River Systems Investigations Update
TVA Kingston Ash Recovery Project

Presentation 1 of 6

March 15, 2012

Agenda

- Purpose
- Overview of presentation series
- Update on Environmental Data Collection
  - Sampling and Analysis Plan (SAP) for Engineering Evaluation/Cost Analysis (EE/CA)
  - Supplemental Investigations

Purposes of Briefings

- Process leading to residual ash decision
- Information that will support decision
- Preview results of river investigations

Preview of "Upcoming Attractions"

Tonight's focus: *Environmental Data Collection*

April 5: Residual ash nature & extent, transport modeling

April 19: Aquatics Results

(toxicity testing, bioaccumulation in invertebrates & fishes)

May 3: Wildlife Results

(birds, turtles, mammals, plants)

May 17: Ecological Risk Assessment Process Development of General Response Actions

June 7: Alternatives Evaluation

Environmental Data Collection

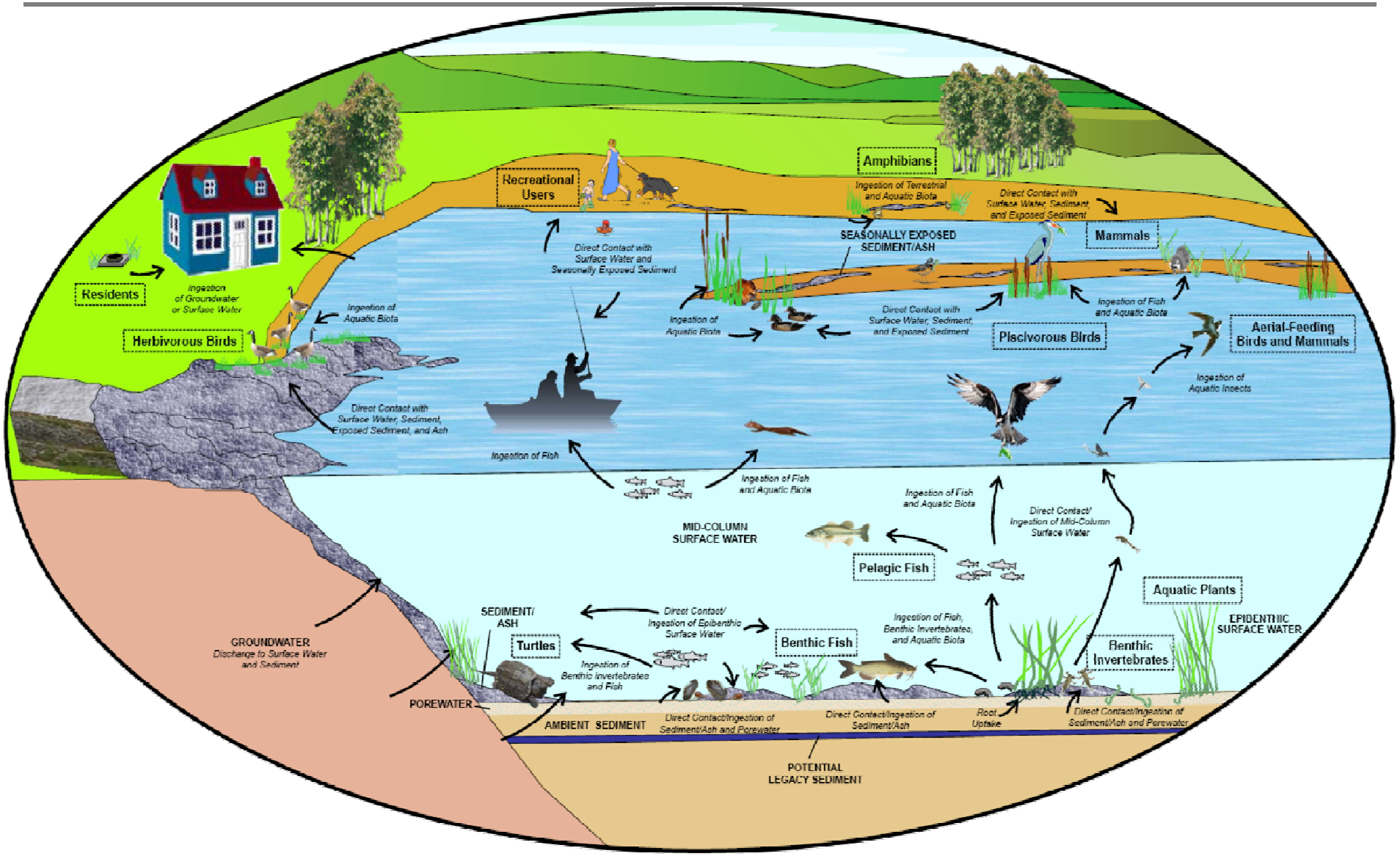
Purposes:

- Assess immediate/intermediate-term effects (Emergency &Time-critical project phases)
- Evaluate likelihood of long-term effects (Non-time-critical phase)
- Provide timely information for decisions

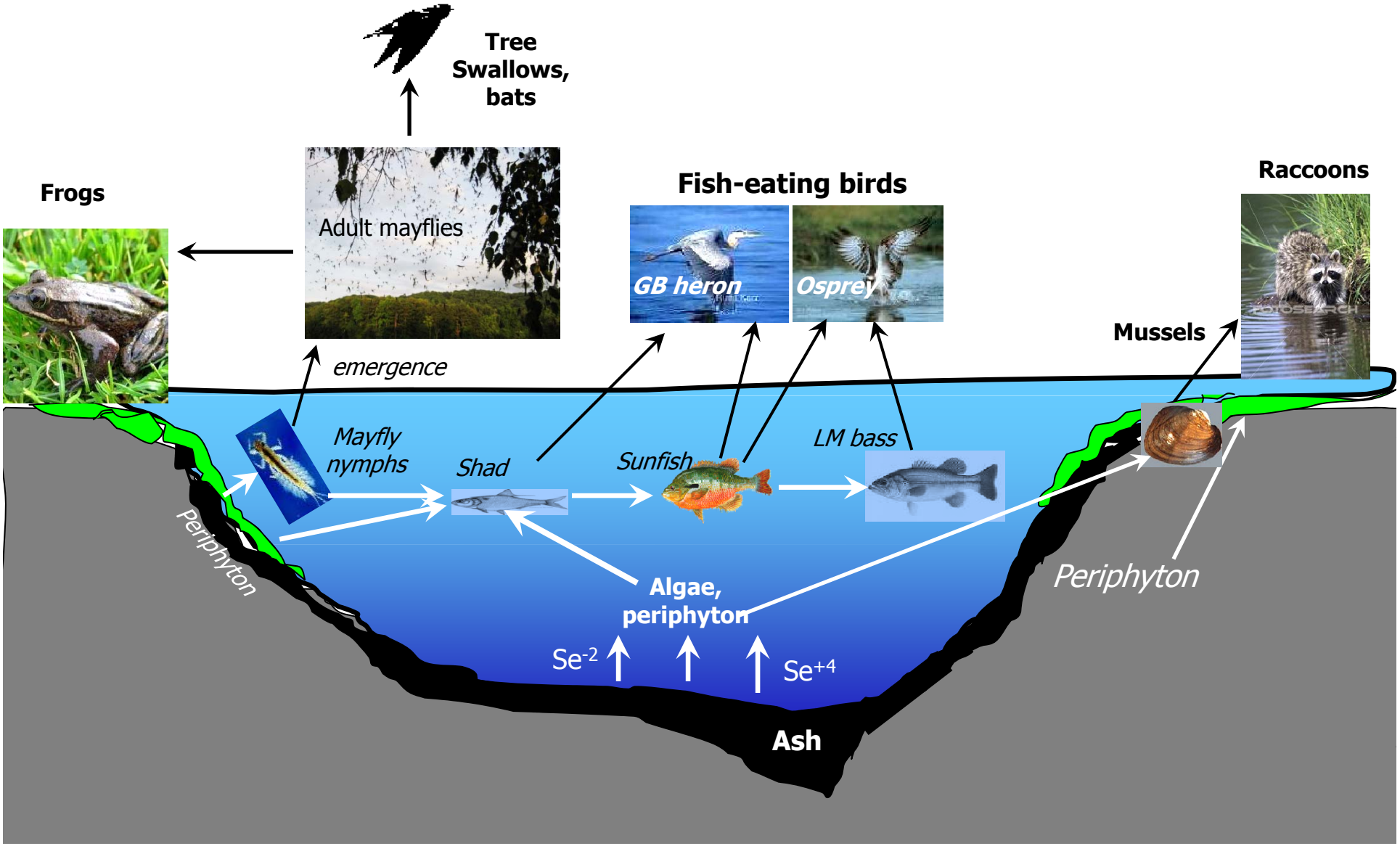
Approach:

- Multimedia monitoring (air, water, sediments, fish, birds...)
- TVA experts (engineers and scientists)
- Independent researchers (Corps of Engineers, ORNL, several universities)
- Inter-disciplinary (geochemical/geophysical, ecological, toxicological, bioconcentration, mathematical modeling…)

Conceptual Exposure Model



Aquatic Food Chain Studies



Environmental Data Collection Overview

Scope:

>16,000 samples collected and analyzed

(air, water, groundwater, soil, sediments, ash, biota)

>400,000 chemical analyses on these samples

~$40 million invested

Quality Assurance/Quality Control Program

- Site-wide Quality Assurance Project Plan
- 61 Standard Operating Procedures
- Laboratory and field audits
- "Hands-on" laboratory sample management

99.8% data acceptance

Participants

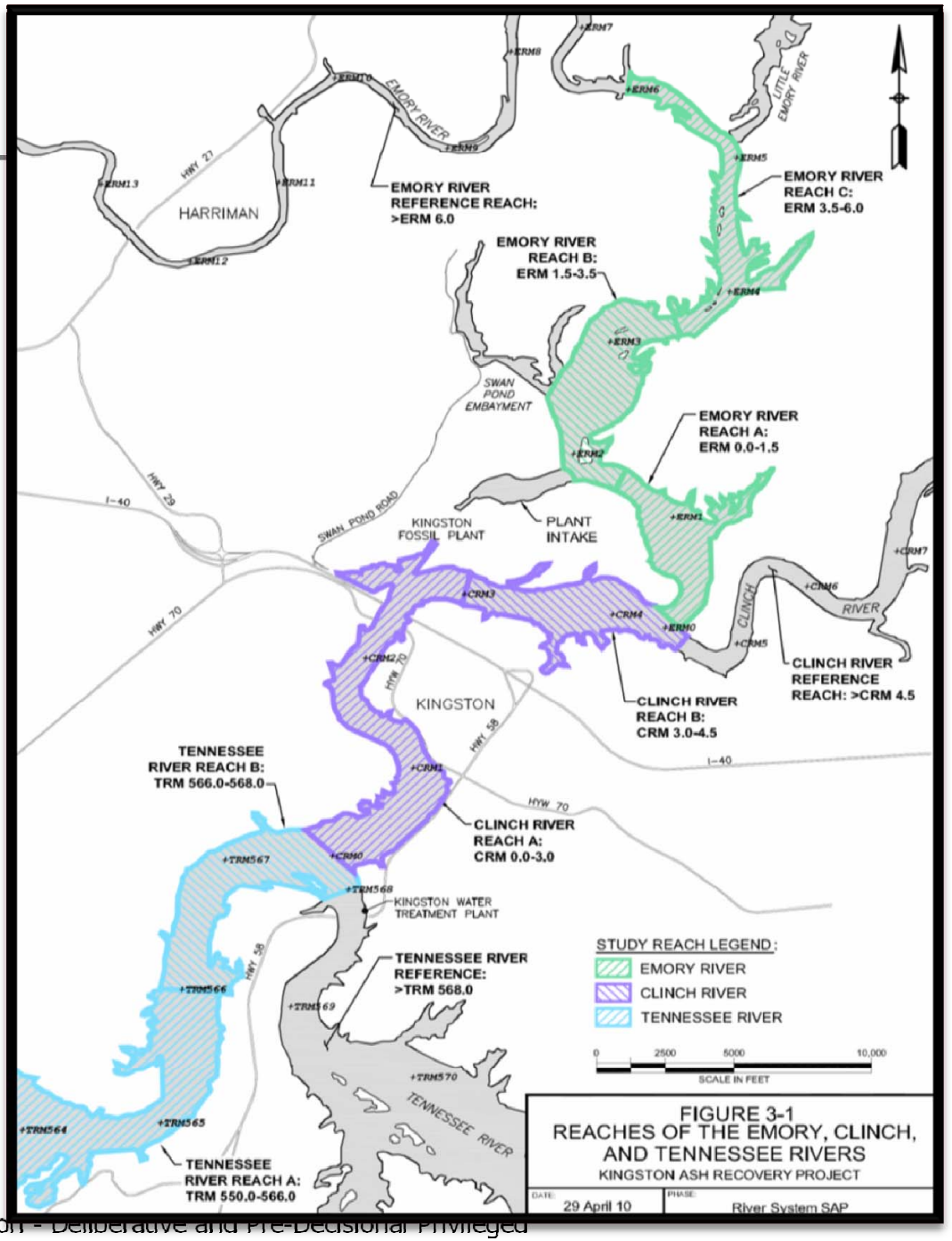
- Ten universities
- Several Federal Agencies (USGS, USACE, FWS, ORNL)
- Several Contract Environmental Services Firms

Engineering Evaluation/Cost Analysis (EE/CA) for the River System

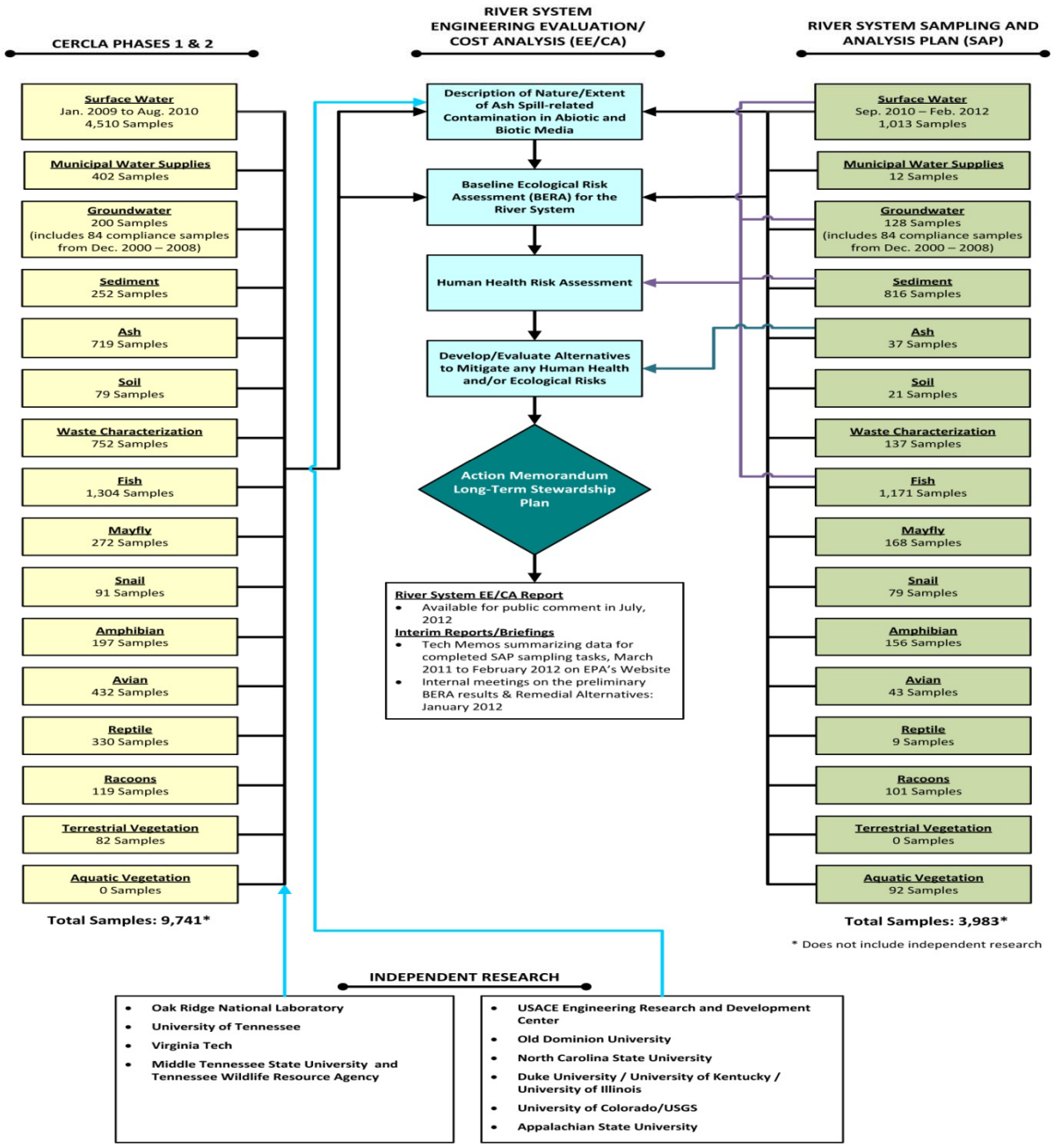
- Sampling and Analysis Plan (SAP) approved by EPA & TDEC May 2010
- Twelve areas of investigation:
  - Ash deposits
  - Ash pore waters
  - Submerged sediments
  - Sediment pore waters
  - Sediment toxicity bioassays
  - Seasonally-exposed sediments
  - Surface waters
  - Ground waters
  - Benthic invertebrates
  - Fish
  - Wildlife
  - Aquatic vegetation

Study Area River Reaches

- Emory River
  - Reference – above ERM 6.0
  - Reach C – ERM 3.5 to ERM 6.0
  - Reach B – ERM 1.5 to ERM 3.5
  - Reach A – ERM 0.0 to ERM 1.5
- Clinch River
  - Reference – above CRM 4.5
  - Reach B – CRM 3.0 to CRM 4.5
  - Reach A – CRM 0.0 to CRM 3.0
- Tennessee River
  - Reference – above TRM 568
  - Reach B – TRM 566 to TRM 568
  - Reach A – TRM 550 to TRM 566



DATA COLLECTION TO SUPPORT RIVER SYSTEM EVALUATION



EE/CA Tasks & Reporting

Tasks

- Sample Collection
- Lab analysis, data validation
- Technical memoranda preparation
- Baseline Ecological Risk Assessment (BERA) preparation
- EE/CA Preparation

Reporting

- Tech memos: March 2011 to February 2012 (on EPA webpage)
- Internal meetings on Preliminary BERA Results & Remedial Alternatives: January 2012
- EE/CA available for public comment in July 2012

EE/CA Supplemental Investigations

- **TVA self-performed investigations**
- **Research grants administered by Oak Ridge Associated Universities (ORAU): Old Dominion, North Carolina State, Duke, University of Kentucky, University of Illinois, University of Colorado, US Geological Survey**
- **Direct Funding from TVA:**
  - Oak Ridge National Laboratory (ORNL)
  - University of Tennessee
  - Virginia Tech
  - Appalachian State University
  - Middle Tennessee State University
  - Tennessee Wildlife Resources Agency (TWRA)
  - US Fish & Wildlife Service
  - US Army Corps of Engineers– Engineer Research and Development Center (ERDC)

- **Results support both EE/CA and NRDA; performed under Quality Assurance Project Plans (QAPP) prepared per CERCLA guidance**

TVA-Performed Investigations

- **Fish Community Assessments**
- **Field Assessments of Fish Health**
- **Invertebrate Community Assessments**
- **Larval Fish Community Assessments** (field collections)
- **Bird Eggs** (Goose, Heron, & Osprey)
- **Amphibians** (toads & frogs)
- **Tree swallows and turtles** (2009 & 2010)

ORAU-Administered Supplemental Investigations

Old Dominion University

- Bio-Geochemical Processes in Flowing River Systems
- Flow-Through Leaching Procedure

North Carolina State University

- Geochemical Characterization of Ash
- Geochemical Transformations—Effects on Selenium Uptake
- Trace Element Uptake by Periphyton

Duke University/University of Kentucky/University of Illinois

- Isotope Ratios as Ash Tracers
- Factors Affecting Mercury Methylation Potential
- Trace Element Transformations: Coal—Fly Ash—Bottom Ash—Disposal
- Geochemical Modeling

University of Colorado/USGS

- Factors Affecting Ash Leaching

Direct-Funded Supplemental Investigations

Oak Ridge National Laboratory

- Fish Health Assessments (laboratory), Reproduction, Bioaccumulation
- Larval Fish Effects (laboratory studies)
- Benthic Invertebrates Bioaccumulation (snails, mayflies)

Oak Ridge National Laboratory and Middle Tennessee State University

- Bluegill & Redear Sunfish Bioaccumulation Differences

USACE Engineering Research and Development Center

- Sediment Transport Modeling
- Geochemical Characterization of Ash and Ash Leaching
- Trace Element Speciation/Geochemical Modeling

Virginia Polytechnic Institute and State University (Virginia Tech)

- Tree Swallows (bioaccumulation, maternal transfer, reproductive effects)
- Turtles (bioaccumulation, maternal transfer, reproductive effects)

Direct-Funded Supplemental Investigations (continued)

Appalachian State University

- Ash Deposit Stratigraphy & Geochemistry,
- Magnetic Susceptibility Potential for Ash Tracking

University of Tennessee

- Raccoons (bioaccumulation, health effects)

Middle Tennessee State University and TWRA

- Freshwater Mussels (bioaccumulation, growth and reproduction)

Data Quality: Verification

- Performed on 100 % of TVA-generated and direct-funded data
- Automated electronic data verification for:
  - Completeness
    - All requested analyses performed? for all samples?
  - Correctness of requested analyses
    - Holding times met? Any blanks contaminated? Do statistics on % recovery and precision meet project requirements?
- Electronic data compared to hard copy summary (Level 1 data package)
  - Manual review by a QA Chemist for inconsistencies
    - Laboratory resubmissions of EDD and/or Level 1 may be necessary.

Data Quality: Validation

- Comprehensive review of the hardcopy (Level 4) data package
  - Includes recalculating reported results from raw data
- Multiple factors examined:
  - Sample condition upon laboratory receipt;
  - Initial instrument calibration linearity
  - Blank analysis results greater than the method detection limit (MDL)
  - Sample preparation and holding times;
  - Initial calibration verification/continuing calibration verification (ICV/CCV) standard recoveries;
  - Inductively coupled plasma (ICP) interference check standard results;
  - MDLs and linear ranges;
  - Internal standard recoveries;
  - Percent moisture;
  - Quantitation of positive results;
  - Laboratory control sample/laboratory control sample duplicate recoveries and precision;
  - Analytical sequence;
  - Reporting limit (RL) standard recoveries;
  - **MDL verification standards**;
  - Standard reference material recoveries;
  - Matrix spike/matrix spike duplicate recoveries and precision; and
  - Laboratory and field duplicate precision.
- Data “flagged” if acceptance criteria not met

What's Next on the Sampling Front?

- **Following EE/CA completion EPA, TDEC, TVA will develop a Long-Term Monitoring Plan**
- **In the interim…**
- **Currently evaluating 2011 biological and sediment results**
- **For the 2012 sampling season, several sampling activities continue at a reduced level of effort:**
  - Spring sport fish survey
  - Spring fish bioaccumulation, fish health, and reproductive competence
  - Goose eggs
  - Mayfly nymphs and adults, snails (benthic invertebrates)
  - Fall fish community and benthic community assessments
  - Sediment toxicity testing
  - Stormwater runoff
- **Catfish, shad, larval fish, heron eggs, osprey eggs, raccoons, amphibians, aquatic and terrestrial vegetation will not be sampled in 2012**
- **US Army Corps of Engineers and University research projects wrap up in 2012--2013**

Summary

- Baseline Eco Risk Assessment is a principal driver for River EE/CA
- River EE/CA will be available for public comment July, 2012
- Data collection is robust and comprehensive; data also will be used in NRDA process
- Data Quality requirements are rigorous: QAPP, SOPs, internal and external audits are producing fully defensible data
- Supplemental investigations are providing additional information to assess potential long-term effects

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