RRF HEALTH RISK ASSESSMENT UPDATE

Montgomery County Resource Recovery Facility (RRF)

Prepared for
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Division of Solid Wastes Services
Rockville, Maryland

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TRC Project No. 200454
November 2014

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EXECUTIVE SUMMARY

The Montgomery County Resource Recovery Facility (RRF), located in Dickerson, MD began operations in 1995. The County made commitments to the Dickerson community to conduct human health risk assessments relative to RRF emissions and ambient environmental monitoring during both preconstruction (pre-operational) and post-construction (post-operational) phases. The County conducted environmental monitoring programs for ambient air and non-air environmental media, generally on a five (5) year and three (3) year periodic basis, respectively, pending budgetary appropriations. The County's most recent non-air media monitoring was conducted during June of 2007, and its most recent ambient air monitoring was conducted during the winter of 2008 (Montgomery County 2013a).

The RRF has been the subject of two previous human health risk assessments sponsored by the County, one in 1989 (pre-construction) and the other published in 2006 (post-construction). A separate HRA was also conducted by the Maryland Department of Natural Resources in 1989. The 1989 health risk assessments were based on literature-based emissions and engineering data available at that time and followed assessment protocols generally accepted at that time. The post-construction health risk assessment (ENSR 2006) relied on measured emissions data from stack tests and one year of onsite meteorological data available for the RRF and the now obsolete 1998 Draft Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities (USEPA 1998a and 1999a). In addition, the 2006 ENSR health risk assessment update used the USEPA's Industrial Source Complex (ISC) model, which has been since supplanted by USEPA's AMS/EPA Regulatory Model (AERMOD). The 2006 health risk assessment update included the chemicals of potential concern (COPCs) identified from the literature research in the County's 1989 assessment and supplemented that list with additional species identified in the stack testing data. Ultimately, the acute (i.e. short-term) and chronic (i.e. long-term) risks associated with a suite of 19 COPCs including metals, inorganics, dioxins/furans, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and formaldehyde were assessed.

Overall, the prior human health risk assessments showed that potential human health risks due to emissions from the Montgomery County RRF facility are within the range of or below regulatory and other benchmark risk levels for protection of human health. The Final 2006 Report concluded that "*the relative risk of harm to human health presented by the RRF, as it is operating today, is very low. In fact, the results indicate a very low chance (less than 1 chance in 1 million) for occurrence of potential carcinogenic health effects, and that no adverse noncarcinogenic health effects are expected as a result of exposure to facility related emissions*."

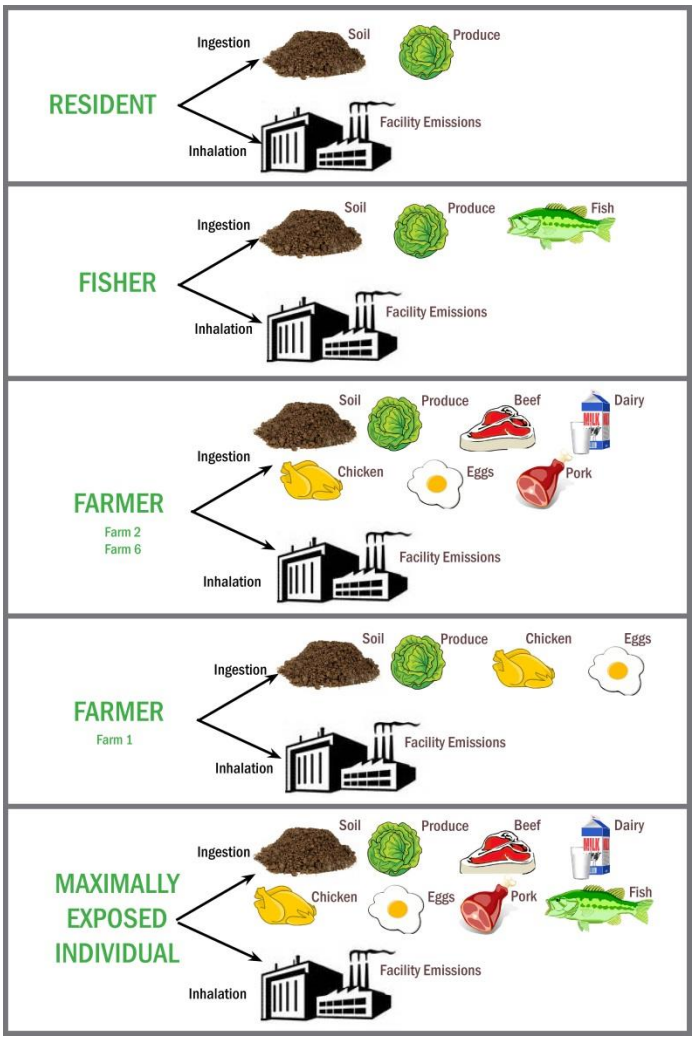
This Human Health Risk Assessment (HHRA) updates the ENSR risk assessment with the following changes:

- Updated the dispersion/deposition modeling from ISCST3 (Industrial Source Complex Short-Term 3) to AERMOD, the current USEPA approved model,
- Updated equations to reflect current USEPA guidance, including updated deposition and media concentration equations for mercury,
- Additional receptors (Reasonable Maximum Exposed (RME) Resident, RME Fisher and RME Farmer) per the 2005 Final HHRAP Guidance for Hazardous Waste Facilities,
- Updated emission rates for metals, dioxins/furans, PCBs, PAHs and formaldehyde to include all stack testing results from start of operations (1995) through August 2013,
- Included acid gas emission rates (hydrogen chloride, hydrogen fluoride and sulfuric acid) for acute inhalation,
- Used 95% Upper Confidence Limit (UCL) of the mean emission rates,
- Included non-detected emissions at full detection limit, and
- Reviewed and updated toxicity criteria to the most current values provided by USEPA.

A draft version of this report has undergone independent 3rd party review by CPF Associates, Inc. and the USEPA. Comments and responses to those comments can be found in Appendix I. All applicable changes have been carried through this final document.

This HHRA evaluated a variety of potential receptors to capture a range of exposure scenarios in the vicinity of the RRF. Three RME exposure scenarios addressing potential long-term exposure and risks, not previously considered in the 2006 ENSR risk assessment, were evaluated. In addition, seven long-term exposure and risk scenarios that were evaluated in the 2006 ENSR report were addressed. An acute inhalation risk scenario and potential impacts associated with breast milk ingestion by an infant were also evaluated. The methods used to evaluate exposures and risks were consistent with current USEPA guidance and are designed to tend to overestimate potential risks (i.e., be health protective).

This HHRA provides theoretical estimates of individual risk for a variety of exposure scenarios as shown in the following schematic:



In order to evaluate potential health risks, USEPA has established targets within which the Agency strives to manage risks. To evaluate potential carcinogenic risks, the Agency generally uses a risk range of 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000), and to evaluate the potential for non-cancer health effects, the Agency generally uses a hazard index/quotient of 1.0. However, for purposes of RCRA combustion permitting decisions, USEPA Region VI has modified the target levels to reflect the contribution of background levels of contamination. Per USEPA Region VI Guidance (USEPA 1998b), calculated cancer risks and the potential for non-cancer effects are compared against the USEPA target risk level of 1 in 100,000 for cancer risks and target hazard level of 0.25 for non-cancer effects. The risk level of 1 in 100,000 indicates a 1 in 100,000 chance of developing cancer due to lifetime exposure to a substance. Lifetime exposure to a substance with a cancer risk of 1 in 100,000 would increase one's current chance of cancer from all causes (which is currently a 1 in 2 chance for males and a 1 in 3 chance for females (American Cancer Society, 2013)) by 0.00001.

The potential for non-carcinogenic effects is represented by a Hazard Quotient (HQ), obtained by dividing the calculated dose to the receptor dose by the chemical-specific reference dose (RfD). The RfD is a lifetime dose of a chemical, established by USEPA or other health agency, that has been determined not to cause health effects over a lifetime of exposure. In calculating the RfD, exposures to sensitive individuals such as infants and the elderly are considered. Noncancer hazard indices (HIs) for each receptor were obtained by adding all COPC-specific HQs regardless of target organ potentially affected of type of health effect. It should be noted that the use of a noncancer hazard level of 0.25 is very conservative (i.e., health-protective) and provides a four-fold safety factor when compared to USEPA's conventional non-cancer hazard target level of 1.0 (USEPA 1989). This four-fold safety factor is meant to be protective of cumulative risk from other sources in the area.

Infant exposures to dioxin/furans in mother's breast milk that are modeled to occur as a result of the RRF emissions breast milk are evaluated by calculating an average daily dose (ADD) for an exposed infant and comparing the ADD against typical infant intakes of dioxin. The typical infant intake of 60 pg/kg-day TCDD-TEQ is identified by USEPA Region VI (USEPA 1998b) and the 2005 HHRAP as the national average background value to compare an infant's exposure to TCDD-TEQ via breast milk. These background intakes were calculated to be about 60 pg/kg-day in 1994; current estimates are not available. This comparison is not meant to be analogous to the comparison with health-based benchmarks such as the RfD, but in the absence of infant exposure benchmarks, it is expected that this comparison will be meaningful. A ratio of the calculated ADD versus the 60 pg/kg/day value is made such that a ratio of 1.0 would indicate that the ADD equaled the comparison value, therefore a ratio of less than one means that exposures are less than the average background intake level. It should be noted that at the time of the finalization of the HHRAP, USEPA had not developed a RfD for TCDD. USEPA has recently promulgated a RfD for TCDD of 0.7 pg/kg/day which is almost 100 times less than the comparison value of 60 pg/kg/day. An evaluation of breast milk ingestion using the RfD is further discussed in the Uncertainty Analysis section of this report.

Acute (short-term) inhalation hazards are evaluated by comparing against the USEPA target level of 1.0.

Table ES-1 summarizes the receptor exposures, while ES-2 summarizes the total risk and noncancer hazard by receptor. The results of the HHRA are summarized below.

RME Scenarios

RME Residential Scenario

The RME Residential scenario assumed that the adult and child resident were directly exposed to COPCs by inhalation and indirectly exposed to chemicals via the incidental ingestion of soil, and the consumption of homegrown produce. Media concentrations were calculated based on the modeled maximum annual concentration or maximum 5-year average dry and wet deposition, regardless of whether they occurred in different locations (i.e., assumes modeled impacts at different locations are collocated). This assumption would tend to overestimate risk. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in Table ES-2 neither the total excess lifetime cancer risk nor the total HIs associated with indirect and direct exposures for the adult and child RME Resident scenarios exceed the target cancer risk of 1 in 100,000 or the HI target of 0.25. The excess lifetime cancer risk estimates of 0.01 in 100,000 and 0.003 in 100,000 for the adult and child, respectively, are well below the benchmark risk of 1 in 100,000. The total HIs of 0.0012 and 0.0018 for the adult and child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.00003 for the infant receptor is well below the target of 1.0.

RME Fisher Scenario

The RME Fisher scenario assumed the Fisher lived at the RME residential location and also ate fish from the Potomac River. Thus, the Fisher was assumed to be directly exposed to COPCs by inhalation and indirectly exposed to chemical via the incidental ingestion of soil, the consumption of homegrown produce from the residential area and via the consumption of fish caught in the Potomac River. Since the Fisher was assumed to live in the residential area, the direct inhalation pathway was modeled using the RME Residential impacts. Air, soil and produce concentrations were calculated based on the modeled maximum annual concentration or maximum 5-year average dry and wet deposition, regardless of whether they occurred in different locations (i.e., assumes modeled impacts at different locations are collocated). This assumption would tend to overestimate risk. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in ES-2 neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child RME Fisher scenarios exceed the target cancer risk of 1 in 100,000 or the HI target of 0.25. The excess lifetime cancer risk estimates of

0.1 in 100,000 and 0.02 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.012 and 0.0095 for the adult and child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.00023 for the infant receptor is well below the target of 1.0.

RME Farmer Scenario

The RME Farmer was hypothetically assumed to live on Farm 2 which has the highest potential facility impacts of four evaluated farm areas. This receptor is assumed to be directly exposed to COPCs by inhalation and indirectly exposed to the COPCs via the incidental ingestion of soil, and the consumption of homegrown produce, beef, dairy, pork, chicken and eggs. These exposures are assumed to occur even if all the food products are not produced at the assumed farm location. In addition, it is assumed that all animal feed ingested by the food producing animals is grown on-site. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

For the RME Farmer, the total excess lifetime cancer risk estimates of 0.06 in 100,000 and 0.01 in 100,000 for the adult and child, respectively, are well below the target cancer risk of 1 in 100,000 (Table ES-2). The total HIs of 0.0069 and 0.011 for the adult and child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.0022 for the infant receptor is well below the target of 1.0.

Additional Chronic Risk Scenarios

Seven additional scenarios from the ENSR report were evaluated in this HHRA. These include two MEI Scenarios, three Fisher Scenarios and two Resident Farm Scenarios.

MEI Scenarios

MEI A Scenario

As discussed in the ENSR Report, MEI A scenario assumed that the adult and child resident were directly exposed to COPCs via maximum inhalation exposure; consumed agricultural products (milk, beef, pork, and poultry products) raised at the closest reference beef and/or dairy farm location (per the Farm Directory, Montgomery County 2008) that was predicted to exhibit maximum facility-related impacts; ingested fish caught from the Potomac River; and consumed above and below ground vegetables, and incidentally ingested soil. Contact with soil and home-grown produce occurred at the location of maximum dry particle deposition. The MEI A scenario assumes that the modeled impacts (maximum concentrations and dry particle deposition are

collocated even though they are not. This assumption would tend to overestimate risk. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

The ENSR Report evaluated the consumption of agricultural products that were hypothetically assumed to come from Farm 5 (Johnson's Dairy Farm) as that was the nearest actual beef and/or dairy farm that was predicted to exhibit maximum facility-impacts. In the current HHRA it was determined that a different farm, designated as Farm 6, was the nearest beef and/or dairy farm that was predicted to exhibit maximum facility-impacts. It was assumed that 100% of consumed produce, agricultural products, fish and incidentally ingested soils were impacted by facility emissions. These exposures are assumed to occur even if all the food products are not produced at the assumed locations. In addition, it is assumed that all animal feed ingested by the food producing animals is grown on-site.

As shown in Table ES-2, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child MEI A scenario exceeds the target cancer risk of 1 in 100,000 or the target HI of 0.25. The excess lifetime cancer risk estimates of 0.1 in 100,000 and 0.02 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.016 for the adult and 0.015 for the child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.0014 for the infant receptor in the 2013 assessment is well below the target of 1.0.

MEI B Scenario

As discussed in the ENSR Report, MEI B scenario assumed that the adult and child resident were directly exposed to COPCs via inhalation exposure at the secondary maximum location; consumed agricultural products (milk, beef, pork, and poultry products) raised at the closest reference beef and/or dairy farm location (per the Farm Directory, Montgomery County 2008) that was predicted to exhibit maximum facility-related impacts; ingested fish caught from the Potomac River; and consumed above and below ground vegetables, and incidentally ingested soil. Contact with soil and home-grown produce occurred at the location of maximum total particle and vapor deposition. The MEI B scenario assumes that the modeled impacts (secondary maximum air concentrations and maximum total particle and vapor deposition are collocated even though they are not. This assumption would tend to overestimate risk. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

The ENSR Report evaluated the consumption of agricultural products that were hypothetically assumed to come from Farm 5 (Johnson's Dairy Farm) as that was the nearest actual

beef and/or dairy farm that was predicted to exhibit maximum facility-impacts. In the current HHRA it was determined that a different farm, designated as Farm 6, was the nearest beef and/or dairy farm that was predicted to exhibit maximum facility-impacts. It was assumed that 100% of consumed produce, agricultural products, fish and incidentally ingested soils were impacted by facility emissions. These exposures are assumed to occur even if all the food products are not produced at the assumed locations. In addition, it is assumed that all animal feed ingested by the food producing animals is grown on-site.

As shown in Table ES-2, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child MEI B scenario exceeds the target cancer risk of 1 in 100,000 or the target HI of 0.25. The excess lifetime cancer risk estimates of 0.1 in 100,000 and 0.02 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.015 for both the adult and child receptors are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.0014 for the infant receptor is well below the target of 1.0.

Additional Fisher Scenarios

Three additional Fisher Scenarios from the ENSR report were evaluated and are discussed below.

Monocacy River Fisher

The Monocacy River Fisher scenario assumed the Fisher lived at the RME Residential location and also ate fish from the Monocacy River. Thus, the Fisher was assumed to be directly exposed to COPCs by inhalation and indirectly exposed to chemicals via the incidental ingestion of soil, the consumption of homegrown produce from the RME Residential location and via the consumption of fish caught in the Monocacy River. Air, soil and produce concentrations were calculated based on the modeled maximum annual concentration or maximum 5-year average dry and wet deposition, regardless of whether they occurred in different locations (i.e., assumes modeled impacts at different locations are collocated). This assumption would tend to overestimate risk. Since the Fisher was assumed to live in the RME Residential area, the direct inhalation pathway was modeled using the RME Residential impacts. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in Table ES-2, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child Monocacy Fisher scenarios

exceed the target cancer risk of 1 in 100,000 or the target HI of 0.25. The excess lifetime cancer risk estimates of 0.09 in 100,000 and 0.01 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.0099 and 0.0079 for the adult and child receptors are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.00042 for the infant receptor is well below the target of 1.0.

Resident Fisher near Farm 1

The Resident Fisher near Farm 1 scenario assumed the Resident Fisher lived in the vicinity of Farm 1 and ate fish from Farm Pond 2 (see Figure 4-3). Thus, the Resident Fisher was assumed to be directly exposed to COPCs by inhalation and indirectly exposed to chemicals via the incidental ingestion of soil, the consumption of homegrown produce and via the consumption of fish caught in Farm Pond 2. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in Table ES-2, respectively, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child RME Fisher scenarios exceed the target cancer risk of 1 in 100,000 or the target HI of 0.25. The excess lifetime cancer risk estimates of 0.06 in 100,000 and 0.009 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.014 and 0.01 for the adult and child receptors are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.0004 for the infant receptor is well below the target of 1.0.

Resident Fisher near Farm 2

The Resident Fisher near Farm 2 scenario assumed the Resident Fisher lives in the vicinity of Farm 2 and ate fish from Farm Pond 3 (see Figure 4-3). Thus, the Resident Fisher was assumed to be directly exposed to COPCs by inhalation and indirectly exposed to chemicals via the incidental ingestion of soil, the consumption of homegrown produce and via the consumption of fish caught in Farm Pond 3. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in ES-2 neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child RME Fisher scenarios exceed the target cancer risk of 1 in 100,000 or the target HI of 0.25. The excess lifetime cancer risk estimates of 0.1 in 100,000 and 0.02 in 100,000 for the adult and child, respectively, are well below the target risk of 1 in 100,000. The total HIs of 0.025 and 0.018 for the adult and child receptors are well

below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.00069 for the infant receptor is well below the target of 1.0.

Additional Resident Farmer Scenarios

Two additional Resident Farmer Scenarios from the ENSR report were evaluated and are discussed below.

Resident Farm 1

As discussed in the ENSR report, the Resident Farmer 1 was hypothetically assumed to live on Farm 1 (see Figure 4-3) and thus, is directly exposed to COPCs by inhalation and indirectly exposed to the COPCs via the incidental ingestion of soil, and the consumption of homegrown produce and chicken and eggs. These exposures are assumed to occur even if all the food products are not produced at the assumed farm location. In addition, it is assumed that all animal feed ingested by the food producing animals is grown on-site. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in Table ES-2, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child Resident Farmer 1 exceed the target cancer risk of 1 in 100,000 or the target HI of 0.25. The total excess lifetime cancer risk estimates of 0.005 in 100,000 and 0.0009 in 100,000 for the adult and child, respectively, are well below the target cancer risk of 1 in 100,000. The total HIs of 0.00055 and 0.00066 for the adult and child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.000013 for the infant receptor is well below the target of 1.0.

Resident Farm 6

The ENSR report evaluated a subsistence Farmer scenario in which a subsistence Farmer was located at Johnson Dairy Farm (Farm 5). Farm 5 was described as being the nearest actual beef/dairy farm location predicted to be maximally impacted by facility-related emissions. However, for this update Farm 6 was determined to be the nearest beef/dairy farm location predicted to be maximally impacted by facility-related emissions. Therefore, the Resident Farmer 6 was assumed to live on Farm 6 and thus is directly exposed to COPCs by inhalation and indirectly exposed to the COPCs via the incidental ingestion of soil, and the consumption of homegrown produce, and home-raised beef, dairy, pork, chicken and eggs. These exposures are assumed to occur even if all the food products are not produced at the assumed farm location. In addition, it is

assumed that all animal feed ingested by the food producing animals is grown on-site. An exposure pathway for infants via the ingestion of breast milk was also evaluated.

As shown in Table ES-2, neither the total excess lifetime cancer risks nor the total HIs associated with indirect and direct exposures for the adult and child Resident Farmer 6 exceed the target cancer risk of 1 in 100,000 or the target HI of 0.25. The total excess lifetime cancer risk estimates of 0.02 in 100,000 and 0.006 in 100,000 for the adult and child, respectively, are well below the target cancer risk of 1 in 100,000. The total HIs of 0.0036 and 0.0057 for the adult and child receptor are well below the target HI of 0.25. In addition, the dioxin/furan intake ratio of 0.0011 for the infant receptor is well below the target of 1.0.

Acute Inhalation Scenario

As shown in Table ES-2, the total acute inhalation index (AHI) associated with the acute inhalation of the one-hour maximum air concentrations of the stack emissions is 0.054, which is less than the acute target AHI of 1.0.

Groundwater

Since groundwater wells and not surface water are the source of drinking water in the area, the drinking water pathway was not evaluated in the HHRA. However, due to a local concern that emissions from the RRF are depositing onto soils and leaching into groundwater, a comparison of maximum predicted soil concentrations to groundwater protection soil screening levels (SSLs) (USEPA, 2013c) was conducted.

Deposition of facility emissions onto surrounding soils does not pose a risk to groundwater drinking wells. A comparison of maximum predicted soil concentrations potentially associated with stack emissions to USEPA's groundwater protection soil screening levels (SSLs) showed that the predicted soil concentrations were well below the SSLs by more than 430 times (for cobalt) to more than 370 billion times (for 2-methylnaphthalene) (Table ES-3).

Conclusion

This HHRA was conducted using USEPA's 2005 HHRAP guidance. Assumptions used in the HHRA were meant to be health protective and would tend to overestimate risk. For example, the RME Resident, RME Fisher, MEI A and B receptors and the Monocacy River Fisher scenarios all assume that exposure occurs regardless if modeled impacts occur at different locations (i.e., assumes modeled impacts at different locations are collocated). All Farmer scenarios assume that

all the food products consumed are grown on the property, including the feed (forage, silage and grain) ingested by the food producing animals. This would overestimate exposure if feed is actually bought and not grown on the property.

It can be concluded from the results of the HHRA that potential risks associated with stack emissions from the RRF are below regulatory and other target risk levels for human health. All calculated cancer risks were approximately 10 to 250 times less than the cancer target level of 1 in 100,000, while calculated noncancer hazard indices were approximately 10 to 600 times less than the noncancer target level of 0.25. Calculated infant exposures to TCDD were approximately 500 to 34,000 times less than the 60 pg/kg/day background comparison value. These results indicate a very low likelihood that potential health effects would occur as a result of exposure to RRF emissions under the various exposure conditions evaluated in this HHRA.

Table ES-1
Summary of Receptor Scenarios
Montomery County RRF
Dickerson, MD

	Soil	Produce	Beef	Dairy	Pork	Chicken	Eggs	Fish	Inhalation	Point of Modeling Impacts (a)
RME Scenarios										
Reasonable Maximum Exposed Resident	x	x							x	Maximum wet and dry deposition, maximum air concentrations, assumed to be collocated in same location
Reasonable Maximum Exposed Fisher (Potomac River)	x (a)	x (a)						x	x (a)	Maximum wet and dry deposition, maximum air concentrations, assumed to be collocated in same location. Average over Potomac River and watershed
Reasonable Maximum Exposed Farmer (Farm 2)	x	x	x	x	x	x	x		x	Potential farm location with highest potential concentration and depositional impacts. Concentration and depositional impacts at Farm 2.
MEI Scenarios										
Maximally Exposed Individual A	x	x	x (b)	x (b)	x (b)	x (b)	x (b)	x (c)	x	Maximum dry particle deposition, maximum air concentration, assumed to be collocated in same location
Maximally Exposed Individual B	x	x	x (b)	x (b)	x (b)	x (b)	x (b)	x (c)	x	Maximum total particle and vapor deposition, secondary maximum air concentration, assumed to be collocated in same location
Additional Fisher Scenarios										
Monocacy River Fisher	x (a)	x (a)						x	x (a)	Maximum wet and dry deposition, maximum air concentrations, , assumed to be collocated in same location. Average over Monocacy River and watershed
Resident Fisher near Farm 1 (Fishes Farm Pond 2)	x	x						x	x	Concentration and depositional impacts at Farm 1 and Farm Pond 2
Resident Fisher near Farm 2 (Fishes Farm Pond 3)	x	x						x	x	Concentration and depositional impacts at Farm 2 and Farm Pond 3
Additional Resident Farm Scenarios										
Resident Farm 1	x	x				x	x		x	Concentration and depositional impacts at Farm 1
Resident Farm 6	x	x	x	x	x	x	x		x	Actual farm location with highest potential concentration and depositional impacts. Concentration and depositional impacts at Farm 6.
Acute (1-hr) Hazard Index									x	Maximum 1-hr air concentrations, , assumed to be collocated in same location

(A) It should be noted that each modeling parameter (air concentration, vapor, dry and wet deposition) each have a vapor, particulate and particle-bound component. So even with in a modeling parameter (e.g., air concentration), the vapor, particulate and particulate-bound fractions may not impact the same location. In addition, AERMOD models the vapor phase of the COPCs individually which can potentially result in the maximums for each COPC also impacting in different locations. For the purpose of this risk assessment, they were assumed to all be collocated at the receptor location. This would tend to overestimate risk.

x - exposure pathway at receptor location, unless otherwise footnoted:

(a) Resides at location of RME resident, therefore same inhalation, soil and produce exposure as RME Resident

(b) Obtains beef, dairy, pork, chicken and eggs from Farm 6

(c) Ingests fish from the Potomac River

Table ES-2
Summary of Total Excess Lifetime Cancer Risk and Total Noncancer HIs
Montomery County RRF
Dickerson, MD

	Cancer Risk		Chronic Noncancer HI			Acute
	Adult	Child	Adult	Child	Infant	HI
Reasonable Maximum Exposed Scenarios						
RME Resident	0.01E-05	0.003E-08	0.0012	0.0018	0.00003	
RME Fisher (a)	0.1E-05	0.02E-05	0.012	0.0095	0.00023	
RME Farmer (a)	0.06E-05	0.01E-05	0.0069	0.011	0.0022	
Maximally Exposed Individual Scenarios						
MEI A (a)	0.1E-05	0.02E-05	0.016	0.015	0.0014	
MEI B (a)	0.1E-05	0.02E-05	0.015	0.015	0.0014	
Additional Fisher Scenarios						
Monocacy River Fisher (a)	0.09E-05	0.01E-05	0.0099	0.0079	0.00042	
Resident Fisher near Farm 1 (Fishes Farm Pond 2) (a)	0.06E-05	0.009E-05	0.014	0.01	0.0004	
Resident Fisher near Farm 2 (Fishes Farm Pond 3) (a)	0.1E-05	0.02E-05	0.025	0.018	0.00069	
Additional Resident Farm Scenarios						
Resident Farm 1 (a)	0.005E-05	0.0009E-05	0.00055	0.00066	0.000013	
Resident Farm 6	0.02E-05	0.006E-05	0.0036	0.0057	0.0011	
Acute (1-hr) Hazard Index						0.054
Cancer and Non-Cancer Target Values (b)	1E-05	1E-05	0.25	0.25	1	1

Table ES-3
Comparison of Predicted Soil Concentrations to Groundwater Protection Soil Screening Levels (SSLs)
Montomery County RRF
Dickerson, MD

	Protection of Ground Water SSLs (a)			
	MCL-based SSL (mg/kg)	Risk-Based SSL (mg/kg)	Maximum Soil Concentration (mg/kg)	SSL vs. Soil Conc.
Inorganics				
Antimony	0.27		0.0000000001	1,968,361,786
Arsenic	0.29		0.00000012	2,398,189
Beryllium	3.2		0.000026	121,410
Cadmium	0.38		0.000010	36,779
Chromium +3	180000 (b)		0.00090	199,983,752
Chromium +6	180000 (b)		0.00037	488,513,726
Cobalt		0.21	0.00048	437
Copper	46		0.0069	6,652
Lead	14		0.0017	8,112
Manganese		21	0.0051	4,099
Mercury as HgCl2	0.1		0.00019	539
Mercury as Methyl Hg	0.1		0.0000038	26,552
Nickel		20	0.000017	1,169,168
Selenium	0.26		0.0000024	106,341
Zinc		290	0.00018	1,622,323
Dioxins/Furans				
2,3,7,8-TCDD-TEQ	0.000015		0.0000000017	9,010
PCBs				
Total PCBs	0.078		0.000000056	1,404,124
PAHs				
Acenaphthene		4.1	0.000000073	55,917,219
Acenaphthylene	NA	NA	0.000000000017	NC
Anthracene		42	0.000000083	504,067,054
Benzo(a)anthracene	0.24 (c)		0.0000015	160,315
Benzo(a)pyrene	0.24		0.0000018	134,469
Benzo(b)fluoranthene	0.24 (c)		0.00000041	589,834
Benzo(k)fluoranthene	0.24 (c)		0.0000045	52,757
Benzo(ghi)perylene			0.000000067	NC
Chrysene	0.24 (c)		0.0000089	27,084
Dibenzo(a,h)anthracene	0.24 (c)		0.000063	3,822
Fluoranthene		70	0.00000018	395,146,572
Fluorene		4	0.000000014	291,425,788
Indeno(1,2,3-cd)pyrene	0.24 (c)		0.000040	6,015
2-Methylnaphthalene		0.14	0.00000000000038	371,798,675,437
Naphthalene		0.00047	0.000000013	36,947
Phenanthrene	NA	NA	0.0000010	NC
Pyrene		9.5	0.00000072	13,145,730
Aldehyde Ketones				
Formaldehyde		0.62	0.0000084	73,567

(a) When no MCL-based SSL is available, risk-based SSL is used. From USEPA RSL Tables (USEPA 2013c)
(b) MCL for Total Chromium
(c) MCL for cPAHs based upon benzo(a)pyrene
NA = Not Available
NC = Not Calculated