

## **Sampling Analysis Plan (SAP)**

# **Sampling and Analysis Plan for Cultural Resource Index Development for Culturally Significant Plants and Toxicity of Soils in Tribal Jurisdictional Lands**

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Prepared For: **Cherokee Nation, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Seneca-Cayuga Tribe, and Wyandotte Nation**

Date: **September 28, 2010**

Revision: **2**

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## **Contents**

1) Background .....	1
2) General Study Design .....	2
3) Study Objectives .....	3
4) Tribal Cultural Resource Index Development Methods.....	3
5) Plant and Soil Collection .....	4
5.1) Plant and Soil Sampling Locations .....	4
5.2) Plant Sampling Methods .....	5
5.3) Soil Sampling Methods .....	6
5.4) Decontamination Procedures .....	6
5.5) QA/QC Samples .....	6
5.6) Sampling Documentation.....	7
5.7) Identification of Samples.....	8
5.8) Analysis .....	8
5.9) Health and Safety .....	9
6) Injury Benchmark Identification .....	9

## 1) Background

For centuries Native Americans have relied upon traditional hunting and gathering for subsistence. The use of traditional plants and animals continues today to provide food, medicine, and clothing for Tribes as well as being important for ceremonial purposes. The traditional methods used to hunt and gather have and continue to be passed to future generations through the teachings of elders within the Tribe and are essential for the preservation of cultural identity.

The Cherokee Nation, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Seneca-Cayuga Tribe and Wyandotte Nation have jurisdictional lands located in Northeastern Oklahoma just downstream of the Tar Creek, Cherokee County, Kansas; Jasper and Newton counties, Missouri Superfund Site (aka Tri-State Mining District or TSMD). Heavy metals released from mining activities have been transported by the Neosho and Spring river watershed (including Tar Creek) in Northeast Oklahoma to the Grand Lake O' The Cherokee's (McDonald 2009). A large number of tribal gathering trips takes place within riverine habitats located within the floodplains of the Neosho and Spring rivers. However the rivers have moved contamination into these tribal gathering areas (Pita and Hyne 1975). It is a concern that these areas may be exposed to heavy metal contamination during seasonal flooding events. The Tribes have documented that tribal citizens have stopped using these areas because of the contamination and fear of contamination (Tribal Cultural Resource Survey 2009). Additionally, studies have shown that upland prairies are contaminated by nearby mine tailings (EPA 2000, OU4 2008, ROD 2008) Gathering areas that are located near these mine tailings may be affected by heavy metal contamination. Due to documented and potential heavy metal contamination of gathering areas, the tribal citizens are losing the knowledge of traditional gathering and use of culturally significant plants.

Heavy metal contamination of gathering areas poses serious threat to tribal members and to the cultural identity of Tribes. Many tribal members gather from areas that may be contaminated by heavy metal runoff. Other tribal members no longer gather or gather in areas that are far away from their jurisdictional lands because of the widespread of contamination in the stream and river systems. Additionally, tribal members are no longer able to find certain culturally significant plants where they were once abundant on jurisdictional lands (Tribal Cultural Resource Survey 2009). This may be due to a particular plant's inability to withstand elevated levels of heavy metals within the soil or it is out competed by non native, weedy species that can tolerate such conditions. Since Tribes may be deterred from practicing traditional gathering on their own jurisdictional lands due to heavy metal contamination, there is a major concern that their cultural identity is significantly threatened.

An EPA Region 6 – Operable Unit (OU)4, Human Health (HHR) Study and by the 2009 Tribes Cultural Resource Survey that was conducted within the Tar Creek Superfund Site revealed that wild asparagus, cattail, and willow contained elevated levels of lead, cadmium, and zinc within their roots, stem, and leaves. The tribes use these plants as part of their cultural practices and as part of a subsistence lifestyle that is important to the tribal members.

The information presented in the EPA – OU4, HHR study and by the 2009 Tribal Cultural Resource Survey, indicates that Tribal trust resources have been injured from the heavy metals released from the TSMD. The Tribal Trustees must quantify the injuries to culturally significant plant communities that may be affected by heavy metal contamination. Currently, there is *no* tool available that takes into account the value that a Tribe has for their culturally significant plants. In addition, no published data exists that quantifies the concentrations of heavy metals within culturally significant plants that are downstream of the Tar Creek OU4 and TSMD. In addition, the Tribes do not know the concentrations of heavy metals within the most valued culturally significant plants. In order for the tribes to quantify the injuries to tribal trust plant resources, they need additional information on both of these topics.

This Sampling and Analysis Plan (SAP) describes the general study design, sampling methods, locations, numbers and analytical techniques that will be used by the Tribes for the development of the CRI and the assessment of the level of injury to the culturally significant plants.

## **2) General Study Design**

The information presented in studies from the TSMD (i.e. EPA – OU4, HHR study, and the Tribal Cultural Resource Survey) indicate that Tribal trust resources have been injured from the heavy metals released from the TSMD. The tribal Trustees must quantify the injuries to culturally significant plant communities that may be affected by heavy metal contamination as part of the Natural Resource Damage Assessment and Restoration (NRDAR) process. Currently, there is no tool available that take into account the value that a Tribe has for their culturally significant plants. No published data exists that quantifies the concentrations of heavy metals within culturally significant plants that are downstream of the Tar Creek OU4 and TSMD areas. In addition, the Tribes do not know the concentrations of heavy metals within the most valued culturally significant plants. In order for the tribes to quantify the injuries to tribal trust plant resources they need additional information of both of these topics.

Each of the Six Treaty Tribes has established a matrix of the value of each plant on an extensive list of locally culturally significant plants to determine the value of that plant to the Tribe. Each plant is rated: highly important to the Tribe, medium importance to the Tribe, low importance to the Tribe, or not important. Values of plants will range from 1 (little value) to 10 (highest value). How that plant is used by tribal members determines the value of that plant to the Tribe. Plants are used in several ways by tribal members such as subsistence, crafts, medicine, ceremonial, or culture/tradition (Tribal Cultural Resource Survey 2009). Transects will be set up along riverine/prairie areas of the tribes' jurisdictional lands in a similar manner to the way tribal members gather plants and culturally significant plants will be counted and rated according to that Tribe's importance matrix. Abundance and diversity of plants will be considered in the Cultural Resource Index. Samples of the culturally significant plants will be taken (parts that are used by the tribes) and sent to a certified lab for heavy

metal analysis. At the same time, soil samples near the plants will be taken and also sent to the same lab for analysis. The samples will be taken during the various seasons of the year to include those plants that are gathered in the spring and summer, berries and fruit which ripens over the growing season, nuts which are gathered in the fall, and roots which are gathered during the winter.

Plant transects will also be sampled in control sites located away from mining contamination, but in similar habitats and eco-zones. CRI values for control sites will be determined in order to establish a range of CRI values for uncontaminated gathering areas. CRI values from contaminated sites will be compared to the range of control values in order to determine injury to culturally significant plant populations. If concentrations of heavy metals in culturally significant plants are higher than the culturally significant plants in the control sites, then those plants will be considered injured. If the soil in the test area has a higher concentration of heavy metals than the soil from the control sites, then the test area is considered contaminated.

### **3) Study Objectives**

- 1) Develop the plant portion of the Cultural Resource Index (CRI) that is specific to each of the following Tribes: Cherokee Nation, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Seneca-Cayuga Tribe and Wyandotte Nation and is based on a matrix that each Tribe has established for its own culturally significant resources within a particular habitat.
- 2) Measure the concentrations of lead, zinc, and cadmium in soils located within gathering areas that may be injured by heavy metal contamination.
- 3) Measure concentrations of lead, zinc, and cadmium within the most important culturally significant plants that are within gathering areas that may be injured by heavy metal contamination.
- 4) Determine the level of injury to culturally significant plants from the heavy metals released by Tar Creek and TSMD.

### **4) Tribal Cultural Resource Index Development Methods**

- 1) Data from the Tribal Cultural Survey of 2009 and a continuation of the Survey in 2010 will be compiled to determine the most important culturally significant plants that are used by each of the Six Treaty Tribes of Oklahoma.
- 2) Plants do not have to be native of Oklahoma to be considered culturally significant.
- 3) The cultural importance of each culturally significant plant species will be ranked on a scale of 1 to 10 that is based on its cultural value to each Tribe:
  - a. A plant ranked 0 would be a species with no cultural significance.

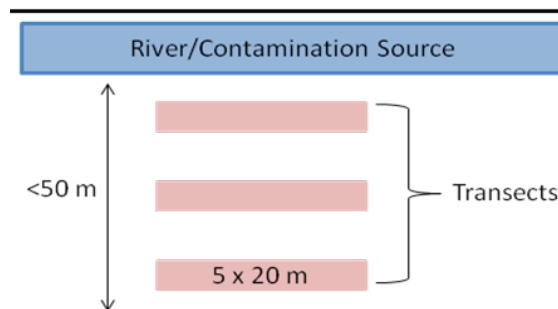
- b. A plant ranked 10 would be widely used in traditional cultural practices.
- 4) The index will be divided into sections according to habitat type (i.e. prairie and riverine/aquatic).
- 5) The equation by which the plant portion CRI is under development.

## 5) Plant and Soil Sample Collection

Sampling sites for soils and culturally significant plants will be selected within each Tribe's jurisdictional gathering areas that may be injured by heavy metal contamination. The number of sampling sites within each Tribe's jurisdictional lands will be determined by the amount of acreage of the total gathering areas that are accessible by the Tribe. Sampling sites will be located in either prairie areas or riverine/aquatic areas that Tribal members identify on upcoming cultural surveys to be conducted in 2010. Importantly, sampling locations will be in areas that Tribal members actively gather or have gathered at in the past. Control areas will be chosen in uncontaminated areas that Tribal members identify as gathering areas on the 2010 surveys.

### 5.1) Plant and Soil Sampling Locations

A designated sampling site will consist of three transect lines that are each 5 meters x 20 meters. Transect lines will be placed at varying distances from but yet still within 50 meters from the source of contamination. For all sampling sites that are within riverine habitat, transect lines will run parallel to shore and be located within the floodplain. Soil sampling will be co-located with the plants sampling. All culturally significant plants will be gathered along the transect. It is important to mention that transects within this study are designed to mimic the way a tribal member would gather for traditional plants. Specifically, they are likely to gather in straight lines and their field of view would be within 2 meters to the right or left of them.



**Figure 1. Schematic of a generalized sampling site.**

A total of 42 sampling locations will be selected:

- 1) 12 will be located on Cherokee jurisdictional lands,

- 2) 4 will be located on Eastern Shawnee jurisdictional lands,
- 3) 4 will be located on Miami jurisdictional lands,
- 4) 6 will be located on Ottawa jurisdictional lands,
- 5) 5 will be located on Seneca-Cayuga jurisdictional lands,
- 6) 5 will be located on Wyandotte jurisdictional lands,
- 7) 6 will be control sites located upstream of mining activities.

Personnel from Tribal Environmental Management Services will conduct sampling procedures and may or may not be accompanied by employees of the Six Treaty Tribes' environmental departments. Tribal Environmental Management Services will process samples, Chain-of-Custody, coordinate shipping, etc.

## 5.2) Plant Sampling Methods

### Culturally Significant Plant Species Counting

- 1) Transects will be outlined using wooden posts staked at each corner connected by pre-cut lengths of rope.
- 2) Two samplers will walk abreast down the length of each transect identifying plants.
- 3) Data will be recorded in the Sampling Log Book by a third sampler following behind.

### Collection and Handling of Samples

- 1) Samplers shall wear disposable clear or white latex gloves at all times during the collection of soil samples and gloves will be changed before each new sample is taken.
- 2) Depending on the plant organ to be sampled different sampling methods will be implemented;
  - a. Roots or rhizome:
    - i. A stainless steel trowel will be used to dig up the plant,
    - ii. The organ to be collected will be removed from the plant using stainless steel scissors,
    - iii. The organ will be thoroughly rinsed using de-ionized water,
    - iv. The organ will be placed in a re-sealable plastic bag,
    - v. The re-sealable plastic bag will be stored at 4C until shipment.
  - b. Leaves, stems, or fruit:
    - i. The organ to be collected will be removed from the plant using stainless steel scissors,

- ii. The organ will be thoroughly rinsed using de-ionized water,
  - iii. The organ will be placed in a re-sealable plastic bag,
  - iv. The re-sealable plastic bag will be stored at 4°C until shipment.
- 3) 40 plant samples will be collected for each of the Six Treaty Tribes. Specifically, 10 samples each of the 4 most culturally significant plants will be collected. A total of 240 plant samples will be collected in contaminated areas. An estimated 48 plant samples will be collected from control areas.

The particular plant organ to be collected will depend on how the plant is used by tribal members.

### **5.3) Soil Sampling Methods**

- 1) Samplers shall wear disposable clear or white latex gloves at all times during the collection of soil samples and gloves will be changed before each new sample is taken.
- 2) Three 6 in. deep holes will be dug using a stainless steel trowel at 0, 10, and 20 meters along the length of each transect.
- 3) Soil from each hole within each transect will be composited in a stainless steel bowl and placed in a glass jar.
- 4) In all, three composited soil samples will be collected from each site for a total of 126 samples.
- 5) Samples will be refrigerated at 4 degrees Celsius until preparation.
- 6) Soil samples will be prepared for portable XRF analysis according to EPA Method 6200. The samples will be oven dried to a constant weight, ground using a mortar and pestle, and sieved to 63 microns.
- 7) A total of 12 soil sample will be collected for each of the Six Treaty Tribes. An estimated 72 soil samples will be collected from control areas.

### **5.4) Decontamination Procedures**

Sampling equipment shall be cleaned after each use by scrubbing with Liquinox® and rinsing with de-ionized water. All waste generated during sampling will be placed in a disposable trash bag and placed in a container where the waste will be transported to a landfill.

### **5.5) QA/QC Samples**

Field: Duplicates: 1 out of every 20 samples collected will be a duplicate sample. Blind standards, decontamination blanks, or field blanks will not be submitted for this particular project.

Lab: Laboratory analysis will be conducted by the Elemental Analytical Laboratory at Texas A&M University on a sub-set of the field collected samples following a review

of the data gathered from analysis by portable XRF. The sub-set of samples will consist of no less than 5% of the total number of samples collected as per EPA Method 6200.

## 5.6) Sampling Documentation

### 5.6.1) Sampling Log Book

- 1) A Sampling Log Book shall be maintained.
- 2) The Sampling Log Book shall be bound and constructed of waterproof paper.
- 3) Entries in the Sampling Log Book shall be made in permanent black ink.
- 4) Each page in the Sampling Log Book shall be dated.
- 5) The preparer shall initial each page of the Sampling Log Book.
- 6) For each location sampled, the following information shall be recorded in the Sampling Log Book:
  - a) GPS coordinates,
  - b) Waypoint number,
  - c) Frame numbers of all photographs taken at location,
  - d) Sketch map of location showing transects, locations of samples taken, and approximate dimensions and locations of local features including; water bodies, roads, fence rows, adjacent fields etc,
  - e) The unique numeric identifier of each sample taken at the location (see section 8),
  - f) The name and number of each culturally significant plant species within each transect.

### 5.6.2) Photographic Record

A photographic record shall be made and maintained for all sampling activities on this project. All photographs shall be time and date stamped.

### 5.6.3) Chain-of-Custody

A Chain-of-Custody shall be prepared for each set of samples transferred to the Elemental Analytical Laboratory at Texas A&M University. The Chain-of-Custody shall, at a minimum, contain the following information:

- 1) The project name, ***Cultural Resource Index Development and Sampling and Analysis Plan for Culturally Significant Plant and Toxicity of Soils in Tribal Jurisdictional Lands***,
- 2) Name of person/entity collecting samples,

- 3) Signature blocks with dates and times for all persons having custody (sampler, shipper, processing laboratory, etc),
- 4) For each sample related to a Chain-of-Custody:
  - a) The unique numeric identifier on the submitted sample container (see section 8),
  - b) The date and time the sample was collected,
  - c) The sample matrix (soil/plant)

### **5.7) Identification of Samples**

Identifying information to be included on the sample label for plant and soil samples:

- 1) The tribal identifier pertaining to the jurisdictional land upon which the sample is obtained will consist of an abbreviation of the name of each of the Six Treaty Tribes; Cherokee Nation- CHN, Eastern Shawnee Tribe- ES, Miami Tribe- MT, Ottawa Tribe- OT, Seneca-Cayuga Tribe- SC, Wyandotte Nation- WYN.
- 2) The site identifier will consist of S1, S2, S3 etc.
- 3) The transect identifier will consist of T1, T2, or T3.
- 4) The sample media identifier:
  - a. Soil: will be labeled as S.
  - b. Plant: will consist of the common name of the plant. The specific plant organ sampled will be recorded in the log book only.
- 5) If necessary, an alphanumeric identification will be assigned if more than one sample of the same medium is obtained from the same transect: A, B, C etc.
- 6) Duplicate samples will be identified by assigning additional alphanumeric identification to the end of the identification information and will consist of D.

For example, a soil sample obtained from transect 2 of site 4 on Cherokee Nation jurisdictional lands will be labeled CHN-S4-T2-S.

### **5.8) Analysis**

#### **5.8.1) XRF Analysis**

Portable XRF analyses are being conducted according to EPA Method 6200 by Jason White (918-453-5110) of the Cherokee Nation. Analytical protocols are provided in a separate document.

#### **5.8.2) Laboratory Analysis**

Laboratory analyses are being conducted by the Elemental Analysis Laboratory (979-853-7630) or 979-845-23410. College Station, TX 77843-3144. Analytical protocols are provided in a separate document.

### **5.8.3) Shipment of Samples to Analytical Laboratory**

- 1) Shipping coolers will be packed such that samples are stored with dry ice placed in double-bagged re-sealable plastic bags.
- 2) If possible, samples shall be shipped immediately via overnight shipment to the analytical laboratory. The laboratory address is:  
Elemental Analysis Laboratory  
Center for Chemical Characterization and Analysis  
Texas A&M University  
3144 TAMU  
College Station, TX 77843-3144
- 3) Samples shall be sent to the laboratory under a Chain-of-Custody.
- 4) A custody seal will be placed on the outside of the container across the area between the lid and the container. The custody seal will be signed.
- 5) The Chain-of-Custody will be placed in a re-sealable plastic bag and placed within the container holding those samples to which it refers.
- 6) Sample containers will be boldly marked "Refreeze upon Receipt" on the outside of the container.

### **5.8.4) Data Reporting**

- 1) Data from the laboratory shall be reported in both electronic and paper reports.
- 2) Data reports shall include all quality control data generated, including results for duplicates, blanks, and spikes, as applicable.
- 3) Data reports shall include a copy of the Chain-of-Custody accompanying each set of samples submitted.

## **5.9) Health and Safety**

Contaminated soil and sediment will be frequently encountered during the course of this project. The Health and Safety Plan (provided as a separate document) for this project shall be reviewed by all samplers.

## **6) Injury Benchmark Identification**

The range of CRI values calculated for uncontaminated, control sites will be used to compare CRI values calculated from contaminated areas. If the CRI value of a site within the area of contamination is determined to be lower than the range of control values then the culturally significant plant population within that site will be considered

injured. Also, a range of CRI values for contaminated sites will be documented in order for future comparisons to be made.

Heavy metal concentrations within culturally significant plants in control areas will be compared to those from contaminated sites on a species by species basis. If concentrations are found to be higher in plants living in contaminated sites then they will be considered to be injured. Concentrations of heavy metals in culturally significant plants will be documented and made available for future comparisons.