

AOC 4 HHRA Report: Technical Briefing Paper

This briefing paper summarizes the findings of the Human Health Assessment (HHRA) Report for Area of Concern 4 (AOC 4) of the former E.I. du Pont de Nemours and Company (DuPont) Plant (the site), in Waynesboro, Virginia. Mercury was released to the South River system from the site between 1929 and 1950, during the period of mercury use in acetate flake and yarn production. In February 2014, under the authority of the Resource Conservation and Recovery Act (RCRA), Commonwealth of Virginia, Department of Environmental Quality (VDEQ) modified the Hazardous Waste Management Permit for Corrective Action (VAD003114832) for the site to include AOC 4. The HHRA Report was prepared pursuant to the February 2014 permit modification.

This briefing paper provides a summary of its key components; additional details are documented in the AOC 4 HHRA Report (URS, 2014).

Introduction

The HHRA was conducted consistent with RCRA requirements to evaluate potential exposure of human receptors to mercury detected in environmental media in the South River watershed. The area of the assessment includes the South River and associated floodplains (designated as AOC 4). AOC 4

includes approximately 25 miles of the South River downstream of the site, the associated floodplain, and a segment of the South Fork Shenandoah River in Virginia. The South River watershed within AOC 4 is composed of agricultural, forested, and developed areas.

The primary goals of the HHRA were (1) to evaluate potential risk for AOC 4 human receptors; and, (2) to provide risk information sufficient for remedial decisions consistent with United States Environmental Protection Agency (EPA) and VADEQ requirements.

To support the risk assessment, conceptual site models (CSMs) were developed in collaboration with VADEQ to summarize potential human exposure pathways for the AOC. The CSMs form the basis of the risk assessment detailed within this briefing paper. The CSMs are provided as part of this briefing paper (see [Figures 1, 2 and 3](#)).

As described below, the technical approach for the HHRA consisted of the following basic steps: data review and identification of constituents of potential concern (COPCs), human exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis.

References

- ✓ URS Corporation. 2014. Human Health Risk Assessment Report for the Former DuPont Waynesboro Plant, Area of Concern (AOC) 4, South River and a Segment of the South Fork Shenandoah River, Virginia.
 - ✓ USEPA. 1989. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part A. Interim Final. Office of Emergency and Remedial Response, Washington, D.C. December.
 - ✓ VADEQ, 2011. Current Risk Based Performance Standard for Hazardous Waste Corrective Action.
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Data Review and Identification of Constituents of Potential Concern

The HHRA compiled information from investigations and studies that have been performed as part of on-going investigations of the South River and South Fork of the Shenandoah River over the approximately last 10 years. As part of the data review, DuPont and VADEQ developed an assessment-mechanism [referred to herein as a retrospective data quality assessment (RDQA)] specifically for the data sets to be used in the HHRA. The objective of the RDQA was to document that the analytical data collected during numerous investigations was of sufficient quality for use in risk assessment. The original, historical source of mercury in the South River watershed is the Former DuPont Waynesboro Plant. Potential COPCs for AOC 4 are limited to total mercury (THg) and methyl mercury (MeHg).

Exposure Assessment

Based on an evaluation of the available data compared to screening levels, South River sediment and fish, floodplain area soil and floodplain area pond fish were identified as media of concern. In addition, floodplain area biota (such as wildlife, livestock and garden crops) were evaluated. South river surface water, floodplain area groundwater, floodplain area pond surface water and floodplain area pond sediment were not considered media of concern.

All properties along the approximately 25 miles in the South River watershed were reviewed for land use. Using a landuse-based screening decision logic, potential receptors were identified consistent with land uses in the South River watershed, namely residents, industrial/commercial workers, construction/excavation workers, hunters, farmers, and, recreational users of floodplain area parks and the South River under both current and future conditions.

In addition, a hypothetical future residential scenario and hypothetical future subsistence farmer scenario were evaluated in exposure areas where soil concentrations were above a conservatively adjusted residential screening value of 17 milligrams per kilogram (mg/kg). Potential exposures to all media were combined to provide an upper-bound estimate of potential risk assuming uncontrolled exposures via all possible exposure pathways. The farmer scenario differed from the resident in that potential exposure to livestock was also included.

Exposure via ingestion, inhalation, and dermal contact was evaluated in all exposure scenarios, as applicable. Exposure calculations used reasonable maximum exposure assumptions. Exposure point concentrations were either 95% upper confidence limit (UCL) of the arithmetic mean or the maximum value based on all available data. In some instances for soil data, outliers (THg concentrations greater than 100 mg/kg) were removed and the analysis was repeated.

Toxicity Assessment

Toxicity values for use in the human health risk assessment included reference doses (RfDs) and reference concentrations (RfCs) for THg and MeHg, which are both non-carcinogens. In accordance with EPA guidance, toxicity values for THg specific to the oral and inhalation pathways were obtained from a specific hierarchy of sources

recommended by EPA. Dermal toxicity factors were derived using adjusted oral toxicity values as recommended by EPA.

For the HHRA, the RfD for mercuric chloride was used to assess THg. However, in assessing food sources, it was conservatively assumed that all THg is present as MeHg. Therefore, the MeHg toxicity values were applied to the EPCs calculated for THg.

Risk Characterization

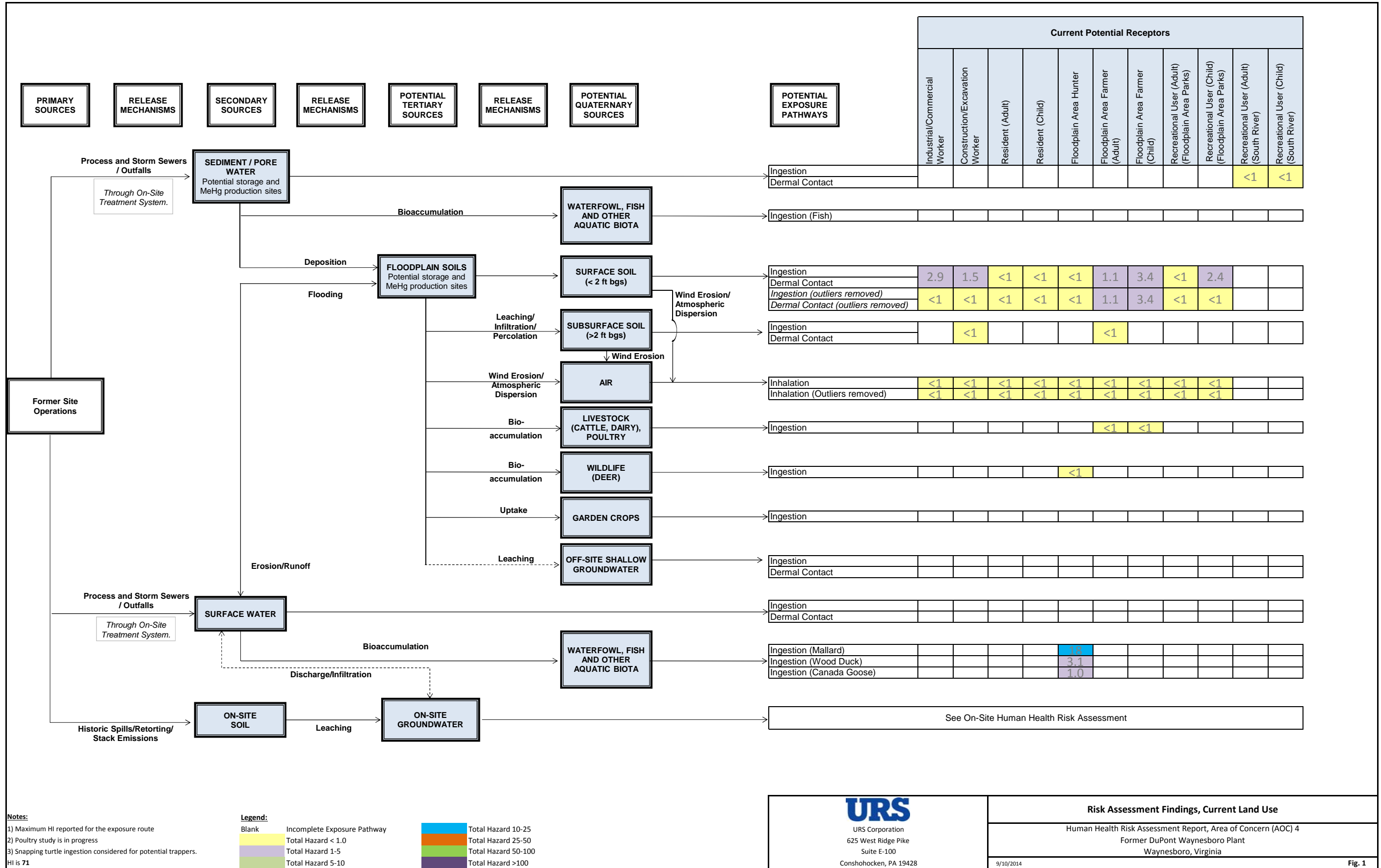
In the risk characterization, the toxicity factors (RfDs and RfCs) were applied in conjunction with COPC concentrations and intake assumptions to estimate noncancer hazards. Potential hazard associated with mercury exposure was evaluated at all properties. Hazard Indices (HI) were compared to EPA's and VADEQ's target hazard quotient (HQ) of 1.0 (EPA, 1989 and VADEQ, 2011).

In general the HHRA concluded the following:

- ❑ For all current potential receptors, HI exceedances were limited to potential exposure to floodplain area surface soil and ingestion of waterfowl (mallards and wood ducks). (The number of soil exceedances is reduced if the outlier analysis is performed.) Maximum exceedances by receptor and pathway are illustrated on [Figure 1](#).
- ❑ For potential future receptors, if floodplain area subsurface soils are assumed to be on the surface and the fish advisory is not in place, these pathways also show HI exceedances. (Similar to above, the number of exceedances is reduced if the outlier analysis is performed). Maximum exceedances under this scenario by receptor and pathway are illustrated on [Figure 2](#).
- ❑ For the both the hypothetical future resident and hypothetical future subsistence farmer, where all pathways are assumed possible on any property where soil concentrations exceed 17 mg/kg, similar pathways exceed the target HQ and maximum HIs are higher. Maximum exceedances under this scenario by receptor and pathway are illustrated on [Figure 3](#).

In all cases, no exceedances are noted for potential exposures directly to sediments and air and indirect pathways associated with consumption of livestock, game (represented by deer) and garden crops.

The report is currently under review by VA DEQ



Notes:
 1) Maximum HI reported for the exposure route
 2) Poultry study is in progress
 3) Snapping turtle ingestion considered for potential trappers.
 HI is 71

Legend:

Blank	Incomplete Exposure Pathway	Total Hazard 10-25
Yellow	Total Hazard < 1.0	Total Hazard 25-50
Light Green	Total Hazard 1-5	Total Hazard 50-100
Dark Green	Total Hazard 5-10	Total Hazard >100

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Risk Assessment Findings, Current Land Use
 Human Health Risk Assessment Report, Area of Concern (AOC) 4
 Former DuPont Waynesboro Plant
 Waynesboro, Virginia
 9/10/2014 **Fig. 1**

