



Document No. EPA-RPT-021B

**Kingston Ash Recovery Project  
Non-Time-Critical Removal Action**

**River System Sampling and Analysis Plan  
Task Completion Technical Memorandum  
Piscivorous and Herbivorous Bird Egg Sampling**

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### List of Acronyms

COC	chain-of-custody
CRM	Clinch River Mile
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	Engineering Evaluation/Cost Estimate
ERM	Emory River Mile
FCN	Field Change Notice
KIF	Kingston Fossil Plant
MDL	method detection limit
mg/kg	milligram per kilogram
ND	not detected
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TRM	Tennessee River Mile
TM	Technical Memorandum
TVA	Tennessee Valley Authority

## 1. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the completion of the 2009 and 2010 piscivorous and herbivorous bird egg sampling as described in the approved *Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan* (SAP), Rev. 3, May 24, 2010, Document No. EPA-AO-021. This TM is one of a series being prepared to summarize the field work and data collection activities as SAP tasks are completed. The technical memorandum series is intended to provide interim presentations of data that will become the basis for the nature and extent of contamination section of the River System Engineering Evaluation/Cost Estimate (EE/CA) Report. No data evaluation or conclusions are presented. Those on the distribution list for these TMs are anticipated to be principal reviewers of the EE/CA Report, so this provides the opportunity to review data summaries in advance of the complete report.

## 2. BACKGROUND

The Data Quality Objective (DQO) problem statement for piscivorous and herbivorous bird egg sampling is:

Naturally-occurring metals (e.g., arsenic, selenium) in ash may accumulate in wildlife (aquatic- and riparian-feeding birds and mammals) inhabiting the river system to concentrations that pose an unacceptable risk to these ecological receptors or ecological receptors who regularly consume these organisms.

Section 2.2.9 of the SAP discusses the design of the avian egg sampling studies. Concentrations of metals detected in bird eggs are commonly used as biomarkers of exposure to these constituents. In order to estimate the potential bioaccumulation of ash-related constituents in wildlife, the concentrations of those constituents needed to be determined. Effects of exposure to some constituents have been described in scientific literature and will be used when available. While only great blue heron biosurveys are required for the Baseline Ecological Risk Assessment, biosurveys of osprey and Canada geese were also conducted as these birds are commonly recognized and are of interest to the general public. When possible, the metal concentrations in eggs of each species were compared between impacted and unimpacted sites as well as between years. Elevated concentrations at impacted sites and changes in concentrations over time may indicate environmental stress and potential risk to heron, osprey, and Canada geese.

Piscivorous and herbivorous bird egg sampling efforts began in 2009, approximately four months after the spill, in order to provide baseline concentrations for future site comparisons. These sampling efforts were continued in 2010. Target species during both years of study included two piscivorous birds, the great blue heron (*Ardea herodias*) and the osprey (*Pandion haliaetus*); and one herbivorous bird, the Canada goose (*Branta canadensis*). When possible, nests located around the ash impacted area near the Kingston Fossil Plant (KIF), downstream of the ash impacted area, and upstream of the ash impacted area (reference site) were sampled. One egg was collected from each occupied, accessible nest, with a target number of ten eggs per area.

In 2009 and 2010, great blue herons occupied two rookeries near KIF. These rookeries were situated in trees at Emory River Mile (ERM) 3.0 and on a transmission line structure upstream of KIF at Tennessee River Mile (TRM) 569.5. Both sites were sampled in 2009 and 2010. Osprey nests were found both upstream and downstream of the KIF facility. These nests occurred in trees as well as on man-made nestling structures built over the water or on channel markers. The number of osprey nests sampled increased from 2009 to 2010 as barges and aerial lifts were enlisted to assist in accessing nests that were previously inaccessible. Canada goose nests were found on river banks, islands, and in grassy and woody

areas both upstream and downstream of the KIF facility. While sampling efforts in 2009 focused on egg collections in the areas immediately surrounding KIF, the 2010 collection efforts expanded to include these potentially impacted areas as well as areas upstream of KIF in order to provide a reference comparison.

### 3. SAMPLING AND ANALYSIS ACTIVITIES

Field activities occurred in the spring of 2009 and 2010 in accordance with Standard Operating Procedure (SOP) *Heron, Osprey, and Canada Goose Eggs, TVA-KIF-SOP-15* (originally issued November 2009; Revision 1 issued April 2010; Revision 2 issued January 2011). Heron, osprey, and Canada goose egg sampling was conducted from April 15 through April 23, 2009 and from April 9 through April 21, 2010. Sampling occurred daily over a one to two week period of time. Heron nests were accessed by Harriman Utility Board tree climbers (Figure 2a) and by TVA transmission lineman (Figure 2b). Osprey nests were accessed by field and river operation crews using a barge and aerial lift (Figure 2c). Egg collections for each species followed the same sampling procedures (Figure 3a through 3c). One egg was randomly selected from each nest, sealed in a labeled plastic bag, placed in a labeled plastic container for transport, and cooled on ice. Clutch size was recorded at the time of collection. Eggs were processed, which included weighing, measuring length and width, and labeling each egg with its designated identification. After processing, each egg was repackaged in a labeled plastic bag, placed in a labeled glass jar and custody sealed, and then frozen. Samples were shipped to the lab on dry ice for chemical analysis. In addition to the field samples, crews collected quality control (QC) samples. Since a true field duplicate is not feasible for biological sampling, co-located samples were collected for each species by collecting two eggs from one randomly selected nest. These eggs were analyzed as part of the data set. Field collection activities for 2009 and 2010 are summarized in Table 1.

**Table 1. Summary of Heron, Osprey, and Canada Goose Egg Field Activities**

Summary	2009	2010
Field collection period	April 15 through April 23	April 9 through April 21
Number egg samples collected <sup>1</sup>	20	45
Number QC samples collected	3	3
Frequency of QC sampling	Once per species per season	Once per species per season

**Note:** <sup>1</sup>See Appendix A for collection details.

Sampling and analysis were performed in accordance with the *Quality Assurance Project Plan For The Tennessee Valley Authority Kingston Ash Recovery Project (QAPP)*, the listed SOPs, field guides, and work packages. Table 2 identifies the applicable TVA documents and SOPs associated with great blue heron, osprey, and Canada goose egg sampling. Equipment rinsate blanks were not collected during either years of study.

All field and QC samples were shipped to Pace Analytical Services, Inc., Green Bay, WI for analysis (see Appendix B for shipping details). Egg samples were analyzed for a suite of 26 metals and percent moisture.

**Table 2. Applicable TVA Documents and Standard Operating Procedures**

<b>Document</b>	<b>Document Number</b>
TVA KIF Ash Recovery Project Quality Assurance Project Plan (QAPP)	TVA-KIF-QAPP
TVA-KIF Work Package: Heron Egg Sampling with TVA PSO (lineman) Support	WP-1003
TVA-KIF Work Package: Osprey Egg Sampling with River Ops Crew	WP-1004
TVA-KIF Work Package: Heron and Osprey Egg Sampling with HUB Support	WP-1005
TVA-KIF Work Package: Canada Goose Egg Sampling	WP-1006
<b>STANDARD OPERATION PROCEDURES</b>	
Heron, Osprey, and Canada Goose Eggs	TVA-KIF-SOP-15
Field Documentation	TVA-KIF-SOP-06
Sample Labeling, Packing, And Shipping	TVA-KIF-SOP-07
Decontamination Of Equipment	TVA-KIF-SOP-08
Field quality control sampling	TVA-KIF-SOP-11
Management and implementation of equis™-based chain of custody	TVA-KIF-SOP-18
<b>FIELD CHANGE NOTICES (FCNs)</b>	
Heron Colony Locations	FCN-008

#### 4. SUMMARY OF CHANGES

FCNs were prepared to document deviations from the SAP. FCNs were prepared and approved for the elimination of collections from the heron colony at CRM 2.5.

In order to support ongoing ecological studies at the Kingston Ash Recovery Project site, great blue heron egg collections were required for three locations (ERM 3.0, CRM 2.5, and TRM 569.5). The heron colony location at CRM 2.5 was inactive in both 2009 and 2010, and therefore could not be sampled. As a result, heron egg collections during both years included eggs from only two colonies (near ERM 3.0 and TRM 569.5). FCN-008 documents this change.

#### 5. ANALYTICAL DATA REVIEW

TVA's contracted laboratories were required to submit three types of deliverables: a limited (Level 1) data package containing sample results and batch QC sample results; a fully-documented (Level 4) data package including raw data for all analyses; and electronic data deliverables (EDDs) for storage in TVA's EarthSoft EQuIS® database.

EDDs were subjected to completeness and correctness testing during loading to TVA's EQuIS database; once loaded to the EQuIS database, the data were subjected to verification. As defined in the QAPP, data verification involved comparison of the data loaded in the EQuIS database to the results reported in the Level 1 data package. In addition, data verification included review of the batch QC summary forms for compliance with the applicable methods and for data usability with respect to the project DQOs and the QAPP.

Following receipt of the Level 4 data package, data were subjected to validation. As defined in the QAPP, data validation included review of raw data and associated QC summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. As stated in the QAPP: "Initially, 100% of the chemical analysis data will be reported in full documentation data

packages for independent data validation. Depending on the nature and frequency of issues identified during data validation, the percentage of data undergoing full data validation may be reduced to a lesser percentage (such as 20%) or data verification may be substituted. The reduction in full data validation may be matrix specific, laboratory specific, or analyte specific. If after the percentage of full data validation has decreased, a trend in frequency of reporting issues, method non-compliances, or data usability issues is identified, data validation will be conducted for specific data points or the percentage of full data validation percentage may be increased until the issues have been minimized to their initial frequency.” Data validation expands upon the completeness, correctness, and usability assessment performed during verification to include evaluation of instrumental QC analyses, review of sample preparation information, and recalculation of reported results from raw data. A summary of the data review effort is presented below in Table 3.

**Table 3. Data Review Summary**

# Chains of Custody	# Samples	# Equipment Blank Samples	# Analytical Results	Percentage Validated
9	71	0	1,918	100%

## 6. DATA QUALITY SUMMARY

Data validation was performed based on the sample results, summary QC data, and raw data provided by the laboratory. Data validation includes a review of the following QC measures (where applicable):

- Sample condition upon laboratory receipt;
- Initial calibration linearity;
- Blank analysis results greater than the method detection limit (MDL);
- Sample preparation and holding times;
- Initial calibration verification/continuing calibration verification standard recoveries;
- Inductively coupled plasma interference check standard results;
- MDLs and linear ranges;
- Internal standard recoveries;
- Percent moisture;
- Matrix spike/matrix spike duplicate;
- Laboratory and field duplicate precision;
- Quantitation of positive results;
- Laboratory control sample/laboratory control sample duplicate recoveries and precision;
- Analytical sequence;
- Reporting limit standard recoveries;
- MDL verification standards; and
- Standard reference material recoveries.

The data met the DQOs defined for this task and are acceptable for use. Table 4 summarizes the data quality based on the review performed and as compared to the data quality measures identified in the QAPP. The text of the data validation reports for the samples included in this technical memorandum will be included in the EE/CA Report.

**Table 4. Summary of Heron, Osprey, and Canada Goose Egg Data Quality**

Analytical Results (Total Count)	Acceptable (No Qualification) <sup>a</sup>		Acceptable (Estimated) <sup>b</sup>		Blank Qualified <sup>c</sup>		Rejected <sup>d</sup>	
	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
1,918	1,559	81%	318	17%	43	2%	0	0%

**Notes:**

<sup>a</sup>Acceptable, No Qualification – Qualification of data was not warranted based on a review of the applicable QC measures.

<sup>b</sup>Acceptable, Estimated – Quantitation or detection limit is approximate due to limitations or bias identified during a review of the applicable QC measures.

<sup>c</sup>Blank Qualified – Result is considered “not-detected” because the target analyte was detected in an associated blank at a similar level.

<sup>d</sup>Rejected – Unreliable result or detection limit; analyte may or may not be present in sample.

**7. DATA SUMMARY**

Summary statistics for each avian species are provided in Tables 5 through 16 for each location collected in 2009 and 2010.

**Table 5. 2009 Blue Heron Egg Samples Collected at ERM 3.0**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	24.73 / 24.98	ND	ND	ND			0 / 5	0
Antimony	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Arsenic	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Barium	mg/kg	0.09983 / 0.1005	ND	0.1321	0.162	ERM 3.0	04/23/2009	2 / 5	0.1471
Beryllium	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Boron	mg/kg	1.982 / 1.998	ND	ND	ND			0 / 5	0
Cadmium	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Calcium	mg/kg		281.6	281.6	1733	ERM 3.0	04/23/2009	5 / 5	698
Chromium	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Cobalt	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Copper	mg/kg		0.6107	0.6107	2.997	ERM 3.0	04/23/2009	5 / 5	1.334
Iron	mg/kg	24.73 / 24.98	ND	ND	ND			0 / 5	0
Lead	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Magnesium	mg/kg	99.09 / 99.49	ND	100.8	116.4	ERM 3.0	04/23/2009	3 / 5	109.7
Manganese	mg/kg	0.4917 / 0.5022	ND	0.555	0.5766	ERM 3.0	04/23/2009	2 / 5	0.5658
Mercury	mg/kg		0.04836	0.04836	0.111	ERM 3.0	04/23/2009	5 / 5	0.07264
Molybdenum	mg/kg	0.9983 / 1.005	ND	ND	ND			0 / 5	0
Nickel	mg/kg	0.09983 / 0.1005	ND	0.486	0.486	ERM 3.0	04/23/2009	1 / 5	0.486
Potassium	mg/kg		1068	1068	1299	ERM 3.0	04/23/2009	5 / 5	1177
Selenium	mg/kg		0.4536	0.4536	0.5735	ERM 3.0	04/23/2009	5 / 5	0.5062
Silver	mg/kg	0.04917 / 0.05022	ND	ND	ND			0 / 5	0
Sodium	mg/kg		1476	1476	1944	ERM 3.0	04/23/2009	5 / 5	1812
Strontium	mg/kg		0.1326	0.1326	0.6804	ERM 3.0	04/23/2009	5 / 5	0.3055
Thallium	mg/kg	0.09983 / 0.1005	ND	ND	ND			0 / 5	0
Vanadium	mg/kg	0.1937 / 0.2046	ND	ND	ND			0 / 5	0
Zinc	mg/kg		4.366	4.366	12.62	ERM 3.0	04/23/2009	5 / 5	8.276

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 6. 2010 Blue Heron Egg Samples Collected at ERM 3.0**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.857 / 4.136	ND	ND	ND			0 / 9	0
Antimony	mg/kg	0.01401 / 0.01499	ND	ND	ND			0 / 9	0
Arsenic	mg/kg	0.02639 / 0.0296	ND	ND	ND			0 / 9	0
Barium	mg/kg		0.08162	0.08162	0.6845	ERM 3.0	04/12/2010	9 / 9	0.253
Beryllium	mg/kg	0.02842 / 0.03136	ND	ND	ND			0 / 9	0
Boron	mg/kg	0.406 / 0.4312	ND	ND	ND			0 / 9	0
Cadmium	mg/kg	0.00731 / 0.00796	ND	ND	ND			0 / 9	0
Calcium	mg/kg		441.6	441.6	1081	ERM 3.0	04/12/2010	9 / 9	630
Chromium	mg/kg	0.1218 / 0.1314	ND	ND	ND			0 / 9	0
Cobalt	mg/kg	0.0136 / 0.0245	ND	ND	ND			0 / 9	0
Copper	mg/kg		0.665	0.665	1.478	ERM 3.0	04/12/2010	9 / 9	1.068
Iron	mg/kg		15.14	15.14	31.75	ERM 3.0	04/12/2010	9 / 9	22.4
Lead	mg/kg	0.02639 / 0.0296	ND	ND	ND			0 / 9	0
Magnesium	mg/kg		85.01	85.01	152.5	ERM 3.0	04/12/2010	9 / 9	121.1
Manganese	mg/kg		0.368	0.368	0.9338	ERM 3.0	04/12/2010	9 / 9	0.6348
Mercury	mg/kg		0.034	0.034	0.378	ERM 3.0	04/12/2010	9 / 9	0.1445
Molybdenum	mg/kg	0.105 / 0.3332	ND	ND	ND			0 / 9	0
Nickel	mg/kg	0.09338 / 0.1018	ND	ND	ND			0 / 9	0
Potassium	mg/kg		1220	1220	1601	ERM 3.0	04/12/2010	9 / 9	1409
Selenium	mg/kg		0.5236	0.5236	0.85	ERM 3.0	04/12/2010	9 / 9	0.6628
Silver	mg/kg	0.00284 / 0.00438	ND	ND	ND			0 / 9	0
Sodium	mg/kg		1627	1627	2986	ERM 3.0	04/12/2010	9 / 9	2087
Strontium	mg/kg		0.175	0.175	0.5887	ERM 3.0	04/12/2010	9 / 9	0.3167
Thallium	mg/kg	0.0132 / 0.01431	ND	ND	ND			0 / 9	0
Vanadium	mg/kg	0.0441 / 0.0481	ND	ND	ND			0 / 9	0
Zinc	mg/kg		8.177	8.177	14.95	ERM 3.0	04/12/2010	9 / 9	11.14

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 7. 2009 Blue Heron Egg Samples Collected at TRM 569.5**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	24.83 / 25.04	ND	ND	ND			0 / 5	0
Antimony	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Arsenic	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Barium	mg/kg	0.09894 / 0.09955	ND	0.1018	0.1342	TRM 569.5	04/15/2009	4 / 5	0.1177
Beryllium	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Boron	mg/kg	1.98 / 1.998	ND	ND	ND			0 / 5	0
Cadmium	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Calcium	mg/kg		439.6	439.6	3041	TRM 569.5	04/15/2009	5 / 5	1053
Chromium	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Cobalt	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Copper	mg/kg		0.5049	0.5049	0.858	TRM 569.5	04/15/2009	5 / 5	0.6979
Iron	mg/kg	24.83 / 25.04	ND	ND	ND			0 / 5	0
Lead	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Magnesium	mg/kg	99.44 / 100.1	ND	109.4	115.3	TRM 569.5	04/15/2009	2 / 5	112.4
Manganese	mg/kg	0.4992 / 0.5049	ND	0.528	0.679	TRM 569.5	04/15/2009	3 / 5	0.6014
Mercury	mg/kg		0.03264	0.03264	0.1792	TRM 569.5	04/15/2009	5 / 5	0.06802
Molybdenum	mg/kg	0.9894 / 1.01	ND	ND	ND			0 / 5	0
Nickel	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Potassium	mg/kg		1029	1029	1464	TRM 569.5	04/15/2009	5 / 5	1205
Selenium	mg/kg		0.4608	0.4608	0.5792	TRM 569.5	04/15/2009	5 / 5	0.5256
Silver	mg/kg	0.04992 / 0.05068	ND	ND	ND			0 / 5	0
Sodium	mg/kg		1444	1444	2034	TRM 569.5	04/15/2009	5 / 5	1696
Strontium	mg/kg		0.1812	0.1812	0.6697	TRM 569.5	04/15/2009	5 / 5	0.3002
Thallium	mg/kg	0.09894 / 0.101	ND	ND	ND			0 / 5	0
Vanadium	mg/kg	0.192 / 0.1991	ND	ND	ND			0 / 5	0
Zinc	mg/kg		8.435	8.435	13.35	TRM 569.5	04/15/2009	5 / 5	10.84

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 8. 2010 Blue Heron Egg Samples Collected at TRM 569.5**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.783 / 3.979	ND	ND	ND			0 / 3	0
Antimony	mg/kg	0.0137 / 0.01443	ND	ND	ND			0 / 3	0
Arsenic	mg/kg	0.0269 / 0.02768	ND	ND	ND			0 / 3	0
Barium	mg/kg		0.1112	0.1112	0.2098	TRM 569.5	04/09/2010	3 / 3	0.1549
Beryllium	mg/kg	0.02702 / 0.02959	ND	ND	ND			0 / 3	0
Boron	mg/kg	0.386 / 0.4152	ND	ND	ND			0 / 3	0
Cadmium	mg/kg	0.00714 / 0.00761	ND	ND	ND			0 / 3	0
Calcium	mg/kg		487.5	487.5	4048	TRM 569.5	04/09/2010	3 / 3	1792
Chromium	mg/kg	0.1197 / 0.1268	ND	ND	ND			0 / 3	0
Cobalt	mg/kg	0.01332 / 0.01404	ND	0.01505	0.01668	TRM 569.5	04/09/2010	1 / 3	0.01505
Copper	mg/kg		0.5536	0.5536	1.749	TRM 569.5	04/09/2010	3 / 3	0.9922
Iron	mg/kg		19.55	19.55	25.64	TRM 569.5	04/09/2010	3 / 3	20.42
Lead	mg/kg	0.0269 / 0.02768	ND	ND	ND			0 / 3	0
Magnesium	mg/kg		106.5	106.5	184.3	TRM 569.5	04/09/2010	3 / 3	139
Manganese	mg/kg		0.4875	0.4875	1.533	TRM 569.5	04/09/2010	3 / 3	0.8811
Mercury	mg/kg		0.04053	0.04053	0.1872	TRM 569.5	04/09/2010	3 / 3	0.09436
Molybdenum	mg/kg		0.0975	0.0975	0.1291	TRM 569.5	04/09/2010	3 / 3	0.1109
Nickel	mg/kg	0.09264 / 0.0975	ND	ND	ND			0 / 3	0
Potassium	mg/kg		1439	1439	1891	TRM 569.5	04/09/2010	3 / 3	1463
Selenium	mg/kg		0.507	0.507	0.7263	TRM 569.5	04/09/2010	3 / 3	0.5221
Silver	mg/kg	0.0027 / 0.00296	ND	ND	ND			0 / 3	0
Sodium	mg/kg		1919	1919	2374	TRM 569.5	04/09/2010	3 / 3	2117
Strontium	mg/kg		0.2145	0.2145	0.865	TRM 569.5	04/09/2010	3 / 3	0.4628
Thallium	mg/kg	0.01312 / 0.01372	ND	ND	ND			0 / 3	0
Vanadium	mg/kg	0.04246 / 0.04573	ND	ND	ND			0 / 3	0
Zinc	mg/kg		8.99	8.99	17.51	TRM 569.5	04/09/2010	3 / 3	12.71

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 9. 2009 Osprey Egg Samples Collected at Potentially Impacted Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	24.88 / 25.03	ND	ND	ND			0 / 6	0
Antimony	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Arsenic	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Barium	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Beryllium	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Boron	mg/kg	1.988 / 2.016	ND	ND	ND			0 / 6	0
Cadmium	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Calcium	mg/kg		223.4	223.4	634.8	ERM 1.8.OS.04	04/15/2009	6 / 6	390
Chromium	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Cobalt	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Copper	mg/kg	0.49 / 0.508	ND	ND	ND			0 / 6	0
Iron	mg/kg	24.88 / 25.03	ND	32.77	38.94	ERM 1.8.OS.04	04/15/2009	2 / 6	35.86
Lead	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Magnesium	mg/kg	99.53 / 100.5	ND	ND	ND			0 / 6	0
Manganese	mg/kg	0.49 / 0.508	ND	0.5664	0.5664	ERM 1.8.OS.04	04/15/2009	1 / 6	0.5664
Mercury	mg/kg		0.02416	0.02416	0.06608	ERM1.8.OS.04	04/15/2009	6 / 6	0.04106
Molybdenum	mg/kg	0.9906 / 1.008	ND	ND	ND			0 / 6	0
Nickel	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Potassium	mg/kg		812.2	812.2	1112	ERM 2.7	04/23/2009	6 / 6	933.8
Selenium	mg/kg		0.2567	0.2567	0.5428	ERM 1.8.OS.04	04/15/2009	6 / 6	0.3976
Silver	mg/kg	0.049 / 0.0508	ND	ND	ND			0 / 6	0
Sodium	mg/kg		1208	1208	1668	ERM 2.7	04/23/2009	6 / 6	1451
Strontium	mg/kg	0.09906 / 0.1008	ND	0.1144	0.1981	TRM 564.6	04/15/2009	4 / 6	0.1536
Thallium	mg/kg	0.09906 / 0.1008	ND	ND	ND			0 / 6	0
Vanadium	mg/kg	0.196 / 0.2016	ND	ND	ND			0 / 6	0
Zinc	mg/kg		4.099	4.099	18.12	ERM 1.8.OS.04	04/15/2009	6 / 6	9.642

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 10. 2010 Osprey Egg Samples Collected at Potentially Impacted Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.85 / 4.15	ND	ND	ND			0 / 5	0
Antimony	mg/kg	0.0139 / 0.01496	ND	ND	ND			0 / 5	0
Arsenic	mg/kg	0.02641 / 0.0578	ND	ND	ND			0 / 5	0
Barium	mg/kg	0.04408 / 0.04814	ND	0.04725	0.05016	TRM 567.6	04/12/2010	2 / 5	0.04871
Beryllium	mg/kg	0.0278 / 0.0612	ND	ND	ND			0 / 5	0
Boron	mg/kg	0.4031 / 0.4316	ND	ND	ND			0 / 5	0
Cadmium	mg/kg	0.00737 / 0.00797	ND	ND	ND			0 / 5	0
Calcium	mg/kg		222.3	222.3	474.2	TRM 567.6	04/12/2010	5 / 5	350.1
Chromium	mg/kg	0.1223 / 0.1311	ND	ND	ND			0 / 5	0
Cobalt	mg/kg	0.01362 / 0.01462	ND	ND	ND			0 / 5	0
Copper	mg/kg		0.2625	0.2625	0.374	ERM 2.8	04/21/2010	5 / 5	0.3248
Iron	mg/kg	11.61 / 12.3	ND	11.82	29.94	TRM 567.6	04/12/2010	4 / 5	18.22
Lead	mg/kg	0.02641 / 0.0289	ND	ND	ND			0 / 5	0
Magnesium	mg/kg		63.35	63.35	111.6	TRM 566.0	04/12/2010	5 / 5	93.59
Manganese	mg/kg	0.1668 / 0.1668	ND	0.2158	0.3952	TRM 567.6	04/12/2010	4 / 5	0.2905
Mercury	mg/kg		0.02736	0.02736	0.1129	TRM 566.0	04/12/2010	5 / 5	0.06053
Molybdenum	mg/kg	0.03336 / 0.03675	ND	ND	ND			0 / 5	0
Nickel	mg/kg	0.09452 / 0.1013	ND	ND	ND			0 / 5	0
Potassium	mg/kg		969.5	969.5	1457	TRM 566.0	04/12/2010	5 / 5	1184
Selenium	mg/kg		0.3336	0.3336	0.51	ERM 2.8	04/21/2010	5 / 5	0.4221
Silver	mg/kg	0.00278 / 0.00306	ND	ND	ND			0 / 5	0
Sodium	mg/kg		1514	1514	2241	TRM 566.0	04/12/2010	5 / 5	1755
Strontium	mg/kg		0.1033	0.1033	0.1824	TRM 567.6	04/12/2010	5 / 5	0.142
Thallium	mg/kg	0.01334 / 0.01428	ND	ND	ND			0 / 5	0
Vanadium	mg/kg	0.04408 / 0.04814	ND	ND	ND			0 / 5	0
Zinc	mg/kg		5.171	5.171	11.23	TRM 567.6	04/12/2010	5 / 5	7.556

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 11. 2009 Osprey Egg Samples Collected at Reference Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	24.95 / 24.96	ND	ND	ND			0 / 2	0
Antimony	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Arsenic	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Barium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Beryllium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Boron	mg/kg	1.987 / 2	ND	ND	ND			0 / 2	0
Cadmium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Calcium	mg/kg		198.2	198.2	254.1	TRM 569.5	04/15/2009	2 / 2	226.2
Chromium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Cobalt	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Copper	mg/kg	0.4928 / 0.4956	ND	ND	ND			0 / 2	0
Iron	mg/kg	24.95 / 24.96	ND	ND	ND			0 / 2	0
Lead	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Magnesium	mg/kg	99.48 / 99.65	ND	ND	ND			0 / 2	0
Manganese	mg/kg	0.4928 / 0.4956	ND	ND	ND			0 / 2	0
Mercury	mg/kg		0.05487	0.05487	0.05544	TRM 569.5	04/15/2009	2 / 2	0.05516
Molybdenum	mg/kg	0.9912 / 1.001	ND	ND	ND			0 / 2	0
Nickel	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Potassium	mg/kg		927.1	927.1	1064	TRM 569.0	04/23/2009	2 / 2	995.6
Selenium	mg/kg		0.231	0.231	0.2832	TRM 569.0	04/23/2009	2 / 2	0.2571
Silver	mg/kg	0.04928 / 0.04956	ND	ND	ND			0 / 2	0
Sodium	mg/kg		1472	1472	1735	TRM 569.0	04/23/2009	2 / 2	1604
Strontium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Thallium	mg/kg	0.09912 / 0.1001	ND	ND	ND			0 / 2	0
Vanadium	mg/kg	0.1947 / 0.2002	ND	ND	ND			0 / 2	0
Zinc	mg/kg	1.987 / 2.336	ND	4.528	4.528	TRM 569.5	04/15/2009	1 / 2	4.528

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 12. 2010 Osprey Egg Samples Collected at Reference Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.884 / 4.127	ND	ND	ND			0 / 4	0
Antimony	mg/kg	0.01404 / 0.0149	ND	0.08342	0.08342	TRM 571.9	04/12/2010	1 / 4	0.08342
Arsenic	mg/kg	0.02652 / 0.0294	ND	ND	ND			0 / 4	0
Barium	mg/kg	0.04524 / 0.04768	ND	0.06014	0.06014	TRM 571.9	04/12/2010	1 / 4	0.06014
Beryllium	mg/kg	0.02808 / 0.0298	ND	ND	ND			0 / 4	0
Boron	mg/kg	0.4056 / 0.4321	ND	ND	ND			0 / 4	0
Cadmium	mg/kg	0.00733 / 0.0079	ND	ND	ND			0 / 4	0
Calcium	mg/kg		283.8	283.8	608.4	TRM 569.5	04/12/2010	4 / 4	524.6
Chromium	mg/kg	0.1232 / 0.1294	ND	0.2235	0.2235	TRM 569.5	04/12/2010	1 / 4	0.2235
Cobalt	mg/kg	0.01373 / 0.01445	ND	ND	ND			0 / 4	0
Copper	mg/kg		0.297	0.297	0.6556	TRM 569.5	04/12/2010	4 / 4	0.472
Iron	mg/kg	11.7 / 12.09	ND	17.67	30.73	TRM 569.5	04/12/2010	4 / 4	23.7
Lead	mg/kg	0.02652 / 0.0294	ND	0.1106	0.1106	TRM 571.9	04/12/2010	1 / 4	0.1106
Magnesium	mg/kg		71.94	71.94	156.5	TRM 569.5	04/12/2010	4 / 4	131.8
Manganese	mg/kg	0.165 / 0.165	ND	0.2744	0.4368	TRM 569.5	04/12/2010	4 / 4	0.3348
Mercury	mg/kg		0.04074	0.04074	0.1744	TRM 571.0	04/12/2010	4 / 4	0.1046
Molybdenum	mg/kg	0.03432 / 0.03576	ND	ND	ND			0 / 4	0
Nickel	mg/kg	0.09516 / 0.09996	ND	0.1341	0.1341	TRM 569.5	04/12/2010	1 / 4	0.1341
Potassium	mg/kg		953.7	953.7	2548	TRM 569.5	04/12/2010	4 / 4	1817
Selenium	mg/kg		0.3135	0.3135	0.7003	TRM 569.5	04/12/2010	4 / 4	0.5575
Silver	mg/kg	0.00281 / 0.00298	ND	ND	ND			0 / 4	0
Sodium	mg/kg		1561	1561	3844	TRM 569.5	04/12/2010	4 / 4	2780
Strontium	mg/kg		0.137	0.137	0.1872	TRM 569.5	04/12/2010	4 / 4	0.1676
Thallium	mg/kg	0.01342 / 0.01416	ND	ND	ND			0 / 4	0
Vanadium	mg/kg	0.04368 / 0.04704	ND	0.07599	0.07599	TRM 569.5	04/12/2010	1 / 4	0.07599
Zinc	mg/kg		5.61	5.61	13.45	TRM 569.5	04/12/2010	4 / 4	11.31

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 13. 2009 Canada Goose Egg Samples Collected at Emory River Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	24.85 / 24.91	ND	ND	ND			0 / 4	0
Antimony	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Arsenic	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Barium	mg/kg		1.626	1.626	3.456	ERM 3.0	04/23/2009	4 / 4	2.459
Beryllium	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Boron	mg/kg	1.975 / 2.007	ND	ND	ND			0 / 4	0
Cadmium	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Calcium	mg/kg		1228	1228	2221	ERM 3.0	04/23/2009	4 / 4	1515
Chromium	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Cobalt	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Copper	mg/kg		0.9423	0.9423	1.315	ERM 3.0	04/23/2009	4 / 4	1.064
Iron	mg/kg		28.65	28.65	74.26	ERM 3.0	04/23/2009	4 / 4	44.12
Lead	mg/kg	0.09875 / 0.1012	ND	ND	ND			0 / 4	0
Magnesium	mg/kg		110.2	110.2	188.9	ERM 3.0	04/23/2009	4 / 4	142
Manganese	mg/kg	0.4844 / 0.504	ND	0.9875	0.9875	ERM 3.0	04/23/2009	1 / 4	0.9875
Mercury	mg/kg	0.01975 / 0.02007	ND	ND	ND			0 / 4	0
Molybdenum	mg/kg	0.9875 / 1.012	ND	ND	ND			0 / 4	0
Nickel	mg/kg	0.09875 / 0.1012	ND	0.1868	0.1868	ERM 3.0	04/23/2009	1 / 4	0.1868
Potassium	mg/kg		628.1	628.1	1356	ERM 3.0	04/23/2009	4 / 4	1147
Selenium	mg/kg		0.288	0.288	2.173	ERM 3.0	04/23/2009	4 / 4	0.7751
Silver	mg/kg	0.04844 / 0.05135	ND	ND	ND			0 / 4	0
Sodium	mg/kg		715	715	1142	ERM 3.0	04/23/2009	4 / 4	1004
Strontium	mg/kg		0.7958	0.7958	1.857	ERM 3.0	04/23/2009	4 / 4	1.08
Thallium	mg/kg	0.09875 / 0.1012	ND	0.1343	0.1343	ERM 3.0	04/23/2009	1 / 4	0.1343
Vanadium	mg/kg	0.1975 / 0.2007	ND	ND	ND			0 / 4	0
Zinc	mg/kg		18.58	18.58	29.98	ERM 3.0	04/23/2009	4 / 4	22.39

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 14. 2010 Canada Goose Egg Samples Collected at Emory River Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.792 / 4.142	ND	ND	ND			0 / 10	0
Antimony	mg/kg	0.01378 / 0.015	ND	ND	ND			0 / 10	0
Arsenic	mg/kg	0.02654 / 0.0292	ND	ND	ND			0 / 10	0
Barium	mg/kg		0.9048	0.9048	4.025	ERM 3.0	04/14/2010	10 / 10	2.481
Beryllium	mg/kg	0.02789 / 0.03064	ND	ND	ND			0 / 10	0
Boron	mg/kg	0.3792 / 0.4354	ND	ND	ND			0 / 10	0
Cadmium	mg/kg	0.00706 / 0.00782	ND	ND	ND			0 / 10	0
Calcium	mg/kg		673.5	673.5	2517	ERM 3.0	04/14/2010	10 / 10	1365
Chromium	mg/kg	0.1201 / 0.1311	ND	ND	ND			0 / 10	0
Cobalt	mg/kg	0.01327 / 0.01467	ND	ND	ND			0 / 10	0
Copper	mg/kg	0.9164 / 1.169	ND	ND	ND			0 / 10	0
Iron	mg/kg		27.21	27.21	47.95	ERM 3.0	04/14/2010	10 / 10	38.78
Lead	mg/kg	0.02621 / 0.02901	ND	0.05287	0.05287	ERM 3.0	04/14/2010	1 / 10	0.05287
Magnesium	mg/kg		122.9	122.9	205.7	ERM 3.0	04/14/2010	10 / 10	159.1
Manganese	mg/kg		0.3974	0.3974	1.05	ERM 3.0	04/14/2010	10 / 10	0.7363
Mercury	mg/kg	0.00632 / 0.02414	ND	ND	ND			0 / 10	0
Molybdenum	mg/kg	0.04032 / 0.1856	ND	ND	ND			0 / 10	0
Nickel	mg/kg	0.09072 / 0.1013	ND	ND	ND			0 / 10	0
Potassium	mg/kg		1305	1305	1621	ERM 3.0	04/14/2010	10 / 10	1434
Selenium	mg/kg		0.2236	0.2236	1.296	ERM 3.0	04/14/2010	10 / 10	0.8212
Silver	mg/kg	0.00272 / 0.003	ND	ND	ND			0 / 10	0
Sodium	mg/kg		1127	1127	1577	ERM 3.0	04/14/2010	10 / 10	1313
Strontium	mg/kg		0.4524	0.4524	1.768	ERM 3.0	04/14/2010	10 / 10	0.96
Thallium	mg/kg	0.01296 / 0.01434	ND	ND	ND			0 / 10	0
Vanadium	mg/kg	0.04368 / 0.0489	ND	ND	ND			0 / 10	0
Zinc	mg/kg		16.56	16.56	31.12	ERM 3.0	04/14/2010	10 / 10	21.77

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

**Table 15. 2010 Canada Goose Egg Samples Collected at Clinch River Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	4.039 / 4.162	ND	ND	ND			0 / 4	0
Antimony	mg/kg	0.01459 / 0.01512	ND	ND	ND			0 / 4	0
Arsenic	mg/kg	0.0289 / 0.05814	ND	ND	ND			0 / 4	0
Barium	mg/kg		1.294	1.294	5.797	CRM 2.5	04/20/2010	4 / 4	3.062
Beryllium	mg/kg	0.0301 / 0.0612	ND	ND	ND			0 / 4	0
Boron	mg/kg	0.4114 / 0.4284	ND	0.63	0.63	CRM 4.0	04/14/2010	1 / 4	0.63
Cadmium	mg/kg	0.00748 / 0.00796	ND	ND	ND			0 / 4	0
Calcium	mg/kg		716.4	716.4	3115	CRM 4.0	04/14/2010	4 / 4	1859
Chromium	mg/kg	0.1272 / 0.1324	ND	ND	ND			0 / 4	0
Cobalt	mg/kg	0.01421 / 0.01445	ND	0.01922	0.02815	CRM 2.5	04/15/2010	2 / 4	0.02369
Copper	mg/kg	0.1459 / 1.103	ND	1.01	1.163	CRM 2.5	04/15/2010	2 / 4	1.087
Iron	mg/kg		26.37	26.37	41	CRM 2.5	04/15/2010	4 / 4	36.26
Lead	mg/kg	0.02805 / 0.02898	ND	ND	ND			0 / 4	0
Magnesium	mg/kg		129.4	129.4	211.4	CRM 4.0	04/14/2010	4 / 4	164.6
Manganese	mg/kg		0.459	0.459	1.481	CRM 4.0	04/14/2010	4 / 4	0.9328
Mercury	mg/kg	0.01159 / 0.02394	ND	ND	ND			0 / 4	0
Molybdenum	mg/kg	0.03553 / 0.04725	ND	0.04114	0.07038	CRM 2.5	04/15/2010	2 / 4	0.05576
Nickel	mg/kg	0.09724 / 0.1008	ND	0.1897	0.1897	CRM 2.5	04/15/2010	1 / 4	0.1897
Potassium	mg/kg		1249	1249	1723	CRM 2.5	04/15/2010	4 / 4	1476
Selenium	mg/kg		0.2408	0.2408	0.4725	CRM 4.0	04/14/2010	4 / 4	0.3577
Silver	mg/kg	0.00292 / 0.00312	ND	ND	ND			0 / 4	0
Sodium	mg/kg		1102	1102	1551	CRM 2.5	04/15/2010	4 / 4	1367
Strontium	mg/kg		0.4515	0.4515	1.355	CRM 4.0	04/14/2010	4 / 4	0.9337
Thallium	mg/kg	0.01384 / 0.0189	ND	ND	ND			0 / 4	0
Vanadium	mg/kg	0.04488 / 0.04816	ND	ND	ND			0 / 4	0
Zinc	mg/kg		15.35	15.35	20.91	CRM 2.5	04/20/2010	4 / 4	19.19

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

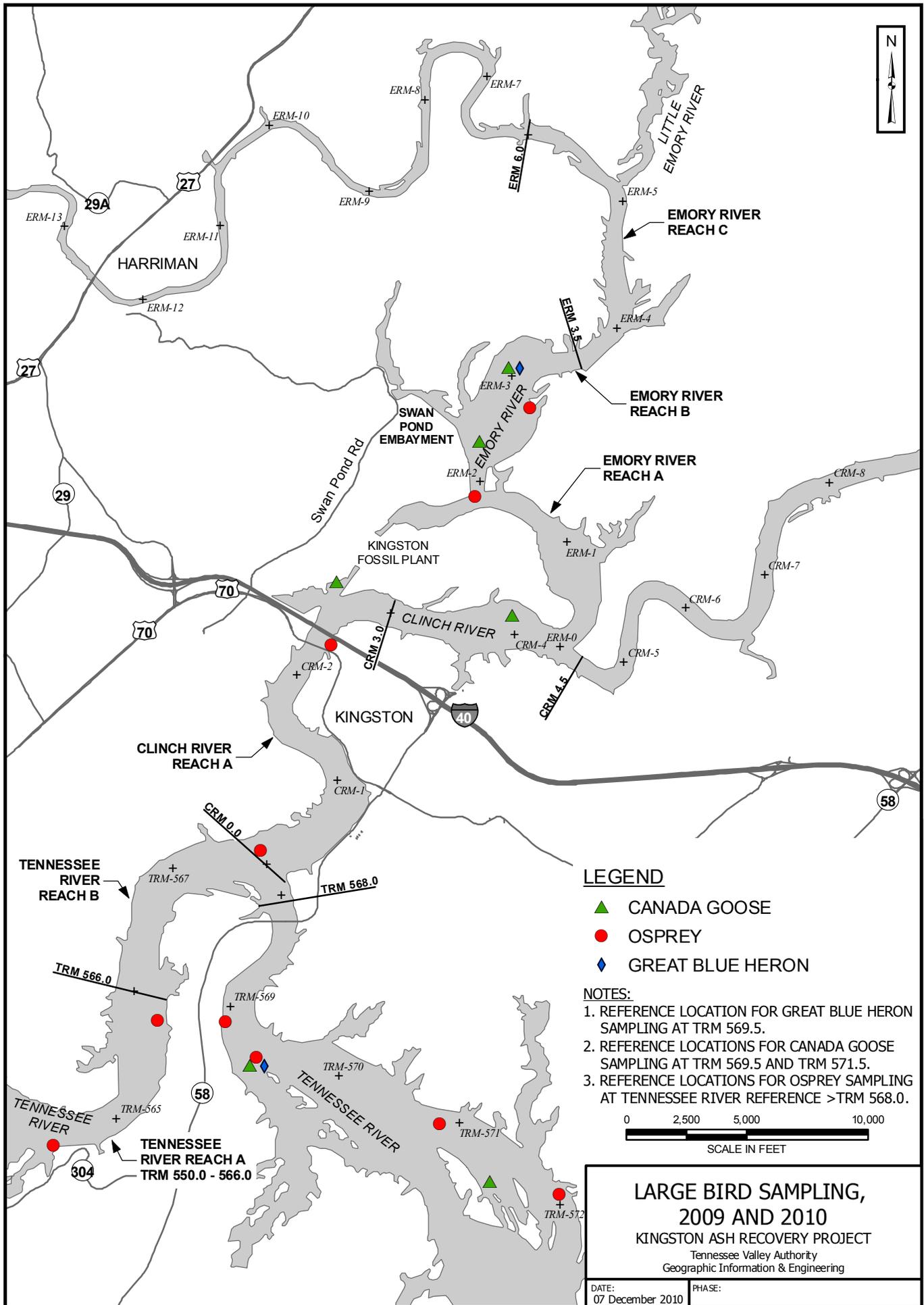
**Table 16. 2010 Canada Goose Egg Samples Collected at Tennessee River Locations**

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum	mg/kg	3.712 / 4.153	ND	ND	ND			0 / 10	0
Antimony	mg/kg	0.01344 / 0.01509	ND	ND	ND			0 / 10	0
Arsenic	mg/kg	0.04448 / 0.06216	ND	ND	ND			0 / 10	0
Barium	mg/kg		1.189	1.189	4.292	TRM 569.5	04/21/2010	10 / 10	2.33
Beryllium	mg/kg	0.05004 / 0.0654	ND	ND	ND			0 / 10	0
Boron	mg/kg	0.384 / 0.4251	ND	ND	ND			0 / 10	0
Cadmium	mg/kg	0.00704 / 0.00785	ND	ND	ND			0 / 10	0
Calcium	mg/kg		669	669	1929	TRM 569.5	04/21/2010	10 / 10	940.9
Chromium	mg/kg	0.1184 / 0.1308	ND	ND	ND			0 / 10	0
Cobalt	mg/kg	0.01312 / 0.01474	ND	0.01447	0.01447	TRM 571.5	04/15/2010	1 / 10	0.01447
Copper	mg/kg		0.8138	0.8138	1.726	TRM 569.5	04/21/2010	10 / 10	1.053
Iron	mg/kg		21.93	21.93	50.48	TRM 571.5	04/15/2010	10 / 10	35.32
Lead	mg/kg	0.02592 / 0.02878	ND	0.07636	0.07636	TRM 569.5	04/21/2010	1 / 10	0.07636
Magnesium	mg/kg		118.8	118.8	181.5	TRM 569.5	04/21/2010	10 / 10	153.7
Manganese	mg/kg		0.4736	0.4736	1.663	TRM 571.5	04/15/2010	10 / 10	0.9407
Mercury	mg/kg	0.01088 / 0.0121	ND	0.01127	0.0113	TRM 571.5	04/15/2010	2 / 10	0.01129
Molybdenum	mg/kg	0.032 / 0.03597	ND	0.0332	0.04726	TRM 569.5	04/21/2010	4 / 10	0.03754
Nickel	mg/kg	0.0896 / 0.1018	ND	0.1047	0.1527	TRM 569.5	04/21/2010	2 / 10	0.1287
Potassium	mg/kg		1225	1225	1741	TRM 571.5	04/15/2010	10 / 10	1502
Selenium	mg/kg		0.1474	0.1474	0.3036	TRM 571.5	04/15/2010	10 / 10	0.1966
Silver	mg/kg	0.00269 / 0.00306	ND	ND	ND			0 / 10	0
Sodium	mg/kg		1171	1171	1657	TRM 569.5	04/21/2010	10 / 10	1301
Strontium	mg/kg		0.2723	0.2723	0.5976	TRM 569.5	04/21/2010	10 / 10	0.4012
Thallium	mg/kg	0.0128 / 0.01439	ND	ND	ND			0 / 10	0
Vanadium	mg/kg	0.0416 / 0.04726	ND	ND	ND			0 / 10	0
Zinc	mg/kg		14.4	14.4	23.33	TRM 571.5	04/15/2010	10 / 10	18.74

**Notes:**

Data are presented in wet weight.  
For definitions, see the Acronyms section.

## **Figures**



**LEGEND**

- ▲ CANADA GOOSE
- OSPREY
- ◆ GREAT BLUE HERON

**NOTES:**

1. REFERENCE LOCATION FOR GREAT BLUE HERON SAMPLING AT TRM 569.5.
2. REFERENCE LOCATIONS FOR CANADA GOOSE SAMPLING AT TRM 569.5 AND TRM 571.5.
3. REFERENCE LOCATIONS FOR OSPREY SAMPLING AT TENNESSEE RIVER REFERENCE >TRM 568.0.



**LARGE BIRD SAMPLING,  
2009 AND 2010**  
KINGSTON ASH RECOVERY PROJECT  
Tennessee Valley Authority  
Geographic Information & Engineering

DATE: 07 December 2010

PHASE:

**Figure 2a. Harriman Utility Board tree climbers collecting great blue heron eggs**



**Figure 2b. TVA transmission lineman collecting great blue heron eggs from power line structure**



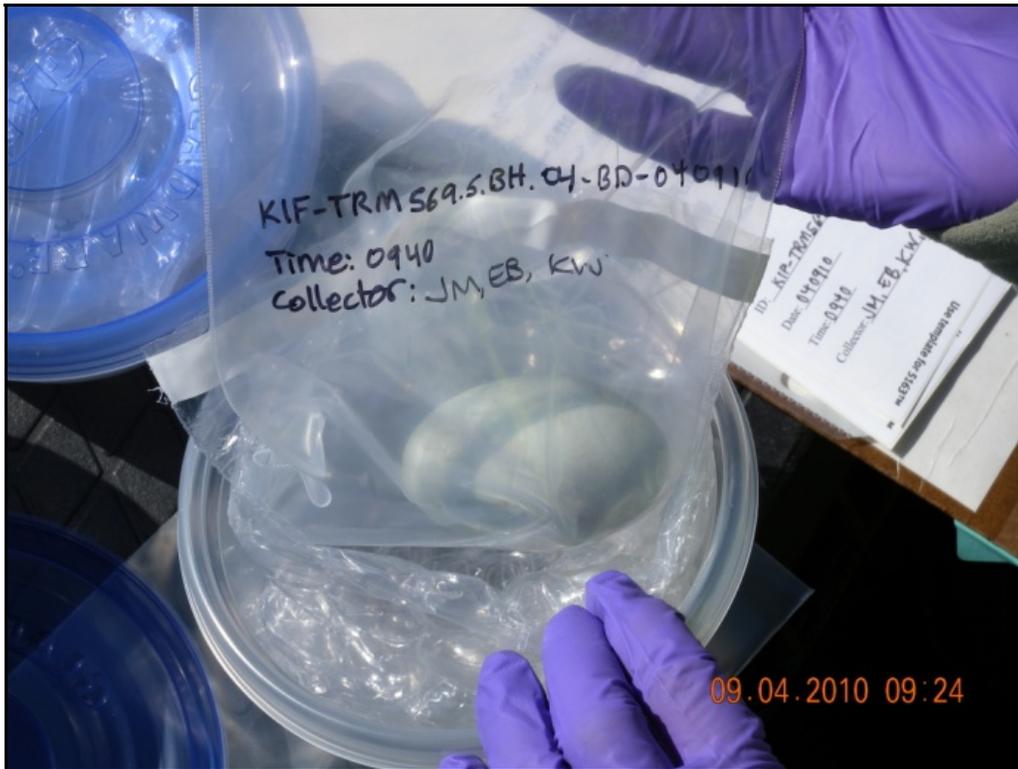
Figure 2c. Field crews using barge and airlift to access osprey eggs



**Figure 2d. Field crews collecting Canada goose egg**



**Figure 3a. Great blue heron egg collection**



**Figure 3b. Osprey egg collection**



**Figure 3c. Canada goose egg collection**



**Appendix A**  
**Summary of Piscivorous and Herbivorous Bird Egg Collections**

**Table A-1. Summary of Piscivorous and Herbivorous Bird Egg Collections, 2009**

Location		Species		
Site Name	Type	Blue Heron	Osprey	Canada Goose
Upstream Tennessee River	Reference Site	5	3	0
Emory River	Potentially Affected Sites	5	2	4
Clinch River		0	2	0
Downstream Tennessee River		0	2	0
<b>Total</b>	<b>All</b>	<b>10</b>	<b>9</b>	<b>4</b>

**Table A-2. Summary of Piscivorous and Herbivorous Bird Egg Collections, 2010**

Location		Species		
Site Name	Type	Blue Heron	Osprey	Canada Goose
Upstream Tennessee River	Reference Site	4	5	10
Emory River	Potentially Affected Sites	9	1	11
Clinch River		0	1	4
Downstream Tennessee River		0	3	0
<b>Total</b>	<b>All</b>	<b>13</b>	<b>10</b>	<b>25</b>

**Appendix B**  
**Summary of Piscivorous and Herbivorous Bird Shipments**

### Appendix B-1. Summary of Piscivorous and Herbivorous Bird Shipments, 2009

Shipment Date	Chains-of-Custody Shipped	Eggs Sampled			Total Samples per COC	Shipment Sample Total
		Blue Heron	Osprey	Canada Goose		
01-May-09	BIO_BD_090415a	51	61	-	11	23
	BIO_BD_090423a	5	3	41	12	
<b>Total</b>		<b>10</b>	<b>9</b>	<b>4</b>	<b>23</b>	<b>23</b>

**Notes:**

<sup>1</sup>Value includes one QC field replicate.

For definitions, see the Acronyms section.

### Appendix B-2. Summary of Piscivorous and Herbivorous Bird Shipments, 2010

Shipment Date	Chains-of-Custody Shipped	Eggs Sampled			Total Samples per COC	Shipment Sample Total
		Blue Heron	Osprey	Goose		
22-Apr-10	RSIBD0409Y10A	41	-	-	0	35
	RSIBD0412Y10A	9	-	-	9	
	BIOBD0412Y10A	-	91	-	0	
	BIOBD0414Y10A	-	-	131	0	
29-Apr-10	BIOBD0415Y10A	-	-	6	6	13
	BIOBD0420Y10A	-	-	1	1	
	BIOBD0421Y10A	-	1	5	6	
<b>Total</b>		<b>13</b>	<b>10</b>	<b>25</b>	<b>22</b>	<b>48</b>

**Notes:**

<sup>1</sup>Value includes one QC field replicate.

For definitions, see the Acronyms section.