



**STANDARD OPERATING PROCEDURE FOR:
PERIPHYTON SAMPLING**

TVA-KIF-SOP-59

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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 periphyton samples for the Kingston Fossil Plant (KIF) Ash Recovery Project for the purpose of generating representative samples. Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in aquatic ecosystems and provides an important food source for invertebrates, tadpoles, and some fish. Periphyton absorbs contaminants, removing them from the water and introducing them into the aquatic food chain. Periphyton play an important role in that food chain as the first step in bio-concentration of contaminants from the water column into aquatic life. The requirements of this SOP are applicable to sampling the naturally-occurring periphyton using artificial substrates.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks are thoroughly evaluated prior to conducting field activities. The *Site-Wide Safety and Health Plan (SWSHP)* provides a description of potential hazards and associated safety and control measures.

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

Sampling personnel use caution when entering collection sites. Personnel wear waders or boots to prevent contact with potential ash that may be present in the water. Water safety hazards and proper precautions are discussed before attempting collection of samples. Sampling events are scheduled with the Field Team Leader. Table 1 presents an example checklist of equipment and materials needed for periphyton sampling.

Additionally, a Float Plan is completed prior to traveling anywhere on a water vessel. A Float Plan includes a description of the water vessel, specifies who is on board, provides a description of the safety equipment being carried, and indicates destination and expected time of return. The float plan is submitted to the Field Team Leader no later than the day of the sampling event.

This SOP was developed using the sampling requirements detailed in the U.S. Environmental Protection Agency's (EPA's) *Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish* (EPA 841-B-99-002); American Society for Testing and Material's (ASTM's) *Methods and*

Measurements of Periphyton Communities: A Review; and TVA's *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); and *Field QC Sampling SOP* (TVA-KIF-SOP-11). This SOP was also developed under the guidelines provided in TVA work plan document *Non-Time Critical Removal Action for the River System Sampling and Analysis Plan* (SAP).

3.0 PERIPHYTON SAMPLING PROCEDURES

This section documents general operating procedures and methods associated with periphyton sampling activities. In the event these procedures cannot be performed as written in this SOP, field personnel contact the Quality Assurance (QA) Officer to obtain approval for the deviation to the procedure prior to conducting periphyton sampling activities and to determine if the deviation is acceptable relative to affecting data reliability. If the deviation is not acceptable to the QA Officer, then the field team ceases sampling activities until the issue associated with the deviation is resolved.

Documentation of approved deviations is recorded in the project dedicated field logbook.

3.1 Pre-Job Preparation

The Project Manager is responsible for overall implementation of this procedure and ensuring that it complies with current regulations and standards as these periodically change. The Project Manager is also responsible for performing the following activities.

- a. Coordinate with appropriate regulatory agencies to ensure that appropriate documentation and/or permits are obtained.
- b. Provide the Field Team Leader with collection locations and schedules of sampling events.
- c. Coordinate with Field Team Leader to ensure that appropriate field equipment and safety gear are available.
- d. Review scientific literature, site-specific *Quality Assurance Project Plan* (TVA-KIF-QAPP), SWSHP, and appropriate SOPs with the TVA Project Manager to determine appropriate field protocols.
- e. Develop and maintain contracts and interact with subject-matter experts to review sampling protocols and results of toxicity analysis, to ensure scientific rigor, and to establish contaminant thresholds as necessary.
- f. Verify collection and sample handling methods and obtain equipment necessary for completing the collection and sampling activities (refer to Table 1).
- g. Identify appropriate laboratories to perform analyses and confirm that they have been contacted and are prepared to receive the samples.

- h. Identify appropriate temporary storage for samples until shipment to the laboratory(s).

3.2 Field Preparation

The Field Team Leader is responsible for implementation of the field collection process, including ensuring that periphyton samples are safely collected, that all decontamination protocols are used to maintain sample integrity, and that associated data are accurate and well-documented. Upon arrival at the site, the Field Team Leader provides a summary of potential hazards (or JSA) and provides appropriate safety equipment to the field team. Contact with property owners is made as appropriate. The Field Team leader is responsible for the following activities.

- a. Identify collection, sampling, and documentation roles for personnel and thoroughly describe the sampling process.
- b. Distribute appropriate collection, sampling, and documentation equipment to the field collection team (see Table 1 for checklist of periphyton sampling equipment and materials).
- c. Maintain documentation of field activities and Chain-of-Custody (COC) records in accordance with the *Field Documentation SOP* (TVA-KIF-SOP-06).
- d. Work with appropriate personnel to produce computerized shipping labels for each specimen collected.
- e. Ensure that QA/QC protocols are followed.
- f. Ensure that periphyton sample locations are pre-selected in coordination with the ecological risk assessors and that representative samples of the periphyton will be collected, as specified in the SAP.

3.3 Placement of Artificial Substrates for Periphyton

Periphyton will be sampled by collecting from artificial substrates placed in aquatic habitats and colonized over a period of time prior to sampling. This procedure is used at the KIF Ash Recovery Project site because it is particularly useful in non-wadeable streams, rivers with no riffle areas, wetlands, and the littoral zones of lentic habitats.

Artificial substrates are deployed in periphytometers as follows. The main channel of the Emory and Clinch rivers will be avoided to the extent practicable while meeting the objectives of the study. Periphyton samples should be collected during periods of stable stream flow, as periods of high stream flow can cause scouring.

- a. Thoroughly decontaminate microslides before placing in periphytometers in a manner consistent with the *Decontamination of Equipment SOP* (TVA-KIF-SOP-08). Clean and dry microslides using Kimwipes® or equivalent.

- b. Place periphytometers fitted with glass slides in the study areas defined in the SAP. Attach periphytometers to rebars staked into the stream bottom or to other stable structures. Hide periphytometers from view to minimize disturbance or vandalism. Orient each periphytometer with the shield directed upstream.
- c. Replicate a minimum of three periphytometers at each study area to account for spatial variability. Upon collection, combine the periphyton from the three periphytometers into one composite sample.
- d. Record GPS coordinates for each collection location.
- e. Allow 2 to 4 weeks for periphyton recruitment and colonization.

3.4 Periphyton Sampling

After the incubation period (two to four weeks), the periphyton is sampled as follows.

- a. Don nitrile gloves and other PPE as appropriate.
- b. At each sampling location, collect the periphytometers.
- c. Place each periphytometer in a separate resealable plastic bag. Label bag with the following information: sample ID, time of collection, and sample collector name(s). Place bag in an environmental cooler on bagged wet ice.
- d. Transport samples to a pre-selected location (such as Lakeshore Drive sampling house) for processing.

3.5 Periphyton Sample Processing

The following steps are conducted for periphyton sample processing.

- a. Remove algae from substrate using decontaminated rubber, ceramic, or similar spatulas and/or scrapers. Successful removal is determined by a change from a smooth, mucilaginous feel (even when no visible algae are present) to a non-slimy or rough texture. Try to collect at least two grams for laboratory chemical analysis. Bahl (1993) recommends up to 4 ounces for population assessments and community impairment studies.
- b. Transfer the periphyton by scraping the spatula or scraper along the inside lip of the appropriate sample container. Sample containers can either be a 4-ounce glass jar or a resealable plastic bag. The sample should be double bagged with labels on both bags if using resealable plastic bags. Combine the samples from all three periphytometers into one composite sample to account for spatial variability.
- c. Place a permanent label on the outside of the sample container with the following information: sample ID, time of collection, and name(s) of collector(s).

- d. Provide collection and sampling information to QA/QC staff so that unique sampling labels can be created for each specimen in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07). Transport samples to the field sample office in a cooler with ice (to maintain samples in a cold and dark environment) and store samples in the dark until they are processed. Stow samples in a way so that transport and shifting does not cause samples to leak. Freeze samples as soon as practical (at a minimum, the collected samples should be placed in a freezer by the end of the sampling day).
- e. Complete a Chain-of-Custody (COC) form to accompany the periphyton samples from time of collection through shipment to the laboratory. Refer to *Field Documentation* SOP (TVA-KIF-SOP-06) for proper COC procedures.

3.6 Periphyton QA/QC Sampling

The subsequent steps are followed to ensure that the periphyton sampling meets QA/QC protocols according to *Field QC Sampling* SOP (TVA-KIF-SOP-11) and the QAPP.

- a. Place one set of replicate periphyton sample slides (3) in a co-located position. Collect replicated periphyton sample per the QAPP. These co-located sample slides are in addition to the three primary sample slides.
- b. Collect one equipment rinse blank per the QAPP on a new resealable plastic bag and unused slide and decontaminated spatula or scraper.

3.7 Sample Handling, Packing, and Shipping

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

3.8 Field Logbook Documentation

Field logbooks are maintained by the Field Team Leader or designee and used to record daily activities, including sample collection and tracking information. Information is entered into the field logbook by the appropriate field team member using waterproof ink. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks should document the collection and sampling characteristics for periphyton sampling activities specific to this SOP and as defined in the applicable project work control documents. Data include date and time, site name, GPS coordinates, collection time, and collector(s). Additional observations related to field access, weather conditions, and anecdotal observations will also be noted.

The Field Team Leader and/or designee reviews the field logbook entries on a weekly basis at a minimum (daily review is preferred) for completeness and accuracy and indicates this review by initialing the entries. The Field Team Leader is also responsible for the completion of required data collection forms.

3.9 Decontamination and Waste Management

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

4.0 REFERENCES

- American Society for Testing and Materials (ASTM). *Methods and Measurements of Periphyton Communities: A Review*. STP 690.
- Bahl, L.A. *Periphyton Bioassessment Methods for Montana Streams*, Montana Water Quality Bureau, Department of Health and Environmental Sciences, 1993.
- Tennessee Valley Authority (TVA). *Decontamination of Equipment* SOP (TVA-KIF-SOP-08), 2010.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), 2009.
- TVA. *Field Quality Control Sampling* SOP (TVA-KIF-SOP-11), 2009.
- TVA. *Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan (SAP)*, 15 February 2010.
- TVA. *Management and Implementation of EQuIS™-Based Chain of Custody* SOP (TVA-KIF-SOP-18), 2010.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), 2010.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), August 16, 2010.
- TVA. *Sampling Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), 2010.
- TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (SWSHP), 2010.
- U.S. Environmental Protection Agency (EPA). *Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish Second Edition*, EPA 841-B-99-002.
- U.S. Geological Survey. *National Field Manual for the Collection of Water-Quality Data: Techniques of Water-Resources Investigations*, Book 9, Handbooks for Water-Resources Investigations, <http://pubs.water.usgs.gov/twri9A>.

Table 1: Periphyton Sampling Equipment and Material Checklist	
Item Description	Check
Health & Safety	
Nitrile gloves	
Chest waders	
U.S. Coast Guard-approved flotation device	
Field first-aid kit	
Reflective safety vest (if necessary)	
Safety glasses	
Paperwork	
Job Safety Analysis	
Field logbook	
Chain-of-custody forms and custody seals	
Periphyton Sampling Equipment	
Periphytometer with shield	
Resealable plastic bags (5-liter size)	
Glass Slides	
Rebar	
Floats	
Waterproof Twine	
Packing tape	
Environmental cooler	
Duct tape	
Hand-held GPS unit	
Rite-in-the-Rain pen (or equivalent)	
Permanent markers	
Digital camera with GPS capability	
Decontamination supplies	
Periphyton Processing Equipment	
Plastic, ceramic, or similar spatula or scraper	
Decontamination and Waste Management Equipment	
Rinse bottle	
Potable and deionized water	
Decontamination fluids (such as Liqui-Nox™, isopropyl alcohol, KimWipes®, or alcohol wipes)	
Brushes	
Trash bags	

End of Procedure