



**STANDARD OPERATING PROCEDURE FOR:  
MANAGEMENT AND IMPLEMENTATION OF EQUIS<sup>™</sup>-BASED  
CHAIN OF CUSTODY**

TVA-KIF-SOP-18

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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 the proper creation, implementation, and submittal of EQUIS™-based chain-of-custody (COC) documentation that is required for environmental sampling events associated with the Kingston Fossil Plant (KIF) Ash Recovery Project and are managed by the EQUIS database. These procedures have been developed to increase the potential for correct COC forms, proper field implementation of the COC forms, interpretation of pertinent information provided on EQUIS-based COC forms, and complete transfer of field data to the Quality Assurance (QA) Team and Data Management Team.

## 2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned field activities 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.

In addition to this SOP, the project procedures defined in the *Field Documentation SOP (TVA-KIF-SOP-06)* and the *Sample, Labeling, Packing, and Shipping SOP (TVA-KIF-SOP-07)* are employed concurrently with particular procedures presented herein.

Procedures are also conducted in accordance to U.S. Environmental Protection Agency (EPA) *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples Operating Procedure (EPA, 2007)*.

The QA and Data Management Teams are responsible for overall implementation of this procedure and ensuring that it complies with current standards. The intent of this SOP is to ensure that samples arrive at the laboratory in good condition, under proper chain of custody, and are accompanied by necessary sample information and documentation.

## 3.0 PROCEDURES

The following sections describe the procedures for creating, implementing, and submitting EQUIS-based COC documentation. Any variation in these procedures is approved by the Project Manager and QA Officer and is fully documented. Field work progresses as deviations are approved or resolved.

Before creating the COC documentation, the following activities are completed.

- a. Review project work control documents such as SWSHP, site-wide *Quality Assurance Project Plan (TVA-KIF-QAPP)*, and relevant work plans. These documents identify the activity-specific sample locations, quality assurance/quality control (QA/QC) sample requirements, bottleware requirements, and analyte list.
- b. Check with the Field Team Leader regarding the unique sample identification nomenclature prior to implementation of chain of custody in the field.

### 3.1 Creation of EQUIS-Based COC Documentation

EQUIS-based COC documentation is created in the Sample Planning Module (SPM) of EQUIS Professional. When using SPM, refer to the *SPM User's Manual* which is attached to this SOP for convenience.

Specific project requirements have been established for creating COC forms in SPM that are not detailed in the *SPM User's Manual*. These additional specific project procedures are detailed below.

- a. Create a new sample plan for each sampling program (for example, whenever a new sample matrix or analytical laboratory is required). Refer to a specific work plan to determine the sample matrix, desired analyses, and analytical laboratory.
- b. Establish only one analytical laboratory for each sample plan.
- c. Contact the QA/QC staff if a method analyte group (MAG) needs to be created. In the event that samples must be submitted to the laboratory prior to MAG creation, the QA/QC staff will provide an appropriate MAG name to be handwritten on the COC record. In the event that a MAG is handwritten and submitted to the laboratory prior to contacting the QA/QC staff, a revision to the submitted COC will be made following Section 3.4 of this SOP.
- d. Repopulate the Sample Matrix field with the field matrix code identified in the investigative sample IDs. For aqueous blanks (such as equipment blanks, field blanks, or trip blanks), an "A" is used to populate the Sample Matrix field. Review the Project Nomenclature Codes Table for field matrix code options (located in the EQUIS COC Codes file on the TVA Kingston SharePoint drive at <http://sharepoint.tva.gov/sites/oer/KingstonEvent/KRP/ENV/default.aspx> under Forms and Templates).
- e. Once a COC form is generated in SPM, notify the QA/QC staff to review the planned chain of custody prior to field implementation (Section 3.2).

### 3.1.1 COC Identification

A unique date-referenced COC identification number is assigned to each COC Record or Task Code generated during the course of the sampling program to facilitate data evaluation and preclude record duplication as defined below.

- a. Generate the unique COC identification number with 15 or fewer characters. The COC identifier is structured as follows:

**(Sampling Program)(Matrix Code)(Date)(Alphabetical Character)**

- **Sampling Program** - See Project Nomenclature Codes Table located in EQUIS COC Codes file on the TVA Kingston SharePoint drive at <http://sharepoint.tva.gov/sites/oer/KingstonEvent/KRP/ENV/default.aspx> under Forms and Templates,
- **Matrix Code** - See Project Nomenclature Codes Table,
- **Date** - MM = Month, DD = Day, YYYY = Year (first Y remains a “Y” followed by last digits of year such as Y09), and
- **Alphabetical character** - designates an order of sequential COC records for each sampling event.

The sequence changes when more than one sampling crew is needed to accomplish one sampling event.

- b. Refer to the Project Nomenclature Codes Table prior to creating a Task Code.
- c. Verify with the QA/QC staff that the Project Nomenclature Codes Table is current and up to date.
- d. If a new sampling program or matrix code is required, notify the QA/QC staff to update the Project Nomenclature Codes Table prior to COC record creation.

### 3.1.2 Sample Identification

Individual samples are assigned a unique date-referenced identification number as defined below.

- a. Assign each individual sample a unique date-referenced identification number (sys\_sample\_code) with a maximum of 40 characters.
- b. Limit the unique sample identification location descriptor (sys\_loc\_code) to 20 characters or less.
- c. Follow the sys\_loc\_code with unique identifiers if other strings of information are needed to further define and distinguish a sys\_sample\_code to capture specific elements of the sampling program. This identifier (such as depth interval or biota code) must be imbedded after the sys\_loc\_code using an underscore (“\_”). For

biota samples, a specific biota\_code is used. See Biota Nomenclature Species Codes in Biota Species Codes file (located on the TVA Kingston SharePoint drive at <http://sharepoint.tva.gov/sites/oer/KingstonEvent/KRP/ENV/default.aspx> under Forms and Templates). Contact the QA/QC staff for further instructions.

- d. Structure the corresponding sample identifier as indicated below.

**{facility\_code}-{sys\_loc\_code}-{matrix\_code}-{sample\_date}**

**{facility\_code}** = Kingston Fossil Plant,

**{sys\_loc\_code}** = Location Descriptor (See Section 3.1.2.1 below for further instruction),

**{matrix\_code}** = Field Matrix (See Project Nomenclature Codes in EQUIS COC Codes file located on the TVA Kingston SharePoint drive at <http://sharepoint.tva.gov/sites/oer/KingstonEvent/KRP/ENV/default.aspx> under Forms and Templates)), and

**{sample\_date}**, = Date of sample collection, MMDDYY: (For example 122808 or 020209.)

### *3.1.2.1 Determination of a Sys\_Loc\_Code*

The following procedure is used to determine the specific sys\_loc\_code.

- a. Select a unique sys\_loc\_code for each sample location. A sample location is defined by accompanying x,y coordinates. Depth (z) is not included as part of the sys\_loc\_code.
- b. Create a unique location name for each distinct sample location. Multiple samples can be collected from one location (over time).
- c. Include a common location descriptor if possible (such as river mile, residence, engineering, or plant operations standard nomenclature) in the sys\_loc\_code.
- d. Refer to specific work plans to identify potential new sample locations or existing sys\_loc\_codes for special studies.
- e. If more than one sample is collected from an area where only one location name is applicable, append a descriptor, such as a sequential number and/or additional information as outlined in the applicable work plan to the sys\_loc\_code as described in Section 3.1.2.c.

Biological samples' locations may encompass study areas where one x,y coordinate per sample is not applicable. For biological sys\_loc\_codes, one common location descriptor can be used for multiple samples.

### 3.1.2.2 *Determination of a Sample\_Class*

In some instances, there will be a need to populate additional information into the EQUIS database that further describes a sample. Within EQUIS SPM is the Sample\_Class field that shall be populated with an additional descriptive word, no more than 10 characters long, that further defines the sample. The Data Management Team shall determine when the Sample\_Class field is needed, and what descriptor to use.

### 3.1.3 QA/QC Sample Identification

An additional QA/QC sample code is required for each QA/QC sample as defined below.

- a. Manually enter an additional QA/QC sample code into the sample ID for each required QA/QC sample.
- b. Place the QA/QC code between the Matrix Code and the Date. For example  
**{facility\_code}-{sys\_loc\_code}-{matrix\_code}-{QA/QC\_Code}-{sample\_date}**.

EQUIS provides QA/QC code options to be selected when adding QA/QC samples to a COC record. Some common Project QA/QC codes are summarized below.

- Field Blank = FB
  - Equipment Blank = EB
  - Matrix Spike = MS
  - Matrix Spike Duplicate = MSD
  - Trip Blank = TB
- c. When a field duplicate or co-located sample is required, simply change the first letter of the matrix code to an “A”. This allows the potential for field duplicate samples to be “blind” to the laboratory.
  - d. Verify that the matrix codes for the QA/QC samples match the field matrix code of the investigative samples in the sample ID.

## 3.2 **Field Implementation of EQUIS-Based COC Forms**

The field sampling crews have the responsibility of documenting sample custody from collection using the EQUIS-based COC in the field. It is vital to the project that the field sampling crews are competent in recording sample custody in the field and required sample-specific field data on the EQUIS-based COC form.

### 3.2.1 COC Forms and Container Labels Generated Prior to Field Activities

The COC forms and container labels are provided to the field sampling team prior to conducting the field sampling event. Whenever possible, the EQUIS-based COC forms

and container labels are downloaded from EQUIS Enterprise which is accessed at <http://www.envstd.net/equis> as follows.

- a. Select the SPM COC template to download project COC forms to Microsoft Excel.
  - For routine surface water COC forms (when multiple field crews are needed to sample one Task code), select the SPM multipage COC template (“SPM Chain of Custody – Grouped By Location”).
  - For other sampling (when one field crew is utilized), select the SPM individual COC template (“SPM Chain of Custody”).
- b. Save the Excel file COC in an unalterable format before sending electronically to the Sample Custodian.
- c. Select the SPM Bottle Labels template (“SPM – Bottle Labels”) to download project container labels directly to pdf.
- d. Print container labels on Avery 2-inch by 4-inch waterproof labels and provide them to the Sample Custodian.
- e. Print and provide to the sampling crew or Sample Custodian a “New Sample Location Form” when new sample locations (sys\_loc\_codes) have been created for the relevant chain of custody.

### 3.2.2 COC Forms and Container Labels Generated After Field Activities

In some instances, field activities are not planned with adequate lead time or the sampling locations cannot be predetermined, and thus COC forms and container labels are not generated from EQUIS SPM prior to field activities. In this case, the following procedures are implemented which supersede the procedures detailed in Section 3.2.1.

- a. Field Team Leader reviews and implements the sample and COC nomenclature requirements detailed in Section 3.1 of this SOP.
- b. Sampling team is provided with a blank project COC form and labels and the required MAGs for the sampling event.
- c. Sampling team completes the COC form and labels with the appropriate identifiers.
- d. Upon completion of the sampling activities, the Sample Custodian or Field Team Leader scans and forwards the handwritten COC form to a qualified EQUIS-based COC generator.

**Note:** If manually generated COC forms are created using a Microsoft Excel template, the COC generator must verify that the Data Management Team

(through TVA\_Deliverables @envstd.com) is aware that the COC form does not exist in EQUIS SPM.

- e. COC form is generated in EQUIS SPM using the nomenclature as dictated on the handwritten COC form.

**Note:** If there are errors in the sample or COC nomenclature on the handwritten COC form, the EQUIS-based COC generator documents the discrepancies and forwards to the Sample Custodian and the QA/QC staff.

- f. The EQUIS-based COC generator writes “Use the handwritten COC for custody records, use the EQUIS-generated COC form for sample nomenclature and requested analyses” in the comment section of the COC form.
- g. Sample Custodian is provided with the EQUIS-based COC forms following Steps *b* through *e* in Section 3.2.1.

### 3.2.3 Sample Custody in the Field

Sample custody is implemented to document sample history from the time of sample collection through shipment, analysis, and disposal. A sample is considered to be in one’s custody if one or more of the following conditions apply:

- The sample is in an individual’s actual possession;
- The sample is in view after being in an individual’s physical possession;
- It is in the physical possession of an investigator who secures it to prevent tampering; and/or
- It is placed in a designated secure area.

### 3.2.4 Completion of COC Forms in the Field

A fully executed EQUIS-based COC record accompanies each sample shipment. An additional copy of the fully executed original COC is placed in each of the remaining coolers in the shipment. This document is used to demonstrate that a sample has been obtained from a specific location and has reached the laboratory without alteration. Accordingly, each EQUIS-based COC record documents evidence of the collection, shipment, laboratory receipt, and laboratory custody of each sample included in a shipment.

- a. Verify the following information on the EQUIS-based COC form and container labels during pre-job preparations (usually conducted by the sample custodian or Field Team Leader) :
  - Project name, number, and site address,
  - Laboratory name and address,

- Preservative used (if applicable),
  - Sample ID, sample location, and sample type,
  - Number of sample containers,
  - Sample matrix,
  - Sample date,
  - Analyses (MAG) requested, and
  - Any special instructions and/or sample hazards.
- b. Record the following information (by the field sampling team) to begin the COC Record:
- Sample collection time,
  - Sample start depth, sample end depth (if applicable),
  - Sample depth units (if applicable),
  - Sample was a grab or composite,
  - Name of lead sampler, signature of lead sampler, date and time of lead sampler signature, and
  - Sample reason (mark which reason code applies to the sampling event).  
Sample Reasons are as follows:
    - 1) *Investigatory* = Samples collected under an approved SAP.
    - 2) *Plant Ops* = Samples collected at the request of or to support Plant Operations (includes NPDES compliance samples).
    - 3) *Special Study* = Samples collected to address specific concerns (such as cenospheres).
    - 4) *Split Comparison* = Samples collected for comparison to Third Party samples (such as Duke or TN Aquarium).
    - 5) *Other – Legal* = Requested by TVA OGC or for legal challenge to compare to outside party's legal sample.
    - 6) *Other – Screening* = Samples collected using field screening techniques (such as XRF) or via a method that does not support Level 4 data deliverable.
    - 7) *Other - Split Legal* = Sample collected for Legal challenge to compare to outside party's legal sample.
    - 8) *Other - Toxicity Testing* = Samples collected for or in direct support of laboratory toxicity testing.
    - 9) *Other -Industrial Hygiene* = Samples collected to evaluate worker protection.
    - 10) *Other-WAC* = Samples collected for waste characterization for disposal.

- c. Document coordinates on an accompanying “Sample Location Form” when it is identified that there is a new location being sampled.
- d. Determine the GPS coordinates using a TVA-approved GPS unit.
- e. Fill in x\_coord, y\_coord, surf\_elev, coord\_sys\_desc, and loc\_desc on the Sample Location Form. Provide the coordinates to EQUIS using NAD83 and NAVD88 geodetic datum and Tennessee State Plane coordinate system in decimal degree format.
- f. Verify that the location name for coordinates matches the sys\_loc\_code detailed in the Sample Location column of the COC form. In the absence of a COC form, a common location name and description is placed in the loc\_desc field.
- g. Attach a completed Sample Location Form to the field COC record and submit them together to the TVA QA and Data Management Teams.

### 3.2.5 Completing Bottle Labels in the Field

Bottleware sample labels are properly completed in the field to facilitate traceability of chemical analytical data results.

- a. Prepare sample labels containing the following information recorded on waterproof labels and/or with indelible ink:
  - The project facility name (KIF),
  - The unique sample identification code,
  - The field matrix code,
  - Date and time of collection,
  - COC number or task code,
  - Identification of preservatives used,
  - Analysis requested,
  - Sampler’s (“Tech”) initials, and
  - A bar code containing sample identification code (EQUIS-based labels only).
- b. Place completed sample labels on each sample container prior to (preferably) sample collection.
- c. Attach the sample label so that container markings are not obscured. If the labels are too large to affix directly to the sample container, place the sample container in a zipper-top bag and affix the label to the bag.

### 3.2.6 Revising COC Records

Competent field sampling personnel that are proficient in the Project nomenclature for EQUIS-based COC forms (identified in Sections 3.1.1 through 3.1.3 of this SOP) have the ability to revise COC forms in the field. It is not uncommon for environmental sampling events to change in real-time. EQUIS-generated COC forms and their planned samples are created prior to field sampling activities. Field personnel shall follow the procedures below when revising an existing COC EQUIS-based COC form in the field.

**Note:** Prior to a sampling event, revise noted changes to an EQUIS-based COC form in SPM and implement a new EQUIS-based COC form. Once a sample is collected and sample custody is required, the existing COC form is used.

- a. Make any revision to an existing COC record by hand using indelible ink.
- b. Initial and date every revision.
- c. Make minor revisions (such as part of a sample ID other than date) on the COC form in compliance with Sections 3.1.1 through 3.1.3 of this SOP.
- d. If a sample is not collected, draw a single line running through that Sample ID row.
- e. If an entire COC page contains samples which were not collected, run a single line through the Sample ID rows.
- f. If an entire COC form is not used, write “VOID” in large print diagonally across every page of the COC form.
- g. Determine if the revision to the COC form is also required for the container label.

### 3.3 Field Submittal of EQUIS-Based COC Forms

The following EQUIS-based COC procedures are followed for samples submitted to the laboratory for analyses.

#### 3.3.1 Submittal of Samples and EQUIS-Based COC Forms to the Laboratory

Each individual field sampler is responsible for the care and custody of the samples collected until the samples are properly transferred to temporary storage or are shipped to the laboratory. The procedures below summarize the requirements of the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), as it pertains to EQUIS-based COC form submittal.

- a. Each individual field sampler is responsible for the care and custody of the collected samples until the samples are properly transferred (relinquished on the COC form by a field team member) to another person (“acceptor” of the samples) or are shipped to the laboratory.

- b. An EQUIS-based COC form is completed by the sampling team for each group of samples submitted to the laboratory.
- c. If multiple coolers are needed, one COC form accompanies each cooler that contains the samples identified on the COC form.
- d. Each time a sample group is transferred (field sampling personnel relinquish custody to the laboratory), signatures of the individuals relinquishing and receiving the sample batch, as well as the date and time of transfer, are documented on the COC or courier documentation form.

**Note:** Commercial courier custody is tracked by commercial courier records and not by COC forms. Private courier custody is tracked by a TVA courier transportation form and not by a COC form (see TVA-KIF-SOP-07).

- e. Sample coolers are packed and sealed with custody seals for transport from field and shipment to laboratory.

### 3.3.2 Submittal of EQUIS-Based COC Records and Sample Data to TVA

The procedures described below provide guidelines for submitting samples and pertinent data associated with each collected sample to the laboratory and TVA QA and Data Management Teams. It is important to note time-critical requirements for the sampling team to submit specific sample data to the laboratory and TVA QA and Data Management Teams while samples are in transit to the laboratory.

- a. Prior to placing a completed COC form inside the sample transport vessel, scan and retain a copy of the completed COC form.
- b. Retain a copy of the carrier air bill or TVA courier transportation form as part of the permanent COC documentation record.
- c. Send the retained copy of the completed COC form (including handwritten, if applicable) and accompanying field data files to the TVA Field Sampling Coordinator, TVA Records Custodian, Incident.Documentation@tva.gov, and TVA\_Deliverables@envstd.com. This transmission of data must be conducted within the first 24 hours from the time the sample custodian relinquishes the samples for transportation to the laboratory.
- d. Submit required field files to TVA QA and Data Management Teams along with the completed EQUIS-based COC form which may include, but are not limited to:
  - Air instrument data files,
  - Sample Location Form (or equivalent),
  - Transportation forms, courier air bills, and
  - Biota Field Sampling Form (or equivalent).

### 3.3.3 Submittal of Laboratory Completed COC Records to TVA

The following information is recorded by the laboratory to complete and verify sample custody and integrity record:

- a. Record sample condition (including temperature) upon receipt as reported by the analytical laboratory.
- b. Verify sample receiving signature, affiliation, date, and time of laboratory custody acceptance.
- c. Complete a Sample Receipt Confirmation (SRC) form and retain SRC form with the final copy of the COC record. These documents are submitted to TVA\_Deliverables@envstd.com, TVA Field Sampling Coordinator, TVA Document Controller, Incident.Documentation@tva.gov, and the QA/QC staff.
- d. Return the original COC from the laboratory to TVA as part of the Level 4 data packages.

### 3.4 Revising Submitted EQUIS-Based COC Records

After-the-fact revisions (or revisions subsequent to sample collection) to COC records are performed in accordance with the procedures detailed in Section 3.2.5 of this SOP. COC revisions occurring after submission of samples to the laboratory are made by the QA/QC staff or the Sample Custodian. Revisions are handwritten on the record copy of the COC form and are transmitted by email as a PDF scan of the revised COC record. Revised COC forms are forward to the laboratory Project Manager, the TVA QA Officer/ Technical Liaison, the TVA Document Controller, [TVA\\_Deliverables@envstd.com](mailto:TVA_Deliverables@envstd.com), and the Field Team Leader. Revised COC records are included in the laboratory data package with the original field COC record to provide complete documentation of the sample collection and analytical request.

#### 4.0 REFERENCES

- Environmental Standards, Inc., *EQUIS™ 5 Documentation – Sample Planning Module User’s Manual*; Revision 01, October 2009.
- Tennessee Valley Authority (TVA). *Field Documentation SOP* (TVA-KIF-SOP-06), 2009.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), December 18, 2009.
- TVA. *Sample Labeling, Packing, and Shipping SOP* (TVA-KIF-SOP-07), 2009.
- TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (SWSHP), 2010.
- U.S. 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.

**End of Procedure**