EAGLE White Paper on the Environmental Protection Agency's (EPA) Endangerment Finding on Lead Emissions Decision

October 18, 2023

This document is a product of the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative and does not necessarily represent the views or policies of any U.S. governmental organization or agency.

The EPA's issuance of its final endangerment finding was well anticipated. With the final finding, the EPA is now subject to a duty under the Clean Air Act to propose and issue regulatory standards for lead emissions from certain aircraft engines. Under its own authorities, the Federal Aviation Administration (FAA) now has the authority and obligation to develop standards that address the composition or chemical or physical properties of an aircraft fuel or fuel additive to control or eliminate aircraft lead emissions. In other words, this action begins a multi-year regulatory process that EAGLE expects will conclude with the eventual elimination of lead from aviation gasoline. The EPA is not proposing aircraft engine lead emission standards with this action.

The general aviation community and fuel suppliers remain committed to reducing and eliminating lead emissions from aviation gasoline no later than the end of 2030 or sooner, without compromising the safe and efficient operation of the U.S. fleet of aircraft and the economic contribution of general aviation. The FAA and the aviation community established the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative in February 2022 to facilitate an orderly and safe transition to a lead-free aviation gasoloine (avgas) future.

Key Points

- The EPA has issued a final determination that lead emissions from certain aircraft engines cause or contribute to lead air pollution that may reasonably be anticipated to endanger public health and welfare under section 231(a) of the Clean Air Act.
- The EPA's finding itself does not limit or ban the sale or use of leaded aviation fuel, 100 low-lead (100LL).
- The FAA encourages the early adoption of unleaded fuels to gain operational experience and reduce the risks of the national transition.
- It is important that 100LL continue to be available throughout the transition to unleaded fuels to avoid compromising safety until a viable replacement unleaded fuel is available, and for certain aircraft engines that require more preparation time to use unleaded fuels.
- The FAA will initiate rulemaking based on the EPA finding. This rulemaking will go through a normal rulemaking process, and the proposed rules are expected to be published for public comment:
    - Over 220,000* aircraft will need to modify their limitations and placards to be able to use an unleaded fuel.
    - The fuel supply chain and airports will need to accommodate different fuels.

    - There are tradeoffs in performance, chemistry, costs, and compatibility among the various candidate fuels. EAGLE is working to obtain additional information on the alternatives to inform the market decisions that will need to be taken.
    - FAA is exploring how to streamline the process for adoption of unleaded fuel by aircraft owners.
- The industry and FAA established the EAGLE initiative to facilitate communication and collaboration amongst stakeholders with the goal of transitioning to safe and commercially viable unleaded replacement fuels by the end of 2030 or sooner.

*Source: FAA Registry database

Background Information – Rulemaking Next Steps

The Clean Air Act prescribes the process for the EPA and the FAA to develop coordinated regulations that will remove lead from aviation fuels. The process is described as follows:

- **The EPA's Endangerment Finding.**

  The EPA has been studying emissions of lead from aircraft operating on leaded fuel, and the contribution of these emissions to lead air pollution, for many years. In response to petitioners to the EPA, the Agency announced in January 2022 that they were developing a proposal under the Clean Air Act regarding the "endangerment finding." On October 7, 2022, EPA announced its proposed determination, which then underwent public notice and comment. After evaluating comments on the proposal, the EPA is now announcing its final determination.

- Upon the finalization of the EPA's positive endangerment finding, the FAA has an obligation to "prescribe standards for the composition or chemical or physical properties of an aircraft fuel or fuel additive" as described in FAA's Fuel Standards below. The EPA and FAA steps outlined below do not necessarily have to occur in series.

- **The EPA Aircraft Engine Emissions Standards.** With the final finding, the EPA is now subject to a duty under the Clean Air Act to propose and issue regulatory standards for lead emissions from certain aircraft engines. The EPA must consult with the FAA to consider technology, safety, and noise when establishing aircraft engine emission standards. The development of these standards will entail another proposed and final rulemaking allowing for public comment and input. EAGLE believes it is reasonable to expect this process could take approximately two years consistent with similar priority rulemakings, as there are no lead emission standards currently in place.

- **FAA Fuel Composition Rulemaking.** Triggered by the EPA's positive endangerment finding, the FAA is obligated under statute 49 USC 44714 to regulate lead as a fuel component or as a fuel additive to control or eliminate emissions. This would be another rulemaking that will be codified in Title 14 of the Code of Federal Regulations and EAGLE believes it is reasonable to expect the usual rulemaking steps could take approximately 2 years.

- **FAA's Certification Standards.** Once the EPA has promulgated lead emissions standards for aircraft engines, the FAA is responsible for implementing the EPA regulations according to sections 231 and 232 of the Clean Air Act. The scope of this rule is dependent upon the requirements that may materialize in subsequent rulemakings noted above. If necessary, this would be another rulemaking process involving a proposal, public comment, internal government coordination, and issuance of a final rule.

Near Term Actions to Reduce Lead Emissions

The transition to an unleaded fuel for the entire general aviation fleet is complex and has implications for the safe operation of aircraft. The FAA and industry will move cooperatively, smartly, and with purpose toward a safe and effective transition to viable replacement unleaded fuel(s).

The EPA's finding does not change the current production, distribution, sale, or use of 100LL fuel. A primary tenet of EAGLE is to ensure that 100LL remains available for the safe operation of the current fleet during an orderly transition. Maintaining safe operations for pilots, other operators at airports and local communities is an essential part of a safe transition to replacement unleaded fuel(s), along with improving health of the surrounding communities.

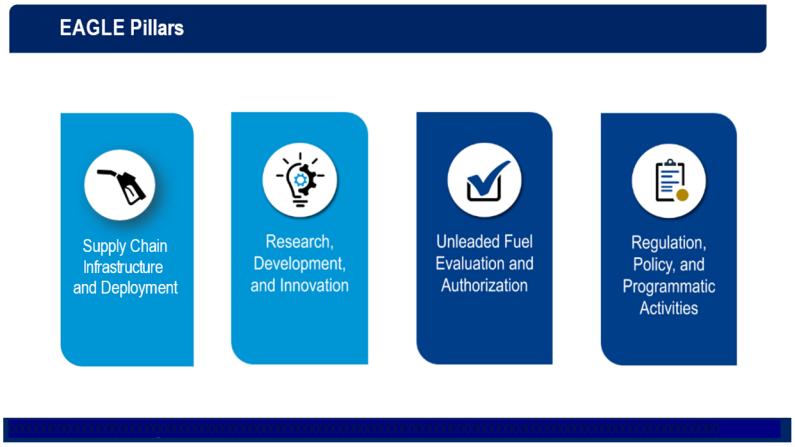
In a report directed by Congress entitled, *"Options for Reducing Lead Emissions from Piston-Engine Aircraft,"* the National Academies of Sciences, Engineering, and Medicine (NASEM) recommended a multi-layered strategy to reduce and ultimately eliminate lead from fuel for piston-engine aircraft. The NASEM report provided a number of interim measures that airports can consider to reduce lead emissions including working with aircraft owners and operators to minimize engine idling and run-up times, relocating and distributing pre-flight and maintenance run-up locations, offering alternative unleaded fuel to supplement avgas sales, and promoting airport and pilot awareness. Airport operators are encouraged to implement these suggested measures while considering the specific operational and safety needs unique to their airport.

For airports in the National Plan of Integrated Airport Systems (NPIAS) working to offer an additional fuel type, they are encouraged to plan for a safe transition by including fuel infrastructure needs in airport planning initiatives. There are potential resources that may be available to support transition-enabling infrastructure. Bipartisan Infrastructure Law (BIL) Airport Infrastructure Grant allocated funds can be used on support facilities such as fuel farms (see BIL FAQs) and the FAA is authorized to provide limited grant funding for non-primary airport-owned aircraft fueling systems (e.g., a fuel tank to provide a fuel type not currently available) through the Airport Improvement Program. NPIAS airports are encouraged to work through their local FAA Airports District Office.

Airport managers, pilots, and aircraft owners will need to rely on their long-standing relationships to educate communities about plans to transition to unleaded fuels, as well as address safety concerns for those in the air and on the ground.

Eliminate Aviation Gasoline Lead Emissions (EAGLE) Initiative – Commitment to Unleaded Fuel(s)

The general aviation industry associations, the American Petroleum Institute, and the FAA established the EAGLE initiative in 2022 with the goal of eliminating aviation gasoline lead emissions before the end of 2030 or sooner without adversely affecting the safe and efficient operation of the general aviation fleet. Consistent with the congressionally directed NASEM 2021 Consensus Study Report "*Options for Reducing Lead Emissions from Piston-Engine Aircraft*," EAGLE's initiatives focus on a multi-faceted approach to reduce and eliminate lead emissions by way of four integrated pillars:



These pillars are committed to the following:

A) Facilitate supply chain and infrastructure readiness for commercial market acceptance and deployment of unleaded aviation fuels from refining to distribution into the wing. Provide options for airports wanting to pursue near-term reductions of lead emissions.
B) Concurrently conduct research and development on technical solutions or modifications that may be necessary for certain aircraft to safely facilitate transitioning to an unleaded fuel.
C) Support the development and deployment of a viable unleaded fuel to replace 100LL that meets the safety needs of the fleet; this includes fuels assessed through the industry/FAA Piston Aviation Fuels Initiative (PAFI) test program and traditional FAA type certification program.
D) Support governmental regulatory and programmatic activities focused on safely transitioning to an unleaded replacement and eliminating lead emissions from aircraft engines.

Unleaded Fuels

When considering a replacement fuel, there are many characteristics to consider such as performance, detonation resistance, materials compatibility, durability, maintenance impacts, potential health effects, and the potential need for related aircraft alterations. There are also other market considerations such as availability, consistency/quality control, and comingling with other avgas options (100LL and other unleaded options). Industry has adopted motor octane number (MON) as a primary indicator of performance, recognizing that fuels with the same MON may not have identical performance due to other, second-order characteristics.

There are two pathways available to obtain FAA approval for the use of a new fuel: (1) the FAA aviation fuel fleet authorization process; and (2) the traditional FAA aircraft Type Certificate (TC)/Supplemental Type Certification (STC) process.

FAA Fleet Authorization Process

The fleet authorization process works in tandem with the PAFI program and allows the FAA to approve data necessary to authorize an unleaded fuel for use without the need for an applicant to apply for an STC or amend an existing TC. Instead, the FAA works with the fuel offeror and engine and aircraft original equipment manufacturers (OEMs) through the PAFI program to ensure that the characteristics of the fuel are well understood. The data obtained through PAFI testing and evaluation will be used to support development of the industry consensus ASTM International production specification for the candidate unleaded fuel. During the fleet authorization process the FAA will consider type certificate data for aircraft and aircraft engines, test reports, and other data generated during the testing to determine which makes and models of aircraft and aircraft engines can safely operate with the qualified unleaded avgas. The FAA will

use that information to develop a report and will also evaluate the available data for the fuel's use in non-type certificated piston engines and aircraft, to include experimental aircraft.

Aircraft owners must take specific actions to implement a fleet authorization by revising the operating limitations in the flight manual on their particular aircraft and replacing the fuel placard. Detailed instructions for doing so will be included as a part of each authorization.

The FAA is working to provide a fleet authorization for UL94, which would also authorize the use of UL91 in the same aircraft. UL94 and UL91 are mid-octane fuels that are adequate for the majority of the general aviation fleet and have gone through extensive testing and the industry consensus process.

FAA Type Certification (TC) / Supplemental Type Certification (STC) Process

Individual companies may also request FAA certification to allow the use of a fuel through the type certificate or supplemental type certificate process. This process requires the applicant to establish that each model of aircraft and aircraft engine for which approvals are requested are compliant to FAA regulations when using the alternate fuel. Each applicant develops a means of compliance to the regulations; however, equivalency to 100LL is not required. In this case, the applicant retains ownership of the compliance data.

As with a fleet authorization, aircraft owners must take specific actions to implement changes to the aircraft typically via Service Bulletins or installation of an STC. For aircraft with a standard airworthiness certificate, the alteration is performed by a certificated mechanic or authorized entity and must comply with the TC/STC. Owners of Special Light Sport Aircraft (SLSA) can implement the authorization after the SLSA aircraft manufacturer issues an authorization to do so. Owners of experimental aircraft must individually determine appropriate unleaded fuels. Those owners may develop their own compatibility or solicit input from the TC/STC holder for data pertinent to their aircraft. Many experimental aircraft have engines and fuel systems in common with aircraft with standard airworthiness certificates.

Fuel Authorization Status

There are a number of fuels that have been authorized for use in many aircraft via the STC process:

Fuel	Approval	Current Airports Selling in US*	Fuel Specification
100LL (Reference case)	TCs for all piston aircraft	3,420	ASTM D910
Autogas (No ethanol)	STCs covering lower-compression aircraft	192	ASTM D4814
UL91	STC AML covering ~ 68% of certified aircraft	0	ASTM D7547
SWIFT Fuels UL94	STC AML covering ~ 73% of certified aircraft	35	ASTM D7547
GAMI G100UL	STC AML covering all certified piston engines and airplanes	0	Independent Specification (Contact GAMI)

* Source: FAA ADIP database (5010 data)

In addition to the existing fuels and approvals, fuel offerors and the FAA are working towards additional fuels and authorizations:

Fuel	Authorization Pathway	Test/ Approval Status	Fuel Specification
UL 94/UL 91	Fleet authorization	Fleet Authorization in progress	ASTM D7547 (UL 94/ UL 91)
GAMI G100UL	STC (AML)	Applied for initial rotorcraft approval	Independent Specification (Contact GAMI)
Swift Fuels 100R	STC (AML)*	Applied for initial engine and aircraft approvals	Applied for ASTM Specification
Afton Chemical/ Phillips 66	Fleet authorization	FAA testing	ASTM D8434
LyondellBasell /VP Racing	Fleet authorization	FAA testing	Applied for ASTM Specification

**Swift Fuels has indicated they may merge their certification efforts with the PAFI Fleet Authorization process in the months ahead, if this can accelerate approvals or help expand their deployment efforts to experimental and Light Sport Aircraft.*

Unleaded Fuel Production and Deployment

The FAA fleet authorization and STC processes both provide pathways for the FAA to authorize fuel for use in engines and aircraft. While the industry is confident in both the fleet authorization and STC approval process, other stakeholders such as producers, distributors, fixed-base operators (FBOs), airports, and engine/aircraft manufacturers need to have an adequate understanding of the fuel necessary to make business decisions. These decisions span the purchasing, producing, distributing, transporting, handling, dispensing, and supporting the operation and use of the fuel. For manufacturers, this also includes extending warranty coverage of their respective products. The FAA will also monitor the safe use of each fuel and work with fuel suppliers and aircraft and engine OEMs to address any issues that arise in service. EAGLE is encouraging fuel developers that hold or are pursuing STC approvals or fuel developers engaged in the fleet authorization process to collaborate with key stakeholders on the necessary information to support the commercial deployment of these fuels.

The Role of Industry Consensus Standards in Fuel Deployment

Historically, the standards for refining, blending, and distributing avgas, and all other transportation fuels including jet fuel, are developed and maintained collaboratively by the petroleum, liquid fuels, and aviation industries. These standards facilitate the international handling of petroleum products and have been a key factor in the consistent and safe production, sale, transportation, and use of fuel in transportation industries. Aviation fuel has been self-regulated through these standards.

ASTM International has served as the primary body for this process, resulting in standards with broad industry understanding and consensus. ASTM International is the globally recognized industry consensus body in which the producers, distributors, providers, users, and many other subject matter experts regarding aviation fuels conduct peer review assessments toward the establishment of testing standards and fuel production specifications.

Currently, the FAA does not directly regulate, approve, or oversee any fuel. The approval to use a fuel for a given aircraft or engine is accomplished through a reference to a fuel specification. For consensus-standard specifications, the FAA participates in the review and approval as one of the many stakeholders to ensure that the specification is adequate. For independent specifications, the FAA reviews the specification and approves it once it is found to provide an equivalent specification of property, performance and quality control. In both cases, the actual production and distribution of fuel are outside of the FAA's purview.

EAGLE's Commitment to Supporting All Unleaded Fuel Candidates

EAGLE continues its efforts to support all fuel sponsors. Industry stakeholders, including engine and airframe manufacturers, provide technical support to the PAFI testing and fleet authorization of the Afton Chemical/Phillips 66 and LyondellBasell/VP Racing Fuels candidates. Additionally, GAMI and Swift Fuels are supported in their efforts as EAGLE stakeholders.

Each fuel developer makes its own business decisions in choosing which FAA approval/authorization pathway to pursue and its approach to commercializing and deploying their fuel to the market. EAGLE is committed to providing the outreach, education, and sharing of information needed by stakeholders directly involved in the deployment of aviation fuel. This information is used by pilots, consumers, government, and industry to help ensure a safe and smart transition to unleaded aviation fuel(s).