

Marshall Steam Station

NPDES Permit No. NC0004987

**Monitoring of Arsenic, Selenium, and Mercury in Fish Muscle Tissue from Lake
Norman, NC.**

Duke Energy
2014

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1.0 Introduction

Duke Energy owns and operates the Marshall Steam Station (MSS) located on Lake Norman in Catawba County, Terrell, NC. The MSS National Pollutant Discharge Elimination System (NPDES) Permit (No. NC0004987 Section A 25) requires monitoring of trace elements (arsenic, selenium and mercury) in fish tissues near the discharge once per permit cycle. Fish were collected according to the submitted study plan (dated December 4, 2013). The resulting data are submitted in this report.

2.0 Study Site Description and Sampling Locations

Fish were collected from three locations on Lake Norman (Figure 1). These locations were adjacent to the MSS discharge (DI), 6.3 kilometers upstream (UP) and 8.5 kilometers downstream of the discharge (DN).

3.0 Target Species

The target species of fish were spotted bass and redear sunfish. As recommended by the US Environmental Protection Agency (EPA), an attempt was made to limit the smallest fish to 75% of the largest fish total length by species depending on availability (US EPA 2000).

4.0 Field Sampling Methods

Fish were collected using electrofishing according to our Biology Program Procedures Manual (Procedure NR-00080, Rev. 1), which is approved by the NC Division of Water Resources under the Company's NC Biological Laboratory Certification (# 006), located at New Hill, NC. Only live fish that showed little or no signs of deterioration were retained for analysis. Retained fish were individually tagged (Floy tags), identified to species, measured for total length (mm), weight (g), placed on ice until frozen and transferred to a freezer within 24 hours of collection.

Water quality data consisting of temperature, pH, dissolved oxygen, specific conductance and turbidity were recorded daily at the surface at each sampling location. Other noteworthy environmental conditions including river flow conditions and weather conditions were noted and are available upon request.

5.0 Laboratory Processing and Arsenic, Selenium and Mercury Analysis

All fish samples were processed in the New Hill trace element laboratory according to procedure NR-00107 (Rev. 4) Trace Element Monitoring Laboratory Procedure. The processed samples (lyophilized left axial muscle; right muscle occasionally included when needed) were analyzed for arsenic, selenium and mercury by x-ray spectrophotometry. Quality control was achieved by analytical standards, replicates and certified reference materials. The remaining fish carcasses were archived and will be kept for at least two years in the event that re-analysis is needed.

6.0 Data Analysis and Reporting

Arsenic, selenium and mercury concentrations (converted to $\mu\text{g/g}$ fresh weight) in the fish muscle tissue collected during 2014 are shown in Table 1. In addition to the length and weight of each fish, the dry-to-fresh weight ratios are presented to convert the arsenic, selenium and mercury concentrations fresh weight values back to dry weight values as desired. All fish collected during 2014 were below the US EPA Screening Values for Recreational Fishermen of $1.2 \mu\text{g/g}$ (fresh weight) for arsenic (US EPA 2000). All fish collected during 2014 were below the NC human consumption advisory level of $10 \mu\text{g/g}$ (fresh weight) for selenium. All fish collected during 2014 had mercury concentrations below the NC Health Directors Action Advisory Level of $0.4 \mu\text{g/g}$ fresh weight (NCDHHS 2006).

7.0 References

NCDHHS. 2006. Health effects of methylmercury and North Carolina's advice on eating fish. North Carolina Occupational and Environmental Epidemiology Branch, Raleigh, NC.

US EPA. 2000. Guidance for assessing chemical contaminant data for use in fish advisories. Vol. 1. Fish sampling and analysis. Third edition. EPA 823-B-00-007. United States Environmental Protection Agency, Office of Water, Washington, DC.

Table 1. Arsenic, selenium and mercury concentrations (fresh weight) in axial muscle of fish from Lake Norman during April 2014.

Fish species	Location	Month	Length (mm)	Weight (g)	As ($\mu\text{g/g}$)	Se ($\mu\text{g/g}$)	Hg ($\mu\text{g/g}$)	Dry-to-fresh weigh ratio*
Spotted bass	UP	April	350	564	0.19	0.39	<0.06	0.207
Spotted bass	UP	April	355	522	0.23	0.37	<0.06	0.208
Spotted bass	UP	April	378	590	0.10	0.40	<0.05	0.201
Spotted bass	UP	April	340	512	0.22	0.40	<0.06	0.224
Spotted bass	UP	April	380	611	0.16	0.47	<0.05	0.198
Spotted bass	UP	April	358	523	0.06	0.39	<0.06	0.205
Redear sunfish	UP	April	241	245	0.06	0.56	<0.06	0.208
Redear sunfish	UP	April	258	311	0.08	0.50	<0.05	0.199
Redear sunfish	UP	April	243	276	0.10	0.56	<0.05	0.201
Redear sunfish	UP	April	234	222	0.04	0.58	<0.06	0.208
Redear sunfish	UP	April	220	176	0.08	0.82	<0.06	0.209
Redear sunfish	UP	April	240	254	0.11	0.53	<0.06	0.211
Spotted bass	DI	April	380	668	0.15	0.62	<0.06	0.215
Spotted bass	DI	April	392	692	0.19	0.43	<0.06	0.215
Spotted bass	DI	April	424	972	0.11	0.53	0.09	0.213
Spotted bass	DI	April	338	458	0.13	0.44	<0.06	0.211
Spotted bass	DI	April	393	702	0.08	0.44	0.13	0.210
Spotted bass	DI	April	435	1136	0.08	0.74	0.21	0.212
Redear sunfish	DI	April	254	202	0.11	0.78	<0.05	0.181
Redear sunfish	DI	April	271	345	0.10	0.64	<0.06	0.207
Redear sunfish	DI	April	172	82	0.10	0.64	<0.05	0.193
Redear sunfish	DI	April	275	380	0.08	0.66	<0.05	0.200
Redear sunfish	DI	April	186	107	0.10	0.58	<0.06	0.208
Redear sunfish	DI	April	185	94	0.10	0.62	<0.06	0.208
Spotted bass	DN	April	429	890	0.08	0.68	<0.05	0.201
Spotted bass	DN	April	404	696	0.08	0.66	<0.05	0.199
Spotted bass	DN	April	367	546	0.08	0.56	<0.06	0.206
Spotted bass	DN	April	416	864	<0.04	0.57	<0.05	0.185
Spotted bass	DN	April	359	602	0.16	0.57	<0.05	0.203
Spotted bass	DN	April	361	562	0.10	0.56	<0.06	0.208
Redear sunfish	DN	April	268	340	0.06	0.77	<0.06	0.209
Redear sunfish	DN	April	261	288	0.10	0.83	<0.05	0.202
Redear sunfish	DN	April	195	109	0.04	0.37	<0.03	0.098
Redear sunfish	DN	April	186	100	0.06	0.82	<0.06	0.206
Redear sunfish	DN	April	177	89	0.04	0.80	<0.06	0.204
Redear sunfish	DN	April	195	118	0.04	0.71	<0.06	0.210

* To convert to a dry weight, divide the fresh weight concentrations by the dry-to-fresh weight ratio.

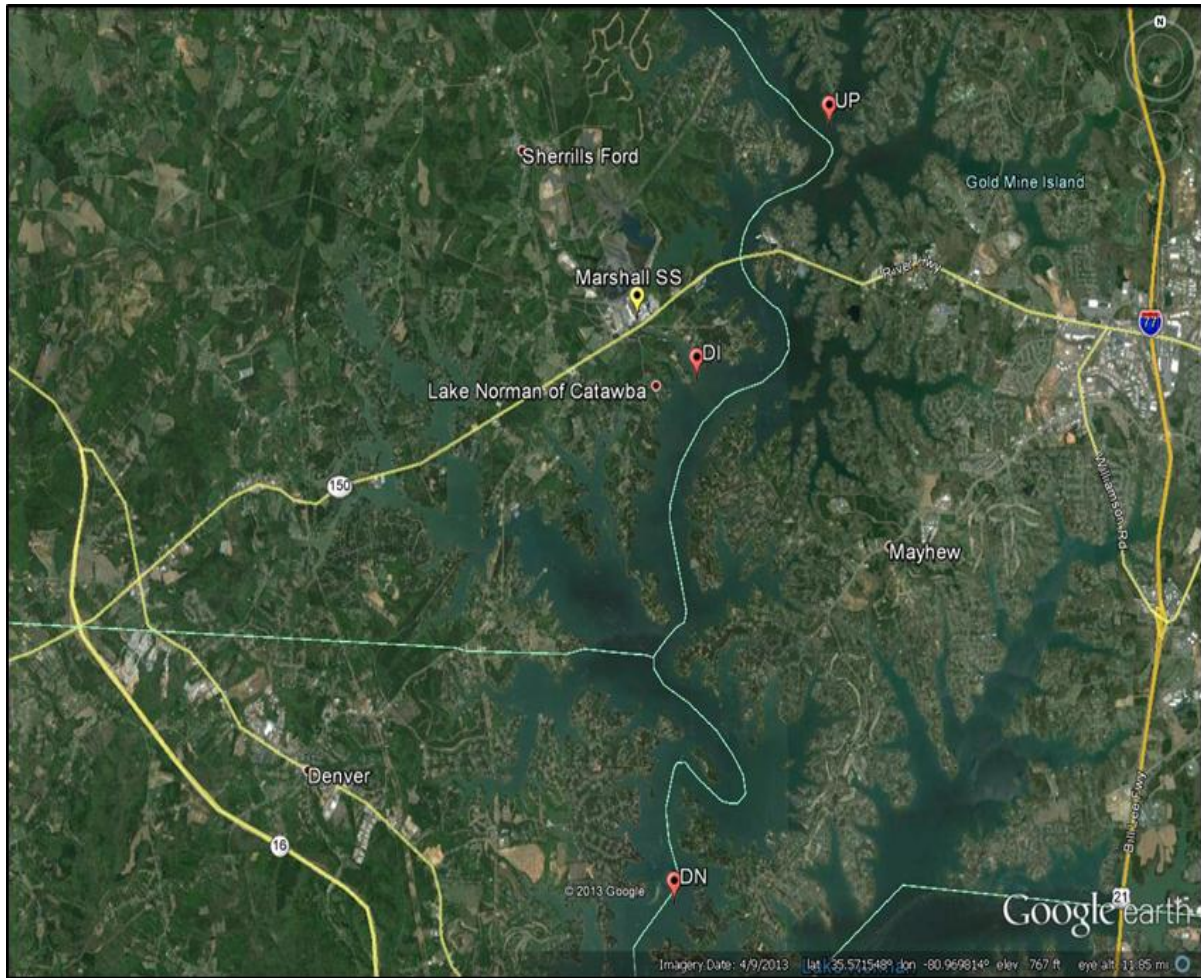


Figure 1. Lake Norman arsenic, selenium and mercury monitoring locations.