

START 9513338 2166

0040996

MANUAL REVISION INSTRUCTIONS (MRI) Date Prepared: March 24, 1995

TO: DEBRA A ISOM
H6-08

0176

Document No.: WHC-CM-7-7 Level: 3

Title: Environmental Investigations and Site Characterization

Release No.: 92 Page 1 of 1

INSTRUCTIONS

1. Remove and/or insert indicated sections into manual as shown below.
2. Update the Revision Record at the front of the manual.
3. Route a copy of the implementation notice to all users of this copy of the manual.
4. Sign this form and return it to Unclassified Document Control.

Section Numbers and Titles	Remove			Insert		
	Pages	REV	Date	Pages	REV	Date
Table of Contents	1 - 4	91	03/17/95	1 - 4	92	03/31/95
Make the following change on Instruction Change Authorization (ICA) #089 (yellow paper, filed in front of EII 5.4 and 6.7): The ICA is only 1 sheet, not 2.						
ADD ICA #095 (blue paper) to EII 5.8, Groundwater Sampling, Rev 3	--	--	--	1 of 1	N/A	03/22/95
EII 11.1, Geophysical Logging	1 - 23	3	06/27/94	1 - 9	4	03/31/95
REMOVE ICA #071 (yellow paper) to EII 11.1, Geophysical Logging	1 of 1	--	05/29/93	--	--	--

If you have any questions about this release contact:
Jean Feaster, 372-2340



Approved for Distribution:	I have entered this release into the manual per the above instructions.
UDC Initials _____	<i>Debra Isom</i> _____
Date _____	Signature _____ Date <i>4/5/95</i>

Please sign, FOLD down to the dotted line, and return within 7 days of receipt.

RETURN TO: Unclassified Document Control MSIN: A4-18 (509) 376-6831
Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352

A-6400-253.1 (06/92) GEF038

PLEASE DO NOT STAPLE OR TAPE

A4-18

START

**THIS PAGE INTENTIONALLY
LEFT BLANK**



9513338.2167

IMPLEMENTATION NOTICE

WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual*
Release No. 92, Effective March 31, 1995

Section: EII 11.1, Geophysical Logging, Rev 4

Procedure revised to:

1. Meet current CM standards.
2. Reduce page count from 23 to 9 pages.
3. Include sodium iodine logging section.
4. Remove the contract logging section used for PNL logging.
5. Include revised form, Borehole Survey Data Sheet.

**THIS PAGE INTENTIONALLY
LEFT BLANK**

Table of Contents

<u>Number</u>	<u>Title</u>	<u>Rev</u>	<u>Effective Date</u>
N/A	Introduction	2	06/27/94
N/A	Quality Assurance Records	0	03/15/93
	PAGE CHANGE 1 (p. 4)		04/05/93
	PAGE CHANGE 2 (pp. 4, 5, 6)		04/19/93
	PAGE CHANGE 3 (pp. 4, 6)		05/24/93
	PAGE CHANGE 4 (pp. 3, 4)		09/07/93
1.0 GENERAL ADMINISTRATIVE REQUIREMENTS			
EII 1.1	Hazardous Waste Site Entry Requirements	3	05/24/93
EII 1.2	Preparing and Revising Procedures	8	12/30/94
EII 1.4	Instruction Change Authorizations	7	02/28/94
EII 1.5	Field Logbooks	5	06/27/94
EII 1.6	Record Processing	4	11/12/93
EII 1.7	Qualification and Training	5	01/13/95
EII 1.9	Primary and Secondary Document Review & Control	2	10/19/92
EII 1.10	Identifying, Evaluating and Documenting Suspect Waste Sites	3	12/22/93
EII 1.12	Performance Audit	1	09/20/93
EII 1.13	Environmental Readiness Review	2	12/29/93
	PAGE CHANGE 1 (p. 3)		04/04/94
	PAGE CHANGE 2 (p. 3)		04/13/94
EII 1.14	Preparation of Descriptions of Work	0	08/10/92
	PAGE CHANGE 1 (p.2)		09/20/93
EII 1.15	Preparation of SOW/LOI	1	01/31/94
EII 1.16	Guidance for Evaluating Unreviewed Safety Questions for Environmental Restoration & Decontamination and Decommissioning Activities	0	05/04/94

Table of Contents

<u>Number</u>	<u>Title</u>	<u>Rev</u>	<u>Effective Date</u>
2.0 HEALTH AND SAFETY			
EII 2.1	Preparation of Site-Specific Health & Safety Plans PAGE CHANGE 1 (p. 2) PAGE CHANGE 2 (pp. 3, 4) PAGE CHANGE 3 (p. 3)	4	04/19/93 06/24/93 09/07/93 09/20/93
EII 2.2	Occupational Health Monitoring	4	03/15/93
3.0 FIELD CHARACTERIZATION			
EII 3.2	Calibration and Control of Monitoring Instruments PAGE CHANGE 1 (p. 5)	4	05/24/93 01/31/94
EII 3.5	Cone Penetrometer	0	01/31/94
4.0 WASTE MANAGEMENT			
EII 4.2	Interim Control of Unknown, Suspected Hazardous and Mixed, and Radioactive Waste PAGE CHANGE 1 (p. 7)	4	01/25/93 10/18/93
EII 4.3	Control of CERCLA and Other Past-Practice Investigation Derived Waste PAGE CHANGE 1 (p. 26) PAGE CHANGE 2 (p. 17)	2	06/24/93 10/18/93 01/31/94
EII 4.4	Control and Storage of Radioactive Materials and Equipment	1	02/28/94
5.0 FIELD SAMPLING			
EII 5.1	Chain of Custody	6	06/27/94
EII 5.2	Soil and Sediment Sampling PAGE CHANGE 1 (pp. 2, 4) PAGE CHANGE 2 (pp. 6, 21)	5	11/12/93 01/31/94 06/27/94
EII 5.3	Biotic Surveying and Sampling PAGE CHANGE 1 (p. 2)	2	10/18/93 05/04/94
EII 5.4	Field Cleaning and/or Decontamination of Equipment PAGE CHANGE 1 (pp. 2, 3) ICA 073 (T) ICA 089 (T)	5	04/05/93 05/24/93 06/25/93 02/08/94

Table of Contents

<u>Number</u>	<u>Title</u>	<u>Rev</u>	<u>Effective Date</u>
EII 5.5	1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment	3	02/28/94
EII 5.7A	Hanford Geotechnical Sample Library Control	4	01/31/94
EII 5.8	Groundwater Sampling	3	03/30/92
	PAGE CHANGE 1 (pp. 2, 7)		05/08/92
	PAGE CHANGE 2 (pp. 14, 16)		07/07/92
	PAGE CHANGE 3 (pp. 3, 8, 9, 11)		10/08/92
	PAGE CHANGE 4 (p. 15)		12/14/92
	PAGE CHANGE 5 (p. 15)		04/05/93
	ICA 074 (T)		08/11/93
	PAGE CHANGE 6 (pp. 2, 4, 5, 6)		01/31/94
EII 5.9	Soil-Gas Sampling	1	05/04/94
EII 5.10	Obtaining Sample Identification Numbers and Accessing HEIS Data	0	12/20/91
EII 5.11	Sample Packaging and Shipping	3	12/14/92
	PAGE CHANGE 1 (p. 3, 6)		04/05/93
	PAGE CHANGE 2 (pp. 3, 7)		01/31/94
6.0 DRILLING			
EII 6.4	Well Services Support	3	06/27/94
EII 6.6	Resource Protection Well Characterization and Evaluation	3	03/17/95
EII 6.7	Documentation of Well Drilling and Completion Operations	4	12/01/93
	ICA 089 (T)		02/08/94
	PAGE CHANGE 1 (p. 2)		04/04/94
	PAGE CHANGE 2 (p. 7)		06/27/94
EII 6.9	Groundwater Well and Borehole Identification and Tracking (No technical impact)	0	06/27/94
EII 6.10	Decommissioning Wells	3	03/17/95
7.0 RESERVED			
8.0 RECLAMATION			
EII 8.3	Remediation of Groundwater Well	2, Change 1	03/17/95

Table of Contents

<u>Number</u>	<u>Title</u>	<u>Rev</u>	<u>Effective Date</u>
9.0 GEOLOGY			
EII 9.1	Geologic Logging PAGE CHANGE 1 (p. 9) ICA 090 (T)	3	03/15/93 05/24/93 02/07/97
10.0 HYDROLOGY			
EII 10.1	Aquifer Testing	5	06/27/94
EII 10.2	Measurement of Groundwater Levels PAGE CHANGE 1 (p. 10)	3	05/04/94 06/27/94
EII 10.3	Purgewater Management	4	10/17/94
EII 10.4	Well Development Activities	2	02/16/93
11.0 GEOPHYSICS			
EII 11.1	<i>Geophysical Logging</i>	4	03/31/95
EII 11.2	Geophysical Survey Work	4	06/27/94
12.0, 13.0 and 14.0 - RESERVED			
14.0 DATA MANAGEMENT			
EII 14.1	Analytical Laboratory Data Management ICA 056 (T) PAGE CHANGE 2 (pp. 3, 5)	0	11/25/91 06/05/92 12/14/92
OTHER			
N/A	Glossary/Acronyms PAGE CHANGE 1 (pp. 9, 18, 19, 20)	4	02/28/94 06/27/94

ICA = INSTRUCTION CHANGE AUTHORIZATION, (P) = PERMANENT (BLUE SHEET), (T) = ONE TIME (GOLDENROD SHEET)

951333B.2170

INSTRUCTION CHANGE AUTHORIZATION		ICA No. 095
Instruction (EII) No. WHC-CM-7-7, EII 5.8, Groundwater Sampling	Rev. No. 3	Page 1 of 1

Description of Change	Approval Designator Q
<p>Dependent on program needs, a modified version of the PNL Groundwater Sample Field Record form may be used in lieu of the Ground Water Sample Report, form A-6000-480. In addition, a modified PNL Chain of Custody/Sample Analysis Order (Request), BD-1200-345(7/94) may be used in lieu of the COC/SAR form specified in EII 5.1.</p>	

One Time Permanent

Justification

Scheduling RCRA/Operational groundwater samples via HEIS does not currently accommodate WHC forms. As soon HEIS is modified to load the WHC forms, this ICA will be canceled and the WHC forms will be used.

No data elements are missed by using the modified PNL forms.

Approvals: (Print/Sign Name and Date)

<p>D. M. Day <u><i>D. M. Day</i></u> ICA Author</p>	<p>3-22-95 Date</p>	<p>D. G. Horton <u><i>D. G. Horton</i></u> ICA Author's Manager</p>	<p>3/22/95 Date</p>
<p>D. G. Horton <u><i>D. G. Horton</i></u> EII Author's Manager</p>	<p>3/22/95 Date</p>	<p>W. R. Thackaberry <u><i>W.R. Thackaberry /telecon</i></u> Quality Assurance (if Required)</p>	<p>3-22-95 Date</p>
<p>N/A</p>	<p>Date</p>	<p>N/R</p>	<p>Date</p>
<p>Other</p>	<p>Date</p>	<p>Safety (if Required)</p>	<p>Date</p>

**THIS PAGE INTENTIONALLY
LEFT BLANK**

Geophysical Logging

1.0 PURPOSE

This Environmental Investigations Instruction (EII) provides the minimum requirements for obtaining borehole geophysical logging data for environmental investigation and site characterization.

2.0 SCOPE

This EII describes the minimum technical requirements for obtaining geophysical logging data. This procedure applies to WHC or its contracted personnel when included in the contract documents.

3.0 DEFINITIONS

See the Glossary/Acronyms Section of this manual.

4.0 RESPONSIBILITIES

4.1 Logging Geophysicist

1. Oversee logging projects, and interface with field team leaders and project scientists/engineers.
2. Review draft remedial investigation plans or other plans involving subsurface investigations, and ensure that logging requirements are included in work plans or contract documents.
3. Prepare logging requirements for inclusion in contract documents (at a minimum, include the requirements of Section 5.2.4 of this EII).
4. Review this EII for applicability to new logging methods as they become available, and implement changes/revisions as required.
5. Prepare new logging procedures for review and approval as new methods become available.

4.2 Logging Technician

1. Maintain and supply the logging equipment in a state of readiness.
2. Monitor equipment performance, and take immediate measures to correct problems.
3. Annually update Radiation Work Permits (RWP), safety documentation, and training and reading requirements.

* This EII has been totally rewritten, therefore, no revision bars were used to denote changes.

Geophysical Logging

4. Stay apprised of changes in access to wells throughout the Hanford Site.
5. Maintain training to the level of Hazardous Waste Site Worker.
6. Ensure that logging and records disposition are performed in accordance with this EII.

5.0 REQUIREMENTS

5.1 Qualifications

The logging geophysicist and logging technician must demonstrate training and qualification to the satisfaction of the cognizant manager. Qualification of personnel shall be documented in accordance with EII 1.7.

5.2 Contract Documents

1. When contracted logging is required for characterization work involving wells or boreholes, the logging geophysicist prepares the logging requirements to be included in or attached to the contract document.
2. The contractor must provide documentation of (and the cognizant manager of Geophysics' Investigations must approve) logging technician training, expertise, and experience.
3. The contractor shall submit logging procedures to the logging geophysicist for approval.
4. The work order/statement of work (SOW) shall be delivered to the contractor two weeks prior to logging and shall contain at least the following requirements:
 - a. Personnel qualifications and training.
 - b. Instrumentation calibration methods.
 - c. Preparation and submittal of logging procedures for WHC approval prior to the start of work.
 - d. Detailed special logging requirements, when applicable.
 - e. Requirements for records maintenance and turnover to WHC.
 - f. List of deliverables, including number of wells and type of data (hardcopy/digital).

5.3 Safety

1. All geophysical logging conducted at active characterization or well construction sites shall comply with applicable site safety plans (e.g., HWOPs) and RWPs.

Geophysical Logging

2. Logging conducted at remote work sites shall be conducted in compliance with the controls outlined in the Hanford Job Hazard Analysis Checklist specific for sitewide geophysical logging.
3. Safety equipment may include steel-toed shoes/boots, hard hat, blue coveralls, leather gloves, eye and hearing protection, and two-way communication.
 - a. Anti-contamination clothing may be required as directed by the RWP regulating the work site, or by the RWP specific to geophysical logging.
 - b. Wells located in the 200 West Area near the 200 West Area Carbon Tetrachloride Expedited Response Action vapor extraction project must be surveyed with an organic vapor monitor (OVM) before being entered.

5.4 Equipment Cleaning/Decontamination

1. **Cleaning:** The logging cable shall be wiped with a 50% mixture of simple green and water and dried as the tool is withdrawn from the well. The tool may be wrapped with plastic sleeving. The cable wipes and sleeving shall be surveyed by a Health Physics Technician (HPT), unless previous arrangements have been made with an HPT. Equipment cleaning shall be documented by signature on the Borehole Survey Data Sheet.
2. **Decontamination:** Decontamination of logging equipment shall be performed and documented in accordance with sections of EII 5.4 appropriate for the equipment being used for the logging work.

6.0 FORMS

Borehole Survey Data Sheet (A-6000-663, Jetform)

7.0 RECORDS

Record processing and disposition shall be performed in accordance with the following table, and according to the details of records processing as described in EII 1.6.

Geophysical Logging

Name Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Borehole Survey Data Sheet (A-6000-663)	QA	TBD	DRS 1.8f	Logging geophysicist transmits completed Borehole Survey Data Sheet to the file custodian (FC). The FC copies the Borehole Survey Data Sheet and files (or transmits the copy to the appropriate file location) the copy in the project file, and transmits a copy to permanent storage per approved RIDS.
Calibration Certificate	QA	TBD	TBD	The original Calibration Certificate will be provided to the FC for transmittal to permanent storage per approved RIDS.
Optical Disks	Record	TBD	TBD	Duplicate optical disks will be provided to the FC and stored in record files.

* QA = Quality Assurance; TBD = To Be Determined

8.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below.

Designated Reviewers

CMPOC

Hanford Technical Services, process owner

STS/HTS

9.0 BIBLIOGRAPHY

American Petroleum Institute (API), 1974, RP 33, Third Edition, *Recommended Practice for Standard Calibration and Format for Nuclear Logs*.

ANSI N4212-1980, *American National Standard Calibration and Usage of Sodium Iodine Detector Systems*.

International Atomic Energy Agency (IAEA), 1982, Technical Reports Series, No. 212, *Borehole Logging for Uranium Exploration*.

WHC-SD-EN-TI-292, *Calibration of the Radionuclide Logging System Germanium Detector*.

WHC-SD-EN-TI-293, *Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools*.

APPENDIX A

SPECTRAL GAMMA-RAY LOGGING

1.0 APPLICABILITY

This appendix describes minimum technical requirements for borehole spectral gamma-ray logging to be performed by WHC. Spectral gamma-ray logs may be used to:

1. Delineate and characterize subsurface lithology.
2. Provide nondestructive, in-situ assays of gamma-ray-emitting nuclides that are present in subsurface lithologic units (using HPGe instrumentation).
3. Provide nondestructive, in-situ relative indications of subsurface lithologic units using scintillator instrumentation.

Instrument field verification and operation instructions presented, conform as much as possible to the *"Recommended Practice for Standard Calibration and Format for Nuclear Logs"* (American Petroleum Institute, 1974), as well as accepted uranium industry standards for spectral gamma-ray logging, *"Borehole Logging for Uranium Exploration"* (International Atomic Energy Agency, 1982).

2.0 DEFINITIONS

2.1 Equipment

Surface and subsurface equipment that operates a borehole detector under conditions of calibration supported configuration as defined on the geophysical logging system configuration.

2.2 Personnel Responsibilities

The logging geophysicist, or a logging technician, operates the logging equipment, ensures that the log data are properly recorded in an interim storage device, and ensures that the log data are transferred to a permanent mass-storage medium.

3.0 PROCEDURES

3.1 Preparations for Logging

3.1.1 Borehole survey data documentation

Use the Borehole Survey Data Sheet (A-6000-663, Jetform) to record pertinent information for each survey conducted.

3.1.2 Completing the Borehole Survey Data Sheet

1. If a particular data field is not applicable to a particular logging session, indicate by entering N/A in that field.
2. Make all log data entries with permanent black ink.
3. Line out corrections with a single line and place the correct entry as close as possible to the incorrect one. Initial and date the correction.
4. The Borehole Survey Data Sheet shall be signed and dated by the individual entering the information.

3.1.3 Calibration

A base calibration of the gamma-ray detection and recording systems is required once a year. The calibration shall be conducted at calibration models under DOE accepted standards (e.g., Hanford, WA, Grand Junction, CO), or other traceable standards of equivalent quality. A calibration is also required when system components are subjected to major repairs or alterations that change performance characteristics. The recalibration shall be completed as soon as practical after the repairs or alterations are completed.

There are two spectral gamma ray detection systems, utilizing the HPGe and NaI types of detectors. These systems require different calibration data analysis, since they provide different quality log data. The NaI detector has significantly poorer energy resolving power than the HPGe detector.

1. The NaI detector based logging systems will be calibrated as described in *Procedures for Calibrating Scintillation Gamma Ray Well Logging Tools Using Hanford Formation Models*, WHC-SD-EN-TI-293, Rev. 0. The collected calibration data will be analyzed in the manner described in the referenced document. Results of the analysis will be written to a page, (hereafter defined as "Calibration Certificate).

The Calibration Certificate, containing the specified instrument calibration results, will contain the following information:

- Unique system calibration configuration (includes the tool identification number and calibration system configuration)
- Date calibration data collected
- Signature by person responsible for calibration analysis and the date of signature
- Equation, values of coefficients, and definition of units
- Energy limits for validity of coefficients

Geophysical Logging

- Electronic file name(s) for archived calibration and analysis data.

The original Calibration Certificate, along with any additional information pertinent to the calibration, will be processed as directed in Section 7.0 of this EII. Copies of the Calibration Certificate will be retained in Geophysics' Investigations' files, and on board the logging system defined in the Calibration Certificate.

2. The HPGe detector based logging systems will be calibrated as described in *Calibration of the Radionuclide Logging System Germanium Detector*, WHC-SD-EN-TI-292, Rev. 0. The collected calibration data will be analyzed in the manner described in the referenced document. Results of the analysis will be written to the Calibration Certificate. The Calibration Certificate for the HPGe instrument will contain the same type of information as listed above for the NaI instrumentation.

3.1.4 Elevation datum

Tool reference zero shall be the top of casing, except at drilling/well construction sites. At these sites, the tool zero reference shall be the estimated ground surface. The method of determining ground surface shall be documented on the Borehole Survey Data Sheet, and subsequent surveys shall use the same method.

1. Casing specifications shall be determined and recorded on the Borehole Survey Data Sheet, and the source shall be provided. At active sites, where ground surface is estimated, the casing stickup shall be recorded.
2. If water is present in the borehole, the level will be determined from top of casing and recorded on the Borehole Survey Data Sheet. If the water level is obtained from another source, the source shall be recorded.
3. Total depth of the borehole shall be recorded along with source of reference.

3.2 Field Operations**3.2.1 Prerequisites**

Boreholes drilled, or existing, in areas where radioactive contaminants are known or suspected to exist in the subsurface shall be checked by swab test prior to logging. The swab shall be surveyed for radioactive contaminants by an HPT.

3.2.2 Equipment setup

1. Position logging truck to access well with logging tool.
2. Swing logging cable suspension boom to rear of truck.
3. Connect logging cable to logging tool.

Geophysical Logging

4. Place logging cable over boom sheave wheel.
5. Suspend logging tool via cable over sheave wheel.

3.2.3 Program startup

1. Start computer logging control program.
2. Enter required information to access "calibration" screen.

3.2.4 Prelogging energy calibration

1. Attach field verifier to logging tool at preselected location.
2. Collect energy-calibration spectra.
3. Execute energy-calibration sequence.
4. Remove field verification source.
5. Adjustments to the logging instrumentation gain settings may be required: a) if the FWHM of the 911KeV peak is greater than 3.2; or b) the low energy detection limit is greater than 60KeV. Observations and adjustments shall be recorded on the Borehole Survey Data Sheet.

3.2.5 Logging

1. Cover logging tool with plastic sleeve (as appropriate).
2. Attach logging tool centralizer when the inside diameter of the casing is greater than 4 inches.
3. Position logging tool over borehole.
4. Position logging tool at "zero" position. (Center of detector is located at depth reference datum.)
5. Enter logging parameters into computer for automated measurement sequence.
6. Position tool and collect spectra.
7. Position tool and relog at least 5 data points using the same acquisition mode and logging parameters as used for the survey.
8. Have cable, tool sleeving, and tool surveyed for radioactivity upon completion of logging in each borehole, unless previous arrangements have been made with an HPT.

Geophysical Logging**3.2.6 Postlogging energy calibration**

Shall be conducted as described above in Section 3.2.4. Any deviations between the pre- and post- calibrations shall be recorded on the Borehole Survey Data Sheet.

3.2.7 Equipment takedown

1. Exit computer logging program.
2. Copy files from computer to optical disk and verify the recording on the optical disk.
3. Record field optical disk number and disk partition used on Borehole Survey Data Sheet.
4. Place logging tool onto the tool rack in truck, disconnect from the cable, and secure.
5. Remove logging cable from boom sheave wheel.
6. Move boom forward to traveling position.

3.3 Logging Activities Conducted Within Surface Contaminated Areas

Movement of logging equipment into and out of surface contaminated areas (SCAs) will be regulated in accordance with guidelines established for vehicle surveys from SCAs. Special instructions pertaining to logging activities in SCAs (e.g., dosimetry, personal protective equipment) are outlined in the RWP regulating geophysical borehole/well logging.

3.4 Records Disposition

When logging is completed, check the Borehole Survey Data Sheet (A-6000-663, Jetform) to ensure that:

1. All information is entered, legible and correct.
2. Abnormalities, observations, and adjustments are recorded in the "Notes" section.
3. Name, signature and date are recorded.

The logging geophysicist processes the logging documentation sheets as specified in Section 7.0 of this EII. The field optical disk will be retained in the logging unit. A copy of the data acquired and processed will be made on a second optical disk. This disk will be retained in Geophysics' Investigations' files. The files will be secured (locked), will be under fire protection conditions, and will have controlled access. As disks are filled, duplicate disks will be processed as described in Section 7.0 of this EII.

**THIS PAGE INTENTIONALLY
LEFT BLANK**