Oral Statement to CASAC to comment on Two Areas of the 2019 Draft Integrated Science Assessment of the Ozone National Ambient Air Quality Standards

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December 4, 2019

Thank you for this opportunity to provide oral comments to CASAC. I am a meteorologist and an air quality scientist with 44 years of experience at AECOM, which is an engineering and environmental consulting company. I have previously delivered comments on NAAQS reviews to CASAC and I have worked with the EPA on the development of air quality dispersion models, including the AERMOD model, which is used extensively for short-range dispersion. My time commitment to prepare these remarks has been sponsored by the American Petroleum Institute.

I am commenting here on two areas involving background ozone that should be considered for updates to the final ISA document. The first area involves stratospheric intrusions and their importance and frequency. The other area is the recent trend in ozone concentrations monitored in China. I have submitted written comments to CASAC to supplement these oral remarks.

The draft ISA notes that deep stratospheric intrusions are "episodic" in nature and they do not typically occur during the peak summer ozone season. In the supplemental document that I submitted to EPA, I cited additional references not mentioned in the draft ISA and I provided an example of how a stratospheric intrusion event documented with the assistance of ozonesondes may have been a contributor to a Maryland ozone NAAQS exceedance event two days after the intrusion event in July 2011.

The stratosphere is characterized by stable temperature lapse rate conditions, low humidity, and high ozone levels. Commercial aircraft typically fly in the lower stratosphere (above 32,000 feet, or about 10 km in the mid latitudes) due to the lower levels of turbulence and lack of clouds at those levels. However, all of you who have flown on aircraft know very well that there can be high levels of turbulence even at those levels, that aircraft need to divert around areas of significant weather to avoid turbulence, and that spring and summer thunderstorms can penetrate to heights well above this level and cause significant air exchanges with the stratosphere.

In addition to tall cumulonimbus clouds associated with thunderstorms, which are a commonplace event in the summer, there is significant mixing with the stratosphere and troposphere along the jet stream where cold or warm fronts are forming. Several investigators that I have noted in my filed comments have studied stratosphere-troposphere exchanges, and the more extensive the upper-level measurements, the more likely the conclusion by these investigators that these events are relatively frequent. However, the most common event is a shallow intrusion into the troposphere rather than a deep intrusion.

With the frequent shallow stratospheric intrusion events, the elevated ozone remains aloft in the troposphere and can still provide somewhat elevated levels of ozone to the ground after a day or two by

the diurnal pattern of strong convective mixing within the troposphere, especially on sunny summer days. This can often happen with the passage of a high pressure system, which is also associated with relatively clear skies and strong photochemical activity. Therefore, high ozone concentrations at the ground can often be a combination of stratospheric ozone transported from the mid-troposphere and ozone generated from anthropogenic emissions.

Now, I would like to briefly address the issue of recent ozone trends in China, which is a source of background ozone. The draft ISA states in Appendix 1 that recent reductions in NOx emissions in China are leading to lower ozone concentrations from that important geographic region, but monitoring indicates that this is not the case. Ozone concentrations continue to increase in China, and I provided a plot of the concentration trend in my written comments to CASAC. The issue in China is complicated due to an important role played by particulate matter in the chemistry of the ozone formation in polluted environments such as those found in Asia. In China, reduction of particulate emissions in recent years has actually led to increases in ozone concentrations in spite of NOx emission reductions because the aerosol sink of hydroperoxy (HO_2) radicals has been reduced, which, in concert with additional sunlight with reduced haze, has stimulated ozone production.

This concludes my oral remarks.