions, use manhole type boxes large enough to accommodate the well casing, well cap, and a lock.

NOTE

Ground-flush completions shall either be water tight or be free-draining (contains a drainage layer made of coarse sand at the bottom of the flush-mount box).

c. Place a mixture of cement, sand, and potable water in a ratio of approximately 1:4:0.5 (by weight) between well riser and outer protective casing to a height just below the drain hole to allow water that enters the annulus to drain.

d. Install a three-foot square by six-inch thick, wire-reinforced, concrete pad around the protective casing. Backfill the upper 30 inches of borehole annulus with concrete. Pour the pad and annular backfill in one operation to limit subsequent movement of the pad by frost heaving. Place at least two inches, but not more than three inches, of the pad below grade.

e. Paint protective casings with high-visibility orange paint.

f. Mark location identification on well protector in two places using two methods: (1) painted on inside of cover with enamel-type paint; and (2) welded, stamped, or engraved into top of locking cover or flush-mount cover. Also mark location on outside of well cap by engraving or indelible marker.

NOTE

In high traffic areas or in areas where vegetation or debris obscures the protective casing, guardposts may be necessary. Guardposts are required only on the high-traffic side of wells.

10. If necessary, install three-inch-diameter steel guardposts, each radially located four feet around the well, and concrete in place two feet below ground surface and four feet minimal above-ground surface.

11. Fill guardposts with concrete or cement grout.

12. Regrade and restore disturbed drilling areas.

13. Prepare and record a sketch of each well/piezometer installation showing the bottom of the boring by depth from surface grade, screen location, granular backfill, seals, grout, cave-in, centralizers (if used), and top of riser relative to ground surface. Also include details of the well protection and above-ground completion in the sketch.

14. Record composition of grout, seals, and granular backfill; screen size; and slot size (in inches) and slot configuration.

J.4.3.3 <u>Installation and Use of Dedicated Equipment</u>. Installation and use of dedicated ground-water sampling equipment is encouraged in cases where either of the following conditions exist.

- High concentrations of contaminants are present at a well site, making handling and decontamination of sampling equipment a problem
- Well access is a problem
- Fixed equipment that cannot be decontaminated

Types of equipment that may be dedicated to a sampling location include, but are not limited to, the following.

- Bladder-type sampling pumps

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- Submersible impeller-type purge pumps
- Submersible piston-type purge pumps
- Packers
- Hoses
- Bailers
- Water-level measurement equipment

Proceed as follows when installing, maintaining, and using dedicated sampling equipment.

1. Require that equipment needing special installation be installed and maintained by personnel trained to manufacturer's specifications.

2. Store sampling equipment in the well casing between uses or pull it from the well and store it in a designated storage structure. If stored outside the well, mark the equipment as to which well (by well number) it is dedicated.

3. Decontaminate equipment removed from a well as specified in para. J.4.7 prior to re-installation.

NOTE

Maintenance may include decontamination to remove mineral precipitation or biological growths.

4. Perform maintenance as specified by the manufacturer. If no specifications are available, perform maintenance on a set schedule based on past usage or when performance is declining.

J.4.3.4 <u>**Monitoring Well/Piezometer Abandonment**</u>**.** The objectives of proper well abandonment include the following.

- Eliminate physical hazards
- Prevent ground-water contamination
- Conserve aquifer yield and hydrostatic head

- Prevent intermixing of subsurface water
- Comply with reasonable property owner requests

Proceed as follows to ensure the attainment of these objectives when abandoning a well.

1. Remove well casing and screens by pulling or overdrilling prior to grouting the borehole. If casing is to be overdrilled, the outside diameter of the overdrilling tool should be at least as large as the original borehole. If screen material is considered relatively inert in the hydrogeologic environment, overdrilling may be terminated at the top of the monitored zone, leaving the screen and filter pack in place. If the screen and filter must be removed, continue overdrilling to bottom of original borehole before grouting.

NOTE

Overdrilling is required when flowing sands are encountered.

2. Grout the borehole using the tremie method from the bottom up.

3. If well casing and screen are pulled from the borehole, make provisions (such as filling the borehole with drilling mud) to prevent borehole collapse within the evacuated area.

4. Remove annular fill material before grouting by the tremie method.

NOTE

The open depth of the borehole can be measured using the tremie pipe and calculating the volume of grout to be added to fill the entire borehole to a depth of 30 inches below grade.

5. If the pipe can be inserted to the original total depth, grout the borehole by the tremie method from the bottom up.

6. Measure the volume of grout added. If significantly more grout is added than that calculated (i.e., 25 percent), stop grouting and consult the FEMP project manager.

7. If the tremie pipe cannot be inserted to the original total depth of the borehole, overdrill the boring to the original depth before proceeding with grouting. The outside diameter of the overdrilling bit must be at least as large as the original borehole (based on the original drilling records).

8. Insert grout to within 30 inches of land surface and allow to harden for 24 hours.

9. Use a concrete plug to fill uppermost 30 inches of the borehole.

10. Insert a metal pin or marker to facilitate locating the abandoned well site.

J.4.4 Monitoring Well Development

Monitoring wells must be properly developed to yield accurate aquifer test results and ground-water samples representative of aquifer conditions. The following steps shall be observed when developing a well.

1. Decontaminate equipment and materials used for well development as specified in para. J.4.7 before each use.

2. Develop monitoring well as soon as possible after well installation, but no sooner than 48 hours after grouting is completed.

3. Continue development of the well until the water is visually clear; temperature, pH, and specific conductance have stabilized.

4. As a minimum, attain the following conditions.

   a. For those wells where the boring was made without use of drilling fluid water, remove five times the standing water volume in the well (water in well screen and casing plus saturated filter pack).

   b. If recharge is so slow that five volumes cannot be removed in a reasonable time frame, or the water remains discolored, or it contains visible particulates after this five-volume removal, contact the FEMP project manager or representative for direction to use an alternate procedure based on the recommendation of the field representative.

NOTE

Do not add water to the well to assist development without prior written approval from the FEMP project manager. Use no chemicals, including dispersing agents, disinfectants, or acids.

c. For those wells where the boring was made or enlarged with use of drilling fluid (water), remove five times the measured amount of total fluids lost while drilling plus five times the standing water volume as before. If slow recharge, discolored, or particulate-laden water is a problem, proceed as in step 4, b.

5. During development, attempt to remove standing water from points near bottom of the well screen as well as from the top of the water column.

6. If problems are encountered during development, promptly notify the FEMP project manager or representative.

7. Record field measurements and comments on applicable data reporting forms; and, if some steps or procedures are not performed as specified, state the reason as completely as possible on the form or submit the statement as an attachment. Include the following data on the appropriate form.

   a. Well designation (location ID)

   b. Date of well installation

   c. Date and time of well development (start and finish)

   d. Static water level before and after development

   e. Quantity of water removed and time of removal

   f. Depth to bottom of the well inside the casing before and after development

   g. Physical character of removed water including changes during development of temperature, turbidity, pH, specific conductance, color, and odor at regular intervals

   h. Physical characteristics of removed sediments including lithology and grain size

   i. Descriptions of equipment used including type and size/capacity of pump and/or bailer used

   j. Description of surge techniques used

J.4.5 Geophysical Surveys

Specific techniques to conducting geophysical surveys by borehole logging or surface methods shall be provided in the project-specific plan based on the following principles.

J.4.5.1 Borehole Geophysical Logging. Borehole geophysical methods are used to acquire information about subsurface geological characteristics including formation breaks, thickness of individual beds, porosity, nature of borehole and formation fluids, identification of high-permeability zones, depth of penetration of drilling fluids, and borehole size.

A minimum of one quality control duplicate run shall be made with each tool used on each project where borehole geophysical logging is specified.

The following procedures generally apply to geophysical surveys.

1. Clean and decontaminate downhole tools and cables prior to downhole logging operation and between each borehole as specified in para. J.4.7.

2. Calibrate logging equipment and provide the FEMP project manager with applicable documentation before and after survey calibrations.

3. Properly clean and decontaminate logging equipment at conclusion of operation.

NOTE

> The project manager or representative shall ensure that originals and copies of logs are placed in project files as required. The team leader shall monitor and record the progress of logging activities.

4. Complete applicable forms and record unusual occurences in the daily log and as remarks on the log header. Identify the log run, logging speed, length of tool and resolution, borehole identification, and team members on the log header. Mark each curve on the log using a unique line format for every curve. Mark the vertical scale in feet and record total depth of the borehole at the bottom of the log. Identify and graduate the horizontal scale for each log run, labeling a minimum of every ten grid spaces horizontally on the log.

NOTE

> When the performance of the logging operation has met project objectives, the geophysical team leader shall sign and date the logging forms.

5. Transfer copies of data generated to the FEMP project manager or representative for distribution, analysis, and archiving. Transmit magnetic recordings generated during the course of downhole logging along with results of logging runs immediately. (Recordings shall be in a format specified by the FEMP project manager or designee.

J.4.5.2 Surface Geophysical Surveys. Surface geophysical methods provide subsurface information without the need for excavation. Information that can be obtained includes delineation of contaminant plumes, identification of high permeability zones, location of disposal areas, location of subsurface anomolies, and identification of subsurface utilities and subsurface stratigraphic data.

The project-specific plan shall specify the geophysical method and instruments to be used, the grid spacing, the speed at which the survey is to be conducted, information desired, and the frequency of duplicating lines for quality control purposes.

A minimum of five percent of the total linear distance of the survey shall be duplicated. Provisions for verifying interpretations through use of borings or excavations shall be included in the project-specific plan.

1. Operate instruments as specified in manufacturer instructions or as specified in the project-specific plan.

2. If manufacturer instructions are not used, provide justification for this variance as specified in Section 15 of the QAPjP.

3. Provide the following information on project-specific logging forms.

   - Date of the activity
   - Times survey was begun and finished
   - Times of breaks in activity
   - Temperature variations
   - Descriptions of variation from an established line caused by topography or vegetation; crossing of drainage features; crossing of swampy areas; instrument settings, calibrations, or malfunctions; and operators.

J.4.6 Aquifer/Permeability Testing

This paragraph defines requirements for hydraulic tests to characterize certain properties of hydrogeologic units (e.g., hydraulic conductivity, transmissivity, and storativity). A decision

to conduct an aquifer test for each project shall be made in accordance with guidelines in the project-specific plan. Determining test type, location, and objectives for each project shall also be specified in the project-specific plan.

Data obtained during field hydraulic tests may include the following.

- Static water level
- Pumping well water discharge rate or volume of water displaced
- Drawdown or pressure versus time data for pumping and monitoring wells
- Water temperature, pH, and specific conductance
- Test interval

J.4.6.1 General Test Procedures.

1. Use equipment specified in the project-specific plan based on approximations of the properties of interest from previous drilling and testing data.

2. Complete an aquifer or permeability test data form for each test including the following information as applicable.

    - Type of test (e.g., slug test, specific-capacity test)
    - Type of data recorded (e.g., recovery or drawdown)
    - Test well identification
    - Identification and relative position of observation wells including a diagram
    - Depth and length of screened or open interval
    - Diameter of both well casing and boring
    - Known or estimated thickness of the aquifer
    - Static water level
    - Start and completion time of test
    - Start and completion time of pumping if applicable

- Drawdown versus time measurements
- Identification of equipment used including pumps, hoses, slugs, transducers, data loggers, and water level measurement devices
- Weather conditions including duration and intensity of precipitation events
- Testing personnel

3. Maintain complete original test records in the project files and make copies available to hydrogeologists and field representatives who performed the test.

4. Prepare a diagram of equipment actually used in each aquifer or permeability test (by the reponsible hydrogeologist). Indicate tubing dimensions, depth of water intake, and location of gauges and packers. Include diagram in the data records of each test.

5. Calibrate gauges, flowmeters, and other instrumentation used and check for proper operation before use. Obtain copies of calibration documentation from the instrument or testing service company; maintain calibration records consisting of laboratory measurements and, if performed, on-site zero adjustment and/or calibration; and include these records in the project file.

6. In cases where a weir or an orifice is used to measure flow volumes or rates, check these devices on site using a vessel of known volume and a stopwatch. Document accuracy before testing proceeds.

NOTE

Equipment shall be installed and demonstrated to the hydrogeologist's satisfaction that it is in proper working order and performing to specifications before start of the pumping test.

7. If past monitoring data indicate the water does not contain hazardous constituents or possess characteristics of hazardous waste as defined by RCRA, dispose of water pumped from the well during the aquifer or permeability test in the general sump and treat it in the FEMP wastewater system.

NOTE

Direct questions about whether water from a certain well constitutes a hazardous waste to FEMP environmental compliance personnel.

8. Make special storage arrangements prior to removing water that may contain hazardous waste.

9. Decontaminate equipment used in boreholes, wells, or piezometers as specified in para. J.4.7 prior to use and between each test site.

J.4.6.2 Borehole Hydraulic Testing for Aquifer Characteristics

Following are procedures for determining hydraulic parameters of aquifers using slug tests and pumping tests. Generally, the procedures in para. J.4.6.1, steps 1 through 9, apply to both slug tests and aquifer pumping tests.

Slug Tests - Slug tests are a quick and inexpensive method of estimating the hydraulic conductivity or transmissivity near the screened zone of the well.

1. Use the following equipment to conduct a slug test.

NOTE

A number of water-level measuring devices may be used for measuring depth to water in a well. Accurate readings can be obtained with electric water-level indicators, pressure transducers, or weighted tapes. Avoid water-level measurement by the weighted-tape method except when conducting tests of intervals suspected of having a very low K value because it may be difficult to obtain enough readings for analysis of the tests if the water level recovers quickly in a short period of time.

- Water level measuring device
- Known volume of slug (solid cylinder or volume of water added or removed) that will fit into the well, borehole, or container to add or remove a known volume of water
- Timer accurate to one second or a pressure transducer and data-logger combination
- Semi-log graph paper and indelible pen or pencil and paper or verified slug-test analysis software

NOTE

Variations to the following procedures shall be specified in project-specific plans.

2. Record the following information before beginning the test.

- Site identification and well or borehole location
- Location and elevation of reference point from which water depth measurements are made
- Elevation of ground water with respect to reference point
- Date and time of test
- Well depth, screen length, riser pipe radius, well screen radius, radius of gravel pack plus well screen or borehole depth and radius
- Thickness of ground water zone to be tested
- Volume of slug added or removed
- Type of measuring device used
- Names of personnel conducting test

3. Determine static water level in well by periodically measuring depth to water for several minutes and taking average of readings.

NOTE

It is important to remove or add the volumes as quickly as possible because the analysis assumes that an instantaneous change in volume is created in the well.

4. Instantaneously introduce or remove a slug of known volume to displace and the water level.

NOTE

The number of depth/time measurements necessary to complete the test are variable, but it is critical to make as many measurements as early as possible in the test.

5. Assign time zero to the moment of volume addition/subtraction and measure and record depth to water and time of each reading. Measure depth to the nearest 0.01 foot.

NOTE

Time required for slug test completion is a function of volume of the slug, hydraulic conductivity of the formation, and type of well completion. Slug volume shall be large enough that a sufficient number of water level measurements can be made before water level returns to equilibrium conditions. Length of the test may range from less than a minute to several hours.

6. Continue measuring and recording depth/time measurements until water level returns to equilibrium conditions or, for slowly recovering wells, a sufficient number of readings have been made to clearly show a trend on a semi-log plot of time versus depth.

7. If the FEMP project manager approves addition of water to the monitoring well, use water from an uncontaminated, and tested source and transport it in a clean, approved container.

8. Decontaminate bailers and measuring devices prior to the test as specified in para. J.4.7.

9. If tests are performed on more than one monitoring well, avoid cross contamination of wells by using decontamination procedures specified in para. J.4.7.

Aquifer Pumping Test - Aquifer pumping tests, commonly referred to as pump tests, are used to determine hydraulic properties of water-bearing zones. Pump tests influence a larger area and provide results that are often more representative of the overall aquifer characteristics than slug tests.

Aquifer characteristics that may be obtained from pumping tests include hydraulic conductivity, transmissivity, and specific yield for unconfined aquifers and the storage coefficient for confined aquifers.

Equipment, personnel, and time commitments needed to conduct pumping tests are greater than those required for slug tests.

The following list includes several types of pumping tests.

- Constant-rate discharge test
- Variable-rate tests
- Injection testing

The test method and procdures to be used shall be provided in the project-specific work plan.

Equipment needed for a pumping test includes the following items.

NOTE

> Pumps are commonly of the submersible or turbine type and are sized consistently with expected aquifer conditions. The test well should be properly developed prior to testing.

- One or more completed observation well/piezometer hydraulically connected to the pumped test aquifer and completed to specifications for the particular test
- An orifice, weir, flow meter, container or other type of water measuring device to accurately measure and monitor discharge from the pumped well
- Sufficient pipe to transport pumped water from pumping well to holding tank or effluent location
- Valve on discharge pipe to control pumping rate
- Outlet valve near well head for water quality sampling
- Depth-to-water measuring devices for each observation well and pumping well (may include steel tapes, electric sounding probes, Stevens recorders, or pressure transducers)
- Thermometer and other necessary water quality equipment
- Watches capable of reading to the nearest second for observers, a stopwatch, or pressure transducers with data loggers

- A 3-cycle by 5-cycle log and 5-cycle semi-log graph paper or appropriate, verified computer software, and necessary hardware
- Indelible pens or pencils and form for recording times and drawdown measurements at each well
- Appropriate references and calculator for determinations in the field
- Barometer or recording barograph for tests conducted in confined aquifers

General procedures for pumping tests are as follows.

1. Prior to the test, monitor water levels in the selected observation well/piezometer to measure diurnal fluctuations. (The number of wells and the monitoring period is specified in project-specific plans.)

2. Record the following data during the test.

   - Identification numbers or locations of pumped well and each observation well
   - Location and elevation of each well
   - Location and elevation of reference point from which water depth measurements are made and elevation of ground surface with respect to the reference point
   - Weather conditions
   - Method of measurement
   - Date and time of test
   - Well depth, pump depth, screen length, well radius, and radius of filter pack plus well screen for each well

3. Calibrate measuring equipment used for pumping tests before use. Obtain copies of calibration documentation and file with the test records. The calibration records shall consist of laboratory measurements and on-site zero adjustment and/or calibration performed.

4. When a weir or an orifice is used to measure flow rates, check it on site with a container of measured volume and stopwatch. Verify accuracy of meters before testing proceeds, check them hourly during the test, and document each check.

5. Record changes in barometric pressure during the test, preferably with an on-site barograph, to correct water levels for fluctuations that may occur as a result of changing atmospheric conditions.

6. Measure water levels to provide data required to meet requirements of test. During early part of the test, ensure that sufficient personnel are available to collect at least ten measurements per log cycle (i.e., 1 to 10 and 10 to 100 minutes) at each selected observation well, or install a pressure transducer and data logger at each well to collect the data at the given frequency.

7. Measure water level recovery after pumping stops to verify results obtained during drawdown portion of the test. Measure recovering water levels in pumped well and observation wells for a period immediately following cessation of pumping.

8. Perform monitoring during recovery period as specified in project-specific work plan.

J.4.7 Decontamination Procedures

Equipment shall be decontaminated in order to limit introduction of contaminants from equipment to sampled media, limit cross-contamination between sampling points, and protect worker health and safety.

The following decontamination procedures are designed to accomplish these objectives without affecting the integrity of the collected samples. Generation of hazardous waste and excessive volumes of waste solutions are discouraged. Use of improperly decontaminated equipment is prohibited.

1. Clean non-dedicated sampling equipment between each use and each sampling point except as described in Appendix L.

2. Clean dedicated equipment as necessary.

The cleaning procedures herein shall be adhered to by field personnel. Variations from procedure shall have prior approval of the FEMP project manager and QA officer. The reason for the variation and its nature and the subsequent procedure to be used shall be described in detail on the daily field log and recorded on sampling logs of samples affected.

Equipment shall be decontaminated at a central decontamination area where a water source and a means of containing decontamination solutions is readily available. If decontamination must be conducted in the field, the circumstances dictating this action shall be documented either in a project-specific work plan or in the daily field log.

J.4.7.1 Cleaning Materials. Requirements for decontamination materials are based on those specified in the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, April 1, 1986 (Region IV SOP) of the U.S. Environmental Protection Agency, Region IV. A similar guidance document is not available for Region V (Craig Thomas, U.S. Environmental Protection Agency, Region V, telephone conversation, January 3, 1991). Variations from use of specified materials shall be recorded on the daily field log and the samples potentially affected shall be indicated. The following materials shall be used during decontamination activities.

- Standard brand of phosphate-free laboratory detergent such as Liquinox or Micro
- Pesticide-grade methanol cleaning solvent
- Potable water from the FEMP water system
- Certified deionized water (may be produced on site by passing potable water through a standard deionizing resin column or purchased) that contains no metals or other inorganic compounds at or above the analytical detection limit of an Inductively Coupled Plasma (ICP) spectrophotometer scan as defined by the EPA Contract Laboratory Program
- Certified deionized, organic-free water (may be produced on site by passing deionized water through an activated carbon filter or purchased) that contains no pesticides, extractable organic compounds, and less than 50 μg/l of volatile organic compounds as measured by a low level Gas Chromatography/Mass Spectrometer (GC/MS) scan as defined by the EPA Contract Laboratory Program
- A 0.02 normal hydrochloric or sulfuric acid solution (replaces nitric acid specified by the Region IV SOP for safety reasons)

J.4.7.2 General Equipment Cleaning Procedures. For purposes of this document, three levels of decontamination have been identified and their descriptions follow. The level of decontamination required is specified in project/program-specific plans.

1. Level I Decontamination - Only equipment, tools, and other items that do not come in contact with sampled media shall be cleaned as follows.

   a. Use high-pressure potable water to wash down the designated items.

2. Level II Decontamination - Most equipment is designated for cleaning at the following level.

   a. Rinse with potable water.

b. Wash with a phosphate-free laboratory detergent and potable water solution or steam-clean with high pressure potable water.

c. Rinse with potable water.

NOTE

Ensure that decontaminated equipment remains covered from the time decontamination is complete until use.

d. Rinse twice with certified deionized organic-free water.

NOTE

Do not cover equipment used to sample for organic parameters with plastic. If aluminum foil is used, wrap equipment with the shiny side out. Do not use aluminum foil if aluminum contamination may be a problem.

e. Air dry and immediately cover with plastic or aluminum foil.

3. Level III Decontamination - If contamination by organic chemicals, metals, radionuclides, or other inorganic contaminants occurs, the following level of cleaning is designated.

a. Rinse with potable water.

b. Wash with a phosphate-free laboratory detergent and potable water solution or steam-clean with high-pressure potable water.

c. Rinse with potable water.

d. Rinse with acid solution.

e. Rinse with potable water.

f. Rinse with approved solvent (methanol).

g. Triple rinse with certified, deionized organic-free water and air dry in a relatively dust-free environment if time permits. Otherwise, cover with plastic or aluminum foil.

J.4.7.3 Drilling Equipment Decontamination.

1. Follow the level II procedure for drilling equipment that contacts contaminated subsurface material including augers, drill rods, drill casings, split spoons, auger teeth, drill bits, core barrels when moving between drill sites. Use level III procedures if screening with field instruments indicates gross contamination.

2. Clean split spoons between sampling intervals if a sufficient quantity are not available for the entire boring. Follow level II procedures when drilling in background areas, and follow level III procedures in areas where contamination is suspected based on visual inspection or screening with field instruments.

3. Determine decontamination level for drilling rig wheel wells, tires, mast, and other potentially contaminated items based on the next usage. If the rig is to remain in the same Operable Unit (OU) area (i.e., the contaminant levels are the same or higher based on existing data), decontamination is not required.

4. Follow level I cleaning procedure if the rig is moved to a cleaner area or to a different OU.

J.4.7.4 Submersible Pumps and Lines.

1. Decontaminate exterior of submersible pumps and lines at a level II.

2. In the final rinse, pump at least five times the amount of deionized water required to fill the system through it.

CAUTION

If a pump becomes grossly contaminated through use at a well, dedicate it to that well.

J.4.7.5 Filtering Apparatus.

1. If in-line filters are not used, remove the used filter and clean sample filtering apparatus at a level II.

2. Do not use filters for more than one sample and do not reuse in-line filters.

J.4.7.6 Water-Level Measurement Probes.

1. Between uses, clean the portion of water-level measurement equipment that contacts ground water at a level II.

J.4.7.7 Verification of Decontamination Effectiveness. To ensure that decontamination measures are effective, proceed as follows.

1. Collect samples of final decontamination rinse at a minimum frequency of 1 per 20 for decontamination of equipment for each type of activity specified in the project/program-specific plan.

NOTE

More frequent sample collection may be required under some circumstances based on results of previous rinsate sample analyses, activities performed, or as required by project-specific plans.

NOTE

Gross contamination is determined by visual inspection or screening with field instruments.

2. Collect rinsate samples after grossly contaminated equipment intended for use at a different sampling point is cleaned.

3. Visually inspect equipment before use. If evidence of contamination is present on the equipment (e.g. caked-on mud, grease on threads, organic odor, etc.), reclean at appropriate decontamination level based on its intended use.

J.4.8 Well Maintenance

It is important to maintain ground water monitoring wells in order to extend the life of the wells and to provide representative levels and samples of the ground water surrounding the wells. The following aspects of well maintenance shall be addressed.

- Well evaluation
- Redevelopment
- Maintenance check lists
- Well head protection

Well maintenance activities shall be the responsibility of the FEMP prime contractor. Also, the prime contractor shall conduct a maintenance survey of ground water monitoring wells,

evaluating well maintenance concerns such as water quality, structural integrity, and well-head protection.

For clarity, the term "well" shall include ground water sampling points such as four-inch diameter monitor wells, above-ground and surface-finished piezometers, and former production wells.

Well maintenance activities shall comply with applicable regulatory and site requirements.

J.4.8.1 Well Evaluation. All existing ground water monitoring wells shall be evaluated to assess whether the status will allow for collection of representative ground water samples. This assessment may include the following activities.

- On-site inspections
- Review of existing well installation documentation
- Determination of well history of producing consistently clear or turbid samples. Wells with irreconcilable turbidity or that lack information on design and construction may be abandoned (para. J.4.3).
- Review of ground water sampling field records
- Down-the-hole camera inspections
- Review of other sources of information that may be applicable to a specific well
- Review of the hydraulic characteristics of the aquifer adjacent to the well that shall include pump and slug tests to determine the following.
    - Pump tests - for aquifer characteristics, degree of hydraulic interconnection between different water-bearing units, and recharge rates
    - Slug tests - for in-situ hydraulic conductivity of low-permeability formations through addition or removal of an inert solid of known volume.

J.4.8.2 Maintenance Procedures. The following procedures shall be conducted at each well as applicable to that specific well.

1. Ensure that exposed parts of monitoring wells and surrounding ground surface including protective casing, well casing, locking lid, padlock, well cap, guard posts, concrete surface seal, and well head protection are in good repair.

2. Inspect protective casing for the following conditions and repair or replace as applicable.

   - Structural integrity, free of corrosion and cracks
   - Reasonably plumb to the ground surface
   - Painted bright orange
   - Well identification number painted in white or welded to top of lid.
   - Drain hole is clear allowing water trapped between protective casing and well casing to escape
   - Structurally sound concrete surface seal and pad around protective casing that is free of voids, cracks, and depressions where it contacts ground surface

3. Inspect well casing for the following conditions and repair as required.

   - Casing free of spider or insect debris
   - Sharp edges. Recondition edges as required.
   - Grout between well and protective casings free of cracks and structurally intact.

4. Inspect locking lids for the following conditions and repair or replace as applicable.

   - Lid opens with minimal effort
   - Eyelets on lid and protective casing align for easy removal of padlock
   - Good seal and integrity of hinge on locking lids that also serve as sanitary seal
   - Padlocks free of accumulated debris within key slot and locking mechanism
   - Padlocks operate freely
   - Padlocks installed with key-slot down to prevent rainwater from entering locking mechanism

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5. Inspect well caps for the following conditions and repair or replace as applicable.

   - Cap free of spider and insect debris, molds, fungi, or anything that could affect representativeness of water samples
   - Well caps on above-ground completions fit securely and vent hole is clear
   - Water-tight seal on well caps on ground-flush completions preventing surface water from entering well.

6. Inspect ground surrounding well for the following conditions and repair as required.

   - Ground free of depressions and channels that allow surface water to collect and flow towards well head
   - Surrounding area clean of debris or foreign material that could leach contaminates into subsurface or otherwise interfere with well sampling activities

7. Inspect well and well records for the following conditions and remedy as appropriate.

   a. Well has been improperly developed or contains improperly sized screen openings causing sediment to accumulate at the bottom. Remove accumulated sediment that significantly affects well performance.

NOTE

For wells that are less than 25 feet deep, sediment can be removed by a centrifugal pump with an intake hose to suck sediment from bottom of well. For deeper wells, a bailer or hose with a foot valve are suggested for sediment removal.

   b. Accumulation of chemical, physical, or biological incrustation on well screens. Remove incrustation or replace screen as appropriate.

NOTE

Avoud chemical removal of incrustation.

8. Evaluate wells for reduced yield by comparing present yield to installation data, previous yield, and past pumping tests. Inspect wells for blockage caused by sampling equipment (e.g., purge pumps and bailers) lodged in well.

9. Evaluate removal of such equipment on an individual basis.

10. Prior to performing maintenance activity at a designated location, develop a project-specific plan that provides the following information.

- Define scope of maintenance activity to be performed
- Work schedule and anticipated completion date
- Anticipated manpower and materials required
- Decontamination procedures to be used and other measures to ensure well integrity throughout subcontractor activity
- Specification for compliance with applicable decontamination procedures in Section 5 for equipment that may enter the well casing or otherwise potentially contaminate the well.
- Specification for documentation of field activities including the following
  - Daily log maintenance in accordance with in para. J.4.1 and submittal to FEMP within one day of task conclusion
  - Progress reports on a weekly basis including photocopies of log entries
  - Final report upon completion of task documenting evaluation and maintenance activities and addressing objectives outlined in the plan for the assigned field activity in the format specified
  - Report of well abandonment activities documenting compliance with applicable OEPA and EPA regulations and FEMP QAPjP requirements

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APPENDIX K

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APPENDIX K

SAMPLING METHODS

K.1 PURPOSE

The purpose of this appendix is to provide methods for sampling activities that will result in data that comply with DOE and EPA requirements and meet Data Quality Objectives (DQO) for FEMP.

K.2 SCOPE

Procedures for the following sampling programs and projects at FEMP are provided in this appendix.

- Aqueous Samples (subsection K.4)
  - Natural water
  - Ground water
  - Surface water
  - Waste water
- Solid Matrix Environmental Samples (subsection K.5)
  - Surface soil
  - Sediment
  - Subsurface soil
  - Drum sampling
- Gaseous Matrix Samples (subsection K.6)
  - Clean Air Act monitoring
  - Radon

- General Area Air
- Organic and inorganic contaminants in the field
- DOE-required air monitoring for off-site exposure

- Biological Samples (subsection K.7)
  - Milk, fish, soil/grass, and produce
  - Biological study
- Miscellaneous Samples (subsection K.8)
  - Paint chips
  - Wood
  - Concrete
  - Dust
- Sample Collection Forms (K.9)
- Field Storage and Shipment of Samples (subsection K.10)

Additional procedures may be submitted to provide detailed information on applicable sampling programs.

K.3 RESPONSIBILITIES

K.3.1 FEMP Project Manager

The FEMP project or program manager is responsible for scoping the project through the project-specific plan, which will include determination of the location and number of samples to be collected (including background), Analytical Support Level (ASL) of the samples, sample collection procedures, health and safety requirements, sample handling and shipping requirements, and sample analytes. Actual performance of these responsibilities may be delegated to other project personnel. However, the FEMP project manager is ultimately responsible for timely and accurate completion of the project and for compliance with this QAPjP. See Glossary for definitions of programs and projects.

K.3.2 Sampling Team Leader

Sampling team leaders are responsible for implementing the requirements of an activity documented in the project-specific plan, which includes ensuring that team members follow specified procedures, work is completed in a safe and efficient manner, documentation is completed and maintained as specified in this QAPjP, and communicating with the project manager or designee concerning progress. Team leaders are also responsible for initial custody of their project samples and transfer of custody to the FEMP project contact.

K.3.3 Sampling Team Members

Members of the sampling team are responsible for performing sampling activities as specified in procedures and by the team leader. They shall adhere to health and safety requirements and shall communicate information on progress and concerns to the team leader.

K.3.4 FEMP Project Contact

The FEMP project contact is responsible for the following activities.

- Issuing requests for analysis prior to collection of the samples
- Distributing sample and shipping containers to sampling teams
- Communications with off-site laboratories
- Resolving discrepancies between sample shipments and documentation
- Receiving custody of samples from team leaders and ensuring that chain-of-custody records are complete from the time of initial sample transfer through packaging
- Arranging shipment of samples to the laboratory
- Receiving laboratory reports
- Documenting final disposition of samples

Actual performance of the FEMP project contact's responsibilities may be delegated to other project personnel; however, the project contact is ultimately responsible for timely and accurate completion of these responsibilities.

K.4 AQUEOUS SAMPLE COLLECTION METHOD

Aqueous samples include natural and waste waters. Ground water and surface water are defined for the purpose of this document as natural waters. Water collected after use or in storm sewers will be treated as waste water. Specific matrices sampled at FEMP are ground water from monitoring wells/piezometers and private wells; surface water from the Great Miami River, Paddys Run, other natural above-ground-water bodies, and the storm-water outfall ditch; process waste water from manhole 175, the sewage treatment plant and any other point in the plant waste-water system; and other waste water, specifically water collected in the storm-water retention basins prior to discharge to manhole 175.

Samples shall be collected for analytical parameters in order of stability. The order of sample collection shall be as follows (U.S. Environmental Protection Agency, 1989b).

- Field measurements of temperature, pH, specific conductance, alkalinity, dissolved oxygen, and redox potential
- Volatile organic compounds
- Total organic halogens
- Total organic carbon
- Extractable organic compounds (acid and base neutral extractables, pesticides, and PCBs)
- Total metals
- Dissolved metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

K.4.1 Field Analytical Method for Natural Water Samples

Temperature, pH, and specific conductance shall be measured in the field and documented on ground- and surface-water sample collection forms. Determinations shall be performed on unpreserved samples. Surface-water measurements may be collected directly from the surface-water body. Ground-water field measurements may also be taken in situ (downhole) to avoid changes that might occur if the sample is removed from the well. Dissolved oxygen, alkalinity, and redox potential (Eh) are also commonly performed field measurements.

K.4.1.1 Temperature. Surface water and ground water temperature is required to normalize data from other analytical determinations such as pH, specific conductance, alkalinity, and dissolved oxygen. If properly collected, temperature is also useful as a tracer for determining recharge and mixing relationships and for tracking plumes.

As a minimum, a standard thermometer accurate to $\pm$ 1 degree Centigrade or a metal-cased, direct-reading thermocouple with a normal range of zero to 50 degrees Centigrade accurate to $\pm$ 1 degree Centigrade is required. Total response time shall be less than two minutes (Manigold, et.al., 1982).

The procedure for measuring temperature of water samples follows.

1. Obtain temperature readings by partially immersing the thermometer in a sample for one minute. Obtain a minimum of two consecutive readings on each sample.

2. Collect temperature readings used to describe aquifer conditions in situ or from a flowing pump discharge as near to the source as possible.

3. If measurements cannot be made in situ or in a flow box, collect a sample in an insulated flask and insert a thermometer. Allow it to equilibrate for one to two minutes. Discard the sample and immediately refill the flask, insert the thermometer, and read the temperature immediately (Manigold, et.al., 1982).

4. Read water temperature during and after well evacuation and after sample collection on unpreserved samples.

5. Immediately document readings for each sample on field measurement or collection forms.

K.4.1.2 pH. The pH of a solution is defined as the negative logarithm of hydrogen ion activity in moles per liter and is a measure of effective hydrogen ion concentration. The pH value determines the basic or acidic nature of a body of water.

The following apparatus is required for pH measurements.

- Standard pH meter (battery operated) or a combination meter that is direct reading and temperature-compensating with an expanded scale capable of measuring pH to the nearest 0.05 unit
- Combination electrode
- Three standard buffer solutions: pH 10.0, pH 7.0, and pH 4.0

The procedure for measuring the pH of water follows.

1. Calibrate pH meters in accordance with manufacturer instructions. Meter shall be accurate to within 0.1 pH unit over a temperature range of -2 to +40 degrees Centigrade, and response time of the instrument shall not be greater than two minutes (Manigold, et.al., 1982).
2. Ensure that the electrode is filled with manufacturer-specified solution (usually potassium chloride).
3. Rinse electrode with de-ionized water.
4. If meter does not automatically correct for temperature, make correction in accordance with manufacturer instructions.
5. Record date of buffer expiration.
6. Calibrate pH meter at start of each sampling event with a neutral buffer (pH 7.0) and an acidic (pH 4.0) or basic (pH 10.0) buffer, depending on expected pH range of the sample.
7. Check calibration with a neutral buffer prior to measuring a sample in accordance with manufacturer instructions for calibration.
8. Transfer sample into an appropriate container, or use an in-situ or flow-through sampling system.
9. Ensure that electrode is properly attached to pH meter and that the filling hole is exposed to sample solution.
10. Insert electrode approximately one inch into sample solution and allow it to remain in the sample solution for approximately two minutes. Stir sample if a flow-through chamber is not used.

11. Read pH value on meter to nearest 0.1 unit.

12. Rinse electrodes with de-ionized water between each measurement and do not allow the bulb to dry out between measurements.

13. Never move or touch connecting cables during pH measurement.

K.4.1.3 <u>Specific Conductance</u>. Specific conductance is the ability of a solution to carry an electric current under specific conditions. This characteristic indicates concentration of dissolved solids in water. Because specific conductance is sensitive to a number of variables, the measurement shall be made in the field, either in-situ (e.g.,directly in a well or stream) or as soon as possible after sample collection.

The following apparatus is required.

- Conductivity cell or probe
- Conductivity meter
- Thermometer or thermocouple
- Two known standards bracketing the expected conductivity of the sample solution to be measured

Determine the specific conductivity of sample as follows.

1. Calibrate the measuring system. The instrument shall be accurate to within three percent of full scale over a temperature range of - 2 to + 40 degrees Centigrade and a response time less than two minutes (Manigold, et.al., 1982).

2. Switch on instrument for a power check. Replace battery when red line adjustment cannot be accomplished or when the meter indicates a low battery.

3. Calibrate to a known standard in accordance with manufacturer instructions each day of use. Verify calibration within a known standard between measurements.

4. Rinse probe with de-ionized water.

5. Insert probe into sample in accordance with manufacturer instructions.

6. Measure temperature of sample with thermometer or thermocouple (para. K.4.1.1) if the conductivity cell or probe does not automatically compensate for temperature and record the value.

7. Switch meter to appropriate scale and record readings in micromhos per centimeter (μmhos/cm).

8. If necessary, correct specific conductance values for temperature using appropriate temperature correction factors.

9. Rinse probe with de-ionized water between each measurement.

10. Store specific conductance probes in accordance with manufacturer instructions between use.

K.4.1.4 <u>Dissolved Oxygen</u>. - The dissolved oxygen concentration affects redox potential of water and chemical behavior of aqueous constituents. Physical, chemical, and biochemical activities in water may affect dissolved oxygen levels. Measurement of dissolved oxygen is useful in tracking contaminant plumes, determining surface-water/ground-water interaction, and locating contaminant source areas.

Dissolved oxygen is normally measured in the field by immersing a membrane electrode in the water. Oxygen gas molecules diffuse through the membrane into a measuring cell at a rate proportional to concentration of molecular oxygen in the water. Inside the sensor, oxygen reacts with an electrolyte and is reduced spontaneously or by an applied voltage, depending on the instrument. Current that is generated is directly proportional to concentration of molecular oxygen in the water outside the sensor.

The following apparatus is required to measure dissolved oxygen.

- Direct-reading, temperature-compensating, auto-calibrating, battery-operated dissolved-oxygen meter
- Oxygen-sensitive membrane electrode (polarographic or galvanic), which usually includes two solid metal electrodes separated from test solution by a selective membrane (commonly polyethylene or fluorocarbon)
- Replacement electrode
- De-ionized water for calibration and instrument cleaning

Determine the dissolved oxygen concentration of water sample as follows.

1. Calibrate instrument as specified in manufacturer instructions. Instrument shall be capable of responding within 0.2 mg/L over water temperature range of - 2 to + 40 degrees Centigrade and shall have a response time of less than two minutes (Manigold, et.al., 1982).

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2. Measure temperature at time of dissolved oxygen reading (para. K.4.1.1).

3. Rinse probe with distilled water.

4. Insert probe into sample and allow sufficient sample flow across membrane surface to overcome erratic responses of instrument.

5. Record readings from meter.

6. Calibrate electrode between each use to eliminate interference from gases other than oxygen.

7. Rinse probe with de-ionized water between each measurement.

8. Store probe in distilled, de-ionized water.

K.4.1.5 <u>**Alkalinity**</u>**.** Alkalinity is a measure of the acid buffering capacity of a water sample and is formally defined as the equivalent sum of bases that are titratable with a strong acid. Because alkalinity concentration is affected by changes in temperature, pH, and degassing; the alkalinity analysis shall be performed in the field as soon as possible after collection. Also, alkalinity measurements require a semi-controlled environment (wind-free, stable work platform), so they shall be conducted in mobile or field laboratories. Uranium and other radionuclides form carbonate complexes; therefore, an accurate determination of carbonate concentration is necessary to quantify radionuclide mobility in water.

The end point of the carbonate titration (where carbonate has been converted to bicarbonate) is approximately pH 8.3. The end point of the bicarbonate titration (bicarbonate converted to carbon dioxide and water) is near pH 4.5. Bicarbonate and carbonate concentrations are determined by electrometric titration. A strong acid of known concentration is added to a water sample while the pH of the sample is monitored. Using the acid volume needed to reach the end point, the concentration of bicarbonate and carbonate is calculated by the method of Brown, Skougstad, and Fishman (1970).

The following apparatus is required.

- pH meter that can be read to 0.05 units
- pH probe
- pH buffer solutions: 4.0, 7.0, and 10.0
- 50-mL buret with 0.1-mL graduations
- 25- and 50-mL volumetric pipets (Class A)

- Magnetic stirrer and small teflon stir bar
- Buret stand and clamp
- Semi-controlled environment (laboratory trailer or equivalent)
- 250 mL beaker
- Standardized sulfuric or hydrochloric acid approximately 0.02 normal solution

Measure alkalinity as follows.

1. Calibrate instrument as specified in manufacturer instructions for calibration of pH meter daily before starting titrations (para. K.4.1.2).
2. Check calibration between samples with a 7.0 buffer solution.
3. Immerse for 20 minutes a securely stoppered bottle of acid in a bath of sample fluid that will not be used in the analysis to adjust acid temperature to that of sample.

NOTE

Acid and sample must be approximately the same temperature.

4. Fill buret with acid from temperature-regulated bottle (step 3), open stopcock, and drain some acid to remove air bubbles.
5. Place clean, dry, teflon stir bar into clean, dry 250-mL beaker.
6. Pipet 50.0 mL of filtered sample into beaker.
7. Rinse pH probe only with de-ionized water.
8. Place beaker in center of stirring plate; gently place clean, dry, calibrated pH probe into beaker; and position buret over beaker.
9. Record initial pH of sample to nearest 0.05 pH unit.
10. Record initial acid volume in the buret to nearest 0.01 mL.
11. Turn on stirring mechanism to a gentle or slow setting.

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12. Titrate acid into the sample. If sample pH is not near an endpoint (i.e., pH is greater than 9 or is between 5 and 8), titrate acid in volumes sufficient to lower the pH by 0.2 to 0.5 units.

NOTE

Very small additions of acid will cause large changes in sample pH.

13. When the pH of sample is near an endpoint (i.e., between pH 8 and 9 or between pH 4 and 5), titrate a drop at a time allowing 15 to 20 seconds for equilibration between drops.

14. Turn off stirring mechanism after allowing sufficient time for sample to mix thoroughly.

15. Record acid volume used and sample pH.

16. Repeat titration of acid into sample until sample pH is in a range of 3.0 to 3.5. Record acid volume and pH.

17. Keep buret full between titrations to prevent development of a film inside buret.

18. Clean glassware, stir bar in soap bath, and rinse three times with de-ionized water.

19. Rinse pH probe with de-ionized water.

20. Plot pH versus titrant volume (mL).

21. Determine end points graphically (Manigold, et.al., 1982).

22. Perform calculations as specified in Manigold, et.al.(1982).

K.4.1.6 <u>**Redox Potential**</u>**.** A chemical reaction in which an element undergoes a loss of electrons is referred to as oxidation or as a reduction if there is a gain. Redox protential (Eh) is a measure of aqueous electron concentration and is controlled by reactions involving elements present in more than one oxidation state. Chemical behavior and mobility of many aqueous constituents are influenced by the redox potential of surface and ground water. Physical, chemical, and biochemical processes in water also affect Eh.

Eh is measured in the field by immersing a combination electrode in water. The electrode consists of a noble metal (usually platinum) redox and a reference electrode (usually silver/silver chloride) combined in one body. Eh measurement is based on potential difference between the constant voltage reference electrode and variable voltage of the

platinum electrode. Voltage of the platinum electrode is dependent on the concentration of electrons in solution. For ground water, Eh is measured using a flow box or similar device that prevents atmospheric contamination of the water sample.

Reference solutions with known Eh are used to standardize and check accuracy of the electrode system. The potassium ferric-ferro cyanide solution described by ZoBell (1946) is the standard recommended. Preparation of reference solutions shall be documented when prepared.

The following apparatus and reagents are required to measure Eh.

- Orion 401 specific-ion meter or equivalent
- Orion combination electrode 96-78-00 or equivalent and Orion electrode filling solution 90-00-01 or equivalent (Thimble platinum and separate reference electrodes are also suitable.)

WARNING

HANDLE THE ZOBELL REFERENCE SOLUTION WITH CARE. IT IS POISONOUS.

- ZoBell reference solution - Dissolve 1.4080 gram of potassium ferrocyanide $K_4Fe(CN)_6\ 3H_20$ (0.00333M), 1.0975 gram of potassium ferricyanide $K_3Fe(CN)_6$(0.00333M), and 7.455 grams of potassium chloride KC1(0.10M) in distilled water to make one liter. This solution is stable for several months but should be kept in a black plastic bottle and out of sunlight as much as possible. It has a standard potential of + 428 millivolts at 25°C.
- Ring stand, clamp holder, and universal V-jaw clamp
- Eh cell
- Plastic 100-mL beaker
- Water bath for ZoBell solution (plastic pail or bottom half of a one-gallon plastic bottle)
- Thermometer
- Equipment for measuring dissolved oxygen (para. K.4.1.4)
- Small strips of crocus cloth for polishing platinum electrode

Determine Eh of water as follows.

1. Fill combination electrode with filling solution (Orion 90-00-01 or equivalent). Depress body and let some of the fluid drain to waste.

2. Bring ZoBell solution to temperature of sample by allowing sample to flow over closed bottle. Record temperature.

3. While the ZoBell solution is equilibrating to the sample temperature, determine the presence of dissolved oxygen in the water sample. If dissolved oxygen is greater than 0.05 mg/L, do not proceed with the Eh measurement (para. K.4.1.4).

4. If dissolved oxygen is less than 0.05 mg/L, proceed to step 5.

5. Place combination electrode in the ZoBell solution that has equilibrated to sample temperature.

6. Plug electrode leads into meter and turn function switch on meter to millivolt mode. Allow several minutes for electrode to equilibrate while keeping bottle of solution in water bath. Record reading.

7. If reading differs by more than 10 millivolts of the theoretical value at that temperature (Mamigold, et.al., 1982), replace reference electrode fluid and repeat measurement.

8. If the second measurement reading is not within 10 millivolts of the theoretical value, polish platinum end of electrode with crocus cloth and recheck reading.

9. If reading is still off, replace electrode.

10. If reading is within ± 10 millivolts of the theoretical value, rinse electrode with sample water and proceed to step 11.

11. Place electrode in Eh cell and let water flow through the cell and ensure that air bubbles are removed from system.

NOTE

Filler hole on side of electrode should be above top of Eh cell.

12. Use control valve on inlet to ensure that head of sample is below level of reference electrode and change the potential of the system.

13. Clamp Eh cell onto ring stand.

14. Turn function switch on meter to millivolt mode and allow water to flow through cell until readings stabilize.

NOTE

Stabilization usually occurs within 20 minutes, but may require an hour or more.

15. Turn off sample flow to prevent streaming potential and immediately record reading.

NOTE

This is the observed Eh of the sample.

16. Record the following data on the data record form.

- Sample temperature
- Observed potential of ZoBell solution, in millivolts, relative to reference electrode at sample temperature
- Theoretical potential of reference electrode system and ZoBell solution, in millivolts, relative to the standard hydrogen electrode at sample temperature (Manigold, et.al., 1982)
- Theoretical potential of reference electrode system and ZoBell solution, in millivolts, relative to standard hydrogen electrode at sample temperature (Manigold, et.al., 1982)
- Observed potential of sample in millivolts

17. Calculate Eh relative to the standard hydrogen electrode as follows.

a. Check the electrode by calculating the difference between observed potential and theoretical potential of ZoBell solution relative to reference electrode.

$$B - C = \text{difference} \qquad \text{(Eq. 1)}$$

Where:

B = observed potential of ZoBell solution

C = theoretical potential of ZoBell solution

b. If the difference is less than ± 10 millivolts, proceed to step 18.

c. If difference is greater than ± 10 millivolts, follow steps 7, 8, and 9 for remedial measures.

18. Calculate Eh of the system as follows.

$$E - B + D = \text{Eh value of system} \qquad \text{(Eq. 2)}$$

Where:

E = observed potential of sample

D = theoretical potential of reference electrode in ZoBell solution relative to hydrogen electrode at measurement temperature.

19. Report Eh value [either positive (+) or negative (-)] to nearest 10 millivolts (mV).

NOTE

A field example may help to clarify the procedure (G. Ehrlich, H. Reeder, W. Wood, 1971).

Artificial-recharge site well 539 feet deep, 6-inch diameter, finished in the Prairie duChein aquifer. Pumping 10 gal/min for 22 hours. Temperature of water from well is 10.0°C. Observed potential of ZoBell solution relative to combination reference-platinum electrode, at 10° C was + 215 mV. Theoretical potential of ZoBell solution relative to this electrode system, at 10°C is + 207 mV. The 8-mV difference was considered small, and the decision was made to proceed with measurements. The observed potential of the water sample after system stabilized in 30 minutes was - 120 mV. The data record showed the following.

Sample temperature . . . . . .10° C

Observed potential of ZoBell solution relative to reference electrode at sample temperature . . . . . + 215 mV

Theoretical potential of ZoBell solution relative to reference electrode at sample temperature . . . . . + 207 mV

Theoretical potential of reference electrode system and ZoBell solution, relative to standard hydrogen electrode at sample temperature. . . .+ 461 mV

Observed potential of sample . . . . . - 120 mV

This was calculated as follows.

$$B - C = (+ 125) - (207) = + 8 \text{ mV}$$

$$Eh_{sys} = E - B + D = (- 120) - (215) + (461) = + 126 \text{ mV}$$

K.4.2 Ground-Water Sampling

Ground-water sampling is currently conducted at FEMP for the following.

- Remedial Investigation/Feasibility Study (RI/FS)
- Resource Conservation and Recovery Act (RCRA)
- Radiological Environmental Monitoring
- Safe Drinking Water Act

K.4.2.1 Water-Level Measurements. Ground-water elevation data are used to monitor aquifer storage, estimate rate and direction of ground-water movement, define recharge/discharge relationships relative to surrounding features, estimate base flow to streams, and calculate the volume of water in a borehole or well. The following are requirements for collecting water-level data from wells including water-level measurements prior to sampling.

Ground-water levels are measured at offsite private wells and at on-site and off-site FEMP monitoring wells and piezometers. Private wells are commonly used for water supply purposes and may be equipped with a pump, discharge line, and wiring.

1. Measure ground water level in private wells as follows.

    a. Obtain permission from owner prior to arrival on site and request that owner not use the well for an hour or so prior to designated arrival time. Arrive at designated time.

b. Obtain well construction information from owner if not previously obtained. Specifically request information on well depth, materials, age, screened interval, method of installation, and installer. If information is not available, document that fact.

c. Upon arrival at the well, check well for visible physical damage. Scan area around well for unusual materials or circumstances (e.g., recently discarded trash, old oil cans, animal burrow). Record observations on daily log.

d. Remove well cap or cover from access hole.

e. Check water level measuring instrument for proper operation. Take care not to measure water level in pump discharge line. Lower measurement probe until water is reached. Be aware of obstacles in the well casing.

f. Raise probe above water level and shake it slightly, then lower it again, and recheck. If measurements do not agree within 0.02 feet, repeat measurement until cause of discrepancy has been determined and agreement of measurements within $\pm$ 0.02 feet has been obtained.

g. Record value and time. Use a 24-hour format for measurements.

h. If water level has not stabilized after use, as indicated by successively higher measured water levels in the well, measure the water level at approximately one-minute intervals until three successive readings agree within 0.02 feet or until 20 readings have been collected.

i. Record value and time of all measurements.

j. Replace well cover.

k. Decontaminate water-level measurement probe between each well as specified in Appendix J.

2. Measure water level of monitoring wells and piezometers as follows.

a. If the well is off site, notify owner prior to arrival on site.

b. Upon arrival at the site, check the well for physical damage or unauthorized entry by scanning the area around the well for unusual materials or circumstances (e.g., recently discarded trash, old oil cans, signs of animal burrowing). Record observations on daily log.

NOTE

At some well sites, preliminary monitoring for volatile gases around the well cap may be required. These sites will be identified in project-specific plans and prcedures will be provided for monitoring.

c. Remove lock from monitoring well.

d. Remove well cap.

e. Check water-level measuring instrument for proper operation (M-Scope or equivalent). Lower measurement probe until water is reached.

NOTE

When probe touches water, a buzzer sounds, a meter needle deflects, or a light appears, depending on meter type.

f. Raise probe above water level and shake it slightly, then lower it again, and recheck. If measurements do not agree to within 0.02 feet, continue to remeasure until cause of discrepancy has been determined or agreement of measurements has been obtained (Appel, et.al., 1980). Be aware of obstacles in the well casing.

g. Record depth to water to 0.01 feet from measuring point, (e.g. top of well casing, top of protective casing, top of sanitary seal) as recommended by the EPA (1986a). Record measuring point on water-level measurement form.

h. Replace well cover and lock protective lid.

i. Decontaminate water-level-measurement probe between each well as specified in Appendix J.

K.4.2.2 <u>General Ground-Water Sampling Requirements</u>. The primary technical consideration in ground-water sampling is to obtain a representative sample of the ground-water body at the well location. Additionally, ground-water sampling at FEMP shall meet certain requirements in order for subsequent data to be used by the CERCLA Program. To ensure that these objectives are achieved, the following guidelines and techniques shall be the

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minimum requirements during sample withdrawal. Additional requirements may be included in project-specific plans.

1. Upon arrival at well site, determine whether the lock is secure. Inspect well for signs of tampering or forced entry. Check the surrounding area for unusual occurrences such as recently disposed trash or animal burrows. Record observations on daily log.

2. Set up sampling van and equipment to avoid interference with sampling activity.

3. Place plastic sheeting on ground where necessary to prevent spillage of water and avoid contamination of equipment from ground contact or other uncontrolled surfaces.

4. Take steps to avoid effects of the following conditions to ensure representative samples of ground water (U.S. Environmental Protection Agency, 1989b).

   - Sample temperature may change rapidly after it is brought to the surface. This change may affect chemical reaction rates, reverse cationic and anionic exchanges on solids, and alter microbial growth rates.

   - The pH may change caused by loss of carbon dioxide through degassing or adsorption, which could affect alkalinity and oxidation of certain compounds.

   - Dissolved gases may be lost as a result of a pressure change.

   - Organic samples may be affected by volatilization, adsorption, photodegradation, or contamination from sampling materials or airborne gases.

5. Complete a ground-water sample collection form for each sample with information specified in subsection K.9 plus the following data.

   - Description of water level measuring point

   - Depth to water

   - Sounded depth of well

   - Depth of well from well construction diagram

   - Well casing diameter and borehole diameter from well construction diagram

   - Monitored interval and screen length

   - Calculated well volume

- Actual volume removed during purging and maximum rate of purge
- Depth to pump intake at start and finish of pumping.

6. If cleaning solvents or internal combustion engines are used at a site when a well is open, place them downwind of the well or far enough away that fumes are diluted beyond the detection limit of a calibrated Photo-Ionization Detector (PID) or Flame-Ionization Detector (FID). Locate the sampling van downwind of the well.

7. Measure depth to ground water in the well as specified in para. K.4.2.1. Measure total depth of monitoring well to the nearest 0.01 foot (U.S. Environmental Protection Agency, 1986a) and compare it to well construction diagrams.

8. Compare total depth measurement to depth indicated on well construction diagram to verify well identity and to determine if silting into the screened portion of the well has occurred. If an identity discrepancy or silting is discovered, immediately refer the matter to the FEMP project manager for resolution. Document the resolution.

NOTE

Evacuation of at least three well volumes of water in concert with stable pH, specific conductance, and temperature measurements, or evacuation of the well to dryness is recommended for a representative sample. (One well volume is defined as the volume of water standing in the well casing, screen, and saturated filter pack under static conditions.)

9. Evacuate stagnant water from monitoring well/piezometer prior to sample collection with a stainless-steel submersible pump, stainless steel or teflon bladder pump, peristaltic pump, or by bailing with teflon or stainless-steel bailer. Place discharge hoses between the sampling van and the well on clean plastic sheeting.

10. Take a minimum of four sets of pH, temperature, and specific conductance measurements when purging three well volumes from a monitoring well (U.S. Environmental Protection Agency, 1986b).

NOTE

A well is considered dry during a sampling event if it does not recover sufficiently within 24 hours after purging to yield a complete sample. Do not sample dry wells. Document well condition on field log.

11. Evacuate monitoring well/piezometer if it can be pumped or bailed dry and allow it to recover prior to sample withdrawal. Ensure that the evacuation rate is low enough to prevent excessive agitation of recharge water (U.S. Environmental Protection Agency, 1986a) based on the hydraulic characteristics of the well. Avoid excessive pumping that can lead to collection of non-representative samples.

12. If a pump is used to purge a monitoring well prior to sample collection, lower pump intake to a depth of five to ten feet below water level in the casing but above well screen where possible. Initially purge well from this depth so that fresh water from screened interval will move upward through casing and completely flush well. Ensure that pumping rate is low enough to prevent significant agitation and that it is less than maximum pumping rate used during monitoring-well development.

13. When pumping of air caused by excessive drawdown of the water level in the well occurs, reduce pumping rate. If pumping of air continues, lower pump intake five to ten feet within the well where possible and reduce pumping rate further to prevent excessive drawdown.

14. When pump and lines are removed from a well, place them on clean plastic sheeting to ensure that they do not come in contact with the ground.

15. Collect water produced during evacuation of and excess water generated during sampling of monitoring wells and piezometers in appropriate containers. Avoid unpermitted release of evacuated water to the environment.

16. Dispose of water that is determined (based on past sampling data) not to contain constituents that would result in a hazadous waste classification under RCRA in the FEMP general sump.

17. Store water that has unknown constituents and is potentially a hazardous waste in a designated area until a classification determination is made (based on an analysis of the water for TCLP parameters) and a disposal method chosen.

NOTE

Observe RCRA requirements for duration of storage.

18. As soon as the well recovers sufficiently to permit sampling, collect samples in accordance with the stability and volatility of parameters to be tested in the following order (U.S. Environmental Protection Agency, 1989b).

- Field measurements (temperature, pH, and specific conductance)
- Volatile organic compounds

- Total organic halogens
- Total organic carbon
- Extractable organic compounds (acid and base neutral extractables, pesticides, PCBs)
- Total metals
- Dissolved metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

19. If the well is purged with a submersible pump, collect samples specified in the project-specific plan from pump discharge prior to removing pump from well and before collection of bailed samples to prevent handling the pump twice and eliminate the need for pump decontamination between well evacuation and sample collection.

20. Evacuate and sample wells with limited access and dedicated pumps from the pump discharge. Data from such wells may be qualified for certain purposes.

21. Decontaminate purge pump, lines, and other equipment used in ground-water sampling between wells following procedures in Appendix J.

22. Take field measurements at well site on unpreserved samples as described in para. K.4.1. Keep samples collected for field measurements separate from samples preserved for shipment to laboratory.

23. Filter samples at well site.

24. Store and preserve samples as specified in Table K-1.

25. Number and label samples as specified in Section 7.

26. Complete chain-of-custody record and laboratory request for analysis as specified in Section 7.

K.4.2.3 Parameter-Specific Sampling Procedures. Perform ground-water sample collection from monitoring wells/piezometers for Volatile Organic Compounds (VOCs) (step 1), acid and base-neutral extractable compounds (step 2), total and dissolved metals (step 3), general chemistry (step 4), and radiological parameters (step 5) in accordance with the following procedures.

1. Volatile Organic Compounds - Prepare VOC samples as follows.

   a. Collect samples for VOC analyses using a stainless-steel or teflon bailer or stainless-steel and/or teflon bladder pump or a Grundfos Redi-Flo 2 pump.

   b. Perform sample collection in a manner to minimize turbulence and volatilization of VOCs. Operate bladder pumps at a maximum of one liter per minute.

   c. Collect samples in 40-mL screw-cap vials with Teflon-lined silicone rubber septa. Fill sample vials to overflowing with a visually apparent meniscus present above the rim of the vial and seal without air bubbles. Avoid excessive overfilling of pre-preserved vials.

   d. Visually check each vial for air bubbles by inverting and sharply tapping it against the hand. If air bubbles are present, top off sample bottle and recheck it for air bubbles. When no air bubbles are present, place sample in a cooler maintained at four degrees Centigrade, plus or minus two degrees.

   e. Complete appropriate field documentation in accordance with para. K.6.2 or as specified in project-specific sampling plan or procedure.

   f. Preserve samples as specified in Table K-1.

   g. Pack samples for shipping as specified in subsection K.10.

2. Acid and Base-Neutral Extractable Compounds and Pesticides/PCBs (Semi-Volatile) - Prepare semi-volatile compound samples as follows.

   a. Collect samples for semi-volatile analysis with a stainless-steel or teflon bailer or a stainless-steel and/or teflon bladder pump or Grundfos Redi-Flo pump.

   b. Because some semi-volatiles are susceptible to photo-degradation, use one-liter amber-glass sample bottles complete with teflon-lined caps as specified in Table K-1. Fill the bottles to the neck and seal.

c. Complete appropriate field documentation.

d. Preserve samples by cooling to four degrees Centigrade plus or minus two degrees and store in a dark place as specified in Table K-1.

e. Pack samples for shipment as specified in subsection K.10.

3. Total Metals - Prepare total metal samples as follows.

a. Collect samples for total metals using a peristaltic pump, stainless-steel or teflon bailer, and stainless-steel and/or teflon bladder pump or Grundfos Redi-Flo pump. If specified in project-specific plan, collect samples through discharge of submersible pump used to purge monitoring well.

b. Fill one-liter polyethylene sample bottles complete with closure to neck and seal as specified in Table K-1.

NOTE

To simplify handling of acid, use one 1-mL ampule of acid per sample.

c. If pre-preserved containers are not used, add approximately one mL of concentrated nitric acid per 1000 mL of sample after sample is placed in an appropriate container.

NOTE

Do not immerse pH paper in sample container.

d. Test sample by administering it to pH paper drop by drop to determine that sample pH is less than 2.0.

e. If pH is not less than 2.0, add a sufficient amount of preservative drop by drop until desired pH range is achieved.

f. Tape pH paper to sample container and document in applicable sample record.

g. Complete appropriate field documentation.

h. Preserve samples by cooling to four degrees Centigrade plus or minus two degrees as specified in Table K-1.

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i. Pack samples as specified in subsection K.10.

4. Dissolved Metals - Prepare dissolved metals samples as follows.

a. Collect samples for dissolved metals using a peristaltic pump, stainless-steel or teflon bailer, stainless-steel and/or teflon bladder pump, or Grundfos Redi-Flo pump. If specified in project-specific plan or procedure, collect samples through discharge of a submersible pump used to purge monitoring well.

NOTE

In-line filters that attach directly to pump or bailer discharges are preferred (Stolzenburg and Nichols, 1986). If not available, use a Millipore filtration apparatus, or equivalent, equipped with a hand or electrical vacuum pump.

b. Use 0.45-micron filters to prepare dissolved metals water samples.

c. Conduct filtering at well site, and record on field documentation forms the method used including use of prefilters .

d. Clean or rinse filtering apparatus as specified in Appendix J.

e. Discard the first 100 to 150 mL of filtrate from each sample to rinse the filter and filtration apparatus of contaminating substances (Manigold, et.al., 1982).

NOTE

In-line, multiple-stage filters are preferred, but a Millipore or equivalent system may be used. Pore size of the prefilter(s) should be based on the lithology of the adjacent formation and amount of sediment in the water. Initial pore size should be 1.0 micron with a doubling of size for each additional larger filter needed.

f. If water is extremely turbid, use one or more stages of prefilters as necessary.

g. If it is still not possible to filter the sample through a 0.45 micron filter, do not collect the dissolved metals sample.

h. Record whether sample is collected and prefilters used on sampling log .

i. Immediately transfer filtered sample to a one-liter polyethylene plastic bottle containing one mL of concentrated nitric acid preservative per 1000 mL of sample.

j. If pre-preserved containers are not used, add approximately one mL of concentrated nitric acid per 1000 mL of sample after sample is placed in an appropriate container.

NOTE

Do not immerse pH paper in sample container.

k. Test sample pH by administering sample drops one at a time to pH paper to determine if sample pH is less than 2.0.

l. If pH is not less than 2.0, add preservative drop by drop until desired pH is achieved. Seal bottle with plastic cap fitted with polyethylene liner.

m. Complete specified field documentation.

n. Preserve samples as specified in Table K-1.

o. Pack samples for shipping as specified in subsection K.10.

5. General Chemistry Parameters - Prepare samples for general chemistry parameters (i.e., major cations and anions and physical parameters) as follows.

a. Collect samples for general chemistry parameters using a peristaltic pump, stainless-steel or teflon bailer, stainless-steel and/or teflon bladder pump or Grundfos Redi-Flo pump, and, if specified in project-specific plan or procedures, through the discharge of a submersible pump to purge the monitoring well.

b. Fill appropriate sample bottles to the neck and seal.

c. Check samples that require acids or bases for preservation for proper pH range as specified in Table K-1.

NOTE

Do not immerse pH paper in sample.

d. If pH is not within the specified range, add appropriate preservative drop by drop to achieve desired pH value.

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e. Complete specified field documentation.

f. Preserve samples as specified in Table K-1.

g. Pack samples for shipping as specified in subsection K.10.

6. Radionuclides - Prepare samples for general radionuclides as follows.

a. Collect samples for radionuclides using a peristaltic pump, stainless-steel or teflon bailer, stainless-steel and/or teflon bladder pump or Grundfos Redi-Flo pump, and, if specified in project-specific plan, through the discharge of a submersible pump to purge monitoring well.

b. Flush sample lines and equipment with sample medium to minimize radionuclide adsorption effects.

c. Use sample containers made of Teflon, polyethylene, or polyvinyl chloride (PVC) as specified in Table K-1 to minimize radionuclide losses by adsorption unless tritium is a parameter of interest. If so, use a glass container with a tritium-seal cap (Korte and Kearl, 1984).

NOTE

Avoid collection of suspended sediments as much as possible.

d. If it is necessary to determine dissolved radionuclides, filter water samples in the field through a 0.45-micron membrane filter as soon as possible after collection using in-line, 0.45 micron filtration if available (Stolzenburg and Nichols, 1986).

e. If in-line filtration is not available, use containers without preservative to initially collect samples prior to filtration.

f. Transfer samples to containers and preserve them after filtration has been performed.

g. When samples are collected for analysis of total radionuclide concentrations, do not filter.

h. Tightly secure sample container lids.

i. Complete specified field documentation.

j. Preserve samples as specified in Table K-1.

k. Pack samples for shipping as specified in subsection K.10.

K.4.2.4 Sampling Ground Water from Private and Other Production Wells

Private water wells near FEMP were sampled as part of the Radiological Environmental Monitoring Program (REMP) monitoring and Remedial Investigation/Feasibility Study (RI/FS). DOE has authorized sampling of private wells by FEMP personnel on a request basis, and they may be sampled during a routine program or project or at request of the property owner. Data collected from private wells may be qualified for certain uses.

Property owner approval shall be obtained and notification made before proceeding to sample a private water well. Requirements of individual property owner license agreements shall be reviewed prior to each sampling round and followed. Sampling shall be conducted only at the time agreed upon by the owner. If additional visits to the site are necessary, the property owner shall be notified before each visit or arrangements made for continued access. Communications with the property owner will be documented in a daily log or a telephone conversation log.

Procedures for collecting water samples from private or other production wells will be included in project-specific plans. Minimum elements of these procedures are as follows.

1. Note location of well relative to nearby buildings, drainage features, cultivated areas, equipment storage areas, leach fields and septic tanks, and other pertinent features on the daily field log.

2. Acquire available well construction information from the owner, including driller; date drilled and installed; total depth; depth to water; casing type, diameter, and length; pump age, type, and size; description of plumbing and electrical equipment; types of treatment systems; and location.

3. Determine whether well is the primary source of water for the household, and document approximate volume of use.

NOTE

Amount of flushing required is dependent on frequency of well use. One minute of flushing at full capacity is the minimum requirement.

4. Flush system before collecting sample to remove stagnant water from lines and wellbore. Use a graduated container or bucket and approximate flow rate at full capacity.

5. Collect samples from as near wellhead as possible and upstream from treatment units using sample containers and preservatives specified in Table K-1. 2375

6. Decontaminate equipment as specified in Appendix J.

7. Maintain chain-of-custody documentation as specified in Section 7.

K.4.3 Surface-Water Sampling

Surface-water sampling is currently being conducted at FEMP in accordance with the National Pollutant Discharge Elimination System (NPDES) requirements and as part of routine monitoring of Paddys Run and the Great Miami River. Samples have also been collected in support of RI/FS.

The following procedures are applicable to collection of water samples from streams, ponds, lakes, rivers, springs, and seeps. Two different techniques are used for collecting surface water samples: grab sampling and composite sampling.

K.4.3.1 Grab Sampling. For grab sampling, proceed as follows.

1. Use clean sample containers and appropriate preservatives approved for specific parameters as specified in Table K-1.

2. Choose a point of sampling so that a representative sample of the water to be tested is obtained. Choose the sampling point with respect for information desired and in conformity with local conditions.

3. Collect samples beginning at the farthest downstream location and work up-stream to prevent contamination during sample collection. Avoid surface debris and artificial turbulence during sample collection.

NOTE

> Sampling depth should be approximately 15 centimeters (6 inches) below water surface if possible. When sampling from a bridge, platform, or boat, it may be necessary to use a bailer or a peristaltic pump to collect sample.

4. Use unpreserved containers (grab bottle, ladle, teflon bailer) to collect water samples directly from a body of water where water depth is sufficient and access conditions permit.

5. If depth is not sufficient, use a teflon or stainless-steel beaker, ladle, scoop, or bailer.

6. Use a peristaltic pump or Kemerer sampler to collect non-volatile samples.

7. Grasp grab bottle securely at the base with one hand and plunge it mouth down into the water avoiding surface debris. Position bottle opening towards the current flow and away from the hand of the collector, the shore, or the side of the sampling platform or boat. Tip bottle slightly upwards to allow air to exit and bottle to fill. Collect a sufficient amount of sample to perform required analyses.

8. Fill sample bottles as specified per parameter in subsection K.4. If a sample bottle is used for collection, cap bottle prior to removal from water.

NOTE

The grab bottle and the sample bottle should be of the same materials or an approved equivalent.

9. After removal of grab bottle from water body, transfer sample to the container with preservative.

10. When more than one grab bottle volume of sample is required to fill necessary sample containers, distribute sample portions equally among individual sample containers to provide homogeneity of collected sample.

11. Perform field measurements as specified in para. K.4.2.1 or filter unpreserved samples immediately after collection. If a peristaltic pump is used to collect samples, use an in-line filter (preferred by Stolzenburg and Nichols, 1986).

12. Complete specified field documentation.

13. Preserve samples as specified in Table K-1.

14. Pack samples for shipping as specified in subsection K.10.

K.4.3.2 <u>Composite Sampling</u>. Composite samples may be collected with automatic sampling equipment, or may be collected manually and composited. Currently, there are no composite, natural surface-water samples being collected at FEMP. Procedures for collection of composite samples shall be included in project-specific plans.

K.4.4 Waste-Water Sampling

Waste-water sampling is regulated by the Ohio Environmental Protection Agency (OEPA) under the Clean Water Act (CWA). The FEMP permit defines the applicable regulation for waste-water sampling as that version of 40 CFR in effect on effective date of permit, which is 1 July 1989. Sampling and analysis requirements are regulated pursuant to 40 CFR 136.

Samples are collected as prescribed by procedures in accordance with the schedule, including preservation and security until samples are delivered to the FEMP Analytical Section. Data are collected in accordance with permit-specific requirements.

Samples are also collected for DOE environmental monitoring purposes and to fulfill requirements of the 1986 Federal Facility Compliance Agreement.

DQOs for ongoing waste-water sampling are provided in Appendix C.

K.4.4.1 Field Procedures. The NPDES permit requires effluent to be monitored continuously for pH at every location except the general sump and for flow whenever a discharge occurs at each location. Meters are in place to fulfill this permit requirement. Flow meter information for each of the NPDES outfalls that require reporting of total daily flow are taken at the following stations.

- 4001 - Six-inch parshall flume. Charts located in MH-175 structure. Flow is annunciated to MH-175 control panel.
- 4002 - No meter. Depth of discharge flow is measured. When depth of flow and geometry of the spillway is known, flow can be calculated.
- 4601 - Flow is measured by a V-notch weir. Charts are located in the building adjacent to the contact basin. Flow is annunciated to sewage treatment plant LCP-2.
- 4602 - No meter required. Discharge from general sump is a batch discharge to MH-175. By knowing geometry of tank and recording depth of tank before and after discharge and the time, a flow volume and rate can be determined.
- 4603 - N/A. The clearwell discharges to the bio-surge lagoon and subsequently to BDN towers.
- 4604 - Venturi meter. Charts and annunciation are at MH-34 and LCP-4.
- 4605 - In line magmeter at each BDN to Effluent Treatment System (ETS) chlorine contact tank. Reading is taken at beginning of first shift and end of third shift and the difference is the flow reported. Flow from the BDN to the ETS is totaled at the control panel in the BDN control room. Flows are recorded on log sheets kept in the BDN control room.
- 4606 - In line magmeter. Charts and annunciation are at SWRB and LCP-3.

Because of the sensitivity of pH monitors, periodic calibration is essential.

Samples are collected six times daily (twice per shift) when a continuous monitor is used to check accuracy of pH monitors. Records documenting results of samples are maintained in the boiler plant office.

An NPDES sampling plan has been developed and is on file with OEPA. The plan identifies samples to be collected weekly under NPDES and contains information relative to location, type of container, number and volume of samples, type of analysis, preservation method, and analytical laboratory.

Chain-of-custody record preparation is initiated in advance of sampling rounds to ensure that the person conducting the sampling has a clear knowledge of samples required and that documentation of samples is complete.

Sample bottles are assembled and labeled in advance for intended locations and sample parameters. Preservatives are added, and bottles are transported to sample locations in coolers.

Most samples are collected with automatic samplers. Grab samples are required for oil, grease, and cyanide samples. Samples from the GS must be collected by the grab method because GS discharge is a batch discharge and is therefore not amenable to automatic sampling. When more than one batch discharge from the GS occurs, a grab sample from each discharge is collected and composited.

Following is the basic procedure for NPDES sample collection.

1. Obtain chain-of-custody record and sample numbers.

2. Obtain and mark new sample bottles to reflect sample numbers shown on the chain-of-custody record.

3. Review sample schedule and add preservatives indicated to sample bottles.

4. Place bottles in coolers and transport them to the sampling location.

NOTE

Automatic samplers shall be turned off before taking samples and restarted when sampling is finished.

5. Fill bottles for composite samples from the automatic sampler, and pour excess water from sampler back into the waste water stream.

6. Obtain grab samples by lowering sample bottle into a tank or effluent stream as applicable.

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7. If more than one GS tank is discharged during the NPDES sampling day, collect one sample bottle from each discharged tank and combine it with equal volumes of samples from the remaining tank discharges.

8. Once the required samples have been obtained at each sampling point, immediately transfer them to the WTP.

9. Seal sample bottles with security tape upon receipt at WTP.

10. Affix a computer-generated label to applicable bottles.

NOTE

> The label shall contain the analytical sample number, customer sample number, customer name, date of sample, and location from which sample was taken. Figure K-1 is an example of the label.

11. Once samples have been collected, accumulated, sealed, and labeled, transfer them to sample receiving laboratory in the FEMP Analytical Laboratories Building.

Automatic samplers can be programmed for either time-dependent or flow-dependent sampling. The NPDES permit requires that samples be flow-dependent. To activate the sampler, a 0-to-20-mA signal is sent from a flow-measurement device to the sampler. The program must be reset each time the sampler is reactivated. The procedure to program the sampler is located at the sampler.

Table K-1 specifies the type of sample bottle required and preservation instructions.

K.4.4.2 NPDES Program-Specific Sample Handling. The only analysis required at an off-site laboratory in the NPDES program is cyanide. The cyanide sample is assigned a release number, and, before final authorization for shipping, signatures certifying that the sample is not hazardous or radioactive are required.

Once the analysis is complete, results are reported along with QA/QC results. A release review is done by the analytical staff to ensure that the reported result is in accordance with QA/QC requirements. Once approved, the result may be entered into the FEMP AnaLIS database as an approved result.

After analyses have been completed, the remaining sample is refrigerated for a period of 30 days in case a re-analysis is necessary. After holding for 30 days, samples are disposed of in the laboratory sink drains.

Control, duplicate, recycle, and spiked samples are delivered on a regular basis and tested along with regular analytes. The Sample and Data Management Section is responsible for ensuring that QC samples are prepared, delivered regularly, and documented.

FEMP participates in a quality assurance program under the authority of Section 308 (a) of the Clean Water Act. Periodically, samples of the same type of constituents that are normally tested are sent by EPA or its designated contractor to FEMP for analysis. Analyses are performed and findings reported to EPA or their designated contractor in accordance with instructions provided with these samples. The results are then compared to the true values to determine accuracy of FEMP laboratory analyses.

K.4.4.3 <u>Additional Sources of Information</u>. 40 CFR Part 136 governs sampling procedures. References of importance are as follows.

- ***Manual of Sampling, Analytical, and Reporting Procedures for Wastewaters*** (revised 1976), OEPA
- ***Standard Methods for the Examination of Water and Wastewater***, American Public Health Association
- ***Annual Book of Standards***, Part 23, "Water; Atmospheric Analysis," American Society for Testing Materials (ASTM)

A list of acceptable reference material for laboratory analyses is included in 40 CFR Part 136.3 (b). The primary references used at FEMP are "Methods for Chemical Analysis of Water and Wastes," U.S. EPA 600/4-79-020 (1983) and "Standard Methods for the Examination of Water and Wastewater," (American Public Health Association, 1985). Analysis procedures used in the FEMP laboratories for testing waste water are developed from specific methods detailed in these references. The method reference for each analyte is identified in Appendix L.

FEMP Standard Operating Procedures are implemented for waste-water sampling and analysis and are available upon request from DOE FO.

K.5 SOLID MATRIX ENVIRONMENTAL SAMPLES

K.5.1 Surface Soil Sampling

Surface soil samples are collected prior to excavation in order to characterize soil for presence of hazardous or radioactive constituents by FEMP as part of routine monitoring.

The following general procedures are applicable to surface-soil sampling.

1. Decontaminate sampling equipment prior to use, preferably at a designated central staging area at FEMP. Perform decontamination in the field only if circumstances prevent decontamination at the staging area.

2. Clean equipment as specified in Appendix J.

3. Remove grass and other vegetation from sample collection area prior to sampling. Do not collect other surface material such as large rocks or trash unless specified in the project-specific plan.

4. When sampling for constituents deposited through air transport, collect only the upper two inches of soil.

NOTE

Size of sampling tool shall be sufficient to collect required volume within the depth interval limitation.

5. When sampling for constituents transported by surface water, collect samples in six-inch intervals to the depth specified in project-specific plans.

6. Collect samples with a trowel, scoop, coring device, or shovel of an inert material relative to material to be sampled and to analytes of interest as specified in the project-specific plan.

7. Collect sufficient sample and rinsate volumes to perform required analyses as defined in project-specific plans.

8. Transfer samples directly from the gathering tool to sample containers specified in Table K-1. Record deviations from these requirements and provide detailed justification.

9. Collect samples for VOC analysis from a depth of three inches or more so there is less chance for constituents of concern to volatilize or photo-degrade except when sampling the location of a fresh spill.

10. Transfer VOC samples directly to standard Volatile Organic Analysis (VOA) vials or two-ounce, wide-mouth VOA jars with teflon-lined septa lids. Fill containers as full as possible to minimize headspace.

11. Transfer soil samples collected for other organic or inorganic analyses to appropriate glass containers (Table K-1) with screw cap closures.

12. Provide a trip blank to accompany each set of VOA samples collected to the field and back to the laboratory as specified in Section 4.

13. Store samples requiring refrigeration in the field as specified in Table K-1 in an ice chest cooled with artificial icing material and maintained at approximately four degrees Centigrade, plus or minus two degrees.

14. Label samples and complete chain-of-custody records, field collection reports, and laboratory requests for analysis.

A mixing or compositing procedure for solid materials is designed to ensure homogeneity within a sample and to ensure that composited samples undergo the same degree of mixing. When compositing is required, adhere to the following procedures unless specifically modified in project-specific plans.

1. Remove sample from collection device and place it in a container or on a flat surface constructed of an inert material relative to the constituents of concern.

2. When a sufficient volume of sample has been collected, divide the entire volume into relatively even quarters.

3. Mix opposite quarters together, and then mix resulting halves together. All of the material will then be regrouped into a single volume.

4. Repeat steps 2 and 3 and then place sample in appropriate containers.

K.5.2 Sediment Sampling

Sediments are materials that have been transported from their place of origin by fluid action and redeposited. Stream sediments are of most interest at FEMP and sediment sampling in Paddys Run and the Great Miami River is conducted for routine characterization.

Specific sampling stations are documented in project-specific plans. The following practices are applicable to sediment sampling.

1. Prior to sampling sediments in a stream, decontaminate the sampling device before each use as specified in Appendix J.

2. When traverse sampling of rivers and large streams is necessary, use a clamshell dredge, trowel, or similar device for sediment collection.

NOTE

Collect sediments from the station farthest down-stream first and work upstream.

3. Collect sediment sample to a depth of approximately six inches below sediment/water interface. Avoid collecting large rocks or trash.

4. If the purpose for sampling is monitoring of recent or ongoing activities, ensure that recently deposited sediments are collected based on stream geomorphology.

5. Collect a sufficient amount of sample to perform required analyses as specified in project-specific plans.

6. Transfer sample directly to a stainless-steel pan for thorough mixing prior to placing it in sample container.

NOTE

Do not mix samples collected for volatile organic analysis, but transfer them directly to the specified container.

7. Store samples requiring refrigeration in the field in an ice chest filled with commercially available icing material maintaining the sample at approximately four degrees Centigrade plus or minus two degrees.

8. Label samples and complete chain-of-custody records, field collection reports, and laboratory requests for analysis.

The mixing or compositing procedure is designed to ensure homogeneity within the sample. When mixing is required, adhere to the following procedure unless it is specifically modified in project-specific plans.

1. Remove sample from collection device and place it in a container or on a flat surface constructed of an inert material relative to the constituents of concern.

2. When a sufficient volume of sample has been collected, divide it into approximately even quarters.

3. Mix opposite quarters together, then mix resulting halves together. Regroup all the material into a single volume.

4. Repeat steps two and three before placing the sample in appropriate containers.

K.5.3 Subsurface Soil Sampling

Subsurface soil samples are collected for RI/FS and RCRA.

K.5.3.1 **Collection of Unconsolidated Subsurface Samples.** Adhere to the following procedures when collecting unconsolidated subsurface materials.

1. Decontaminate sampling equipment as specified in Appendix J. Do not place sampling equipment directly on the ground or other potentially contaminated surfaces prior to insertion into the boring. Place it on a clean plastic sheet adjacent to or around the boring. Take care that potentially contaminated excess sample does not contact the ground.

2. Collect subsurface samples using a split-spoon sampler, thin-wall tube, vibra-core, core barrel, or other appropriate method from borings as specified in Appendix J.

3. Collect undisturbed soil avoiding caving materials at the base of the borehole.

4. If cavings are present in the upper part of a sampler, discard this material prior to packaging samples for shipment.

5. Advance borings as specified in project-specific plans.

6. Collect samples at specified intervals in accordance with project-specific plans.

NOTE

> Because of its ability to maintain the physical integrity of samples collected from depth, a coring tool is commonly used to collect subsurface samples. The tube is generally a thin-wall steel tube (Shelby tube) from one to three inches in diameter and 12 to 36 inches long.

7. Lower an appropriate sampling device consisting of a threaded coupling to fit a standard drill rod and a replaceable Shelby tube sampler down the borehole and push it into undisturbed material at the bottom of the boring. See ASTM-D-1587-83 for sampling procedures and equipment.

8. Leave samples that are to be tested for physical characteristics requiring undisturbed soil in the Shelby tube. Cap the tube ends and tape and seal the cap with wax.

10. Send sample to a geotechnical laboratory for analysis.

NOTE

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Split-tube or split-spoon samplers may be used for sample collection when undisturbed samples are not required.

11. Collect subsurface split-spoon samples in accordance with the following requirements. See ASTM-D-1586-84 for sampling equipment and method.

    a. Lower an appropriate clean sampling device consisting of a threaded coupling to fit a standard drill rod and a replaceable split-spoon sampler down the borehole and push or drive it into undisturbed material at the bottom of the boring. When sampler is driven, record number of blows required to advance it every six inches.

    b. Remove sampling device from the boring, open it and screen sample for VOCs and radionuclides using appropriate field instrumentation.

    c. Screen for VOCs with a photo-ionization or a flame-ionization detector as follows. (See para. K.4.4 for operating requirements.)

        (1) Split sample lengthwise, open it, and place the probe within one cm of inner surface.

        (2) Screen entire length of sample at a rate no greater than two cm per second.

    e. After VOC screening has been completed, screen for radionuclides with an alpha meter and a beta/gamma meter. Place probe approximately one cm from sample surface and screen approximately two cm of sample length per second.

12. Describe sample, remove it from sampler, and transfer it to appropriate containers for shipment to the laboratory.

13. Place samples requiring refrigeration in a cooler maintained at four degrees Centigrade plus or minus two degrees.

14. Take subsurface soil samples collected for volatile organics analysis from interior of sample and transfer them as soon as possible to standard VOA vials or jars. Fill containers completely to minimize headspace. If samples are to be collected for VOC analysis without field screening, brass, stainless steel, or aluminum split-spoon liners may be used to minimize head space.

15. Transfer subsurface soil samples collected for other organic or inorganic analyses to glass containers with screw cap lids.

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16. Complete sample label, chain-of-custody record, field collection report, and laboratory requests for analysis in the field.

17. Decontaminate split-spoon sampler and other sampling equipment such as trowels, pans, and gloves between each use as specified in Appendix J.

K.5.3.2 Field Screening of Samples for Radioactive Contamination. Following are uniform measurement techniques for screening subsurface soil samples for radioactive contamination and instructions for determining which samples should be analyzed for radiological parameters. The procedure also describes the technique for screening subsurface soils for intermediate and high-energy gamma-ray emitters. The screening level is chosen for instrument gross count rates that exceed the background count rate by three standard deviations when the sample is counted in a low-background area.

Screening may be performed with gamma sensitive instrumentation capable of detecting the desired level of contamination. An example of such instrumentation is a portable multi-channel analyzer with associated sodium iodide detector.

Screening shall be performed using field instruments specified in project-specific plans. Perform assay procedure as follows.

1. Calibrate instrument in accordance with applicable procedure.

2. Perform a five minute background count and calculate the time required to obtain the desired minimum detectable activity.

3. Count sample for the predetermined count time and record net counts or count rate.

4. Select samples for radiological analysis based on results of screening at frequency specified in the project-specific plans.

5. Select samples for laboratory analysis that exhibit the highest relative readings for a given location and horizon.

K.5.4 Drum Sampling

Drums are commonly used to store RCRA, non-RCRA, and mixed wastes at FEMP. Drum samples have been and continue to be collected to determine whether material is a RCRA waste. Project-specific plans describe objectives for drum sampling, representative drum selection criteria, analytical testing requirements, statistical analyses for drum sample testing (e.g., confidence levels), and disposal plans.

K.5.4.1 Sampling and Analysis. The FEMP Waste Analysis Plan was prepared in accordance with the requirements of Ohio Administrative Code (OAC) 3745; 40 CFR 264,

268, and 270. The sampling and analysis section of the Waste Analysis Plan describes procedures used at FEMP to characterize waste in order to manage it appropriately. Objectives of the FEMP Waste Analysis Plan are as follows.

- Characterize the hazardous physical and chemical properties of each waste stream and assign applicable hazardous waste codes
- Ensure proper handling and storage of waste
- Provide guidance for evaluating pre-acceptance conditions for receipt of waster from on- and off-site sources
- Permit determination of applicable land disposal restriction information for each hazardous waste stream

The program is initiated by the process operator or project supervisor responsible for the operation generating the waste. These personnel are trained in waste identification and RCRA requirements and are required to identify waste and complete material evaluation forms (in FEMP Waste Analysis Plan) for each waste stream under their responsibility.

The material evaluation form is then reviewed by FEMP regulatory specialists. A RCRA determination is completed when the information is considered sufficient by the FEMP regulatory specialists.

Waste determinations based on process knowledge also rely on supplemental information to support the information supplied by the waste generator. This information can include, but is not limited to, the following.

- Historical knowledge and data on similar FEMP processes
- Conversations with personnel familiar with the process or location
- Text books which describe the processes
- Material safety data sheets
- Vendor specification information

Once the RCRA determination is made, the information is submitted for an independent quality assurance check. If approved, the waste is transported to the appropriate hazardous waste storage unit.

If a waste requires analysis, appropriate analytical parameters are identified and a sampling plan prepared using preliminary information from the material evaluation form. After the

samples have been analyzed, the results are reviewed by FEMP personnel and a RCRA determination made. The waste is then sent to the appropriate hazardous waste storage unit.

K.5.4.2 **Analytical Parameters and Rationale.** A waste stream shall be analyzed for those parameters most likely to yield the maximum amount of chemical and physical information. In addition, specific analyses are selected based on historical knowledge, knowledge of the waste generation process, and the constituents suspected to be in the waste. The waste parameters selected shall represent those characteristics necessary to manage the waste in compliance with the FEMP Part B permit application requirements.

K.5.4.3 **Test Methods.** When process knowledge is insufficient to identify a waste stream as hazardous, additional information shall be requested or analytical methods applied to make the determination. Sample preparation and analytical methods are specified in the Part B permit application.

K.5.4.4 **Sampling Procedures.** Basic requirements for drum sampling process follow.

NOTE

Because drum samples are taken from top to bottom, only the boring location on the top surface needs to be random.

1. Select a boring position within the drum cross section just prior to taking the sample.

2. Collect sample using one of the following techniques.

   a. Use a grain sampler for free-flowing particulate solids that are easy to penetrate and collect sample as follows.

      (1) Ensure that grain sampler is in closed position with slots in the outer tube face up.

      (2) Insert sampler diagonally at a point near the side of the drum, through the center, and to a point opposite the entry point.

      (3) Rotate inner tube of sampler to the open position, collect sample, and rotate inner tube to closed position.

      (4) Withdraw sampler from drum and place it in a horizontal position with slots in the outer tube facing up.

      (5) Rotate inner tube to the open position and place the sample collected in an appropriate container as specified in Table K-1.

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b. Use a pipe sampler for moist or otherwise cohesive particulate solids that can be pulled out as a core and collect sample as follows.

NOTE

Pipe sampler shall be long enough to reach bottom of sampled drum.

(1) Insert sampler diagonally through the contents of drum and rotate once or twice to cut a core of material.

(2) Ensure that slot is face up and slowly withdraw the sampler.

(3) Ensure that entire length of pipe contains material. If it does not, repeat steps (1) and (2).

(4) Use a clean stainless steel spatula and push the material out of sampler into an appropriate container as specified in Table K-1.

(5) Place a lid on container while collecting the next sample.

(6) Repeat steps (1) through (5) to collect samples from the other seven grid points in the drum.

NOTE

Plastic COLIWASAs are suitable for liquid wastes at FEMP. Only if plastic is noticeably attacked (softened) by a solvent waste, is it necessary to use a glass COLIWASA (para. K.5.4.6).

c. Use a Composite Liquid Waste Sampler (COLIWASA) to collect full depth samples from drums of liquid waste.

(1) Adjust locking mechanism of sampler, if necessary, to ensure that neoprene rubber stopper provides a tight closure.

(2) Place stopper rod handle in the T-position and push it down until handle is against the locking block.

(3) Slowly lower COLIWASA vertically into drum so that the levels of liquid inside and outside the sampler tube remain even.

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NOTE

If liquid level in sampler tube is lower than level outside sampler, it is being lowered too fast and a nonrepresentative sample will be obtained.

(4) When stopper hits bottom of drum, push sampler tube downward against stopper to close sampler.

(5) Turn T-handle upright with one end tight on locking block to lock sampler in closed position.

(6) Slowly withdraw sampler with one hand while wiping outside of it with a clean, disposable cloth.

(7) Dispose of cloth in a manner consistent with suspected drum constituents.

(8) Place end of COLIWASA into an appropriate composite sample container.

(9) Empty sampler by slowly pulling lower end of T-handle away from locking block.

3. Transport sample to analytical laboratory under chain-of-custody protocols specified in Section 7.

4. Upon sampling completion of a drum lot, clean sampler at a level III decontamination as specified in Appendix J.

NOTE

It is not necessary to clean sampler between drums within the same lot (i.e., same waste stream).

5. Document sampling activities by completing a daily log including the following specific items.

- Daily field log form or log book
- Chain-of-custody record

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K.5.4.5 Glass COLIWASA. If it is necessary to use a glass COLIWASA, proceed as follows.

1. Insert inner tubing of the glass COLIWASA inside the sheath.

NOTE

If liquid in sampler tube is lower than the level outside the sampler, the sampler is being lowered too fast and a nonrepresentative sample will be obtained.

2. Slowly lower COLIWASA vertically into drum, keeping the ground glass end away from hole in bottom of sheath, so that the levels of liquid inside and outside the sampler tube remain even.

3. When sheath hits bottom of drum, push the inner tube downward so that ground glass end seals the end of the sheath.

4. Slowly withdraw COLIWASA with one hand and wipe outside of sampler with a clean, disposable cloth. Dispose of cloth consistent with suspected drum constituents.

5. Place end of COLIWASA into the appropriate composite sample container.

6. Empty sampler by pulling inner tube upward causing ground glass end to separate from the outer tube bottom.

7. If an organic analysis is required, follow procedure in para. K.5.4.4.

K.5.4.6 Liquid Volatile Organic Analysis Sample Collection. If VOC analysis of a liquid sample is required, collect sample as follows.

NOTE

For VOC analysis, no air bubbles be present in septum bottle.

1. Carefully fill a septum bottle with sample liquid to lip of bottle.

2. Slide teflon spectrum across lip of the bottle covering the opening, and then screw plastic lid on bottle.

3. Check bottle for air bubbles by turning it upside down.

4. If air bubbles are present, empty bottle and repeat steps 1, 2, and 3 until no air bubbles are present.

K.6 GASEOUS MATRIX SAMPLES

Air sampling conducted at FEMP includes stack sampling for compliance with the CAA, radon sampling, general area air sampling for radiological health and safety monitoring, and monitoring for specific organic and inorganic contaminants while conducting field activities. Data may be used for modeling contaminant transport, determining compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP), determining exposure levels, and determining respiratory protection requirements.

K.6.1 Clean Air Act Monitoring

Stack sampling is done at FEMP to measure radionuclide emissions. Stacks with a potential for delivering a dose of 0.1 mrem in one year to any individual shall be monitored and inspected at least weekly as specified in the Clean Air Act, 40 CFR 61, and DOE 5400.5. Total uranium analysis shall be performed as specified in Analytical Laboratories Method Number 3002. Stack sampling shall be conducted as follows.

1. Review stack log for installed filter number and prescribed flow rate and record it on stack sampler inspection report form (Figure K-2).

2. Observe control panel of dust collector and record the following available data on stack sampler inspection report form.

NOTE

On dust collectors equipped with multipoint isokinetic samplers, flow rate adjustments to the sampler are not made during filter changeout. Obtain flow rate information before changeout.

   a. Record high and low pressure from differential pressure chart.

   b. Record Counts Per Minute (CPM) from the Ludlum stack monitor reading in the BEFORE INSPECTION column.

   c. Record stack alarm set point.

3. Check Ludlum stack monitor for proper operation and source response as specified in applicable procedures and record results on Ludlum radiation stack monitor inspection report form (Figure K-3).

4. At stack sampler, verify that stack sampler, vacuum tubing, and other sampling equipment is operating properly. If defects are found, record them on stack sampler inspection report form and notify shift supervisor.

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5. Determine existing sampling rate by inserting a rotameter between vacuum line and filter holder and record sampling rate under RATE-ACTUAL on stack sampler inspection report form.

6. Adjust sampling rate to prescribed rate if necessary. If prescribed rate cannot be obtained, record it on the stack sampler inspection report form (Figure K-2).

7. Strike cone section of filter holder several times around the periphery to dislodge material clinging to inside of cone.

8. Loosen the three fasteners and carefully lower bottom section of filter holder.

NOTE

During inspection and handling of stack filter, ensure that there is no contamination from foreign sources or loss of filtered material.

9. Visually inspect stack filter.

NOTE

When re-assembling filter holder assembly, tighten fasteners sufficiently to prevent a vacuum leak at sealing surface.

10. If filter appears to be clean, re-install it and notify shift supervisor. However, if the filter is scheduled for replacement, remove and bag it; and install a new filter.

    a. Notify shift supervisor and record new filter number on stack sampler inspection report form.

    b. Prepare a request for analysis of total uranium. Maintain a copy for record purposes.

    c. When analysis results are received, calculate total uranium losses as follows.

$$\frac{\text{Total Uranium (mg)} \times \text{Conversion Factor supplied by IH}}{1000} = \text{Loss in Kg}$$

    d. Notify the shift supervisor of calculated loss and record the supervisor's name, time of notification, and calculation results on final stack sampler results form (Figure K-4).

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NOTE

When re-assembling filter holder assembly, tighten fasteners sufficiently to prevent a vacuum leak at sealing surface.

11. If filter appears to be lightly soiled or laden with material, remove and bag it; and install a new filter. Record new filter number on inspection/change report.

    a. Notify shift supervisor of filter condition. If plant is not operating and there is no shift supervisor available, notify Security to contact the area supervisor for notification.

    b. Immediately initiate and time stamp final stack sample results form (Figure K-4).

    c. Request analysis for total uranium on an expedited basis with results to be forwarded immediately upon completion. Maintain a copy of the request for records.

    d. When results are received, immediately calculate total uranium loss as described in step 10, c.

    e. Notify shift supervisor of calculated loss in person or over the telephone and record supervisor's name, time of notification, and calculation results on the final stack sampler results form.

12. Re-check Ludlum reading and flow rate. Adjust flow rate to prescribed CPM if necessary and record Ludlum reading in the AFTER column on stack sampler inspection report form.

13. If required rate cannot be obtained, record it on stack sampler inspection report form and contact shift supervisor for corrective action instructions.

14. Follow up to confirm that proper flow has been obtained and notify shift supervisor if flow rate has been readjusted.

15. Remove rotameter and reconnect vacuum line to sampler.

16. Complete stack sampler inspection report form (Figure K-2) and final stack sampler results form (Figure K-4) and check for accuracy.

17. Record filter number if replaced, sampling date, and analytical results in dust collector stack sampling log (Figure K-5).

K.6.2 Radon Sampling

Various federal regulations (40 CFR Parts 61 and 192) impose limits on the emission of radon gas from a variety of sources either owned or operated by DOE. Measurement of radon flux density using a passive charcoal collector is often the method of choice for determining radon emissions from these sources. Details of this measurement method are given in 40 CFR, Part 61, Appendix B, Method 115. Method 115 also references an EPA document authored by Hartley and Freeman, which describes the Large-Area, Activated-Charcoal Collector (LAACC) in detail and gives general field methods for its use.

Radon sampling shall be conducted as follows.

1. Examine the area to be measured prior to conducting measurements to determine the number of measurement locations required and to identify logistics problems that may arise during sampling.

NOTE

The required measurement density is determined by the intended use of the measurement results. Method 115 requires a minimum of 100 measurements per source.

2. To obtain radon flux measurements that are representative of long term average radon emissions, observe the following restrictions.

   a. Do not initiate measurements within 24 hours after a rainfall.

NOTE

If rainfall occurs within the measurement period, the measurement becomes invalid if seal around lip of collector has washed away or if collector is surrounded by standing water.

   b. Do not perform measurements when ambient temperature is below two degrees Centigrade or when the ground is frozen.

3. Thoroughly purge the activated charcoal to be used in the radon LAACCs prior to use by heating in an oven at 110 degrees Centigrade for approximately four hours. Following this, keep the charcoal in a radon-resistant, sealed container until ready to use in LAACC.

NOTE

A minimum of one blank sample is required for each batch of LAACCs to be exposed in the field.

4. Obtain a blank by sealing approximately 180 grams of the same charcoal to be used to load the LAACCs in a sample can at same time that LAACCs are loaded. Label can with the word "BLANK" and the date, time it was sealed, and initial.

5. Assemble LAACC as follows.

   a. Remove retaining ring and cover pad from LAACC.

NOTE

The correct amount of charcoal is most easily obtained by using an empty sample can as a measuring container. One level can of six-by-six mesh charcoal is approximately 190 grams.

   b. Spread a minimum of 180 grams activated charcoal evenly over support grid.

   c. Replace cover pad and retaining ring.

   d. If LAACC is not placed on the measurement surface immediately, keep it in a radon-resistant, sealed container such as a length of 12-inch-diameter PVC pipe fitted with end caps.

6. Expose LAACC as follows.

   a. Clean surface on which collector is to be placed of vegetation and large pebbles that might prevent a good seal between collector and soil.

   b. Place collector on surface to be measured; and, to ensure a good seal between surface LAACC, pack one to two inches of soil around lip of collector.

   c. Record collector number, sample ID, date, time, and location in the field log. Initial entry.

   d. Following an exposure period of 24 hours (± two hours), remove LAACC from measurement surface.

   e. Record date and time of removal in the log and initial the entry.

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7. Remove collected LAACCs to a staging area away from the measurement area to recover exposed charcoal.

8. Remove charcoal from LAACC and place it in an approved can as soon as possible, proceeding as follows.

   a. Remove retainer ring and cover pad from LAACC.

NOTE

Take care to obtain all the activated charcoal from the LAACC.

   b. Gently pour charcoal from LAACC onto a mixing pad.

   c. Mix charcoal on mixing pad and transfer it to an empty can. Seal can with sealer and affix a label with sample ID and location and dates and times placed and retrieved. Initial label.

NOTE

Radon-222 has a half life of only 3.825 days.

9. Prepare cans for return to laboratory for gamma ray analysis and return them to the laboratory as soon as possible to minimize loss of measurable activity.

K.6.2.1 Long-Term Radon Sampling in Air. The following method provides instructions for collection of samples to determine long-term radon-222 (Rn-222) concentrations in air under ambient outdoor conditions as described in H. W. Alter and R. L. Fleisher (1981) "Passive Integrating Radon Monitor for Environmental Monitoring," Health Physics, Volume 40, p. 693 and Terradex Corporation, "Instruction for Track-Etch[R] Type F Radon Detectors," Walnut Creek, California.

Perform sampling at frequency and locations specified in the project-specific plan and in accordance with the following procedures.

1. Submit an order for purchase and readout of detectors specifying delivery date two weeks prior to planned installation and include the following specifications.

   a. Quantity of detectors required (enough to install a minimum of two detectors at each location and at least ten detectors for known exposures and background determinations)

   b. Requirement that all detectors in order be produced from same batch of film

c. Type F configuration

d. Maximum readout area for outdoor monitoring (Terradex film detector - 19.3 mm^2)

e. Results of readouts in pCi/l and in either tracks/mm^2 or total tracks.

2. Inspect shipment of film detector cups upon arrival from distributor as follows.

a. Check aluminum bags for holes or tears.

CAUTION

DO NOT open sealed aluminum bags until they are installed at monitoring location.

b. Check bag contents by feeling along entire length of bag for crushed cups.

NOTE

Generally, canister should be mounted on north side of mounting post avoiding building walls, highway structures, or large signs. Alternatively, the detector with the protective canister surrounding the plastic cup may be placed inside a larger stand-alone shelter. Canisters should be installed so that the entire detector is at least six inches from any obstruction and with the open mouth facing down. The stand-alone shelter should be open to allow for free air flow. Detectors must be mounted firmly to avoid movement within the shelter.

3. Firmly mount protective canister (shield) on post or other suitable location, two to three meters high, where there are no obstructions to free flow of air past detector.

4. At monitoring location, open one bag and remove enough film detector cups to enable installation of an appropriate number of replicates. Close bag after removing cups.

CAUTION

DO NOT touch film. If film is touched, discard it and use a different cup and detector.

5. Visually inspect film detector to ensure that it is securely fastened to bottom of cup. If not, secure it.

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6. If film is discarded, note serial number of breached cup on field data sheet and indicate what happened in the comments section.

7. Using one filter with the shiny side out, cover mouth of cup.

8. Using one red covering and holding filter taut, firmly push cover ring over the two sets of ribs of the cup.

9. Ensure that cover is fully seated around cup rim, the filter covers the entire mouth of cup, there are no large wrinkles in the filter, and that the filter has not been torn or punctured by assembly.

10. Install film detector cup at monitoring location inside the protective canister.

11. Enter serial number of film detector cup, date bag was opened, date installed, site number, and location on the field data sheet.

NOTE

Do not use film detector cups that have been stored in an open bag overnight.

12. Schedule installation of film detector cups so that all cups can be installed immediately when a bag is opened. Save aluminum bags for use when film detector cups are retrieved.

13. Remove film detector cup from canister, wipe off dust or dirt from outside of cup, and remove red cover ring and filter from mouth of cup.

14. Hold filter up to the light and record visible damage (e.g., pinholes, scratches, tears) in comments section of data sheet.

15. Visually inspect film on bottom of cup and record discoloration or damage to the film in comments section of data sheet.

16. Enter date removed next to the correct serial number on field data sheet.

17. Place film detector cup in aluminum bag. Stack exposed cups in bag until it is full (10 cups, maximum), then insert empty cup provided into the last film detector cup with a yellow plastic separator sheet. If an end cup is not provided, place the yellow plastic separator sheet over the mouth of the last film detector cup and secure it with one of the red coverings.

18. Fold open end of aluminum bag and seal it with tape.

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19. After retrieving exposed detectors, proof-read field data sheets to ensure that detector serial number, date opened, date installed, date removed, site number, and location are recorded in proper columns and comments are legible.

20. Ensure that aluminum bags containing exposed detectors are sealed and have no pinholes or tears.

21. Transcribe data from field data sheets to vendor data sheets and complete vendor preshipping checklist. Specify readout sensitivity and special handling instructions.

22. Include data sheets with detectors and ship detectors to vendor for readout.

K.6.2.2 **Short-Term Radon Sampling in Air.** This procedure describes methods for collecting samples of ambient air and soil gas. Two basic types of sampling are used in radon measurements: gas bag samples and soil gas samples (radon flux). Gas bags provide integrated samples of ambient radon in air while soil gas accumulators provide samples of radon in emanated soil gas. Instantaneous air samples may be collected using an evacuated SC-6 scintillation cell.

Sampling procedures described are in accordance with DOE Order 5480.1, 10 CFR 20, and U.S. EPA standards 40 CFR 192. Sampling shall be performed at the frequency and locations specified in the project-specific plan as follows.

1. Perform sampling of 24, 48, or 72 hours integrated sample of ambient air as follows.

   a. Place radon gas bag at sampling location and turn on pulse pump.

   b. Record date and time of start-up on sample collection log and on gas bag.

   c. To fill 44-liter bag, use the following pump cycles.

Sample Time (Hours)	Pump Interval (Seconds)
24	5
48	12
72	15

   d. Secure and protect sampling equipment from inclement weather conditions and vandalism.

   e. After completion of sampling period, turn off pulse pump and record date and ending time on sample collection log and on gas bag.

f. Take gas bag to counting room for transfer of air sample to an SC-6 scintillation cell.

g. Using a small piece of tygon tubing, attach an evacuated SC-6 cell to valve on gas bag in series with a 0.45-micron filter. Open valves to transfer air into cell. Transfer at least three cell volumes to provide a representative sample.

h. Record date and time of sample transfer on label of SC-6 cell and on sample collection log.

NOTE

Results of the count are used to determine radon gas concentration expressed in pCi/L in the integrated sample.

i. Place SC-6 cell in sample holding area for counting in a SAC-R5 alpha counter. See calibration and counting procedures for use of SAC-R5 and SC-6 scintillation cell radon counting system.

2. Perform soil gas sampling (radon flux measurements).

a. Position a special 55-gallon drum section over sampling point and, with a downward twisting motion, countersink the barrel one to two inches into the soil or otherwise seal the drum to the ground.

b. Attach a 50-cc syringe to valve assembly, open valve, and rapidly pump syringe ten times.

c. Close valve, remove syringe, and attach an evacuated SC-6 cell with a piece of tygon tubing with in-line 0.45-micron filter.

d. Open valve on drum, then open valve on SC-6, and fill the SC-6 cell.

e. Close valve on SC-6 cell and close barrel valve.

f. Record time and date for sample.

NOTE

A 55-gallon drum with a diameter of 22.5 inches has an area equivalent to 0.256 m^2.

g. Record cross-section area of drum as the sample area.

h. After 45 minutes, repeat steps b through g using a second evacuated SC-6 cell.

NOTE

The first sample is considered a background sample. The second sample represents radon buildup over the 45-minute sampling time.

NOTE

Radon concentration is determined by counting in a SAC-R5 alpha counter. Results are used to determine the radon flux ratio, which is expressed in pCi/m^2-sec.

i. Submit samples to counting lab for counting.

3. Perform instantaneous air sampling.

a. Collect instantaneous or "spot" air samples using an evacuated SC-6 scintillation cell.

b. At the sampling location, collect a sample by opening the valve on a SC-6 cell that has an in-line 0.45-micron filter connected to the valve by means of a small piece of tygon tubing.

c. Record location, date, and time of collection on SC-6 cell label.

d. Transfer filled SC-6 cell to counting lab for counting in a SAC-R5 alpha counter.

NOTE

Results in pCi/L are used to determine concentration of radon in the sample.

K.6.3 General Area Air Samples

Routine air sampling is performed to measure levels of airborne radioactive material in order to properly characterize areas in accordance with DOE Order 5480.11 and to establish a basis for determining respiratory protection requirements. Sampling is accomplished as follows using instrumentation that includes a pump with an appropriate filter set at a

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designated location (e.g., the breathing zone of workers) and counting instruments to determine amount of collected contaminants.

1. Prior to taking a sample, determine amount of activity required for sample being taken.

2. Base sample collection time on pump flow rate and parameters in step 1 so that ten percent of derived air concentration is detected if present.

3. Record start time of sample collection and flow rate.

4. When collection is complete, turn off pump and record the end time.

5. Count filter media on appropriate instrument. Record elapsed time between time of counting and time that filter was removed from pump.

6. If necessary, recount sample and follow applicable procedure for determining long-lived, radon or thoron concentrations.

Continuous Air Monitors (CAM) are used to provide real-time air monitoring as required by DOE Order 5480.11. There are several different types of CAMs in use at the site and each must be operated in accordance with applicable documented procedures. These instruments are generally used as warning devices and do not normally produce data useable by the FEMP CERCLA group. However, instruments equipped with strip charts may be used for tracking ambient airborne levels of radioactive contaminants.

K.6.4 Monitoring for Organic and Inorganic Contaminants in the Field

Air monitoring is done to screen samples for organic analysis in the field and to protect workers from organic and inorganic contaminants in accordance with FEMP and OSHA requirements. Types of equipment used and contaminants detected include the following.

- A Photo-Ionization Detector (PID) and Flame-Ionization Detector (FID) for organic vapors relative to a standard gas

- Colorimetric Indicator Tubes (CIT) for parameter-specific organic and inorganic vapors

- Explosimeters for combustible gases, usually calibrated relative to methane

- Filter pumps and petrographic microscopes for quantification of asbestos contamination

- Portable gas chromatographs for quantification of specific parameters.

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Portable air monitoring equipment shall be permanently labeled with a unique identification number. Calibration gases used shall be in the approximate expected range of contaminants to be measured, as most monitoring equipment response is not linear throughout the range of operation. Calibrations shall be checked on a daily or per-use basis. Instrument response shall be checked at each use and rechargeable batteries recharged after each day of use and checked prior to the start of each work day. The manufacturer, batch number, type, and response range shall be recorded for disposable materials used, such as air filters and CITs.

K.6.4.1 <u>Photo-Ionization Detector</u>. The PID is the standard field instrument for monitoring the work zone for organic and certain inorganic vapors, screening samples for organic analysis, and performing head space measurements on wells. The instrument may be affected by humidity and electromagnetic fields, and certain older instruments may be affected by wind speed into the probe. Common PIDs include the HNu PI-102, the Photovac TIP and TIP II, and the Environmental Instruments OVM.

The PID shall be calibrated to a standard gas of known response (usually isobutylene) and measurements normalized to calibrated units of the gas. Readings shall be qualified to indicate the standard gas (e.g., 10 ppm of isobutylene). Because different gases have different responses to a PID, the concentration of a particular gas cannot be quantified unless it is known that only one ionizable gas is present and wavelength of the PID bulb, ionization potential of the gas, and response factor for that gas at wavelength of the bulb are known. When a mixture of gases is measured, only the relative response of the mixture to the standard is known.

When a PID is used, the following items shall be addressed.

1. Check the calibration with a known standard on a daily basis and record the response on an instrument log. If a declining trend in instrument response is noted or if the response is not within ten percent of the standard, recalibrate the instrument.

2. Prior to each use, verify the response of the instrument to an organic vapor source such as an indelible marker and allow the instrument to purge itself of the vapor before continuing use.

3. Change the filter, as applicable, on a monthly basis or more often under high-use or harsh conditions. Record the last cleaning or replacement on the instrument log.

4. Clean the lamp and ion chamber on a PID or the burn chamber on a FID (para. K.6.4.2) monthly or more often under high-use or harsh conditions. Record cleanings on the instrument log.

5. Set zero either with ultra-pure air or by operating the instrument in a known "clean" area. Measure background readings at the site before start of work.

6. When monitoring for health and safety purposes, consider background readings as part of the total.

7. When screening samples for organic contaminants, subtract background from reading.

K.6.4.2 Flame-Ionization Detector. A FID is used to detect organic compounds using a hydrogen flame-ionization source. Like the PID, a FID measures total concentration of ionizable compounds rather than parameter-specific concentrations. Responses of different compounds may vary from the calibration gas. Because of the requirement for a hygrogen gas source, special labeling and packaging are required to ship a FID. A commonly used FID is the Century Systems OVA.

When a FID is used, items 1 through 7 listed in para. K.6.4.1 shall be addressed.

K.6.4.3 Colorimetric Indicator Tubes. CITs are used to detect a wide variety of organic and inorganic gases and vapors. Individual tubes can be used only once and only for specific elements or compounds. Also, many tubes are useful only in a specified concentration range. Either manual or automatic pumps may be used. However, only tubes manufactured for a specific pump may be used with that pump. Detailed instructions for use accompany each box of tubes.

Prior to using CITs, check the pump for leaks by inserting an unopened tube into the pump and operating it. A sufficient vacuum should be present to prevent further operation of the pump until the tube is removed. If a sufficient vacuum is not present, recheck the pump with another unopened tube. If test still fails, repair or replace pump.

Care shall be taken when handling broken glass from opened tubes. Used CITs shall be disposed of properly.

Different tubes have different response times, so it is important that activities depending on the result of the CIT response be curtailed until the response is complete.

K.6.4.4 Explosimeters. Explosimeters are used to test an atmosphere for concentration of combustible gases and vapors. When used in confined spaces, an explosimeter should always be used in combination with an oxygen meter. The explosimeter will only detect presence of explosive gases and vapors, not dusts or mists. Most explosimeters are calibrated relative to methane gas. If a gas or vapor that is more explosive than methane could be encountered, make adjustments in the alarm settings to increase the sensitivity of the instrument. Never set the initial alarm setting higher than ten percent of the lower explosive limit.

K.6.4.5 Filter Pumps. Filter pumps are used to collect particulates from the air. Size filters to collect the particulates of interest using prefilters if necessary. Check pumps for leaks by blocking the intake to see if a vacuum forms. Filters are quantified for asbestos analysis by point-counting fibers or particles of interest with a petrographic microscope.

Other types of measurements rely on weight change of the filters or quantification of chemical changes. Record the filter manufacturer, filter size, installation and removal time, beginning and ending flow rate, and length of pump operation time on the daily field log when a filter pump is used.

K.6.4.6 Gas Chromatographs. Portable gas chromatographs are commonly outfitted with PIDs or FIDs and a separating capillary or packed collumn attached to the intake. A sample is injected into the carrier stream and separated on the basis of molecular size. As each individual compound reaches the detector, the instrument responds. Standards are used to determine how long it takes compounds of interest to traverse the column and to calibrate the response of the instrument on a parameter-specific basis.

Portable air monitoring equipment shall be permanently labeled with a unique identification number. Calibration gases shall be in the approximate expected range of measured contaminants because most monitoring equipment response is not linear throughout the range of operation. Calibrations shall be checked daily or per-use. Instrument response shall be checked at each use and rechargeable batteries recharged after each day of use and checked prior to the start of each work day. The manufacturer, batch number, type, and response range shall be recorded for disposable materials used (e.g., air filters and CITs).

K.6.5 DOE-Required Air Monitoring for Off-Site Exposure.

The goal of air sampling at a site is to adequately characterize air-related contaminant exposures. At a minimum, sampling results shall be adequate for predictive short-term and long-term modeling. When long-term inhalation exposures are required, sample results shall be representative of the long-term exposure points. This requires an air sampling program of sufficient temporal scale to encompass the range of meteorological and climatic conditions potentially affecting emissions and of sufficient spatial scale to characterize associated air concentrations at potential exposure points.

Potential exists for exposure to air particulates from past and present releases, both directly from the facility and from resuspension of materials following deposition. Uranium is the primary particulate constituent of concern making particulate air sampling an important part of the environmental surveillance program in order to comply with applicable dose limits. Selection of air monitoring type depends on emission sources investigated and exposure routes evaluated. For example, if dust inhalation is an exposure pathway of concern, the monitoring equipment shall be able to collect respirable dust samples.

Air sampler locations are based on DOE requirements, public concern, control location, and special studies. Justification of additional monitoring stations or omission of existing stations shall be documented. In general, indicator locations should not be placed in valleys, near structures that would affect measurements, in areas of different geology, or in areas where altitude differs significantly (150 meters). At least one control air monitoring station shall be maintained and monitored at the same frequency as the indicator stations.

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Air samplers shall be mounted in locked, all-weather stations with the sampler discharge located to prevent the recirculation of air. The air sampling system shall have a flow rate meter. The air sampling rate shall not vary by more than 20 percent and total air flow or total running time shall be indicated. Linear flow rate across air particulate filters shall be maintained between 20 to 50 m/min. Air sampling systems shall be leak-tested, flow-calibrated, tested, and inspected routinely according to a written procedure (DOE/EH-0173T, Summary 5q). Flow calibration shall be at least as often as suggested by the manufacturer. If the projected dose equivalent from inhalation of particulates exceeds 20 percent of the regulatory limit (two mrem), a particle-size analysis of the emission shall be conducted at least annually (DOE/EH-0173T, Summary 5f).

Selection of the filter type for collection of air particulates shall be based on site-specific needs. As a minimum, collection efficiency, particle size selectivity, ease of radiochemical analyses, and cost shall be considered when selecting filters.

Meteorologic monitoring shall be completed to assess potential off-site impacts for releases of airborne contamination. Assessments may be completed for actual, projected, or accidental releases. Necessary data shall be obtained from on-site instrumentation. Instruments that may be used include wind speed, wind direction, ambient and dewpoint temperature, precipitation, and barometric pressure measuring devices. Sensors and on-site measurement locations shall be determined based on a project-specific plan and DQOs.

K.7 BIOLOGICAL SAMPLING

Biological sampling is conducted at FEMP to evaluate radiological parameters (e.g., uranium) in selected flora and fauna. Following is a description of procedures for ongoing biological studies and key elements for a work plan for future studies.

K.7.1 Ongoing Sampling

Ongoing biological sampling at FEMP is conducted for milk, fish, produce, game, meat, and grass. Sampling methods follow.

K.7.1.1 <u>General Methods</u>. Following are methods that are generally applicable for collection of biological samples for FEMP. Methods specific to each sample type are presented in the following paragraphs.

1. For off-site properties, obtain permission from property owner and arrange a date and time to collect samples.

2. Obtain appropriate sample equipment, containers, and preservatives as specified in Table L-1 or in project-specific plans.

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NOTE

Sampling shall include collection and testing of field QA/QC blanks.

3. Collect biological samples as specified in paras. K.7.1.2 through K.7.1.5.

4. Document sample collection activities in a bound field log and complete request for sample analysis, summary of biological sampling, and chain-of-custody records.

5. Handle samples as specified in Section 7 and send samples to laboratory for testing.

K.7.1.2 Milk Samples. Proceed as follows when collecting milk samples.

1. Provide sample containers to dairy operator and request they be filled with whole milk.

2. Observe filling of sample bottles by operator.

3. Place filled sample containers into cooler and refrigerate at two to six degrees Centigrade.

K.7.1.3 Fish Samples. Proceed as follows when collecting fish samples.

1. Collect fish using electro-fishing methods at the designated water body locations.

2. Complete a sampling site survey that includes water depths, number of collected fish, family and species of fish, and frequency distribution.

3. If whole fish specimens require testing, freeze fish for transportation to laboratory.

4. If fish fillets are required, cut fish flesh from back bone to provide sufficient sample quantity for analysis and freeze fillets for transportation to laboratory.

K.7.1.4 Grass Samples. Proceed as follows when collecting grass samples.

1. Plan to sample soil/grass several days in advance and provide sufficient flexibility in schedule to avoid sampling during a wet period or within 48 hours of precipitation.

2. Select a sampling location that has not been disturbed by recent activity.

3. Collect two soil samples as specified in subsection K.5: one from a depth of zero to five cm and the second from five to ten cm.

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NOTE

It may be necessary to collect grass samples from several locations in the same general area to obtain a sufficient quantity.

4. Collect grass samples as near as possible to the soil sample location. Do not cut clover, weeds, dry grass, or roots.

5. Using clean scissors, cut grass at ground surface without getting soil in the sample.

K.7.1.5 **Produce Samples.** Proceed as follows when collecting samples of farm and garden produce.

1. Complete sampling prior to fall harvest.

2. Select samples from locations that have not been disturbed recently.

NOTE

If there is insufficient produce, collect from as many locations as possible; and, if necessary, augment the sample with leaves and stems from the produce plant.

3. At a given farm garden, select samples of the same produce type from six locations if available and combine them into one sample.

4. Collect a sample of fertilizer used on plants if available.

K.7.1.6 **Meat Samples.** Meat samples are obtained from domestic animals (e.g., cattle) and game (e.g, deer).

K.7.2 Biological Study Work Plan

The purpose of a study shall be clearly defined prior to preparation of a work plan. Biological studies may be implemented to assess the following conditions.

- Difference between biological parameters at a site relative to a control area
- Detect biological (flora/fauna) contamination
- Quantify risks to human health from contamination in the food chain

General elements of a work plan shall include the following.

- Identification of target compounds
- Field sampling plan development
- Field sampling procedures
- Laboratory testing

These elements are described in paragraphs K.7.2.1 through K.7.2.4.

K.7.2.1 **Target Compound Identification.** Target compounds are on-site contaminants of concern that are studied to assess effects of site contamination on flora and fauna. A list of these compounds is compiled based on review of soil, sediment, ground water, surface water, and air test data relative to Applicable or Relevant and Appropriate Requirements (ARAR) and ambient water quality criteria. Detailed methodology for comparison is presented in the EPA Risk Assessment Guidance Manual (U.S. Environmental Protection Agency, 1989c).

K.7.2.2 **Field Sampling Plan Development.** There are two primary steps required when developing a field sampling plan.

First, background data are reviewed to understand physical/chemical properties of target compounds and their migration routes (e.g., air, water). Existing studies relative to biological/ecological surveys of the immediate vicinity of the study area are examined to evaluate permissible collection techniques for flora and fauna.

The second step consists of a preliminary field survey by qualified biologists or similar individuals to collect preliminary data regarding flora and fauna in the study area. This information is obtained by mapping vegetation, animals observed, tracks, burrows, and aquatic habitats. Photo documentation shall be compiled to support survey findings.

Information gained during these two steps allows identification of specific issues of concern and establishment of project goals. Now the work plan can be written to provide guidance for accomplishing the project using the best methodologies to achieve established goals.

K.7.2.3 **Field Sampling Procedures.** FEMP and its surrounding area consist of terrestrial and aquatic habitats. Numerous field methods exist for collecting and assessing effects of contamination on flora and fauna within these habitats and vary widely depending upon the study purpose. For example, stressed vegetation can be assessed using color infrared aerial photography for a broad analysis or by physical collection and observation of vegetation for a more localized scale. Consequently specific methodologies will be addressed in project-

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specific plans. Procedures for sample processing and handling will be provided in project-specific plans.

K.7.2.4 Laboratory Testing. Two types of testing are commonly used to evaluate the effects of hazardous substances on flora and fauna: bioassay (or toxicity tests) and analytical laboratory chemical tests. In general, bioassay tests consist of using living organisms and subjecting them to site-specific chemical conditions (e.g., waste water) to compare before and after conditions. Analytical laboratory chemical tests consist of analyzing plant or animal tissue for target compounds. Procedures for tissue analysis, for the most part, are adapted from current EPA procedures for examination of solid waste. Neither bioassay or analytical laboratory chemical test methods for biological samples are approved by the EPA. Test methodologies shall be specified in project-specific plans.

K.8 MISCELLANEOUS SAMPLES

A variety of media samples are collected at FEMP to characterize radiological, chemical, and metal contaminants to determine handling and disposal requirements. Samples are non-biased and collection processes are similar for each Analytical Support Levels A through E.

K.8.1 Sample Requests

Sampling operations of on-site media (soil, water, sediment, construction rubble, waste streams) shall be performed based on a written request for media sampling from responsible project managers, engineers, and supervisory personnel to the appropriate sample collection organization. The request for media sampling is usually generated as a result of the following types of activities.

- Pre-/post-construction and demolition projects
- Remedial activities
- Characterization of on-site programs
- Renovation projects
- Site emergency response activities
- Support of site regulatory programs
- Support of site remediation programs

- On-site routine environmental media sampling
- RCRA characterization of drummed wastes

The sample request shall contain, as a minimum, the following information.

- Project name
- Requestor's name
- Purpose (objective) of sampling
- Media type
- Sample locations and justification for selected locations
- Regulatory drivers
- Analytical parameters
- Requested completion date
- Notifications required
- Analytical support level
- Appropriate approvals

Based on project knowledge and regulatory guidance, specific parameters for analysis shall be determined.

Media samples shall be collected at sample point locations specified in project-specific plans. Each sample shall be placed in appropriate sample containers as identified in the project-specific plan and labeled as specified in Section 7.

K.8.2 Sample Collection Procedures

The following methodology shall be used to collect solid debris samples from construction, renovation, and demolition (paint chip, wood, concrete, and dust) for radiological and chemical analyses.

K.8.2.1. Paint Chip Samples. Collect paint chip samples as follows.

1. Place clean plastic sheeting on ground, concrete, or floor surface within sample area.

2. Use a decontaminated putty knife or paint scraper and remove loose paint material from host surface.

3. Collect chips in a stainless-steel pan or tray and transfer them to an appropriate sample container (as specified in Table L-1 or project-specific plans) with a stainless steel-scoop or spoon.

4. Seal container with custody tape, label it, and submit samples to FEMP analytical laboratory with chain-of-custody record.

K.8.2.2. Wood Samples. Collect wood samples as follows.

1. Place clean plastic sheeting on ground, concrete, or floor surface within sample area.

2. Use a rotary drill and decontaminated wood bit and collect wood cuttings in a clean stainless-steel pan or tray.

3. Transfer wood cuttings from pan or tray with a stainless-steel scoop or spoon to appropriate sample container.

4. Seal container with custody tape, label it, and submit samples to FEMP analytical laboratory with chain-of-custody record.

K.8.2.3. Concrete Samples. Collect concrete samples as follows.

1. Place clean plastic sheeting on ground, concrete, or floor surface within sample area.

2. Use Milwaukee rotary drill and decontaminated coring bit and collect concrete cuttings in a clean stainless steel pan or tray.

3. Transfer cuttings from pan or tray with a stainless-steel scoop or spoon to appropriate sample container.

4. Seal container with custody tape, label it, and submit samples to FEMP analytical laboratory with chain-of-custody record.

K.8.2.4. Dust Collector Residue Samples. Collect dust samples as follows.

1. Place clean plastic sheeting on ground, concrete, or floor surface within sample area.

2. Use a decontaminated stainless-steel scoop to collect samples.

3. Transfer dust residue to appropriate sample container.

4. Seal container with custody tape, label it, and submit samples to FEMP analytical laboratory with chain-of-custody record.

K.9 SAMPLE COLLECTION FORMS

Complete a sample collection form for each sample including specific information about the sample collected and information indicated on the forms plus the following data.

- Project identifiers
- Sample location
- Description of sampling points (e.g., east bank of Miami River 500 feet upstream of confluence with Paddys Run)
- Sampling dates
- Start and finish time of sampling activity and collection times
- Weather conditions including significant changes during the activity
- Sample numbers
- Description of sample containers (e.g., three 40 mL-glass vials)
- Parameters to be analyzed
- Preservation methods including refrigeration
- Field measurements including replicate measurements
- Visual description of samples

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- Unusual occurrences (e.g., "semi-volatile sample could not be collected because of insufficient recovery of well" or "truck passed while sampling stirring up significant volume of dust upwind of sample collection site")
- Sampling team members
- Types and identification numbers of equipment used

K.10 FIELD STORAGE AND SHIPMENT OF SAMPLES

Samples collected in response to the various programs on site shall be classified by personnel identified in the Field Sampling Plan (FSP) prior to shipment as either environmental or hazardous substances samples. Generally, environmental samples include the following.

- Drinking water
- Natural water
- Sediment
- Background/control soils
- Treated municipal and industrial waste water effluent
- Biological specimens or samples not expected to be contaminated with high levels of hazardous materials.

Shipment of samples designated as environmental samples are not regulated by the U. S. Department of Transportation (DOT). However, these samples shall be transported in a manner to preserve their integrity; and, if there is any doubt as to the sample classification, it will be considered a hazardous substance and shipped accordingly.

DOT has regulatory responsibility for the safety of hazardous materials transported off site by any means. Regulations for packaging, marking, labeling, and shipping of hazardous substances are promulgated by DOT and described in 49 CFR 171 through 177 (1991).

Samples shipped by common carrier or through the United States Mail must comply with DOT Hazardous Materials Regulations [49 CFR 172 (1991)]. The person sending such material is responsible for ensuring compliance as applicable.

RadioActive Materials (RAM) samples are, by definition, hazardous and are subject to specific stringent regulations governing their transportation. RAM transportation is regulated by DOT under the Transportation Safety Act of 1974.

Samples collected from process waste water streams, drums, and bulk storage tanks or soil, sediment, and water samples from areas suspected of being highly contaminated may need to be shipped as hazardous material.

The Nuclear Regulatory Commission (NRC) is responsible for governing transportation of RAM. Specifically included in NRC responsibilities is approval of certain types of packages (type B and fissile). DOE Orders require shipment compliance with applicable DOT and NRC rules or to provide equivalent safety to the public.

Chain of custody is discussed in detail in Section 7.

K.10.1 Field Storage

Procedures for storage of samples in the field are as follows.

1. Keep samples cool and away from direct sunlight.

2. As soon as samples requiring refrigeration are collected, filtered as necessary, and preserved, ensure that sample container lids are secure before storing them in an ice chest.

3. Store samples in chests packed with artificial icing material maintaining a temperature range of two to six degrees Centigrade.

NOTE

> Special precautions, procedures, and secondary containment areas within laboratories are necessary when samples classified other than environmental are received. If there is doubt as to the classification of a sample, it is considered hazardous and handled and shipped accordingly.

4. Ship samples promptly to the laboratory to avoid exceeding holding times as specified in Section 7.

5. Transport samples in a manner that protects the integrity of the sample and also prevents detrimental effects from the potentially hazardous nature of the samples.

K.10.2 Sample Container Preparation

Following are procedures for sample container preparation.

NOTE

> Sample bottles may be purchased precleaned in accordance with EPA specifications with appropriate supplier documentation. VOA vials are purchased precleaned. Glass containers for other organic analyses may be purchased precleaned or washed in the laboratory.

1. If glass containers are cleaned in the laboratory, wash them with a nonphosphate detergent.

2. Rinse with tap water, rinse with methanol, and then rinse with de-ionized water.

3. Allow to air dry.

4. Wash plastic containers for metals analyses with a nonphosphate detergent.

5. Rinse with tap water, with de-ionized water, and then with diluted nitric acid.

6. Wash plastic containers for other general chemistry and radiological procedures with a nonphosphate detergent and rinse with tap water and de-ionized water.

7. Prepare sample bottles in sample coordination area with premeasured amounts of appropriate chemical preservatives and ship to the field.

8. Take appropriate container blanks.

K.10.3 Sample Preservation

Methods of preservation are relatively limited and intended to accomplish the following.

- Retard biological action
- Retard hydrolysis of chemical compounds and complexes
- Reduce volatility of constituents
- Reduce absorption effects

Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing.

Recommended preservatives for various constituents are given in Table L-1. These choices are based on the accompanying references and on information supplied by various quality assurance coordinators. As more data become available, recommended holding times will be adjusted to reflect the new information.

The DOT Office of Hazardous Materials, Materials Transportation Bureau, has determined that hazardous materials regulations do not apply to sample preservatives that do not exceed the following concentrations (U.S. Environmental Protection Agency, 1986b).

- HCl in water solutions at concentrations of 0.4 percent by weight or less
- $HgCl_2$ in water solutions at concentrations of .0004 percent by weight or less (pH about 1.96 or greater)
- HNO_3 in water solutions at concentrations of 0.15 percent by weight or less (pH about 1.62 or greater)
- H_2SO_4 in water solutions at concentrations of 0.35 percent by weight or less (pH about 1.15 or greater)
- NaOH in water solutions at concentrations of 0.080 percent by weight or less (pH about 12.30 or greater)
- H_3PO_4 in water solutions at concentrations yielding a pH range between 2 and 4

K.10.4 Sample Classification

K.10.4.1 <u>RCRA and CERCLA Initial Sampling Programs</u>. RCRA and CERCLA programs that require initial sampling of unknown substances specify that samples be shipped in accordance with hazardous materials regulations if process knowledge suggests presence of a substance classified as hazardous.

If process knowledge does not indicate presence of a hazardous substance or if initial tests are for spectrum testing for hazard identification, the samples may be shipped as environmental samples.

K.10.4.2 <u>Routine Sampling</u>. For programs that require routine sampling, a comparison of past test results are made to the requirements of 49 CFR (1991) to establish the sample classification as environmental or hazardous for shipping purposes.

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K.10.4.3 Classification of Samples as Hazardous or Non-Hazardous Substances. Process knowledge, previous sampling results, and field test (i.e., pH) results are used to decide whether a sample should be handled as an environmental or hazardous substance. If it is decided that the sample can be classified as environmental or, if it meets the "reportable quantity" or the "exception for small quantities" definition in 49 CFR 173 (1991), the samples may be shipped in accordance with the FSP for sample integrity and chain-of-custody requirements. However, if it is decided that the sample may contain radionuclides, it must be transported as specified in paras. K.10.8 through K.10.14.

Detailed requirements for handling, packaging, labeling, and transportation of samples are provided in program-specific FSPs.

K.10.5 Environmental Samples

Samples collected and designated environmental samples as specified in the FSP shall be shipped to maintain sample integrity and chain-of-custody requirements. However, if a hazardous material preservative is added to a sample, the amount of preservative must not exceed the reportable quantity listed in Table L-2. If it does, the sample must be reclassified as a hazardous material under DOT Hazardous Materials Tables, 49 CFR (1991), and the sample must be shipped accordingly as a corrosive substance.

Shipment of nitric acid is forbidden on aircraft unless packaged in accordance with 49 CFR 173 (1991).

When samples are dispatched to the laboratory for analysis, separate chain-of-custody and request-for-analysis records shall accompany each set of samples. Process sample sets for shipment as follows.

1. Upon receipt of original sample containers in the field in boxes or coolers, note whether the custody tape is properly affixed to the package or the attached chain-of-custody record for shipping empty containers to the field.

2. Keep lids on original sample containers until they are used for sampling. Do not mix lids. If lids are contaminated, dispose of both lid and container.

3. After a sample is placed in a container, secure it with a custody seal and place it in a plastic bag to minimize the potential for contamination by vermiculite or other packing material.

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NOTE

Sample containers placed in a box with cardboard separators need not be placed in plastic bags (e.g., subsurface soil sample jars are returned to their original shipping container, a cardboard box with cardboard inserts).

CAUTION

Do not, under any circumstances, use locally obtained material such as sawdust or sand. Also, do not use ice or earth as packing material.

4. Initially fill metal or plastic picnic-type coolers used for shipping refrigerated/preserved samples with approximately three inches of vermiculite or other suitable (non-combustible, absorbent packing) material.

NOTE

Do not use ice is as a substitute for packing material.

5. Place breakable (e.g., glass) sample containers in a cooler and isolate them from contact with one another using protective material such as bubble wrap or new, unused paint cans. Keep cooler closed except when placing samples in cooler.

6. Pack containers in coolers with commercially available artificial icing material. If unavailable, use ice placed in a new, zipper-type, plastic freezer bag.

NOTE

Dry ice is classified as an ORM-A hazard by DOT and there is no labeling requirement for samples thus preserved.

7. If dry ice is used for coolant, the following procedures apply.

   a. Mark each package on at least one side with the designation "ORM-A" and with "Dry Ice" or "Carbon Dioxide, Solid" and "Frozen Diagnostic Specimens."

   b. Package samples in accordance with other requirements of 49 CFR 173 (1991).

   c. Make advance arrangements between the shipper and each carrier.

8. After packing container with coolant, fill remaining space in cooler with vermiculite or suitable substitute. 2375

9. Transport original chain-of-custody record and request for analysis to laboratory along with samples. Hand carry records or place them in a plastic bag and tape it to bottom of cooler lid for shipment with the samples to a laboratory. (See Section 7 for detailed chain-of-custody and request-for-analysis requirements.)

   a. Padlock or seal containers for shipment as appropriate. Wrap filament tape around container with custody seals affixed on front and back of cooler to prevent access to the container without breaking the seal. Use other appropriate custody seals for other containers.

   b. Address shipping containers to laboratory with indelible pen or ink.

NOTE

Do not mark individual samples within each package with hazard warning labels for environmental samples.

   c. If a hazard warning label is applied to container, mark and label the shipping package accordingly.

   d. Arrange for transportation of samples, and, when custody is relinquished by field personnel to shipper, notify receiving laboratory custodian by telephone of expected time of arrival of sample shipment and holding-time constraints for sample analysis or extraction.

   e. Attach shipping waybill to chain-of-custody record and provide appropriate shipping papers.

   f. Upon receipt by laboratory sample management personnel, examine contents of shipping containers and record on chain-of-custody record whether all containers are present and custody seals on all sample containers are intact as specified in Section 7.

10. See program-specific FSP for additional requirements.

K.10.6 Hazardous Substance Samples

K.10.6.1 <u>Known, Suspected, or Routine Hazardous Substance Samples</u>. If a sample contains a known or a suspected substance listed in the Hazardous Materials Table in 49 CFR 172 (1991) or meets the definition of a hazardous substance but not the exceptions for

small quantities criteria, the sample shall be handled, packaged, marked, labeled, and shipped as specified in the CFR instruction for that material. A hazardous substance is a material, including its mixtures and solutions, that meets the following criteria.

- Listed in appendix to 49 CFR 172 (1991)
- Exhibits hazardous characteristics (e.g., flash point)
- In a quantity in one package that equals or exceeds the reportable quantity listed in appendix to 49 CFR 172 (1991)

This definition does not apply to petroleum products that are lubricants or fuels.

K.10.6.2 <u>Exceptions-for-Small-Quantities Criteria</u>. The criteria for this substance category covers flammable liquids; flammable solids; oxidizers; organic peroxides; corrosive materials; poison B and ORM A, B, C; and radioactive materials that are normally classified as hazardous. However, if they are present in known or suspected quantities that are less than the following limits, a hazardous classification is not required, and they are not subject to the requirements of 49 CFR 173 (1991). However the substance-specific guidelines of 49 CFR 173 (1991) do apply. Maximum limits for inner receptacle quantities to meet exceptions-for-small-quantities critera are as follows.

- Thirty milliliters for liquids other than poisons
- Thirty grams for solids other than poisons
- One gram for materials classed poison B or subject to poison-inhalation-hazard criteria for shipping documents as described in 49 CFR 172 (1991)
- Activity level less than that specified in 49 CFR 173 (1991) as appropriate for packages containing radioactive material

K.10.6.3 <u>Exemptions for Treatability Studies</u>. For off-site treatability studies, the Federal Treatability Study Sample Exception Rule [40 CFR 261] shall be used to collect, store, and transport samples to an off-site laboratory or testing facility if the following conditions exist.

- The generator or sample collector uses no more than 1000 kg of a nonacute hazardous waste; 1 kg of acute hazardous waste; or 250 kg of soils, water, or debris contaminated with acute hazardous waste per waste stream per treatment process. If additional samples are required, the regional administrator or state director may, on a case-by-case basis, grant requests for waste stream limits up to an additional 500 kg

of nonacute hazardous waste; 1 kg of acute hazardous waste; and 250 kg of soils, water, or debris contaminated with acute hazardous waste. 2375

- Quantity of each sample shipment does not exceed these quantity limitations.
- Sample is packaged so it will not leak, spill, or vaporize during shipment.
- Transportation of each shipment complies with regulations for shipping hazardous material as specified in para. K.9.7.
- Sample is shipped to a laboratory or testing facility that is exempt under 40 CFR 261 or that has an appropriate RCRA permit or interim status.
- The generator or sample collector maintains copies of shipping documents, contract with facility conducting treatability study, and records showing compliance with shipping limits for three years after completion of treatability study.
- The generator provides specified documentation in its biennial report.

The Federal Treatability Study Sample Exemption Rule is only applicable in states that do not have final authorization (i.e., EPA authorization to manage NPL Sites) or in authorized states that have revised their program to adopt the equivalent regulations under state law. Thus, the states through which these materials pass and the location of the off-site treatability laboratory or testing facility need to be evaluated relative to the regulations prior to selection/implementation of the study.

K.10.7 Packing and Transporting Hazardous Waste Samples

The following are basic steps for handling, packaging, labeling, and shipping hazardous substance samples.

K.10.7.1 <u>Hazard Classification</u>. See table in 49 CFR 172 (1991) for the hazard classification of the material. If more than one class is shown for the shipping name, determine the class by definition.

K.10.7.2 <u>Proper Shipping Name</u>. The proper shipping name and materials are listed in the Hazardous Materials Table (HMT) in 49 CFR 172 (1991).

K.10.7.3 <u>Identification Number</u>. See table in 49 CFR 172 (1991) and select the IDentification (ID) number that corresponds to the proper shipping name and hazard class. Enter applicable ID numbers on shipping documents and display them on the packaging as required.

K.10.7.4 Mode of Transportation and Modal Restrictions. Certain modes of transportation are forbidden for shipment of some substances (e.g, nitric acid may not be transported on aircraft). The mode of transportation may affect packaging, quantity per package, marking, labeling, shipping papers, or certification.

K.10.7.5 Proper Packaging. See table in 49 CFR 172 (1991) for authorized exceptions and specific packaging authorization. When selecting packaging for transport, the following should be considered: type of sample, sample integrity requirements, quantity per package, necessary cushioning material or absorbent materials, proper pressure, and outage.

Standard general requirements for packages used to ship hazardous materials are contained in 49 CFR 173 (1991). In general, packages shall be designed and constructed so that, under normal transportation conditions, there will be no release of the hazardous material and the effectiveness of the packaging will not be reduced. 49 CFR 173 (1991) states that, where there are no detailed specifications for packaging, the hazardous substance shall be enclosed in strong, tight packaging that does not leak or have its effectiveness reduced.

K.10.7.6 Shipping Documentation. Basic requirements for preparing shipping documentation for hazardous materials include proper shipping name, hazard classification, ID number, total quantity, and the shipper certification. Provide information on shipping papers required by 49 CFR 172 (1991). See 49 CFR 172 through 172 (1991) for additional requirements.

K.10.7.7 Certification. Authorized personnel will certify, by printing on the shipping papers, that the materials being offered for shipment are properly classified, described, packaged, marked, and labeled and are in proper condition for transport as specified in the applicable DOT regulation [49 CFR 172 (1991)]. See 49 CFR 172 (1991) for surface shipment and for air shipments.

K.10.7.8 Marking the Package. Apply markings specified in 49 CFR 172 (1991). Requirements for packaging of 110 gallons or less are identified in 49 CFR 172 (1991) and include the following.

- Shipping name
- Identification number
- FEMP name and address
- Laboratory name and address
- Inhalation hazard if required [49 CFR 173 (1991)]
- Name and address required on all packages

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K.10.7.9 Labeling. See the table in 49 CFR 172 for required labeling, additional labels, location of labels, and packaging of samples.

The HMTs in 49 CFR 172 (1991) identify proper labels for hazardous materials. Labeling requirements in at 49 CFR 172 (1991) are in specific sections as follows.

- 49 CFR 172.400(a) (1991) - Labels specified for hazardous materials shipment
- 49 CFR 172.401 (1991) - Labels affixed to packages even though not required by regulations, provided they represent hazards of material in the package
- 49 CFR 172.406(a) (1991) - Label location on the package
- 45 CFR 172.406(c) - Positioning of two or more labels
- 49 CFR 173.3a (1991) - Inhalation hazard/poison label requirements
- 49 CFR 172.404(b) (1991) - Label requirements when two or more packages containing compatible hazardous materials are packaged within the same overpack

K.10.8 Radioactive Samples

In general, most samples collected at FEMP are classified as radioactive for transport purposes; however, certain samples may fall into categories for which special packaging and shipping restrictions are mandated. Guidelines for determining the category to which a particular sample shipment belongs and for selecting a suitable mode of shipment and appropriate packaging follow.

Potentially radioactive samples shall be screened as specified by individual laboratory licensing requirements before they can be accepted for analysis. The method for screening in Appendix G shall be followed when applicable. Laboratory-specific license requirements shall take precedence over this requirement.

Regulations impose limits on the total radioactivity (i.e., specific activity times the weight of the package) contained within a package of radioactive material. With respect to type A packages, the limits are expressed as two quantities, A1 and A2, which refer to the maximum permissible activity for radionuclides in special form and normal form radioactive materials, respectively. The samples from FEMP fall into the latter category so the A2 value sets the activity limits for packages of samples. In those cases where contaminated material shipments are designated "low specific activity" or "limited quantity," some fraction of the A2 value will normally apply.

Table L-3 lists A1 and A2 values cited in 49 CFR 173 (1991) for radionuclides of the uranium decay series. Values for radionuclides not listed in the regulations (e.g., lead-214, bismuth-214, polonium-214) have been assigned in accordance with 49 CFR 173 (1991).

Determination of permissible quantities for samples of contaminated waste from FEMP is more complicated than simple reference to A2 values because such material contains a mixture of radionuclides for which two rules apply. A mixture of radionuclides from a single decay chain is considered to be a single radionuclide if the following criteria apply.

- Parent and daughters are present in their naturally occurring proportions (e.g., in secular equilibrium)
- No daughter has a half-life longer than 10 days or a half-life longer than the parent radionuclide.

The A2 quantity applied is that of the parent radionuclide (49 CFR 173 (1991) for such mixtures.

For those mixtures in which the identity and activity of radionuclides is known, the permissible quantity for each radionuclide shall be such that the following equation is true.

$$F_1 + F_2 + \ldots + F_k \ldots F_n \leq 1$$

Where F_k is the ratio of the total activity of the kth radionuclide to its A1 or A2 quantity [49 CFR 173 (1991)].

K.10.9 Low-Specific-Activity Materials

Low-Specific-Activity (LSA) materials include uranium and thorium ores, physical and chemical concentrates of these ores (e.g., yellow cake), unradiated natural or depleted uranium or thorium, nonradioactive material externally contaminated with radioactivity that is not readily dispersible, and material in which the radioactivity is essentially uniformly distributed and does not exceed certain prescribed concentration limits. Table L-4 lists limits for radionuclides of the uranium decay series, beginning with thorium-230. In general, these concentrations will not be exceeded in FEMP samples.

Details for shipping LSA materials are described in 49 CFR 173 (1991). The chief advantage of shipping under the LSA category arises when the shipment is consigned "Exclusive Use," that is, under the supervision or direction of a single consignor from point of origin to final destination [49 CFR 173 (1991)]. When packaged shipments of LSA materials are consigned as "Exclusive Use", the shipment is exempt from specification

packaging, labeling, and marking. Requirements that shall be met include the following [49 CFR 173 (1991)]. 2375

- Shipment shall be consigned as "Exclusive Use", unloaded from the conveyance in which it was originally loaded, and accompanied by written instructions for the maintenance of Exclusive-Use shipping controls. LSA materials shall not be shipped by air.

- Material shall be packaged in strong, tight packages that will not leak under normal transport conditions. Each package shall be marked "Radioactive - LSA."

- Package shall not exceed limits for removable radioactive contamination and radiation level.

- The transport vehicle shall be appropriately placarded unless the shipment consists solely of unconcentrated uranium and thorium ores.

K.10.10 Limited Quantities of Radioactive Material

Limited quantity shipments of radioactive material shall meet the requirements specified in 49 CFR 173 (1991). If the activity per package does not exceed 10^{-3} A2 quantity of the radionuclide, then it is exempt from specification packaging and from the associated shipping paper, marking, and labeling requirements. Instead, the package need only comply with the following requirements.

- Material shall be packed in strong, tight packages will not leak under normal transport conditions. The outside of the inner packaging or the outside of the packaging itself when there is no inner packaging shall be marked "Radioactive."

- The package shall not exceed limits for removable radioactive contamination and radiation level.

- The package shall be certified acceptable for transport by an enclosed notice in or attached to the package. The notice shall state name of consignor and include the following statement.

  "This package conforms to conditions and limitations specified in 49 CFR 173.421 (1991) for excepted radioactive material, limited quantity, n.o.s., UN2910."

K.10.11 General Requirements for Packaging Radioactive Materials

The type of packaging for a radioactive material shipment depends upon general requirements in 49 CFR 173 (1991) and specific requirements for the shipping category (type A or type

B). Unless otherwise specified, shipments of radioactive materials shall comply with requirements of 49 CFR 173 (1991) as follows.

- Packages shall be tamper-sealed.
- The smallest outside dimension of a package shall be four inches.
- Packages shall be designed to maintain shielding efficiency and leak tightness under normal transport conditions. Internal bracing or cushioning shall be adequate.
- Decay heat generated within the package shall not cause deterioration of the package.
- Surface temperatures of the package shall not exceed 122 degrees Fahrenheit for mixed loadings or 180 degrees Fahrenheit for vehicles in sole use.
- Pyrophoric materials shall meet packaging requirements in 49 CFR 173 (1991). Pyrophoric radioactive liquids shall not be shipped by air.
- Each package shall be designed for easy handling and proper security in or on a conveyance during transport.
- The external surface of each package shall be easily decontaminated as far as practical.
- Liquid radioactive material shall be packaged in leak-resistant and corrosion-resistant inner containment vessels. In addition, the package shall meet the following requirements.
    - Maintain its integrity if subjected to drop test
    - Contain enough material to absorb twice the volume of liquid from a secondary leak
    - Provide a corrosion-resistant containment vessel
- There shall be no significant, non-fixed radioactive contamination on the exterior surface of the package.

Prior to each use, the following examinations and tests of the packaging are required.

- Proper labeling for contents
- Physical condition

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- Closure device inspection
- Instructions followed
- Closure and valves secured
- Leak tests
- Radiation limits
- Contamination limits
- Temperatures at equilibrium

K.10.11.1 Type A Package. FEMP shall maintain on file for at least one year after the latest shipment a complete certification with supporting safety analysis demonstrations that the packaging design, packaging construction methods, and materials were in compliance with specifications. The file shall also relate the contents of the packages shipped to the contents used for testing purposes. The following specifications apply to type A packages.

- General radioactive materials requirements in 49 CFR 173 (1991)
- Type A design requirements in 49 CFR 173 (1991)
- Type A performance tests in 49 CFR 173 (1991)
- Type A test for liquids and gases (required only when form of material is liquid or gas) in 49 CFR 173 (1991)

Type A quantities shall be packaged in specification 7A type A general packaging requirements [(49 CFR 173 (1991)]. Each package shall comply with applicable requirements of 49 CFR 173 (1991).

Each package shall be designed and constructed to comply with the standards for type A packaging and specific requirements in 49 CFR 178 (1991).

Marking on the outside of each package shall comply with 49 CFR 178 (1991) and shall include the following: "USA DOT-7A Type A and Radioactive Materials." FEMP shall also comply with number size and additional marking requirements of 49 CFR 173 (1991).

Type B packaging may be used for type A quantities [49 CFR 173 (1991)]. Type A packaging for fissile materials is listed in 49 CFR 173 (1991).

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K.10.11.2 Type B Package. It is not anticipated that samples from FEMP will require Type B packaging, but if it is required, the following quality assurance and quality controls will be adhered to as a minimum.

- Type A criteria shall apply plus adequate provisions for certain serious accident conditions with resultant limited loss of shielding and essentially no loss of containment.

- Each type B package for fissile materials shall meet the test requirements prescribed in 10 CFR Part 71 for ability to withstand accident conditions during transportation. Type B packaging requirements for fissile materials are listed in 49 CFR 173 (1991).

NOTE

Type B packaging is used for both type B quantity and highway-route-controlled quantity shipments.

- Type B packaging shall comply with requirements for type A packaging plus test conditions and requirements specified in 49 CFR 173 (1991).

K.10.12 Marking and Labeling Radioactive Samples

K.10.12.1 Marking. General requirements for marking packages containing radioactive material include the following.

- Container specification number and name/address (or symbol) of company (specification containers only) (49 CFR 173 (1991).

- Proper shipping name and identification number (UN or NA) for packages with rated capacity of 110 gallons or less [49 CFR 172 (1991)]

- Markings in English and printed on or affixed to the surface of a package or on a label tag or sign [49 CFR 172 (1991)]

- Gross weight if greater than 110 pounds [49 CFR 172 (1991)]

- Plain, durable marking on outside of package in letters at least half an inch high with the words "Type A" or Type B" as applicable [49 CFR 172 (1991)]

- FEMP and FEMP address [49 CFR 172 (1991)]

- Marked "THIS SIDE UP" or "THIS END UP" for liquids packaged with closures upward [49 CFR 172 (1991)]

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K.10.12.2 **Labeling.** Label selection shall be based on actual radiation levels at surface and at one meter, the transport index [49 CFR 173 (1991)], and, if applicable, the fissile characteristics of the package. The proper category of the label shall be determined using Table L-5.

If the sample contains a hazardous substance, a hazardous substance label is required in addition to the radioactive label (e.g., nitric acid solution of radioactive material). Place the labels next to each other on the package, and provide two radioactive labels per package on opposite sides of the package. Each label shall contain the following information.

- Contents (radionuclides)
- Number of curies
- Transport index (on yellow II or III labels only)

K.10.12.3 **Shipping Documentation.** General requirements for shipping documentation are specified in 49 CFR 172 (1991) and are as follows.

- Shipping name
- Hazard class
- ID number
- Quantity

Radioactive requirements for shipping papers are specified in 49 CFR 172 (1991) and are as follows.

- Radionuclide (chemical) abbreviation permitted by chemical symbol
- Physical and chemical form if not in special form
- Activity of each package in curies, millicuries, or microcuries
- Package labeling hazard class and category
- Transport index for packages labeled radioactive yellow II and yellow IIIa
- Fissile data class I, II, or III or "Fissile Exempt"
- For DOE/NRC approved packages, a notation of the package identification marking

K.10.13 Radiation and Contamination Control

Measurements of radiation level (dose rate) and of nonfixed (removable) radioactive contamination shall be conducted on radioactive-material shipments to control exposure to radioactivity. The radiation level is the radiation-dose-equivalent rate expressed in millirem per hour (mrem/h) as specified in 49 CFR 173 (1991). Following are the permissible radiation levels for various shipping categories.

- Limited Quantity Packages - Radiation level at any point on the external surface of the package does not exceed 0.5 mrem/h [49 CFR 173 (1991)].

- LSA Packages - Radiation level of LSA packages transported as "Exclusive Use" shipments does not, at any time during transport, exceed the following limits [49 CFR 173 (1991)].

  - 200 mrem/h on the accessible external surface of the package or 1,000 mrem/h if the following criteria are met: the shipment is made in a closed transport vehicle, the package is secured so that its position remains fixed during transport, and no unloading/loading operations occur between the beginning and end of transport

  - Ten mrem/h at any point on the outer surface of the transport vehicle

  - Ten mrem/h at any point two meters (6.6 feet) from the outer surfaces of the transport vehicle

  - Two mrem/h at any normally occupied position in the transport vehicle (This provision does not apply to private motor carriers when personnel operate under a radiation protection program.)

- Other Packages - Radiation level does not exceed 200 mrem/h at any point on the external surface of the package, and the transport index does not exceed ten.

Maximum permissible limits for removable radioactive contamination allowed on a package are specified in 49 CFR 173 (1991) and are summarized as follows.

NOTE

These limits apply to any area of 300 square centimeters.

- 10^{-5} micro Ci/cm^2 or 22 disintegrations per minute (dpm)/cm^2, for beta/gamma-emitting radionuclides, radionuclides with half-lives less than 10 days, natural uranium, natural thorium, uranium-235, uranium-238, thorium-232, and thorium-228 and thorium-230 when contained in ore, and physical concentrates

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- 10^{-6} micro Ci/cm^2 or 2.2 dpm/cm^2 for other alpha-emitting radionuclides

Exclusive-use consignments of radioactive material shall not exceed these limits at the beginning of transport and shall not exceed ten times the limits at any time during transport [49 CFR 173 (1991)].

K.10.14 Transportation of Samples on Public Highways

FEMP contractors and subcontractors that transport samples classified as a hazardous substance over public highways shall comply with applicable Federal and State of Ohio regulations pertaining to transportation of hazardous materials.

NOTE

> The only exception to this requirement is if a shipment of radioactive materials is made under DOE and is escorted by personnel specially designated by or under the authority of DOE for the purpose of national security and is exempt from the regulations in 49 CFR 170 through 189 (1991) [49 CFR 177 (1991)].

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ANALIS NUMBER	:	000000-000
CUSTOMER NUMBER	:	RRR-x
CUSTOMER	:	J.DOE
DATE SAMPLED	:	mo-day-yr
SAMPLED FROM	:	OU-1
MTL. DESCRIPTION	:	Ground Water

Figure K-1. Example of a Sample Label

EXAMPLE

FMPC
ENVIRONMENT, SAFETY & HEALTH - INDUSTRIAL HYGIENE

Date _____

STACK SAMPLER INSPECTION REPORT (REFINERY)

Inspected By _____

NOTE: Contaminated Type "S" pleated filter should be replaced by a new prenumbered filter.

	COLLECTOR NUMBER	IDENTIFICATION NUMBER		RATE (L/m)		COND. CODE (A-B-C)	D. P. READING		LUDLUM (CPM)		ALARM SET POINT	TIME	LOCATION
		NEW FILTER	OLD FILTER	PRE-SCRIBED	ACTUAL		MINIMUM	MAXIMUM	BEFORE INSP.	AFTER CHANGE			
REFINERY	G1-94												Top level, N/E corner of digestion area
	G1-856												Top level, N/W corner of digestion area
	G1-252												Top level, West center of digestion area
	Plant 3 North												Top level, N/E corner of denitration area
	Plant 3 South												Top level, S/E corner of denitration area

NOTES:

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3	Chemical Plants Superintendent
4	General Supervisor
5	Area Supervisor
6	Industrial Hygiene Technician

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Code: A - Filter Sample appeared to be clean.
B - Filter sample showed evidence of small accumulation of material.
C - Filter Sample laden with material.

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Figure K-2. Stack Sampler Inspection Report Form

FMPC
QUALITY & SAFETY

LUDLUM RADIATION STACK MONITOR INSPECTION REPORT (Pg. 1 of 2)

Inspected By: _____ Time: _____ Date: _____

Stack Monitor ID	Honeywell Number	Ludlum Reading (CPM)	Scale Setting	Stack Alarm Set Point	Stack Alarm Audio Check	Source Check	Ludlum Dectector		Honeywell		Printer		Lights Test			System Power On
							Power on	Battery Check	Alarm Check	Trouble Check	Power on	Response Check	Low Flow	High Flow	Alarm	
G5-247 Stack	13201															
G5-248 Stack	13202															
G5-251 Duct																
G5-253 Duct																
G5-251/253 Stack																
G5-254 Stack	13302															
G5-259 Duct																
G5-259 Stack																
G5-260 Stack																
G5-261 Stack																
G5-262 Stack																
G5-267 Stack	1340															
W. Cool. Well, Plt. 5 Stack																
E. Cool. Well, Plt. 5 Stack																
W. Burnout Stack																
E. Graphite Breakup Exhaust																
E. Burnout Stack																

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2	Metals Plants Superintendent
3	Chemical Plants Superintendent
4	Health & Safety Instrumentation

Note:
- Cool. Well - W. Plt. 5 - Near G5-267 on Platform
- E. Burnout Stack - N. end of E. Burnout
- E. Graphite Breakup - behind E. Remelt Furnaces, 589'
- Cool. Well - E. PH 5 - Near breakout
- W. Burnout Stack - N. end of W. Burnout

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Figure K-3. Ludlum Radiation Stack Monitor Inspection Report Form (sheet 1 of 2)

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FMPC
ENVIRONMENT, SAFETY & HEALTH - INDUSTRIAL HYGIENE

LUDLUM RADIATION STACK MONITOR INSPECTION REPORT (METALS PLANTS)

Inspected By: _____ Time: _____ Date: _____

STACK NUMBER	HONEY-WELL NUMBER	LUDLUM READING (CPM)	SCALE SETTING	STACK ALARM SET POINT	STACK ALARM AUDIO CHECK	LUDLUM DETECTOR		HONEYWELL		PRINTER		LIGHTS TEST			SYSTEM POWER ON
						POWER ON	BATTERY CHECK	ALARM CHECK	TROUBLE CHECK	POWER ON	RESPONSE CHECK	LOW FLOW	HIGH FLOW	ALARM	
G5-247	13201														
G5-248	13202														
G5-249	13203														
G5-250	13204														
G5-251	13301														
G5-254	13302														
G2-87	13401														
G5-258	13303														
G5-259	13304														
G5-260															
G5-261															
G5A-100	13402														
G55E-100	13403														
G9N1-1039															

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3	General Supervisor
4	Health & Safety Instrumentation

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Figure K-3. Ludlum Radiation Stack Monitor Inspection Report Form (sheet 2 of 2)

FMPC
OPERATIONS SAFETY & HEALTH DEPARTMENT - RADIOLOGICAL SAFETY
FINAL STACK SAMPLER RESULTS

Date: _____

PLANT NUMBER	COLLECTOR NUMBER	FILTER NUMBER	FILTER DATES		* CHANGE CODE	SAMPLE COLLECTED BY	TOTAL URANIUM (mg)	FINAL LOSS (kg U)	RESULTS CALCULATED BY	REVIEWED BY
			ON	OFF						

* CHANGE CODE:
1. Filter changed as a result of a routine inspection.
2. Filter changed at the request of plant supervision.

NOTIFICATION OF STACK RESULTS			
PLANT NUMBER	SUPERVISOR NOTIFIED	TIME	NOTIFIED BY

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Figure K-4. Final Stack Sampler Results Form

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ENVIRONMENT, SAFETY & HEALTH - ENVIRONMENT & RADIOLOGICAL MONITORING

DUST COLLECTOR STACK SAMPLING LOG

Plant: _____ Collector No.: _____ Conversion Factor: _____

FILTER NUMBER	SAMPLING DATA				ANALYTICAL RESULTS				NOTES
	ON		OFF		Total mg U In Sample	U Exh (kg)	Total mg Particulate On Sample	Particulate Exh. (kg)	
	Date	Rate	Date	Rate					

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Figure K-5. Dust Collector Stack Sampling Log Form

TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Parameter	Container	Preservative	Permissible Sample Type
Radiological Samples			
Gross Alpha	1,000 ml plastic or glass	None	G or C
Gross Beta	1,000 ml plastic or glass	None	G or C
Radium-226	1,000 ml plastic or glass	None	G or C
Radium-228	1,000 ml plastic or glass	None	G or C
Strontium-99	1,000 ml plastic or glass	None	G or C
Technetium	1,000 ml plastic or glass	None	G or C
Cesium-137 Gamma Spec	1,000 ml plastic or glass	None	G or C
Ruthenium-106	1,000 ml plastic or glass	None	G or C
Plutonium, Isotopic	1,000 ml plastic or glass	None	G or C
Neptunium	1,000 ml plastic or glass	None	G or C
Thorium, Total	1,000 ml plastic or glass	None	G or C
Thorium, Isotopic	1,000 ml plastic or glass	None	G or C
Uranium, Total	1,000 ml plastic or glass	None	G or C
Uranium, Isotopic	1,000 ml plastic or glass	None	G or C
Concentrated Waste Samples			
Organic Compounds[A]	8-oz. widemouth glass with Teflon liner	None	G or C
Metals and Other[A] Inorganic Compounds	8-oz. widemouth glass with Teflon liner	None	G or C
EP Toxicity[B]	8-oz. widemouth glass with Teflon liner	None	G or C
TCLP	500-ml amber glass with Teflon lined lid	Cool, 4°C	G or C
Flash Point and/or[B] Heat Content	8-oz. widemouth glass with Teflon liner	None	G
Fish Samples			
Organic Compounds[A]	Wrap in aluminum foil	Freeze	G or C
Metals and Other[A] Inorganic Compounds	Place in plastic ziplock bag	Freeze	G or C

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TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Liquid - Low to Medium Concentration Samples			
Alkalinity[C]	1-liter polyethylene[1] with polyethylene or polyethylene lined closure	Cool, 4°C	G or C
Acidity[C]	500-ml or 1-liter poly-[1] ethylene with polyethy-lene or polyethylene lined closure	Cool, 4°C	G or C
Ammonia	1-liter polyethylene[1] with polyethylene or polyethylene lined closure	Cool, 4°C H_2SO_4 to pH < 2	G or C
Bacteriological[C]	250-ml glass with glass closure or plastic capable of being autoclaved	Cool, 4°C	G
Static Bioassay[D]	1-gal. amber glass (not solvent rinsed)	Cool, 4°C	G or C
Biochemical Oxygen[C] Demand (BOD)	1/2-gal. polyethylene[1] with polyethylene closure	Cool, 4°C	G or C
Chloride[C]	500-ml or 1-liter poly-[1] ethylene with polyethy-lene or polyethylene or polyethylene lined closure	None	G or C
Chlorine Residual[C]	In-situ, beaker or bucket	None	G
Color[C]	500-ml or 1-liter poly-[1] ethylene with polethy-lene or polyethylene line closure	Cool, 4°C	G or C
Conductivity[C]	500-ml or 1-liter poly-[1] ethylene with polyethy-lene or polyethylene lined closure	Cool, 4°C	G or C

TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Liquid - Low to Medium Concentration Samples (cont.)			
Chromium, Hexavalent[C]	1-liter polythylene with polyethylene closure	Cool, 4°C	G
Cyanide[C]	1-liter or 1/2 gallon polyethylene with polyethylene or polyethylene lined closure	Ascorbic Acid[2,3] Sodium Hydroxide, pH >12 Cool, 4°C	G
Dissolved Oxygen[C] (Probe)	In-situ, beaker or bucket	None	G
Dissolved Oxygen[C] (Winkler)	300-ml glass, BOD bottle	Fix on site, store in dark	G
EP Toxicity[B]	1-gal. glass (amber) with Teflon liner	Cool, 4°C	G or C
Fluoride[C]	500-ml or 1-liter polyethylene with polyethylene or polyethylene lined closure	None	G or C
Hardness[C]	500-ml or 1-liter polyethylene with polyethylene or polyethylene lined closure	50% Nitric[2] Acid, pH <2	G or C
LAS[C]	500-ml or 1-liter polyethylene with polyethylene or polyethylene lined closure	Cool, 4°C	G or C
Metals[C]	1-liter polyethylene with polyethylene lined closure	50% Nitric[2] Acid, pH <2	G or C
Metals, Dissolved[C]	1-liter polyethylene with polyethylene lined closure	Filter-on-site[2] 50% Nitric Acid, pH <2	G

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TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Liquid - Low to Medium Concentration Samples (cont.)			
Nutrients[4]	1-liter polyethylene or 1/2-gal. polyethylene with polyethylene or polyethylene lined closure	50% Sulfuric[2] Acid, pH <2 Cool, 4°C	G or C
Oil and Grease[C]	1-liter widemouth glass with Teflon liner	50% Sulfuric[2] Acid, pH <2 Cool, 4°C	G
Organic Compounds -[C] Extractable and Pesticide Scan			
No Residual Chlorine[C] Present	1-gal. amber glass or 2 1/2-gal. amber glass with Teflon liner	Cool, 4°C	G or C
Residual Chlorine[C] Present	1-gal. amber glass or 2 1/2-gal. amber glass with Teflon liner	Add 3 ml 10% sodium thiosulfate per gallon Cool, 4°C	G or C
Organic Compounds - Purgeable (Volatile Organic Analysis)			
No Residual Chlorine[C] Present	2 40-ml vials with Teflon lined septum caps	4 drops conc. hydrochloric acid, Cool, 4°C	G
No Residual Chlorine[C] Present	2 40-ml vials with Teflon lined septum caps	Cool, 4°C	G
Residual Chlorine[C] Present	2 40-ml vials with Teflon lined septum caps	Footnote 6	G
Organic Compounds -[C] Specified and Pesticides (non-Priority Pollutants such as Herbicides)	1-gal. glass (amber) or 2 1/2-gal. glass (amber) with Teflon lined closure	Footnote 7	G or C

TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Liquid - Low to Medium Concentration Samples (cont.)			
Organic Halogens -[E] Total (TOX)	250-ml amber glass with Teflon lined septum closure	Cool, 4°C	G
pH[C]	In-situ, beaker or bucket	None	G
Phenols[C]	1-liter amber glass with Teflon lined closure	50% Sulfuric Acid, pH <2 Cool, 4°C	G
Phosphate-Ortho[C]	500-ml or 1-liter polyethylene with polethylene or polyethylene lined closure	Filter-on-site Cool, 4°C	G
Phosphorus, Total[C] Dissolved	500-ml or 1-liter polyethylene with polyethylene or polyethylene lined closure	Filter-on-site 50% Sulfuric Acid, pH <2 Cool, 4°C	G
Solids, Settleable[C]	1/2-gal. polyethylene with polyethylene closure	Cool, 4°C	G or C
Solids (Total and[C] Suspended, etc.)	500-ml or 1-liter poly-[1] ethylene with polyethylene or polyethylene lined closure	Cool, 4°C	G or C
Sulfates[C]	500-ml or 1-liter poly-[1] ethylene with polyethylene or polyethylene lined closurer	Cool, 4°C	G or C
Sulfides[C]	500-ml or 1-liter poly-[2] ethylene with polyethylene or polyethylene lined closure	2 ml Zinc Acetate[2] Conc. Sodium Hydroxide to pH >9 Cool, 4°C	G

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TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Liquid - Low to Medium Concentration Samples (cont.)			
Temperature[C]	In-situ, beaker or bucket	None	G
Total Dissolved Solids	1000-ml polyethylene[1] with polyethylene or polyethylene lined closure	None	G or C
Soil, Sediment, or Sludge Samples - Low to Medium Concentration			
Turbidity[C]	500-ml or 1-liter poly-[1] ethylene with polethy-lene or polyethylene lined closure	Cool, 4°C	G or C
Cation Exchange Capacity	1000-ml polyethylene[1] with polyethylene or polyethylene lined closure	Cool, 4°C	G or C
E.P. Toxicity[B]	8-oz. widemouth glass with Teflon® lined closure	Cool, 4°C	G or C
Metals[A]	8-oz. widemouth glass with Teflon® lined closure	Cool, 4°C	G or C
Nutrients Including[A] Nitrogen, Phosphorus, Chemical Oxygen Demand	500-ml polyethylene with polyethylene closure or 8 oz. widemouth glass with Teflon lined closure	Cool, 4°C	G or C
Total Petroleum Hydrocarbons	1000-ml glass with Teflon lined closure	Cool, 4°C HCl to pH < 2	G or C
Organics -[A] Extractable	8-oz. widemouth glass with Teflon liner	Cool, 4°C	G or C
Organics -[A] Purgeable (VOA)	4-oz. (120 ml) widemouth glass with Teflon liner	Cool, 4°C	G or C

TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.)

Parameter	Container	Preservative	Permissible Sample Type
Soil, Sediment, or Sludge Samples - Low to Medium Concentration (cont.)			
Other Inorganic[A] Compounds Including Cyanide	500-ml polyethylene with polyethylene closure or 8-oz. wide-mouth glass with Teflon lined closure	Cool, 4°C	G or C
TCLP	500-ml amber glass wide-mouth with Teflon lined closure 4-oz glass with Teflon lined closure for VOC	Cool, 4°C	G or C
Total Petroleum Hydrocarbons	500-ml glass with Teflon lined closure	Cool, 4°C	G or C

Notes

1. Use indicated container for single parameter requests, 1/2 gallon polyethylene container for multiple parameter requests except those including BOD, or 1-gallon polyethylene container for multiple parameter request which include BOD.

2. Must be preserved in the field at time of collection.

3. Use ascorbic acid only if the sample contains residual chlorine. Test a drop of sample with potassium iodide-starch test paper; a blue color indicates need for treatment. Add ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.6 g of ascorbic acid for each liter of sample volume.

4. May include nitrogen series (ammonia, total Kjeldahl nitrogen, nitrate-nitrite), total phosphorus, ;chemical oxygen demand and total organic carbon.

5. Samples must be extracted within seven days and extract must be analyzed within 40 days.

6. Collect the sample in a 4 oz. soil VOA container which has been pre-preserved with four drops of 10 percent sodium thiosulfate solution. Gently mix the sample and transfer to a 40 ml VOA vial that has been pre-preserved with four drops concentrated HC1, cool to 4°C.

7. See Organic Compounds - Extractable (page ?). The Analytical Support Branch should be consulted for any special organic compound analyses in order to check on special preservation requirements and or extra sample volume.

TABLE K-1. SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS (cont.) 2375

Abbreviations

G = Grab
C = Composite
ASAP = As Soon As Possible
NS = Not Specified
VOA = Volatile Organic Compound

References

A. US-EPA, Region IV, Environmental Services Division, "Analytical Support Branch, Operations and Quality Control Manual," June 1, 1985 or latest version.

B. EPA Method 1310, Extraction Procedures, "SW 846," US-EPA, Office of Solid Wastes, Washington, DC, 1982.

C. 40 CFR Part 136, Federal Register, Vol, 49, No. 209, October 26, 1984.

D. US-EPA, Region IV, Environmental Services Division, "Ecological Support Branch, Standard Operating Procedures Manual," latest version.

EPA Interim Method 450.1, "Total Organic Halide" US-EPA, ORD, EMSL, Physical and Chemical Method Branch, Cincinnati, Ohio, November, 1980.

TABLE K-2. REPORTABLE QUANTITIES FOR CLASSIFICATION AS A HAZARDOUS MATERIAL

Reportable Quantity (pounds/kilograms)	Concentration by Weight (percent)	Parts per Million (PPM)
5,000 (2270)	10	100,000
1,000 (454)	2	20,000
100 (45.4)	0.2	2,000
10 (4.54)	0.02	200
1 (0.454)	0.002	20

TABLE K-3. ALLOWABLE SHIPPING QUANTITIES FOR URANIUM DECAY SERIES RADIONUCLIDES

A_1 AND A_2 QUANTITIES FOR RADIONUCLIDES OF THE URANIUM DECAY SERIES

Isotope	Atomic Number	Decay	Half-Life[1]	Quantity in Curies A1	A2
U-238	92	Alpha	4.5×10^9 y	Unlimited	
Th-234	90	Beta	24 d	10	
U-234	92	Alpha	2.5×10^5 y	100	0.1
Th-230	90	Alpha	7.5×10^4 y	3	0.003
Ra-226	88	Alpha	1622 y	10	0.05
Rn-222	86	Alpha	3.8 d	10	2.0
Pb-210	82	Beta	22 y	100	0.2
Bi-210	83	Beta	5 d	100	4.0
Po-210	84	Alpha	138 d	200	0.2

1. y = years
   d = days

TABLE K-4. LOW SPECIFIC ACTIVITY CONCENTRATION LIMITS FOR RADIONUCLIDES OF THE URANIUM DECAY SERIES

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Nuclide	A2 Value (curies)	Estimated Average Concentration (microcuries/gram)	Estimated Average Concentration (curies/kilogram)
Th-230	0.003	0.1	0.0001
Ra-226	0.05	0.1	0.0001
Rn-222	2.0	300	0.3
Pb-210	0.2	5.0	0.005
Bi-210	4.0	300	0.3
Po-210	0.2	5.0	0.005

TABLE K-5. LABEL SELECTION

Transport Index (T.I.) Category	Radiation Level at Package Surface (RL)	Fissile Criteria	Label Category[1]
N/A	RL < 0.5 Millirem Per Hour (MREM/H)	Fissile Class I Only, No Fissile Class II or III	White - 1
T.I. < 1.0	.05 MREM/H < RL < 50 MREM/H	Fissile Class I, Fissile Class II with a T.I. < 1.0, No Fissile Class III	Yellow - 11
1.0 < T.I.	50 MREM/H	Fissile Class II with a T.I. < 1.0, Fissile Class III	Yellow - 111

Note

1. Any package containing a highway-route-controlled quantity (49 CFR 173.403) shall be labeled "Radioactive Yellow."

APPENDIX L

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APPENDIX L

ANALYTICAL METHODS

L.1 INTRODUCTION

This appendix presents the general laboratory quality control procedures and components that laboratories performing under this QAPjP will be required to meet. Specific laboratory analytical methods for each analyte, by matrix (soil, sediment, air, water, biota) are included in the FEMP Laboratory Analytical Methods Manual.

The methods manual is a compilation of standardized analytical methods, identified to date, which will be used by the FEMP. As new analytical requirements are identified at the FEMP, additional methods will be added to the methods manual.

The following field methods for determining properties of natural waters at ASL A are provided in Appendix K.

- Ph
- Temperature
- Specific conductance
- Alkalinity
- Redox potential (Eh)
- Dissolved oxygen content

L.2 GENERAL LABORATORY REQUIREMENTS

L.2.1 Purpose

These general laboratory requirements define quality control procedures and components that are mandatory for performance of analyses and to identify quality control information that shall be generated with the analytical data. Certain activities in an integrated program to generate quality data can be classified as management (quality assurance) and others as functional (quality control). The presentation given here is an overview of the FEMP program, which laboratories generating analytical data under this document must meet.

L.2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decision making. Because they are based on end uses of the data collected, different uses may require different levels of data quality.

Analytical Support Levels (ASLs) are defined in Section 2 of this QAPjP. There are five levels, A through E. Differences in ASLs relate to the level of quality control implemented throughout the collection and analytical process. Table L.2-1 is a summary of the Quality Control (QC) requirements for ASLs B, C, and D.

L.2.3 Data Package Deliverables

Different ASLs require differing amounts of supporting data to support sample results. Table L.2-2 is a summary of deliverables.

L.2.4 Quality Control Samples

QC samples shall be scheduled with all batches of samples analyzed for a given matrix and a given parameter. Following are general considerations concerning types, frequency, and acceptance criteria. Specific requirements for control samples for each parameter and appropriate corrective actions are addressed in the Standard Operating Procedure (SOP) for that parameter.

L.2.4.1 <u>**Method Blank**</u>**.** The method blank (e.g., reagent blank, preparation blank) consists of a de-ionized (or distilled) water sample prepared in exactly the same manner as the samples (i.e., extraction, digestion, distillation). Water for method blanks shall meet ASTM Type II water standards. (The method blank is also known as a preparation blank or a reagent blank.)

NOTE

A batch is defined as 20 samples.

A method blank shall be prepared with each batch of samples or fraction thereof. For some projects or levels of QC, the method blank frequency may vary.

For more specific information on blank compliance criteria, refer to the specific method. Method blanks shall be analyzed at the frequency specified in Table L.2-1 (for ASL C and D), or in the project specific plans.

L.2.4.2 Laboratory Control Samples. Laboratory Control Samples (LCS) (e.g., reference standards) consist of a spike of a selected target analyte into a controlled matrix. The spiking concentration shall be well within the calibration range of the procedure. The purpose is to measure laboratory accuracy for the total analytical system. The LCS shall be processed through the preparation and analysis steps in the same manner as samples. (The LCS may also be called a method blank/spike.)

The LCS for liquid samples can be prepared from EPA reference samples or from verified analytical standards used to calibrate the instrument or titrant. Preferably, the LCS for solids shall be a QC material supplied by EPA if available.

The LCS shall be analyzed at the frequency specified in Table L.2-1 (for ASL C and D), or in the project specific plan. The LCS frequency will vary based on the method and the ASL.

LCS data for a selected analyte shall be statistically summarized and processed on control charts. Acceptance criteria will be determined from this summary. Acceptance criteria for the LCS will be $\pm$ 3 standard deviations from the mean.

If an LCS in an analytical run exceeds the acceptance criteria, the procedure shall be examined, affected instruments recalibrated, and the LCS re-analyzed. If, upon re-analysis, the LCS still exceeds the limit, the analysis is out of control. A Corrective Action Report (CAR) (Figure B-3) shall be initiated to discuss reasons for the problem and corrective actions taken to regain control. The associated batch of samples and another LCS shall be re-prepped and re-analyzed.

L.2.4.3 Duplicate Samples. Duplicate samples are identical aliquots of a sample analyzed separately, but concurrently. They are used to evaluate precision of an analysis. Duplicates shall be analyzed at the frequency specified in Table L.2-1 for ASL C and D. For some specific projects or levels of QC, the required frequency of duplicates may vary, and will be described in the project specific plan.

Precision is calculated as Relative Percent Difference (RPD) as given in equation (1).

$$RPD = \frac{|D_1 - D_2|}{D_1 + D_2} \times 200$$

Eq. (1)

Where:

D_1 = Sample Result

D_2 = Duplicate Sample Result

Duplicate data shall be statistically summarized and processed on control charts. Acceptance criteria are determined from this summary. Acceptance criteria for duplicates shall be + 3 standard deviations from the mean RPD.

If a duplicate RPD in an analytical run exceeds the acceptance criteria, the procedure shall be examined. Actions could include acceptance of results, or instrument recalibration and reanalysis. A Corrective Action Report (CAR) (Figure B-3) may be initiated to discuss reasons for the problem and corrective actions taken to regain control.

L.2.4.4 Matrix Spikes. A Matrix Spike (MS) consists of a known amount of the analytes added to a sample. Spikes measure accuracy of an analysis. Specified frequencies for MS/MSD samples at ASL C and D are shown in Table L.2-1. For some projects or levels of QC, the required frequency of matrix spikes may vary, and will be described in the project specific plan.

Accuracy is calculated as Percent Recovery (% R) as given in equation (2).

$$\% R = \frac{SSR - SR}{SA} \times 100$$

Eq. (2)

Where:

SSR = Spiked Sample Result

SR = Sample Result

SA = Spike Added

The MS data shall be statistically summarized and processed on control charts. Acceptance criteria are determined from this summary. Acceptance criteria for duplicates shall be $\pm$ 3 standard deviations from the mean % R.

If an MS in an analytical run exceeds the acceptance criteria, the procedure shall be examined, instruments recalibrated, and the MS re-analyzed. If, upon re-analysis, the MS still exceeds the limit, the analysis is out of control. A CAR may be initiated to determine reasons for the problem and corrective actions taken to regain control.

L.2.4.5 Matrix Spike Duplicates. The Matrix Spike Duplicate (MSD) is a matrix spike repeated and is run along with a matrix spike (MS). MSDs may be run in place of a duplicate for some analytes. The MSD measures precision and accuracy of an analysis.

Specified frequencies for MS/MSD samples at ASL C and D are shown in Table L.2-1. For some projects or levels of QC, the required frequency of matrix spikes may vary, and will be described in the project specific plan.

The MS/MSD data shall be statistically summarized and processed on control charts. They are calculated as both duplicates and spikes, yielding an RPD and a % R.

L.2.4.6 Surrogates. Surrogates are compounds that are similar in analytical behavior to target analytes and are not subject to method or matrix interferences. Surrogates are used in organic and some radionuclide analyses to monitor system performance.

L.2.5 Calibration/Standardization Samples

For Titrimetric procedures, the titrant shall be standardized against a primary standard. For some procedures, instruments shall be calibrated using standard solutions. For other procedures, an analytical curve based on absorbance or other measured characteristic of known standards shall be established. This initial calibration curve shall meet the acceptance criteria for the method. Actual techniques and criteria for calibration will be defined in the SOP for each particular method.

Following are some examples of samples used in calibration procedures.

1. Initial Calibration Verification Sample - The Initial Calibration Verification Sample (ICVS) is a sample of known concentration used to verify calibration of the standard curve. This sample shall be from a source different from the calibration standards. The ICVS shall be run immediately after the calibration standards and evaluated. The ICVS is evaluated as % R using equation 3.

$$\% R = \frac{OV}{TV} \times 100$$

Equation 3

Where:

OV = Observed Value for ICVS

TV = True Value of ICVS

The allowable range for each analyte is stated in the SOP for that analyte. If an ICVS in an analytical run exceeds the acceptance range, the analytical run is out of control and the analyst shall stop the run. The procedure shall be examined, affected instruments recalibrated, and the ICVS re-analyzed. A new curve made with fresh calibration standards may have to be generated. The analytical run cannot proceed until the standard curve is verified by an ICVS within the acceptable control limits. A CAR shall be initiated to discuss reasons for the problem and corrective actions taken to regain control.

For analytical procedures that do not use a standard curve, the ICVS equivalent will be addressed in the SOP for that procedure.

2. Continuing Calibration Verification Sample - The Continuing Calibration Verification Sample (CCVS) is an analytical standard run to verify continued calibration of the analytical system. This sample shall be at mid-range of the calibration curve and may be a calibration standard or a rerun of the ICVS. The same CCVS shall be used throughout the run. The CCVS is evaluated as % R using the same formula used for the ICVS.

The allowable range and required frequency for each analyte is stated in the method for that analyte. If a CCVS in an analytical run exceeds the acceptance range, the analytical run is out of control and the analyst shall stop the run. The procedure shall be examined and affected instruments recalibrated and calibration verified. Samples run since the last acceptable CCVS shall be re-analyzed. A CAR shall be initiated to discuss reasons for the problem and corrective actions taken to regain control.

For analytical procedures that do not use a standard curve, the CCVS equivalent will be addressed in the SOP for that procedure.

L.2.6 Documentation of Quality Control Data

Quality control data shall be summarized and processed statistically in the form of control charts. These shall be available for easy review by analysts, supervisors, QC personnel, auditors, and laboratory management. Additionally, CARs shall be maintained in organized files for easy reference.

L.2.7 Method Detection Limits

Method detection limits shall be determined and validated by the EPA procedure or equivalent.

L.2.7.1 Procedure. Method Detection Limits (MDL) are determined/verified according to EPA procedures given in 40 CFR Part 136, Appendix B or equivalent. The procedure consists of spiking seven replicate spikes into either a sample or control matrix at a concentration of 1 to 5 times the estimated detection limit. The spiked matrix replicates shall be carried through sample extraction, distillation, or other preparation steps in the same manner as samples. The MDL is calculated by multiplying the standard deviation from spiking results (in concentration units) by 3.143. Estimated detection limits obtained by this method shall be considered the minimum MDL.

L.2.7.2 Interpretation. The reporting limit is the minimum concentration of a substance that will be reported. Reporting limits are considered to be valid if the calculated MDL is less than the reporting limit. The associated error at the MDL can be as high as $\pm$ 100 percent. Therefore, a standard at this concentration shall not be used to establish a calibration curve. A standard at this concentration or at the reporting limit concentration

shall be analyzed to verify capability of the instrument to detect the analyte at the reporting limit.

L.2.8 Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true value. Accuracy is measured by results of spiked samples and LCSs. As data is acquired for QC samples, statistically generated acceptance ranges are defined and regularly updated as additional data is acquired.

L.2.9 Precision

Precision is defined as the measurement of agreement of a set of replicate results without assumption of prior information as to the true result. Precision is measured by results of analysis of duplicate or MS/MSD samples. As data are acquired for QC samples, statistically generated acceptance ranges are defined and regularly updated as additional data is acquired.

L.2.10 Corrective Actions

Corrective action procedures for out-of-control conditions are the responsibility of the analyst. Failure to achieve initial calibration may indicate instrument maintenance is needed. Initial calibration failure may also indicate the need for preparing new analytical standards or investigation of other possible errors in the procedure.

Failure to achieve acceptable recovery on the LCS indicates problems with performance of sample preparation procedures. Corrective actions shall be initiated and samples associated with the LCS shall be re-prepped and re-analyzed until an acceptable LCS is acquired.

Repeated failure to achieve method blank criteria indicates a problem with laboratory contamination. Sample analysis shall stop until the source of contamination is located and corrected.

Poor MS, MSD, or duplicate precision may indicate matrix interference problems or poor sampling precision of the sample matrix. Soils are especially complex in nature. The MS/MSD/duplicate data shall be reviewed for possible reasons for poor performance. Both accuracy and precision shall be evaluated together to provide possible clues to poor performance. Dilution analyses and standard addition procedures can often provide valuable data related to matrix complexity.

Investigations, detected problems, and resolutions shall be documented in CARs. CARs shall be reviewed by the laboratory QC supervisor. Unresolved problems with QC data shall be carefully evaluated and documented in the case narrative or cover letter to the client.

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L.2.11 Data Management

The Data Management Plan in Appendix F provides requirements for managing and maintaining data.

L.2.12 Data Review

L.2.12.1 Quality Control Data. Data acquired for samples shall be reviewed and validated against QC data acquired during sample analysis. The following items shall be checked against acceptance criteria as they apply to analysis of a particular parameter.

- Initial calibration
- ICVS
- CCVS
- Instrument blanks
- Method blanks
- LCS results
- QC check sample results
- Matrix spike results
- Duplicate or MSD results
- Acceptable frequency of QC samples
- Calculations verified
- Significant figures and reporting units verified
- Holding time compliance

L.2.12.2 Data Review and Verification. The division managers, supervisor, or an analyst not involved in the original analysis shall next review data and shall have the following responsibilities.

- Evaluate data completely

- Initiate investigation of apparent discrepancies
- Initiate corrective actions
- Bring problems to attention of original analyst

NOTE

Under no circumstances shall an analyst or a data-entry person enter results from a bench sheet or analytical notebook that has not been reviewed and signed.

Data shall be entered within 24 hours of completion of the review. After data is entered, the person responsible for entry shall sign and date the bench sheet or analytical notebook.

L.2.12.3 Out-of-Control Events. The analyst, peer reviewer, supervisor, laboratory QC officer, or division manager may initiate investigation into out-of-control events or other problems detected during data validation and reporting. CARs may be filed by any one of these persons. The original CAR shall be filed in the laboratory and copies sent to proper personnel for action.

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Table L.2-1. QUALITY CONTROL REQUIREMENTS

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
INORGANICS			
Field blanks	A/S	1 per 20 or 1 per sampling event, whichever is more frequent	1 per 20 or 1 per sampling event, whichever is more frequent
Equipment Rinsate Blanks	A/S	1 per 20 or 1 per sampling event, whichever is more frequent	1 per 20 or 1 per sampling event, whichever is more frequent
Field Duplicates	A/S	1 per 20 or 1 per sampling event, whichever is more, frequent	1 per 20 or 1 per sampling event, whichever is more, frequent
Preservative Blanks	A/S	1 per preserved parameter per sampling event	1 per preserved parameter per sampling event
Container Blanks	A/S	1 per QC lot of containers	1 per QC lot of containers
Laboratory Control Samples (LCSs)	A/S	1 per analytical batch, if applicable	1 per analytical batch, if applicable
Method Blanks	A/S	1 per analytical batch of samples	1 per analytical batch of samples
Matrix Spikes	A/S	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method

Table L.2-1. QUALITY CONTROL REQUIREMENTS (cont.)

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
Duplicate Samples	A/S	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method
Interference Check	A/S	1 per analytical batch per matrix	1 per analytical batch per matrix
Dilution Check	A/S	1 per analytical batch per matrix	1 per analytical batch per matrix
Initial Calibration	As required by method	As required by method	As required by method
Continuing Calibration	A/S	As required by method	As required by method
ORGANICS			
Field Blanks	A/S	1 per 20 or 1 per sampling event, whichever is more frequent	1 per 20 or 1 per sampling event, whichever is more frequent
Equipment Rinsate Blanks	A/S	1 per 20 or 1 per sampling event, whichever is more frequent	1 per 20 or 1 per sampling event, whichever is more frequent
Field Duplicates	A/S	1 per 20 or 1 per sampling event, whichever is more frequent	1 per 20 or 1 per sampling event, whichever is more frequent
Trip Blanks (VOAs)	A/S	1 per shipping container	1 per shipping container
Preservative Blanks	A/S	1 per preserved parameter per sampling event	1 per preserved parameter per sampling event
Container Blanks	A/S	1 per QC lot of containers	1 per QC lot of

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Table L.2-1. QUALITY CONTROL REQUIREMENTS (cont.)

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
Method (Reagent) Blanks	A/S	1 per analytical batch of samples	1 per analytical batch of samples
Matrix Spikes (MS)	A/S	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method
Matrix Spike Duplicates (MSD)	A/S	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method	1 per 20 samples or 1 per analytical batch, whichever is more frequent (per matrix), if applicable to the method
Surrogates	A/S	Present in every determination	Present in every determination
DFTPP and BFB Performance Results	Daily	Once every 12 hours	Once every 12 hours
Internal Standard (GC/MS)	A/S	In every determination	In every determination
Performance Evaluation Standard (Pesticides/PCBs)	A/S	1 per 10 samples	1 per 10 samples
Initial Calibration	As required by method	As required by method	As required by method
Continuing Calibration	As required by method	As required by method	As required by method
2nd Column Confirmation (GC Analyses)	A/S	For all positive hits	For all positive hits

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A/S = As specified in method or project

Table L.2-2. DATA PACKAGE DELIVERABLES

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
Methods	Yes	Yes	Yes
Detection Limits	Yes	Yes	Yes
Sample Cross Reference	Yes	Yes	Yes
Date of Collection	Yes	Yes	Yes
Date of Receipt	Yes	Yes	Yes
Preparation or Extraction Date	Yes	Yes	Yes
Analysis Date	Yes	Yes	Yes
Copy of COC	A/S	Yes	Yes
Case Narrative	A/S	Yes	Yes
INORGANICS			
Sample Results	Yes	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Field Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Equipment Rinsate Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Field Duplicates	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Preservative Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Container Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Laboratory Control Samples (LCSs)	A/S	CLP Form 7 or equivalent	CLP Form 7 or equivalent
Method Blanks	A/S	CLP Form 3 or equivalent	CLP Form 3 or equivalent
Initial/Continuing Cal. Blanks	A/S	CLP Form 3 or equivalent	CLP Form 3 or equivalent

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Table L.2-2. DATA PACKAGE DELIVERABLES (cont.)

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
Matrix Spikes	A/S	CLP Form 5A or equivalent	CLP Form 5A or equivalent
Duplicate Samples	A/S	CLP Form 6 or equivalent	CLP Form 6 or equivalent
Interference Check Samples (ICP)	A/S	CLP Form 4 or equivalent	CLP Form 4 or equivalent
Dilution Check Samples (ICP)	A/S	CLP Form 9 or equivalent	CLP Form 9 or equivalent
Initial Calibration	A/S	CLP Form 2 or equivalent	CLP Form 2 or equivalent
Continuing Calibration	A/S	CLP Form 2 or equivalent	CLP Form 2 or equivalent
ORGANICS			
Sample Results	Yes	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Field Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Equipment Rinsate Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Field Duplicates	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Trip Blanks (VOAs)	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Preservative Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Container Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Method (Reagent) Blanks	A/S	CLP Form 1 or equivalent	CLP Form 1 or equivalent
Method Blank Blanks	A/S	CLP Form 4 or equivalent	CLP Form 4 or equivalent
Matrix Spikes (MS)	A/S	CLP Form 3 or equivalent	CLP Form 3 or equivalent

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Table L.2-2. DATA PACKAGE DELIVERABLES (cont.)

	ANALYTICAL SUPPORT LEVELS		
	B	C	D
Matrix Spike Duplicates (MSD)	A/S	CLP Form 3 or equivalent	CLP Form 3 or equivalent
Surrogates	Yes	CLP Form 2 or equivalent	CLP Form 2 or equivalent
DFTPP and BFB Performance Results	A/S	CLP Form 5 or equivalent	CLP Form 5 or equivalent
Internal Standard (GC/MS)	A/S	CLP Form 8 or equivalent	CLP Form 8 or equivalent
Performance Evaluation Standard (Pesticides/PCBs)	A/S	CLP Form 8 or equivalent	CLP Form 8 or equivalent
Initial Calibration	A/S	CLP Form 6 or equivalent	CLP Form 6 or equivalent
Continuing Calibration	A/S	CLP Form 7 or equivalent	CLP Form 7 or equivalent
2nd Column Confirmation (GC analyses)	A/S	Retention time of hits compared to retention time windows	Retention time of hits compared to retention time windows

A/S = As specified in method or project

CLP = EPA Contract Lab Program Statement of Work for Inorganic Analysis (SOW No. 788) or EPA Contract Lab Program Statement of Work for Organics Analysis (2/88)