

JET-POWERED AIRPLANES EXHAUST EMISSIONS[©]

by Dan Pemble, Kissimmee, Florida – January 9, 2021

In an article I wrote during late 2019 I stated: 'At one time, every jet airplane flying created visible smoke trails. These emissions were created by unburned products from the fuel (basically high-grade kerosene) and included carbon dioxide (CO₂), carbon debris, sulfur, and nitrous oxides (NO₂). Today these emissions are known as Green House Gases (GHG) and in fact contribute to the overall harmful pollutants in the world's atmosphere. However, over the years, each successive generation of jet engine designs has become more and more fuel efficient and their exhausts rarely emit any visible smoke at all and, most importantly, contain less and less pollutants.

During August of 2020, the United States Environmental Protection Agency (EPA) announced that they were finalizing the first-ever proposed standards to regulate GHG emissions from airplanes. The following web site contains some general information in addition to the actual proposed rule, as contained in a 139-page pdf file:

<https://www.epa.gov/regulations-emissions-vehicles-and-engines/notice-proposed-rulemaking-control-air-pollution>

As you may imagine, the proposed rule is a long and somewhat difficult read. Just as an introduction, the following is a direct quote from the above web site:

Rule Summary

In this action, EPA is proposing greenhouse gas (GHG) emission standards that would apply to certain new commercial airplanes, including all large passenger jets. These proposed standards would match the international airplane carbon dioxide (CO₂) standards adopted by the International Civil Aviation Organization (ICAO) in 2017. This proposed action, if finalized, would implement EPA's authority under the Clean Air Act and would maintain the worldwide acceptance of U.S. manufactured airplanes and airplane engines.

Certainly, if you are interested, you can read the entire 139-page contents of the rule at your leisure. The EPA also has published a 168-page supporting document: [Draft Airplane Greenhouse Gas Standards Technical Support Document \(TSD\)](#), available for review as also accessible on the above web site under the "Additional Resources" heading. This too is a long and somewhat difficult read.

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A few interesting facts that I have gleaned & paraphrased from the noted EPA documents are as follows:

- Jet engine exhaust emissions are composed of 99% carbon dioxide (CO_2) and 1% of nitrous oxides (NOX or NO_2); NOX is actually nitric acid and nitric dioxide, the source of “acid rains”. (New engine design goals include significant attention to NOX reduction.)
- Airplanes covered by the proposed standards account for 10% of all transportation-related emissions and about 3% of the total USA emissions
- All transportation-related fuels are responsible for approximately 54% of all NOX emissions
- Modern airplanes’ jet engines are overall consumers of methane, hydro fluorocarbons (used as refrigerants), perfluorocarbons (used for semi-conductor production), and sulfur hexafluoride (used as electrical insulators and arc suppressants) and, while classified as GHGs, these are not products of airplane fuel combustion
- The proposed EPA standards are basically an endorsement of the existing International Civil Aviation Association standards – without any other particular restrictions.

