

**Case Study of the
use of X-ray Fluorescence
Spectrometry in the Application of
the Triad
Approach to Site Characterization
of Lead Contamination in Soil**

Presenters:

Mr. JP Kumar, P.E. (Michael Baker Corporation, Inc.)

Ms. Deborah Cohen, P.E. (Tetra Tech NUS, Inc.)

Overview

- What is the Triad Approach?
- What are the perceived advantages and disadvantages of using Triad?
- Case study results on the application of X-Ray Fluorescence Spectrometry for characterization of lead in soil
- Benefits realized in the case study from using XRF
- Lessons learned

What is the Triad Approach?

- A shift from traditional approaches towards approaches for improving the efficiency of environmental investigations to meet project objectives
- Triad consists of the following:
 - Systematic Project Planning including Data Quality Objectives (DQOs)
 - Dynamic Work Strategies
 - Real-time Measurement Technologies

Perceived Advantages of Triad Approach

- Better investigation quality
- Faster and more cost-effective investigations, restoration, and redevelopment
- Improved stakeholder communication
- More effective cleanups

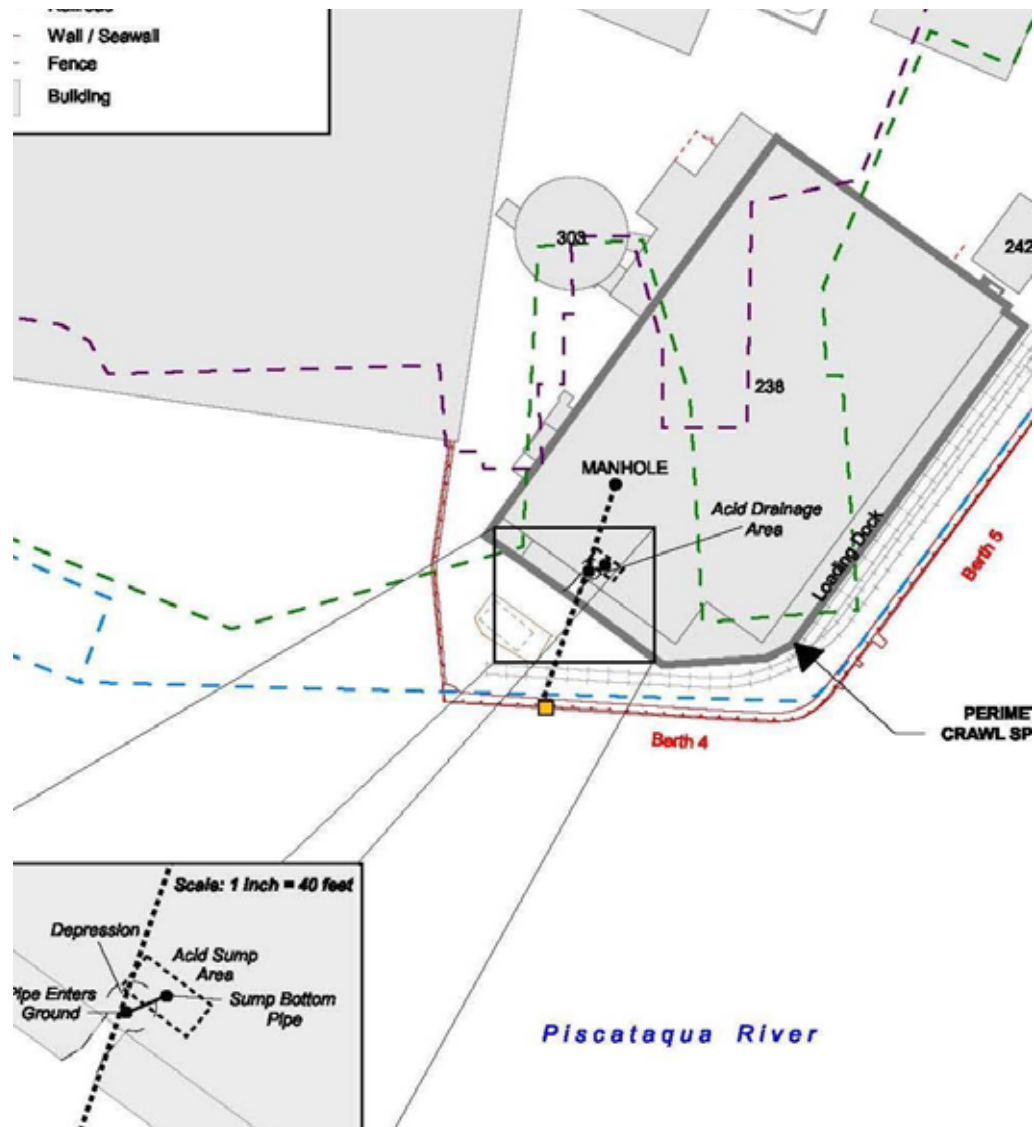
Source: ITRC Sampling, Characterization, and Monitoring Team
(December 2003)

Perceived Disadvantages of Triad Approach

- Higher up-front costs (more emphasis on “what ifting” and describing data flow/intepretation/communications)
- Change in approach to data quality
- Lack of tools to manage decision uncertainty
- Greater need for training about Triad
- Negative bias towards field-generated data

Case Study of Site 10

Portsmouth Naval Shipyard, Kittery, Maine



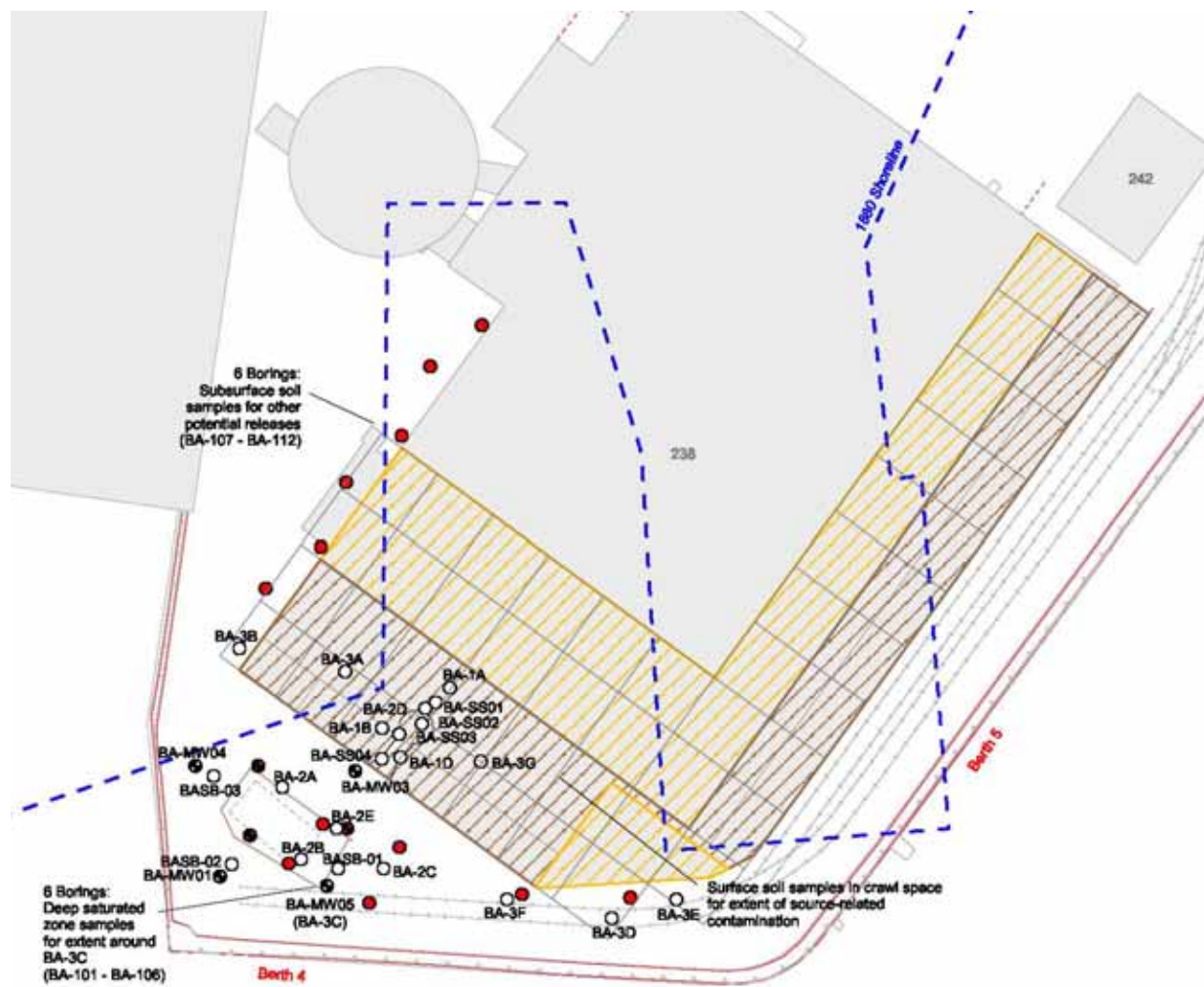
Source: TtNUS, 2007

ACID DRAIN



Background and Objectives

- Former submarine battery maintenance site with lead contamination associated with acid drainage
- Data Quality Objectives including action levels were established for determining the extent of lead contamination in soil
- Targeted known and suspected areas of releases:
 - Former drain under building
 - Former acid storage tank outside the building



Source: TtNUS, 2007

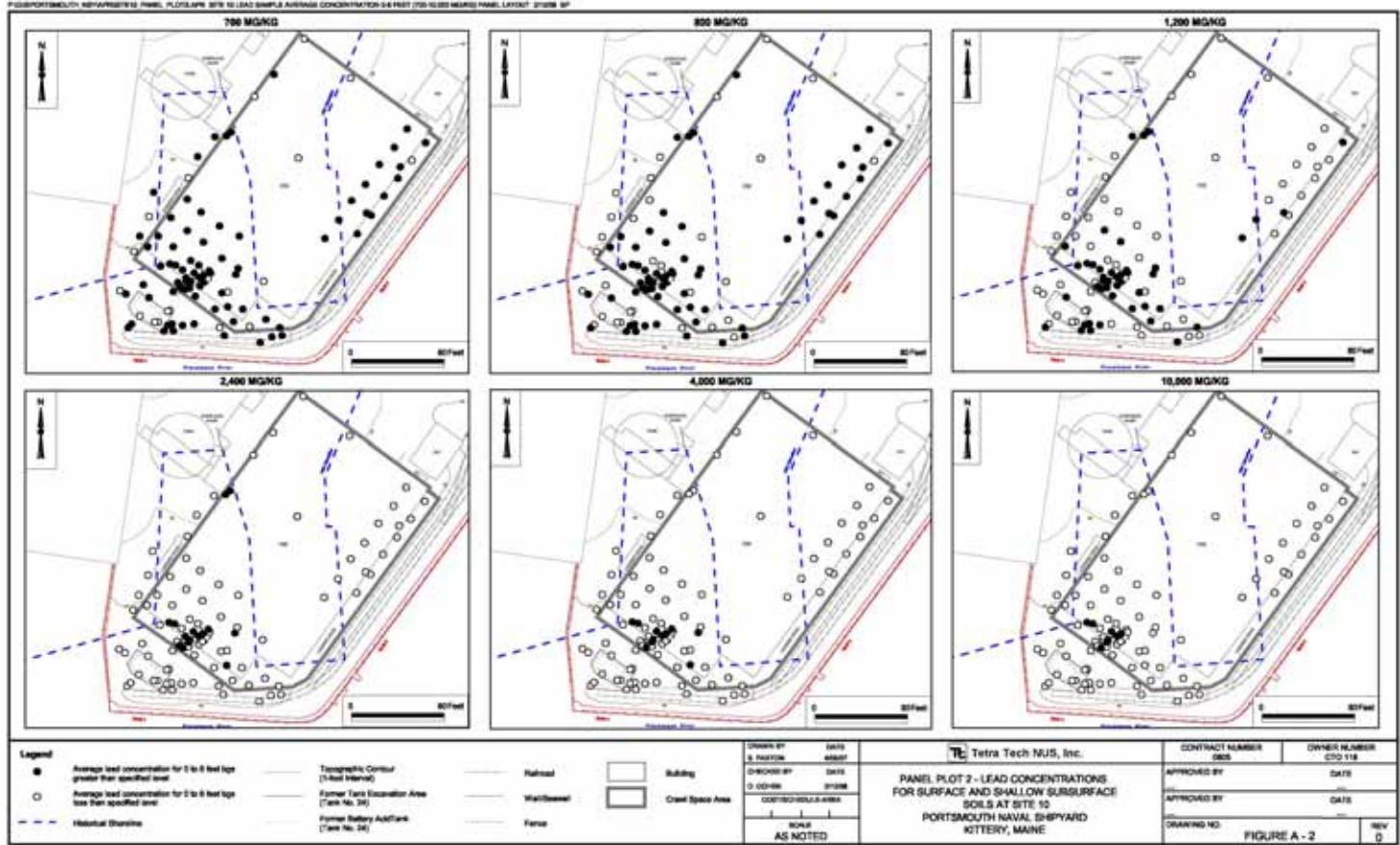
Investigation Tasks

- Obtained security and facility clearance for XRF operation
- Collected surface and shallow subsurface soil samples from grid centers covering known and suspected areas of releases under the building
- Collected subsurface soil samples from borings outside the building
- Task Manager frequently communicated XRF results and field conditions to Project Manager to make sampling decisions to meet project objectives
- Selected split samples spanning the range of XRF results for fixed-base laboratory analysis and correlation

Interpretation of Results

- Correlation equations were developed between XRF results and fixed-base laboratory results
- XRF results were adjusted to estimate equivalent fixed-base laboratory results
- Compared these results to action levels to estimate extent of contamination

Lead Concentrations vs. Potential Action Levels



Source: TtNUS, 2007

Benefits Realized

- Enhanced ability to make field decisions
 - Selected/investigated suspected release points in real time
 - Used XRF surface soil data to select subsurface sampling points
- Gained confidence in decisions based on field XRF results (with correlation to laboratory results exceeding 0.95 ⁽¹⁾)
 - Greater confidence in delineating contamination
 - Potential remediation zones within site boundary were cost-effectively identified
- Cost savings from avoiding additional field investigations to determine the extent of lead contamination

(1) Correlation measured as Pearson Product Moment Correlation (TtNUS, 2007)

Lessons Learned

- Client's facility may have security or training requirements affecting the use of the XRF on site
- Coordination and information transfer efforts are a two-way process and must occur frequently during field work.
- Knowledge of nature of contamination at the site is necessary to evaluate the usefulness of XRF.

References

1. ITRC, 2003. Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management. Prepared by Interstate Technology & Regulatory Council (ITRC) Sampling, Characterization, and Monitoring Team. December 2003.
2. TtNUS, 2007. Remedial Investigation Report for Operable Unit 1, Portsmouth Naval Shipyard, Kittery, Maine. Prepared by Tetra Tech NUS, Inc., King of Prussia, Pennsylvania. July 2007.