

Response to Reviewer # 2 (RC1)

Manuscript title: Emission control redirects aerosol formation toward nocturnal oxidant chemistry: Observations at a Korean petrochemical complex

Manuscript ID: egusphere-2026-2795

We appreciate the anonymous reviewer for the thoughtful review and constructive comments. We have carefully considered every suggestion and revised the manuscript accordingly. In the reply that follows, reviewer comments are shown in blue, our responses are in black, and manuscript modifications are shown in red, with the revised text quoted verbatim so that the referee can see exactly how each change appears. Line and figure references correspond to the revised manuscript.

General comments:

This manuscript presents a study investigating the aerosol formation due to nocturnal oxidant chemistry based on observations at an emission-controlled petrochemical complex in South Korea. The topic of this study falls within the scope of the journal Atmospheric Chemistry and Physics. This manuscript is generally laid out well and shows its academic value. This manuscript is recommended to be published after addressing the following minor concerns.

We sincerely thank the referee for the positive overall assessment of our manuscript and for confirming that the topic fits the scope of Atmospheric Chemistry and Physics. We are grateful for the constructive minor comments, which we have addressed point-by-point below. All corresponding revisions have been implemented in the revised manuscript.

Minor comments:

Line 98: What does NR stand for? Does it mean non-refractory? Please provide the full form first before using the acronym by itself.

We have revised the manuscript to define "NR" as "non-refractory" before using the acronym.

Line 138: Please provide the name and definition of m/z even though this is a common parameter in the field of mass spectrometry.

We have added the name and definition of " m/z " to the text as requested.

Line 304: What does MLH stand for? Does it stand for mixing layer height? Please provide the full form first before using the acronym by itself.

We have revised the manuscript to define "MLH" as "mixing layer height" before using the acronym.

Line 323: Please provide the full form of AGL. Does it stand for above ground level?

We have revised the manuscript to define "AGL" as "above ground level."

Figure 1: Please provide the orientation in the map for clarity and to ensure academic rigor.

We have added a directional orientation indicator to the map for clarity and academic rigor.

Figure 3: It seems that mixing layer height is also provided but not mentioned in the caption for Panel (b).

We have updated the caption for Panel (b) to include the mixing layer height.

Figure 3: Total Particulate Matter in the literature is usually referred to as TSP (total suspended particulate) rather than PM1 (Particulate Matter with aerodynamic diameters less than or equal to 1 micrometer). Please revise the caption for Panel (e) to avoid confusion.

We appreciate your suggestion. To avoid any confusion regarding the terminology, we have revised the caption for Panel (e) to specify that 'PM1' refers to submicron particulate matter.

Figure 4: It seems that Panel (b) shows not only from 01:00 to 07:00 but from 00:00 to 24:00. Please revise either the caption or the figure.

We thank the referee for identifying this inconsistency. Panel (b) does display the full 24-hour diurnal cycle rather than only the 01:00–07:00 window originally stated in the caption. We kept the full 24-hour presentation because it more clearly reveals the day-to-night transition of NO_2/O_3 that motivates the subsequent mechanistic discussion. Accordingly, the caption has been corrected, and the 01:00–07:00 window is now described as the specific night-to-dawn window highlighted within the full diurnal profile for mechanistic interpretation.

Now, the relevant section reads: *“(b) Diurnal variations in NO_2/O_3 and nitrate concentrations, highlighting the night-to-dawn period (01:00–07:00 LT) where chemical production occurs under NO_2 -limited conditions.”*

Figure 4: Panel (c) seems to show NO_3 production on the left vertical axis and $[\text{NO}_2] \times \text{radiation}$ on the right vertical axis, which are not N_2O_5 concentration and not consistent with the caption. Please revise the manuscript to ensure consistency.

We thank the referee for this careful and important observation. The referee is correct: Panel (c) does not depict N_2O_5 concentration. The left vertical axis shows the modeled NO_3 radical production rate $p(\text{NO}_3)$ calculated from NO_2 and O_3 concentrations, and the right vertical axis shows the daytime photochemical proxy $[\text{NO}_2] \times \text{solar radiation}$. The original caption's reference to “ N_2O_5 concentration” was a residual from an earlier draft and has been fully removed. The revised caption now describes both quantities explicitly, and the interpretive sentences in Section 3.2 have been reworded to be consistent with what is actually plotted.

Now, the relevant section reads: *“(c) The Nitrate production rate ($p\text{NO}_3$) was calculated from NO_2 and O_3 concentrations, and the product of NO_2 and solar radiation was used as a proxy for photochemical oxidation.”*

Figure 5: What Ox concentration range is used for each box plot? Please provide the description in the caption for readability.

We have added a description to the caption, clarifying that the data are binned by 10 ppb increments for the Ox concentration.

Figure 6: What is the range of binned VOC levels for each box plot? Please provide the description in the caption for readability.

We have revised the figure caption to include a description of the binned VOC levels.

Table 1: What does the bold font mean for each parameter shown in Panel (c)?

We initially used bold font to highlight specific characteristics during stagnant periods. However, we agree that this may cause confusion, and we have removed the bold formatting to present the data more clearly.

We thank the referee once again for the careful and constructive review. We believe the revisions above satisfactorily address all points raised.