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| Minnesota Pollution Control Agency (MPCA), 520 Lafayette Road North, St. Paul, MN 55155-4194 | Refined HHRAP-based Analysis form AERA-26Air Emissions Risk Analysis (AERA)*Doc Type: Air Emissions Risk Assessment – External Documentation*  |

**Purpose:** This form is required for AERAs that include an analysis based on U. S. Environmental Protection Agency’s Human Health Risk Analysis Protocol (HHRAP). Consult the Minnesota Pollution Control Agency’s (MPCA) AERA guidance for instructions on completing this form. The AERA guidance can be found on the MPCA’s AERA website at <https://www.pca.state.mn.us/business-with-us/air-emissions-risk-analysis-aera>. Air quality dispersion modeling working practices and policies can be found on the MPCA’s Air quality modeling website at <https://www.pca.state.mn.us/business-with-us/air-quality-modeling>.

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| **Contents:**General submittal informationHhrap-based analysis toolsAERA AERMOD modeling settings | HHRAP-based software settingsToxicity valuesWatershed and water body parameter |

**Instructions:** Check appropriate boxes below by clicking on them. Response areas may be expanded as needed. All AERA documents must be submitted electronically. Spreadsheets should not be submitted in PDF format. The AERA will be deemed incomplete if all requested forms and support documents are not included.

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| This form is being submitted as part of a: | Submittal date (mm/dd/yyyy) |  |
| [ ]  HHRAP-based analysis protocol |       |  |
| [ ]  Explanation of HHRAP-based analysis results |       |  |
| \*If applicable, explain any differences in methodologies between the approved protocol and the modeled results: |

Facility information

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| Facility name: |       | TEMPO AI number: |       |

General Submittal Information

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| Are the MPCA AERA and modeling guidance followed? [ ]  Yes [ ]  NoIf no, describe any deviations from the MPCA recommended guidance:  |
| The MPCA recommends some deviations from the HHRAP guidance (e.g., different fish ingestion rates). Are there additional deviations from the HHRAP guidance that are not included in the MPCA’S AERA guidance? [ ]  Yes [ ]  NoIf yes, describe these deviations: |
| Are there any additional analyses (e.g., analysis using MPCA-suggested central tendency human exposure factors)? [ ]  Yes [ ]  NoIf yes, describe additional analyses: |

**HHRAP-based analysis tools**

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| [ ]  IEUBK model is used for modeled lead air concentrations greater than 10% of the National Ambient Air Quality Standard for lead. |
| [ ]  AERMOD version: |       |
| [ ]  IRAP version: |       |
| [ ]  MMREM if mercury emissions are above one pound per year, and there are fishable water bodies within 3 kilometers (km) of a stack under 100 meters (m) high or within 10 km of a stack that is 100 m high or higher. If mercury is not found to be a risk driver for the inhalation or other non-fish ingestion pathways, then it can be excluded from the HHRAP-based software modeling as long as MMREM is used. |
| [ ]  Other tools: |       |

*AERMOD = American Meteorological Society/EPA Regulatory Model*

*IRAP = Industrial Risk Assessment Program*

AERA AERMOD modeling settings

**Note:** Project proposers using HHRAP-based software need to follow up-to-date MPCA’s Modeling Guidance, especially when choosing building parameters, flag pole receptors, downwash parameters, and meteorological data.

The following practices are followed:

[ ]  Submitted all files necessary to recreate AERMOD and HHRAP-based software runs (input files), output files and plot files

[ ]  Calculated chronic risk results using HHRAP-based software

[ ]  Calculated acute risk results in a Risk Assessment Screening Spreadsheet (RASS) or Emission Rate/Chemical Health Index spreadsheet

[ ]  Used HHRAP-based software default options unless specifically stated otherwise below

Results of an MPCA sensitivity analysis suggests that benzo(a)pyrene properties will result in “conservative” (i.e., upper bound) estimates of gas deposition if applied across a range of volatile and semi volatile substances. Thus, the MPCA generally suggests using the following benzo(a)pyrene characteristics:

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| --- | --- | --- | --- |
| **Property** | **Minnesota** | **Units** | **Source** |
| Diffusivity in Air  | 5.13E-02 | cm2/s | Wesley-Deposition Parameterization for ISC, 2002 and derived from Fuller et al. 1966 and 1969 |
| Pollutant Diffusivity in Water | 4.44E-06 | cm2/s | Wesley-Deposition Parameterization for ISC, 2002 and derived from Hayduk and Minhas 1982 |
| Cuticular Resistance | 4.41E-01 | s/cm | Wesley-Deposition Parameterization for ISC, 2002 and derived from Kerler and Schönherr 1988 |
| Henry's Law Constant at 25°C | 4.6E-02 | pa-m3/mol | ten Hulscher et al., 1992 |

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| Are the benzo(a)pyrene gas deposition properties listed above used? [ ]  Yes [ ]  NoIf no, explain what gas deposition properties are used and why: |

The following particle distributions need to be used unless more site specific data are appropriate.

|  |  |  |
| --- | --- | --- |
| **Particle ranges (Use Method 1)** |  |  |
| Particle diameter | Composition | Particle density |
| 1 | 0.25 | 1 |
| 2.5 | 0.25 | 1 |
| 10 | 0.50 | 1 |

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| Are the particle distributions listed above used? [ ]  Yes [ ]  NoIf no, explain what other particle distributions are used and why: |
| Is the default algorithm for plume depletion used in the HHRAP software? [ ]  Yes [ ]  NoIf yes, explain why: |

HHRAP-based software (e.g., IRAP) settings

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| Other than those exceptions specifically stated below, are any non-default HHRAP-based software options used?[ ]  Yes [ ]  NoIf yes, explain any additional changes to default HHRAP-based software options: |
| a) | Is the drinking water pathway turned off? [ ]  Yes [ ]  No MPCA recommends turning off the drinking water pathway unless there are site specific conditions indicating that people are expected to drink untreated surface water. |
|  | If no, explain below: |
| b) | Does the HHRAP analysis incorporate non-default exposure assumptions (e.g., a non-dairy farmer or MPCA central tendency assumptions)? [ ]  Yes [ ]  No |
|  | If yes, explain: |
| c) | Are the following ingestion rates used instead of the default HHRAP fisher ingestion rates? [ ]  Yes [ ]  No

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Raw fish tissue consumption rate****(g/day)** | **Daily dose****(kg/kg-day)** | **Weekly consumption** |
| Subsistence fisher \* |  |  |  |
| Adult | 142 | 0.00203 | Approx. ½ lb fish 4-5 times a week (adult) |
| Child | 21.4 | 0.00143 |  |
| Recreational fisher\* |  |  |  |
| Adult | 30 | 0.00043 | Approx. ½ lb freshwater fish per week (adult) |
| Child | 4.5 | 0.00030 |  |
| Native American treaty rights-based  | 224 | 0.0032 | Approx. ½ lb fish 7 times a week (adult) |

\*Adult subsistence fish consumption rate is from EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA, 2000). Adult recreational fish consumption rate is consistent with MDH fish consumption advice.Child fish consumption rates are calculated using the HHRAP ratio of adult to child fish consumption rates.  |
|  | If no, explain what assumptions are used and why: |

Toxicity Values

Check the following practices used. If a box is not checked, provide an explanation here:

[ ]  Inhalation toxicity values from the most recent RASS is used in the HHRAP-based analysis.

[ ]  Acute analysis is conducted using the RASS rather than the HHRAP-based tool.

[ ]  MPCA ingestion toxicity values are used following the AERA hierarchy (MPCA staff provides ingestion toxicity values upon request).

Watershed and Water Body Parameters

Check the practices below that are followed:

[ ]  MMREM and general AERA guidance are followed in choosing the most impacted water bodies for evaluation. Those water bodies are:

[ ]  Minnesota parameters listed below (or others generated by the MPCA) are used. (Source information for MN-specific values and the HHRAP variable code and HHRAP input location are provided in the AERA guidance.)

 If these parameters are not used, provide proposed value and its basis in the table below.

**Watershed and water body parameters**

| **Variable name** | **Site specific value**  | **MN specific value** | **Units** | **Source of site-specific value** |
| --- | --- | --- | --- | --- |
| Average annual wind speed |  | 4.80 | m/s |       |
| Fraction (percentage) of watershed that is impervious |  | 0.05 | unitless  |       |
| USLE erodibility factor |  | 0.39 | ton/acre |       |
| USLE length slope factor |  | 0.50 | unitless |       |
| Air viscosity (temp corrected) |  | 1.72E 04 | g/cm s |       |
| Water viscosity (temp corrected) |  | 1.31E 02 | g/cm s |       |
| Sediment delivery empirical slope coefficient |  | 0.125 | unitless |       |
| Dry particle deposition velocity |  | 0.15 | cm/s |       |
| Dry vapor depositional velocity |  | 1.50 | cm/s |       |
| Average annual precipitation  |  | 83.82 | cm/yr |       |
| Average annual temperature |  | 280.93 | K |       |
| Average annual irrigation |  | 0.01 | cm/yr |       |
| Average surface runoff from pervious areas |  | 16.61 | cm/yr |       |
| Water body temperature |  | 14.5 | °C |       |
| Total suspended solids |  | 13 | mg/L |       |
| Cover Management Factor (for USLE) |  | 0.3 | unit less |       |
| USLE rainfall (erosivity) factor |  | 175 | yr^ 1 |       |
| Average evapotranspiration  |  | 67.22 | cm/yr |       |