



**STANDARD OPERATING PROCEDURE FOR:  
VEGETATION SAMPLING**

**TVA-KIF-SOP-38**

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for  
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## 1.0 PURPOSE

This standard operating procedure (SOP) provides the general technical requirements and operational guidelines for collecting vegetation samples at the Kingston Fossil Plant (KIF) for the purpose of generating samples that are representative of the media the samples are intended to characterize. The requirements of this SOP are applicable to sampling the vegetation that has been planted to add stability to the crust of the ash.

## 2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The site-specific *Health and Safety Plan* (HASP) provides a description of potential hazards and associated safety and control measures.

Every sampling personnel must wear powder-free nitrile gloves while performing the procedures described in this SOP. Specifically, nitrile gloves must be worn while preparing sample bottleware, preparing and decontaminating sampling equipment, collecting and processing samples, and packing samples. At a minimum, nitrile gloves must be changed prior to the collection of each sample, or as necessary to prevent the possibility of cross-contamination with the sample, the sample bottleware, or the sampling equipment.

This vegetation sampling SOP was developed using the sampling requirements detailed in the *Field Documentation* SOP (TVA-KIF-SOP-06); *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07); *Decontamination of Equipment* SOP (TVA-KIF-SOP-08); *Field QC Sampling* SOP (TVA-KIF-SOP-11); and *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12). This SOP was also developed under the guidelines provided in TVA work plan document *Vegetation Sampling Plan* (VSP).

## 3.0 VEGETATION SAMPLING PROCEDURES

This section documents general operating procedures and methods associated with vegetation sampling activities. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the Quality Assurance/Quality Control (QA/QC) to obtain approval for the deviation to the procedure prior to conducting vegetation sampling activities and to determine if the deviation is acceptable relative to affecting data reliability. If the deviation is not acceptable to the QA/QC Lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the project dedicated field logbook.

### 3.1 Pre-Job Preparation

The Field Team Leader (FTL) will ensure that the following activities have been completed prior to mobilizing to the site.

- a. Obtain equipment necessary for completing the project-specific sampling activities (see Table 1 for an example checklist of vegetation sampling equipment and materials).
- b. Ensure that appropriate laboratory-provided bottleware is available for both the required analyses and for quality control (QC) samples and that there has been thorough coordination with the analytical laboratory.
- c. Review project work control documents including the *Quality Assurance Program Plan* (QAPP) and work plan document VSP in an effort to determine the project-specific sampling requirements, procedures, and goals.
- d. Ensure that a random grid system has been generated for each sample area and that the cells in the grid have been randomly numbered. Vegetation sample collection areas shall be properly surveyed and marked with GPS coordinates as specified in the VSP.

### 3.2 Vegetation Sampling

Unwashed and washed vegetation samples will be collected at every sample location. Vegetation samples will be collected as described below.

- a. Vegetation samples will be collected using plastic scissors (or similar inert non-metallic bladed scissors).
- b. Scissors will be decontaminated prior to the collection of each vegetation sample set with a Liqui-Nox™ (or similar laboratory-grade detergent) wash/scrub, potable water rinse, isopropyl alcohol rinse, potable water rinse, and deionized (DI) water rinse and dried with KimWipes® (or similar) following the general protocols in the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08).
- c. Vegetation samples will be collected from aboveground plant material. Roots and other subterranean parts of the plant will not be included in the collected vegetation sample material.
- d. Vegetation samples sets shall be collected directly into new approximately 4-liter (or larger) Ziploc® bags (or similar sealable bags). Sufficient volumes of plant material will be collected into two separate bags at each sample location for separate processing that will produce an unwashed and washed vegetation sample (sample set). Sufficient volume of vegetation shall be collected to fill approximately half the 4-liter bag.

- e. Ziploc<sup>®</sup> bags containing samples will be labeled, double bagged, and packed in environmental coolers on bagged wet ice for temporary storage until they are taken to TVA's Greenway Laboratory for vegetation sample processing. Appropriate chain-of-custody must be maintained during sample collection and transport to Greenway Laboratory according to the *Field Documentation SOP* (TVA-KIF-SOP-06).

### **3.3 Vegetation Sample Processing at the TVA Laboratory**

The following steps will be followed for vegetation sample processing in the TVA laboratory.

- a. Unwashed and washed vegetation samples will be processed separately. Washed samples shall be processed first following steps *b* through *h* listed below. Unwashed samples shall be processed second following steps *c* through *h* listed below.
- b. Ziploc<sup>®</sup> bags containing washed vegetation samples shall be partially filled with DI water, sealed, and then agitated (for approximately 45 seconds) to suspend ash residue. The DI water will be emptied from the bag (care shall be taken to avoid losing any vegetation sample) then refilled with fresh DI water and rinsed again an additional 2 times using the same agitation procedure. If excess residual material is present in the Ziploc<sup>®</sup> bag it may be necessary to transfer the vegetation material to a new bag after the each rinse.
- c. Vegetation samples will be placed in labeled new 4-liter (or larger) paper bags and placed in a decontaminated oven.

- d. The bags containing the vegetation samples will be dried at 40°C until constant weight is achieved (Woodbury, et al., 1999). Constant weight is obtained using the following procedure.
- Dry the vegetation samples in the oven for a minimum of 12 hours.
  - Weigh approximately 10% of the vegetation samples including the paper bags ( $W_{t-1}$ ) then return the samples to the oven and continue drying for another hour.
  - Reweigh the same vegetation samples previously weighed ( $W_t$ ) – if the percent difference (PD; Equation 1) between the measured masses is less than 5%, then constant weight is achieved. If the PD is greater than 5%, then dry the samples for an additional three hours and repeat this step.

*Equation 1:*

$$PD = \frac{(W_{t-1} - W_t)}{W_{t-1}} \times 100\%$$

*PD = percent difference*

*$W_t$  = most recent measured mass of the vegetation sample*

*$W_{t-1}$  = previous measured mass of the vegetation sample*

- e. The oven will be decontaminated prior to drying vegetation samples using a new sponge to apply a Liqui-Nox™ (or laboratory-grade detergent) wash, a potable water wash, an isopropyl alcohol wash, a potable water wash, and then a DI water wash and allowed to air dry following the general protocols in the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08).
- f. Once vegetation samples are sufficiently dried, vegetation samples will be milled using a Wiley Mill (Model: 3383-L10) set to mill to a particle size of less than 1 millimeter particle size (sufficient to pass through 40 mesh sieve).
- g. The Wiley Mill will be decontaminated prior to milling each vegetation sample by vacuuming the chamber, using an alcohol swab to wipe-out interior surfaces, then inspect for loose material and re-vacuum if necessary.
- h. Milled vegetation samples will be placed in a 4-ounce, laboratory provided, glass sample jar. The sample jar will be labeled, custody sealed, and placed in an environmental cooler on bagged wet ice under appropriate chain-of-custody documentation in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07) for shipment to the analytical laboratory.

- i. The samples shall be kept in secure laboratory storage, under proper custody, at all times during processing. If samples are left unattended (such as overnight), a key sign-out sheet shall be used to track personnel who have access to the secure laboratory storage.

### 3.4 Vegetation QA/QC Sampling

The subsequent steps will be followed to ensure that the vegetation sampling meets QA/QC protocols.

- a. One duplicate vegetation sample set will be collected for every 20 investigative samples or once per day (whichever is greater) according to the *Field QC Sampling* SOP (TVA-KIF-SOP-11) and the QAPP.
- b. One MS/MSD vegetation sample set will be collected for every 20 investigative samples or once per day (whichever is greater) according to the *Field QC Sampling* SOP (TVA-KIF-SOP-11) and the QAPP.
- c. One equipment rinse blank will be collected on a new Ziploc<sup>®</sup> bag, one on a new paper bag, and one on the decontaminated Wiley Mill for every 20 investigative samples collected or once per day (whichever is greater) according to the *Field QC Sampling* SOP (TVA-KIF-SOP-11) and the QAPP.
  - Collection of the equipment blank on the new Ziploc<sup>®</sup> bag will be conducted by pouring laboratory-provided DI water into a new Ziploc<sup>®</sup> bag and then pouring the water from the bag directly into the 4-ounce, laboratory provided, glass sample jar.
  - Collection of the equipment blank on the new paper bag will be conducted by pouring laboratory-provided DI water into the paper bag and then pouring the water from the paper bag directly into 4-ounce, laboratory provided, glass sample jar.
  - Collection of the equipment blank on the Wiley Mill will be conducted by pouring water through the grinding chamber of the Wiley Mill directly into the 4-ounce, laboratory-provided, glass sample jar.
- d. Field observations and sample collection methods will be detailed in a project-specific field logbook according to the *Field Documentation* SOP (TVA-KIF-SOP-06).

### 3.5 Sample Handling, Packing, and Shipping

Samples will be containerized, labeled, packaged, and shipped in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

### 3.6 Field Logbook Documentation

Field logbooks will be maintained by the FTL or designee and used to record daily activities. In addition to the minimum requirements discussed in the *Field Documentation SOP* (TVA-KIF-SOP-06), the field logbooks will document the vegetation sampling activities specific to this SOP and as defined in the applicable project work control documents (listed in this SOP in Section 3.1.c).

The FTL and/or designee will review the field logbook entries for completeness and accuracy and will indicate this review by initialing each page of the logbook. The FTL is responsible for completion of the required data collection forms.

### 3.7 Decontamination and Waste Management

Sampling equipment decontamination will be performed in a manner consistent with the *Decontamination of Equipment SOP* (TVA-KIF-SOP-08). Investigation-derived wastes produced during vegetation sampling or decontamination will be managed in accordance with the *Management of Investigation-Derived Waste SOP* (TVA-KIF-SOP-12).

## 4.0 REFERENCES

- Tennessee Valley Authority (TVA). *Decontamination of Equipment SOP* (TVA-KIF-SOP-08), February 2009.
- TVA. *Field Documentation SOP* (TVA-KIF-SOP-06), February 2009.
- TVA. *Field Quality Control Sampling SOP* (TVA-KIF-SOP-11), April 2009.
- TVA. *Management of Investigation-Derived Waste SOP* (TVA-KIF-SOP-12), March 2009.
- TVA. *Quality Assurance Program Plan (QAPP)*, 2009.
- TVA. *Sampling Labeling, Packing, and Shipping SOP* (TVA-KIF-SOP-07), February 2009.
- TVA. *Vegetation Sampling Plan (VSP)*, Work Plan, 2009
- Woodbury, P.B., G. Rubin, D.C. McCune, L.H. Weinstein, and E.F. Neuhauser. "Assessing Trace Element Uptake by Vegetation on a Coal Fly Ash Landfill," Water, Air, & Soil Pollution, Volume 111, Numbers 1-4, April 1999.

<b>Table 1: Vegetation Sampling Equipment and Material Checklist</b>	
<b>Item Description</b>	<b>Check</b>
<b>Health &amp; Safety</b>	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Reflective safety vest	
Eyewash	
Safety glasses	
Respirator and cartridges (if necessary)	
Saranex™/Tyvek® suits and booties (if necessary)	
<b>Vegetation Sampling Equipment</b>	
Plastic, ceramic, or similar scissors	
Resealable plastic bags (5-liter size)	
Packing tape, custody seals	
Environmental cooler	
Duct tape	
Field logbook	
Chain-of-Custody forms	
Digital camera with GPS capability	
Trash bags	
Decontamination supplies	
<b>Vegetation Processing Equipment</b>	
Oven	
Paper bags (5-liter size)	
Scale	
Wiley Mill	
<b>Decontamination and Waste Management Equipment</b>	
DOT-approved 55-gallon drums or other appropriate containers	
Drum wrench	
Rinse bottle	
Potable and deionized water	
Decontamination fluids (Liqui-Nox™, isopropyl alcohol, KimWipes® or alcohol wipes)	
Vacuum	
Brushes	
Trash bags	

**End of Procedure**