Designing/Approving Sampling Plans
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Who am I to be training about sampling?
As the Tohono O’odham Nation’s Brownfields Environmental Specialist, I work for the Tohono O’odham Nation (Nation) Department of Public Safety’s Environmental Protection Office (TONEPO). Our Mission is to “...protect human health and the environment including the air, water, flora and fauna, ecological systems and natural resources on the Tohono O’odham Nation...” The Nation is a federally recognized Tribal Nation located in southern Arizona with the second largest reservation in the United States consisting of 2.8 million acres (roughly the size of the state of Connecticut). About 20,000 members live in small rural communities throughout the desert terrains. My experience includes laboratory, mining, and oil/gas exploration. I’m familiar with sites including: mine scarred lands; manufacturing; farms; mold, asbestos, and lead based paints; underground and above ground storage tanks; and remediation. My tribal training includes Phase I & II Assessments, Asbestos, HAZWOPER and Tribal Inspector Training.

What will we cover during this session?
✓ When is sampling needed?
✓ What is the role of a Phase I Site Investigation in designing a sampling plan?
✓ What is the role of sampling in a Phase II Site Investigation?
✓ What questions need to be answered for a sampling plan?
✓ How much and how many samples should be taken?
✓ When are sampling plans approved and who approves them?
✓ What are some reasons for developing sampling plans?
✓ How is a sampling plan designed?
✓ What are “project data quality objectives”?
✓ What technical sampling information is specific to different contamination issues?
✓ Is there a good way of estimating assessment costs?
✓ What do I need to do if a Licensed Contractor is to be hired?
When is sampling needed?

When a site review has identified a potential environmental concern then sampling and testing are needed to confirm the presence or absence of contaminants, and/or the extent of concentration.

What role has a Phase I Investigation in designing sampling plans?

The Phase I inspection is an important document for planning what we are looking for and potentially where to sample because it includes the past usages of a site along with potential environmental risks in the immediate area. A Phase I entails a site visit to identify recognized environmental concerns (RECs).

What is the role of sampling in a Phase II Site Investigation?

Very simply put, a Phase II Investigation involves testing a site to determine the presence or absence of pollutants by taking samples from the site, which may include air, soil, water and/or other media. A Phase II will present sound, scientifically valid data concerning actual site conditions in an objective, reproducible, and defensible manner for a variety of objectives. The information gathered during a Phase II will determine if the site warrants further investigation. The Phase II Assessor will include the scope and objectives of the investigation; the substances possibly released or known to be released at the property, the nature of the concerns presented by their presence or likely presence, quality control and quality assurance measures, the portion of the property investigated, the sampling and chemical testing completed, along with any project constraints, such as physical or natural barriers.
There are four basic components of a Phase II Site Assessment:

1. **Develop the Scope of Work**
2. **Assessment Activities**
   - Review Existing Information
   - Develop Hypothesis
   - Test Hypothesis – Sampling
     - Collect potentially highest concentrations
     - Confirmation or Characterization
     - Remember – Health and Safety first!
3. **Evaluation of Data**
4. **Presentation of Findings and Conclusions**

**What questions need to be answered for a sampling plan?**

Why are we testing; to buy, sell or redevelop?
What is the proposed reuse; housing, industrial, a playground, grazing land?
Who is trained to safely sample?
What personal protection is needed?
What media needs sampling; air, vapors, soil, water, petroleum, building materials?
What is the most likely spot for highest concentrations?
What am I testing for – metals, chemicals, asbestos, mold, stability?
Do I need pH, permeability, moisture contents?
What standards should I use?
What equipment do I need?
Do I have sample containers?
How quickly are results needed?
How much money is available?
How much and how many samples should be taken?
The number of samples and how much sample is necessary must be made on a case-by-case basis. Qualitative confirmation (a field screening) is simply a “YES or NO” that a contaminant is present. Quantitative confirmation (laboratory analysis) will help determine “HOW MUCH” or “HOW BAD”. Consult with your laboratory on sample quantity, containers/preservatives, holding times, and costs.

How much and how many samples should be taken?

- **Qualitative confirmation**
  - a field screening
  - “YES or NO” that a contaminant is present.

- **Quantitative confirmation**
  - laboratory analysis
  - “HOW MUCH” or “HOW BAD”.

When are sampling plans approved and who approves them?
As soon as sampling plans are designed and reviewed internally, then the external approval begins. Tribal approval may include the environmental office, oversight committees, council, and the Chairman. If federal funding is involved than most sampling plans will need to be approved by the head agency. For all USEPA Brownfields 128(a) Response Program projects, talk with your USEPA Project Officer.

When are sampling plans approved and who approves them?

- As soon as sampling plans are designed then approval begins
- Internal Tribal approval 1st
- For all USEPA funded projects, talk with your Project Officer

What are some reasons for developing sampling plans?

- **Mine Scared Lands/Mining Operations**
  There are thousands of borrow pits, abandoned and working mines on tribal lands. Contaminants may be detected in excess of federal standards in the soils or groundwater such as arsenic, cyanide, selenium, uranium, sulfates, perchlorates, nitrates, volatiles, petroleum, and so on and so forth. Traces of Toxins sometimes show up in vegetation near mines, so plants could be another media to sample.
• **Land Redevelopment**
Geotechnical data can help determine site suitability for potential reuse options such as a Solar Facility.

• **Water Quality Inventory: Surface and Ground Water**
Sampling helps determine the availability and suitability of water resources on tribal lands. Sampling is essential to determine soil and/or water components to determine if pollution has occurred.

• **Inadequate Water/Wastewater infrastructure**
There are homes without potable water, sewer and/or water systems that may use either hand-dug or agricultural wells for drinking water which are potentially exposed to contaminants such as fecal coliform, arsenic, and fluoride above Drinking Water Standards. Sampling can define these issues.

• **Emergency Response to Chemical/Hazardous Materials/ Bioterrorism incidents**
There are numerous spill incidents on tribal lands including fuels, acids, metals, and chemicals as well as incidents involving tankers or aircraft. Sampling is needed to confirm site cleanup levels are met.

• **Air Quality**
Sampling can determine sources of major air pollution such as factories. Natural air issues cannot be prevented but man-made causes of dust can be limited including construction sites and dirt roads.

• **Indoor Air Quality**
  - **Asbestos**: Abandoned structures, tribal buildings, schools, and some homes may have Asbestos Containing Material (ACM) in the insulation, floor or ceiling tiles, drywall and/or roofing.
  - **Radon**: Radon is a colorless, odorless, radioactive gas created by natural decay of uranium in the soil.
  - **Mold**: Substandard construction in tribal homes and buildings has caused widespread mold problems.
  - **Utility Poles/Railroad ties (Creosote/CCA-treated)**
Homes built with railroad ties or utility poles as support beams may be hazardous because of being treated with preservatives and pesticides linked to asthma, cancer, and arsenic poisoning.
  - **Lead based paint**
Lead paint can be an issue during renovation and demolition projects and sampling for lead can help determine whether or not compliance is required for removal and disposal of lead-contaminated waste.

• **Industrial**
Future activities could encounter residual chemical contaminated materials given historical usage for a variety of chemical manufacturing and storage activities. Sampling helps determine contaminants.

• **Petroleum Contamination**
Petroleum contamination can be released from a number of sources, including underground storage tanks (USTs), aboveground storage tanks (ASTs), refineries, or pipelines resulting in potential pollution of surrounding soil and groundwater. Sampling determines extent and the completion of remediation.

• **Above Ground Storage Tanks (ASTs)**
Above ground tanks with a capacity of over 10,000 gallons must have Spill Prevention, Containment, and Countermeasure, but a failure necessitates sampling to determine the extent of necessary remediation.
How is a sampling plan designed?

Sampling Plan Design

- Introduction
- Background
- Project Data Quality Objectives
- Sampling Rationale
- Analyses
- Field Methods And Procedures
- Sample Containers, Preservation And Storage
- Disposal Of Residual Materials
- Sample Documentation And Shipment
- Quality Control
- Field Hazards
- Field Health And Safety Procedures

INTRODUCTION

Site Name/Sampling Area, Location
Responsible Agency, Project Organization

BACKGROUND

Site/Sampling Area Description
Operational History
Previous Investigations/Regulatory Involvement
Geological Information
Potential Environmental and/or Human Impact
PROJECT DATA QUALITY OBJECTIVES

- Project Task and Problem Definition
- Assessment Oversight

SAMPLING RATIONALE

- Soil Sampling, Sediment Sampling, Water Sampling, Other Sampling

ANALYSES

- Analyses & Analytical Laboratory Information Narrative

FIELD METHODS AND PROCEDURES

- Field Equipment/List of Equipment Needed
- Calibration of Field Equipment
- Field Screening
  - Soil Sampling: Surface Soil, Subsurface Soil, Sediment
  - Water Sampling: Wells, Surface Water, Groundwater, Level, Flow
  - Other: pH, moisture, air, vapors, asbestos, mold, critters, e-coli
- Decontamination Procedures

SAMPLE CONTAINERS, PRESERVATION AND STORAGE

- Soil Samples, Sediment Samples, Water Samples, Other Samples

DISPOSAL OF RESIDUAL MATERIALS

SAMPLE DOCUMENTATION AND SHIPMENT

- Field Notes, Field Logbooks
- Photographs
- Container Labeling, Custody Seals
- Sample Chain-Of-Custody Form
- Packaging and Shipment

QUALITY CONTROL

- Field Quality Control Samples:
  - Blanks – Equipment, Field, Trip, Temperature
  - Background Samples, Field Screening and Confirmation Samples, Split Samples
- Laboratory Quality Control Samples

FIELD VARIANCES

FIELD HEALTH AND SAFETY PROCEDURES

What are “project data quality objectives”?

Data Quality Objectives are qualitative and quantitative statements for establishing data collection designs and defines what the data will be used for and what quality of results is needed.
What sampling information is specific to different contamination issues?

Essentially every contamination issue requires specific sampling procedures, techniques, equipment, and containers (with or without preservatives, bottles vs. jars vs. bags), as well as analytical methods for each media. Here are a few types of sampling specific to different contamination issues:

ASBESTOS SAMPLING
Certified Asbestos Containing Materials (ACM) Inspectors are taught sampling protocol for asbestos, which is typically found in many buildings throughout tribal lands in fireproofing, acoustical ceiling, wall plasters, insulation, and floor/roof tiles. Sampling plans limit exposure and disturbance of asbestos.

MOLD SAMPLING
There are a variety of ways to conduct mold sampling. Mold spores are not visible to the human eye, so Lab analysis will provide evidence of the mold problem in a building and types of molds present.

- Viable Samples of live mold that can be grown in a culture plate, usually taking 7-10 days to grow.
- Nonviable samples are those that cannot be grown into colony forming units and takes 1-3 days.
- Bulk samples typically are 2 x 2 inch pieces cut from surrounding material with mold growth.
- Tape samples are a sticky material pressed onto the visible mold surface and microscope counted.
- Swab samples swab visible mold and the sample is placed in a test tube for the lab analysis.
- Scrape samples are literally scraped moldy material, which are bagged and labeled for lab analysis.
- Air Samples determine the level of mold in the air and consists of three basic impaction mediums.

SOIL SAMPLING
Soil sampling for environmentally-related purposes requires special tools and procedures. Deeper subsoil sampling may be essential to evaluate potential sources of minerals. Geotechnical sampling is the way to obtain physical properties concerning the conditions below the surface can include test pits, trenching, boreholes, and in situ tests. Collect soils in glass, plastic or stainless steel containers.

SEDIMENT SAMPLING
Generally, a sediment sampling program will include the kind and extent of contamination, as well as identification of highest contamination areas. In aquatic systems, the areas of greatest contamination will generally occur in depositional areas, or where known historic discharges can be targeted. In addition to bulk chemistry analysis, sediment quality may include additional physical measurements such as river depth, flow rate, suspended solids, bed load, pH, and temperature. Total organic carbon (TOC) and particle grain size are indicators of contaminant bioavailability and sediment deposition.
SURFACE WATER SAMPLING
As a general guide, surface water samples should be collected near banks/depositional areas where water current is slower and there is greater retention time for the water to accumulate contaminants. Since contaminated groundwater and surface water can serve as sources of sediment contamination, obvious surface-runoff channels, leachate seeps, groundwater discharge areas, etc., should be targeted.

DRINKING WATER SAMPLING
The National Primary Drinking Water Standards have been established to protect public health by limiting the levels of contaminants allowed in drinking water. Tools are available to determine the monitoring requirements for public drinking water systems as they relate to system’s size, water source, and treatment. Drinking water testing includes Standard Water Analysis, Microbiological testing, Heavy Metals, Mercury, Fluoride, Pesticides, Disinfection By-products and Radiological testing.

Is there a good way of estimating assessment costs?

It’s difficult in advance to estimate the cost for Phase II Site Assessments since a crucial purpose is to determine contamination, if any. The site size plus types of contaminants of concern can vary costs significantly since evaluation costs depend on representative sampling, equipment and laboratory costs. Laboratory’s pricing is influenced by quantity of samples (more for less), analyses, media, QA/QC, etc. The range for various sites, some similar and some not, were explored via internet for cost comparisons:

<table>
<thead>
<tr>
<th>Site Designation</th>
<th>Acres</th>
<th>Notes: description, history Clean-Up Issues</th>
<th>Phase I &amp; Phase II Assessment Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST UST AZ</td>
<td>1</td>
<td>Contamination not found</td>
<td>$1,800</td>
</tr>
<tr>
<td>ST Carismatico AZ</td>
<td>1</td>
<td>Petroleum, Soil, Water, etc.</td>
<td>$5,528</td>
</tr>
<tr>
<td>Auto shop MI</td>
<td>1</td>
<td>Prior to the 1940s, a gasoline station was on the property with pump island in concrete. In 1982 USTs removed but no assessment was completed.</td>
<td>$17,497</td>
</tr>
<tr>
<td>Dorset VT</td>
<td>2.5</td>
<td>Gas station Abandoned in the 1970s. 2 gasoline USTs and 2 pumps. USTs were removed in 1993</td>
<td>$18,728</td>
</tr>
<tr>
<td>La Junta CO</td>
<td>0.90</td>
<td>Gas station Abandoned in the 1970s. 2 USTs which were filled in-place with sand</td>
<td>$30,001</td>
</tr>
<tr>
<td>mine ID</td>
<td>218</td>
<td>Lead, Metals, Soil</td>
<td>$37,100</td>
</tr>
<tr>
<td>G Rvr school AZ</td>
<td>4</td>
<td>Petroleum, Soil, Water</td>
<td>$47,988</td>
</tr>
<tr>
<td>ST PW Yard AZ</td>
<td>1.5</td>
<td>Petroleum, Soil, Water, etc.</td>
<td>$49,715</td>
</tr>
<tr>
<td>Salmon ID</td>
<td>0.27</td>
<td>3 USTs; contaminated soils 5-9 ft below surface</td>
<td>$62,519</td>
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<tr>
<td>Salem OR</td>
<td>0.35</td>
<td>Gas station with UST</td>
<td>$67,770</td>
</tr>
<tr>
<td>mine CA</td>
<td>5</td>
<td>PCB, VOC, Lead, Soil</td>
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</tr>
<tr>
<td>Yuma mine AZ</td>
<td>40</td>
<td>Lead, Soil</td>
<td>$149,800</td>
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<tr>
<td>Peanut mine</td>
<td>82</td>
<td>Petroleum, Soil, Water, etc.</td>
<td>$200,000</td>
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<tr>
<td>Shoe mine</td>
<td>4</td>
<td>Surface water, Metals</td>
<td>$225,000</td>
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<tr>
<td>S Rvr feedlot AZ</td>
<td>160</td>
<td>Extensive issues</td>
<td>$249,381</td>
</tr>
</tbody>
</table>
What do I need to do if a Licensed Contractor is to be hired?

Search the web or the telephone directory to locate licensed environmental contractors who specialize in Phase II ESAs in your area to solicit a “Request for Proposal” (RFP). The cost of the project depends on the site size, conditions, travel distances, equipment, sampling parameters and laboratory costs. The contractor provides a project sampling plan, which your environmental team reviews. After the contractor is chosen a contract authorizing the project to begin will to be signed and documents filed with regulatory agencies. Schedule a site visit to assess conditions. The contractor will need daily site access and will test the site. You should monitor the entire process. Keep reports for your legal records.

References

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