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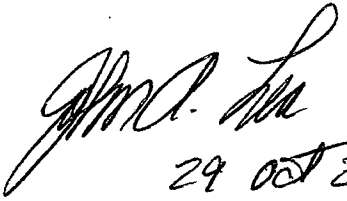
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**PADUCAH**  
Remediation Services  
A Portage Shaw Joint Venture Company

OWNER: ER/EM	PRS-ENR-0034	REV. NO. 0
SUBJECT MATTER AREA: XRF FIELD LAB ANALYSIS OF SOILS	PREPARER: Barry Kinsall	Page 1 of 8
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0	Initial Release.	All

**CAUTION**

Any proposed changes must be processed in accordance with the procedure change control process defined in PRS-DOC-1107 and all changes shall be reviewed by the USQD process and approved by PRS Nuclear/Facility Safety. **IF** this procedure describes specific safety basis requirements for safety significant items used by the Paducah Project, the specific safety basis requirements are noted in this document in the following format: <SB DOCUMENT REFERENCE>.

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**1.0 PURPOSE**

This procedure describes the methods and equipment needed to prepare and analyze samples for the screening of elemental concentrations in soil utilizing X-Ray Fluorescence Spectrometry (XRF).

**2.0 SCOPE**

The requirements of this procedure apply to work performed by Paducah Remediation Services, LLC (PRS) and its subcontractors at the U.S. Department of Energy-owned Paducah Site.

**3.0 CONDITIONS AND LIMITATIONS**

- 3.1.1 Refer to applicable project-specific Activity Hazard Analysis (AHA) for precautions concerning specific hazards that may be encountered and determine Personal Protective Equipment (PPE) requirements
- 3.1.2 XRF equipment use is limited to the following facilities: C-752-C, C-755, and C-762.
- 3.1.3 Preparation and analysis of samples shall be limited to those individuals who have read the required operational material, received hands on training in the XRF analysis of soils, and have been approved by the PRS Field Lab Manager.
- 3.1.4 Sample preparation covered by this procedure does not include the grinding, sieving, or drying of samples and data generated from this analysis should be viewed as equivalent to in-situ analysis. However, samples should not have any visible water prior to analysis.
- 3.1.5 Data collected from the XRF instrument is specifically intended for screening purposes only. However when obtainable values for precision, accuracy, and laboratory-established sensitivity of this method meet project-specific data quality objectives (DOQs), XRF may be considered as a viable option for site characterization.
- 3.1.6 A minimum of 5% of all samples tested by XRF should be confirmed by fixed laboratory analysis.
- 3.1.7 This procedure describes the setup associated with the use of a Niton XRF, however an alternate XRF from a different manufacturer may be used if the instrument provides comparable analysis capabilities and results.
- 3.1.8 This procedure specifically describes the steps required for operation of the XRF within the field laboratory. However, analysis of bagged soil samples is permissible within the field and/or field laboratory providing the user adheres to the manufacturers instructions and specifications.

**4.0 PROCEDURE**

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#### 4.1 Pre-Performance Activities

- |                             |  |
|-----------------------------|--|
| Project Manager or designee | <p><b>4.1.1</b> Coordinate all safety planning activities and obtain appropriate Radiological Work Permits (RWPs) and any other permits required for the location and technical scope of the proposed analysis.</p> <p><b>4.1.2</b> Document field lab personnel HAVE completed all assigned required readings. Required readings should include, at a minimum, AHA, Sampling and Analysis Plan, Health and Safety Plan, Quality Assurance Project Plan, Waste Management Plan, and necessary permits. A copy of any applicable project-specific document shall be available before the onset of any field activities. These documents should be consulted, as necessary, to obtain specific information regarding equipment and supplies, health and safety precautions, sample collection and identification, sample packaging and decontamination.</p> <p><b>4.1.3</b> Document that all field lab personnel have read the latest version of the following procedures before beginning any sampling:</p> <ul style="list-style-type: none"> <li>• PRS-ENM-2700, <i>Logbooks and Data Forms</i></li> <li>• PRS-ENM-2704, <i>Trip, Equipment and Field Blank Preparation</i></li> <li>• PRS-ENM-2708, <i>Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals</i></li> </ul> |
| Field Lab Tech              | <p><b>4.1.4</b> The items listed in this section may be used as a guide, but <u>may not be a complete list</u>. Refer to the task-specific AHA(s) and Work Plan, and the RWP (if one is required), to determine what supplies, materials, and equipment are needed. Check that the following items are available and in good working order, as needed, prior to initiating any XRF analysis.</p> <ul style="list-style-type: none"> <li>• Project-specific documents</li> <li>• Lab book</li> <li>• Indelible black ink pens and markers</li> <li>• PPE</li> <li>• Counter top covers</li> <li>• Kim wipes</li> <li>• Paper towels</li> <li>• Tongue depressors</li> <li>• Polyethylene sample cups</li> <li>• Mylar X-ray window film</li> <li>• Filter paper discs</li> <li>• Cotton balls</li> <li>• Laptop</li> <li>• XRF</li> <li>• Niton XRF data logging software</li> <li>• Manufacturer provided analytical standards</li> <li>• USB cable (10 feet)</li> </ul>   |

#### 4.2 Approvals and Notifications

- |           |  |
|-----------|--|
| Field Lab | <b>4.2.1</b> Notify the project Safety and Health Specialist and Radcon to |
|-----------|--|

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- Manager request and schedule any required support for monitoring during field laboratory activities.
- 4.2.2 Notify Material Disposition personnel of any sample residual or lab waste that requires pick-up and disposal
  - 4.2.3 Restrict access to field laboratory, as necessary. Apply proper signage and entry control boundary markers for areas designated to be Contaminated Areas (CA)
  - 4.2.4 Review RWP and HAZWOPER exclusion zone work records daily for personnel logging/exiting entries
  - 4.2.5 Monitor field lab personnel for application of work control procedures.

#### 4.3 Field Laboratory Access and Contaminated Area Entry – General Steps

- Field Lab Manager 4.3.1 Prior to entering the CA all personnel will sign and date the RWP and HAZWOPER exclusion zone work record. Prior to exiting the mobile lab, time of exiting will be entered.
- 4.3.2 All personnel entering and exiting the CA will don and doff PPE, according to applicable health and safety documents.
- Radcon 4.3.3 All lab equipment, instruments/supplies, and samples should remain within the CA until scanned by Radcon, and deemed uncontaminated.
- 4.3.4 Radcon will take daily readings while the instrument is running to verify the absence of source leaks and to confirm that the instrument is operating within safe limits.

#### 4.4 Field Laboratory Sample Preparation

- Field Lab Technician 4.4.1 Document laboratory analysis information in the appropriate logbook, in accordance with PRS-ENM-2700, Logbooks and Data Forms.
- 4.4.2 Compare sample identification number and requested analysis to corresponding Chain of Custody (COC) for accuracy.
- 4.4.3 Prepare the sample cups by tightly stretching a mylar window film over the bottom of the cup. While keeping the film taut, place the provided Polyethylene ring over the top of the film and the rim of the cup. Snap it into place.
- 4.4.4 Remove all visible debris from the soil prior to collecting sample
- 4.4.5 Using a clean tongue depressor, add debris-free soil to the sample cup (where the inner volume is between the one-half to three-quarters full, at a minimum).
- 4.4.6 Place a pre-cut filter paper disc on top of the soil sample and compress with your gloved finger tip in order to provide a smooth, continuously distributed, surface at the mylar film window/soil interface.
- 4.4.7 Place cotton ball material on top of the filter paper disc in order to fill remaining void space.
- 4.4.8 Place the Polyethylene cap on top of the sample cup, compress the cotton ball material, and snap into place.
- 4.4.9 Label sample cup lid with corresponding sample number.
- 4.4.10 In order to avoid cross contamination, use a clean tongue

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depressor to transfer each soil sample from the sample bag to the prepared Polyethylene sample cup. Also, avoid touching any of the soil sample directly with gloves.

#### 4.5 Field Laboratory Sample Analysis

Field Lab  
Technician

- 4.5.1 Connect the XRF to the XRF benchtop stand in accordance with the manufacturer manual (Niton, 2008). Connect to the laptop, pre-loaded with the Niton data transfer software required for downloading XRF data in real time.
- 4.5.2 The XRF operator shall remain a minimum of 10 feet away from the XRF while it is analyzing in order to prevent the possibility of exposure. In addition, the laptop shall be used at a separation distance of 6 feet to prevent any electrical interference with the XRF analysis and data collection.
- 4.5.3 Prior to using, the XRF will be allowed to warm up for a minimum of 15 minutes.
- 4.5.4 Prior to using, the detector will be calibrated. Low, medium, and high standards as well as instrument and method blanks will be analyzed per manufacturer's instructions to confirm the XRF is operating within the manufacturer's specifications.
- 4.5.5 In the event that readings of standards exceed  $\pm 20\%$  of the true value, the detector will be recalibrated and standards will be reanalyzed per manufacturer's instructions.
- 4.5.6 The instrument blank will be reanalyzed once per 20 samples. Standards will be reanalyzed every 4 hours during the day of operation for Quality Assurance (QA)/Quality Control.

#### 4.6 Post-Performance Activities

Field Lab  
Technician

- 4.6.1 Retain all XRF samples until all samples are analyzed and data has been verified as completed.
- 4.6.2 Dispose of all excess sample media, PPE, analysis waste, and other waste material, as specified by the Waste Management Plan, Statement of Work, or other applicable documents. XRF analysis does not change the physical or chemical state of the sample material thus remaining residual material can be disposed of in the same manner as unanalyzed material.
- 4.6.3 Maintain custody of the samples in accordance with PRS-ENM-2708, *Chain of Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*, and transfer custody of the samples to the designated sample management facility. If applicable, survey out samples per the requirements of the RWP.
- 4.6.4 Record all applicable lab results, observations, and notes within the appropriate logbook(s), in accordance with PRS-ENM-2700, *Logbooks and Data Forms*. Maintain custody of the samples in accordance with PRS-ENM-2708, *Chain of Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*, and transfer custody of the samples to the designated sample management facility.

Radcon

- 4.6.5 If applicable, survey out samples per the requirements of the RWP. Dispose of all excess sample media, PPE, analysis waste,

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- and other waste material, as specified by the Waste Management Plan, Statement of Work, or other applicable documents.
- Field Lab Manager
- 4.6.6** All data generated from the field lab shall be reviewed for accuracy prior to submission to data management.
- 4.6.7** Submit a copy of the COC form and logbook pages and/or electronic copies of the data to the PRS Data Manager for entry into PEMS

## 5.0 RECORDS

- The COC forms and logbooks are project QA records and shall be maintained according to PRS-DOC-1009, *Records Management, Administrative Records, and Document Control*.

## 6.0 SOURCE DOCUMENTS

- Niton Thermoscientific. Sacket and Martin. 1998. EPA Method 6200 and Field Portable X-ray Fluorescence. EON Products, Inc, 2009. Soil Testing with XRF.
- NITON Thermoscientific. 2009. NITON Analyzers Release Notes fro XL3 Test Stand Quick Reference Guide
- EON Products, Inc, 2009. Soil Testing with XRF. DOE. 2008. *Site Evaluation Report for Soil Pile 1 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. DOE/LX/07-0108&D2. U.S. Department of Energy, Paducah, KY, November.
- U.S. Environmental Protection Agency (EPA), February 2007. Method 6200: Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment.



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**Attachments A**  
**DEFINITIONS/ACRONYMS**  
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**DEFINITIONS**

**X-ray Fluorescence** – The emission of x-rays from a substance during exposure to an external source of x-rays.

**ACRONYMS**

**AHA** – Activity Hazard Analysis  
**CA** – Control Area  
**COC** – Chain of Custody  
**DOQ** – **Data Quality Objectives**  
**PPE** – Personal Protective Equipment  
**PRS** – Paducah Remediation Services, LLC  
**RWP** – Radiological Work Permit  
**QA** – Quality Assurance  
**XRF** – Xray Fluorescence Spectrometry