Response to Reviewer #5 comments:

This paper presents the results of a thermodynamic equilibrium analysis to isolate the NH_3-dominant vs. HNO_3 dominant regimes by analyzing the atmospheric chemical observations measured during the KORUS-AQ campaign. The authors related the results to the policy of mitigation strategies for high levels of PM concentrations over the Korea. Above all, this study seems to be important in terms of dividing emission reduction strategies into two regimes in terms of policy approaches. Overall, this manuscript seems to deserve publication in acp, suggesting that between two emission reductions (HNO_3 vs. NH_3), HNO_3 (or NO_x) reduction is better to be chosen as a priority in emission reduction, than NH_3 reduction. However, the current conclusion would become more solid by supplementing the following comments (below).

Answer: *We thank the reviewer for the positive view of our work! Below, we include the response to each comment and question raised.*

Key comments:

1. Before submitting the current comment, I noticed the point of anonymous referee#2, pointing out the implications for policy making: transported nitrate via free troposphere (L48) vs. local concentrations within PBL(1km). I recommend the authors to take a note on the differences from identical tests for two separated synoptic periods (classified by Peterson et al. 2019): Stagnation under a persistent anticyclone (May 17–22) and transported haze development (May 25–31).

Peterson, D. A., Hyer, E. J., Han, S.-O., Crawford, J. H., Park, R. J., Holz, R., Kuehn, R. E., Eloranta, E., Knote, C., Jordan, C. E., Lefer, B. L., 2019. Meteorology influencing springtime air quality, pollution transport, and visibility in Korea. Elem. Sci. Anth. 7 (1), https://doi.org/10.1525/elementa.395.

Answer: *We thank the reviewer for pointing this out. As suggested, we will discuss the two cases mentioned in the analysis and policy implications of the revised manuscript.*

2. It needs to be stated that HNO_3 control does not have the same meaning as NO_x control. (e.g., line 367). Even if NO_x emissions are reduced, HNO_3 generation may not decrease much due to fluctuations in HNO_3 generation efficiency. This is related to the non-linearity of NO_x-HNO_3 reaction from three dimentional atmospheric chemistry viewpoint, rather than from equilibrium perspectives.

Fu et al. (2020), https://dx.doi.org/10.1021/acs.est.9b07248, Environ. Sci. Technol., 2020, 54, 3881-3889

Answer: *This is a good point, and we will clarify these points in the revised manuscript.*

3. It is worth mentioning that besides chemical equilibrium, there may be a role of ammonia, e..g in the oxidation process of NOx: Li et al(2018), PNAS 115 (28) 7236 7241, doi .org/10.1073/pnas.1807719115, Zhang et al(2020), PNAS 117 (8) 3960 3966, doi .org/10.1073/pnas.1919343117

Answer: *Thank you for raising this point, we will note this chemical feedback in the modified manuscript.*

4. Regarding the NOx control vs NH3 control described in "Summary and broader implications", why not both "NOx and NH3 controls"? Reductions in both NOx and NH3 emissions at the same time seems to be a reasonable approach to reducing both nitrate and avoiding large increases in particle acidity. If there are any advantages of reducing both, please describe in the manuscript.

Answer: *Indeed, for a significant fraction of the data points, the aerosol is sensitive to both NO_3 and NH_3 levels – for which both NO_3 and NH_3 controls would be effective. The aerosol, however, is always sensitive to NO_3 reductions, especially for cases where aerosol levels were high. For this reason, we ranked the controls for NO_3 higher than reductions of NH_3 – but still mention both. We will clarify these points in the revised text.*

Minor comments:

5. line 52, 56, 655-656: RSSR, 2016 => RSSR, 2017

6. line 58: rephrase "air quality mitigation strategies", e.g., air pollution mitigation strategies

7. line 425: add the citation info for Wong et al. (2020) to the references section

8. line 701-710: cite Warner et al. (2017) and Womack et al. (2019) in the text

9. Figure 2: need to switch "Yes" and "No"

Answer: *Thank you for pointing out these issues! All corrections made.*

References

Nenes, A., Pandis, S. N., Kanakidou, M., Russell, A., Song, S., Vasilakos, P., and Weber, R. J.: Aerosol acidity and liquid water content regulate the dry deposition of inorganic reactive nitrogen, Atmos. Chem. Phys., in press, 2021.