

Pre-Assessment Screen Determination

for

The South and South Fork of the Shenandoah Rivers, Virginia

Issued by:

**The Commonwealth of Virginia and the United States Department of Interior in their joint
capacity as Trustees for Natural Resources the DuPont Site Trustee Council**

October 2008

1.0 INTRODUCTION

Pursuant to the authority of Section 107(f) of the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. § 9607(f), Federal Water Pollution Control Act, as amended, 33 U.S.C. 125, *et seq.* (CWA), Subpart G of the National Contingency Plan, 40 CFR Sections 300.600, 300.605, and other applicable Federal and State laws, designated Federal and State authorities may act on behalf of the public as natural resource trustees to pursue claims for natural resource damages for injury to, destruction of, or loss of natural resources resulting from the release of hazardous substances to the environment. Claims may be pursued against parties that have been identified as responsible for releasing hazardous substances to the environment. Under CERCLA, sums recovered by trustees as damages shall be used to restore, replace, or acquire the equivalent of such natural resources.

The first step in developing a natural resource damage claim is the preparation of a pre-assessment screen (PAS). The PAS provides the basis for the Trustees' determination that further investigation and assessment efforts are warranted, and that there is a reasonable probability of making a successful claim against party or parties responsible for the release of hazardous substances. It is based on a review of the readily available information on hazardous substance releases and the potential impacts of those releases on natural resources under the trusteeship of Federal and State authorities.

This PAS addresses potential claims for natural resource damages for injury to, destruction of, or loss of natural resources resulting from the release of hazardous substances to the South River, the South Fork of the Shenandoah River (SFSR), and adjacent habitat (Site). It was prepared in accordance with the PAS provision of the Federal regulations for natural resource damage assessments (NRDA) under CERCLA, 43 CFR Part 11, Subpart B, sections 11.23 through 11.25. The natural resource trustees for the South River who have participated in the preparation of this PAS include the Secretary of Natural Resources acting on behalf of the Commonwealth of Virginia (Virginia), and the Northeast Regional Director of the U.S. Fish and Wildlife Service (Service) acting as Authorized Official on behalf of the Secretary of the Department of the Interior (DOI) (collectively the "Trustees").

A review of readily available information has led us to now conclude that releases of mercury from the DuPont (Facility) in the vicinity of Waynesboro, Virginia, have occurred. These releases may have affected many miles of the South River and the SFSR and natural resources for which Federal and State agencies may assert trusteeship under Section 107(f) of CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Specifically, the Trustees have determined that:

- A release of hazardous substance has occurred;
- Natural resources for which the Trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release;
- The quantity and concentration of the released hazardous substance is sufficient to potentially cause injury to natural resources;
- Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
- Response actions, if any, carried out or planned, may not or will not sufficiently remedy the injury to natural resources without further action.

Trusteeship

The President has designated Federal resource trustees in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.600 and through Executive Order 12580, dated January 23, 1987, as amended by Executive Order 13016, dated August 28, 1996. Pursuant to the NCP, the Secretary of the DOI acts as a trustee for natural resources and their supporting ecosystems, managed or controlled by the DOI. In this matter, the Service is acting on behalf of the Secretary of the DOI as trustee for natural resources under its jurisdiction, including but not limited to migratory birds and endangered and threatened species.

In accordance with 42 U.S.C. 9607(f)(2)(B) and the NCP, the Virginia Secretary of Natural Resources has been designated the natural resource trustee by the Governor of Virginia. The State trustee acts on behalf of the public as trustee for natural resources, including their supporting ecosystems, within the boundaries of their state, or belonging to, managed by, controlled by, or appertaining to Virginia. The State trustee has, or shares trusteeship, with the Service over the natural resources potentially affected in this matter. This shared trusteeship is reflected in the coordinated wildlife management practices of the Service and Virginia, and is consistent with the management policies of Virginia and the Service.

1.2 Description of the Affected Environment

The South River arises in Augusta County in the western portion of Virginia and flows northward where it meets the SFSR in Rockingham County, Virginia. The rivers meet near the town of Port Republic and eventually merge with the Middle and North Forks to form the

Shenandoah River proper. The surrounding area along the South River and the SFSR are typically rural, interspersed with small urban populations including the towns of Waynesboro, Grottoes, and Elkton.

2.0 INFORMATION ON THE SITE AND ON THE RELEASE OF HAZARDOUS SUBSTANCES

2.1 Time and Quantity of the Release

A variety of studies over the past decades have documented elevated levels of mercury in the Site area. Due to releases of hazardous substances EPA issued the Corrective Action portion of the Facility RCRA permit in 1998. Sampling of soils, surface water, groundwater, sediments and biota from the South River has been performed from the late 1970s to the present with mercury being detected in most media. Mercury released from the Facility has contaminated soils, surface water, and sediments of the Site. An accurate measure of the quantity of mercury released to the environment is not possible. However, efforts to quantify fate and transport and transport and mass balance modeling are on-going.

2.2 Hazardous Substance Released

Elemental and organic forms of mercury are the pollutants of primary concern. These forms of mercury are listed as hazardous in Table 302.4, List of Hazardous Substances and Reportable Quantities under CERCLA (40 CFR § 302.4 (A)), and as toxic pollutants pursuant to 40 CFR § 401.15, as amended.

Most authorities on the ecotoxicology of mercury agree that mercury and its compounds have no known biological function, and its presence in living organisms is undesirable and potentially hazardous. Forms of mercury with relatively low toxicity can be transformed into forms with very high toxicity through biological and other processes. Methylmercury can be bioconcentrated in organisms and biomagnified through food chains, transporting mercury directly to upper trophic level consumers in concentrated form. Mercury is a mutagen, teratogen, and carcinogen, and causes embryocidal, cytochemical, and histopathological effects (Eisler 1987).

Methylmercury is the most hazardous mercury species due to its high stability, its lipid solubility, and its possession of ionic properties that lead to a high ability to penetrate membranes in living organisms (Beijer and Jernelov 1979). All mercury discharged into rivers, bays, or estuaries as

elemental (metallic) mercury, inorganic divalent mercury, phenylmercury, or alkoxyalkyl mercury can be converted into methyl mercury compounds by natural processes (Jernelov 1969).

2.3 History of the Current and Past Use of the Site Identified as the Source of the Discharge of a Hazardous Substance

The DuPont Company used mercury as part of their process for manufacturing acetate fibers on the Facility from approximately 1929 to 1950. Mercury was used as a catalyst in the process and afterward became part of their industrial waste. The mercury was recycled for reuse by heating the waste so it would separate. However, this process did not capture all of the mercury. The remaining mercury was flushed into the river along with the remaining waste. In 1976 metallic mercury was discovered at the Facility. In 1977 DuPont notified the State and Federal Government, and the State Health Department closed 130 miles of the South River and the SFSR to fishing. A sediment survey conducted in 1977 – 78 estimated 77,000 lbs of mercury was in the river system downstream from the Facility.

2.4 Potentially Responsible Parties (PRPs)

The acetate fiber manufacturing facility was owned and operated by DuPont during the period from 1929 to 1950 when mercury was used as a catalyst in fiber processing, and mercury was being released into the South River. Mercury releases have occurred and continue to occur to the present.

2.5 Damages Excluded from Liability Under CERCLA or CWA

The regulations at 43 CFR Part 11.24 provide that the Trustees must determine whether the damages being considered are barred by specific defenses or exclusions from liability under CERCLA or the Clean Water Act (CWA). These determinations are as follows:

- § The Trustees must determine whether the damages: (i) Resulting from the discharge or release were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable environmental analysis, that the decision to grant the permit or license authorizes such commitment of natural resources, and that the facility or project was otherwise operating within the terms of its permit or license, so long as, in the case of damages to an Indian tribe occurring pursuant to a Federal permit or license, the issuance of that permit or license was not inconsistent with the fiduciary duty of the United States with respect to such Indian tribe; or (ii) And the release of a hazardous substance from which the

damages have resulted have not occurred wholly before the enactment of CERCLA; or (iii) Resulted from the application of a pesticide product registered under the Federal Insecticide, Fungicide, and Rodenticide Act 7 U.S.C. 135-135k; or (iv) Resulted from any other Federally permitted release, as defined in section 101 (10) of CERCLA; or (v) Resulting from the release or threatened release of recycled oil from a service station dealer described in section 107(a)(3) or (4) of CERCLA if such recycled oil is not mixed with any other hazardous substance and is stored, treated, transported or otherwise managed in compliance with regulations or standards promulgated pursuant to section 3014 of the Solid Waste Disposal Act and other applicable authorities.

§ The Trustees must also determine whether the discharge meets one or more of the exclusions provided in section 311(a)(2) or (b)(3) of the CWA.

The Trustees do not believe that any potential injuries referred to herein meet one or more of the above criteria, nor are they subject to the exceptions to liability provided in 107(f), (i), and (j) and 114(c) of CERCLA, and section 311 (a)(2) or (b)(3) of the CWA. Therefore, the continuation of an assessment of injuries to natural resources is not precluded.

3.0 PRELIMINARY IDENTIFICATION OF RESOURCES POTENTIALLY AT RISK

3.1 Preliminary Identification of Pathways

Beginning in 1929, discharges containing significant quantities of mercury have flowed from the Facility to the adjacent South River. Over time, mercury has spread to the SFSR and throughout the Site. Matrices in which mercury and/or its organic counterparts have been, and are still be found within the Site ecosystems include: soils, sediment (including related particulate transport), and food chain organisms. Possible pathways of organismal exposure include direct contact with mercuric species, direct contamination with water soluble fractions in the water column and sediments, indirect contact through ingestion of contaminated prey species, direct contact with contaminated sediments, direct contact with contaminated sediment interstitial pore water, exposure by re-suspended, pre-contaminated sediments, and/or ingestion of contaminated sediment during foraging or feeding.

3.1.1 Sediment Pathway

Concentrations of mercury in sediment are elevated in the South River adjacent to the Facility and remain elevated many miles downstream. The sediment pathway is significant due to the fact that elemental mercury is transformed to the highly toxic, and readily bio-accumulated, methylated form by bacteria residing within sediments and within the bodies of many aquatic organisms (Ankley 1996). Mercury has a strong propensity to adsorb to fine silt and clay particles suspended within the water column (Lindberg *et al* 1975, Cranston and Buckley 1972). This phenomenon is especially important to consider because most of the mercury that has been, or will be, released from the Facility and into the Site will eventually migrate into river sediments and floodplain soils where it will remain until it is either washed downstream and/or taken up by biota.

3.1.2 Surface Water Pathway

Concentrations of mercury within the surface water pathway have changed over time (ftp.southriverscienceteam.org). The significance of the surface water pathway is disjunct over time and over the distance of potentially affected river reaches.

3.1.3 Food Chain Pathways - Bioaccumulation

Methylated mercury and other organic mercury species are stored in nervous system and fatty tissues and tend to be bioaccumulated and biomagnified within the food chain. Bioaccumulation of mercury through the food chain from contaminated sediments may be an important mechanism to consider in the assessment of certain trust resources such as floodplain mammals and migratory birds.

3.2 Sampling of Exposed Areas and Potentially Injured Natural Resources

Mercury has been detected in various media within the South River, the SFSR and the Site to approximately 100 river miles downstream. Examples of mercury concentrations in different biota range from 6.30 mg/kg in kingfisher blood collected from the South river to 0.952 mg/kg in eels collected 85 miles downstream of the Facility. A large database of mercury concentrations within biotic and abiotic media could be generated (ftp.southriverscienceteam.org). It is not practical to present all relevant data that have been collected. However, data of primary concern

to the Trustees can be found herein in the attached Tables which contain examples of selected data for the several natural resources which are listed in the following section.

3.3 Potentially Affected Resources

Natural resources affected or potentially affected include, but are not limited to the following, all of which fall within the jurisdiction of the Trustees:

- freshwater fish;
- mammals, including two Federally listed bats, amphibians, and reptiles;
- migratory birds, including songbirds, waterfowl, raptors, and others;
- lands, including wetlands, flood plain, and instream;
- aquatic and terrestrial plants, invertebrates, and microorganisms, and;
- surface waters and sediments.

Services provided by these natural resources include, but are not limited to, the following:

- habitat for trustee species, including food, shelter, breeding areas, and other factors essential to survival, and;
- recreational uses such as sport fishing, water-contact recreation, boating, canoeing, hiking, nature observation, hunting, and other activities.

4.0 GENERAL CRITERIA FOR PROCEEDING WITH A DAMAGE ASSESSMENT

In accordance with section 43 CFR § 11.23, the Trustees have determined that all of the following criteria have been met.

4.1 Criterion 1 - A release of a hazardous substance has occurred.

Information reviewed by the trustees indicates that hazardous substances have been emitted, emptied, discharged, allowed to escape, disposed, or otherwise released directly or indirectly in the South River and, subsequently, the SFSR. Over the past years, thousands of samples have been collected by numerous entities from surface water, ground water, soil, and sediments as part of response and academic activities and analyzed for chemical contamination. It has been observed that on-going mercury release continues via storm water and wastewater handling conduits and/or other unidentified source(s) at the Facility.

4.2 Criterion 2 - Natural resources for which the trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release.

The exposed areas and the natural resources likely to have been adversely affected by the releases of mercury are within the purview of the Trustees as defined under CERCLA. The release of hazardous substances from the Facility may have affected, and may continue to affect, migratory birds, fish, aquatic insects, herpetiles, amphibians, flood plain mammals including two species of Federally-protected bats (Table 1), surface water and sediment of the South River, a variety of human uses of the South River, and the general supporting habitat for all of these resources.

Sediment levels in the South River during the four year period of 1992 – 1996 ranged from 0.018 to 147 mg/kg (RM 0-120). The highest levels are between the Facility and RM 25 (0.723 – 147 mg/kg). Sediment samples were conducted this year to provide current levels.

Periphyton, representing a lower trophic level, was studied to determine the amount of mercury and methylmercury present in the river (Newman, 2006). The study is being further enhanced with a biomagnification component to quantify biomagnification. The initial portion of the study revealed mercury levels in periphyton increased from less than 0.1µg/g above the Facility to 25 µg/g below the point of release from the Facility. Methylmercury also increased below the Facility, from 1 to 50 ng/g. These results clearly indicate that mercury is currently accumulating in periphyton, a base of the food web in aquatic systems.

Migratory birds, representing most feeding guilds have been exposed and are likely injured by mercury. Migratory birds are subject to Federal jurisdiction with overlapping oversight from the Commonwealth of Virginia as a State-owned resource. Initial studies have found blood mercury levels are greatly elevated compared to the upstream reference area levels (Cristol, 2005). Table 2 provides preliminary data of blood mercury levels in adult birds in the South River watershed. Results of particular note are; the kingfisher (6.30 mg/kg), a piscivorous bird, the eastern-screech owl (2.94 mg/kg), a carnivorous bird, tree swallow, an insectivorous bird – primarily flying insects, (2.64 mg/kg), and the Carolina wren (3.08 mg/kg), insectivorous bird – including spiders. All represent different feeding guilds, indicating mercury is biomagnifying up the food web. Preliminary results of studies conducted this summer show mercury levels in tree swallows in the contaminated area are twice as high in 2006 as they were in 2005 while reference levels remain the same (2.28 mg/kg in 2005 and 4.48 mg/kg in 2006, Cristol, College of William and Mary, pers. comm. 2006). Currently there is not an established Lowest Observable Effects Level (LOEL) affects level for mercury in birds. However, a LOEL of 1.0 mg/kg is hypothesized

by David Evers (Biodiversity Research Institute) based on regressing the mercury levels in blood on mercury levels in eggs that are known to have adverse affects.

In April 2006, a dying otter was opportunistically sampled alongside the river near the town of Harriston, Virginia, over 15 miles downstream of the Facility. Kidney and liver mercury levels were greater than 80 mg/kg and 50 mg/kg wet weight, respectively. Although information on mercury levels in otter tissues and their corresponding effects are not known, they are for mink. Mink, like otters, are small mammals that live and depend on river and associated floodplains. Mercury levels in the kidney and liver of mink that were fatally dosed with 5.0 mg/kg were 37.7 mg/kg and 55.6 mg/kg, respectively (Sheffy and St. Amant, 1982). Compared to mink, otters are more sensitive to mercury. Kucera (1983) reported otters were fatally dosed at dietary levels of greater than 2.0 mg/kg of mercury, less than half the fatal dosage of mink.

American eels (*Anguilla rostrata*), have been exposed to and likely been injured by mercury. This species is considered to be a migratory fish and thus is subject to Federal jurisdiction with general overlapping oversight from the Commonwealth of Virginia as a State-owned resource. In 1998 eels were collected by K. Goodwin (VA Tech.) from four locations along the SFSR from Island Ford to Compton, stretching from approximately 33 to 85 miles downstream of the Facility. Mercury levels in eels sampled in 1998 ranged from 0.247 to 0.952 mg/kg whole body wet weight (Table 3).

Table 4 provides the 2002 mean total mercury levels of fish fillets sampled through out the watershed. The mercury levels in the majority of fillets from Waynesboro to Shenandoah exceed the Federal Food and Drug Administration (FDA) mercury action level of 1ppm. Mercury levels exceeding the FDA action level were found in fish collected from Front Royal, over 85 miles downstream.

4.3 Criterion 3 - The quantity and concentration of the released hazardous substances are sufficient to potentially cause injury.

Tables 2- 4 provide examples of mercury residue sample chemical analyses taken from several media types along the South River and SFSR. Mercury has been detected in various concentrations in all South River and SFSR organisms that have been analyzed. In summary, data in Table 2-4 indicate that: (1) mercury levels have exceeded action and guidance levels for fish, shellfish, crustaceans, and/or other aquatic animals¹ and may continue to do so for certain

¹ FDA Office of Regulatory Affairs CPG 540.600 and CPG 7108.07.

species into the future; (2) residues in lower trophic levels are sufficiently elevated to warrant investigation into the potential injury of certain organisms that occupy higher trophic levels than those previously studied within the South River and SFSR Site; (3) SFSR sediment mercury concentrations may be sufficiently elevated to cause direct mortality and sub-lethal effects to certain benthic invertebrates.

4.4 Criterion 4 - Data sufficient to pursue an assessment can be obtained at a reasonable cost.

Significant amounts of data relevant to natural resources and potential injuries resulting from exposure to mercury in the South River and SFSR Site are available to the Trustees. These data include information on contaminant releases, concentrations in the environment, and the effect of contamination on natural resources. Given the volume of available information, the Trustees believe that any outstanding required data sufficient to pursue an assessment can be obtained at a reasonable cost compared to the potential damage claim. While media at the Facility and within the South River and SFSR Site have been repeatedly sampled by various entities for many years, Quality Assurance/Quality Control parameters for some of these data may be unknown and/or unacceptable to the Trustees. In additions, the focus of these studies has not completely addressed affects to trust resources.

4.5 Criterion 5 - Response actions, if any, carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

Remedial actions at the Facility began in the 1970s and continue to the present. Due to hazardous substances released from these wastes and other industrial activities, EPA issued the Corrective Action portion of the site RCRA permit in 1998. As part of a RCRA Facility Investigation, DuPont sampled soil and groundwater, installed new groundwater wells, and tested aquifers and outfalls. DuPont also issued a Land Use Report, which confirmed the land will continue to be classified as industrial. DuPont entered into a settlement with the State Water Control Board in 1984 to conduct monitoring of mercury levels in fish tissue for 100 years. Subsequent fish tissue monitoring indicates mercury levels are not declining as anticipated. Remedial activities for the Facility are ongoing. While these remedial activities may have reduced the amount of mercury that entered the South River, they will not be sufficient to restore the natural resources potentially affected by the release(s) of mercury over the past decades, or any potential ongoing and future mercury releases.

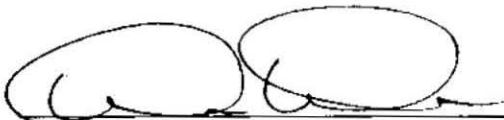
In 2005 the Natural Resources Defense Council and Sierra Club sued DuPont alleging that “mercury levels in the fish were too high and that mercury presents an imminent and substantial endangerment to health and the environment along the South River and the South Fork of the Shenandoah River.”

5.0 PRE-ASSESSMENT SCREEN DETERMINATION

Based on the information in this PAS, the Trustees have made the preliminary determination that the criteria specified in 43 CFR § 11.23 have been met. The Trustees further determine that current information indicates that there is reasonable probability of making a successful NRDA claim for injuries to natural resources under their trusteeship pursuant to CERCLA § 107. The trustees have further determined that an assessment should be carried out within the South River Watershed in accordance with Federal Regulations 43 CFR § 11, Subparts C and E. Thus, we the undersigned designated natural resource trustee agencies, acting on behalf of the public, pursuant to Federal and State law, do find sufficient cause and intend to seek restoration or compensation for injuries suffered by natural resources for which we are responsible. The outcome of this process will be measures to restore natural resources in the South River watershed.

*Preassessment Screen Determination
South River and South Fork of the Shenandoah Rivers
October 2008*

Natural Resource Trustee:



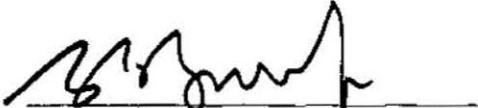
Acting Marvin E. Moriarty, Authorized Official
U.S. Department of Interior

10-3-08
Date

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*Preassessment Screen Determination
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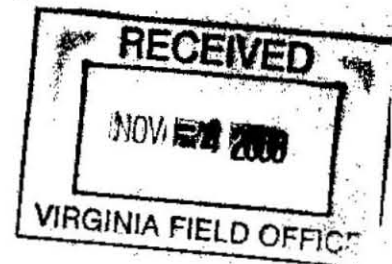
Natural Resource Trustee:



The Honorable L. Preston Bryant, Jr.
Commonwealth of Virginia, Secretary of Natural Resources

10/20/08

Date



6.0 REFERENCES

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Table 1. Bats found in Virginia

| Scientific Name | Common Name | Species Status* | Foraging Type |
|----------------------------------|--------------------------|-----------------|---|
| <i>Myotis grisescens</i> | Gray Myotis | FE, SE | Regularly forage over water on emergent insects |
| <i>Myotis lucifugus</i> | Little Brown Myotis | | Regularly forage over water on emergent insects |
| <i>Eptesicus fuscus</i> | Big Brown Bat | | At least occasionally forage over water on emergent insects |
| <i>Lasionycteris noctivagans</i> | Silver-haired Bat | | At least occasionally forage over water on emergent insects |
| <i>Lasiurus borealis</i> | Eastern Red Bat | | At least occasionally forage over water on emergent insects |
| <i>Lasiurus cinereus</i> | Hoary Bat | | At least occasionally forage over water on emergent insects |
| <i>Myotis leibii</i> | Small-footed Myotis | | At least occasionally forage over water on emergent insects |
| <i>Myotis septentrionalis</i> | Northern Myotis | | At least occasionally forage over water on emergent insects |
| <i>Myotis sodalis</i> | Indiana Myotis | FE, SE | At least occasionally forage over water on emergent insects |
| <i>Nycticeius humeralis</i> | Evening Bat | | At least occasionally forage over water on emergent insects |
| <i>Pipistrellus subflavus</i> | Eastern Pipistrelle | | At least occasionally forage over water on emergent insects |
| <i>Corynorhinus townsendii</i> | Townsend's Big-eared Bat | FE, SE | Not reported to forage over water on emergent insects |

*FE= Federally Endangered Species; SE= State Endangered Species

**Table information from O'Shea et al. 2001.

Table 2. Mean \pm SD (and sample size) total mercury level (mg/kg wet weight) in blood collected in 2005 from adult birds on the contaminated South River, the South and South Fork Shenandoah Rivers from Waynesboro to Shenandoah, and reference sites in the South, Middle, and North Rivers. Hypothesized LOEL is 1.0 mg/kg.

| Species | South (mg/kg) | Wayne-Shen (mg/kg) | Reference | Wilcoxon(P) |
|--------------------------|--|----------------------|----------------------|-------------|
| tree swallow | 2.64 \pm 1.16 (22) | 2.06 \pm 1.12 (38) | 0.18 \pm 0.12 (33) | < 0.001 |
| belted kingfisher | 6.30 \pm 4.7 (4) | 2.47 \pm 3.75 (10) | 0.28 \pm 0.23 (10) | 0.018 |
| screech-owl | 2.94 \pm 1.1 (8) | 2.85 \pm 1.1 (9) | 0.28 \pm 0.20 (5) | 0.004 |
| eastern bluebird | 1.91 \pm 0.64 (6) | 1.62 \pm 0.69 (9) | 0.12 \pm 0.02 (3) | 0.028 |
| American goldfinch | 0.02 \pm 0.15 (2) | No sampling | No sampling | n/a |
| American robin | 0.43 \pm 0.45 (2) | No sampling | No sampling | n/a |
| blue jay | 0.11 (1) | No sampling | No sampling | n/a |
| black-and-white warbler | 0.19 (1) | No sampling | No sampling | n/a |
| Carolina chickadee | 0.42 \pm 0.18 (5) | No sampling | No sampling | n/a |
| Carolina wren | 3.08 \pm 1.70 (11) | No sampling | No sampling | n/a |
| eastern phoebe | 1.62 \pm 0.38 (2) | No sampling | No sampling | n/a |
| field sparrow | 0.47 (1) | No sampling | No sampling | n/a |
| great-crested flycatcher | 0.53 (1) | No sampling | No sampling | n/a |
| gray catbird | 0.53 \pm 0.36 (9) | No sampling | No sampling | n/a |
| house sparrow | 0.06 (1) | No sampling | No sampling | n/a |
| indigo bunting | 1.53 \pm 2.68 (4) | No sampling | No sampling | n/a |
| northern cardinal | 0.60 \pm 0.63 (6) | No sampling | No sampling | n/a |
| n. rough-winged swallow | 1.60 (1) | No sampling | No sampling | n/a |
| orchard oriole | 0.70 \pm 0.37 (2) | No sampling | No sampling | n/a |
| song sparrow | 1.03 \pm 0.82 (7) | No sampling | No sampling | n/a |
| tufted titmouse | 1.16 \pm 0.49 (3) | No sampling | No sampling | n/a |

Table 3. Total Mercury levels (mg/kg) in whole body eels collected from the South Fork Shenandoah River in 1998. FDA action level is 1 mg/kg.

| Town | Location | Hg (mg/kg) | River Miles downstream of the Site |
|-------------|-----------------|-------------------|---|
| Island Ford | Rt. 649 bridge | 0.389 | 33 |
| Island Ford | Rt. 649 bridge | 0.578 | 33 |
| Whitehouse | Rt. 211 bridge | 0.524 | 60.5 |
| Hawksbill | Rt. 660 bridge | 0.457 | 72 |
| Compton | Rt. 717 bridge | 0.952 | 85 |

Table 4. 2002 Mean Total Mercury Values, by Species at each Site.

| Stream | Location | Species | Mean Hg (ppm) |
|---------------|-----------------------------|-----------------|----------------------|
| North River | Rt. 668 bridge | Redbreast | |
| North River | Rt. 668 bridge | Sunfish | 0.11 |
| North River | Rt. 668 bridge | Smallmouth Bass | 0.47 |
| North River | Rt. 668 bridge | White Sucker | 0.28 |
| South River | Above Rife Loth Dam | Redbreast | |
| South River | Above Rife Loth Dam | Sunfish | 0.19 |
| South River | Above Rife Loth Dam | Smallmouth Bass | 0.18 |
| South River | Above Rife Loth Dam | White Sucker | 0.21 |
| South River | North of DuPont footbridge | Rainbow Trout | 0.10 |
| South River | North of DuPont footbridge | Redbreast | |
| South River | North of DuPont footbridge | Sunfish | 0.58 |
| South River | North of DuPont footbridge | Smallmouth Bass | 0.53 |
| South River | North of DuPont footbridge | White Sucker | 0.34 |
| South River | 2nd Street, Waynesboro | Redbreast | |
| South River | 2nd Street, Waynesboro | Sunfish | 0.74 |
| South River | 2nd Street, Waynesboro | Smallmouth Bass | 1.55 |
| South River | 2nd Street, Waynesboro | White Sucker | 0.47 |
| South River | Hopeman Parkway, Waynesboro | Largemouth Bass | 1.76 |
| South River | Hopeman Parkway, Waynesboro | Redbreast | |
| South River | Hopeman Parkway, Waynesboro | Sunfish | 1.06 |
| South River | Hopeman Parkway, Waynesboro | White Sucker | 1.09 |
| South River | Dooms | Redbreast | |
| South River | Dooms | Sunfish | 1.30 |
| South River | Dooms | Smallmouth Bass | 2.68 |
| South River | Dooms | White Sucker | 1.61 |
| South River | Crimora | Redbreast | |
| South River | Crimora | Sunfish | 1.34 |
| South River | Crimora | Smallmouth Bass | 3.34 |
| South River | Crimora | White Sucker | 1.69 |
| South River | Grottoes | Rainbow Trout | 0.10 |
| South River | Grottoes | Redbreast | |
| South River | Grottoes | Sunfish | 1.00 |
| South River | Grottoes | Smallmouth Bass | 1.82 |
| South River | Grottoes | White Sucker | 0.95 |
| SF Shenandoah | Lynwood | Redbreast | |
| SF Shenandoah | Lynwood | Sunfish | 0.46 |
| SF Shenandoah | Lynwood | Smallmouth Bass | 1.60 |
| SF Shenandoah | Lynwood | White Sucker | 0.60 |
| SF Shenandoah | Shenandoah, VA | Channel Catfish | 1.72 |
| SF Shenandoah | Shenandoah, VA | Largemouth Bass | 1.27 |

*Preassessment Screen Determination
South River and South Fork of the Shenandoah Rivers
August 2008*

| cont. | | | |
|---------------------|--------------------------------------|-----------------------|------------------|
| Stream | Location | Species | Mean [Hg] |
| SF Shenandoah | Shenandoah, VA | Redbreast | |
| SF Shenandoah | Shenandoah, VA | Sunfish | 0.55 |
| SF Shenandoah | Shenandoah, VA | Smallmouth Bass | 1.26 |
| SF Shenandoah | Shenandoah, VA | White Sucker | 0.78 |
| SF Shenandoah | Newport Landing | Redbreast | |
| SF Shenandoah | Newport Landing | Sunfish | 0.57 |
| SF Shenandoah | Newport Landing | Smallmouth Bass | 1.29 |
| SF Shenandoah | Newport Landing | White Sucker | 0.78 |
| SF Shenandoah | Whitehouse Landing | Channel Catfish | 0.52 |
| SF Shenandoah | Whitehouse Landing | Largemouth Bass | 1.09 |
| SF Shenandoah | Whitehouse Landing | Northern Hogsucker | 1.05 |
| SF Shenandoah | Whitehouse Landing | Redbreast | |
| SF Shenandoah | Whitehouse Landing | Sunfish | 0.49 |
| SF Shenandoah | Whitehouse Landing | Smallmouth Bass | 1.74 |
| SF Shenandoah | Fosters Landing | Northern Hogsucker | 0.70 |
| SF Shenandoah | Fosters Landing | Redbreast | |
| SF Shenandoah | Fosters Landing | Sunfish | 0.47 |
| SF Shenandoah | Fosters Landing | Smallmouth Bass | 1.30 |
| SF Shenandoah | Bentonville Landing | Northern Hogsucker | 0.69 |
| SF Shenandoah | Bentonville Landing | Redbreast | |
| SF Shenandoah | Bentonville Landing | Sunfish | 0.71 |
| SF Shenandoah | Bentonville Landing | Smallmouth Bass | 0.66 |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Channel Catfish | 0.56 |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Largemouth Bass | 0.91 |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Northern Hogsucker | 0.70 |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Redbreast | |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Sunfish | 0.66 |
| SF Shenandoah | Luray Avenue Launch - Front Royal | Smallmouth Bass | 1.42 |
| Shenandoah River | Rt. 17/50 bridge | Channel Catfish | 0.30 |
| Shenandoah River | Rt. 17/50 bridge | Largemouth Bass | 0.74 |
| Shenandoah River | Rt. 17/50 bridge | Redbreast | |
| Shenandoah River | Rt. 17/50 bridge | Sunfish | 0.19 |
| Shenandoah River | Rt. 17/50 bridge | Smallmouth Bass | 0.58 |

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*Preassessment Screen Determination
South River and South Fork of the Shenandoah Rivers
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| | | | |
|---------------------|------------------|----------------------|----------------------|
| Shenandoah River | Rt. 17/50 bridge | White Sucker | 0.34 |
| cont. | | | |
| Stream | Location | Species | Mean [Hg] |
| Shenandoah River | Berryville, VA | Redbreast Sunfish | 0.19 |
| Shenandoah River | Berryville, VA | Smallmouth Bass | 0.72 |
| Shenandoah River | Berryville, VA | White Sucker | 0.29 |

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Figure 1. Site Map

