# Sensitivity of ozone concentrations at the Fort Mountain site to reductions in $NO_x$ emissions from various sources in Georgia

## Introduction

GA-EPD has performed an analysis of the sensitivity of ozone concentrations to reductions in emissions of both nitrogen oxides ($NO_x$) and volatile organic compounds (VOCs). The analysis was based off of the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) modeling, using the "Base D" emissions inventory (for both 2002 and 2009), and CMAQ version 4.4 with the CB-IV chemical mechanism. A 12 km modeling grid was used, covering most of the southeastern USA. The episode modeled was May 25 – June 25, 2002, as it contained many days of elevated ozone concentrations and has been found representative of longer term trends in ozone concentrations. More details regarding the model setup and sensitivity analysis can be found in Marmur et al., 2005.

## Cases modeled

Results from the sensitivity analysis indicated that the region modeled is $NO_x$ limited. Therefore, the focus here is on the effect of $NO_x$ reductions from various sources/regions within GA on ozone levels at the Fort Mountain site. Several $NO_x$ emissions reductions scenarios/cases have been modeled, and their effect on ozone concentrations at Fort Mountain analyzed. Below is a summary of the cases modeled (also see Table 1):

**Case 1:** $NO_x$ reductions from the existing SCRs at GA-Power Plants Bowen (all four units), Wansley (both units) and Hammond (unit #4), compared to the pre-installation conditions. These SCRs reduce total combined $NO_x$ emissions by 184 tons per day (TPD).

**Case 2:** $NO_x$ reductions from a potential future installation of SCRs on all four units at Plant Scherer (a potential reduction of 30 TPD).

**Case 3:** A 10% reduction in emissions of anthropogenic, non-EGU, ground level $NO_x$ emissions in the Atlanta 20 counties non-attainment area (NAA) (a potential reduction of 38 TPD).

**Case 4:** A 10% reduction in emissions of anthropogenic, non-EGU, ground level $NO_x$ emissions in the Georgia counties of the Chattanooga NAA (Catoosa and Walker counties, a potential reduction of 2.1 TPD).

**Case 5:** A 10% reduction in emissions of anthropogenic, non-EGU, ground level $NO_x$ emissions in the entire Chattanooga NAA (Catoosa and Walker counties in Georgia, Hamilton and Meigs counties in Tennessee, Jackson county in Alabama; a potential reduction of 7.6 TPD).

**Table 1**: Summary of emissions reduction scenarios modeled

| Case # | Plant/Region modeled | $NO_x$ TPD reduction |
|---|---|---|
| 1 | Bowen, Hammond and Wansley (benefits of existing SCRs) | 184 |
| 2 | Scherer (potential future installation) | 30 |
| 3 | Atlanta 20 counties NAA | 38 |
| 4 | Chattanooga NAA (Georgia counties only) | 2.1 |
| 5 | Chattanooga NAA (entire area) | 7.6 |

**Results**

Reductions in daily maximum 8-hour ozone concentrations for each of the above cases, along with the modeled base-case concentrations (based on both 2002 and 2009 VISTAS Base D emissions), are shown in Figure 1. Case 1 (modeled benefits of existing SCRs at Plants Bowen, Hammond and Wansley) shows the highest benefits in terms of ppb reduction in 8-hour ozone concentrations at Fort Mountain, with reductions of up to 4.7 ppb. These reductions are the highest on days of high ozone concentration, which demonstrates the contribution of these power plants to elevated ozone concentrations (and to the design-value) at Fort Mountain. Also evident are the impacts of $NO_x$ emissions from Georgia-Power Plant Scherer and from ground level sources in the Atlanta metropolitan area (maximum reductions of 0.8 and 1.2 ppb, respectively). These reductions are also the highest on days of high ozone concentrations. $NO_x$ emissions from the Chattanooga metropolitan area also influences the Fort Mountain monitor, but to a lesser degree, and not on many of the days of high ozone concentrations. However, the

emissions reductions modeled here differ in magnitude. To address this issue, we also normalized the reductions in ozone to the tons of $NO_x$ controlled. The average and normalized reductions in ozone , for days in which the 2002 base case concentration was above 70 ppb (7 days total), are given in Table 2. These data once again demonstrate the benefits of the existing SCRs at plants Bowen, Hammond and Wansley, along with the impact of $NO_x$ emissions from plant Scherer and from the Atlanta metropolitan area. However, the normalized reductions indicate that on a per-ton basis, $NO_x$ reductions from nearby sources (such as ground level sources in the Georgia counties of the Chattanooga NAA, as modeled in Case 4) are the most efficient. It is, however, unfeasible to control these emissions to a level that would introduce a significant reduction in ozone concentrations at Fort Mountain.

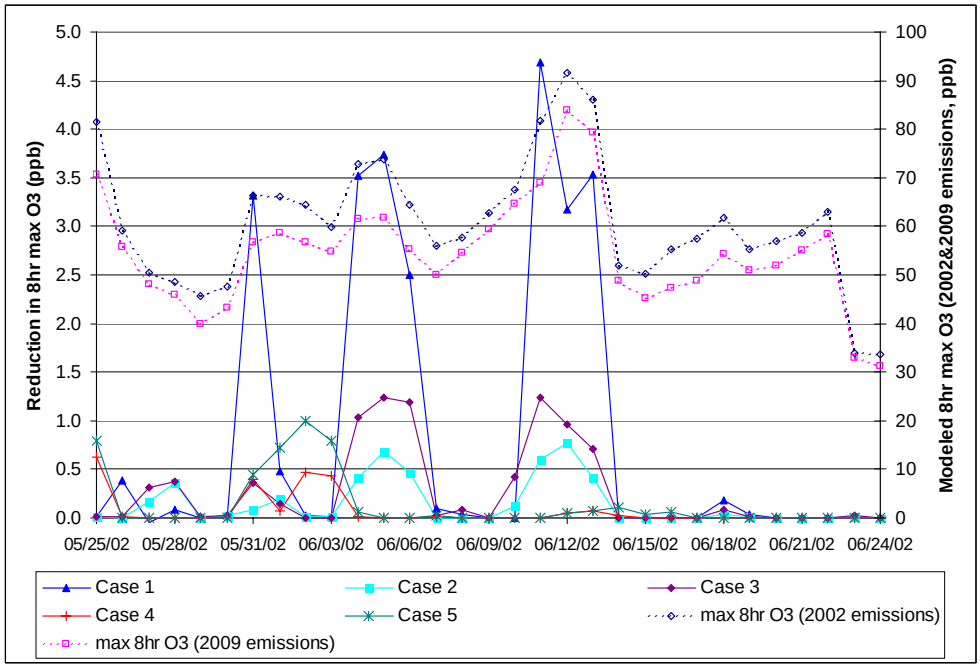


**Figure 1**: Daily reductions in maximum 8-hour ozone concentrations, along with base case concentrations, at the Fort Mountain site

Also evident in Figure 1 are the impacts of $NO_x$ emissions reductions expected by 2009, compared to the 2002 case (most of the reductions are from the mobile-source and EGU sectors; for more details see Marmur et al., 2005). This further demonstrates that

ongoing reductions in $NO_x$ emissions will continue to lower concentrations of ozone at the Fort Mountain site.

**Table 2**: Average reductions in 8-hour ozone concentrations (ppb) and normalized reductions (ppt O3 / TPD $NO_x$) for days in which the 2002 base case concentration was above 70 ppb (7 days total)

| Case # | Average reduction (ppb) | Normalized reduction (ppt O3 / TPD $NO_x$) |
|---|---|---|
| 1 | 3.11 | 16.9 |
| 2 | 0.48 | 16.1 |
| 3 | 0.86 | 22.8 |
| 4 | 0.13 | 62.2 |
| 5 | 0.16 | 21.6 |

**Summary and conclusions**

This analysis has shown that existing SCRs in several power-plants throughout northern Georgia have lead to reduced ozone concentrations at the Fort Mountain site. Also demonstrated were the impacts of reductions in $NO_x$ emissions from the Atlanta metropolitan area on ozone concentrations at Fort Mountain. Since such reductions are ongoing (fleet turnover, as indicated by data from the emissions inventory), lower ozone concentrations at the Fort Mountain site are expected.

**References**

Marmur, A., Boylan, J., Khan, M., and Cohan, D. (2005), 8-Hour Ozone and $PM_{2.5}$ Modeling to Support the Georgia SIP, 4th Annual CMAS Models-3 Users' Conference, Chapel Hill, NC (http://www.cmascenter.org/conference/2005/abstracts/7_6.pdf)