Federal Aviation Administration

Memorandum

FAA Order 1050.1E, Change 1, Guidance Memo #3[1]

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To: FAA Lines of Business and Managers with NEPA Responsibilities

From: Julie Marks, Manager, Environmental Policy and Operations, AEE-400

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Subject: **Considering Greenhouse Gases and Climate Under the National Environmental Policy Act (NEPA): Interim Guidance**

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Purpose

This document provides FAA guidance concerning the consideration and evaluation of greenhouse gases (GHGs) and climate under the National Environmental Policy Act of 1969 (NEPA), as amended, 42 USC §§4321 et seq.

Introduction

FAA Order 1050.1E (Change 1) *Environmental Impacts: Policies and Procedures* (March 20, 2006) establishes agency-wide policies and procedures for compliance with NEPA and the implementing regulations issued by the Council on Environmental Quality (40 CFR parts 1500-1508). The Council on Environmental Quality (CEQ) has recently affirmed the applicability of NEPA and the CEQ regulations to GHGs and climate. CEQ has also noted that "...it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate

[1] This document is interim guidance memo #3 for FAA Order 1050.1E (Change 1). It is the third in a series of memos to provide additional guidance on FAA's NEPA requirements, procedures, and practices.

change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives."[2]

GHGs are defined as including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), in accordance with Executive Order 13514 *Federal Leadership in Environmental, Energy, and Economic Performance*. There are currently no federal standards for GHG emissions applicable to aviation.

This guidance supplements FAA Order 1050.1E in order to explicitly identify climate as a category of potential environmental impact that should be considered in FAA Environmental Assessments (EAs) and Environmental Impact Statements (EISs), and to provide additional details on how to consider: 1) GHGs in the FAA NEPA evaluation process, 2) the context of those emissions, and 3) reducing GHGs. This guidance does not change any current requirements of Order 1050.1E, including FAA significance thresholds, actions normally requiring an EA or EIS, categorical exclusions or extraordinary circumstances. There is a considerable amount of ongoing scientific research to improve understanding of global climate change and FAA guidance will evolve as the science matures or if new federal requirements are established.

1. NEPA Evaluation Process

NEPA requires the consideration of the environmental impacts of a proposed action and alternatives. In the case of GHGs this could be qualitative or quantitative. Considering GHG emissions for an FAA NEPA review should follow the basic procedure of considering the potential incremental change in GHG emissions (i.e. the Delta) that would result from the proposed action and alternatives compared to the no-action alternative for the same timeframe, and discussing the context for interpreting and understanding the potential changes. Currently, there are no federal standards for reporting GHG emissions from aviation sources, as well as no significance thresholds. For FAA NEPA reviews, GHG emissions should be quantified under the following circumstances:

1) When there is reason to quantify emissions for air quality purposes, then metric tons of CO_2equivalent (MT CO_2e) should also be quantified and reported in the NEPA documentation; or
2) When fuel burn is computed and reported in the NEPA document, quantification of MT CO_2e calculated from the fuel burned should also be included in the document.

<u>*Data Analysis*</u>

GHGs result primarily from combustion of fuels, and there is a direct relationship between fuel combustion and MT CO_2. The CEQ document *Federal Greenhouse Gas Accounting and Reporting Guidance* (October 6, 2010; hereafter "federal protocol") "serves as the Federal Government's

[2] *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emission*, CEQ (2010).http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf

official Greenhouse Gas reporting protocol."[3] In accordance with that federal protocol, and to provide a single metric that embodies all GHGs, emissions should be reported in metric tons of carbon dioxide equivalent (MT CO_2e). *It is important to note that for aircraft, CO_2 emissions are equivalent to CO_2e emissions because CO_2 is the only combustion product of the six GHGs in the federal protocol.*

For FAA NEPA evaluations the amount of CO_2 and/or fuel burn from aircraft operations should be calculated from an FAA-approved tool appropriate for the action. The Aviation Environmental Design Tool (AEDT) and/or the Emissions Dispersion Modeling System (EDMS) can generate CO_2 emissions for aircraft operations, as well as ground service equipment, motor vehicles, and other sources of emissions. If aircraft CO_2 is not calculated directly by the tools used (e.g., Noise Integrated Routing System, or NIRS), the CO_2 emissions should be calculated from projections of total fuel burned.

To convert fuel quantities to CO_2 use the following equation factors:

1 gallon of jet fuel = 9.7438 kg CO_2
1 pound jet fuel = 1.4329 kg of CO_2
1 gallon of avGas = 8.3182 kg CO_2
1 pound avGas = 1.3864 kg of CO_2
(one metric ton = 1,000 kilograms)

The calculation of aircraft CO_2 for an action alternative would be added to any other potential GHGs for that alternative in order to reach an overall CO_2e total for that alternative. If the proposed action involves only aircraft operational changes, then the MT CO_2e would be exactly the same as the aircraft MT CO_2. If further details are necessary on converting to CO_2e for non-aircraft sources (e.g., stationary sources) the federal protocol should be consulted. The total MT CO_2e should be calculated for what is reasonably foreseeable, using the same analytical timeframes currently used for NEPA analyses.

Documentation

The discussion of GHGs in a NEPA document could be qualitative or quantitative. When CO_2e is quantified by one of the methods above, the values for CO_2e for the proposed action and alternatives should be documented in a separate section of the NEPA document distinct from air quality, under a heading labeled Climate. The MT CO_2e calculations should be provided in a table or similar format that compares the alternatives. If proxy measurements are used, such as delay time or fuel, it should be clear how the changes of each relate to CO_2.

For an air traffic action, when fuel burn is computed and reported in the energy section of the NEPA document, the MT CO_2 equal to that fuel content should be documented in the section of the document on Climate. The boundary for the GHG consideration will be the same as the study

[3] *Federal GHG Accounting and Reporting*, and the corresponding *Technical Support Document*, available at: http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg

area for the air traffic study. Note that non-aircraft emission sources are typically not affected by airspace and procedural actions.

For an airport action, the GHG evaluation should include the same emission sources that would typically be included in the air quality analysis. The maximum altitude for any analyses for an airport NEPA action would be the landing-takeoff cycle (LTO) emissions up to the local mixing height, which is consistent with the current approach and EPA guidance with regard to local air quality evaluations.[4] For non-aircraft sources of emissions, GHG emissions should be determined from projections of fuel burn and converted to CO_2e.

Below are descriptions of two potential circumstances, with explanations of how the NEPA evaluation process should be conducted for each:

> *Proposed action or reasonable alternative would not increase GHG emissions compared to the no-action alternative*
> If the proposed action and alternatives would cause no net change or a net reduction in GHG emissions as a result of a quantitative or qualitative assessment, this should be briefly explained in the EA or EIS and no further consideration of GHGs is necessary.
>
> *Proposed action or reasonable action alternative would result in an increase of GHG emissions over the no-action alternative*
> Projected increases in GHG emissions should be discussed in their context. The process for considering the context of MT CO_2e is described below, and the Appendix contains sample language that can be adapted for specific actions. If the increase in GHG emissions is not quantified (i.e., because other air emissions are not quantified and fuel burn is not computed), context should be considered qualitatively. If necessary, the appropriate FAA Headquarters program office or the Office of Environment and Energy (AEE) should be consulted regarding how best to scope the analysis and discussion of GHG emissions.

2. Considering the context of GHG emissions

The context of GHG emissions from a proposed action should be considered on a case-by-case basis, and can include qualitative discussion of GHGs, accompanied by quantitative analyses when appropriate. To establish context, the difference in the MT CO_2e value for the proposed action and alternatives should be compared to national CO_2e emission totals publically reported by the EPA and to global emission totals.[5] Projected increases in CO_2e that would result from the

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[4] *Procedures for Emission Inventory Preparation, Volume IV, Chapter 5: Emissions from Aircraft,* U.S. Environmental Protection Agency (1992). Document number EPA 420-92-009.

[5] See EPA website for national CO_2e emission totals. http://www.epa.gov/climatechange/emissions/usgginventory.html. The IPCC estimates global GHGs in 2004 at 49 Gigatonnes CO_2e with CO_2 being the single largest source. http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-ts.pdf

proposed action and alternatives should be discussed as a percentage of national and global CO_2e totals from all GHG sources. Sample language for discussing context and significance of GHG emissions is provided in the Appendix, and can be adapted to the specific NEPA document depending on the proposed action. Analyses of GHG emissions should not attempt to model the effects that project emissions would have on climate at this time based on CEQ advice that it is not currently useful to attempt to link project-specific GHG emissions to climate effects.

3. Reducing GHGs

For NEPA review of proposed FAA actions that would result in increased emissions of GHGs, consideration should be given to whether there are areas within the scope of the project where emissions could be reduced. GHG emission reductions contribute towards the U.S. goal to reduce aviation's effect on climate. The selection of a lower emitting alternative under NEPA is one means of minimizing GHG emissions. Also GHG emission reduction can come from measures such as changes to ground-based equipment, use of biofuels, and through operational changes such as performance-based navigation designed to reduce aircraft fuel burn. These types of reductions can be used to offset increases and thereby minimize overall emissions from a proposed action. However, reduction is not mandated and will not be possible in all situations.

Related Requirements

There may be state or local requirements applicable to particular proposed projects. Other federal agencies with permitting or approval responsibility may also have guidance that must be considered. Early coordination with other agencies should identify any additional documentation needs.

For further information, contact:

Your Federal Aviation Administration Headquarters Program Office

or

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Appendix – Foundational Text for Discussion of GHGs in FAA NEPA Documents

This Appendix presents sample language that can form the basis for a discussion of greenhouse gases (GHGs) in FAA NEPA documents where a proposed action or reasonable alternative would cause an increase in GHG emissions.

Affected Environment

Research has shown there is a direct correlation between fuel combustion and GHG emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that "domestic aviation contributes about 3 percent of total carbon dioxide emissions, according to EPA data," compared with other industrial sources including the remainder of the transportation sector (20 percent) and power generation (41 percent).[6] The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic GHG emissions globally.[7] Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate.[8]

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., NASA, NOAA, EPA, and DOE), has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for AiR Transportation Noise & Emissions Reduction (PARTNER) Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the International Civil Aviation Organization.[9]

Environmental Consequences

Although there are no federal standards for aviation-related GHG emissions, it is well-established that GHG emissions can affect climate.[10] The Council on Environmental Quality (CEQ) has indicated that climate should be considered in NEPA analyses. As noted by CEQ, however, "it is not currently useful

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[6] *Aviation and Climate Change.* GAO Report to Congressional Committees, (2009). http://www.gao.gov/new.items/d09554.pdf

[7] Alan Melrose, "European ATM and Climate Adaptation: A Scoping Study," in *ICAO Environmental Report.* (2010).

[8] As explained by the U.S. Environmental Protection Agency, "greenhouse gases, once emitted, become well mixed in the atmosphere, meaning U.S. emissions can affect not only the U.S. population and environment but other regions of the world as well; likewise, emissions in other countries can affect the United States." Climate Change Division, Office of Atmospheric Programs, U.S. Environmental Protection Agency, *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3* (2009), available at http://epa.gov/climatechange/endangerment.html.

[9] Lourdes Q. Maurice and David S. Lee. *Chapter 5: Aviation Impacts on Climate.* Final Report of the International Civil Aviation Organization (ICAO) Committee on Aviation and Environmental Protection (CAEP) Workshop. October 29th – November 2nd 2007, Montreal. http://www.icao.int/icaonet/cnfrst/CAEP/CAEP_SG_20082/docs/Caep8_SG2_WP10.pdf

[10] See *Massachusetts v. E.P.A.*, 549 U.S. 497, 508-10, 521-23 (2007).

for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand".[11]

For airport actions:

The [proposed action or alternative] would increase GHG emissions by ___ MT CO_2e over the no-action alternative, an increase of ___ percent. This increase would comprise less than ___ percent of U.S.-based GHG emissions and less than ___ percent of global GHG emissions.[12]

For air traffic actions:

GHG emissions are commensurate with fuel consumption. As explained in section ___ of this document, the [proposed action or alternative] will increase aircraft fuel burn by ___ (gallons/pounds). The equivalent amount of CO2 emissions is ___. Based on these data, GHG emissions associated with [proposed action or alternative] would represent an increase of ___ percent. This would comprise less than ___ percent of U.S.-based greenhouse gas emissions and less than ___ percent of global greenhouse gas emissions.[13]

Cumulative Effects

The cumulative impact of this proposed action on the global climate when added to other past, present, and reasonably foreseeable future actions is not currently scientifically predictable. Aviation has been calculated to contribute approximately 3 percent of global carbon dioxide (CO_2) emissions; this contribution may grow to 5 percent by 2050. Actions are underway within the U.S. and by other nations to reduce aviation's contribution through such measures as new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, market-based measures and environmental regulations including an aircraft CO_2 standard. The U.S. has ambitious goals to achieve carbon-neutral growth for aviation by 2020 compared to a 2005 baseline, and to gain absolute reductions in GHG emissions by 2050. At present there are no calculations of the extent to which measures individually or cumulatively may affect aviation's CO_2 emissions. Moreover, there are large uncertainties regarding aviation's impact on climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., NASA, NOAA, EPA, and DOE), has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions, with quantified uncertainties for current and projected aviation scenarios under changing atmospheric conditions.[14]

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[11] *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions,* CEQ (2010). http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf

[12] See EPA website for national CO_2e emission totals. http://www.epa.gov/climatechange/emissions/usgginventory.html. IPCC estimates global GHGs in 2004 at 49 Gigatonnes CO_2e with CO_2 being the single largest source. http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-ts.pdf

[13] See EPA website for national CO_2e emission totals. http://www.epa.gov/climatechange/emissions/usgginventory.html. IPCC estimates global GHGs in 2004 at 49 Gigatonnes CO_2e with CO_2 being the single largest source. http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-ts.pdf

[14] Nathan Brown, et. al. *The U.S. Strategy for Tackling Aviation Climate Impacts*, (2010). 27th International Congress of the Aeronautical Sciences