



**STANDARD OPERATING PROCEDURE FOR:
FISH SAMPLING USING BOAT-MOUNTED ELECTROSHOCKER**

TVA-KIF-SOP-33

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June 2010

1.0 PURPOSE

The objective of this Standard Operating Procedure (SOP) is to prescribe the standard method for electrofishing using boat-mounted electroshockers for collection of fish samples relative to the ash spill at Kingston Fossil Plant (KIF). This SOP describes the procedures necessary to maintain appropriate documentation and proper sample handling for sample integrity.

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. A pre-job safety analysis (JSA) highlighting potential hazards is discussed at each sampling event. The JSA worksheet is provided in Table 4. Sampling is only conducted by properly trained personnel.

If fish are retained for contaminant analysis, powder-free nitrile gloves are worn while preparing sample bottleware, preparing and decontaminating sampling equipment, collecting samples, and packing samples. At a minimum, nitrile gloves are changed prior to the collection of samples at each site, or as necessary to prevent the possibility of cross-contamination with the sample, the sample bottleware, or the sampling equipment.

Electrofishing basically involves using a power source (generator) and wire leads (electrodes) to send DC (direct current) electric current into water. For safety reasons, AC (alternating current) is not used. A control box allows the operator to vary current output for maximum shocking efficiency in waters of varying conductivity. When the voltage is sufficient to produce a current that temporarily stuns fish, the fish that float to the surface are collected with dip nets.

CAUTION: Electrofishing operations are potentially more dangerous than other fisheries sampling techniques. Special consideration is given to personnel safety. The electrofishing unit is kept in good working order and carefully checked for proper operation before use. Personnel adhere to the safety precautions listed in the JSA.

Fast-flowing waters or those with high or low conductivity may considerably reduce the effectiveness of electrofishing or even preclude its use. Electrofishing is effective for collecting a large size range of most species in shoreline (shallower) areas, as well as fish near the surface in open water areas. Collection of bottom-dwelling species is limited by the depth to which the current field extends (about two to three meters) or by visibility.

3.0 PROCEDURES

This section documents general operating procedures and methods associated with collecting samples of fish using a boat-mounted electroshocker. Any variation in these procedures is approved by the Project Manager and Quality Assurance (QA) Officer and is fully documented. Field work progresses as deviations are approved or resolved.

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 are subject to change. The Project Manager is also responsible for the following activities.

- a. Coordination with appropriate regulatory agencies to ensure that appropriate documentation and/or permits are obtained.
- b. Review project work control documents including the *Quality Assurance Project Plan* (TVA-KIF-QAPP), SWSHP, and appropriate SOPs to determine appropriate field protocols.
- c. Refer to specific Sampling and Analysis Plan (SAP) or work plan to ensure project objectives are met such as sampling design (transects, random, stratified), number and length/duration of electrofishing runs, season(s)/month(s) for sampling, required life history information.
- d. Identify approximate sample-station locations. If necessary, make a reconnaissance visit of perspective sampling locations to evaluate their suitability.
- e. Discuss project objectives and potential hazards with project personnel.
- f. Coordinate with Field Team Leader to make sure that appropriate field equipment and safety gear are available.
- g. Make sure that training requirements and needs have been identified and that project personnel complete the necessary training.
- h. Verify that the appropriate laboratory to perform analyses has been identified and confirm they have been contacted and are prepared to receive the samples.

3.2 Field Preparation

The Field Team Leader is responsible for implementation of the field collection process. Field Team Leader confirms that samples are safely collected, that decontamination protocols are used to maintain sample integrity, and that the associated data are accurate and well-documented. Field Team Leader is also responsible for the following activities:

- a. Gather equipment necessary for completing the collection and sampling activities (refer to Table 1 for an example checklist of required equipment).

- b. Provide a summary of potential hazards (or review appropriate JSA worksheet) and appropriate safety equipment to the field sampling team.
- c. Confirm that QA and quality control (QC) protocols are followed.
- d. Maintain documentation of field activities and chain-of-custody (COC) records in accordance with the *Field Documentation* SOP (TVA-KIF-SOP-06).
- e. Set up electrical components (normally stored on the boat) and check their operation immediately prior to sampling.
- f. Prior to departure (a week in advance if possible), notify the appropriate district office of the state fish and wildlife agency of the sampling schedule and of the area where electrofishing will be conducted.
- g. Coordinate with personnel processing fish for analysis of contaminants, if applicable.

3.3 Electrofishing

The following provides electrofishing procedures for collection of fish samples and includes set up, sampling, and sample processing procedures.

3.3.1 Set Up for Electrofishing

- a. Adjust fiberglass booms to an appropriate distance from bow of boat (about six to eight feet).
- b. If night electrofishing, attach lights to bow rail if not permanently attached.
- c. Check generator crankcase oil level (four-cycle engines only). Add oil if required and fill gas tank (use secondary containment to make sure any spills are collected).
- d. Put on rubber gloves (netters) and ear protectors (boat operator).
- e. Start generator.
- f. Switch control box on and depress foot switch on front deck. Check control box dials to adjust current output. Select DC current, half or full pulse, and adjust voltage to obtain six amp output.
- g. After satisfactory electrical output is attained, maneuver the boat to the desired sampling area.
- h. For quantitative or qualitative sampling, enter site-specific abiotic information on data logger including date, time of day, weather conditions, and crew leader's initials (see Section 3.4.1). If no data logger is present, record data on *Reservoir Fisheries Field Data Form* (see Section 3.4.2 and Table 2).

3.3.2 Sampling

Two or three people are required for operation—a boat operator and one or two dippers, one of whom operates the foot control switch on the front deck. Four people are recommended if fish are being processed as they are collected (one dipper, one boat operator, one recording data, and one processing fish).

- a. Record the surface temperature with a boat-mounted gauge or hand thermometer or take Hydrolab readings (temperature, dissolved oxygen, pH, and specific conductivity) if required by the SAP. Refer to *Hydrolab Datasonde*[®] *Standardization and Field Parameter Measurement* SOP (TVA-KIF-SOP-14) for operating procedures.
- b. Maneuver the boat slowly through the sampling area, as close to shore as water depth and/or aquatic vegetation permits, while one person on the front deck applies current by depressing the foot control switch.
- c. As fish are affected, collect fish with dip nets and place them in the holding tank. When collecting quantitative samples and large numbers of fish (such as shad), which are affected simultaneously, it may be necessary to estimate numbers. Estimated numbers are noted on the data sheet by using the symbol "~" or appropriately entered on the data logger. If a fish is positively identified, but escapes capture, count and record it in the data logger or on the data forms.
- d. Turn off the generator after the desired transect/electrofishing run (such as timed or measured distance) is completed. During routine quantitative sampling, apply the current continuously (current may be applied intermittently during qualitative sampling).

3.3.2.1 Loss of Power

If gauges indicate a loss of power to the electrodes or the control box the following steps should be taken.

- a. Prior to attempting any corrective actions, ensure the generator is turned off.
- b. Check any fuses or circuit breakers built into the generator or electrode wiring.
- c. Check fuses and reset circuit breakers on the control box. Inspect control box for loose connections and ensure gauges are operating properly. Install spare control box if necessary.
- d. Check/install foot switch on front deck of boat.

- e. If the problem cannot be identified by the above steps, further repairs should only be attempted by qualified technicians. Crew members should not attempt repairs to the control box or wiring.

3.3.3 Quantitative and Qualitative Sample Processing

After completion of sampling event and while still on the water, process fish as follows.

- a. Sort and count the fish by species. Record the results in the data logger, including any life history information required, such as length (mm) and weight (g), and overall health observations. If data logger is not available, enter results on a *Reservoir Fisheries Field Data Form* (Table 2).

Note: Weigh fish using a scale that has been calibrated using check weights. See Table 5 for *Weekly Balance Check* scale calibration table.

- b. Release live fish not needed for the project. If fish are retained for contaminant analysis, see Section 3.3.4 and complete *Biota Field Sampling Form* (Table 3). If there are any dead fish that are not needed, puncture the air bladder with a knife and allow them to sink to the bottom of the reservoir or river in water deeper than three meters.
- c. Preserve fish of questionable identity or vouchers specimens of rarely captured species in 10% formalin and retain for taxonomic verification. (Refer to JSA for safety and handling precautions for formalin in Table 4.) Pierce the body cavity of large specimens (≥ 210 mm in length) to allow penetration by the preservative. Label specimen jars with site, reservoir or river name, date of collection, river mile, and collector's name(s).

Pictures of specimens taken with a camera can substitute for preservation (refer to *Photograph Management SOP*, TVA-KIF-SOP-26). Include in the picture a numbered tag or some other method of identifying which fish is being photographed and record the tag number in the data logger or on a *Reservoir Fisheries Field Data Form* (Table 2).

Note: Specimens known to be endangered species must be released immediately unless prior arrangements (such as permits) have been made for their collection. If a mortality of an endangered species occurs, the specimen must be preserved, and the Project Manager is notified within 12 hours of the mortality.

- d. At the end of the sampling day, review data in the data logger and check for errors (such as key punch errors). If the *Reservoir Fisheries Field Data Form* (Table 2) is used, check the field form for completeness and correctness of data entered.

3.3.4 Fish Collected for Analysis of Contaminants of Potential Concern (COPC)

Sample integrity is maintained by preventing the loss of contaminants of potential concern (COPC) that might be present in the sample and taking precautions to avoid possible introduction of extraneous contaminants during handling. The loss of COPC can be prevented in the field by ensuring that the sample collected remains intact, that is, sample collection procedures are performed with the intention of minimizing the laceration of fish skin. Preventable sources of extraneous contamination can include the sampling gear, oils and greases on boats, spilled fuel, skin contact, contact with soil or sand, boat motor exhaust, and other potential sources. Potential sources are identified before the onset and during sample collection, and appropriate measures are taken to minimize or eliminate them.

- a. Maintain sample integrity through careful and controlled sample handling, storage, and preservation procedures.
- b. Wear powder-free nitrile gloves when handling fish to be processed for contaminant analysis.
- c. Place fish in separate resealable plastic bags for each species and site. Appropriately label sample bags with site, reservoir or river name, date of collection, river mile, and collector's name(s).
- d. Place bags containing fish in a cooler with ice; ensure ice completely covers the fish. Maintain use of *Biota Field Sampling Form* (Table 3) for sample custody.
- e. Transport samples on wet ice to the laboratory or processing location. Fish placed on wet ice undergo initial processing and are frozen within 48 hours. Initial processing usually involves measuring and weighing, and potentially filleting of fish. No fish with flesh deteriorated beyond that desired for human consumption is included in the sample. Coordination with personnel processing the fish is critical during the collection process.
Note: If fish are needed alive for analysis, transport them in aerated containers with water from the site.
- f. Maintain samples under appropriate chain of custody in accordance with *Sample Labeling, Packing, and Shipping SOP* (TVA-KIF-SOP-07).

3.4 Data Recording

Data are recorded in the data loggers using the appropriate computer program after sampling events. In the absence of a data logger, the *Reservoir Fisheries Field Data Form* (Table 2) is used.

3.4.1 Data Loggers

Data loggers are only operated by personnel experienced with the appropriate computer program.

- a. Record site information not already contained in the data logger upon arrival at the KIF Project Site. Site information includes reservoir name, river name, river mile, and other abiotic site information to help describe location. Global positioning system (GPS) receivers are used to identify exact sample locations. GPS coordinates taken in the field are downloaded to laptop computer upon returning from the field.
- b. Enter the date; for example, January 3, 2010, is entered 01 03 10. (Time is automatically recorded on the data logger.)
- c. Record the crew leader's initials in the data logger.
- d. Record each sample transect (such as electrofishing run) in the corresponding transect number on the data logger.
- e. Record duration (minutes or seconds) for each transect.
- f. Record the number of each species collected, lengths and weights, if applicable, and any abnormalities observed (such as scoliosis, blind eye, or fungus).
- g. When transects are completed, review information for errors.
- h. Submit data logger files to the Project Manager for final technical review.
- i. After successful review, upload data files to TVA's project server.

3.4.2 Reservoir Fisheries Field Data Form

In the absence of a data logger, the *Reservoir Fisheries Field Data Form* (Table 2) is used. Each transect is recorded on its own individual page.

- a. At the top of each form, list the reservoir name, river mile, sample date, transect/run number, and check the ELECTRO line.
- b. Enter the date as MMDDYY.
- c. Record the initials of all members of the field sampling crew, with crew leader's initials listed first. (Note that only crew leader's initials are recorded in the data logger).

- d. Record the time (military time) for the start of each transect (such as 3:00 p.m. would be recorded as 1500).
- e. Record duration (minutes or seconds) of each transect.
- f. In the appropriate columns, list the common name of each species collected (such as largemouth bass), the number of each species collected, lengths and weights if applicable, and any abnormalities observed (such as scoliosis, blind eye, or fungus).
- g. When transects are completed, review information for errors.
- h. At the end of the sample day, again check the field form for completeness and correctness of data entered. As soon as possible, enter the data from the data form into a data logger. Once entered, sign and date the data form citing that the data were entered.
- i. Submit data logger files to the Project Manager for final technical review.
- j. After successful review, upload data files to TVA's project server.

3.5 Sample Labeling and Sealing

Fish samples are labeled and custody sealed in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

After samples are prepared for shipping, EQUIS-based COC form is prepared, and the samples are shipped or delivered to the appropriate laboratory.

3.6 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, are maintained by the Field Team Leader. 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 document those collection and sampling characteristics specific to this SOP and as defined in the SAP.

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 all required data collection forms.

3.7 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 field sampling or decontamination is managed in accordance with *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), 2010.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), 2009.
- TVA. *Hydrolab Datasonde[®] Standardization and Field Parameter Measurement* SOP (TVA-KIF-SOP-14), 2010.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), 2010.
- TVA. *Photograph Management* SOP (TVA-KIF-SOP-26), 2009.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), 18 December 2009.
- TVA. *Sample 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), June 2009.

Table 1: Suggested Boat-Mounted Electroshocker Equipment and Materials Checklist	
Item Description	Check
Health & Safety	
Fire extinguisher, first aid kit, rain gear, insulated coveralls, sunscreen, whistle, and knife.	
Gloves – nitrile for sample processing and leather for equipment handling	
U.S. Coast Guard approved personal flotation devices (one per individual)	
Insulated (rubber) gloves	
Safety glasses, hard hat, and steel-toed boots	
Hearing protection	
Paperwork	
Job Safety Analysis (generic)	
Bound field logbook	
One set of maps of the sampling area and vicinity	
Indelible ink pens and permanent markers	
Two sheets each of label paper (waterproof paper type for inside of collection jar and adhesive label for outside)	
Chain-of-custody forms and custody seals	
Equipment/Materials	
Flat-bottom boat with 4-ft high safety railing around front deck w/ appropriate sized motor	
Gasoline power generator (at least 2000 watt)	
Control box (including isolation transformer)	
"Dead-man" switch	
Positive and negative electrodes (galvanized or stainless steel) mounted on fiberglass poles	
Fish holding tank with water pump and aerator	
Spare control box replacement fuses, control safety switch	
Long-handled fiberglass-shaft dip nets and insulated short-handled dip nets	
Tool box stocked with various tools and spare parts (such as spark plugs and spare drain plug) to maintain outboard motor, generator, and perform general operator maintenance	
Two outboard gas tanks (or one "built-in" tank) with extra oil and generator gas tank with proper gas/oil mixture (when applicable)	
Spare prop for boat engine	
Lights with extra bulbs (for night work) including a spot light for navigation	
Hand pail (13 L)	
10-kg platform scale for weighing and measuring board (if not boat mounted)	
Ice chest(s) and ice for preservation of samples	
Resealable plastic bags, and labels	
GPS	
Hydrolab (if necessary) and thermometer (if necessary)	
Data logger and field data forms, clipboard	
Formalin and 6 one-quart plastic jars for chemical preservation of fish	
Camera	
Decontamination	
Laboratory grade detergent (such as Liqui-Nox® or Alconox® Powdered Precision Cleaner)	

Table 2. Reservoir Fisheries Field Data Form

RESERVOIR _____ RUN/NET# _____ SHEET _____ OF _____
 SITE _____ DUR _____ ELECTRO _____ XGN _____
 DATE _____ HABITAT _____ / _____

COMMENTS:

SPECIES	NO.	LENGTH	WEIGHT	YOY	ABNORMALITY
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Table 4. Job Safety Analysis Worksheet

Number:		Job: Electrofishing - boat mounted		Date: June 22, 2009	
Page 1 of 2		Supervisor: Sandra S. Robertson		Plant / Facility: OER/AMM	
Skills Required: Boat operation		Reviewed By: Kurt Lakin		Analysis By: Dennis S. Baxter	
Skills Required: Boat operation		Reviewed By: Kurt Lakin		Approved By: Daniel H. Ferry	
Required Personal Protective Equipment: Safety glasses, rubber linesman gloves, Personal Floatation Device (P.F.D.), ear plugs, foul weather gear for various weather conditions					
Tools and Equipment Required: Depth finder, fire extinguisher, paddles, first aid kit, tool box with various hand tools, spare parts (fuses wire fittings), duct tape					
Job Preparation: Read and understand JSA's pertaining to work performed and project workplan. Conduct pre-job briefing. Implement two-minute rule upon arriving at job site.					
Hazardous Materials: Gasoline, Formaldehyde (Formalin)				Special Requirements: Review MSDS sheets	
Number	Sequence of Basic Job Steps	Potential Accidents or Hazards		Recommended Safe Job Procedures	
1.	I. Trip planning. A. Crew leaders should ensure that crew members are aware of general safety procedures and project specific safety factors/procedures before starting field work.	A. A well written work plan can prevent injury Emergency numbers for area hospitals and police are kept with crew leaders B. Pre-planning ensures that everyone understands the potential hazards that exist 1. Electric shock 2. Electrocutation 3. Falling from the boat 4. Brush and trees causing eye injury 5. Loss of hearing		A. Plan the work; work the plan. 1. The crew leader is responsible for pre-job planning for all workers. B. All safety procedures must be discussed. 1. Use linesman's (insulated) rubber gloves 2. Use fiberglass handled dip nets (insulated) 3. Always wear a personal flotation device (P.F.D.) 4. Use safety glasses when shocking in or near brush or near trees 5. Use hearing protectors	

- | | | | |
|------------------------|----------------------|---------------------------|-----------------------|
| 1. Struck By (SB) | 4. Contact With (CW) | 7. Caught Between (CBT) | 10. Overexertion (OE) |
| 2. Struck Against (SA) | 5. Caught On (CO) | 8. Floor level Fall (FLF) | 11. Exposure (E) |
| 3. Contact By (CB) | 6. Caught In (CI) | 9. Fall to Below (FB) | |

