

Nitrogen and Sulfur Deposition

Compounds of nitrogen and sulfur that are emitted into the atmosphere from industrial processes eventually deposit on the surface at some distance downwind from the source. The deposition of these pollutants can result in acidification of lakes and streams, soil acidification, the alteration of nutrient cycling, over-fertilization of ecosystems and other adverse impacts. To address potential adverse impacts within the Class I boundaries, the Federal Land Managers (FLMs) formed a workgroup to evaluate the impact that sulfur and nitrogen deposition have on the air quality related values (AQVRs).

To aid applicants in deposition assessments, the FLMs from the National Park Service and the Fish and Wildlife Service have developed screening level values, referred to as Deposition Analysis Thresholds (DATs), to determine if the increase in nitrogen or sulfur deposition is likely to be negligible. The DAT for nitrogen deposition is 0.010 kilograms per hectare per year and 0.005 kilograms per hectare per year for sulfur deposition. If either value is exceeded, the FLM for the Mingo Wildlife Refuge must be contacted to determine what steps must be taken to determine if adverse deposition rates will occur.

The Forest Service has also developed screening levels similar to the DATs. Unlike the DATs, the screening levels for the Forest Service Class I areas vary from site to site. The screening levels for the Hercules Glades Wilderness Area are 0.005 kilograms per hectare per year for nitrogen and sulfur deposition. If this value is exceeded for either pollutant, the FLM must be contacted to determine what steps must be taken to determine if adverse deposition rates will occur. It is important to note that screening levels for the Upper Buffalo Wilderness Area are not provided by the Forest Service, refer to the following website: [USDA Forest Service - Caring for the land and serving people](#). The FLM for this area should be contacted to determine an appropriate screening level.

Deposition rates for each Class I area under consideration should be estimated through the execution of the CALPUFF modeling system, refer to the following documents for recommendations and default modeling options: [Meteorological Data & CALMET](#) and [Emissions Data, Receptor Grids & Other CALPUFF Inputs](#).

The CALPUFF modeling system will produce two deposition flux files, dry and wet, for use in the post processing tool, POSTUTIL. To calculate the annual nitrogen and sulfur deposition rates, the applicant must elect to calculate the wet and dry fluxes for sulfur dioxide (SO₂), sulfates (SO₄), nitrogen oxides (NO_x), nitric acid (HNO₃) and nitrates (NO₃) in the initial CALPUFF run. The wet and dry flux CALPUFF outputs are required inputs in the POSTUTIL run script. In addition, the user is required to normalize each modeled species by the molecular weight of sulfur or nitrogen.

For total sulfur deposition, the user must assign a scaling factor to SO₂ and SO₄ in the POSTUTIL file in order to normalize the species by the molecular weight of sulfur. The scaling factors for SO₂ and SO₄ are 0.5 and 0.333, respectively.



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For total nitrogen deposition, the user must assign a scaling factor to NO_x , HNO_3 , NO_3 and SO_4 in the POSTUTIL file in order to normalize the species by the molecular weight of nitrogen. The scaling factors for NO_x , HNO_3 , NO_3 and SO_4 are as follows: 0.30435, 0.22222, 0.451613 and 0.2916697.

Lastly, the user must provide a background ammonia value in order for POSTUTIL to calculate accurate deposition rates. The background ammonia value is variable and is directly dependent upon the land use within the region. For example, the background ammonia value for grasslands is ten parts per billion, 0.5 parts per billion for forest and one part per billion for an arid region. The FLM should be contacted to determine an appropriate ammonia background value.

The output file produced by the POSTUTIL program is the file that should be used in CALPOST to calculate the total sulfur and total nitrogen deposition rates for the Class I area under consideration. If the predicted values are below the DATs and/or the Forest Service screening levels, no further analysis is necessary. If the predicted values exceed the DATs and/or the Forest Service screening levels, the FLM should be contacted for additional guidance. Contact information for the FLMs can be found in the following document: [Class I Areas and the Federal Land Managers](#).