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NATURAL RESOURCES

Source Characterization

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Modeling Input Overview

- We will be going over a list of items you will need in order to create a modeling input file
- MoDNR's requirements on how to describe an emission source in a modeling input file

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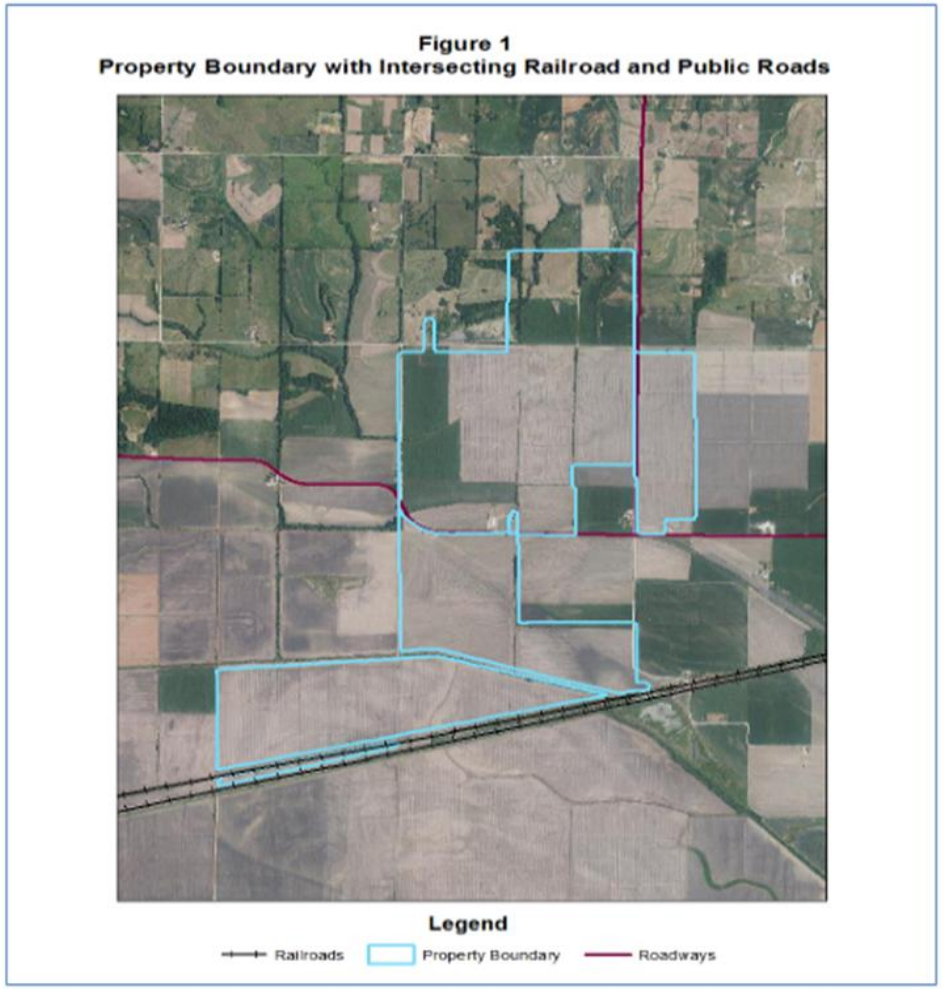
Property Boundary and Ambient Air

- Ambient Air starts at the applicant's property line and expands out to anything that is not owned or controlled by the applicant to which the public has access
- If a publicly accessible road, water body or rail line intersects property owned by the facility; those areas are considered ambient
- An applicant does not have to consider on-site impacts of air pollution on their property from their own sources
- PSD sources will be required to preclude access to the property boundary proposed in the modeling, either by fence, physical barriers, foot patrol or cameras



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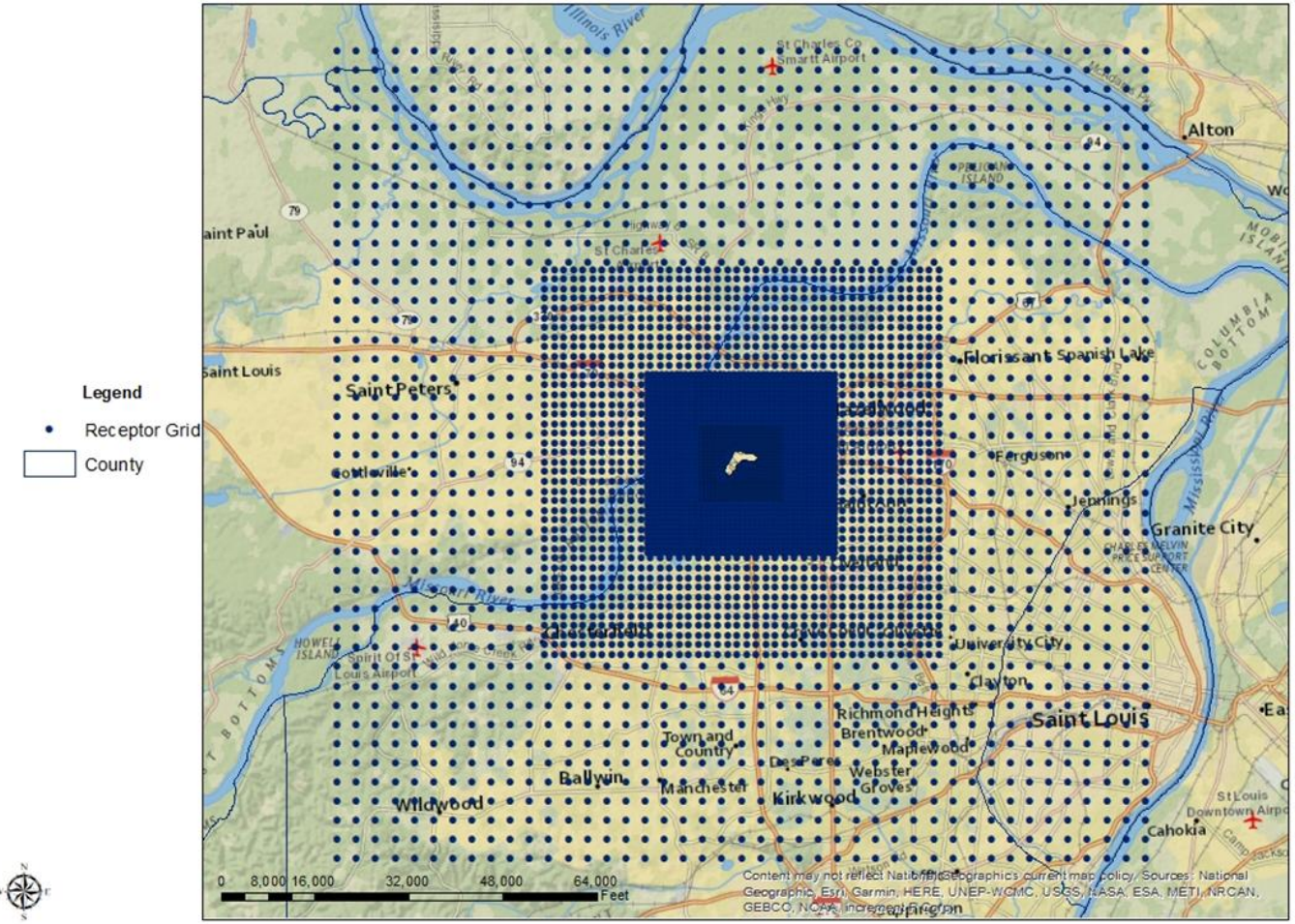
Receptor Grids

- **Property**
  - 50-Meter Spacing
- **Property Boundary to 1-Kilometer**
  - 100-Meter Spacing
- **1-Kilometer to 2.5-Kilometer**
  - 250-Meter Spacing
- **2.5-Kilometer to 5-Kilometer**
  - 500-Meter Spacing
- **5-Kilometer to 10-kilometer**
  - 1000-Meter Spacing
- **Hot Spots (Areas of Elevated Concentrations)**
  - 100-Meter Spacing

Figure 1
Receptor Grid



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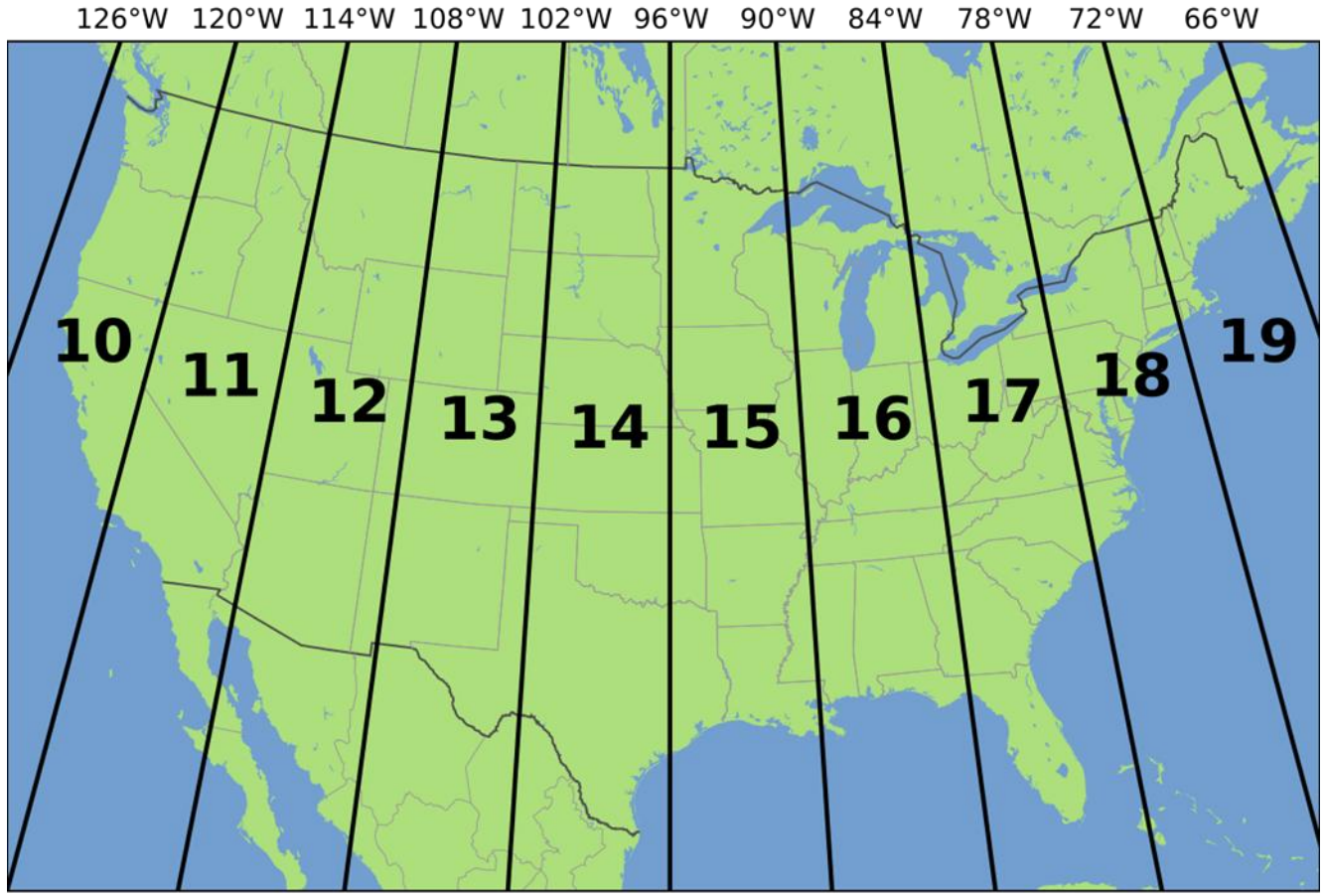
Terrain & Locational Data

- MoDNR Preferences:
  - Locational Data should be submitted UTM, NAD83, Zone 15

- Terrain Data
  - Digital elevation data files
  - We have switched from 7.5 minute data to using 1/3 arc second data



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Source Characterizations

- Sources can be classified as point, volume, area, open-pit or line sources
  - Point sources are emission releases from stacks or isolated vents with fans
  - Volume sources are all fugitive emission releases with the exception of haul roads, storage piles and equipment leaks. This would include: conveyors, buildings vents, crushers, screens, building openings, etc.
  - Area sources are low level releases that are spread out over a larger area. MoDNR models storage piles and haul roads as area sources
  - Line Sources are similar to area sources in that they are low level sources that are uniformly distributed along a specific line. Used for the aluminum smelting facilities

Point Sources

- Stack Height
  - Height above the ground (not just the height from a building roof)
- Exit Temperature
  - Temperature of the gas stream as it is leaving the stack
  - If gas stream is equivalent to ambient temperature use 0.0 in the model input and the model will automatically use the temperature contained within the met data file. No longer using a standard 77°F
- Exit Velocity
  - The velocity of the gas stream as is exits the stack
  - If unknown can use flow rate to calculate just make sure you are using actual cubic feet per minute rather than the standard cubic feet per minute. (Standard is using a standardized set of atmospheric conditions instead of the actual volume of gas after it is pressurized.)
- Stack Diameter
  - Should be based upon the inside diameter of the stack
  - If the stack is a dual flue, one should model two release with the diameter based upon the inside diameter of each flue
  - If the stack is square you will need to calculate an effective stack diameter

    Effective Stack Diameter = 2*((Length * Width) / (Length + Width))

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Specialty Point Sources

- Rain Caps and Horizontal Stacks
  - Used to be we would physically input a reduced exit velocity of 0.001 meters/second into the model input
  - Now there are keywords in the modeling system that will account for the restriction of vertical air flow that occurs
- POINTCAP – will internally assign an initial horizontal velocity of the plume equal to 25% of the exit velocity, and the initial vertical velocity to 0.001 m/s
- POINTHOR – will internally assign an initial horizontal plume trajectory in the downward direction and the initial vertical velocity to 0.001 m/s

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Specialty Point Sources

- Vents
  - Vents that have a fan associated with them should be modeled as a point source because they have an exit velocity from the fan
- Cooling Towers
  - Each cooling tower cell should be modeled as an individual point source
- Flares
  - Constants should be used as the effective stack exit velocity and temperature
  - Calculations should be done to calculate an adjusted stack height and diameter
- Modifications to Existing Stacks – Prohibited Dispersion Techniques
  - Facilities cannot avoid the installation of a control device or an enforceable permit limits by altering the dispersion of the gas stream through the manipulation of the release characteristics
  - This does not limit a facility from actually making the changes, for example increase the stack height, but merely limits the credit being taken within the modeling

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Volume Sources

- Release Heights
  - Height of the center of the volume source above the ground

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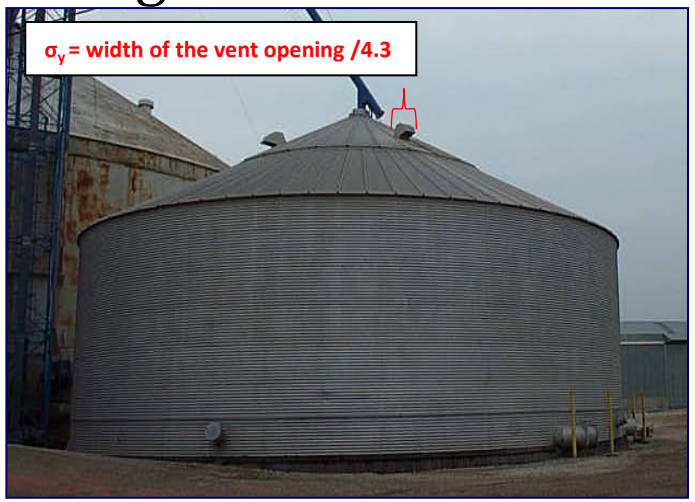
Volume Sources

- Initial Lateral Dimension
  - Take the actual width of the release and divide by a constant. Almost always the constant is 4.3 which is for a single volume source



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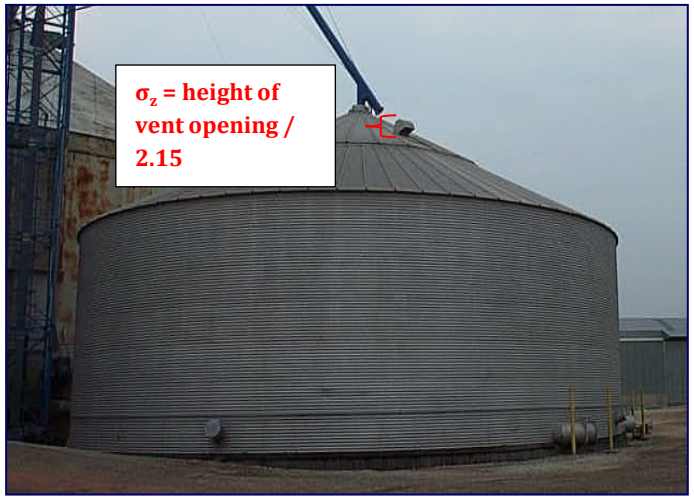
Volume Sources

- Initial Vertical Dimension
  - Height of the emission release divided by a constant. Constant will vary depending on release location and its surroundings
  - Constant = 2.15 if it is a ground level source or if the source is elevated and on or adjacent to a building
  - Constant = 4.3 if the source is elevated but not on or adjacent to a building



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Storage Piles

- Can be modeled as AREA, AREAPOLY or AREACIRC in the model input
- 4 Components to storage piles
  - Load In – loading of material into the storage pile
  - Load Out – removing material from storage pile
  - Wind Erosion – emissions from the wind blowing across the storage pile
  - Vehicular Activity- maintenance of the pile (not a haul road leading to pile)
- Load In and Load out can be considered a volume source depending on the method or equipment used. Example if a conveyor is used to load a pile, it can be described as a volume source with the appropriate release parameters
- Wind Erosion – will always be an area sources that is "operating" 8760
- Vehicular Activity – just because you calculate the emissions using the haul road equation does not mean this is to account for emissions driving to the pile. It is to account for maintenance of the pile by a front end loader. The area for driving to the pile should be accounted for as an haul road.

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Haul Roads

- MoDNR models haul roads as AREA sources!
- Need a release height, X & Y Dimension, an angle and an initial vertical dimension
  - Release Height – is defined as the center of the plume above the ground; you will need the vehicle height to calculate
  - X Dimension is the east to west length of the road
  - Y Dimension is the north to south length of the road
    - X and Y lengths should only account for the actual driving lanes plus a small shoulder
      - Most single driving lanes are approximately 12 ft wide with an additional of 4 ft shoulder on each side
      - Double driving lane would approximately be 25 ft with the addition of the 8 ft shoulder
  - Angle – orientation angle for the X & Y dimensions in degrees from North
  - Initial Vertical Dimension – also uses plume height to calculate, so will need the height of vehicle
- All haul road segments should connect and overlap each other. There should not be any spacing between segments

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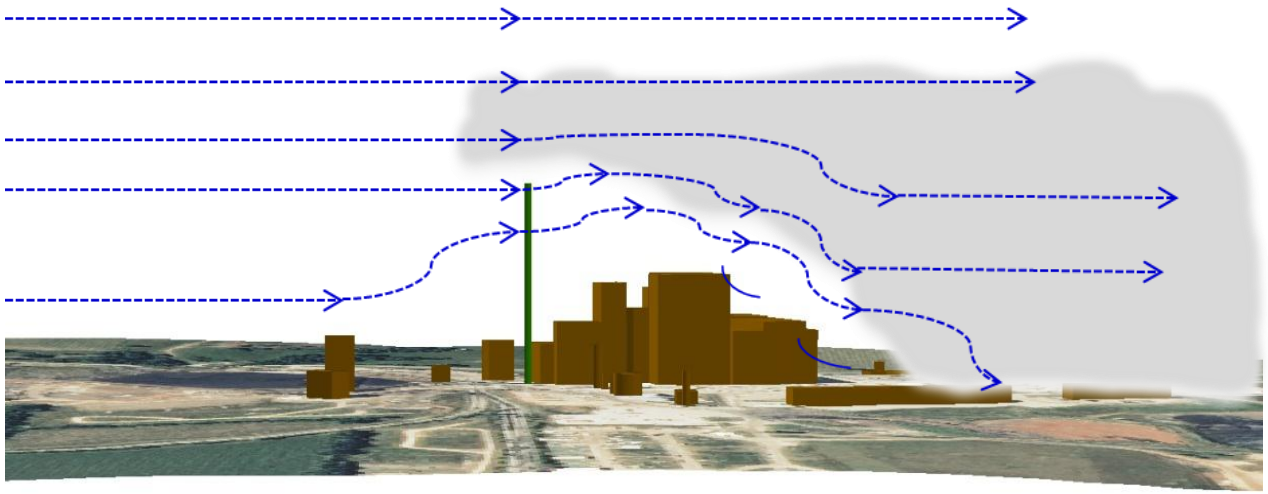
Figure 1
Haul Road with Gaps and Poorly Defined Corners

Building Downwash

- The presence of buildings can affect plume rise and the initial dispersion of pollutants. Turbulent wake zones can be created around buildings that force pollutants to the ground instead of allowing them to rise
- GEP stack height is what EPA uses to insure that emissions from stacks do not result in excessively high concentrations due to atmospheric downwash, eddies or wakes
  - GEP Stack Height
    - 65 meters from ground to top of stack
    - Height = H + 1.5L
      - Height of nearby structures + 1.5 lessor dimension (height of width) of nearby structures
    - If stack was in existence on 1/12/79 than GEP is 2.5H (2.5 * height of nearby structures)
    - Stack built prior to 12/30/70 is grandfathered



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Emergency/Intermittent Equipment

- Intermittent sources are ones that only operate for a short period of time throughout the year. For example emergency generators or fire pumps, that require monthly testing
- EPA guidance states that emergency/intermittent sources can be removed from the 1-hour averaging periods but must be included in all other short term and annual averaging periods
- Applicants can take credit for limited hours of operation in the other averaging periods as long as there is a federally enforceable permit condition
- In order to classify a source as an intermittent sources MoDNR requires the acceptance of special conditions within their permit

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Emergency /Intermittent Equipment

- Example Special Condition
  - 5. Diesel Generator No. 1(EP-XX) - Specifications, Operating Limits and Emission Limits
    - A. The emergency generator shall be fired with diesel fuel or #2 fuel oil
    - B. The emergency generator shall be limited to one (1) hour per month for testing during the hours of 10:00 AM to 2:00 PM
    - C. The emergency generator shall be limited to 24 hours of operation per year for maintenance purposes
    - D. The emergency generator shall only be allowed to operate during emergency situations outside of the testing and maintenance requirement found in Special Condition 5.B. and 5.C.
    - E. Facility X shall meet the requirements of the applicable compression ignition internal compression engines (CI ICE) standards by using engines that are certified to meet the applicable standards based on size and model