REVISED
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Rotary Kiln and Fixed Box Incinerators

Prepared for

MOMENTIVE PERFORMANCE MATERIALS
Waterford, New York

Prepared by

TRC Environmental Corporation
Windsor, Connecticut

February 2012

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TRC Project No. 179282
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EXECUTIVE SUMMARY

TRC Environmental Corporation (TRC), on behalf of GE Silicones Product Division, prepared a Screening Level Ecological Risk Assessment Work Plan in accordance with the U.S. Environmental Protection Agency's (USEPA's) guidance, "Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities" (Protocol; EPA 1999). The work plan was accepted by NYSDEC in March, 2004. On December 4, 2006, Momentive Performance Materials Silicones, LLC (MPM) acquired the Waterford, NY silicones manufacturing plant from GE Silicones, LLC.

This Report presents the results of the revised screening level ecological risk assessment (SLERA) conducted for the MPM facility. The SLERA quantifies risks associated with the stack emissions from the Rotary Kiln (RKI) and Fixed Box Incinerator Number 2, stacks 1 and 2 (FBI 1 and 2) quantified during a Comprehensive Performance Test and Trial Burn completed in April, 2004 (TRC 2006) and a Compliance Performance Test (FEG 2011 and OBG 2011) completed in 2010/2011. This SLERA includes updated computer dispersion modeling using the AMS/EPA Regulatory Model (AERMOD; EPA 2004) as EPA's guideline air quality model (EPA 2005a) to estimate the impact of the stack emissions at various receptor sites representative of the ecological habitats and exposure pathways considered in the SLERA. In addition, maximum emission rates were used in calculating media concentrations at the request of NYSDEC in their letter to MPM dated December 19, 2011 (NYSDEC 2011). Previously, average emission rates were used to calculate media concentrations. This update increases the conservative nature of the SLERA.

This SLERA evaluated ecological receptors for five ecological habitats: Hudson River and Tomhannock Reservoir aquatic habitats and forest, wetland and scrub/shrub/agricultural terrestrial habitats. Measurement receptors expected to inhabit these habitats were selected to represent both community receptors (i.e., fish, aquatic/terrestrial plants and invertebrates) and ecological receptors representative of specific foraging guilds (e.g., herbivorous bird). Receptor exposure was based on direct ingestion of environmental media (water, sediment or soil) and indirect ingestion of chemicals of potential concern (COPCs) through the ingestion of plants and prey species that were assumed to be exposed to COPCs through direct ingestion or indirectly through the ingestion of lower trophic level prey species.

Daily doses were calculated for the selected guild measurement receptors for comparison to conservative toxicity reference values (TRVs) to characterize potential risks to ecological receptors. The resulting ecological screening quotients (ESQs), which are calculated by dividing the estimated daily doses by the TRVs, are presented on Table ES-1. As shown on this table, all community and habitat receptor ecological screening quotients (ESQs) are below the target risk level of 1E+00 for all habitats.

Conservative exposure assumptions have been incorporated into the SLERA, as required by EPA guidance (1999). The SLERA assumes that COPCs in environmental media are 100% bioavailable; the total COPC mass ingested by the measurement receptor species is the dose absorbed and bioavailable to cause the toxic effect; measurement receptors take up 100% of the COPC concentration to which they are exposed; all COPC mass taken up by a plant or animal food item is assimilated into edible biomass; an ecological receptor is continuously exposed during its entire life, including critical life stages; the measurement receptor's home range is 100% within the study area; and the measurement receptor's food is 100% contaminated based on exposure to maximum chemical concentrations.

The SLERA is a conservative assessment of the potential for adverse impacts associated with emissions from the RKI and FBI incinerators under Trial Burn Conditions. The SLERA did not identify risk exceedances for the measurement receptors and habitats evaluated based on using maximum emission rates obtained from the emissions testing. Only two slight exceedances of the target risk level of 1E+00 were identified when process upsets were factored into the assessment. The PUF-adjusted ESQ of 1.1E+00 was calculated for the carnivorous mammal ingesting a diet consisting solely of omnivorous birds and a PUF-adjusted ESQ of 1.2E+00 was calculated for the carnivorous bird ingesting a diet consisting solely of omnivorous birds in the Tomhannock Reservoir habitat. However, further evaluation of the risk drivers identified under process upset conditions shows that the PUF-adjusted ESQs are overly conservative, considering the risk drivers were either not detected, not likely to be present, or risks are overstated due to conservative assumptions used in the SLERA. Therefore, results of the SLERA indicate that no further risk analysis is warranted.

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LIST OF ACRONYMS

AERMOD	AMS/EPA Regulatory Model
AWFCO	Automatic Waste Feed Cut Off
AWQC	Ambient Water Quality Criteria
BCF	Bioconcentration Factor
BEHP	Bis(2-ethylhexyl)phthalate
BW	Body Weight
cm	Centimeter
COPC	Chemical of Potential Concern
CPT	Compliance Performance Test
Eco-SSL	Ecological Soil Screening Level
EEL	Estimated Exposure Level
EPA	US Environmental Protection Agency
ESPBTU	Equilibrium Sediment Partitioning Benchmark Toxicity Unit
ESQ	Ecological Screening Quotient
FBI	Fixed Box Incinerator
FCM	Food Chain Multiplier
HCP	Halfmoon Cogeneration Project
ISCT3	Industrial Source Complex Short Term
kg	Kilogram
L	Liter
LULC	Land Use Land Cover
mg	Milligram
MPM	Momentive Performance Materials
NED	National Elevation Dataset
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No observable adverse effect level
NWI	National Wetland Inventory
NWS	National Weather Service
NYCRR	New York Code Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PAH	Polynuclear Aromatic Compound
PCB	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PeCDF	Pentachlorodibenzo-p-dioxins
PIC	Product of Incomplete Combustion
PUF	Process Upset Factor
RKI	Rotary Kiln Incinerator
SLERA	Screening Level Ecological Risk Assessment
SLERAP	Screening Level Ecological Risk Assessment Work Plan
TCDD	Tetrachlorodibenzodioxin
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalent
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TOE	Total Organics Emissions
TRC	TRC Environmental Corporation
TRV	Toxicity Reference Value
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey

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WW	Wet Weight

1.0 INTRODUCTION

The Momentive Performance Materials (MPM) facility (formerly the General Electric Silicones facility) located in Waterford, New York operates two hazardous waste incinerators, the Rotary Kiln Incinerator (RKI) and the Fixed Box Incinerator Number 2. The Fixed Box Incinerator (FBI) operates in a cross-tie mode and exhausts through two stacks identified in this report as FBI1 and FBI2. The RKI exhausts through a single stack. The incinerators are located in the Waste Treatment Plant portion of the facility (refer to Figures 3-1a and 3-1b).

A Screening Level Ecological Risk Assessment Work Plan (SLERAP; TRC 2003) was prepared for the MPM Waterford Facility in accordance with the Environmental Protection Agency's (EPA's) guidance, "Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities." (Protocol; EPA 1999) and was accepted by NYSDEC in March 2004. A draft SLERA Report was submitted in September 2004. The report was revised in accordance with comments provided by NYSDEC, NYS DOH and USEPA in August, 2007 and was resubmitted in October 2007. This report was revised in accordance with comments provided by NYSDEC, NYS DOH and EPA in September 2008 and December 2011. Per these comments, the following changes were made:

- Updated the dispersion/deposition modeling from ISCST3 to AERMOD;
- Updated equations to reflect changes made to the calculation of soil concentrations per the EPA's finalized "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities" (USEPA 2005b);
- Updated emission rates for metals, and Dioxins/Furans to include 2010/2011 Compliance Performance Test (CPT) results;
- Used maximum emission rates;
- Calculated upset factors based upon all automatic waste feed cut-offs (AWFCOs);
- Included non-detects at full detection limit, and
- Updated toxicity criteria.

The SLERA provides theoretical, conservative estimates of potential risks to ecological receptors using measurement receptors representing food web-specific guilds and communities and readily available exposure and ecological effects information in accordance with the SLERAP.

This SLERA consists of the following components:

- Facility Characterization;
- Air Dispersion/Deposition Modeling;
- Problem Formulation; and
- Risk Characterization.

Each component of the SLERA is presented in the following sections.

2.0 FACILITY CHARACTERIZATION

The facility characterization component of the SLERA is comprised of compiling basic facility information, identifying emission sources, estimated emission rates, identifying chemicals of potential concern (COPCs), and estimating COPC concentrations for non-detects.

2.1 Facility Information

The facility is located approximately 1.7 miles north of the downtown area of Waterford, New York. The MPM Waste Treatment Plant is located between Highway US 4/ NY 32 and the Hudson River. Highway US 4/NY 32 bisects the MPM property, separating the Waste Treatment Plant from the rest of the facility, as shown on Figure 3-1a. A cluster of single-family homes is located to the north of the site. A combination of homes and small commercial businesses is located to the south. The incinerator stacks are located approximately 0.3 km west of the Hudson River as shown on Figure 3-1b.

2.2 Emission Sources

The emission sources for this facility are the RKI and FBI#2. The FBI#2 incinerator exhausts through two stacks (Stack Nos. 1 and 2) identified as emission points 97001 and 97002. The RKI exhausts through a single stack (Stack No. 3) identified as emission point 97003. The incinerators are located in the Waste Treatment Plant portion of the facility.

2.3 Stack Emission Characterization Data

This SLERA is based on the 2004 Comprehensive Performance Test and Trail Burn (TRC 2006a and 2006b) and the 2010/2011 CPT for the MPM RKI and FBI stacks (FEC 2011 and OBG 2011a and 2011b). The following sections provide a summary of the Trial Burn testing conducted at the incinerators along with the rationale to identify the constituents of concern. Table 2-1 lists constituents that were analyzed for during the Comprehensive Performance Test/Trial Burn and CPT. Table 2-2 presents the top 30 tentatively identified volatile and semi-volatile compounds (TICs).

2.3.1 2004 Comprehensive Performance Test and Trial Burn Data

A Comprehensive Performance Test and Trial Burn was conducted at MPM's Rotary Kiln and Fixed Box incinerators during March and April 2004. The purpose of the performance test was to demonstrate compliance with applicable performance standards (including 6 New York Code Rules and Regulations (NYCRR) Part 373-2.15(d) and 40 CFR 63 Subpart EEE), to set the appropriate parameter operating limits to operate these units, and to provide data required to complete risk assessments. Performance testing was conducted in accordance with NYSDEC approved plans. The 2004 Trial Burn/Comprehensive Performance Test consisted of conducting testing at four different operation conditions. A specific Risk Burn condition (condition 3) was conducted to generate data for the risk assessments. Maximum emission rate data obtained from the 2004 comprehensive testing includes volatile and semi-volatile organics, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), total organics, aldehydes and ketones. Detailed test results are presented in TRC's Trial Burn/Performance Test Report for the Rotary Kiln Incinerator and Trial Burn/Performance Test Report for the Fixed Box Incinerator #2 (2006a and 2006b).

2.3.2 Compliance Performance Test Data

MPM submitted a plan and received agency approval for an April 2010 CPT of the Rotary Kiln Incinerator (RKI). The NYSDEC approved this plan on April 9, 2010. MPM conducted the CPT from June 9 through 18, 2010. The performance testing included two operating conditions (minimum temperature condition and maximum temperature condition). Due to issues with metals spiking and stack analysis during the June testing, the maximum temperature test condition was repeated for metals, particulate and chlorine on December 2 and 3, 2010.

MPM submitted a plan for CPT of the FBI #2 in July 2010. NYSDEC approved this plan on August 10, 2010. The CPT was conducted on October 13, 14, and 15 and on December 7, 8 and 9, 2010. The 2010 CPT consisted of conducting tests at three different operation conditions (minimum temperature, maximum temperature and maintenance mode).

Maximum emission rate data obtained from the 2010/2011 CPT includes dioxin/furans, and metals.

2.3.3 Fugitive Emissions

MPM maintains both incinerators under negative pressure that should preclude any fugitive emissions from the incinerators. Emissions from upsets that could result in increased emissions due to reductions in system vacuum are considered in upset factor calculations below.

However, fugitive emissions from the combustor process may occur from waste storage tanks, process equipment ancillary to the combustion units (pumps, valves, pipe connectors, etc.) and the handling and disposal of ash.

Particulate matter from the IWS systems is collected in the scrubber water, from which the solids are removed and shipped off-site as sludge. There is no dry fly ash removal system for collected particulate matter. Clinker formed in the kiln, which which consists of large chucks of solid metal from drums and large chucks of silica is conveyed from the kiln into trailers used to transport it off-site for proper disposal..

The methodology for estimating component fugitive emissions is based on the USEPA document "Protocol for Equipment Leak Emission Estimates (Protocol)" dated November 1995 (USEPA 1995a). MPM performs periodic component leak monitoring and records the screening values for each component associated with the FBI#2 and RKI. The recorded screening values for each component are categorized by location and waste stream serviced.

Since screening values are available, the EPA Correlation Approach is the preferred method for estimating emissions from components. The leak rate was developed for each component by using one round of measured screening values with the associated correlations from "*Table 2-9* SOCMI Leak Rate/Screening Value Correlations" as presented in the Protocol. It is assumed that the components for the various waste streams are categorized as "light liquid valves" and "light liquid pumps." Using the correlations, hourly and annual total organic compound emissions are estimated based on actual hours of service estimated for each of the waste streams and locations.

Although some components have a monitored value of 0 ppmv, the USEPA has determined there may still be emissions from the components, therefore; the protocol requires the use of default zero-reading factors to estimate emissions. Since the leak monitoring was performed using a portable monitoring system with a minimum detection limit of 1 ppmv or less, emissions are estimated using factors from "*Table 2-11* Default-Zero Values: SOCMI Process Units" as presented in the Protocol. Emissions are estimated using the "light liquid" factors from *Table 2-11*. There were no "pegged" values measured during the monitoring.

Annual total organic compound emissions were speciated using data collected for each waste stream during the trial burn. Fugitive emissions were estimated for compounds that were detected in the waste samples taken during the emissions testing. These emission estimates are based on an average of each sample run.

Appendix L contains the calculation of the fugitive emission estimates as well as the comparison of the fugitive emissions to the incinerator emissions. The fugitive emissions were incorporated into the risk assessment only if they were within a factor of 10 when compared to the incinerator emissions. If the incinerator emissions were greater than 10 fold higher than the fugitive emissions, the fugitive emissions were considered insignificant and were not evaluated further. Table 2-3 shows the constituents and the fugitive emission rates that were added to the incinerator emission rates.

2.3.4 Upset Emissions

When a process upset occurs at the Facility, operating parameters that are tied to waste feed cutoffs are triggered. During the waste feed cutoff, all liquid wastes being fed to the RKI and FBI#2 are shut off almost instantaneously and residual liquid waste is burned within seconds. No additional drums are fed to the RKI and the only wastes of any significance would be those drummed wastes that have already been fed to the RKI. These wastes are floor dry material that normally does not contain significant quantities of organic compounds. In most cases the secondary combustion chamber will burn off any organics that may escape the incinerators after a process upset. The pollution control equipment remains operational during an upset condition. During a waste feed cutoff, the quantity and amount of waste burned during is minimal.

At the RKI and the FBI#2, there are 76 and 81 types of AWFCOs, respectively. The AWFCO events during 2011 were used to calculate upset emission factors. Four main categories of pollutant are considered: organics, Chlorine (HCl and Cl2), particulates, and metals. Each AWFCO condition that could cause a temporary increase in facility emissions was considered. In each case, the total time of occurrence is paired with instantaneous upset factors that reflect the level of potential short-term increases in contaminant emission rates (conservatively estimated from combustion dynamics, modes of release, control technology performance, and professional judgment). The ratios of AWFCO-specific upset emissions to stack emissions were used with the site-specific percentage of time in upset to calculate the process upset factor (PUF). Appendix M presents tables that provide information on the frequencies and effects of various types of WFCOs and the basis for the duration of upsets and the emission multiplier used to calculate the PUFs.

The RKI PUFs for metals and organics were calculated to be 1.429 and 1.196, respectively. The FBI PUFs for metals and organics were calculated to be 1.526 and 1.454, respectively. These PUFs were applied to the RKI and FBI metals and organics emission rates. The impact of process upsets on the results of the risk assessment is discussed in Section 6.3.2.3.

2.3.5 Estimates of the Total Organic Emission Rate

In order to account for unidentified organic compounds, TOE testing was conducted during the Comprehensive Performance Test/Trial Burn conducted in 2004. A TOE factor was calculated according to the SLERAP using the average TOE rate information collected during the Trial Burn (see Table 3.3-37 of the Trial Burn Report for the RKI (TRC, 2006a) and Tables 3.3-44 and 3.3-46 of the Trial Burn Report for the FBI (TRC, 2006b)). The TOE factor is defined by the guidance as the ratio of the TOE mass to the mass of identified organic compounds evaluated in the SLERA. The mass of identified organic compounds includes all detected and non-detected organic compounds evaluated in the risk assessment. Table 2-4 presents the calculation of the TOE factor. As shown in Table 2-4, the TOE Factor is 1.13. The application of the TOE Factor and its impact on the results of the risk assessment are discussed in Section 6.3.2.4.

2.4 Compounds of Potential Concern

The results of the Trial Burn were evaluated to select the COPCs for the SLERA. The selection of the COPCs focused on those compounds that were likely to pose the most risk to ecological receptors exposed to emissions from the facility (EPA, 1999). The selection focused on compounds that were likely to be emitted based on the potential presence of the compound or its precursors in the waste feed, or compounds that are potentially toxic to ecological receptors, and/or bioconcentrate in ecological receptors or bioaccumulate in higher trophic-level receptors. The following steps were performed in identifying the list of COPCs that were evaluated quantitatively in the SLERA, as shown on Table 2-5:

1. A list of all compounds specified in the analytical methods performed in the Trial Burn for the RKI and FBI#2 stacks was compiled (refer to Table 2-1).

2. A detection in any one of the sample components (e.g., front half rinse, XAD resin, condensate, Tenax tube) in any run constituted a detection for that specific

compound. As a conservative measure, no compounds were eliminated based on a comparison to laboratory blanks.

3. Detected compounds were selected as COPCs. Compounds that were not detected were selected as COPCs if they:

   - Are potentially present in the waste stream;
   - Are likely to be emitted as products of incomplete combustion (PICs);
   - Have a tendency to bioaccumulate or bioconcentrate (i.e., have log Kow values equal to or greater than 4.0, or for inorganics, have a whole body bioconcentration factor (BCF) equal to or greater than 100); or
   - Are within the top 30 TICs for which toxicity data or surrogate toxicity data is available.

4. PCDD/PCDFs and PCBs were included in the SLERA as required by the SLERA protocol (EPA 1999). However, the majority of PCDD/PCDF congeners analyzed for were not detected. Risks from individual PCDD/PCDFs are assumed to be additive (EPA, 1999). Therefore, individual PCDD/PCDFs concentrations in each media were converted to a 2,3,7,8-tetrachlorinated dibenzodioxin (TCDD) toxic equivalent (TEQ) using applicable toxic equivalency factors (TEFs) for birds, mammals or fish. The resulting TEQ were summed, and the total compared to the toxicity reference value (TRV) for 2,3,7,8-TCDD. For class-specific guild measurement receptors, computed congener-specific daily doses were converted to 2,3,7,8-TCDD TEQs and summed for comparison to applicable TRVs. A similar approach was used to evaluate dioxin-like (i.e., co-planar) polychlorinated biphenyls (PCBs), where a PCB TEQ was computed using PCB TEFs (EPA, 1999). Fate and transport properties for Aroclor 1254 were used in modeling dioxin-like PCBs (EPA, 1999), which introduces a level of uncertainty to the assessment.

Table 2-6 presents the COPCs and corresponding emission rates evaluated in the SLERA.

2.4.1 Estimating Concentrations for Non-Detect COPCs

As specified in EPA's protocol (1999), method appropriate detection limits were provided by the analytical laboratory and were used as the COPC concentration in determining emission rates for nondetect compounds in the list of COPCs evaluated in the SLERA.

3.0 AIR DISPERSION AND DEPOSITION MODELING

Data collected during the trial burn and other facility data were used as input to an air quality dispersion model used to predict one-hour and long-term average concentrations as well as long-term average deposition rates for pollutants emitted by MPM. The previous modeling analyses, conducted in September 2004, utilized the Industrial Source Complex Short Term (ISCST3) Model (Version 02035) (EPA, 1995). Since then, ISCST3 has been replaced by the AMS/EPA Regulatory Model (AERMOD; EPA, 2004) as U.S. EPA's guideline air quality model (EPA, 2005a). The modeling approach has been subsequently revised to utilize AERMOD and also follows revised EPA guidance (EPA, 1999 and 2005b).

3.1 Model Selection

The latest version of AERMOD (Version 11353) was used to predict airborne concentrations and surface deposition rates of emissions from the RKI, FBI and ancillary equipment. AERMOD is listed in the "Guideline on Air Quality Models" as a "preferred air quality model" applicable to industrial sources. The model was run in its "regulatory default mode" as recommended in the guidance.

3.2 Site Specific Information Required to Support Air Modeling

The MPM facility is located in the Town of Waterford, NY along Routes 4 and 32 and the west shore of the Hudson River, approximately 2 miles north of the Village of Waterford and 12 miles north of the City of Albany. Figure 3-1a presents a plot plan of the facility indicating the property fenceline and Figure 3-1b presents an aerial photograph showing the locations of the RKI and FBI. Figure 3-2 and 3-3 are USGS maps showing the plant location and terrain out to 10 km and 50 km from the plant, respectively. National Elevation Dataset (NED) 1 arc-second (about 30 meters) terrain height data files were obtained from the United States Geological Survey (USGS) for the area surrounding the plant (these files are included on the attached modeling CD ROM). All digital terrain data were handled using a Geographical Information System (GIS).

Digital land use and land cover (LULC) data were obtained from USGS corresponding to the 1:250,000 scale Albany quadrangle, with a resolution of 200 meters. These data were used to identify populated areas, forests, farms, etc. for the risk assessment. Following the Guideline on Air Quality Models, the LULC data within 3 km of the facility were categorized as urban or rural and were used to determine whether the emission sources require AERMOD's special urban source option. The land use analysis was performed objectively using ArcMap software and showed the area is 64 percent rural (see Table 3-1), and thus, following the guidance, the urban source option was not required.

Unlike ISCST3, AERMOD has its own special land use pre-processing program, AERSURFACE (Version Date 08009) which can calculate surface characteristics required for the AERMET meteorological pre-processing program. The newest land cover dataset which can be used with AERSURFACE is USGS's National Land Cover Dataset (NLCD) 1992. AERSURFACE used this dataset to determine surface characteristics for the onsite (primary) location and the Albany airport (secondary) location. AERSURFACE's input and output files are included on the attached modeling CD ROM.

Direction-specific building downwash parameters were input into AERMOD for the three point sources. The stack height analyses and the necessary model input downwash parameters were determined using EPA's BPIPPRM (Version Date 04274). Building dimensions were estimated using Pictrometry Online's height measurement tool, which bases measurements on aerial imagery taken from multiple flyovers of the facility (unique images available looking from the north, south, east, and west). Figure 3-4 shows a three-dimensional rendering of the building tiers as entered into BPIPPRM for analysis.

3.3 Source Locations and Emission Rates

AERMOD was used to model three point sources: FBI 1-North Stack (S1), FBI 2-South Stack (S2), and RKI Stack (S3), as shown in Figure 3-5. Stack parameters and UTM coordinates are shown in Table 3-2. Fugitive emissions were modeled as 10 volume sources, as shown in Figure 3-6. Their respective source parameters are shown in Table 3-3.

As specified by EPA guidance (1999 and 2005b), unit emission rates (1 g/s) were modeled for each emission source. Each source was modeled separately, so that source specific COPC emission rate could be combined with the predicted unitized concentration/deposition rates at each receptor node to calculate the impact of each source. Total facility impacts were calculated by adding the source specific impacts.

3.4 Partitioning of Emissions

As specified by the EPA guidance (1999 and 2005b), separate AERMOD model runs were made to predict vapor concentrations and deposition rates for vapor phase COPCs, particle phase COPCs (particle mass weighting) and particle-bound COPCs (particle surface area weighting). Tables 3-4, 3-5 and 3-6 present the particle fractionation data measured during the trial burns.

As a first step, vapors were modeled as 0.1 micron particles, which enabled AERMOD to model wet and dry deposition without the need of chemical specific parameters (such as the Henry's Law constant).

3.5 Meteorological Data

The AERMOD model requires observations of representative meteorological variables to calculate ambient concentrations of emissions from the proposed project. These data, which include both near surface and upper air meteorological observations, are used as input to the AERMET (Version Date 11059) meteorological pre-processing program. AERMET stores the observations in a specially formatted profile file (GES8889.PFL). AERMET also utilizes surface characteristics calculated from AERSURFACE, as described above, to calculate meteorological parameters (such as mechanical and convective mixing heights), which it stores in a surface file (GES8889.SFC).

Previously, the ISCST3 model was run using surface observation data (wind direction, speed, temperature, etc.) from the Halfmoon Cogeneration Project (HCP) in Halfmoon, New York as provided by NYDEC. The period of record for the meteorological observations is October 1, 1988 to September 30, 1989. The HCP meteorological tower was located near the Facility (approximately 1.1 km away) and is therefore representative for modeling applications in this region. The meteorological dataset received from NYSDEC was from the 100 meter level on the HCP tower and was complete, in ISCST3 model format, and had no missing data. This dataset was reformatted into an AERMET onsite input format, and provided the primary surface source of wind speed, wind direction, and temperature data. Data capture rates are provided in Table 3-7. A wind rose of the hourly surface winds is shown Figure 3-7. Note the winds predominately occur from the north and south, which is consistent with a flow of winds along the Hudson River Valley.

The HCP meteorological data lacked additional variables required by AERMET for a complete set of surface observations. These variables included hourly precipitation (needed to calculate deposition rates) and percentage of cloud cover (used to calculate stability-related parameters). These values were provided instead by surface observations collected at the nearest National Weather Service (NWS) station which is located in Albany, NY (WBAN 14735). The data was acquired from Webmet.com in SAMSON format. Data capture rates are provided in Table 3-8.

Upper air meteorological observations were provided by radiosonde measurements taken at NWS's Albany, NY station (WBAN 14735). The data was acquired from Webmet.com in TD-6201 format. Data capture rates are provided in Table 3-9.

3.6 AERMOD Model Input Files

AERMOD was run three times for each emission point source:

- A "vapor phase" run to predict concentration, dry deposition, wet deposition and total deposition for gaseous compounds (simulated as 0.1 micron particles),
- a "particle phase" run to predict concentration, dry deposition, wet deposition and total deposition for particles, and
- a "particle-bound phase" run to predict concentration, dry deposition, wet deposition and total deposition for compounds that condense on or coat the surface of particles emitted from the sources.

In addition, fugitive emissions were modeled exclusively as a "vapor phase" (0.1 micron particles). The appended CD ROM contains the AERMOD input files for all final modeling runs. Figures 3-8 through 3-17 present the AERMOD model input runstreams for each phase and each source.

The Control Pathway in AERMOD was set to run in the "regulatory default" (DFAULT) mode, following EPA recommendations (1999 and 2005b). Wet and/or dry plume depletion algorithms are included in each model run, as appropriate and both annual average and hourly predictions were made, following the recommendations of the risk assessment protocols. The model was run considering terrain elevations, however pollutant half-life and decay coefficients were not invoked.

In the Source Pathway, the source type was set to point sources for the stacks and volume sources for the fugitive emissions. Source locations were entered in UTM coordinates (NAD27, Zone 18). Point source variables (stack temperatures, exit velocities, particle size distribution as diameters and mass fractions) were based on the averages of these variables measured during the "risk burn" tests (see Tables 3-2, 3-4, 3-5, and 3-6). Particle densities were all assumed to be 1.0 g/cm^3, as recommended in the protocols. Building downwash parameters are also included for the point sources, as calculated by BPIPPRM.

The Receptor Pathway contains the nested Cartesian receptor grid. The grid has receptor nodes beyond the facility fenceline every 100 meters out to 2 km from the fenceline, 250 meters to 5 km, 500 m to 15 km and every 1,000 meters at further distances. In addition, receptors were placed every 50 meters along the fenceline of the facility. Each receptor node has an elevation calculated from AERMAP (Version Dated 11103) using USGS National Elevation Dataset 1 arc-second (about 30 meter) data. Figure 3-18 shows a map of the receptor node grid together with the USGS DEM quadrangles regions. Digital compilations of the receptor node grid are included in the input and output for each AERMOD run, included on the appended CD ROM. The locations of the maximum predicted one-hour and annual concentrations and deposition rates for the stacks and fugitive emissions are shown in Figures 3-19 and 3-20 respectively. Note that the predicted maxima are within 2 kilometers of the centroid of the sources, and thus contained well within the modeling grid.

The Meteorological Pathway specifies the one-year HCP meteorological data as supplied by the NYDEC. The height of the anemometer at the HCP site was 100 meters above grade. The meteorological input file is presented in the appended CD ROM.

3.7 Model Output

Maximum hourly (not used in the SLERA) and annual average AERMOD model output for each of the four runs (vapor, particle, particle-bound, and fugitive emissions) for each source was written to a plot file and subsequently transferred to Excel spreadsheets for use in the risk assessments. The plot files and spreadsheets are contained on the appended CD ROM.

4.0 PROBLEM FORMULATION

Problem formulation establishes the exposure setting used as the basis for exposure analysis and risk characterization. Problem formulation includes:

- Characterization of the exposure setting for identification of potentially exposed habitats in the assessment area;
- Development of food webs representative of the habitats to be evaluated;
- Selection of assessment endpoints relevant to food web structure and function; and
- Identification of measurement receptors.

4.1 Exposure Setting Characterization

The MPM Facility is situated adjacent to the Hudson River within a mosaic of agricultural land, successional shrubland, terrestrial and palustrine forest, aquatic habitat, and old-field patch (habitat) types. Habitats were characterized within a 10-km radius of the facility on July 19, 2004. The characterization included identifying habitat types present within the area of concern and potential ecological receptors (i.e., wildlife) that may utilize these habitats. The identification of all habitat types followed the terminology provided in Ecological Communities of New York State (Reschke, 1990).

Habitat types potentially impacted by airborne emissions from the facility were identified in the field through the use of (1) a wind rose plot generated using wind speed data (Figure 4-1); (2) a 10-km radius circle superimposed on a USGS topographic map (Figure 4-2); (3) LULC Maps (Appendix B); and (4) National Wetland Inventory (NWI) maps (refer to Figure 4-3). Within the area of interest, habitat types were characterized with particular attention to the habitats directly impacted by the prevailing winds. Given the geometry of the Hudson River valley, prevailing winds are oriented nearly exclusively in a north-south direction, with winds originating from the west to a lesser degree, as shown on Figure 4-1.

Nineteen separate habitats were encountered within the 10-km radius assessment area as described in Sections 4.1.1 through 4.1.3 below. The habitats were organized into three main types: terrestrial, palustrine wetland and aquatic. The terrestrial habitats consisted of two habitat types: forest and scrub/shrub/agricultural. Wetland habitats consisted of three types: emergent, forest and scrub/shrub. The aquatic habitats consisted of river or streams or impoundments. The following sections briefly discuss the 19 habitats encountered within the 10-km radius assessment area, organized by habitat type. Habitat descriptions incorporate both Reschke's published accounts (Reschke, 1990) and those observations made by TRC Ecologists during the July 2004 field visit.

4.1.1 Terrestrial Habitats

4.1.1.1 Forest

***Successional Northern Hardwood Stand* -** This is a broadly defined hardwood or mixed coniferous/deciduous stand type that occurs on sites that have been cleared for farming or logging (Reschke, 1990). Dominant tree species cited by Reschke include *Populus tremuloides* (quaking aspen)(observed), *Pinus strobus* (white pine (observed), *Ulmus americana* (American elm)(observed) in addition to *Quercus alba* (white oak)(observed only), *Q. rubra* (northern red oak)(observed only). Given that this forest type is dependent upon disturbance and a concomitant increase in understory light levels, dense stands of *Rhus copallinum* (sumac) and quaking aspen were also observed in the field.

This stand type is the dominant terrestrial forested stand observed within the area of interest.

***Hemlock-Northern Hardwood Stand* -** This stand type occurs on the mid to lower elevations of steep ravines and along the better-drained margins of swamps. Dominant tree species include *Tsuga canadensis* (eastern hemlock) (observed); *Acer saccharum* (sugar maple) (observed), white pine (observed); *Betula lenta* (sweet birch)(observed). In addition to these species, *Betula alba* (European white birch) was observed. As observed in the field, the understory is poorly developed and the shrub species *Viburnum acerifolium* (maple leaved viburnum) is dominant along with the herbs *Maianthemum canadense* (Canada mayflower) and *Dryopteris intermedia* (common wood fern).

***Pine Plantation* -** This stand type can consist of monotypic stands of white pine, *Pinus resinosa* (red pine), *P. rigida* (pitch pine), and *P. banksiana* (jack pine). As observed in the field, dense stands of red pine were observed adjacent to the Tomhannock Reservoir. There was very little in the way of an understory.

4.1.1.2 Scrub/Shrub/Agricultural

***Field Crops/Row Crops* -** As observed in the field, field crops consisted primarily of timothy, while row crops include *Zea* mays (corn). The agricultural component within the area of interest is considerable and quite nearly dominates the landscape.

***Pastureland* -** This is agricultural land set aside for grazing. Shrub species observed include scattered Rosa *multiflora* (multiflora rose).

***Rural Structure Exterior* -** This habitat type simply consists of the exterior surface of commercial buildings, barns, houses, and bridges.

Successional Old Field **-** As it was observed in the field, this is largely a low-stature, herbaceous community with scattered shrub and vine species including multiflora rose and *Celastrus orbiculatis* (oriental bittersweet). Herbaceous and graminoid species observed in the field include *Solidago rugosa* (goldenrod); *Dauca carota* (Queen Anne's Lace); *Bromus inermis* (smooth brome); *Dactylus glomeratus* (orchard grass); and *Phleum pratense* (timothy) amongst others.

Successional Shrubland - This community is a more advanced form of the old field in that shrub and sapling cover increases to approximately 50%. Tree species observed include *Juniperus virginiana* (E. red cedar), *Crataegus spp*. (hawthorns), along with thickets of *Cornus foemina* (gray dogwood). Herbaceous species and graminoids characteristic of the old field are also present, albeit at lover cover values.

4.1.2 Palustrine Wetland Habitats

Shrub Swamp - Dominant wetland shrub species observed in the shrub swamp habitat include *Sambucus canadensis* (American elder) and *Cornus amomum* (silky dogwood) with an admixture of *Ilex verticillata* (winterberry) and *Alnus rugosa* (speckled alder), *Vaccinium corymbosum* (highbush blueberry). Scattered herbaceous species include *Eupatorium maculatum* (spotted joe pye weed) and *Sparganium americanum* (American burreed). Surface water depths within this community type were highly variable and ranged from 0 to approximately 1.5 feet.

Reedgrass/Purple Loosestrife Marsh - Dominant species within the reedgrass/purple loosestrife community include *Lythrum salicaria* (purple loosestrife), *Phalaris arundinacea* (reed canarygrass), and *Phragmites australis* (giant reed). Surface water depths in this plant community were typically on the order of at least 0.5-1.0 feet. In certain instances, this wetland type was associated with a large body of open water or a stream.

Red Maple Swamp - Dominant wetland tree species include *Fraxinus pennsylvanica* (green ash), *Acer rubrum* (red maple), *Ostrya virginiana* (American hophornbeam), with scattered examples of *Platanus occidentalis* (sycamore), *Tsuga canadensis* (eastern hemlock), and rarely *Quercus bicolor* (swamp white oak). Dominant wetland shrub species include *Lindera benzoin* (spicebush) and *Vaccinium corymbosum* (highbush blueberry), with occasional examples of Ilex verticillata (winterberry) and Cephalanthus occidentalis (buttonbush). The few herbaceous species observed in the forested wetlands include *Carex stricta* (tussock sedge), *Carex lurida* (lurid sedge), *Polystichum achrostichoides* (Christmas fern), *Symplocarpus foetidus* (skunk cabbage), *Osmunda cinnamomea* (cinnamon fern), and *Sphagnum spp*.

Water depths were also highly variable in this community type and ranged from 0-0.5 feet.

4.1.3 Aquatic Habitats

Shallow Emergent Marsh - This is a marsh meadow community that occurs on soils that are permanently saturated and are seasonally flooded. During times of flooding in the spring water depths range from 0.5 to 3 feet. Typically, however, water depths during the growing season are either at or just below the soil surface. Dominant plant species observed in the shallow marsh community typically included *Phalaris arundinacea* (reed canarygrass) with lesser amounts of *Calamagrostis canadensis* (bluejoint) and *Carex stricta* (tussock sedge). Oftentimes, the shallow marsh was associated with stream edges, although it was also observed in large depressions in the landscape.

Deep Emergent Marsh - This habitat type was observed within portions of the Tomhannock Reservoir. Dominant aquatic plant species observed include *Nuphar luteum* (yellow pond lily), *Nymphaea odorata* (white pond lily) and *Myriophyllum spp*. (water milfoil). A dense thicket of interlocking speckled alder formed a fringe around the marsh. Water depths at this point in the reservoir were estimated to be at least 4 feet in depth.

Rocky Headwater Stream - This is the aquatic community of a small to moderate sized rocky stream with a very steep gradient. An alternating riffle/pool complex was noted in this stream type and flows were often quite vigorous, especially within the steep bed gradients. Channel width ranged from 2 to 4 feet, and water depths ranged from 3 inches to approximately 1 foot. This particular stream type was often associated with the Hemlock-hardwoods stand.

Main Channel Stream (Hudson River) - As it occurs within the vicinity of the Project Area, the Upper Hudson River is a freshwater environment. This is a direct consequence of the presence of the Federal Dam at Troy that separates the Upper Hudson from the Lower Hudson, which is an estuarine environment. Average annual freshwater discharge at the Federal Dam at Troy is 13,500 cubic feet per second (cfs). In general, Hudson River flow is highest during the spring (maximum flow is 32,000 cfs) and lowest during the summer and early fall (minimum is 7,000 cfs). Large stands of aquatic macrophytes including *Peltandra virginica* (arrow arum) were observed along the shores of the Hudson River. Given increased water depths, the swift attenuation of incoming light (due to high turbidity), and high flows in the center of the channel, aquatic plants were not observed.

Canal - Given the controlled flow of the Hudson River above the Troy Dam, canals are ubiquitous. The flow gradient is extremely gradual. Very little aquatic vegetation was noted in the canals.

Farm Pond/Artificial Pond - A number of farm ponds were observed throughout the study area, and were generally eutrophic. Clumps of *Lythrum salicaria* (purple loosestrife) were observed along the margins of many of these ponds.

Reservoir/Artificial Impoundment - This habitat type is represented by the Tomhannock Reservoir. The reservoir itself possesses a surface area of approximately 6.9E+06 square meters. Water entering the reservoir is collected from a watershed of 1.4E+08 square meters. The dominant plant communities noted adjacent to the reservoir include the pine plantation, the northern successional hardwoods stand, and the hemlock-hardwoods stand.

The dominant aquatic habitats identified for evaluation in the SLERA include the Hudson River and the Tomhannock Reservoir.

4.1.4 Identification of Ecological Receptors

The identification of ecological receptors during exposure setting characterization is used to define food webs specific to potentially impacted habitats. In accordance with the EPA guidance, ecological receptors were identified to ensure that plant and animal communities identified are represented by the food web for a given habitat and that complete exposure pathways are identified.

Given the enormous spatial extent of the area of interest and the broad range of habitat types contained therein, it can be expected that a correspondingly broad range of wildlife species including avian species, amphibians, reptiles, and mammals might be expected. A list of wildlife receptors either observed or expected to utilize a given habitat type is presented in Table 4-1 along with the particular feeding guild to which a wildlife receptor belongs. With regard to feeding guilds, C denotes a carnivorous species; H denotes an herbivorous species; O denotes an omnivorous species; I denotes an insectivorous species; G denotes a granivorous species; P denotes a piscivorous species; and F denotes a frugivorous species. With respect to diet type, the omnivorous red fox has been characterized as a carnivore for the purposes of this analysis (EPA, 1999). The list was compiled based on direct observations in the field and data sources, including inland fisheries texts specific to New York State (Lavett-Smith, 1985); published life history accounts of various wildlife species (DeGraaf, 1986); and the Wildlife Exposure Factors Handbook (EPA, 1993).

Brief summaries of wildlife receptors expected to be present within each habitat type including terrestrial, wetland, and aquatic habitats are provided in the following sections. Habitat types with a high degree of similarity with regard to wildlife species composition have been pooled for the purposes of evaluation in the SLERA.

4.1.4.1 Terrestrial Habitats

Forest Food Web - A varied assemblage of avian species representing a number of different feeding strategies is likely to inhabit the terrestrial forested stands within the study area. For example, shrub nesters such as the northern cardinal, chestnut-sided warbler, and the gray catbird are likely to nest and forage within this cover type. Other bird species potentially utilizing this habitat include the American robin and the blue jay. Where it occurs in the stand, early growth is also expected to provide additional foraging/nesting habitat for species such as the downy woodpecker, black-capped chickadee, thrushes and flycatchers. Raptors including the red-tailed hawk, Cooper's hawk, and the broad winged hawk can be expected in this habitat type. Tree nesters such as the eastern kingbird are expected, in addition to several species of swallows and owls. Based upon the results of the list of potential bird species within the successional northern hardwoods, the pine plantation, and the hemlock-northern hardwoods stand, a total of 66 avian species representing four feeding guilds were identified. Of the 63 avian species identified as potentially occurring within the terrestrial forested stands, 14.3% are carnivores, 28.6% are omnivores, 55.5% are insectivores, and 1.6% are frugivores.

Small mammals expected to occur in this habitat type include shrews, moles, the white footed mouse, and squirrels, while larger mammals include the eastern cottontail, woodchucks, the red fox and white-tailed deer. Mammals representing a broad range of foraging strategies are expected to use the patches of terrestrial forest within the study area. Twenty-two mammal species representing five foraging strategies were identified, 22.3% are omnivores; 36.4% are insectivores; 22.3% are herbivores; 13.6% are granivores; and 4.5% are carnivores.

Amphibian species expected to occur within the terrestrial forest type include a number of species of salamander including red back salamanders and the northern dusky salamander. Where streams occur, species such as wood frogs may also be observed. Of the 11 species that might be encountered in this habitat type, all are insectivores. Reptiles that might be expected to occur in the terrestrial forest type include the wood turtle, in addition to several species of snakes such as the eastern smooth green snake. Of the five species identified as potentially occurring in this habitat type, 20% are omnivores, 40% are carnivores, and the remaining 40% are insectivores.

Scrub/Shrub/Agricultural - Characteristic avian species that can be expected within agricultural habitats include the Canada goose, wild turkey, northern bobwhite, and the mourning dove. Shrub cover within the successional shrubland community will also provide habitat for species such as the American woodcock, which forages primarily on invertebrates. Raptors that may prey upon small mammals foraging in croplands or scrub/shrub include the red-tailed hawk, rough legged hawk, turkey vulture, and the broad-winged hawk. In an examination of the relative distribution by diet type for each of the 64 avian species, 1.6% are herbivores; 12.5% are carnivores; 34.4% are insectivores; 45.3% are omnivores; 1.6% are frugivores; and finally 4.7% consist of granivores.

Small mammals that might be expected to occur in this habitat type include the Virginia, opossum, deer mouse, white-footed mouse, eastern chipmunk, masked shrew, eastern mole, and the eastern cottontail, while larger mammals include the red fox, woodchuck and white tailed deer. In that the little myotis, little brown bat, and the big brown bat utilize structures, it is likely that these species will also be observed within agricultural habitats where farm buildings and attendant structures are present. The mammal community is comprised of 19 species. Of these 19 species 31.6% are omnivores; 36.8% are insectivores; 21.0% are herbivores; 5.3% are granivores; and 5.3% are carnivores.

The American toad is the only amphibian species that is expected to utilize this habitat type.

4.1.4.2 Wetland Habitats

The emergent dominated, scrub-shrub, and forested wetland communities are each expected to provide suitable habitat for a variety of semi-aquatic and terrestrial wildlife. Furthermore, the palustrine, forested areas contain greater vertical structural diversity and concomitantly greater niche differentiation than that observed in emergent dominated communities or shrub swamps.

With regard to the avian community, shrub nesters such as the grey catbird and the northern cardinal are likely to nest and forage in wetland habitats. Emergent dominated and scrub shrub communities are expected to provide habitat for avian species that may forage on invertebrates and/or seeds such as various sparrows (e.g. chipping sparrow), finches, brown-headed cowbird, American kestrel and the American woodcock. Additionally, swallows and the American robin are likely to forage on insects and several raptor species such as the broad-winged hawk are also likely to prey on small mammals. Of the 43 avian species that are expected to occur in this habitat type, 20.9% are carnivores; 4.6% are granivores; 39.5% are insectivores; 32.5% are omnivores; and 2.3% are frugivores.

A number of small mammal species such as the Virginia opossum and the short tailed shrew are also likely to occur in the forested wetlands in addition to a number of other herbivores, omnivores, and insectivores. Small mammals found in wetland habitats throughout the year (with the exception of flooding events) include herbivores (meadow vole); omnivores (white-footed mice and woodland jumping mice); and insectivores (short-tailed and masked shrews, bats). Larger herbivorous mammals such as white tailed deer and muskrat, in addition to omnivorous species such as the Virginia opossum and raccoon are also likely to forage on the vegetation or the invertebrates and amphibians present within the wetland communities. Predators such as the red fox will prey on small mammals inhabiting wetland communities. A total of 21 mammal species were identified as potentially occurring across the three wetland types. Of the 21 species, 4.7% are carnivores; 42.8% are insectivores; 28.6% are omnivores; and 23.8% are herbivores.

Within those wetland communities where areas of standing water are present, but are free of fish populations, suitable amphibian breeding habitat may occur. Specifically, the seasonally ponded water present in certain wetlands may provide vernal pool habitat for aquatic species, including spotted salamanders. Amphibians such as the spotted salamanders breed almost exclusively in vernal pools and are referred to as obligate vernal pool species. Obligate species include those vertebrate and invertebrate species that rely on vernal pools for all or a portion of their life cycle and are unable to successfully complete their life cycle without vernal pools. In addition to these species, spring peepers will also utilize vernal pool habitat, yet are not completely dependent on this type of habitat and are referred to as facultative species. Facultative species include those vertebrate and invertebrate species that can use vernal pool habitat for all or a portion of their life cycle, but are able to successfully complete their life cycle without vernal pools. All of the species just discussed would utilize adjacent upland habitat as foraging areas during the remaining portions of the year when they are active. Of the 11 amphibian species, 81.8% are insectivores while the remaining 18.2% are carnivores.

Several turtle and snake species are also likely to breed within areas of standing water in emergent and other open wetland community types including the painted turtle and terrestrial species such as the northern redbelly snake and the northern black racer. The reptile community is comprised of 20% omnivores; 40% insectivores; and 40% carnivores.

4.1.4.3 Aquatic Habitats

A diverse assemblage of waterfowl, wading birds, and shorebirds representing a variety of feeding guilds may utilize the aquatic habitats. These species may be attracted by the presence of aquatic vegetation and benthic macroinvertebrates inhabiting bottom substrates and vegetation. Fish present in aquatic environments may also provide food for wading birds such as green-backed herons and piscivorous species such as the belted kingfisher. Aerial screeners such as the various swallows are likely to feed on emerging insects above the given water body. Carnivorous species include the American bittern, the American kestrel, the great blue heron, the snowy egret, and the green-backed heron. Of the 42 avian species noted as potentially occurring within or near to aquatic habitats, 11.9% are piscivorous; 14.3% are carnivorous; 33.3% are omnivorous; 2.4% are herbivorous; 33.3% are insectivorous; and 4.8% are granivorous.

Herbivorous rodents, including aquatic species such as the muskrat and the beaver, may inhabit these types of habitats. Emerging aquatic insects would provide an important food source for bats in the vicinity of the site. Species such as the little brown bat and the big brown bat are often associated with structures near aquatic habitats, and species such as the red bat and the silver-haired bat might also be expected. Other mammals such as the herbivorous muskrat, piscivorous mink, and river otter may also occasionally forage on fish, amphibians, and larger macroinvertebrates such as crayfish. Other mammals that might be expected in this habitat type include the Virginia opossum and the short-tailed shrew. The mammalian community is comprised of 21 species that are distributed across five diet types. Of the 21 species, 19.1% are omnivores; 38.1% insectivores; 23.8% herbivores; 9.5% are piscivores; and 4.5% are carnivores.

A variety of amphibian and reptilian species may use the aquatic habitats associated with the shallow and deep marsh communities and other fish-free aquatic habitats. Examples of these amphibians include the green frog and the bullfrog. Additional amphibians may use the aquatic habitat as breeding or foraging habitat. At other times of the year, these species may forage within uplands or wetlands located adjacent to the aquatic habitat. The amphibian community is comprised of 83.3% insectivores and 16.6% carnivores.

Several species of snakes and turtles are also expected to inhabit aquatic habitats associated with the shallow and deep marsh communities, the Hudson River, and the Tomhannock Reservoir. Snake species that may be present are generally carnivorous and include the northern water snake and the eastern ribbon snake. Turtle species potentially present are generally omnivorous species that forage along bottom substrate. Egg deposition for several of these species, including the common snapping turtle and painted turtle, is usually in close proximity to an aquatic habitat such as a riverbank for example. The amphibian community is evenly divided across omnivores (33.3%), carnivores (33.3%), and insectivores (33.3%).

4.1.5 Selection of Exposure Scenario Locations

The air modeling results indicate that in general, the highest unitized air parameters corresponded to receptor nodes located near the facility for all three stacks. Terrestrial forest, scrub/shrub/agricultural and wetland habitats were identified in the vicinity of the facility based on a review of data collected during the site survey, recent aerial photographs, USGS topographical maps, NWI maps and LULC maps. The habitats identified in the vicinity of the facility are shown on Figure 4-4. As a conservative measure, the maximum value for each unitized air parameter was selected for use in in the SLERA.

Two aquatic habitats were also evaluated in the SLERA: the Hudson River and the Tomhannock Reservoir. Both are significant aquatic habitats that may be impacted by aerial deposition from the facility. The effective watershed for the Hudson River was established as a 10-km radius circle centered at the facility as shown on Figure 4-5. This effective watershed captures the maximum impact from aerial deposition without incorporating areas of the watershed where little or no deposition is likely to occur. The receptor nodes located within the effective area of the Hudson River and watershed are shown on Figures 4-6 and 4-7. The Tomhannock Reservoir and its watershed were also evaluated. The Tomhannock Reservoir watershed was delineated as shown on Figure 4-5. It is possible that aerial deposition could occur over the watershed. Therefore, the entire watershed was evaluated. The receptor nodes located with the Tomhannock Reservoir and watershed are shown on Figures 4-8 and 4-9.

Average unitized air parameter values were calculated for each water body and watershed based on a weighted average approach, since receptor node spacing is not uniform across each area. The weighted average unitized parameter values were calculated by multiplying each receptor node value by the area represented by that receptor node, summing all receptor node values then dividing by the total area represented by the receptor nodes.

The unitized air parameter values used in modeling environmental media concentrations for each habitat corresponding to these receptor node locations are included on the spreadsheets used to calculate COPC impacts for each habitat. These spreadsheets are provided in Appendix C.

4.2 Food Web Development

Habitat-specific food web(s) were developed for the four major habitat types evaluated in the SLERA: forest, wetland, scrub/shrub/agricultural and aquatic. The food webs were developed using the information on identified ecological receptors and corresponding feeding strategies for each habitat type as discussed in Section 4.1 and incorporate threatened or endangered species as specific measurement endpoints as appropriate. The food webs are provided in Appendix D.

4.3 Selecting Assessment Endpoints

Assessment endpoints represent expressions of an ecological attribute that is to be protected (EPA, 1996b). The selection of the assessment endpoints considered the following:

- Existing habitats and species potentially present in the study area;
- Contaminants present and their modeled concentrations;
- Modes of toxicity to various receptors by contaminants;
- Ecologically relevant receptors that are potentially sensitive or likely to be highly exposed to life history attributes; and
- Potentially complete exposure pathways.

The selected assessment endpoints represent both community level endpoints (e.g., soil, surface water, sediment) and population level endpoints (e.g., survival, growth and reproduction of particular guilds, such as carnivorous birds). Assessment endpoints were selected that represent a critical ecological attribute for each community and class-specific guild for each trophic level for the food webs evaluated in the SLERA. Table 4-2 lists the assessment endpoints for the SLERA.

Measurement Receptors - In order to evaluate the potential effects of air emissions from the facility on ecological receptors, receptors representative of the assessment endpoints were selected for each community and class-specific guild. Individual species were selected for class-specific guilds based on the following criteria (EPA, 1999):

- Ecological relevance;
- Exposure potential;
- Degree of sensitivity to COPCs;
- Social or economic importance; and
- Availability of natural history information such as body weight and food, water, soil, and sediment ingestion rates.

4.3.1 Measurement Receptors for Communities

For soil communities, soil invertebrates and terrestrial plant communities are the measurement receptors. For sediment communities, benthic invertebrate communities are the measurement receptors. For surface water communities, water invertebrates, phytoplankton, zooplankton and fish communities are the measurement receptors. As directed by EPA (EPA 2006), fish were evaluated by comparing fish tissue concentrations calculated for herbivorous/planktivorous, omnivorous, and carnivorous fish with available fish tissue TRVs. However, AWQC were developed "to protect fish, benthic invertebrate and zooplankton assemblages in lakes, reservoirs, estuaries, and oceans" (USEPA 1985). Therefore, for those compounds for which fish tissue TRVs are not available, the comparison of calculated surface water chemical concentrations to AWQC is also considered protective of fish.

4.3.2 Food Web Measurement Receptors

Based upon the five factors considered in determining measurement receptors, 14 indicator species were selected as representative of the broad range of habitat types within the assessment area. Specific indicator species include the American kestrel (*Falco sparverius*); American robin (*Turdus migratorius*); canvasback (*Aythya valisneria*); deer mouse (*Peromyscus maniculatus*); great blue heron (*Ardea herodias*); mallard (*Anas platyrhynchos*); mink (*Mustela vision*); mourning dove (*Zenaida macroura*); muskrat (*Ondrata zibethicus*); northern bobwhite (*Colinus virginanus*); red fox (*Vulpes vulpes*); red-tailed hawk (*Buteo jamaicensis*); short-tailed shrew (*Blarina brevicauda*); and, white-footed mouse (*Peromysus leucopus*). These measurement receptors are denoted in italics in the food webs provided in Appendix D. A brief discussion of the underlying rationale for the selection of each measurement follows.

American Kestrel - The American kestrel was selected as a measurement receptor for carnivorous bird guild. It can be found in marsh habitat and was selected for evaluation for the aquatic and wetland food webs based on the following information:

- The kestrel is important in regulating small mammal populations through predation.
- The kestrel's prey includes a variety of invertebrates as well as small to medium-sized birds and mammals.
- The availability of natural history information and the higher ingestion rate on a body weight basis supported the selection of this species as a conservative measurement receptor.

American Robin - The American robin inhabits forested areas but prefers to forage in open areas containing herbaceous vegetation. Although there is a seasonal trend in the diet of the robin, diet composition includes seeds and fruits (which are dispersed via excrement) as well as invertebrates including insects and worms. The robin is fairly representative of a ground-feeding omnivore that might be exposed to contaminants that might accumulate in both plants and invertebrates. This species was identified as an ecological receptor within the study area and was selected as a measurement receptor for the omnivorous bird guild for the wetland and forest food webs based on the following information (EPA, 1999):

- The American robin eats a wide variety of foods including fruits and berries, worms, grubs and caterpillars.
- The robin serves an important function in seed dispersion.
- Habitats include forests, wetlands, open woodlands and fields.
- The American robin has a small home range and would tend to have a higher potential for exposure than other receptors.
- The availability of natural history information (e.g., ingestion rates and body weights).

Canvasback - Although the Canada goose was identified as an ecological receptor within the study area, the canvasback was selected as the measurement receptor for the herbivorous bird guild in the aquatic food web due to the availability of modeling parameters data (e.g., BCFs). The selection of the canvasback as the measurement receptor for the herbivorous bird guild is conservative due to the higher ingestion rate on a body weight basis than the Canada goose. The canvasback is also a suitable measurement receptor based on the following information:

- The Canvasback serves an important function in seed dispersion.
- The Canvasback eats invertebrates and aquatic vegetation.

The natural history data for the lesser scaup (*Aythya affinis*) was used to represent the Canvasback (EPA, 1999a).

Deer Mouse - The deer mouse was identified as an ecological receptor within the study area and was selected as the measurement receptor for the herbivorous mammal guild in the forest and scrub/shrub/agricultural food webs based on the following information (EPA, 1999a):

- The deer mouse is an important prey species for higher trophic level mammals, birds and reptiles.
- The Deer mouse services an important function in seed dispersion.
- The Deer mouse has a small home range and would tend to have a higher potential for exposure than other receptors.
- The availability of natural history information (e.g., ingestion rates and body weights).

Great Blue Heron - The great blue heron was identified as an ecological receptor within the study area and was selected as the measurement receptor for the carnivorous shore bird in the aquatic food web based on the following information (EPA, 1993):

- The great blue heron inhabits lakes, ponds, rivers and marshes.
- The great blue heron is a high trophic level predator that feeds on fish, frogs, insects and reptiles.
- The availability of natural history information (e.g., ingestion rates and body weights).

Mallard - The mallard was identified as an ecological receptor within the study area and was selected as the measurement receptor for the omnivorous bird guild in the aquatic food web based on the following information (EPA, 1993 and 1999):

- The Mallard inhabits rivers, lakes, marshes and swamps where it feeds on plants, seeds, insects and occasionally crustaceans and mollusks.
- Mallards are exposed to contaminants as they forage on both plants and invertebrates with shallow water and sediment.
- The mallard is an important seed disperser.
- The Mallard is an important game species.
- The availability of natural history information (e.g., ingestion rates and body weights).

Mink - The mink was identified as an ecological receptor within the study area and was selected as the measurement receptor for the carnivorous mammal guild for the aquatic food web based on the following information (EPA, 1999):

- The mink is a high trophic level predator that provides an important component to the ecosystem by influencing the population dynamics of their prey. They in turn are prey for other carnivores, such as fox, bobcats and great-horned owls.
- The mink inhabits rivers, creeks, lakes and marshes where they consume small mammals, fish, birds, reptiles, amphibians, crustaceans and insects.
- Home ranges of mink are often correlated with the shape of the water body they inhabit, while the use of areas within the home range depends on prey availability.
- They have been shown to be sensitive to PCBs and similar chemicals and have a high potential for exposure due to their aquatic diet and direct contact with media.
- The availability of natural history information (e.g., ingestion rates and body weights).

Mourning Dove - The mourning dove was identified as an ecological receptor within the study area and was selected as the measurement receptor for the herbivorous bird guild for the forest, wetland and scrub/shrub/agricultural food webs based on the following information (EPA, 1999):

- The mourning dove inhabits open woodlands, forests and croplands.
- The mourning dove plays an important functional role in seed dispersion as its main food source is seeds.
- The mourning dove has a high potential for exposure through the ingestion of inorganic contaminants.
- The availability of natural history information (e.g., ingestion rates and body weights).

Muskrat - The muskrat was identified as an ecological receptor within the study area and was selected as the measurement receptor for the herbivorous mammal guild for the aquatic food web based on the following information (EPA, 1993 and 1999):

- The muskrat is an important prey species for hawks, mink and red fox.
- The muskrat is important to the overall structure of the aquatic habitat through the regulation of aquatic vegetation diversity and biomass.
- The roots and basal portions of aquatic plants make up most of the muskrat’s diet although some muskrats are omnivorous.
- The availability of natural history information (e.g., ingestion rates and body weights).

Northern Bobwhite - The northern bobwhite was identified as an ecological receptor within the study area and was selected as the measurement receptor for the omnivorous bird guild for the scrub/shrub/agricultural food web based on the following information (EPA, 1999):

- The northern bobwhite inhabits brushy pastures, grassy roadsides, farmlands, and open woodlands where it feeds on seeds and invertebrates and plants during the winter months.
- The northern bobwhite plays an important role in seed dispersion and is an important prey species for snakes and small mammals.
- The availability of natural history information (e.g., ingestion rates and body weights).

Red Fox - The red fox was identified as an ecological receptor within the study area and was selected as the measurement receptor for the carnivorous mammal guild for the forest, scrub/shrub/agricultural and wetland food webs based on the following information (EPA, 1993 and 1999):

- Red fox have a high potential for exposure due to bioaccumulation through the food chain and regulate lower trophic level prey.
- The majority of their diet consists of meadow voles, mice and rabbits, whereas birds are seasonally important food items along with plant material such as fruits, berries and nuts to a lesser extent.
- The availability of natural history information (e.g., ingestion rates and body weights).

Red-Tailed Hawk - The red-tailed hawk was identified as an ecological receptor within the study area and was selected as the measurement receptor for the carnivorous bird guild for the forest and scrub/shrub/agricultural food webs based on the following information (EPA, 1999):

- The red-tailed hawk inhabits forests and open grasslands.
- The red-tailed hawk is a high trophic level predator.
- The red-tailed hawk ingestions small mammals, birds, lizards, snakes and large insects.
- The red-tailed hawk has shown sensitivity to may chemicals which disrupt reproduction or egg development.
- The availability of natural history information (e.g., ingestion rates and body weights).

Short-Tailed Shrew - The short-tailed shrew was identified as an ecological receptor within the study area along with the water shrew and the masked shrew. The short-tailed shrew inhabits woods and wet areas, including pond margins, while the water shrew predominately inhabits streams or lake margins. The short-tailed shrew was selected as representative of the shrews that inhabit wetland and aquatic habitats for the measurement receptor for the omnivorous mammal guild in the aquatic and wetland food webs based on the availability of modeling parameter data. Shrews were selected based on the following information (EPA, 1999):

- The shrew is an important prey species for higher trophic level species such as mink and weasels.
- The shrew has a high ingestion rate relative to body weight.
- Their diet is comprised of aquatic and terrestrial invertebrates, which makes the shrew a sensitive indicator species given the exposure to contaminants accumulated in invertebrates.
- The short-tail shrew has a small home range and would tend to have a higher potential for exposure than other receptors.
- Burrowing activity along with their feeding strategy increases the potential for contact with contaminants.
- The Short Tailed Shrew was selected based on the availability of natural history information (e.g., ingestion rates and body weights).

White-Footed Mouse - The white-footed mouse was identified as an ecological receptor within the study area and was selected as the measurement receptor for the omnivorous mammal guild for the forest and scrub/shrub/agricultural food webs based on the following information (EPA, 1999):

- The white-footed mouse is an important prey species for higher trophic level animals such as the red-tailed hawk, snakes and the red fox.
- The white-footed mouse feeds on nuts, seeds, fruits and insects.
- The availability of natural history information (e.g., ingestion rates and body weights).

4.3.3 Species of Concern

A search of the Federal Lands and Indian Reservations of the United States (USGS, 2004) indicated that there are no federal or state refuges within the modeling domain. With regard to the presence/absence of rare, threatened and/or endangered species, the US Fish and Wildlife Services (USFWS's) list of threatened or endangered species in New York indicates that the Bald Eagle and Indiana Bat may inhabit the area, along with small whorled pogonia, a plant species and the karner blue butterfly (refer to database information provided in Appendix E). However, the habitat for the karner blue butterfly may not extend north into the assessment area. At the state level, NYSDEC's Natural Heritage Program was contacted on September 16, 2004 for information on threatened, endangered or special concern species that may be present in the vicinity of the facility. Based upon written correspondence received from the NYSDEC dated September 17, 2004, there are several records of state-listed rare, threatened, and endangered species within the 10-km study area. Specifically, records of fishes, invertebrates, bivalves, and a large number of vascular plants have been recorded, as have records of a shale cliff/talus community and 14 vernal pools located on Peebles Island. No mammal or avian species were identified; however, a review of NYSDEC data on their website indicates that the bald eagle, peregrine falcon and Indiana bat may inhabit or forage in the vicinity of the facility. According to the USFWS, the bald eagle has wintering grounds north of the facility at the confluence of the Hoosik and Hudson Rivers and may forage within the assessment area; the Indiana bat may inhabit the area; and the peregrine falcon has been observed on bridges in Albany, south of the assessment area (USFWS, 2004). The bald eagle is a state and federally listed threatened species, the Indiana bat is a state and federally listed species, and the peregrine falcon is a state-listed endangered species. In addition, the shortnose sturgeon may also be found in Hudson River south of the facility within the assessment area. Due to the availability of life history data and the likely presence within the assessment area, the bald eagle and Indiana bat were evaluated as measurement receptors in the SLERA. As directed by USEPA (USEPA 2006), fish species were evaluated by comparing calculated fish tissue concentrations with available fish tissue TRVs. The shortnose sturgeon is considered an omnivore, as it eats insects, crustaceans and small mollusks. Therefore, this species was evaluated through the comparison of calculated fish tissue concentrations for the omnivorous fish to available TRVs. However, AWQC were developed “to protect fish, benthic invertebrate and zooplankton assembleges in lakes, reservoirs, estuaries, and oceans” (USEPA 1985). For those compounds for which TRVs are not available for comparison to fish tissue concentrations, the comparison of surface water chemical concentrations to AWQC is also considered protective of fish. Database listings obtained from NYSDEC and USFWS websites and information on these species are provided in Appendix E.

Bald Eagle - The bald eagle is identified as a state and federally listed threatened species that may inhabit the region in the vicinity of the facility based on the presence of suitable nesting and foraging habitat. Bald eagles prefer undisturbed areas near open water along large lakes or reservoirs and rivers (refer to USFWS and NYSDEC information provided in Appendix E). The bald eagle was evaluated for the two aquatic food webs, Hudson River and Tomhannock Reservoir.

Indiana Bat - The Indiana bat is identified as a state and federally listed endangered species that may be found during the summer months in the vicinity of the facility where suitable foraging habitat exists. The Indian bat is an insectivore and forages for insects along the corridors of aquatic habitats, upland forests and old fields (refer to information provided in Appendix E). The Indiana bat was evaluated for the Hudson River and Tomhannock Reservoir aquatic food webs, the forest food web and the scrub/shrub/agricultural food web.

5.0 EXPOSURE ASSESSMENT

The exposure assessment evaluates the exposure of a measurement receptor to a COPC and evaluates the toxicity of a COPC to a measurement receptor. Ecological receptors within the assessment area were evaluated through the following exposure pathways: direct uptake pathways from media for lower trophic level receptors evaluated at the community level and ingestion of a COPC-contaminated organism (plant or animal food item) and media for higher trophic level receptors evaluated as class-specific guilds (EPA, 1999a). Due to limited data, inhalation and dermal exposure pathways for upper trophic level organisms, ingestion via grooming and preening, and foliar uptake of dissolved COPCs by aquatic plants were not evaluated in the SLERA (EPA, 1999a).

5.1 Exposure to Community Measurement Receptors

For community measurement receptors (e.g., water, sediment, soil and plant communities), the exposure assessment consisted of determining COPC concentrations for each media of concern (including plant tissue). Soil, water, sediment, soil and plant concentrations were calculated using the equations provided in Appendix F. The modeling parameter values used in estimating the media concentrations are provided in Appendix G, including physical/chemical parameters, BCFs and TEFs. Soil concentrations were calculated assuming soil was untilled for all terrestrial habitats (i.e., COPCs were incorporated into the top 1 centimeter (cm) of soil, rather than being incorporated into the top 20 cm). Plant tissue concentrations were calculated assuming that roots were in contact with untilled soil COPC concentrations. This is a conservative assumption due to the dilution that occurs as COPCs are incorporated into the top 20 cm of soil during tilling. The COPC concentrations in soil, sediment, surface water and plants are provided in Appendix H.

5.2 Exposure to Class-Specific Guild Measurement Receptors

For class-specific guild measurement receptors, exposure was assessed by quantifying the COPC daily dose ingested of contaminated food items and media within the specific habitat supporting the food web being evaluated. The daily dose ingested was calculated using the following general equation:

$$DD = \sum IR_F \times C_i \times P_i \times F_i + \sum IR_M \times C_M \times P_M$$

where

DD	=	Daily dose of COPC ingested (mg COPC/kg BW-day)
IR_F	=	Measurement receptor plant or animal food item ingestion rate (kg/kg BW-day)
Ci	=	COPC concentration in i^{th} plant or animal food item (mg COPC/kg)
Pi	=	Proportion of i^{th} food item that is contaminated (unitless)
Fi	=	Fraction of diet consisting of plant or animal food item i (unitless)
IR_M	=	Measurement receptor media ingestion rate (kg/kg BW-day [soil or bed sediment] or L/kg BW-day [water])
C_M	=	COPC concentration in media (mg/kg [soil or bed sediment] or mg/L [water])
P_M	=	Proportion of ingested media that is contaminated (unitless)

For measurement receptors ingesting more than one plant or animal food item, exposures were determined assuming that the measurement receptor ingested an equal diet and an exclusive diet, as recommended by the EPA (EPA, 1999).

The following assumptions were made for the SLERA:

- The COPC concentrations estimated to be in food items and media ingested are bioavailable and each food item is assumed to be 100% contaminated;
- Only contributions of COPCs from the emission sources are considered in estimating COPC concentrations in food items and media;
- The measurement receptor's most sensitive life stage is present in the assessment area
- The body weights and food ingestion rates for measurement receptors are conservative;
- Each individual species in a community or class-specific guild is equally exposed; and
- The measurement receptor feeds only in the assessment area, (i.e., P_i is assigned a value of 1.0).

The spreadsheets used to calculate the daily dose ingested for each measurement receptor for each habitat are presented in Appendix I.

5.2.1 Ingestion Rate for Measurement Receptors

Species-specific ingestion rates of food items and media were obtained from the EPA guidance (1999) or the "*Wildlife Exposure Factors Handbook*" (EPA, 1993), as a secondary source, for all measurement receptors evaluated in the SLERA. The Little brown bat was used as a surrogate for the Indiana bat, and ingestion rate values were obtained from *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants* (Sample et al, 2007). Species-specific ingestion rates are summarized in Table 5-1. Food and water ingestion rates are presented on a wet weight basis and soil and sediment ingestion rates are presented on a dry weight basis.

5.2.2 COPC Concentrations in Food Items

The COPC concentrations in food items of the measurement receptors were calculated as provided in the following sections. Food items include invertebrates, aquatic and terrestrial plants and prey species.

5.2.2.1 COPC Concentrations in Invertebrates, Plants and Fish

COPC concentrations in invertebrates and aquatic plants food items of measurement receptors were calculated using BCFs and the following equation:

$$C_i = C_M \times BCF$$

where

BCF	=	Bioconcentration factor, soil or sediment to invertebrate (unitless for soil and sediment, L/kg for water)
C_i	=	COPC concentration in plant or invertebrate food item (mg COPC/kg)
C_M	=	COPC concentration in media (mg/kg for soil and sediment or mg/L in water)

The COPC concentrations for invertebrate and aquatic plant food items for each aquatic habitat are provided in Appendix J.

5.2.2.2 COPC Concentration in Terrestrial Plants

The COPC concentrations in terrestrial plants were determined by summing the plant concentration due to direct deposition, air-to-plant transfer and root uptake as follows:

$$C_{TP} = P_d + P_v + P_r$$

where

C_{TP}	=	COPC concentration in terrestrial plants (mg COPC/kg WW)
P_d	=	COPC concentration in plant due to direct deposition (mg/kg WW)
P_v	=	COPC concentration in plant due to air-to-plant transfer (mg/kg WW)
P_r	-	COPC concentration in plant due to root uptake (mg/kg WW)

The equations that were used to calculate P_d, P_v, and P_r are presented in Appendix F. The calculated plant tissue COPC concentrations (C_{TP}) for each terrestrial habitat evaluated are provided in Appendix H. The air-to-plant transfer coefficients are provided in Appendix G.

5.2.2.3 COPC Concentration in Fish

The COPC concentrations in fish were determined by multiplying the COPC-specific BCF and trophic level-specific food-chain multiplier (FCM) by the dissolved water concentration, as follows:

$$C_F = BCF \times FCM \times C_{dw}$$

where

C_F	=	COPC concentration in fish (mg/kg)
BCF	-	Bioconcentration factor for water-to-fish (L/kg)
FCM	-	Food-chain multiplier (unitless)
C_{dw}	-	Dissolved phase water concentration (mg/L)

The BCF values used in calculating fish tissue concentrations were obtained from the EPA guidance (1999) and are provided in Appendix G. The FCM used to calculate the COPC concentration in higher trophic level fish is representative of the trophic level of the fish ingested by the measurement receptor. The FCM values are provided in Appendix G. COPC tissue concentrations in fish are provided in Appendix J for each habitat. Note that these COPC tissue concentrations calculated for herbivorous/planktivorous, omnivorous and carnivorous fish were compared to available fish tissue TRVs as requested by USEPA (2006) for the purpose of evaluating potential impacts to fish.

5.2.2.4 COPC Concentration in Mammals and Birds

The equations that were used to estimate COPC tissue concentrations in food items of mammalian and avian measurement receptors are presented in the following sections, organized by the guild to which the prey or food item belongs.

5.2.2.5 COPC Concentration in Herbivorous Mammals and Birds

The COPC concentrations in herbivorous mammals and birds were calculated by summing the contribution due to ingestion of contaminated plant food items and media as follows:

$$C_H = \sum (C_{Pi} \times BCF_{Pi\text{-}H} \times P_{Pi} \times F_{Pi}) + (C_{s/sed} \times BCF_{S/BS\text{-}H} \times P_{S/BS}) + (C_{wctot} \times BCF_{W-H} \times P_W)$$

where

C_H	=	COPC concentration in herbivore (mg/kg)
C_{Pi}	=	COPC concentration in *i*th plant food item (mg/kg)
$BCF_{Pi\text{-}H}$	=	Bioconcentration factor for plant-to-herbivore for *i*th plant food item (unitless)
P_{Pi}	=	Proportion of *i*th plant food item in diet that is contaminated (unitless)
F_{Pi}	=	Fraction of diet consisting of *i*th plant food item (unitless)
$C_{s/sed}$	=	COPC concentration in soil or bed sediment (mg/kg)
$BCF_{S/BS\text{-}H}$	=	Bioconcentration factor for soil-to-plant or bed sediment-to-plant (unitless)
$P_{S/BS}$	=	Proportion of soil or bed sediment in diet that is contaminated (unitless)
C_{wctot}	=	Total COPC concentration in water column (mg/L)
$BCF_{W\text{-}HM}$	=	Bioconcentration factor for water-to-herbivore (L/kg)
P_w	=	Proportion of water in diet that is contaminated (unitless)

For prey species that ingest more than one plant or animal food item, exposures were determined assuming that the species ingests an equal diet, as recommended by the EPA (EPA, 1999). The equations that were used to estimate COPC concentrations in media are presented in Appendix F. The COPC tissue concentrations in herbivorous mammals and bird prey species are presented in Appendix J.

5.2.2.6 COPC Concentration in Omnivorous Mammals and Birds

The COPC concentrations in omnivorous mammals and birds were calculated by summing the contribution due to ingestion of contaminated animal and plant food items and media as follows:

$$C_{OM} = \sum \left(C_{Ai} \times \frac{FCM_{TL3}}{FCM_{TLn=Ai}} \times P_{Ai} \times F_{Ai} \right) + \sum (C_{Pi} \times BCF_{Pi\text{-}OM} \times P_{Pi} \times F_{Pi}) + (C_{s/sed} \times BCF_{S/BS\text{-}OM} \times P_{S/BS}) + (C_{wctot} \times BCF_{W-OM} \times P_W)$$

where

C_{OM}	=	COPC concentration in omnivore (mg/kg)
C_{Ai}	=	COPC concentration in *i*th animal food item (mg/kg)
FCM_{TL3}	=	Food chain multiplier for trophic level 3 (unitless)
FCM_{TLn-Ai}	=	Food chain multiplier for trophic level of *i*th animal food item (unitless)
P_{Ai}	=	Proportion of *i*th animal food item in diet that is contaminated (unitless)
F_{Ai}	=	Fraction of diet consisting of *i*th animal food item (unitless)
BCF_{Pi-OM}	=	Bioconcentration factor for plant-to-omnivore for *i*th plant food item (unitless)
C_{Pi}	=	COPC concentration in *i*th plant food item (mg/kg)
P_{Pi}	=	Proportion of *i*th plant food item that is contaminated (unitless)
F_{Pi}	=	Fraction diet consisting of *i*th plant food item (unitless)
$C_{s/sed}$	=	COPC concentration in soil or bed sediment (mg/kg)
$BCF_{S/BS-OM}$	=	Bioconcentration factor for soil- or bed sediment-to-omnivore (unitless)
$P_{S/BS}$	=	Proportion of soil or bed sediment in diet that is contaminated (mg/kg)
C_{wctot}	=	Total COPC concentration in water column (mg/L)
BCF_{W-OM}	=	Bioconcentration factor for water-to-omnivore (L/kg)
P_w	=	Proportion of water in diet that is contaminated (unitless)

For prey species that ingest more than one plant or animal food item, exposures were determined assuming that the prey species ingests an equal diet, as recommended by the EPA (EPA, 1999). COPC tissue concentrations in omnivorous mammal and bird prey species are presented in Appendix J.

5.2.2.7 COPC Concentration in Carnivorous Mammals and Birds

The COPC concentration in carnivorous mammals and birds were calculated by summing the contribution due to ingestion of contaminated animal food items and media as follows:

$$C_C = \sum \left(C_{Ai} \times \frac{FCM_{TL4}}{FCM_{TLn=Ai}} \times P_{Ai} \times F_{Ai} \right) + \left(C_{s/sed} \times BCF_{S/BS-C} \times P_{S/BS} \right) + \left(C_{wctot} \times BCF_{W-C} \times P_W \right)$$

where

C_C	=	COPC concentration in carnivore (mg/kg)
C_{Ai}	=	COPC concentration in *i*th animal food item (mg/kg)
FCM_{TL4}	=	Food chain multiplier for trophic level 4 (unitless)
FCM_{TLn-Ai}	=	Food chain multiplier for trophic level of *i*th animal food item (unitless)
P_{Ai}	=	Proportion of *i*th animal food item in diet that is contaminated (unitless)
F_{Ai}	=	Fraction of diet consisting of *i*th animal food item (unitless)
$C_{s/sed}$	=	COPC concentration in soil or bed sediment (mg/kg)
$BCF_{S/BS-C}$	=	Bioconcentration factor for soil- or bed sediment-to-carnivore (unitless)
$P_{S/BS}$	=	Proportion of soil or bed sediment in diet that is contaminated (mg/kg)
C_{wctot}	=	Total COPC concentration in water column (mg/L)

$BCF_{W\text{-}C}$	=	Bioconcentration factor for water-to-carnivore (L/kg)
P_w	=	Proportion of water in diet that is contaminated (unitless)

For prey species that ingest more than one plant or animal food item, exposures were determined assuming that the prey species ingests an equal diet, as recommended by the EPA (EPA, 1999). The equations that were used to estimate COPC concentrations in media are provided in Appendix F. COPC tissue concentrations in carnivorous mammal and bird prey species are presented in Appendix J.

5.3 Assessment of Toxicity

Toxicity of a COPC was assessed by identifying TRVs specific to a COPC and the measurement receptor being evaluated. A TRV represents a COPC concentration or dose that causes no observed adverse effects to an ecologically relevant endpoint for a receptor exposed for a chronic (long-term) duration (EPA, 1999).

TRVs for sediments were obtained from the following sources, listed in order of preference:

- Technical Guidance for Screening Contaminated Sediment (NYDEC, 1999)
- Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems (Macdonald, D.D. et al, 2000)
- Ecotox Thresholds (EPA, 1996b)
- Freshwater sediment TRVs (EPA, 1999a)

In addition to evaluating individual COPC concentrations in sediments, the PAHs were evaluated as a mixture for potential adverse effects on benthic organisms in accordance with current EPA guidance (EPA, 2003a). Individual equilibrium partitioning benchmark concentrations for individual PAHs ($C_{OC,PAHi,FCVi}$), normalized to a total organic carbon content of 1%, are provided in this guidance in micrograms per gram total organic carbon (TOC; ug/g_{OC}). The default organic carbon content recommended by EPA for the SLERA is 4%. To be consistent, the ESBs were converted to micrograms per kilogram of sediment by multiplying each $C_{OC,PAHi,FCVi}$ in (ug/gOC) by 40 (g OC/kg sediment), which is equivalent to 4% TOC, resulting in individual screening criteria (in ug/kg) that are directly comparable to the calculated sediment PAH concentrations.

TRVs for surface water were obtained from the following sources, listed in order of preference:

- NYSDEC Ambient Water Quality Criteria and guidance values
- National Ambient Water Quality Criteria (EPA, 2002);
- Freshwater TRVs (EPA, 1999)
- National Oceanic and Atmospheric Administration (NOAA) Surface Water Chronic Values (Buchman, 1999); and
- Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao, 1996).

TRVs for soil were obtained from EPA guidance (EPA, 1999 and 2012).

TRVs for wildlife were obtained from the following sources, listed in order of preference:

- TRVs for Wildlife Receptors (EPA, 1999)
- Ecological Soil Screening Levels (Eco-SSLs; EPA 2012)
- Toxicological Benchmarks for Wildlife (Sample, B.E. et al, 1996) and
- Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals (Jarvinen, A.W., and G.T. Ankley, 1998).

TRVs for terrestrial plants were obtained from EPA guidance (EPA, 1999 and 2012).

TRVs for fish were obtained from the following sources, listed in order of preference:

- Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations. (Beyer, W.N. et al, 1996) and
- Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals (Jarvinen, A.W., and G.T. Ankley, 1998).

The TRVs used to characterize risks to community and guild measurement receptors are summarized in Table 5-2. The $C_{OC,PAHi,FCVi}$ used to characterize risks to benthic invertebrates associated with exposure to PAH mixtures are summarized in Table 5-3.

6.0 RISK CHARACTERIZATION

The Risk Characterization portion of the SLERA is comprised of the risk estimation and risk description. Risks to ecological receptors were estimated quantitatively using the quotient method to calculate an ecological screening quotient (ESQ). The magnitude and nature of the potential risks for each community and guild and uncertainties and limitations associated with the risk estimation is discussed in the in the risk description section.

6.1 Risk Estimation

An ESQ is a quotient of the COPC estimated exposure level (EEL) divided by the COPC and measurement receptor-specific TRV as follows:

$$ESQ = \frac{EEL}{TRV}$$

where

ESQ = Ecological screening quotient (unitless)
EEL = COPC estimated exposure level (mass COPC/mass media [communities] or mass daily dose COPC ingested/mass body weight-day [class-specific guilds])
TRV = COPC toxicity reference value (mass COPC/mass media [communities] or mass daily dose COPC ingested/mass body weight-day [class-specific guilds])

An ESQ was calculated for each measurement receptor, COPC, and habitat evaluated in the SLERA.

In addition, the equilibrium sediment partitioning benchmark toxicity unit (ΣESBTU), representing the sum of the quotients of the estimated sediment concentration for each identified PAH divided by the $C_{oc,\ PAHi,\ FCVi}$ was calculated.

For measurement receptors ingesting more than one food item, the ESQ was calculated based on an equal diet dose and on an exclusive diet dose. COPC concentrations in species representing food items were calculated assuming the species ingested an equal diet.

The risks estimates associated with exposure to multiple COPCs were evaluated by summing each of the COPC-specific ESQ values as follows:

$$ESQ_{ReceptorTotal} = \sum ESQ_{COPC\,Specific}$$

where

$ESQ_{ReceptorTotal}$ = Total ecological screening quotient for receptor (unitless)
$ESQ_{COPC\ Specific}$ = COPC specific ecological screening quotient (unitless)

The COPC-specific ESQs, including ΣESBTUs for PAH mixtures in sediments, for community and guild measurement receptors are provided in Appendix K. Cumulative ESQs and ΣESBTUs for community and guild measurement receptors for each habitat are summarized in Table 6-1 and discussed below.

6.1.1 Community Measurement Receptors

As shown in Table 6-1, the ESQs for surface water and sediment for both aquatic habitats are well below the target risk level of 1E+00. The ΣESBTU for PAH mixtures in sediment are also well below the target risk level of 1E+00. A conservative uncertainty factor was incorporated into the calculation of the ΣESBTU for PAH mixtures for both habitats to account for the reduced list of PAHs evaluated. The EPA guidance indicates that multiplying the ΣESBTU for 13 PAHs by 11.5 will approximate $\Sigma ESBTU_{TOT}$ and the ΣESBTU for 23 PAHs by 4.14 to approximate $\Sigma ESBTU_{TOT}$. The ΣESBTU for the 17 PAHs detected was multiplied by 11.5 as a conservative measure. The resulting $\Sigma ESBTU_{TOT}$s for sediments in both the Hudson River and Tomhannock Reservoir aquatic habitats are several orders of magnitude below 1, therefore the uncertainty associated with the use of this factor is low. These ESQs indicate no unacceptable risk to community level aquatic ecological receptors that may inhabit the Hudson River in the vicinity of the facility where aerial deposition may occur and the Tomhannock Reservoir.

6.1.2 Fish Receptors

As shown in Table 6-1, the ESQs for herbivorous/planktivorous, omnivorous and carnivorous fish for both aquatic habitats are below the target risk level of 1E+00. The omnivorous fish is representative of the shortnose sturgeon, a protected species which may potentially inhabit the area. Therefore, the SLERA results indicate no unacceptable risk to the shortnose sturgeon.

6.1.3 Guild Measurement Receptors

Table 6-1 lists each measurement receptor and cumulative ESQs based on an equal diet and exclusive diet consisting of the specific food item identified. The cumulative ESQs for each habitat are all below the target risk level of 1E+00.

6.2 Risk Description

There are no exceedances of the target risk level for the measurement receptors associated with each habitat.

6.3 Sources of Uncertainty

6.3.1 Screening Level Assessment

The SLERA incorporates conservative fate and exposure assumptions that likely result in an overestimation of risk, as summarized below (EPA, 1999).

- COPCs in environmental media are 100% bioavailable. It is likely that a portion of the COPC is not bioavailable to the measurement receptor species, resulting in an overestimation of the exposure dose received.

- The total COPC mass ingested by the measurement receptor species is the dose received and bioavailable to cause the toxic effect. This is not likely to be the case since it assumes that no fraction of the COPC mass is metabolized or excreted without causing a toxic effect. This assumption will likely overestimate risk associated with exposure to 2,3,7,8-TCDD due to studies which show that a wide range of mammalian and aquatic species metabolize this compound to more polar metabolites, which plays a role in regulating the rate of excretion of these compounds (EPA, 1999).

- Community measurement receptors take up 100% of the COPC concentration to which they are exposed, and all COPC mass taken up by a plant or animal food item is assimilated into edible biomass. This assumption likely results in an overestimation of risk associated with 2,3,7,8-TCDD exposure due to a tendency for this compound to distribute in lipid tissue (EPA, 1999).

- An ecological receptor is continuously exposed during its entire life, including critical life stages. The extent to which this assumption contributes to the overestimation of risk is unknown and is dependent upon the home range and foraging strategies of specific ecological receptors.

- The measurement receptor's home range is 100% within the study area.

- The measurement receptor's food is 100% contaminated. This assumption assumes that all food items are exposed to maximum chemical concentrations (based on the selection of conservative receptor locations) such that tissue concentrations would be predicted by the theoretical BCFs. The BCFs further assume that chemicals are 100% bioavailable. These assumptions are likely to significantly overestimate true risks.

The following limitations and assumptions may result in an underestimation of risks to ecological receptors:

- As discussed in the SLERA protocol, the SLERA selects specific measurement receptors to evaluate potential risks to populations, communities and the ecosystem. The assumption that protection of an individual measurement endpoint representative of a particular guild and trophic level may not be protective of all species for that guild or relevant assessment endpoints; however, the nature of the screening level approach serves to minimize the uncertainty associated with protection of other species and assessment endpoints within the habitat evaluated.

- Limited data is available on the toxicity of COPCs to ecological receptors. In some cases, chemicals detected during the Trail Burn were carried through the SLERA, but were not quantitatively evaluated due to the lack of fate, exposure or TRV data. The available physical/chemical data for COPCs is presented in Appendix G. The available toxicity data is presented in Table 5-2. The extent to which the lack of data serves to underestimate risks is unknown.

- Lack of data available to evaluate amphibians and reptiles is a source of uncertainty that will serve to underestimate risks. Amphibians and reptiles may absorb COPCs through direct contact with environmental media or through the ingestion of food items. However, data is lacking to quantify risks to these ecological receptors.

- The use of uncertainty factors in the development of no observable adverse effect level (NOAEL)-based toxicity data is a source of uncertainty. However, the extent to which this uncertainty contributes to an underestimation or overestimation of risk is unknown.

6.3.2 Uncertainty Associated with the Trial Burn Emissions

6.3.2.1 Incinerator Operation During Emissions Testing

During the Comprehensive Performance Test/Trial Burn conducted in 2004, the feeding of liquid waste into the incinerator was kept as close to the typical firing rates as was practical. The derivation of emission rates and selection of the Risk Burn dataset for evaluation in the screening assessment would result in a “worst case” dataset for screening evaluations.

Source emission testing was conducted during the Compliance Performance Test conducted in 2010/2011 to demonstrate the FBI#2 and RKI operate in compliance with revised Hazardous Waste Combustor (HWC) MACT standards (40 CFR 63 Subpart EEE) which were originally promulgated in September 1999 and updated in 2005 and 2008. These regulations establish standards for incinerators for particulate matter, metals, hydrogen chloride/chlorine gas, dioxins and furans, destruction removal efficiency (DRE), and hydrocarbons (carbon monoxide). The minimum temperature represented a worst case scenario for POHC (monochlorobenzene, toluene, and naphthalene) destruction. During this operating condition, DRE testing was conducted as well to evaluate emissions of PM, HCl, chlorine, PCDD/PCDF, and total hydrocarbons. The FBI was tested under three operating conditions: Low Temperature, Maintenance Mode, and High Temperature. The RKI was tested under Low Temperature and Maximum Temperature operating conditions.

Metals emissions data were obtained from the Maximum Temperature operating condition for the FBI and the RKI. For the metals testing arsenic, beryllium, cadmium, chromium, lead, mercury and nickel were spiked in the metals feed. Chlorine/HCl, particulate and Dioxin/Furan emission data were obtained from the Low Temperature operating condition for the two units. These operating conditions represent the "worst-case" operating conditions for emissions of these constituents.

6.3.2.2 Derivation of Emission Rates

Detected and non-detected concentrations were used to calculate average emission rates. In calculations involving a series of measurements composed of detected values and non-detect quantitation limits, the detection limit was used as the emission rate for the non-detects. This computational procedure yields higher average emission estimates and would result in a "worst case" dataset for screening evaluations. In addition, non-detected compounds were included in the evaluation if they passed the additional evaluation for inclusion in the risk assessment as discussed in Section 2.4.

6.3.2.3 Process Upset

Combustion upsets have the potential to cause short term emission excursions. The AWFCO events during 2011 were used to calculate upset emission factors. The two main categories of pollutant considered in the SLERA are organics and metals. The AWFCOs that potentially affect each pollutant category were considered in the process upset factor derivation. It should be noted that these factors do not account for the decreases in emissions that result during the time that waste feed remains out of the combustion train due to AWFCO-induced downtime. By considering only emission increases during AWFCOs, the risk assessment becomes more conservative.

As discussed in Section 2.3.4, the RKI PUFs for metals and organics were calculated to be 1.429 and 1.196, respectively, and the FBI PUFs for metals and organics were calculated to be 1.526 and 1.454, respectively. The factors were used to evaluate the effect of process upsets on the facility emissions. These PUFs were applied to the maximum RKI and FBI emission rates, resulting in PUF-adjusted ESQs. Table 6-2 presents the cumulative ESQs after the PUFs were applied.

As shown on Table 6-2, all ESQs were below the target risk level of 1E+00 with the exception of the carnivorous mammal and carnivorous bird measurement receptors ingesting a diet exclusively comprised of omnivorous birds in the Tomhannock Reservoir habitat, where the PUF-adjusted ESQs are 1.1E+00 and 1.2E+00, respectively. For the carnivorous mammal, the risk driver is dioxin/furans, with a PUF-adjusted TEQ ESQ of 1.1E+00. For the carnivorous bird measurement receptor, the primary risk driver is bis(2-ethylhexyl)phthalate (BEHP), with a PUF-adjusted ESQ of 8.4E-01. Dioxin/furans also contribute to the total PUF-adjusted ESQ, with a TEQ EQH of 2.8E-01.

Emissions testing was designed to operate during worst-case conditions, where the PUF were applied to the maximum emission rates and do not account for the decreases in emissions that result during the time that waste feed remains out of the combustion train due to AWFCO-induced downtime.

Bis(2-ethylhexyl)phthalate was not detected during the emissions testing. EPA recommends including BEHP as a COPC if the facility burns plastics or materials with phthalate plasticizers, since BEHP can be produced as a PIC (EPA, 1999). However, the facility does not burn plastics or materials with phthalate plasticizers; therefore, BEHP is not likely to be emitted from the incinerators during process upsets. It was included as a COPC solely based on its bioaccumulation potential as a conservative measure. In addition, the Protocol-recommended avian TRV of 0.111 mg/kg-day includes an uncertainty factor of 10 applied to the NOAEL obtained from the referenced study (1.11 mg/kg-day), as presented in Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al, 1996), thereby increasing the assessment for this chemical by an order of magnitude.

The dioxin/furan congeners contributing significantly to the PUF-adjusted ESQs for both measurement receptors are 1,2,3,7,8-TCDD, 1,2,3,7,8-PeCDF and 2,3,4,7,8,PeCDF. Only

2,3,4,7,8-PeCDF was detected during the emissions testing. The other two congeners were not detected. The chemicals-specific PUF-adjusted ESQs for 2,3,4,7,8-PeCDF for the carnivorous mammal and bird ingesting a diet comprised solely of omnivorous birds are 4.6E-01 and 1.3E-01, respectively. These ESQs are below the target risk level. The TRV used in this assessment is the NOAEL-based value; the lowest observable adverse effect level (LOAEL) reported is 10 times higher, based on the same study (Sample et al, 1996). The PUF-adjusted LOAEL-based ESQ for the carnivorous mammal and carnivorous bird would be 1.1E-01 and 8.4E-02, respectively.

The slight exceedance of the target risk level for these measurement receptors assumes a diet consisting solely of omnivorous birds, which is not likely. The PUF-adjusted ESQ for a carnivorous mammal ingesting a more varied diet represented by the equal diet dose is 3.1E-01, which is below the target risk level. The PUF-adjusted chemical-specific dioxin/furan TEQ ESQ for the carnivorous bird ingesting a diet comprised exclusively of omnivorous birds is 2.8E-01, which is below the target risk level. For comparison, the PUF-adjusted ESQ for the carnivorous bird ingesting a more varied diet represented by the equal diet dose is 7.8E-02, which is well below the target risk level.

These lines of evidence indicate that the PUF-adjusted ESQs are overly conservative, where nondetect chemicals are significant contributors to risk and more realistic risk estimates are below a level of concern.

6.3.2.4 TOE Factor

The potential risks associated with the unknown fraction of organics were evaluated using the TOE factor, as discussed in Section 2.3.4. The TOE factor calculated for the SLERA is 1.13, as shown on Table 2-4. The TOE factor is used to evaluate the potential risks from the fraction of organic compounds that cannot be identified by laboratory analysis. The evaluation consisted of multiplying the cumulative ESQs for each measurement receptor in each food web by the calculated TOE factor to account for the risks associated with unidentified compounds that were not quantified. It is assumed that the risks of unidentified compounds are similar to the risks associated with identified compounds. The results of this analysis are presented in Table 6-3. All TOE-adjusted ESQs are at or below the target risk level of 1E+00, noting that the TRVs are based on NOAEL toxicity data; therefore, ESQs of 1.0 are not indicative of potential adverse effects. Therefore, the risks associated with unidentified organics emissions are not of concern.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Conservative exposure assumptions have been incorporated into the SLERA, as required by EPA guidance (1999). These conservative assumptions include:

- That COPCs in environmental media are 100% bioavailable;
- The total COPC mass ingested by the measurement receptor species is the dose received and bioavailable to cause the toxic effect;
- Measurement receptors take up 100% of the COPC concentration to which they are exposed and all COPC mass taken up by a plant or animal food item is assimilated into edible biomass;
- An ecological receptor is continuously exposed during its entire life, including critical life stages;
- The measurement receptor's home range is 100% within the study area; and
- The measurement receptor's food is 100% contaminated based on exposure to maximum chemical concentrations (based on the selection of conservative receptor locations).

The SLERA did not identify risk exceedances for the measurement receptors and habitats evaluated based on using maximum emission rates obtained from the emissions testing. Only two slight exceedances of the target risk level of 1E+00 were identified when process upsets were factored into the assessment. The PUF-adjusted ESQ of 1.1E+00 was calculated for the carnivorous mammal ingesting a diet consisting solely of omnivorous birds and a PUF-adjusted ESQ of 1.2E+00 was calculated for the carnivorous bird ingesting a diet consisting solely of omnivorous birds in the Tomhannock Reservoir habitat. As discussed in Section 6.3.2.3, the PUF-adjusted ESQs are overly conservative, considering the risk drivers were either not detected, not likely to be present, or risks are overstated due to conservative assumptions used in the SLERA. Therefore, results of the SLERA indicate that no further risk analysis is warranted.

8.0 REFERENCES

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TABLES

FIGURES