



**STANDARD OPERATING PROCEDURE FOR:
SAMPLE LABELING, PACKING, AND SHIPPING**

TVA-KIF-SOP-07, Revision 2

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for
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| Revision Log SOP for Sample Labeling, Packing, and Shipping (TVA-KIF-SOP-07) | | |
|---|----------------|--|
| Revision and Date | Page Reference | Revision Description |
| 1, December 2009 | Throughout | Field Sampling Plan reference was replaced with specific project work plans. |
| | Section 3.4 | Updated to provide more specifics on custody seals and courier documentation. |
| | Section 3.5 | Added paragraph on use of courier form to document pickup and delivery of samples. |
| | Section 3.6 | Added section on Laboratory Receipt and Inspection to ensure sample quality documentation. |
| | Section 4.0 | Added U.S. EPA reference for Sample and Evidence Management |
| | Table 1 | Updated checklist with courier form and tamper-evident seals. |
| | Table 2 | Added Courier Transport Documentation Form. |
| 2, July 2010 | Section 3.4.f | Added new procedure for labeling coolers that are shipped each day. |

1.0 PURPOSE

This standard operating procedure (SOP) provides the general technical requirements and operational guidelines for the proper labeling, packing, and shipping of environmental samples to a laboratory for analysis for TVA's Kingston Fossil Plant (KIF). These procedures have been developed to reduce the risk of damage to the samples (such as breakage of the sample containers), to maintain sample temperature (as required) within the cooler, and to ensure and document sample custody from collection to receipt at the analytical laboratory. This SOP includes the guidance and regulatory requirements that ensure proper labeling, packing, and shipping of environmental samples classified as "hazardous material" and "dangerous goods" in accordance with the following documents (see Section 4.0 for full reference).

- 49 Code of Federal Regulations (CFR) Parts 171-180
- U.S. Department of Transportation (DOT)
- International Air Transport Association (IATA) standards as detailed in the most current edition of the IATA Dangerous Goods Regulations
- International Civil Air Organization (ICAO) Technical Instructions
- International Maritime Organization (IMO)
- International Maritime Dangerous Goods (IMDG) Code

IATA and ICAO regulations apply strictly to commercial air transportation - both domestic and international. The IMDG regulations apply to the international transport of dangerous goods by waterway. DOT regulations apply to domestic and international shipments originating in or imported to the United States.

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.

Personnel wear powder-free nitrile gloves while performing the procedures described in this SOP. Specifically, powder-free nitrile gloves are worn while preparing and handling sample bottleware and packing samples.

Protocols for sample temperature maintenance and sample packing are applicable to collection of samples year-round or as otherwise specified. The intent is to ensure that samples arrive at the laboratory in good condition—both physically intact and appropriately preserved.

3.0 PROCEDURES

The following sections describe the procedures for sample labeling, packing, and shipping. Any variation in these procedures is approved by the Project Manager and Quality Assurance (QA) Officer and is fully documented. 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 since the regulations and standards may be periodically revised.

- a. Check with the Field Team Leader regarding the equipment required, sample types and preservatives, and anticipated range of contaminant concentrations.
- b. Obtain labeling, packing, and shipping materials as listed in the example checklist provided in Table 1; the field logbook; and copies of the *Quality Assurance Project Plan* (TVA-KIF-QAPP), SWSHP, and project-specific work plans.
- c. Verify methods to be used to transport materials (such as the contractor's courier or commercial driver). Identify the telephone numbers, locations, and any special requirements of couriers that are used.
- d. Prepare DOT paperwork in advance where practical.

3.2 Sample Labeling

Sample containers are pre-labeled before sample collection, and the labels are protected from the sample matrix by using waterproof labels or by covering with clear tape. For instances when labeling errors have occurred, a permanent marker or pen is used to write the correct information on the waterproof label, or when clear tape is used, the correct information is written over the clear tape and another piece of clear tape placed over the corrections. Sample labels include the unique sample ID, location code, parameter sampled, date and time sampled, sampler's initials, preservative, and site name or location.

3.3 Sample Temperature Maintenance

In order to facilitate preservation of samples, samples requiring preservation by chilling are cooled to an appropriate temperature ($< 6^{\circ}\text{C}$) and maintained at this temperature from the point of collection through transport and receipt at the laboratory. To achieve this chilling and temperature maintenance, the procedures listed below are followed for samples collected from May through September (or during warm periods of other months).

Note: Blue Ice is used for temperature preservation of particulate matter sample media.

- a. Prepare an ice bath(s) prior to sample collection. Obtain ample amounts of ice and potable water and place the ice and water in a container large enough to accommodate several sample jars (for example, a 5-gallon bucket or sample cooler). Depending on the number of sample containers anticipated, more than one ice bath may be necessary.
- b. If applicable, place trip blank vials and/or the temperature blank bottle (sealed in resealable plastic bags) in the ice bath immediately after preparation. Label the trip blank and temperature blank bottles in accordance with Section 3.2 of this SOP. Whenever possible, locate the ice bath(s) out of direct sunlight or other sources of heat.
- c. Immediately after sample collection, place sample containers in an appropriately sized resealable plastic bag (however, up to three 40-mL vials can be placed in one bag). Place the bagged samples in the prepared ice bath. Place samples in the ice bath such that bottles shall not be broken. Avoid placing too many containers in an ice bath at one time.

Note: At the discretion of the field sampling team, custody seals may be placed over individual sample containers and/or bags. Custody seals are initialed and dated by the field sampler.

- d. Allow samples to remain in the iced cooler for a minimum of 30 minutes to chill the samples quickly. Maintain samples on ice until preparations are made for packing the samples for shipment.

3.3.1 Frozen Sample Maintenance

Samples requiring frozen preservation are maintained at a temperature of $\leq -10^{\circ}\text{C}$ with the use of dry ice as defined below.

- a. Don protective gloves before handling dry ice or placing hands inside cooler containing dry ice.

- b. Place samples in an onsite freezer or in a dry cooler containing sufficient amount of dry ice. Maintain samples on dry ice or in freezer until preparations are made for packing the samples for shipment.

Note: If a cooler containing dry ice is used, do not place head near the inside of the cooler as the sublimation of dry ice can cause asphyxiation.

3.4 Sample Packing

Environmental samples are collected as outlined in the SOPs for the KIF Ash Recovery Project.

The following is a summary of steps required for packing and sealing samples for shipment.

- a. Obtain samples in the laboratory-specified containers and verify the completeness of the sample identification information on the label and the Chain-of-Custody (COC) record. Verify custody seals on sample containers and/or bags are intact and have been initialed and dated.
- b. If packaging aqueous samples or using wet ice for temperature preservation, place a garbage bag or liner in the cooler.
- c. Place samples in resealable plastic bags and then into the cooler. If appropriate, place a temperature blank in the center of the cooler.
- d. Place ample amounts of wet ice contained in doubled resealable bags inside the garbage bag/liner in cooler. As needed, place bubble wrap or other inert packing material around the garbage bag/liner in the cooler.

Note: Blue Ice is used for temperature maintenance for particulate matter sample media.

- e. Seal the garbage bag/liner with duct tape. This is to ensure that if the contents were to spill that the garbage bag/liner would contain the spill.

Note: If samples are to be maintained frozen during shipment, refer to Section 3.4.1 which defines the procedures for the use of dry ice.

- f. Place a self-adhesive label on each cooler indicating cooler number based on total number of coolers sent out each day (such as 4 of 8). Use a permanent marker to write number on the label.
- g. Sample custodian or designee relinquishes the samples on the COC record by signing their name and providing the date and time that the samples were packed.
- h. Write the shipper's tracking number (such as courier and courier airbill number) on the COC form when a commercial courier is used. If a courier other than UPS or

FedEx is to be used for sample transport, a Courier Transport Documentation Form (Table 2) is used (see Section 3.5).

- i. Place the completed COC form in a large resealable plastic bag and tape to the inside lid of the cooler. If multiple coolers are needed, a copy of the original COC form accompanies each cooler that contains the samples identified on the COC form.
- j. The sample custodian or designee who relinquished the samples in Step *d* above signs and places date and time on the custody seals. The custody seal signature, dates and times must match the relinquished signature, dates and times as they appear on the COC form from Step *d* above. Place tamper-evident custody seals/tape on two sides such that opening the cooler breaks the custody seal/tape. Tamper-evident custody seals/tape must be able to indicate that the seal has been disturbed (such as leave remnants of the seal or some type of ink residue on the surface when the seal is lifted).

3.4.1 Shipping Samples Using Dry Ice

In addition to the steps identified in Section 3.4, the following steps are required for packing and sealing frozen samples for shipment on dry ice.

- a. Place inert material (such as bubble wrap and/or cardboard) in the bottom of the cooler.
- b. Place samples requiring frozen preservation in the cooler on top of the inert material.
- c. Place an additional piece of inert material on top of the samples to prevent the samples from contacting the dry ice.
- d. Put on leather gloves and place one layer of dry ice (approximately 2 inches thick) on top of the second layer of inert material, covering as much surface area as possible.

Note: Do not place more than one layer of dry ice in the cooler. The weight of the dry ice may cause container breakage.

- e. If using a commercial courier to transport the cooler with dry ice by domestic air freight, place a placard on the outside of the cooler following the 49 CFR and IATA regulations presented below.
 1. For non-medical, non-hazardous U.S. domestic air packages with ≤ 2.5 kg (≤ 5.5 pounds) of dry ice, mark the outside of the cooler with the words "Dry Ice" or "Carbon Dioxide, Solid."

2. For non-medical U.S. domestic packages with >2.5 kg (>5.5 pounds) of dry ice, the following are required under 49 CFR and IATA:
 - Hazardous Materials shipping papers are completed.
 - The package is properly marked as containing "Dry Ice" (or "Carbon Dioxide, Solid"), "UN1845", and with a Class 9 Diamond label.
 - The net weight of dry ice is indicated (in kg) on the shipping papers and is also marked on the outer package.
 - The shipping paperwork is processed through UPS WorldShip 2008 version 10.0 (or higher), CampusShip, or compliant software.

3.5 Shipping Procedures for Environmental Samples

If a courier other than UPS or FedEx is used for sample transport, a Courier Transport Documentation Form (Table 2) is used. This form tracks sample delivery and receipt when commercial shipping airbills and tracking numbers are not used. This document is initiated by sample custodian or designee prior to transfer of sealed sample coolers/containers to courier representatives for subsequent transport to the analytical laboratory. This completed form is retained by TVA with associated COC records to document the proper transfer of custody-sealed coolers/containers from the sample custodian or designee to the courier, and then from the courier to the analytical laboratory.

A transportation subject matter expert is consulted to determine the proper shipping category for samples—either “non-hazardous material” or “hazardous material or dangerous goods.” Once the sample category has been determined, the following steps are followed.

3.5.1 Environmental Samples Shipped as **Non-Hazardous** Material

Environmental samples are shipped as non-hazardous material unless the samples meet the established DOT criteria for a “hazardous material” or the International Air Transport Association, ICAO Technical Instructions, and IMDG Code definition of “dangerous goods” (see Section 3.5.2). When preparing the cooler for shipment, labels from the outside of the container are removed while being careful not to disturb the custody seals. When completing the paperwork for shipment, the standard non-hazardous shipping forms provided by the courier are completed.

3.5.2 Environmental Samples Shipped as **Dangerous Goods** or **Hazardous Material**

DOT, IATA, and IMDG regulations governing the shipment of hazardous materials and dangerous goods are followed. These regulations (49 CFR Parts 171 - 180 and the Dangerous Goods Regulations [DGR] for IATA and IMDG) describe proper marking, labeling, placarding, packaging, and shipping of hazardous materials. IATA regulations

apply strictly to both domestic and international commercial air transportation. The IMDG regulations apply to the international transport of dangerous goods by waterway. DOT regulations apply to domestic and international shipments originating in or imported to the United States.

The definitions of dangerous goods and hazardous materials, as defined by IATA, IMDG and DOT, respectively, are presented below.

Dangerous Goods – “Articles or substances which are capable of posing a significant risk to health, safety, or to property when transported by air and which are classified according to the UN hazard classes”.

Hazardous Material – “A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials.”

Quantities of certain dangerous goods may be transported as “Small Quantity Exception” or “Limited Quantity Exception.”

Shippers and transporters of hazardous materials or dangerous goods are required to have specialized training (DGR, 1.5.0.2 and 49 CFR Part 172, Subpart H). Hazardous material or dangerous goods are only shipped by appropriately trained personnel.

3.6 Laboratory Receipt and Inspection

Upon receipt by the analytical laboratory, coolers are inspected for evidence of tampering (such as broken custody seals). In the event that custody seals are missing or broken, the laboratory reports this condition to the TVA QA Officer immediately.

The laboratory records the condition of sample containers, and laboratory personnel accept the samples by signing the COC, including date and time, in the appropriate location. If a Courier Transport Documentation Form is used, the laboratory personnel sign and place date and time on that form. For sample shipments that require temperature preservation, the analytical laboratory personnel measures and records the cooler temperature upon receipt.

The original COC record and documented changes to the original COC form and/or the Courier Transport Documentation Form are included as part of the final analytical report to the TVA Project Manager. This record is used to document sample custody transfer from the sampler to the laboratory and becomes a permanent addition to the Project file. The courier form is also retained in the permanent Project file.

3.7 Field Logbook Documentation

Field logbooks recording daily sample custodian activities, including sample verification and tracking information, are maintained by the Field Team Leader. Information is entered into the field logbook by the appropriate field team member using indelible ink. In addition to the minimum requirements discussed in the *Field Documentation SOP* (TVA-KIF-SOP-06), the field logbooks document the following shipping activities:

- Method of transportation,
- Courier tracking number,
- Material shipped (for example, sample COC numbers) associated with each courier tracking number, and
- Date shipped.

The shipper's copies of the manifest or the shipper's copy of the courier's airbill is retained in the Project files.

4.0 REFERENCES

- International Air Transport Association (IATA). *Dangerous Goods Regulations*, 49th Edition, Montreal, 2008.
- International Civil Aviation Organization (ICAO). *The ICAO Technical Instructions on the Safe Transport of Dangerous Goods by Air*, 2007 - 2008 Edition.
- International Maritime Organization (IMO). *International Maritime Dangerous Goods Code*, 2006 Edition.
- Office of the Federal Register, National Archives and Records Administration, 49 CFR Parts 171-179, U.S. Government Printing Office, Washington, DC, 2006.
- Tennessee Valley Authority (TVA). *Field Documentation SOP* (TVA-KIF-SOP-06), 2009.
- TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (SWSHP), 2010.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), December 18, 2009.
- United States Environmental Protection Agency (EPA). Region 4, *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples Operating Procedure*. Document Number SESDPROC-209-R1, November 2007.
- United States Environmental Protection Agency (EPA). Region 4, *Sample and Evidence Management*. Document Number SESDPROC-005-R1, November 2007.

| Table 1: Sample Labeling, Packing, and Shipping Equipment & Material Checklist | |
|---|--------------|
| Item Description | Check |
| Health & Safety | |
| Nitrile gloves | |
| Steel-toed boots | |
| Field first-aid kit | |
| Eyewash | |
| Safety glasses | |
| Respirator and cartridges (if necessary) | |
| Saranex™/Tyvek® suits and booties (if necessary) | |
| Paperwork | |
| SWSHP | |
| Project work control documents | |
| Chain-of-custody forms | |
| Field logbook | |
| Packing and Shipping Supplies | |
| Packing Tape | |
| Tamper-evident custody seals/tape | |
| Coolers | |
| Resealable plastic bags (gallon and pint sizes) | |
| Ice (wet and dry) | |
| Permanent markers or pens | |
| Shipping labels | |
| Shipping forms and courier forms | |
| Scale | |
| IATA Dangerous Goods Regulations Manual | |

TABLE 2. COURIER TRANSPORT DOCUMENTATION FORM

DATE: _____

COURIER COMPANY:

| | |
|-------|-----|
| From: | To: |
|-------|-----|

| | |
|---------------|--------------|
| No. of Items: | Description: |
|---------------|--------------|

Shippers Name/Company: _____

Date / Time: _____

Courier Signature/Company: _____

Date / Time: _____

Receipt Signature/Company: _____

Date / Time: _____

Corresponding Chain of Custody:

| | | |
|--|--|--|
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End of Procedure