

USE OF XRF FOR HRS

FIELD-PORTABLE X-RAY FLUORESCENCE

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FOCUS POINTS

- ❖ WHAT IS XRF?
- ❖ HOW DOES XRF TECHNOLOGY WORK?
- ❖ CURRENT PRACTICES
- ❖ USING XRF IN HRS DOCUMENTATION
- ❖ WHAT IS THE FUTURE OF XRF USE?

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WHAT IS XRF?

- ❖ XRF ANALYSIS IS USED TO DETERMINE THE METALS COMPOSITION OF ENVIRONMENTAL SAMPLES, SUCH AS SOIL SAMPLES.
- ❖ 30 YEARS AGO, FIELD PORTABLE XRF WAS DEVELOPED FOR MEASURING LEAD IN PAINT AND HOUSE DUST.
- ❖ THE PROCESS IS NON-DESTRUCTIVE, SO THE SAME SAMPLE CAN BE SENT TO A FIXED LAB FOR FURTHER ANALYSIS IF NECESSARY.

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HOW DOES XRF TECHNOLOGY WORK?

- ❖ XRF ANALYZERS EMIT X-RAYS THAT IRRADIATE THE SAMPLE.
- ❖ ELECTRONS OF THE METAL(S) PRESENT ARE EXCITED.
- ❖ ELECTRONS RETURN TO THEIR NORMAL STATE GIVING OFF ENERGY THAT IS TRANSLATED INTO WAVELENGTH PATTERNS BY XRF EQUIPMENT.
- ❖ THE ELEMENT AND ITS QUANTITY CAN BE IDENTIFIED BY DISTINGUISHING THE WAVELENGTH AND ITS INTENSITY.

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HOW DOES FIELD PORTABLE XRF TECHNOLOGY WORK?

- ❖ XRF SOURCES TRADITIONALLY USE RADIOISOTOPE EXCITATION (E.G., FE-55, CD-109, AND AM-241).
- ❖ RECENTLY MINIATURE X-RAY TUBES HAVE COME INTO USE.
- ❖ ANALYSIS CAN BE CONDUCTED IN 2 WAYS:
 - IN SITU: "POINT AND CLICK"
 - EX SITU OR INTRUSIVE

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CURRENT PRACTICES

- ❖ PRIMARILY USED AS A SCREENING TOOL IN NPL DOCUMENTATION.
 - DETERMINE AREAS OF CONCERN FOR FURTHER SAMPLING
 - USE DURING REMEDY STAGES TO DETERMINE EFFECTIVENESS OF CLEANUP ACTIVITIES
 - USE AS SUPPORTING INFORMATION TO LAB SAMPLES IN HRS PACKAGES (NOT RELIED ON FOR HRS SCORE)
 - USE TO HELP DEFINE AN AOC IN CONJUNCTION W/ LAB SAMPLES (PARTIALLY USED FOR HRS SCORE)
- ❖ XRF HAS ALSO BEEN USED OVER THE YEARS FOR REMOVALS, RI/FS, SETTLEMENTS NEGOTIATIONS, BROWNFIELD STUDIES, AND LEAD STUDIES.

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USING XRF IN HRS DOCUMENTATION

- ❖ IDEALLY, EX SITU ANALYSIS IS PREFERRED FOR ANY DATA THAT ARE TO BE USED TO SUPPORT AN HRS SCORE IN SOME CAPACITY.
- ❖ INCLUDE DOCUMENTED ADHERENCE TO A STANDARD OPERATING PROCEDURE (SOP) AND METHOD GUIDELINES WITH QA/QC MEASURES IN THE HRS PACKAGE.
 - EPA REGION 1, SOP FOR X-MET 920 FIELD XRF ANALYZER
 - ENVIRONMENTAL RESPONSE TEAM SOP 1707, X-MET 880
 - ENVIRONMENTAL RESPONSE TEAM SOP 1713, SPECTRACE 9000
 - OFFICE OF SOLID WASTE, SW-846 METHOD 6200 (UPDATE IVA)

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USING XRF IN HRS DOCUMENTATION -CONT.-

- ❖ IF XRF DATA ARE USED IN CONJUNCTION W/LAB SAMPLES TO DOCUMENT AN AOC, THE XRF DATA SHOULD ALSO MEET THE HRS CRITERIA FOR OBSERVED CONTAMINATION.
- ❖ DETECTION LIMITS MAY NOT BE SENSITIVE ENOUGH TO MEET DOCUMENTATION NEEDS.
- ❖ THE USER SHOULD ALSO KEEP IN MIND EPA'S RECOMMENDATION OF COMPARING "LIKE" SAMPLES AND ITS GUIDANCE REGARDING SAMPLE SIMILARITY.

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VARIABLES

- ❖ HOMOGENEITY AND PARTICLE SIZE
- ❖ MOISTURE
- ❖ ABSORPTION AND ENHANCEMENT EFFECTS
- ❖ OVERLAPPING WAVELENGTHS
- ❖ AMBIENT TEMPERATURE CHANGES

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FUTURE OF XRF USE

- ❖ WHAT IS THE NEXT STEP FOR XRF USE IN SITE ASSESSMENT? WILL IT EVER BE MORE THAN A SCREENING TOOL?
- ❖ WHAT ARE THE HURDLES THAT NEED TO BE OVERCOME?
- ❖ WHAT ARE THE BENEFITS OF TAKING THE NEXT STEP?
- ❖ HOW WOULD YOU LIKE TO USE THE TECHNOLOGY IN THE FUTURE? – SEND YOUR IDEAS TO TAMME2@CSC.COM

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SUMMARY

- ❖ XRF IS A NON-DESTRUCTIVE ANALYTICAL TOOL FOR MEASURING THE METAL COMPOSITION OF A SAMPLE.
- ❖ XRF IS PRIMARILY A SCREENING TOOL; HOWEVER, IT IS CURRENTLY BEING USED WITH LAB SAMPLING TO DOCUMENT CONTAMINATION AT NPL SITES.
- ❖ RELIANCE ON XRF ANALYSIS FOR REGULATORY PURPOSES REQUIRES INCREASINGLY ACCURATE RESULTS.
- ❖ ADHERENCE TO AN SOP AND METHOD GUIDELINES IS RECOMMENDED FOR ACHIEVING ACCURATE RESULTS.
- ❖ FULLY PREPARED EX SITU SAMPLES ARE RECOMMENDED FOR DOCUMENTING CONTAMINATION AT NPL SITES.

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DO YOU HAVE MORE QUESTIONS?

HRS TECHNICAL STAFF CAN BE ACCESSED THROUGH
EPA HEADQUARTERS

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