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Physical Sampling for Site and Waste Characterization (U)

by

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DISCLAIMER

PHYSICAL SAMPLING
FOR SITE AND WASTE CHARACTERIZATION

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ABSTRACT

Physical sampling plays a basic role in high-level radioactive waste management program effort. The term "physical sampling" used here means collecting tangible, physical samples of soil, water, air, waste streams, or other materials. The industry defines the term "physical sampling" broadly to include measurements of physical conditions such as temperature, wind conditions, and pH, which are also often taken in a sample collection effort. Most environmental compliance actions are supported by the results of taking, recording, and analyzing physical samples and the measurements of physical conditions taken in association with sample collecting. Therefore, the when and how to take samples is needed to be known and planned.

INTRODUCTION

Each potential sampling situation involves many decisions, starting with **the first decision as to whether a sample is needed.**

Whenever sampling is undertaken, additional decisions should be made to assure that **three key elements** of a good sampling effort are addressed:

1. Well-articulated objectives, and plans to meet them;
2. Observance of policy and procedures, and
3. Established context and relevance to the regulations and site conditions.

Physical samples confirm the presence and concentration of contaminants or pollutants. Samples also can indicate the operating conditions of key processes or equipment at a facility or site. In environmental compliance efforts, sampling results are used for two principle purposes: (1) as evidence to substantiate compliance to regulatory requirements; and (2) to determine the extent of environmental contamination, needed to calculate a proper level of effort for compliance.

Everyone in high-level radioactive waste management programs are likely at some point to do two things. One, request others to conduct sampling. Or two, will need to use the results of sampling in their work; and/or will review the results of sampling conducted.

Consequently, there is a need to be familiar with what goes into planning for and conducting a sampling effort. This knowledge will help responsible organizations to:

1) **Communicate sampling needs** effectively, particularly about setting sampling objectives and data quality requirements;
2) **Make realistic projections** of the costs and time required for carrying out sampling and getting the results, and,
3) **Consider data quality limitations** when interpreting and using sampling data.

DATA QUALITY SAMPLING OBJECTIVES

Precision and accuracy are the data quality measures of representative field samples. Precision refers to the variability of the measurement process when the same sample is measured more than once, and accuracy refers to the closeness of an observed measurement value to its true value. If the resulting data is to meet the objectives established for the sample collection effort, precision and accuracy must be maintained in both the field and at the laboratory.

Often, precision and accuracy are dependent on the type of procedure or equipment that is chosen, making the procedure or equipment that provides the greatest precision and accuracy the most complex or expensive to use. Great care must be taken when weighing the objectives of the sampling against the cost of the sampling. Understanding what level of precision and accuracy will be required to meet sampling objectives is important.

The information essential to the assessment process can be divided into the following three major groups:

Objective(s) of the Data Collection Activity. The fundamental step in setting the objective(s) of a sample collection effort is clearly establishing the ultimate end use of the data. This step provides the foundation for designing the sampling plan and a means by which to compare and assess the results. The objective should serve as the basis for the design of the sampling locations, sampling frequency, types of sample to be collected, and parameters to be analyzed to obtain the data.

Field Measurement and Sampling Process. The second step is the development of SOPs that include the detailed procedures for collecting and handling samples, performing field measurements, and documenting the sampling process.

Laboratory Analytical Methodology. The last step for data assessment to be performed is the identification of the actual analytical methods in SOPs to be used for analyzing samples for specific constituents or groups of constituents.

WHY AND WHEN TO SAMPLE (Samples as Evidence)

Physical sampling is used to determine if hazardous substances have, or have not, been released to the environment. Sample results can demonstrate:

a. That a particular regulation applied to the site or facility (e.g., that a drum contained PCBs and therefore should have been marked with a PCB label);

b. That a permit standard has been exceeded (e.g., that a waste stream has a higher concentration of pollutants than allowed by the permit); or

c. The extent of a contamination problem (e.g., that contamination has seeped from the soil under a leaking tank to the ground water).

For the results of physical samples to be readily accepted as evidence in court, the samples must be of known quality, collected following sound technical procedures, and representative of conditions at the location where they were collected. The wide variety of field situations encountered make it virtually impossible to specify in advance in all cases whether samples should or should not be taken. The final judgment must be made by the responsible person in the field. The following provides general principles for sampling and priorities for the types of situations in which sampling should be undertaken.

1. **Always take a sample to disprove a potential violation.**

   This would mean taking a sample of all environmental media needed to determine if the particular substance(s) are present. Examples: To show that a release should have been reported to EPA under CERCLA, there must be proof that a substance subject to CERCLA was involved.

   Showing that a transformer should have borne a PCB label, there must be proof that it actually contains PCBs at the regulated concentration.

   Showing that a discharge point is exceeding the permit limit for a parameter, there must be proof that the discharge actually contains the constituent above the permitted amount.

2. **Sample only when there is reason to suspect the substance is present.**

Unless there is some reason to believe that the regulated substance at issue is present, there is little likelihood of finding it through indiscriminate sampling.

Example: If there is no independent reason (e.g., a statement by a facility employee) to suspect that the several stacks of drums that are observed contain hazardous waste, there is no reason to assume that they do.

In many instances, a very large number of samples would have to be collected, resulting in an unduly long inspection and unreasonable backlog of samples to analyze. Collection and transport of that many samples may be logistically impossible. Thus, there is a third rule.

3. **Always attempt to verify the presence of the substance by a means other than sampling.**

The most common sources of independent verification of the presence of the substance are the company's records, nameplate or label information, and statement by facility personnel (which may or may not be correct). Other sources include obtaining information on raw materials, process operations and waste streams. Such sources may be contested, but experience to date indicates that usually they are not. Thus, sampling may become less important when there is other evidence of the presence of the substance (or an amount in excess of a limit) although there is always the

potential that records and/or labels are erroneous or falsified.

SAMPLING DECISIONS

Not all compliance evidence involves collecting physical samples. Guidance established by each regulatory program provides general direction on when to sample. Sampling protocols for the various types of laws and regulations prescribe specific activities (records review, interviews, observations, and/or physical sampling) that should be conducted to assess and document compliance.

Some types of sampling by definition involve collection of physical samples. Other types of sampling might involve collection of samples only if a violation is suspected that would need to be substantiated by sample results. The amount of certainty on sample collection will affect, of course, the degree of detailed planning to be done. The decision to sample must always be made on a case-by-case basis.

SAMPLING TECHNICAL CONSIDERATIONS

Several technical issues must be considered to assure that the sampling data collected will be of a quality sufficient to draw conclusions about the compliance status of a facility. Sampling data must be viewed as credible evidence substantiating the company's position should an enforcement action be pursued by a regulatory agency. This is the fundamental objective of any characterization sampling conducted to demonstrate regulatory compliance.

While this objective is relatively straightforward, meeting the objective involves many decisions and actions regarding how samples will be collected and analyzed. These include such decisions as determining:

- The number, location, and type of samples and/or measurements that will be taken;
- The specific techniques that will be used to collect the samples;
- The volume of samples that will be collected; and
- How the samples will be managed in the field (e.g., sample preservation, packing and shipping).

This planning activity should be designed to make sure that each sampling collection and analysis effort will meet its intended objectives. Other choices can only be made in the field, once actual site conditions or potential compliance problems are known.

REPRESENTATIVE SAMPLING

Proper sampling procedures require the selection of sampling points that will produce a representative sample. A representative sample is any sample which is similar to the total population in composition and physical and chemical properties. Selection of a sample that is truly representative of the material or media being sampled provides the strongest foundation for demonstrating regulatory compliance. If a sample can be shown to be representative, conclusions about the compliance status of the rest of the population may also be drawn. In all cases, the sampling objectives are meant to determine how and where representative samples should be collected. There are a wide variety of factors that define a representative sample. These factors include:

- Operating conditions
- Types of waste
- Statistical considerations
- Temporal considerations, and
- Spatial considerations.

SUMMARY

For site and waste characterization each sampling situation involves many decisions, starting with the first decision as to whether a sample is needed. When the decision is made to take physical samples the effort for planning and conducting of sampling must not be minimized and must cover:

- **Communication of sampling needs**, particularly the setting of sampling objectives and data quality requirements.

- **Realistic projections of the costs and time** required for carrying out sampling and getting the results, and

- **Data quality limitations** when interpreting and using sampling data.

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