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|  | EC-03  Internal combustion engine screen modeling  Air Quality Permit Program  *Doc Type: Permit Application* |

**Instructions on page 3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1a)** AQ Facility ID number: | |  | **1b)** Agency Interest ID number: |  |
| **2)** Facility name: |  | | | |

Complete screen model for ambient air impacts to determine if refined modeling is needed. The recommended screening model is SCREEN3. Screening should be completed for each fuel burned in each non-emergency engine to be installed, and/or each non-emergency engine that was installed in its current location after January 1, 2000, and has not been modeled in its current location. Engines being tested in test cells are not considered non-emergency engines.

If more than one engine must be modeled, the screen model should be run as a merged stack, as provided in the Minnesota Pollution Control Agency (MPCA) [*Air Dispersion Modeling Practices Manual*](https://www.pca.state.mn.us/sites/default/files/aq2-58.pdf) found on the MPCA website at <https://www.pca.state.mn.us/>. (The *Modeling Guidance* can be found on the MPCA *Air Quality Dispersion Modeling* webpage at <https://www.pca.state.mn.us/air/air-quality-dispersion-modeling-working-practices-and-policies>.)

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| **3)** Run SCREEN3, enter name for this run | | | | | | | | | | | | | | | | | | | | | |
| **4)** Source type: | P | | | | | | | | | | |
| **5)** Emission rate: | 1.0 | | | | | | | | | | | gram/second | | | |
| **6)** Stack height: |  | | | | | | | | | | | meters | | | |
| **7)** Stack inside diameter: | | |  | | | | | | | | | meters | | | | |
| **8)** Stack velocity: | | | | | | | | | | | | | | | | | | | | | |
| Option 1: the velocity directly in meters/second as a number only (default) | | | | | | | | | | | | | | | | | | | |  | |
| Option 2: the flowrate in cubic meters/second | | | | | | | | | | | | | | |  | | | | | | |
| Option 3: the flowrate in cubic feet/minute | | | | | | | | | | | | | | |  | | | | | | |
| **9)** Stack temperature: | | | | | | | | | | | | | | | | | | | | | |
| Option 1 (default) | | | | | 700 | | | | | | | | | | | | | | | | |
| Option 2: the manufacturer’s estimated typical operating temp (K) | | | | | | | | | | | | | | | | | |  | | | |
| **10)** Ambient air temperature (K) | | | | | | | | 293 | | | | | | | | | | | | | |
| **11)** Receptor height: | 0.0 | | | | | | | | | | | | | | | | | | | | |
| **12)** Urban or rural? |  | | | | | | | | | | | | | | | | | | | | |
| **13)** Consider building downwash? | | | | | | | | | Yes | | | | | | | | | | | | |
| **14)** Building height: (meters): | | | | | |  | | | | | | | | | | | | | | | |
| **15)** Building horizontal dimensions (meters): Minimum: | | | | | | | | | | | | | |  | | | | | Maximum: | |  |
| **16)** Complex terrain option | | | | No | | | | | | | | | | | | | | | | | |
| **17)** Simple terrain option | | | | No | | | | | | | | | | | | | | | | | |
| **18)** Select full meteorology, option 1 | | | | | | | | | | | | | | | | | | | | | |
| **19)** Select automated distance array | | | | | | | | | | Yes | | | | | | | | | | | |
| **20)** Enter distances: | | , | | | | | | | | | | | | | | | | | | | |
| **21)** Record highest ambient air impact: | | | | | | | | | | |  | | | | | | | | | | |
| **22)** Select discrete distances: | | | | | | | 10  20  30  40  50  60  70  80  90 | | | | | | | | | | | | | | |
| **23)** Highest predicted 1-hour ambient air impact: | | | | | | | | | | | | |  | | | | | | | | |

**24)** Ambient air impact table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **24a)** | **24b)** | **24c)** | **24d)** | **24e)** | **24f)** | **24g)** |
| **Pollutant and averaging time** | **Maximum uncontrolled emissions** | **Pollution control efficiency** | **Maximum controlled emissions** | **Maximum controlled emissions** | **1-hour**  **Ambient air impact at 1 gram/sec** | **Averaging time scaling factor** | **Ambient air impact for stated averaging time** |
|  | **lb/hour** | **%** | **lb/hr** | **grams/sec** | **μg/m3** |  | **μg/m3** |
| PM10 24-hr |  |  |  |  |  | 0.4 |  |
| PM2.5 24-hr |  |  |  |  |  | 0.4 |  |
| SO2 1-hr |  |  |  |  |  | 1.0 |  |
| NO2 1-hr |  |  |  |  |  | 1.0 |  |
| CO 1-hr |  |  |  |  |  | 1.0 |  |
| CO 8-hr |  |  |  |  |  | 0.7 |  |

*PM10 = Particulate Matter less than 10 µm in size*

*PM 2.5 = Particulate Matter less than 2.5 µm in size*

*SO2 = Sulfur Dioxide*

*NO2 = Nitrogen Dioxide*

*CO = carbon monoxide*

*µg/m3 = microgram per cubic meter*

**25)** Compare ambient air impacts for the appropriate averaging time to the following screening values in micrograms/cubic meter:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PM10 24-hour: | 150 |  | NO2 1-hour: | 188 |
| PM2.5 24-hour: | 35 |  | CO 1-hour: | 35,000 |
| SO2 1-hour: | 196 |  | CO 8-hour: | 10,000 |

**26)** If any screening value is exceeded, there are two options. First, SCREEN3 may be rerun using a different stack height, until no exceedance is predicted; each stack must have a stack height equivalent or higher than the stack height used for screening. The stack height resulting in non-exceedance for each applicable screening value is the stack height that must be installed. Alternatively, a refined air quality dispersion modeling demonstration may be completed for the entire facility for each of the pollutants exceeding a particular screening value. (The scope of a refined modeling demonstration requires the entire facility, ambient air quality background concentration value and the contributions of neighboring facilities. See the MPCA *Air Dispersion Modeling Practices Manual* for details.)

Form EC-03 instructions

**1a) AQ Facility ID number** – Fill in your Air Quality (AQ) Facility Identification (ID) number. This is the first eight digits of the permit number for all permits issued under the operating permit program. If your facility has never been issued a permit under this program, leave this line blank.

**1b) Agency Interest ID number** – Fill in your agency interest ID number. This is an ID number assigned to your facility through the Tempo database. If you don’t know this number, leave this line blank.

**2) Facility name** – Enter your facility name.

**Running the screening model:** You can obtain the SCREEN3 model from U.S. Environmental Protection Agency (EPA) at the following webpage: <https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models>. Instructions are provided here.

**3) Start SCREEN3:** enter a name for this run.

**4) For “Source Type:”** choose “P” for Point Source.

**5) Emission rate**: Enter 1.0 gram/second. At the end of this form, you will adjust the results from the SCREEN3 model for the calculated maximum grams/second for each pollutant.

**6) Stack height**: Enter the stack height above grade level in meters (3.28 feet = 1 meter).

**7) Stack inside diameter**: Enter the stack inside diameter in meters.

**8) Stack velocity**: SCREEN3 provides three ways to enter this data. The default (Option 1) is to enter the exhaust gas velocity directly in meters/second as a number only. As an alternative, you can enter the flowrate in cubic meters/second (Option 2) or cubic feet/minute (Option 3) but you must include the appropriate notation so the program will know which data you are giving it. The diesel engine manufacturer will be able to provide this data for the engine.

**9) Stack temperature**: The exhaust gas temperature must be entered in degrees Kelvin (K). Enter the manufacturer’s estimated typical operating temperature, converted to K, or use 700 as default.

As an example, a typical temperature might be 800 degrees Fahrenheit (F). First convert to Celsius (C) using the following equation:

Degrees C = ( 5 / 9 ) x (degrees F – 32)

427 degrees C = ( 5 / 9 ) x (800 degrees F – 32)

Next convert to Kelvin (K) by adding 273:

Degrees K = degrees C + 273

700 degrees K = 427 degrees C + 273

**10) Ambient air temperature**: Enter 293

**11) Receptor height**: Enter 0.0

**12) Urban or rural option**: Choose “Urban” unless the generator is in a truly rural area. If there are several buildings in the vicinity of the generator, the urban option should be selected.

**13) Consider building downwash**: Enter Yes. **Note:** For a generator located far from any buildings, the generator enclosure itself acts as a building and can cause downwash. For buildings that are short in height compared to the length and width, and the generator is located more than five building heights from the closest wall, use the generator enclosure dimensions for building downwash. For tall buildings, use five times the projected width, which is the diagonal length across the roof of the building. In general, use five times the LESSER of the building height or projected width to determine if a building is close enough to cause downwash.

**14) Building height**: Enter the roofline height of the nearby building that dictates the most severe building downwash effect. This may be difficult to predict, and you may need to run SCREEN3 more than once, using different nearby buildings and the generator enclosure, to determine which one produces the highest ambient air impact.

**15) Building minimum and maximum horizontal dimensions**: Enter the horizontal dimensions of the building used in item 25.

**16) Complex terrain option:** Enter No.

**17) Simple terrain option:** Enter No.

**18) Meteorology:** Select the full meteorology option, Option 1.

**19) Automated distance array**: Select by entering Yes.

**20) Enter distances:** Enter two numbers here, separated by a comma. The first number is the distance to the nearest fence line, in meters, from the stack you are modeling. The second number is 1000, or 500 meters more than the distance to the nearest fence line, whichever is higher. For example, if the nearest fence line is 50 meters from the source, enter “50,1000” and SCREEN3 will automatically calculate and display the ambient air impact from 50 to 1000 meters in increments of 100 meters. If the nearest fence line is 1500 meters from the source, enter “1500,2000” and SCREEN3 will automatically calculate and display the ambient air impact from 1500 to 2000 meters in increments of 100 meters. If there is no fence line at the facility, enter “0, 1000.”

**21) Record highest ambient air impact:** Record the highest ambient air impact for 100 to 1000 meters.

**22) Select discrete distances**: Enter distances of 10, 20, 30, 40, 50, 60, 70, 80, and 90. As you enter each one, SCREEN3 will compute the ambient air impact at that distance and display it.

**23)** Record the highest predicted 1-hour ambient air impact. Also enter this number in all rows under column 24e in the *Ambient air impact* table on page 2.

**24) Ambient air impact table.**

**24a) Emission rate in lb/hr:** For all pollutants other than NO2, use the hourly emission rate you calculated as your potential to emit (PTE). For NO2, the default is to use the nitrogen oxides (NOX) hourly emission rate calculated as the PTE, multiplied by 0.6. If you want to use source-specific test data or manufacturer’s data that shows that NO2 is a smaller fraction (less than 0.6) of NOX at the ambient boundary, contact the MPCA at 651-296-6300 or 800-657-3864 or [airmodeling.pca@state.mn.us](mailto:airmodeling.pca@state.mn.us) to discuss options, including the possibility of a more refined modeling analysis.

**24b) Pollution control efficiency**: The pollution control efficiency is the product of the capture efficiency and the destruction/collection efficiency indicated on form *GI-05A* (items 3g and 3h); or if you are using this form for *Registration Permit Option D*, the control efficiency is indicated on form *RP-D2*. Enter the number here and remember to include on form *CD-01* a plan to demonstrate and maintain the destruction/collection efficiency. If you are using this form for *Registration Permit Option D*, you do not need to fill out form *CD-01*. The efficiency should be expressed for each pollutant. If there is no control equipment for the particular pollutant, then indicate zero.

**24c) Maximum controlled emissions in lb/hour**: For each line, calculate the maximum controlled emissions in lb/hour using the following equation:

Maximum controlled emissions [lb/hr] = Emission rate [lb/hr] x ( (100 – PCE)/100)

(item 24c) = (item 24a) x ( (100 – (item 24b))/100)

**24d) Maximum controlled emissions in grams/second**: For each line, calculate the maximum controlled emissions in grams/second by dividing the maximum controlled emissions in lb/hour by 7.94:

Maximum controlled emissions [grams/second] = Maximum controlled emissions [lb/hr] ÷ 7.94

(item 24d) = (item 24c) ÷ 7.94

**24e) 1-hour ambient air impact at 1 gm/second:** This is the number identified in item 23. This should be the same number in each line of the table.

**24f) Averaging time scaling factor:** This has been provided for you.

**24g) Ambient air impact for stated averaging time:** This is the number you will compare to the standards shown in item 25. Calculate this number by multiplying the maximum controlled emissions in grams/second by the 1-hour ambient impact at 1 gram/second and then by the averaging time scaling factor, to obtain the ambient air impact in micrograms per cubic meter (μg/m3) as follows:

Ambient air impact [μg/m3] = Max. controlled emissions [gram/second] x 1-hour Ambient impact [μg/m3] x scaling factor

(item 24g) = (item 24d) x (item 24e) x (item 24f)

**25)** Compare ambient air impact for each pollutant modeled and the applicable screening value based on the appropriate pollutant averaging time and numeric value of the standard:

PM10 24-hour ambient air standard = 150 micrograms/cubic meter[[1]](#footnote-1)

PM2.5 24-hour ambient air standard = 35 micrograms/cubic meter1

SO2 1-hour ambient air standard = 196 micrograms/cubic meter1,2

NO2 1-hour ambient air standard = 188 micrograms/cubic meter1,2

CO 1-hour ambient air standard = 35,000 micrograms/cubic meter1

CO 8 hour ambient air standard = 10,000 micrograms/cubic meter1

**26)** If any screening value is exceeded, rerun SCREEN3 using a different stack height, until no exceedance is predicted. That is the stack height that must be installed; *or*:

**27)** If any screening value is exceeded:

* + - * Rerun SCREEN3 using a different stack height, until no exceedance is predicted; if so, each stack must have a stack height equivalent or higher than the stack height used for screening; or
      * For each of the pollutants for which an exceedance is predicted, model all new units (the new engines and any other units associated with the project) using AERMOD (available at https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod). If the modeled increase from the project is de minimis (i.e., below the pollutant’s significant impact level (SIL)), the demonstration would be complete; or
      * Complete a refined modeling exercise for the entire facility for each of the pollutants for which an exceedance is predicted. (Refined modeling requires the inclusion of the entire facility – including all new units – as well as a background value and the contributions of neighboring facilities. See the MPCA Air Dispersion Modeling Guidance for details.)

**28)** Submit the final SCREEN3 input and output files (or other modeling results) with this *EC-03* form.

1. National Ambient Air Quality Standard (NAAQS)

   2 NAAQS, converted from standard’s units of parts per billion (ppb) [↑](#footnote-ref-1)