



# Environmental Fact Sheet

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## Adopted Aircraft Engine Emission Standards

*The Environmental Protection Agency (EPA) is promulgating new emission standards for oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO) for commercial aircraft engines. This rule will adopt the current voluntary NO<sub>x</sub> and CO emissions standards of the United Nations International Civil Aviation Organization (ICAO), bringing the United States aircraft standards into alignment with the international standards.*

### Emissions From Aircraft Engines

Aircraft engines contribute about 2 percent of the total U.S. mobile source NO<sub>x</sub> and CO emissions. However, in some U.S. airport areas, aircraft can contribute up to 4 percent of mobile source NO<sub>x</sub> emissions. Commercial aircraft emissions are a fast growing segment of the transportation emissions inventory. In the Los Angeles area for example, commercial aircraft NO<sub>x</sub> emissions are expected to double by 2010. This growth is occurring at a time when other significant mobile and stationary sources are drastically reducing emissions, thereby accentuating the growth in aircraft emissions.

### Health and Environmental Concerns

NO<sub>x</sub> is harmful to human health and the environment. Nitrogen dioxide, a form of NO<sub>x</sub>, can reduce pulmonary function and increase airway irritation in healthy people as well as individuals with pre-existing pulmonary conditions. The risk of respiratory illness appears to increase in children exposed

to nitrogen dioxide. NO<sub>x</sub> contributes to acid rain, which affects both terrestrial and aquatic ecosystems, including acidification of waters, reductions in fish populations, damage to forests and wildlife, soil degradation, and damage to materials, monuments, and buildings. NO<sub>x</sub> is also a precursor to ozone, which affects both biological tissues and man-made materials. Ozone affects human pulmonary and respiratory health and causes damage to forests and vegetation. NO<sub>x</sub> emissions could also form secondary particulate matter, which causes detrimental health and welfare effects.

CO also has significant human health effects. CO enters the blood stream through the lungs and reduces the delivery of oxygen to the body's organs and tissues. Persons with heart disease are especially sensitive to CO and may experience chest pain when breathing CO. Infants, elderly persons, and individuals with respiratory diseases are also particularly sensitive. CO can affect healthy individuals, impairing exercise capacity, visual perception, manual dexterity, learning ability and the ability to perform complex tasks.

To protect public health and the environment, EPA has established National Ambient Air Quality Standards (NAAQS) for air pollutants, including nitrogen dioxide, ozone, CO, and PM. Because aircraft emissions contribute to increases in these air pollutants, the ICAO aircraft standards adopted in this rule will help states achieve and/or maintain compliance with NAAQS.

## **History of EPA's Regulation of Aircraft Engine Emissions**

Prior to this rule, EPA regulations on aircraft were limited to smoke and fuel venting emissions standards for all commercial jet aircraft classes. This includes: turboprop engines (TP); turbofan and turbojet engines (TF); turbine engines of the JT3D model family (T3); turbine engines of the JT8D model family (T8); and turbine engines for aircraft designed to operate at supersonic flight speeds (TSS). EPA also had HC emission standards for newly manufactured aircraft gas turbine engines (TF, T3, and T8) with a thrust greater than 26.7 kN. Separate HC emission standards exist for gas turbine engines employed in supersonic aircraft, and the smoke standards vary for the several different classes of engines. EPA regulations for smoke and HC emissions have been in effect since 1984.

## **EPA's Participation in ICAO**

EPA has worked with the Federal Aviation Administration (FAA) of the Department of Transportation and ICAO in the development of international aircraft emission standards. FAA is responsible for enforcing the aircraft emissions standards established by EPA. ICAO was established by the United Nations to ensure equality and consistency among international air transport services. One of ICAO's objectives is to lead international bodies in the development of standards and procedures for aircraft engines. The United States is one of more than 150 participating member States of ICAO. Under the basic ICAO treaty established in 1944, the participating nations have an obligation to adopt, to the extent possible, the ICAO standards. However, ICAO standards are voluntary. EPA has been supportive of the ICAO development of aircraft standards and this rule formalizes EPA's adoption of ICAO standards.

## **Main Components of the Rule**

This rule will codify into United States law the current voluntary NO<sub>x</sub> (a two-staged NO<sub>x</sub> standard) and CO emission standards of ICAO, and thereby bring the United States emission standards into alignment with the internationally adopted standards. The ICAO CO and first-stage NO<sub>x</sub> standards have been in effect since 1986. In addition, EPA is amending the test procedures for gaseous exhaust emissions and smoke exhaust emissions to correspond to recent ICAO amendments. EPA is also adopting ICAO's requirement that these standards also apply to applications that otherwise would have been fulfilled by turbojet and turbofan engines (e.g. propfan, unducted fan, and advanced ducted fan). United States certification test fuel specifications are also being amended to make them consistent with ICAO's test fuel specifications. The adopted emission standards and test procedures apply to commercial aircraft engines with rated thrust greater than 26.7 kilonewtons (kN) that are either newly certified or newly manufactured after the effective date of these regulations. No general aviation or military engines are covered by this rule. The adopted emission standards are described below.

### **CO Standard**

The CO standard applies to newly manufactured aircraft gas turbine engines (turbofan and turbojet engines).

CO = 118 grams/kilonewton (g/kN)(rated output)

## **NOx Standards**

The NOx standards apply to newly certified and newly manufactured aircraft gas turbine engines (turbofan and turbojet engines).

- For engines of a type or model of which that date of manufacture of the first individual production model was on or before December 31, 1995 and for which the date of manufacture of the individual engine was on or before December 31, 1999:

$$\text{NOx} = (40 + 2(\text{rated pressure ratio}))\text{g/kN}(\text{rated output});$$

- For engines of a type or model of which the date of manufacture of the first individual production model was after December 31, 1995 or for which the date of manufacture of the individual engine was after December 31, 1999:

$$\text{NOx} = (32 + 1.6(\text{rated pressure ratio}))\text{g/kN}(\text{rated output}).$$

The first NOx emission standard presented above matches the ICAO standard that became effective in 1986. The second NOx emission standard above matches the ICAO 1993 amendments which will result in a 20 percent reduction and will become effective in the year 1996 for newly certified engines and in the year 2000 for newly manufactured engines. There is a four year period between when newly certified engines must meet the standards and when all newly manufactured engines must meet the standards to provide lead time for the production of 100 percent compliant products.

## **Benefits of Adopting ICAO Standards**

This rule will establish consistency between U.S. and international standards, requirements, and test procedures. Since aircraft engines are international commodities, there is a commercial benefit to consistency between U.S. and international emission standards and control program requirements. It would be easier for manufacturers to certify products for international markets since the U.S. can certify engines for ICAO compliance. Emission certification tests meeting U.S. requirements will also be applicable to all ICAO requirements. In addition to the economic benefit, this rule ensures that domestic commercial aircraft will meet the current ICAO standards, and thus, the public can be assured they are receiving the air quality benefits of the international standards.

All engines covered by the new federal standards already meet ICAO standards or will meet them by the standards' effective dates. Manufacturers have already been developing improved technology in response to the ICAO standards. Therefore, there are no additional costs to be incurred by the aircraft industry as a result of this rule. In addition, the test data necessary to determine compliance are already collected by manufacturers during current engine certification tests. Thus, the regulations will impose no additional burden on manufacturers.

### **For More Information**

Information on aircraft emission standards is available electronically via the EPA Internet server or via dial-up modem on the Technology Transfer Network (TTN), an electronic bulletin board system (BBS).

World Wide Web: <http://www.epa.gov/OMSWWW>

TTN BBS: 919-541-5742 (1200-14400 bps, no parity, 8 data bits, 1 stop bit); voice helpline: 919-541-5384.

For further information, please write to:

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