Testing & Data Management for an Effective and Efficient Remediation

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Introduction

- Since 1980, a great deal of time and money has been wasted when data use and management was not given the attention it deserved.

Introduction contd.

- People were trying to do their best in trying circumstances.
- The focus will be on what we have learned about doing things better and what would be considered best practice today.
- Site remediation is still evolving and continuing to improve as we all get more experience.

Overview

- Focus on selected aspects of monitoring that are important to site characterization and remediation.
- Focus is on what managers should look for to ensure is that monitoring is done ***correctly, effectively***, and ***efficiently***.
- Time does not permit going into detail or even mentioning several important topics.

Overview contd.

- We will look at Data Quality Objectives (DQOs) to reduce costs while ensuring accurate decisions.
- Talk is aimed at managers and senior experts managing remediation programs or projects.
- Brief examples will be used to illustrate how the DQO concept can be used to reduce the cost and time for a cleanup and, also factors to consider when selecting data gathering organizations.

Working Less by Working Smart

- Main message is that by better planning and data management you will be able to clean up contaminated sites more effectively and less expensively.

- Site cleanups will be done in a way that both reduces the cost, and ensures that the cleanup decisions will be accepted by government authorities and the public

Working Smart

- Collecting data without having clearly stated the questions to be answered and how good (accurate, precise, etc.) the data needs to be is wasteful.

- It leads to:

  1. spending time and money to collect data that is not important to answering the questions, and

  2. not collecting necessary data the first time,

Working Smart (2)

3. Using methods that are more precise, more accurate, and more sensitive than needed.

4. Not using field analytical tools to give the site characterization and site cleanup processes.

Working Smart (3)

- Asking the right questions before one begins any field work is, therefore, critically important.

Data Management

- The gathering and use of appropriate data is critical to ensuring:
  - that the remediation is done correctly and in a cost-effective manner; and
  - that all stakeholders (regulatory officials, site owners, public) will have confidence in the approach being taken to carry out the remediation; and the quality of the work that was done (i.e., that the site has been remediated; and that the site is now fit for its intended use).

Data Management contd.

- EPA has found that when doing cleanups, two documents are critical to success.
- The first is the Conceptual Site Model or CSM.
- The second is the Quality Assurance Project Plan or QAPP serves as a guide to the data gathering.

Conceptual Site Model

- The CSM describes hazards posed by the contamination, where the contamination is, and impact pollutant migration concerns.
- The CSM is an iterative tool that is constantly updated as new information is obtained.
- The level of detail in the CSM should match the complexity of the site.

Conceptual Site Model

- The CSM is so important is that it shows the decision maker/project manager, what is known about the site and, what needs to be known to conduct a proper remediation.

- The CSM identifies the data that still needs to be collected, and how good the data needs for effective project management and decision making.

Conceptual Site Model

- The staff or contractors preparing the CSM for you need to be clear about which aspects of the site or data they are uncertain about or are based on untested assumptions.
- This is vital to understanding risk and designing cost-effective cleanups.
- Data collection should focus on resolving those uncertainties rather than just blindly gathering data.

Quality Assurance Project Plan

- The Quality Assurance Project Plan (QAPP) is the master plan for gathering data.
- The QAPP describes the sampling, analysis, and other data gathering that is to be conducted; methods to be used; work responsibility for conducting what work; documented; and how the results will be reviewed to ensure usability.
- The QAPP describes the controls that will be put in place to ensure that the data generated is of known and documented quality and suitable for the intended use.

Quality Assurance Project Plan

- A large part of the budget of any remediation project is dedicated to the collection and analysis of samples. It is important to take:

  1. the correct number of samples, of the correct type, from the correct places, and using the correct techniques; and

  2. analyzing these samples for the correct contaminants with the proper methods.

Quality Assurance Project Plan

- The QAPP is a direct extension of resolving the uncertainties and knowledge gap identified in the CSM.
- In the QAPP the technical experts determine the most efficient manner of gathering reliable data to fill in the missing gaps.
- Once these decisions are made, they are codified in the QAPP.

Quality Assurance Project Plan

- Once the data that needs to be collected is identified, the QAPP guides the data collection process.
- Following it ensures that you can have confidence in the data and everyone will have confidence in the decision making.
- While time consuming to prepare, its preparation ensures that money and time are not wasted later in the cleanup process.

Ensuring Data Quality

- Four key areas that I want to emphasize are:
  1. Sampling and sample
  2. The relationships between data accuracy, data completeness, and the desired confidence in the decision making.
  3. Field and laboratory testing methodology
  4. Selecting and working with field and laboratory testing management and staff

Sampling and Sample Handling

- To ensure representative data use statistical sampling.
  - To reduce the number of samples to be analyzed, use field screening and sample compositing.
  - To sample contamination during transport and in the laboratory use blanks and spiking.
  - For samples that may change after collection ensure proper sample preservation.
  - Use field testing to flag "hot spots" and reduce help eliminate analyzing "clean" areas.

Data Quality vs Decision Quality

- Decision quality is what is important and is different from data quality.
- Data of relatively poor accuracy and precision can often answer a question with high accuracy.
- To save resources, use the lowest quality of data that is sufficient to generate high decision confidence.
- Diet Soda Example

Selecting Testing Organizations

- When selecting a data provider look for.
  - Demonstrated expertise and competency,
  - Availability of appropriate instrumentation and trained staff,
  - A well defined and functioning quality system.

- How to identify such organizations?
  - Look for ISO 17025, TNI or DOD accredited organizations
  - Use competent laboratory assessors

(the assessor is your friend).

Data Quality Objectives

- What is a Data Quality Objective or DQO.
- It is the degree of confidence that you want in decisions.
- It is the statistical certainty or uncertainty in the decision.
- Example: As decision maker, I want the data to be complete, accurate, and precise enough that I can state with a 95% certainty that the remediated site meets the cleanup standards.

Determining Appropriate DQOs (1)

1. Define the specific question(s) to be answered (e.g. What areas of the site are contaminated by heavy methods; is the remediation process working; has the site been successfully cleaned up?).
2. Define the decision criteria.
3. Determine the impact of a decision error. Would the mistake have adverse health consequences or, would it just lead to a bit more cleaning up than needed? Would subsequent testing identify and correct any decision errors?

Determining Appropriate DQO (2)

4. Determine the level of uncertainty that key stakeholders are willing to accept in the decision or characterization.

- Example 1: Assume that waste from the site is being monitored to determine what type of disposal facility the waste is to be taken to. If the disposal facilities are all well designed and not likely to result in harm from contaminant leakage, then a relatively low DQO (e.g., 75%) can be set for the work which reduces sampling and testing costs and permits use of relatively imprecise testing methods and few samples.

Determining Appropriate DQOs (3)

- Example 2: A site is being characterized to determine if remediation can be considered finished and the site turned over for public use. If the use to which the site will be put entails a high level of potential human exposure to the soil, then a high DQO should be established (e.g., 95-99%). In order to meet the high DQO, more sampling and more accurate testing methods would need to be employed than in Example 1.

Determining Appropriate DQOs (4)

- Example 3: Contaminated water at the site is being cleaned up before discharge to a nearby river. The water is being treated by being passed through a charcoal column. The water from the column is being monitored to ensure that the treatment is working. Since when using such a system, the treated water will contain a very low level of the contaminant until the column stops working, one does not need a sensitive or precise method to monitor the treated water.

Analytical Method Selection

- What methods one should employ in conducting the data gathering is, therefore, a function of the Data Quality Objectives for each part of the remediation.
- Sources of validated field and laboratory testing methods include:
  - US Environmental Protection Agency methods
  - ASTM Methods
  - Standard Methods for Water and Wastewater

Field Testing Methodology

- While less expensive than laboratory methods; field testing methods can often give one as high a degree of confidence in the answer as laboratory methods. It depends on the DQO and the situation.
- Field methods to consider include:
  - X-Ray Fluorescence,
  - Organic Vapor Analyzers,
  - Field Portable GC,
  - Raman Spectroscopy

References

Analytical Methods

- US Environmental Protection Agency
  - Test Methods for Evaluating Solid Waste (SW-846)(www2.epa.gov/measurements)
  - EPA Contract Laboratory Program Statements of Work
  - 40 CFR Part 136 Clean Water Act testing methods
- ASTM International Committees D-19 and D-34 methods (www.astm.org)

References contd.

- Standard Methods for the Examination of Water and Wastewater (www.standardmethods.org)

Laboratory Competency Standards

- ISO 17025 (www.iso.org)
- The NELAC Institute (www.nelac-institute.org)
- US Department of Defense (www.navylabs.navy.mil/QSM%20Version%205.0%20Final.pdf)

Sampling Methods

- http://www2.epa.gov/region8/environmental-sampling

References contd.

- **Conceptual Site Model**
  - http://www2.epa.gov/region8/hh-site-conceptual-model
  - https://clu-in.org/contaminantfocus/default.focus/sec/Sediments/cat/Conceptual_Site_Models/
  - ASTM E1689 – 95(2014) Standard Guide for Developing Conceptual Site Models for Contaminated Sites

References contd.

Quality Assurance Project Plans

- http://nepis.epa.gov/Adobe/PDF/20011HPE.pdf
- https://clu-in.org/conf/tio/osc3/ChemTFMQAPPexample_Oct2009.pdf

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