

70.76, “Backfitting,” 10 CFR 50.109, “Backfitting,” and as described in NRC Management Directive (MD) 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests” (ADAMS Accession No. ML18093B087); does not constitute forward fitting as that term is defined and described in MD 8.4; and does not affect the issue finality of any approval issued under 10 CFR part 52, “Licenses, Certificates, and Approvals for Nuclear Powerplants.”

#### V. Submitting Suggestions for Improvement of Regulatory Guides

A member of the public may, at any time, submit suggestions to the NRC for improvement of existing RGs or for the development of new RGs. Suggestions can be submitted on the NRC’s public website at <https://www.nrc.gov/reading-rm/doc-collections/reg-guides/contactus.html>. Suggestions will be considered in future updates and enhancements to the “Regulatory Guide” series.

Dated: April 18, 2024.

For the Nuclear Regulatory Commission.

**Meraj Rahimi,**

*Chief, Regulatory Guide and Programs Management Branch, Division of Engineering, Office of Nuclear Regulatory Research.*

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## DEPARTMENT OF TRANSPORTATION

### Federal Aviation Administration

#### 14 CFR Part 34

[Docket No.: FAA–2023–2434; Amdt. No. 34–7]

RIN 2120–AL83

#### Control of Non-Volatile Particulate Matter From Aircraft Engines: Emission Standards and Test Procedures

**AGENCY:** Federal Aviation Administration (FAA), Department of Transportation (DOT).

**ACTION:** Final rule; request for comments.

**SUMMARY:** This action adopts standards for measuring non-volatile particulate matter (nvPM) exhaust emissions from aircraft engines. With this rulemaking, the FAA implements the nvPM emissions standards adopted by the Environmental Protection Agency (EPA), allowing manufacturers to certificate engines to the new nvPM emissions standards in the United States, and fulfilling the statutory

obligations of the FAA under the Clean Air Act.

**DATES:** This rule is effective May 24, 2024.

The incorporation by reference of a certain publication listed in this rule is approved by the Director of the Federal Register as of May 24, 2024. The incorporation by reference of a certain other publication listed in this rule was approved by the Director of the Federal Register as of December 31, 2012 (77 FR 76842).

Comments on this rule must be received by June 24, 2024.

**ADDRESSES:** You may send comments identified by docket number using any of the following methods:

- **Federal eRulemaking Portal:** Go to [www.regulations.gov](http://www.regulations.gov) and follow the online instructions for sending your comments electronically.
- **Mail:** Send comments to Docket Operations, M–30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue SE, Room W12–140, West Building Ground Floor, Washington, DC 20590–0001.
- **Hand Delivery or Courier:** Take comments to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- **Fax:** Fax comments to Docket Operations at 202–493–2251.

**Privacy:** In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to [www.regulations.gov](http://www.regulations.gov), as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at [www.dot.gov/privacy](http://www.dot.gov/privacy).

**Docket:** Background documents or comments received may be read at [www.regulations.gov](http://www.regulations.gov) at any time. Follow the online instructions for accessing the docket or visit Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

**FOR FURTHER INFORMATION CONTACT:** For technical questions concerning this action, contact Ralph Iovinelli, Office of Environment and Energy (AEE–300), Federal Aviation Administration, 800 Independence Ave SW, Washington DC 20591; telephone (202) 267–3566; email [Ralph.Iovinelli@faa.gov](mailto:Ralph.Iovinelli@faa.gov).

**SUPPLEMENTARY INFORMATION:**

#### Authority for This Rulemaking

The FAA’s authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator.

The Clean Air Act Amendments of 1970, title 42 of the United States Code, Chapter 85, Subchapter II, part B, Section 7572, grant the Secretary of Transportation the authority to ensure compliance with aviation emission standards adopted by the United States EPA. Further, 49 CFR 1.83(c) delegates to the FAA Administrator the authority to “[C]arry out the functions vested in the Secretary by part B of title II of the Clean Air Act.”

This rulemaking adopts regulations to enforce the standards adopted by the EPA under its authority in the Clean Air Act (the Act) in 40 CFR part 1031 at the time of aircraft certification to control certain emissions from airplane engines. This rulemaking is issued under 42 U.S.C. 7572 and 49 CFR 1.83(c).

#### Good Cause Statement

Section 553 of the Administrative Procedure Act (APA) (5 U.S.C. 553) requires Federal agencies to publish a notice of proposed rulemaking unless “. . . the agency for good cause finds (and incorporates the finding in a brief statement of reasons therefor in the rules issued) that notice and public procedure thereon are impractical, unnecessary, or contrary to the public interest.” Under this section, an agency, upon finding good cause, may issue a final rule without seeking comment prior to the rulemaking.

This rule adopts the procedures necessary for the FAA to implement the regulatory emissions limits and test requirements (together referred to as standards) for nvPM emitted by aircraft engines adopted by the EPA under 42 U.S.C. 7571 (sec. 231 of the Act) (87 FR 72312, November 23, 2022) that were effective December 31, 2022. These standards are set forth in 40 CFR part 1031. The FAA is statutorily required (see 42 U.S.C. 7572 (sec. 232 of the Act)) to incorporate the EPA’s nvPM emissions standards into its regulations (14 CFR part 34) and apply the regulatory requirements that will allow applicants to demonstrate compliance with the emissions standards at the time of engine airworthiness certification. The FAA has no authority to alter the standards (emission limits and test requirements) adopted by the EPA for engine emissions in 40 CFR part 1031.

The emission standards adopted by the EPA in 40 CFR part 1031 represent the results of widely coordinated

international efforts and public notice and comment rulemaking. The FAA, EPA, industry representatives, and foreign certification authorities all participated in a multi-year process that resulted in the nvPM standards adopted by the International Civil Aviation Organization (ICAO), which the EPA thereafter prescribed in 40 CFR part 1031. Because the FAA has no authority to change any of the standards adopted by the EPA, a solicitation of comments will not result in any substantive changes to the standards and would unnecessarily delay their implementation.

Accordingly, the FAA finds that notice and comment on the standards and procedures adopted in this rulemaking is unnecessary because the FAA does not have authority to make changes to the standards or procedures adopted by the EPA and the EPA issued its proposed rule for notice and sought public comment on these standards and test procedures prior to promulgating them on November 23, 2022.

Therefore, FAA finds that good cause exists under 5 U.S.C. 553(b)(3)(B) to waive prior notice and the opportunity for comment because such procedures are unnecessary.

Although the FAA has no authority to change any of the emission standards or procedures adopted by the EPA in accordance with the Act, the FAA is requesting comment from interested parties regarding the parts of this rulemaking that adopt the certification regulations in 14 CFR part 34 and implement them at the time of aircraft engine certification. The FAA will review and consider any comments received. Notice of any action the FAA takes as a result of a comment will be published in the **Federal Register**.

#### Comments Invited

The FAA encourages interested persons to participate in this rulemaking by submitting written comments containing relevant information, data, or views. The FAA also invites comments relating to the economic, environmental, energy, or federalism impacts that might result from the adoption of these requirements. While the FAA cannot amend the substance of the rule based on comments, it may take them under advisement for future actions. The FAA will consider comments received on or before the closing date for comments. The FAA will also consider late filed comments to the extent practicable.

See section VII., "How to Obtain Additional Information," for information on how to comment on this final rule and how the FAA will handle comments received. That section also

contains related information about the docket, privacy, and the handling of proprietary or confidential business information. In addition, there is information on obtaining copies of related rulemaking documents.

#### I. Executive Summary

This rulemaking adopts the regulations necessary for the Federal Aviation Administration (FAA) to implement the Environmental Protection Agency's (EPA) new aircraft engine emissions standards and certification test procedures for non-volatile particulate matter (nvPM) that were effective December 23, 2022.<sup>1</sup> The nvPM standards replace the historical smoke number (SN) requirements for certain larger aircraft engines and create new standards to address nvPM<sub>mass</sub> and nvPM<sub>number</sub>.

Since the EPA and FAA share the authority for aircraft engine emission standards under the Clean Air Act (the Act),<sup>2</sup> this action modifies 14 CFR part 34 (part 34) by adopting maximum nvPM mass concentration (nvPM<sub>MC</sub>) as the standard that addresses emissions plume invisibility, limits for nvPM<sub>MC</sub>, and limits for nvPM mass (nvPM<sub>mass</sub>) and nvPM number (nvPM<sub>num</sub>), for certain classes of subsonic turbofan engine emissions. As part of this action, the FAA is incorporating by reference the ICAO test procedures needed to measure nvPM at certification and adding the definitions and abbreviations to part 34 that are used in the nvPM certification standards. The new nvPM emissions standards apply to engines having a rated output greater than 26.7 kilonewtons (kN). The FAA is also amending its regulations to reflect the EPA's application of smoke number (SN) standards to all new supersonic engines regardless of size, and by adopting the same clarifying language promulgated by the EPA for the current fuel venting standard.

The FAA is adopting the same nvPM emissions limits as those promulgated by the EPA and ICAO. Engine manufacturers are already complying with ICAO nvPM standards; this rule will not cause manufacturers to incur additional costs to certify an engine in the United States. Manufacturers would likely incur higher costs if this rule is not implemented, since they would be required to seek certification

with a non-U.S. authority to remain competitive globally. More detail on the cost analysis is provided in Section V. A. of this document.

This final rule fulfills FAA's obligation to implement EPA's new emissions standards for U.S. civil aircraft and conforms U.S. regulations with the standards and recommended practices (SARPs) adopted by ICAO.

#### II. Background

Aircraft engine exhaust is comprised of gaseous compounds, and of particulate matter that contributes to both visible plume exhaust and atmospheric particulate matter. Particulate matter emissions include both volatile and non-volatile components. Non-volatile particulate matter (nvPM) is emitted directly from the engine and is comprised of a small amount of carbon particles (or "soot") that did not fully convert to the gaseous form of carbon dioxide (CO<sub>2</sub>) during the combustion process. Volatile particulate matter (vPM) condenses and agglomerates in the aircraft exhaust plume or where the gaseous emissions from the plume react with ambient chemicals present in the atmosphere. Since vPM are affected by atmospheric conditions and undergo rapid changes when emitted, they are difficult to predict or measure accurately. This rule does not address vPM, nor are there international standards for aircraft engine vPM emissions.

In 1973, the U.S. first addressed particulate matter emissions by adopting the smoke number (SN) standards of part 34 that focused on visible aircraft exhaust plumes. The SN standard was established to eliminate the visible particulate matter directly emitted by aircraft engines, rendering exhaust plumes invisible to the human eye. SN is determined by measuring the opacity of a filter after soot has been collected on it during the engine emissions certification test required by § 34.23(a).

In 2013, ICAO recognized that measuring nvPM emissions allowed a more comprehensive approach to controlling visible aircraft exhaust plumes by describing the nvPM emissions that are most likely to impact human health and welfare, and by establishing regulatory limits for them. As a result, the ICAO Committee on Aviation Environmental Protection (CAEP) began the first of two standard-setting actions work programs in its tenth triennial cycle (CAEP/10, 2013–2016) to incorporate non-volatile particulate matter emissions measurement and limits in ICAO's

<sup>1</sup> 87 FR 72312—Control of Air Pollution From Aircraft Engines: Emission Standards and Test Procedures.

<sup>2</sup> Clean Air Act mandates under 42 U.S.C. 7571 and 7572—Establishment and Enforcement of Standards. 42 U.S.C. 7571: Establishment of standards ([house.gov](https://www.house.gov)) and 42 U.S.C. 7572: Enforcement of standards ([house.gov](https://www.house.gov))

SARPs for turbofan engines greater than 26.7 kilonewtons (kN) of rated thrust.

As part of its first standard setting action, ICAO recognized that the measurement known as maximum nvPM mass concentration (nvPM<sub>MC</sub>) is a more accurate and modern replacement for the optical visibility standard represented by the long-standing SN standard. The visibility limit for nvPM<sub>MC</sub> was developed by ICAO using both measured SN and nvPM<sub>MC</sub> data from several modern engines to derive a SN-to-nvPM<sub>MC</sub> correlation. This correlation was then used to transfer the existing regulatory SN limit into an equivalent nvPM<sub>MC</sub> limit without increasing stringency. The nvPM<sub>MC</sub> measurement standard maintains the standard of invisibility of the exhaust plume that was achieved using SN but uses modern testing methodologies. The ICAO/CAEP analysis confirmed that an nvPM<sub>MC</sub> standard at maximum concentration is equivalent to the existing SN standard in controlling exhaust plume visibility.

In 2017, ICAO adopted the nvPM<sub>MC</sub> standard for engines with a rated output of greater than 26.7 kN to provide for a more precise measurement of particulate matter exhaust emissions than was possible using the SN standard. The ICAO SARP that included the nvPM<sub>MC</sub> standard was effective January 1, 2020, officially replacing ICAO's SN standard for civil subsonic aircraft engines that produce more than 26.7 kN of rated thrust.

From 2016 to 2019 (the CAEP/11 triennial cycle), ICAO set standards for two additional parameters for nvPM emissions from affected aircraft engines: nvPM mass (nvPM<sub>mass</sub>) and nvPM number (nvPM<sub>num</sub>) as the second of the two standard-setting actions. These nvPM standards were directed at controlling emissions from larger aircraft engines by addressing nvPM levels that are produced near airports, measuring nvPM<sup>3</sup> during landing and takeoff (LTO) cycles. The ICAO SARP that included the nvPM<sub>mass</sub> and nvPM<sub>num</sub> standards was effective January 1, 2023, for the same engines to which the nvPM mass concentration SARP applied.

As a signatory State to the Chicago Convention, the United States must establish standards that have the highest practicable degree of uniformity to the ICAO SARPs, or file a difference. By implementing the standards

<sup>3</sup> ICAO SARPs address only aircraft engines large enough to be used on international flights. ICAO leaves the regulation of smaller engines likely to be operated only domestically to the member States.

promulgated by EPA<sup>4</sup> that included ICAO's nvPM emissions standards, this rulemaking is the final action the United States needs to take to conform U.S. nvPM certification standards to the ICAO SARPs. This rule incorporates into 14 CFR part 34 the aircraft engine nvPM emissions standards adopted by the EPA in 40 CFR part 1031 that are required when certificating certain aircraft engines in the United States.

### III. Summary of Regulatory Changes

This final rule adopts the emissions levels and test requirements that will allow the FAA to certificate aircraft engines to the nvPM emissions standards developed by ICAO and made effective in the United States by the EPA on December 23, 2022. These new nvPM standards apply to subsonic aircraft turbofan engines having a rated output greater than 26.7 kN.<sup>5</sup> As a practical matter, the new nvPM emission standards allow engine manufacturers to use the same probe and rake collection system used to measure gaseous pollutants to simultaneously measure nvPM emissions for certification purposes. This simultaneous measurement eliminates the separate SN collection and measurement of soot on filter paper, reducing the amount of fuel needed to conduct separate engine tests, and making the component emissions measurements more representative of an engine's output.

The new nvPM emissions standard has three parameters: maximum nvPM<sub>MC</sub>, nvPM<sub>mass</sub>, and nvPM<sub>num</sub>. Maximum nvPM<sub>MC</sub> ensures the measurement continuity for visible particle emissions that SN established. nvPM<sub>mass</sub> measures the total weight (mass) of the non-volatile carbon particles emitted during a time-weighted landing and takeoff (LTO) test cycle. nvPM<sub>num</sub> is a measurement of the number of non-volatile carbon particles emitted during the same time-weighted LTO test cycle. The addition of nvPM<sub>mass</sub> and nvPM<sub>num</sub> represents the first time the component characteristics of non-volatile emissions are being measured. The ability to identify and measure these components will allow

<sup>4</sup> The EPA final rule that amended 40 CFR part 1031 was published at 87 FR 72312 (November 22, 2022).

<sup>5</sup> In 2003, ICAO found that "[T]here was an insignificant impact on the environment from aircraft engines of less than 26.7 kN (6000lb) thrust, and the cost of emissions reduction for these engines was high. There was no evidence to support emissions regulation for these small engines." The 26.7kN applicability for emissions has been the accepted standard in FAA part 34 regulations such as §§ 34.21(d)(1) and 34.23(a)(1). ICAO has left emissions regulation of engines with lesser output to the discretion of the member States.

regulatory authorities to establish more stringent limits in the future as a means to better protect human health and welfare. For a comprehensive discussion of the health effects of particulate matter on humans, see the preamble to EPA's final rule for nvPM at 87 FR 72319 (Nov 23, 2022).

The nvPM test and measurement procedures require the use of additional equipment and procedures compatible with those currently in use for measuring gaseous pollutants. The FAA is both incorporating by reference the nvPM test and measurement procedures described in ICAO Annex 16, Volume II (as adopted by the EPA), and adding additional test procedures in new §§ 34.71 and 34.73 in order to fully implement the EPA's standards.

In addition to the nvPM standards and methods described, the FAA has included other minor, nonsubstantive changes to the existing emissions regulations as they relate to nvPM to make part 34 consistent with the EPA regulations of 40 CFR part 1031, as described in Section H below. The FAA has also created a centralized incorporation by reference (IBR) section to index the ICAO materials that part 34 incorporates by reference, as described in Section G, below.

### IV. Discussion of This Final Rule

This final rule establishes the certification standards for nvPM<sub>MC</sub>, nvPM<sub>mass</sub>, and nvPM<sub>num</sub> emissions from certain classes of subsonic engines that have a rated output greater than 26.7 kN, and adopts the associated test procedures established by ICAO and adopted by the EPA at 87 FR 72319 (Nov 23, 2022) required for certification in the United States. These regulations replace SN with nvPM as the required emission standard for particulate matter for applicable engines, as adopted by the EPA. None of the changes made in this rule adding nvPM measurements as a requirement for certain engines are meant to affect the SN requirements for engines of any class having a rated output of 26.7 kN or less, for turboprop engines (Class TP), or for supersonic engines (Class TSS). The nvPM requirement is adopted in § 34.25, and the test requirements in a new Subpart H to part 34 comprised of §§ 34.71 and 34.73. This rulemaking adds nvPM characteristics to the requirements for a finding of similarity of a derivative engine in § 34.48. These substantive changes are described as follows.

*A. Addition of Maximum nvPM Mass Concentration Standards for Aircraft Engines—§§ 34.25(a)(1) and 34.25(c)(1)*

For Class TF, T3, or T8 engines (regulated classes of large turbofan engines) with a rated output greater than 26.7 kN, this rule replaces the SN requirement with a measurement of a maximum nvPM mass concentration (nvPM<sub>MC</sub>) limit in micrograms per cubic meter [ $\mu\text{g}/\text{m}^3$ ]. This action maintains the standard that aircraft engine exhaust plumes remain invisible, which was the intent of the ICAO standards adopted in the United States by the EPA. When determining nvPM<sub>MC</sub>, values must be obtained from measurements made across the entire thrust range of an engine. The characteristic level of the measured maximum nvPM<sub>MC</sub> value may not exceed the regulatory limit established using the formula in § 34.25. The required test procedures and compliance demonstration for nvPM are discussed in section I.

*B. Addition of nvPM Mass and nvPM Number Standards for Aircraft Engines—§§ 34.25(a)(2) and 34.25(c)(2)*

The standards for nvPM<sub>mass</sub> and nvPM<sub>num</sub> apply to all subsonic turbofan and turbojet engines that have a rated output greater than 26.7 kN. The nvPM<sub>mass</sub> limit is the mass of emissions of nvPM expressed in milligrams (mg) divided by kN of rated thrust, as determined over the LTO cycle. The nvPM<sub>num</sub> limit is the number of particles divided by kN of rated thrust, as determined over the LTO cycle.

An engine for which an application for an original type certificate is submitted on or after January 1, 2023, is subject to the nvPM<sub>mass</sub> and nvPM<sub>num</sub> emission limits of § 34.25. An engine that was type certificated before January 1, 2023, for which an application for type design modification is submitted on or after January 1, 2023, is also subject to the nvPM<sub>mass</sub> and nvPM<sub>num</sub> emission limits of § 34.25. This date is consistent with the effective date of the EPA final rule that adopted these standards.

The FAA is incorporating by reference into part 34 the nvPM test and measurement procedures of ICAO Annex 16, Volume II, Appendices 4, 6 and 7. The EPA incorporated these appendices and Appendix 8, which is not relevant to FAA regulations,<sup>6</sup> This

<sup>6</sup> Control of Air Pollution From Aircraft Engines: Emission Standards and Test Procedures quotes “The EPA is incorporating by reference Appendix 8 of Annex 16, Volume II, which outlines procedures used to estimate measurement system losses, which are a required element of the reporting provisions.” page 72333 in FR Vol 87 No 225, November 23, 2022.

incorporation by reference continues the FAA use of these procedures in part 34 to conform to accepted international standards. These requirements are discussed in Section I of this document.

*C. Smoke Number Standards in § 34.21(e)*

As stated in Section IV, the nvPM standards for engines with a rated output greater than 26.7 kN are a replacement for SN requirements in certain classes of engines. For all other classes of engines, this rule revises § 34.21(e) to group the continuing SN requirements in one paragraph for ease of reference; the SN standards had been scattered in various sections of part 34 as compliance dates were added over time. Consistent with the standards adopted by the EPA and ICAO, the SN requirements are unchanged for engines not subject to nvPM. The applicability of § 34.21(e) was modified as described here to maintain regulatory consistency.

Section 34.21(e)(1)(A) and (B) carry forward the SN requirements for engines of the applicable class and size produced before January 1, 2023. The SN requirements of paragraph(e)(1)(B) were misplaced in § 34.23(a)(1) and referenced as a gaseous emission standard. The requirement was moved to (e)(1)(B) and § 34.23(a)(1) is marked reserved to maintain the integrity of references to the gaseous emissions standards of § 34.23.

Paragraph (e)(1)(C) applies to described engines manufactured after January 1, 2023, and contains a modification to the applicability of the SN requirements to maintain consistency with EPA regulations. Over time, regulatory changes by the U.S. and ICAO resulted in a discrepancy of applicability between the two sets of regulations. If the United States maintained its applicability division, an engine with exactly 26.7 kN of rated output would be subject to the SN standard in other ICAO member States, but subject to nvPM standards in the United States. In its rulemaking, the EPA adopted the ICAO standard for the division between SN and nvPM applicability. The FAA is adopting the same EPA and ICAO applicability descriptors to prevent a situation where an engine of exactly 26.7 kN of rated output would, without reason, be subject to two different standards. Accordingly, the SN standard for engines manufactured on or after January 1, 2023, has been modified to apply to engines having a rated output of 26.7 kN or less. The FAA is not aware of any engines rated at exactly 26.7 kN, so there are no practical consequences

to this realignment, and it has no retroactive applicability.

Section 34.21(e)(2) contains the SN requirements for certain classes of engines manufactured on or after January 1, 1984, and before January 1, 2023. Engines of those classes manufactured on or after January 1, 2023, are subject to the new nvPM requirements of § 34.25.

Section 34.21(e)(3) carries forward the SN standard for certain turboprop (class TP) engines manufactured on or after January 1, 1984. This requirement is unchanged.

Section 34.21(e)(4) makes the SN standard applicable to all supersonic (class TSS) engines regardless of rated thrust. Because emissions standards for supersonic engines have not yet been agreed to internationally, these engines were not included by ICAO in the new nvPM standard. The EPA adopted the ICAO standard for SN to apply to all supersonic engines regardless of rated output in 40 CFR part 1031. This regulation carries forward that requirement in part 34.

*D. Fuel Venting Description § 34.11*

The fuel venting standard in part 34 subpart B prohibits the discharge of fuel to the atmosphere following engine shutdown. Fuel venting emissions are described as fuel discharge during all normal ground and flight operations. Following discussions with the EPA and ICAO, this rule adds the word “liquid” before “fuel” in the fuel venting requirements to prevent the application of the regulation to small amounts of fuel that vaporize on hot engine parts after shutdown. Small amounts of vaporizing fuel was not the concern of the fuel venting prohibition drafted in the 1960s, which was intended to address the then-common practice of dumping large amounts of liquid fuel on the ground after engine shutdown. This change will not have any effect on the requirements for engine type certification, and is a concept commonly understood in the industry.

*E. Adding nvPM Characteristics for Derivative Engine Findings—§ 34.48*

Section 34.48 prescribes standards for finding that an engine is a “derivative engine for emissions purposes” by assessing the emissions similarity between an engine and its proposed derivative. Status as a derivative engine determines whether the proposed derivative must undergo complete emissions testing. The addition of an nvPM standard requires that the derivative engine considerations also include nvPM characteristics for engines that may be considered as a

derivative of an engine manufactured after January 1, 2023. These emission similarity ranges for nvPM have been included in § 34.48(b)(1)(v). Section 34.48(b)(3) is added for consistency with EPA regulations. The requirements for nvPM testing of a derivative engine are addressed in § 34.25(b).

*F. Addition of Test Procedures and Compliance Demonstration for nvPM—Subpart H, §§ 34.71 and 34.73*

In order to implement the nvPM standards adopted by the EPA, FAA regulations must include effective test and measurement procedures in the emissions certification requirements for use by manufacturers. These tests and procedures have been placed in a new subpart H to part 34 as §§ 34.71 and 34.73.

Section 34.71 identifies the nvPM emissions test requirements, such as the minimum number of emissions test runs required, the number of engines of the same type design that may be used to gather test data, and the operational conditions required for emissions certification (§ 34.71 (b), (c), and (g)). The section also includes test fuel specifications (§ 34.71 (d)), a description of the LTO cycle (§ 34.71(h)), and how to prepare and operate an engine for emissions certification (§ 34.71 (f)). Section 34.71(i) states how characteristic values, in conjunction with Table A6–1 of Annex 16 Vol II, Appendix 6, are to be determined.

Many of the test and measurement procedures required for nvPM were identified and described by ICAO. Section 34.71(e)(1) includes an incorporation by reference of ICAO Annex 16, Volume II and its Appendices requiring that those tests and procedures in the applicable Annex appendices be used when measuring and collecting data, including the other requirements of § 34.71.

Section 34.71 (e)(2) instructs the applicant on the procedures necessary when requesting a deviation from any of the test procedures or compliance demonstrations of subpart H. The FAA expects that any such deviation request would be from a test or procedure that was included in the approved test plan, but was discovered to be unworkable before the test is actually conducted. Any deviation proposed must be approved by the FAA before any emissions test is conducted. The FAA will consult with the EPA prior to making a written determination on any requested deviation.

Section 34.71(j) requires that all measurements be included in nvPM calculations. This section also cautions that if an applicant seeks to exclude any

measurements, that data must be submitted to the FAA with justification for the exclusion, and that the exclusions must be approved by the FAA before the applicant makes any nvPM calculations.

Section 34.73 requires applicants to perform a compliance demonstration that shows the engine emissions of nvPM are within the applicable limits provided in § 34.25. A demonstration of compliance includes calculations to determine the characteristic nvPM emissions levels for maximum  $nvPM_{MC}$ ,  $nvPM_{mass}$ , and  $nvPM_{num}$  using the measurements collected in accordance with § 34.71. The applicant's compliance demonstration must be conducted within 90% confidence intervals (§ 34.73(d)), use the required rounding in calculations (§ 34.73(a)(3)), and correct for standard temperature and pressure as prescribed in the ICAO Annex 16, Volume II Appendix 1.

Section 34.73(c)(1) directs the applicant to conduct the minimum number of measurements at the thrust settings given in § 34.71(h). However, this section also provides an applicant with the flexibility to make as many additional measurements as it chooses across the entire thrust range of an engine when measuring nvPM. More measurements conducted across the thrust range of an engine result in improved understanding of any trending nvPM behavior. Section 34.71(c)(1) also allows an applicant to choose one of the three equivalent evaluation methods listed in that section when calculating  $nvPM_{MC}$ . Once nvPM emissions certification testing is complete, § 34.73(e) identifies the required information to be reported to the FAA in the emissions test report. The FAA notes that the EPA has separate reporting requirements that are not part of this rulemaking.

*G. Incorporation by Reference (IBR) Section*

This final rule includes a new section, § 34.4, that indexes all material incorporated by reference in part 34. The FAA determined that it was appropriate with this final rule to create a centralized IBR section indexing all the materials incorporated by reference in Part 34, for ease of reference and future revision.

The OFR has regulations concerning incorporation by reference (1 CFR part 51). These regulations require that, for a final rule, agencies must discuss in the preamble the way in which the materials that the agency incorporated by reference are reasonably available to interested persons, and how interested parties can obtain the materials. In

addition, in accordance with 1 CFR 51.5(b), the agency must summarize the material in the preamble of the final rule.

Because this rule was passed to harmonize United States regulations with international standards, this final rule incorporates Annex 16 to the Convention on International Civil Aviation: Environmental Protection, Volume II—Aircraft Engine Emissions, Fourth Edition, July 2017 (ICAO Annex 16, Volume II). Appendices 1, 4, 6, and of the 2017 Annex are referenced in § 34.71 and 34.73, and appendices 4 and 6 of the Annex are referenced in § 34.73. The content of these appendices is described above, in sub-part F.

The 2008, Third Edition, of the Annex is referenced in §§ 34.1 and 34.60. The incorporation by reference of the 2008, Third Edition, of the Annex was approved by the Director of the Federal Register as of December 31, 2012 (77 FR 76842). The new § 34.4 includes the 2008 and 2017 editions of the ICAO Annex as well. All approved material is available for inspection at the FAA. Contact the FAA Office of Rulemaking (ARM), 800 Independence Avenue SW, Washington, DC 20590 (telephone 202–267–9677). Interested parties can also purchase the Annex online from ICAO at: [store.icao.int/en/annexes/annex-16](https://store.icao.int/en/annexes/annex-16).

*H. Miscellaneous Amendments*

This rule includes the following changes to part 34 to improve the clarity of the nonvolatile particulate matter emissions standards, align the provisions described with those of the EPA in 40 CFR part 1031 (formerly 40 CFR part 87), and make other minor changes as described:

(1) Definitions in § 34.1. This rule adds a definition of nvPM, and revises the definition of “Derivative engine for emissions certification purposes” for consistency with EPA regulations in 40 CFR part 1031 and ICAO Annex 16 Volume II. This rule revises the definition of “Reference day condition” to include a more accurate value for specific humidity that is recognized in the general scientific community and is consistent with the definitions used by the EPA and ICAO. This rule removes the definition of “Fuel venting” from § 34.1 in favor of the more specific description of fuel venting in § 34.11, where it applies.

(2) Abbreviations in § 34.2: The following terms are added to the list of abbreviations in § 34.2:  $nvPM$ ,  $nvPM_{MC}$ ,  $nvPM_{mass}$ , and  $nvPM_{num}$ . The abbreviation “lb” is corrected to “lbf.” Pound force (lbf) is used in part 34 as the English measurement equivalent of a rated output stated in kilonewton



TABLE 1—SMALL BUSINESS ADMINISTRATION SIZE STANDARD

NAICS code	Description	Size standard
336412 .....	Aircraft Engine and Engine Parts Manufacturing .....	1,500 Employees.

Source: SBA (2022).<sup>12</sup>  
 NAICS—North American Industrial Classification System.

*C. International Trade Impact Assessment*

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards.

The FAA has assessed the potential effect of this rule and determined that it maintains the same standards for engine emissions certification of nvPM as was adopted by ICAO. As a result, the FAA does not consider this rule as creating an unnecessary obstacle to foreign commerce.

*D. Unfunded Mandates Assessment*

The Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531–1538) governs the issuance of Federal regulations that require unfunded mandates. An unfunded mandate is a regulation that requires a State, local, or tribal government or the private sector to incur direct costs without the Federal government having first provided the funds to pay those costs. The FAA determined that this final rule will not result in the expenditure of \$177 million or more by State, local, or tribal governments, in the aggregate, or the private sector, in any one year.

*E. Paperwork Reduction Act*

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The

FAA has determined that there is no new requirement for information collection associated with this final rule since emissions testing is already required as part of aircraft engine certification.

*F. International Compatibility and Cooperation*

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified the no differences with these regulations. This regulation is a conforming action to adopt the same standards for nvPM certification that are contained in the ICAO SARPs.

*G. Environmental Analysis*

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act (NEPA) in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 5–6.6f for regulations and involves no extraordinary circumstances.

*H. Regulations Affecting Intrastate Aviation in Alaska*

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying 14 CFR regulations in a manner affecting intrastate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish appropriate regulatory distinctions. Because this final rule sets standards for aircraft engine emissions at the time of certification, no effect on intrastate aviation in Alaska is expected.

**VI. Executive Order Determinations**

*A. Executive Order 13132, Federalism*

The FAA has analyzed this final rule under the principles and criteria of Executive Order (E.O.) 13132,

Federalism. The FAA has determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, will not have federalism implications.

*B. Executive Order 13175, Consultation and Coordination With Indian Tribal Governments*

Consistent with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments,<sup>13</sup> and FAA Order 1210.20, American Indian and Alaska Native Tribal Consultation Policy and Procedures,<sup>14</sup> the FAA ensures that Federally Recognized Tribes (Tribes) are given the opportunity to provide meaningful and timely input regarding proposed Federal actions that have the potential to have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes; or to affect uniquely or significantly their respective Tribes. The FAA has not identified any unique or significant effects, environmental or otherwise, on tribes resulting from this final rule.

*C. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use*

The FAA analyzed this final rule under E.O. 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The FAA has determined that this rule is not a “significant energy action” under the executive order and is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

*D. Executive Order 13609, Promoting International Regulatory Cooperation*

Executive Order 13609, Promoting International Regulatory Cooperation, promotes international regulatory cooperation to meet shared challenges

<sup>12</sup> Small Business Administration (SBA). 2022. Table of Size Standards. Effective October 1, 2022. <https://www.sba.gov/document/support-table-size-standards>.

<sup>13</sup> 65 FR 67249 (Nov. 6, 2000).

<sup>14</sup> FAA Order No. 1210.20 (Jan. 28, 2004), available at <http://www.faa.gov/documentLibrary/media/1210.pdf>.

involving health, safety, labor, security, environmental, and other issues and reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA has analyzed this action under the policy and agency responsibilities of Executive Order 13609. The FAA has determined that this action will eliminate differences between U.S. aviation standards and those of other civil aviation authorities by implementing the same aircraft certification requirements for nvPM emissions that are in ICAO Annex 16.

## VII. How To Obtain Additional Information

### A. Electronic Access and Filing

A copy of this final rule, any background material, and all comments received may be viewed online at [www.regulations.gov](http://www.regulations.gov) using the docket number listed above. Electronic retrieval help and guidelines are available on the website. It is available 24 hours each day, 365 days each year. An electronic copy of this document may also be downloaded from the Office of the Federal Register's website at [www.federalregister.gov](http://www.federalregister.gov) and the Government Publishing Office's website at [www.govinfo.gov](http://www.govinfo.gov). A copy may also be found at the FAA's Regulations and Policies website at [www.faa.gov/regulations\\_policies](http://www.faa.gov/regulations_policies).

Copies may also be obtained by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW, Washington, DC 20591, or by calling (202) 267-9677. Commenters must identify the docket or notice number of this rulemaking.

All documents the FAA considered in developing this final rule, including economic analyses and technical reports, may be accessed in the electronic docket for this rulemaking.

### B. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. To find out more about SBREFA on the internet, visit [www.faa.gov/regulations\\_policies/rulemaking/sbre\\_act/](http://www.faa.gov/regulations_policies/rulemaking/sbre_act/).

## List of Subjects in 14 CFR Part 34

Aircraft, Aviation safety, Air pollution control, Incorporation by reference, Reporting and recordkeeping requirements.

In consideration of the foregoing, the Federal Aviation Administration is amending chapter I of title 14, Code of Federal Regulations as follows:

## PART 34—FUEL VENTING AND EXHAUST EMISSION REQUIREMENTS FOR TURBINE ENGINE POWERED AIRPLANES

- 1. The authority citation for part 34 continues to read as follows:

**Authority:** 42 U.S.C. 4321 *et seq.*, 7572; 49 U.S.C. 106(g), 40113, 44701–44702, 44704, 44714.

### Subpart A—General Provisions

- 2. Amend § 34.1 by:
  - a. Revising and republishing the definition for *Characteristic level*;
  - b. Revising the definition for *Derivative engines for emissions certification purposes*;
  - c. Removing the definition for *Fuel venting emissions*;
  - d. Adding in alphabetical order a definition for *Non-volatile particulate matter*; and
  - e. Revising the definition for *Reference day conditions*.

The revisions, republication, and addition read as follows:

#### § 34.1 Definitions.

\* \* \* \* \*

*Characteristic level* has the meaning given in Appendix 6 of ICAO Annex 16 as of July 2008 (incorporated by reference, see § 34.4). The characteristic level is a calculated emission level for each pollutant based on a statistical assessment of measured emissions from multiple tests.

\* \* \* \* \*

*Derivative engine for emissions certification purposes* means an engine that is similar in design to an engine that has demonstrated compliance with the applicable exhaust emission standards of this part, as determined by the FAA, and has a U.S. type certificate issued in accordance with part 33 of this chapter.

\* \* \* \* \*

*Non-volatile particulate matter (nvPM)* means emitted particles that remain at the exhaust nozzle exit plane of a gas turbine engine, and that did not volatilize after being heated to a temperature of at least 350 °C.

\* \* \* \* \*

*Reference day condition* means the reference ambient conditions to which

the measured smoke, nvPM, and gaseous emissions must be corrected. The reference day conditions are as follows:

- (1) Temperature = 15 °C,
- (2) Specific humidity = 0.00634 kg H<sub>2</sub>O/kg of dry air, and
- (3) Pressure = 101.325 kPa

\* \* \* \* \*

- 3. Revise § 34.2 to read as follows:

#### § 34.2 Abbreviations.

The abbreviations used in this part have the following meanings in both upper and lower case:

CO<sub>2</sub> Carbon dioxide  
 CO Carbon monoxide  
 EPA United States Environmental Protection Agency  
 FAA Federal Aviation Administration, United States Department of Transportation  
 g Gram(s)  
 HC Hydrocarbon(s)  
 HP Horsepower  
 hr Hour(s)  
 H<sub>2</sub>O Water  
 kg Kilogram(s)  
 kJ Kilojoule(s)  
 kN Kilonewton(s)  
 kW Kilowatt(s)  
 lbf Pound force  
 LTO Landing and takeoff  
 m Meter(s)  
 mg Milligram(s)  
 µg Microgram(s)  
 min Minute(s)  
 MJ Megajoule(s)  
 NO<sub>x</sub> Oxides of nitrogen  
 nvPM Non-volatile particulate matter  
 nvPM<sub>mass</sub> Non-volatile particulate matter mass  
 nvPM<sub>MC</sub> Non-volatile particulate matter mass concentration  
 nvPM<sub>num</sub> Non-volatile particulate matter number  
 Pa Pascal(s)  
 rO Rated output  
 rPR Rated pressure ratio  
 sec Second(s)  
 SP Shaft power  
 SN Smoke number  
 T Temperature in degrees Kelvin  
 TIM Time in mode  
 °C Degrees Celsius  
 % Percent

- 4. Revise and republish § 34.3 to read as follows:

#### § 34.3 General requirements.

(a) This part provides for the approval or acceptance by the Administrator or the Administrator of the EPA of testing and sampling methods, analytical techniques, and related equipment not identical to those specified in this part. Before either approves or accepts any such alternate, equivalent, or otherwise

nonidentical procedures or equipment, the Administrator or the Administrator of the EPA shall consult with the other in determining whether or not the action requires rulemaking under sections 231 and 232 of the Clean Air Act, as amended, consistent with the responsibilities of the Administrator of the EPA and the Secretary of Transportation under sections 231 and 232 of the Clean Air Act.

(b) Under section 232 of the Act, the Secretary of Transportation issues regulations to ensure compliance with 40 CFR part 1031. This authority has been delegated to the Administrator of the FAA in accordance with 49 CFR 1.47.

(c) This part applies to civil airplanes that are powered by aircraft gas turbine engines of the classes specified herein and that have U.S. standard airworthiness certificates.

(d) Pursuant to the definition of "aircraft" in 40 CFR 1031.205, this regulation applies to civil airplanes that are powered by aircraft gas turbine engines of the classes specified herein and that have foreign airworthiness certificates that are equivalent to U.S. standard airworthiness certificates. This regulation applies only to those foreign civil airplanes that, if registered in the United States, would be required by applicable regulations to have a U.S. standard airworthiness certificate in order to conduct the operations intended for the airplane. Pursuant to 40 CFR 1031.5, this regulation does not apply where it would be inconsistent with an obligation assumed by the United States to a foreign country in a treaty, convention, or agreement.

(e) Reference in this regulation to 40 CFR part 1031 refers to title 40 of the Code of Federal Regulations, chapter I—Environmental Protection Agency, part 1031, Control of Air Pollution from Aircraft and Aircraft Engines (40 CFR part 1031).

(f) This part contains regulations that implement compliance with certain standards contained in 40 CFR part 1031. If EPA takes any action, including the issuance of an exemption or issuance of a revised or alternate procedure, test method, or other regulation, the effect of which is to relax or delay the effective date of any provision of 40 CFR part 1031 that is made applicable to an aircraft under this part, the Administrator of FAA will grant a general administrative waiver of the more stringent requirements until this part is amended to reflect the requirements relaxed by EPA.

(g) Unless otherwise stated, all terminology and abbreviations in this part that are defined in 40 CFR part

1031 have the meaning specified in that part, and all terms in 40 CFR part 1031 that are not defined in that part but that are used in this part have the meaning given them in the Clean Air Act, Public Law 91–604, as amended.

(h) All interpretations of 40 CFR part 1031 that are promulgated by the EPA also apply to this part.

(i) If the EPA, under 40 CFR part 1031, approves or accepts any testing and sampling procedures or methods, analytical techniques, or related equipment not identical to those specified in that part, this part requires an applicant to show that such alternate, equivalent, or otherwise non-identical procedures have been complied with, and that such alternate equipment was used to show compliance, unless the applicant elects to comply with those procedures, methods, techniques, and equipment specified in 40 CFR part 1031.

(j) If the EPA, under 40 CFR 1031, prescribes special test procedures for any aircraft or aircraft engine that is not susceptible to satisfactory testing using the procedures in 40 CFR part 1031, the applicant must demonstrate to the FAA Administrator that they are in compliance with those special test procedures.

(k) Wherever 40 CFR part 1031 requires agreement, acceptance, or approval by the Administrator of the EPA, this part requires a showing that such agreement or approval has been obtained.

(l) Pursuant to 42 U.S.C. 7573, no state or political subdivision thereof may adopt or attempt to enforce any standard respecting emissions of any air pollutant from any aircraft or engine thereof unless that standard is identical to a standard made applicable to the aircraft by the terms of this part.

(m) If EPA, by regulation or exemption, relaxes a provision of 40 CFR part 1031 that is implemented in this part, no state or political subdivision thereof may adopt or attempt to enforce the terms of this part that are superseded by the relaxed requirement.

(n) If any provision of this part is rendered inapplicable to a foreign aircraft as provided in 40 CFR 1031.5 (international agreements), and paragraph (d) of this section, that provision may not be adopted or enforced against that foreign aircraft by a state or political subdivision thereof.

(o) For exhaust emissions requirements of this part that apply beginning February 1, 1974, January 1, 1976, January 1, 1978, January 1, 1984, and August 9, 1985, continued compliance with those requirements is

shown for engines for which the type design has been shown to meet those requirements, if the engine is maintained in accordance with applicable maintenance requirements of 14 CFR chapter I. All methods of demonstrating compliance and all model designations previously found acceptable to the Administrator shall be deemed to continue to be an acceptable demonstration of compliance with the specific standards for which they were approved.

(p) Each applicant must allow the Administrator to make, or witness, any test necessary to determine compliance with the applicable provisions of this part.

■ 5. Amend Subpart A by adding § 34.4 to read as follows:

**§ 34.4 Incorporation by Reference.**

Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51). All approved material is available for inspection at the FAA and at the National Archives and Records Administration (NARA). Contact the FAA Office of Rulemaking (ARM), 800 Independence Avenue SW, Washington, DC 20590 (telephone 202–267–9677) For information on the availability of this material at NARA, visit [www.archives.gov/federal-register/cfr/ibr-locations](http://www.archives.gov/federal-register/cfr/ibr-locations) or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov).

(a) The material may be obtained from the following source: International Civil Aviation Organization (ICAO): Document Sales Unit, 999 University Street, Montreal, Quebec H3C 5H7, Canada, phone + 1 514–954–8022, or [www.icao.int](http://www.icao.int).

(1) Annex 16 to the Convention on International Civil Aviation: Environmental Protection, Volume II—Aircraft Engine Emissions, Third Edition, July 2008 (ICAO Annex 16); in §§ 34.1 and 34.60.

(2) Annex 16 to the Convention on International Civil Aviation: Environmental Protection, Volume II—Aircraft Engine Emissions, Fourth Edition, July 2017 (ICAO Annex 16, Volume II), in §§ 34.71 and 34.73.

(b) [Reserved]

■ 6. Amend § 34.6 by revising paragraph (b) to read as follows:

**§ 34.6 Aircraft safety.**

\* \* \* \* \*

(b) Consistent with 40 CFR part 1031, if the FAA Administrator determines that any emission control regulation in this part cannot be safely applied to an aircraft, that provision may not be adopted or enforced against that aircraft

by any state or political subdivision thereof.

\* \* \* \* \*

■ 7. Amend § 34.7 by revising paragraph (d) to read as follows:

**§ 34.7 Exemptions.**

\* \* \* \* \*

(d) *Applicants seeking exemption from other emissions standards of this part and 40 CFR 1031.15.* Applicants must request exemption from both the FAA and the EPA, even where the underlying regulatory requirements are the same. The FAA and EPA will jointly consider such exemption requests, and will assure consistency in the respective agency determinations.

\* \* \* \* \*

■ 8. Amend § 34.11 by revising paragraph (a) and the introductory text of paragraph (c) to read as follows:

**§ 34.11 Standard for fuel venting emissions.**

(a) No liquid fuel venting emissions shall be discharged into the atmosphere from any new or in-use aircraft gas turbine engine subject to the subpart. This paragraph is directed at the elimination of intentional discharge to the atmosphere of fuel drained from fuel nozzle manifolds after engines are shut down and does not apply to normal fuel seepage from shaft seals, joints, and fittings.

\* \* \* \* \*

(c) As applied to an airframe or an engine, any manufacturer or operator may show compliance with the liquid fuel venting and emissions requirements of this section that were effective beginning February 1, 1974 or January 1, 1975, by any means that prevents the intentional discharge of fuel from fuel nozzle manifolds after the engines are

shut down. Acceptable means of compliance include one of the following:

\* \* \* \* \*

■ 9. Amend § 34.21 by revising paragraph (e) to read as follows:

**§ 34.21 Standards for exhaust emissions.**

\* \* \* \* \*

(e) Smoke exhaust emissions from each gas turbine engine shall not exceed:

(1)(A) For Class TF of rated output less than 26.7 kN (6,000 lbf) manufactured on or after August 9, 1985, and before July 18, 2012:

SN = 83.6(rO)<sup>-0.274</sup> (rO is in kN) not to exceed a maximum of SN = 50.

(B) For Classes TF, T3, and T8 of rated output less than 26.7 kN (6,000 lbf) manufactured on or after July 18, 2012, and before January 1, 2023:

SN = 83.6(rO)<sup>-0.274</sup> or 50.0, whichever is smaller.

(C) For Classes TF, T3, and T8 of rated output of 26.7 kN (6,000 lbf) or less manufactured on or after January 1, 2023:

SN = 83.6(rO)<sup>-0.274</sup> or 50.0, whichever is smaller.

(2) For Classes T3, T8, TSS, and TF of rated output greater than or equal to 26.7 kN (6,000 lbf) manufactured on or after January 1, 1984, and before January 1, 2023:

SN = 83.6(rO)<sup>-0.274</sup> (rO is in kN) not to exceed a maximum of SN = 50.

(3) For Class TP of rated output equal to or greater than 1,000 kW manufactured on or after January 1, 1984:

SN = 187(rO)<sup>-0.168</sup> (rO is in kW).

(4) For Class TSS manufactured on or after January 1, 2023:

SN = 83.6(rO)<sup>-0.274</sup> (rO is in kN) not to exceed a maximum of SN = 50.

\* \* \* \* \*

**§ 34.23 [Amended]**

■ 10. Amend § 34.23 by removing and reserving paragraph (a)(1).

■ 11. Amend Subpart C by adding § 34.25 to read as follows:

**§ 34.25 Non-volatile particulate emissions standards (nvPM).**

The standards of this section apply to an aircraft engine of Class TF, T3, or T8 with a rated output greater than 26.7 kN that is manufactured after January 1, 2023. Where a maximum nvPM<sub>MC</sub> standard is expressed as a formula, calculate and round the standard to the nearest 1.0 µg/m<sup>3</sup>. Where an nvPM<sub>mass</sub> standard is expressed as a formula, calculate and round the standard to three significant figures or to the nearest 0.1 mg/kN. Where an nvPM<sub>num</sub> standard is expressed as a formula, calculate and round the standard to three significant figures. Engines comply with an applicable standard if the test results show that the engine type certificate family's characteristic level does not exceed the numerical level of the nvPM standard when tested as described in subpart H of this part.

(a) Except as provided in paragraph (b) or (c) of this section;

(1) The characteristic level for the maximum nvPM<sub>MC</sub> expressed in units of µg/m<sup>3</sup> must not exceed the following:

$$nvPM_{MC} = 10^{(3 + 2.9rO^{-0.274})}$$

and

(2) The characteristic level for nvPM<sub>mass</sub> expressed in [mg/kN] and for nvPM<sub>num</sub> expressed in [particles/kN] must not exceed the following:

TABLE 1 TO PARAGRAPH (a)(2)

Class	Rated output (rO) (kN)	nvPM <sub>mass</sub> (mg/kN)	nvPM <sub>num</sub> (particles/kN)
TF, T3, T8	26.7 < rO ≤ 200 rO > 200	4646.9 – 21.497 (rO) 347.5	2.669 × 10 <sup>16</sup> – 1.126 × 10 <sup>14</sup> (rO) 4.170 × 10 <sup>15</sup> .

(b) For a change in type design by the type design holder, when the application for an amended type certificate is filed after January 1, 2023:

(1) If the engine qualifies as a derivative engine in accordance with § 34.48 of this part, no testing is required for the engine to use the same nvPM certificated parameters (nvPM<sub>mass</sub>,

nvPM<sub>num</sub>, and maximum nvPM<sub>MC</sub>) as the engine it is derived from; or

(2) If the engine does not qualify as a derivative engine in accordance with § 34.48 of this part, the applicant must demonstrate compliance with each requirement in paragraph (a) of this section.

(c) For issuance of an original type certificate when an application for type

certification is filed after January 1, 2023, the applicant must demonstrate that the engine does not exceed:

(1) For maximum nvPM<sub>MC</sub>: as prescribed in paragraph (a)(1) of this section; and

(2) For the characteristic level for nvPM<sub>mass</sub> expressed in units of [mg/kN], and for nvPM<sub>num</sub> expressed in units of [particles/kN], the following:

TABLE 2 TO PARAGRAPH (c)(2)

Class	Rated output (rO) (kN)	nvPM <sub>mass</sub> (mg/kN)	nvPM <sub>num</sub> (particles/kN)
TF, T3, T8 .....	26.7 < rO ≤ 150 .....	1251.1 – 6.914 (rO) .....	1.490 × 10 <sup>16</sup> – 8.080 × 10 <sup>13</sup> (rO).
	rO > 150 .....	214.0 .....	2.780 × 10 <sup>15</sup> .

■ 12. Amend § 34.48 by revising paragraph (a) introductory text and paragraph (b) to read as follows:

**§ 34.48 Derivative engines for emissions certification purposes.**

(a) *General.* A type certificate holder may request from the FAA a determination that an engine configuration is considered a derivative engine for emissions certification purposes (all gaseous emissions and either nvPM or smoke number as applicable). To be considered a derivative engine for emissions certification purposes under this part, the configuration must have been derived from the original engine that was certificated to the requirements of part 33 of this chapter and one of the following:

\* \* \* \* \*

(b) *Emission similarity* (1) The type certificate holder must demonstrate that the proposed derivative engine model's emissions meet the applicable standards and differ from the original model's emission rates within the following ranges and values:

- (i) ±3.0 g/kN for NO<sub>x</sub>.
- (ii) ±1.0 g/kN for HC.
- (iii) ±5.0 g/kN for CO.
- (iv) ±2.0 SN for smoke (where applicable).

(v) The following values apply for maximum nvPM<sub>MC</sub>, nvPM<sub>mass</sub>, and nvPM<sub>num</sub> (where applicable):

(A) maximum nvPM<sub>MC</sub>:

(1) ±200 µg/m<sup>3</sup> if the characteristic level of maximum nvPM<sub>MC</sub> is below 1,000 µg/m<sup>3</sup>; or

(2) ±20% of the characteristic level if the characteristic level for maximum nvPM<sub>MC</sub> is at or above 1,000 µg/m<sup>3</sup>.

(B) nvPM<sub>mass</sub>:

(1) 80 mg/kN if the characteristic level for nvPM<sub>mass</sub> emissions is below 400 mg/kN; or

(2) ±20% of the characteristic level if the characteristic level for nvPM<sub>mass</sub> emissions is greater than or equal to 400 mg/kN.

(C) nvPM<sub>num</sub>:

(1) 4 × 10<sup>14</sup> particles/kN if the characteristic level for nvPM<sub>num</sub> emissions is below 2 × 10<sup>15</sup> particles/kN; or

(2) ±20% of the characteristic level if the characteristic level for nvPM<sub>num</sub>

emissions is greater than or equal to 2 × 10<sup>15</sup> particles/kN.

(2) If the characteristic level of the original certificated engine model (or any other sub-models within the emission type certificate family tested for certification) before modification is at or above 95% of the applicable standard for any pollutant, an applicant must measure the proposed derivative engine model's emissions for all pollutants to demonstrate that the derivative engine's resulting characteristic levels will not exceed the applicable emission standards. If the characteristic levels of the originally certificated engine model (and all other sub-models within the emission type certificate family tested for certification) are below 95% of the applicable standard for each pollutant, the applicant may use engineering analysis consistent with good engineering judgment to demonstrate that the derivative engine will not exceed the applicable emission standards. The engineering analysis must address all modifications from the original engine, including those approved for previous derivative engines.

(3) In unusual circumstances and consistent with good engineering judgement, the FAA may adjust the ranges specified in paragraph (b)(1) of this section to evaluate a proposed derivative engine.

\* \* \* \* \*

■ 13. Amend § 34.60 by revising paragraph (h) to read as follows:

**§ 34.60 Introduction.**

\* \* \* \* \*

(h) The system and procedure for sampling and measurement of gaseous emissions shall be as specified by in Appendices 2, 3, 4, 5 and 6 to the International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume II, Aircraft Engine Emissions, Third Edition, July 2008 (incorporated by reference, see § 34.4).

■ 14. Add subpart H to read as follows:

**Subpart H—Test Procedures and Compliance Demonstration for Non-Volatile Particulate Matter Emissions**

34.71 Non-Volatile Particulate Matter (nvPM) Test Procedures.

34.73 Demonstration of compliance for nvPM emissions.

**Subpart H—Test Procedures and Compliance Demonstration for Non-Volatile Particulate Matter Emissions**

**§ 34.71 Non-volatile particulate matter (nvPM) test procedures.**

For each Class TF, T3, or T8 engine manufactured after January 1, 2023, that has a rated output greater than 26.7 kN, the test procedures for measuring each required nvPM parameter are as follows:

(a) Measure the emissions of all nvPM parameters required in this part, as applicable.

(b) Collect data from at least three engine tests, with each test conducted at the reference LTO time/thrust combinations shown in paragraph (h) of this section.

(c) For the engines referenced in paragraph (b) of this section, all emissions certification tests may be conducted on one or more engines of the same type design.

(d) Use a test fuel that meets the specifications described in Appendix 4 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4). The test fuel must not have any additive whose purpose is to suppress nvPM emissions.

(e) (1) When conducting test measurements in accordance with paragraphs (a) through (c) of this section, use the equipment and procedures specified in Appendix 1, Appendix 4, Appendix 6, and Appendix 7 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4), when demonstrating whether an engine meets the applicable nvPM limit specified in § 34.25 of this part.

(2) An applicant that seeks to use a procedure or equipment that differs from any specified in this part must request FAA approval in writing with supporting justification before the alternative procedure or equipment may be used to demonstrate compliance. The FAA will consult with the EPA on any such request. The FAA may approve the requested alternative for measuring nvPM, including testing and sampling methods, analytical techniques, and equipment specifications. Each request must meet one of the following conditions:

- (i) The engine cannot be tested using a specified procedure; or
- (ii) The alternative procedure is shown to be equivalent to, or more accurate or precise than, the specified procedure.

(f) Any engine accessory included in a type design that may reasonably be expected to influence either nvPM emissions or measurements must be installed on the engine before testing. The test engine must not extract shaft power or bleed service air to provide power to auxiliary gearbox-mounted components necessary to drive aircraft systems;

(g) For each percentage of rated output thrust level prescribed in paragraph (h) of this section, a test engine must reach and maintain a steady operating condition before any nvPM emission measurement is made;

(h) The following landing and takeoff (LTO) cycles apply for nvPM emissions testing and for calculating weighted LTO values:

TABLE 1 TO PARAGRAPH (h)

Mode	Class TF, T3, T8	
	TIM (min)	% of rO
Taxi/idle .....	26.0	7
Takeoff .....	0.7	100
Climbout .....	2.2	85
Descent .....	NA	NA
Approach .....	4.0	30

(i) An engine complies with an applicable limit if the test results show that the engine type certificate family's characteristic level does not exceed any limit for maximum nvPM<sub>MC</sub>, nvPM<sub>num</sub>, and nvPM<sub>mass</sub> described in § 34.25.

(j) All measurements collected during engine tests required in paragraph (b) of this section must be used in the calculation of nvPM. Before any calculations are made, the FAA must approve the exclusion of any measurements that the applicant seeks to exclude, including any justification for such exclusions.

(k) The system and procedure for sampling and measurement of gaseous emissions shall be as specified by Appendices 1, 4, 6, and 7 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4).

**§ 34.73 Demonstration of compliance for nvPM emissions.**

(a) Each compliance demonstration by an applicant requires:

- (1) Establishing a mean value from tests conducted on one or more engines;
- (2) Calculating a "characteristic level" by applying a set of statistical factors

that take into account the number of engines tested in accordance with § 34.71(b) of this part; and

(3) Rounding each characteristic level to the same number of decimal places as the corresponding emission limit.

(b) In demonstrating compliance with this subpart, an applicant must use the nvPM measurements collected in accordance with § 34.71 as follows:

- (1) An engine complies with an applicable standard when the engine type certificate family's characteristic level does not exceed any nvPM limit described in § 34.25 of this part; and
- (2) A compliance demonstration consists of:

(i) Determining the maximum nvPM<sub>MC</sub>, and the mean value for nvPM<sub>mass</sub> and nvPM<sub>num</sub> from the data collected in accordance with paragraph § 34.71(f) of this part;

(ii) Correcting each data point to standard temperature and pressure conditions;

(iii) Applying the appropriate statistical factor shown in Table 6–1 of Appendix 6 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4) to account for the number of engines tested; and

(iv) Rounding each characteristic level to the same number of decimal places as the corresponding nvPM limit in § 34.25 of this part.

(c) (1) In determining maximum nvPM<sub>MC</sub>, an applicant must use one of the following evaluation methods for all engines measured in accordance with § 34.71(c) of this part and using the thrust settings given in § 34.71(h) of this part. An applicant may choose to measure additional thrust settings; while there is no restriction on the number of thrust settings measured, the same thrust settings must be used on each engine tested. A dataset consists of nvPM<sub>MC</sub> measurements made at each thrust setting across the thrust range chosen by the applicant for each engine. Plot all nvPM<sub>MC</sub> measurements versus thrust setting.

(i) Method 1—

(A) Average the individual data points measured at each thrust setting to develop one dataset of nvPM mass concentration for each engine tested, creating an average dataset for each engine; and

(B) Use the averages generated in paragraph (c)(1) of this section to develop a single curve fit to determine the overall maximum nvPM<sub>MC</sub> value;

(ii) Method 2—

(A) Measure individual data points of nvPM<sub>MC</sub> versus thrust. Using all datasets generated for each engine physically tested, develop a single, separate curve fit;

(B) Determine the maximum nvPM<sub>MC</sub> from each engine curve fit resulting from paragraph (c)(1) of this section; and

(C) If more than one engine is physically tested, average the nvPM<sub>MC</sub> values from paragraph (c)(2) of this section to determine the overall maximum nvPM<sub>MC</sub> value for the model tested; or

(iii) Method 3—

(A) Develop a curve fit of nvPM<sub>MC</sub> versus thrust for each test conducted on each engine physically tested;

(B) From each curve fit developed in paragraph (c)(1) of this section, use the resultant curve fit equation to solve for each maximum;

(C) Average the maximum values for each engine physically tested; and

(D) Average the maximum values determined in paragraph (c)(1)(iii)(C) of this section to determine the overall average maximum nvPM<sub>MC</sub> value.

(2) Using the data measured in § 34.71(b) of this part, determine the nvPM characteristic levels for nvPM<sub>num</sub> and nvPM<sub>mass</sub> as follows:

(i) Average all nvPM<sub>num</sub> and nvPM<sub>mass</sub> measurements in units of number of particles per kN or mg per kN, as applicable, from each emissions test at each percentage of rated output thrust setting;

(ii) Multiply the averaged measurement from paragraph (a)(2)(i) of this section by the appropriate time in mode (TIM) as shown in § 34.71(h);

(iii) Sum the products from paragraph (a)(2)(ii) of this section to determine the LTO values for nvPM<sub>num</sub> and nvPM<sub>mass</sub>; and

(iv) Divide the result of paragraph (a)(2)(iii) of this section by the characteristic level factor, shown in Table A6–1 of Appendix 6 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4), for the number of engines physically tested to determine the nvPM<sub>mass</sub> and nvPM<sub>num</sub> characteristic values.

(d) The data used to determine the regressed curves must meet a 90% confidence interval, CI<sub>90</sub>, limit of ±1.5% of each nvPM limit specified in § 34.25 of this part. If a certification test fails to meet the CI<sub>90</sub> limit, the engine type may still comply with the requirements. Failure may be caused by excessive data scatter, too few data points, or erroneous data used to regress an accurate curve. Without deleting or removing any prior measurement data, additional data acquired from further tests may improve the CI<sub>90</sub> by adding to the sample population.

(e) The following information must be reported to the FAA substantiating

compliance with nvPM limits of § 34.25 of this part:

(1) The values of nvPM emissions measured and computed in accordance with the procedures and calculated as required by this subpart in § 34.71 of this part and paragraphs (a) through (d) of this section;

(2) For each engine tested:

(i) Engine model, series, and serial number;

(ii) Rated thrust (kN);

(iii) Overall pressure ratio;

(iv) The methods of data acquisition; and

(v) The method of data analysis chosen by the applicant under paragraphs (a) through (d) of this section.

(3) Demonstration that the fuel used for each test is in compliance with the fuel specification listed in Appendix 4 of ICAO Annex 16, Volume II (incorporated by reference, see § 34.4). For the fuel used for nvPM emissions certification, include the following fuel characteristics:

(i) Hydrogen/carbon ratio;

(ii) Net heat of combustion (MJ/kg);

(iii) Hydrogen content (mass per cent);

(iv) Total aromatics content (volume per cent);

(v) Naphthalene content (volume per cent); and

(vi) Sulfur content (ppm by mass).

(4) For each engine tested for certification purposes, the following values measured and computed in accordance with the procedures of § 34.71 of this part:

(i) Fuel flow (kg/s) at each thrust setting of the LTO cycle;

(ii) nvPM  $EI_{mass}$  (mg/kg of fuel) at each thrust setting of the LTO cycle;

(iii) nvPM mass emission rate [nvPM  $EI_{mass} \times$  fuel flow] in mg/s;

(iv) nvPM  $EI_{num}$  (particles/kg of fuel) at each thrust setting of the LTO cycle;

(v) nvPM number emission rate [nvPM  $EI_{num} \times$  fuel flow] in particles/s;

(vi) Total gross emissions of nvPM mass measured over the LTO cycle in mg;

(vii) Total gross emissions of nvPM number measured over the LTO cycle in particles;

(viii) LTO nvPM $_{mass}$ /thrust in mg/kN;

(ix) LTO nvPM $_{num}$ /thrust in particles/kN; and

(x) Maximum nvPM $_{MC}$  in  $\mu\text{g}/\text{m}^3$ ; and

(5) For each engine tested for certification purposes, the characteristic levels for the maximum nvPM $_{MC}$ , the LTO nvPM $_{mass}$ /thrust, and the LTO nvPM $_{num}$ /thrust.

Issued under authority provided in 42 U.S.C 4321 *et seq.*, 7572, 49 U.S.C. 106(f),

40113, 44701–44702, 44703, and 44704, in Washington, DC.

Michael G. Whitaker,

Administrator.

[FR Doc. 2024–08453 Filed 4–23–24; 8:45 am]

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## DEPARTMENT OF HOMELAND SECURITY

### Coast Guard

#### 33 CFR Part 165

[Docket Number USCG–2024–0317]

RIN 1625–AA00

#### Safety Zone; San Diego Bay, San Diego, CA

AGENCY: Coast Guard, DHS.

ACTION: Temporary final rule.

**SUMMARY:** The Coast Guard is establishing a temporary safety zone for certain waters of the San Diego Bay. The safety zone is needed to protect personnel, vessels, and the marine environment from potential hazards during the XPONENTIAL 2024 demonstration. Entry of vessels or persons into this zone is prohibited unless specifically authorized by the Captain of the Port Sector San Diego.

**DATES:** This rule is effective from 8 a.m. on April 22, 2024, to 1 p.m. on April 25, 2024.

**ADDRESSES:** To view documents mentioned in this preamble as being available in the docket, go to <https://www.regulations.gov>, type USCG–2024–0317 in the search box and click “Search.” Next, in the Document Type column, select “Supporting & Related Material.”

**FOR FURTHER INFORMATION CONTACT:** If you have questions about this rule, call or email Lieutenant Shelley Turner, Waterways Management Sector San Diego, U.S. Coast Guard; telephone 619–278–7261, email [Shelley.E.Turner@uscg.mil](mailto:Shelley.E.Turner@uscg.mil).

#### SUPPLEMENTARY INFORMATION:

##### I. Table of Abbreviations

CFR Code of Federal Regulations  
DHS Department of Homeland Security  
FR Federal Register  
NPRM Notice of proposed rulemaking  
§ Section  
U.S.C. United States Code

##### II. Background Information and Regulatory History

The Coast Guard is issuing this temporary rule under authority in 5 U.S.C. 553(b)(B). This statutory

provision authorizes an agency to issue a rule without prior notice and opportunity to comment when the agency for good cause finds that those procedures are “impracticable, unnecessary, or contrary to the public interest.” The Coast Guard finds that good cause exists for not publishing a notice of proposed rulemaking (NPRM) with respect to this rule because it is impracticable. The Coast Guard did not receive adequate notice to solicit comments provide prior notice on the need for the safety zone. We must forgo notice and comment to provide safety to protect personnel, vessels, and the marine environment from potential hazards during the demonstration.

Also, under 5 U.S.C. 553(d)(3), the Coast Guard finds that good cause exists for making this rule effective less than 30 days after publication in the **Federal Register**. Delaying the effective date of this rule would be impracticable and contrary to the public interest because the Coast Guard must establish this safety zone by April 22, 2024 to protect the public and property in the area.

##### III. Legal Authority and Need for Rule

The Coast Guard is issuing this rule under authority in 46 U.S.C. 70034. The Captain of the Port Sector San Diego (COTP) has determined that potential hazards associated with the XPONENTIAL 2024 demonstration from April 22, 2024, to April 25, 2024, will be a safety concern for anyone within a 100-yard distance from the proposed zone. This rule is needed to protect personnel, vessels, and the marine environment in the navigable waters within the safety zone during the demonstration.

##### IV. Discussion of the Rule

This rule establishes a safety zone from 8 a.m. on April 22, 2024, to 1 p.m. on April 25, 2024. The safety zone will cover all navigable waters within 100 yards of the following coordinates: 32°42′16.81″ N 117°09′58.72″ W, 32°42′10.57″ N 117°10′04.98″ W, 32°41′57.10″ N 117°09′46.17″ W, 32°42′08.28″ N 117°09′33.50″ W, 32°42′14.00″ N 117°09′44.63″ W, 32°42′09.58″ N 117°09′49.26″ W, 32°42′16.81″ N 117°09′58.72″ W. The duration of the zone is intended to protect personnel, vessels, and the marine environment in these navigable waters while the XPONENTIAL 2024 demonstration is being conducted. No vessel or person will be permitted to enter the safety zone without obtaining permission from the COTP or a designated representative.