

# ABS Air Safety Foundation Special Report: The EPA's 100LL Endangerment Finding

by Thomas P. Turner, ABS/ASF Executive Director

The U.S. Environmental Protection Agency (EPA) issued its long-expected Endangerment Finding for 100LL aviation gasoline on October 18, 2023. An endangerment finding states a conclusion that the lead in exhaust created by burning 100LL avgas in piston aircraft engines presents a health hazard to the general public. A great deal of action and reporting has followed announcement of the EPA's finding. This article attempts to bring ABS members up to speed on what's happened since then up to the date of this writing in mid-November.

I attended a same-day briefing at the National Business Aviation Association (NBAA) convention in Las Vegas that included leaders from NBAA, AOPA, EAA, and other owner groups. NBAA summarizes that briefing:

"We are working with the administration toward the ultimate elimination of lead from avgas, and this finding mirrors and reinforces our shared goal of, and plan for, an unleaded fuel future. This finding is another step in the process, with rulemaking and other regulatory steps still to come, for developing and deploying viable unleaded avgas alternatives. We remain committed to removing lead from avgas by the end of 2030 or sooner, and are making considerable progress toward the introduction of market-viable high-octane unleaded replacement fuels that meet the safety performance needs of the entire U.S. fleet of piston aircraft.

"It is important that the flying community and the public understand that aviation safety depends on an orderly, nationally coordinated transition to unleaded avgas. The premature removal of an essential fuel that many aircraft require for safe operation, before a replacement is available, would compromise the safety, efficiency, and economic viability of the U.S. airspace and airports, the general aviation industry, and transportation infrastructure.

"While the EPA finding is a key step in the process, the EPA is not given the authority to ban, regulate or limit aviation fuel. Instead, the EPA's finding triggers further deliberate rulemaking by FAA as the nation's aviation safety regulator to ensure the successful development and deployment of viable unleaded avgas alternatives, given the critical safety and other issues at stake."

## **AOPA ADDS:**

"The EPA determined that 'lead emissions to air from certain aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health and welfare.' The finding puts into motion a multiyear, multistep regulatory rulemaking process from the EPA and the FAA, but should have no immediate impact on the availability of 100LL at airports, as the EPA is not given the authority to ban, regulate, or limit aviation fuel. The finding reiterates the need for what the industry is already working toward—a safe and smart transition to an unleaded future.

"'We expected this finding for some time now,' said AOPA President Mark Baker. 'In essence, it mirrors the GA industry's commitment to get lead out of avgas by 2030, if not sooner. However, it is as important to note what the finding does not mean—it does not mean that 100LL is going away before we have viable alternatives. It also does not mean that airports should stop offering 100LL, as it would adversely impact safety and hinder commerce. This action does not cause aircraft to be grounded or become prohibited from using 100LL.'

"Under the [1970] Clean Air Act, the EPA and the FAA must consult with each other on rulemaking requirements, to ensure they are developed in a manner that does not adversely impact aviation safety. The EPA is not proposing aircraft engine lead emission standards with this action. The EPA has spent years studying the effects of leaded avgas emissions, originally publishing a proposed endangerment finding in October 2022 followed by a public hearing and comment period. The GA indus-

try has been working alongside the EPA, with the same goal of eliminating lead from avgas. In February 2022 a broad array of aviation stakeholders—including GA leaders, fuel manufacturers, and the FAA—launched the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative. The public-private partnership announced intentions to transition all piston-engine aircraft to lead-free avgas by 2030.

“There are more than 220,000 GA aircraft in the United States—many of which require the higher-octane fuel to fly safely for search-and-rescue operations, medevac, agricultural support, and flight training. The GA industry remains determined to remove lead from the piston-engine fleet and is working aggressively to ensure a viable solution is available by the 2030 deadline. In the meantime, airports must keep 100LL available for pilots must to able to fly safely.”

## **ABS/ASF ACTIONS**

The full EPA Endangerment Finding was published in the Federal Register October 20th. I saw an advance copy and reported on it on the ABS Members Forum on October 10th. On first read of the draft I sent this to Jim Coon of AOPA's Government and Regulatory Affairs and coordinator of the Unleaded Avgas Coalition:

I know you're well ahead of me, but looking at wording of the proposed EPA endangerment ruling I am concerned about what I've highlighted in this specific passage:

“...the EPA is proposing to make endangerment and cause or contribute findings for the lead air pollution and engine emissions of lead from certain aircraft. The classes of aircraft engines and of aircraft relevant to this proposed action are referred to as 'covered aircraft engines' and as "covered aircraft," respectively throughout this document. Covered aircraft engines in this context means any aircraft engine that is capable of using leaded aviation gasoline.”

My concern is that, should an unleaded 100 octane fuel become available at airport fuel pumps, would EPA still consider emissions from engines originally certificated for leaded fuel (i.e., all of them) to be hazardous because those engines are “capable” of being run on leaded avgas?

To date AOPA has not directly answered my question. Industry consensus, however, is that any future regulation would concern leaded aviation gasoline itself and not engines that might use it. The 33-page Federal Register document is on the ABS website at [www.bonanza.org/globalassets/asf/epa-endangerment-finding-2023-23247.pdf](http://www.bonanza.org/globalassets/asf/epa-endangerment-finding-2023-23247.pdf)

I also participated in a stakeholder's Zoom call October 26th organized by Andre Castro of the General Aviation Manufacturers Association (GAMA). This was an official briefing from the EAGLE Initiative “to address the [EPA] finding, provide some insight into the potential impact on general aviation, and discuss what the EPA finding does not mean.”

A key reason for establishing EAGLE was to negotiate a no-later-than-2030 goal for 100LL replacement, so that when the expected Endangerment Finding was released there would already be an agreement in place between EPA, FAA, and industry to provide sufficient time for an orderly transition to unleaded fuel. Speaking as outgoing industry co-chair of EAGLE, AOPA's Mark Baker announced “we are making progress” including “one STC-approved” replacement fuel “and three others in testing.” He reiterated that “it is essential we have” 100LL available “until a viable unleaded replacement is fielded.”

Lirio Liu, Executive Director AIR-1 of the FAA's Aircraft Certification Office and EAGLE co-chair from the government side, added: “This will be a multiyear effort” and FAA is “initiating rulemaking...through our standard process...and the proposed rules will be subject to public comment as they always are.” The FAA “does not want instantaneous removal” of 100LL. “There are over 220,000 aircraft” that will need approval, and airports will have to transition to a new fuel. “The FAA requires that 100LL will be available across the breadth of the aviation community until a replacement is available.”

She reviewed the “two pathways” available for fuels approval: the fleet authorization process, under way through the FAA's PAFI (Piston Aviation Fuels Initiative) process, and the Supplemental Type Certificate process already used by GAMI and by which Swift Fuels is pursuing its unleaded 100 octane alternative, what she called the “traditional” certification process. There are currently “two candidate fuels under each of these pathways,” Liu said, the previously mentioned GAMI STC and Swift's proposed 100R STC fuel, and Phillips 66/Afton Chemical and the Lyondell Basell /VP Racing team, both pursuing fleetwide approval and now undergoing FAA-funded testing after having been “proven viable” in preliminary testing. Engine durability testing on both fleetwide candidates is expected to be complete by the end of 2023 and, if successful, “full-scale”

performance and flight testing “is expected to be completed in a 12- to 18-month period.” Successful candidate fuels will receive an ASTM fuel specification and fleetwide authorization, i.e., available to all aircraft without requiring purchase of an STC.

Liu then noted GAMI’s success in earning an STC for G100UL with an extensive approved models list for airplanes and which has “applied for approval for rotorcraft,” with that approval process “under way now.” GAMI is “responsible for” and “working with” partners for quality control and to “establish a pathway to production and distribution.” Swift fuels “has applied for engines on airplanes and rotorcraft” for 100R under the STC process. Swift is also “working through the ASTM process in addition to the STC...to create an industry specification for [its] unleaded 100R fuel.” She recognizes that Swift already holds an STC for its 94UL fuel and has since 2015, which is “available at 35 public airports now, and a number of private airfields.” Swift is pursuing the fleet authorization pathway for 94UL, which works for “approximately 70% of the general aviation fleet” and may move 100R approval to the fleet authorization process.

Additional speakers on the call addressed replacement fuels from the airport perspective, including “limited” FAA funding for duplicate fuel tanks and other airport infrastructure during the transition period, the business perspective from aviation business owners, and possible mitigations such as relocated engine run-up areas and pilot training to minimize ground run-up times to reduce local lead exposure.

Answering a viewer question about whether FAA will approve a single fuel or multiple fuels Liu said, “FAA is ‘pursuing multiple options because I think that is what has been presented to us. I think it will be industry demand and the industry market that will determine the number of fuels that will be available.’” Baker added, “The market’s going to dictate whether price, availability, logistics and support for the fuel” determines success. “We’re interested in getting as many across the finish line as quickly as possible.”

## G100UL UPDATE

As owners on the only current approval for a lead-free 100 octane avgas, I asked George Braly and Tim Roehl of General Aviation Modifications, Inc. (GAMI) to update ABS members on its status regarding production and distribution of G100UL, GAMI’s unleaded, 100 octane aviation gasoline, and what if any impact the EPA’s finding has on GAMI’s plans for fielding its FAA-STC fuel. GAMI President Tim Roehl replied:

“The long anticipated ‘Endangerment Finding’ issued by the EPA adds further fuel to the fire in support of a near-term transition to an unleaded fuel. GAMI recognized the likelihood of this action close to 20 years ago with our participation on the ASTM Unleaded Avgas Group, then as a member of the Unleaded Avgas Transition Aviation Rulemaking Committee and then finally with the independent development and initiation of our STC Project for the FAA Certification of our G100UL, all prior to the PAFI and/or EAGLE/PAFI efforts. To date, something near \$80,000,000 of your federal dollars has been spent on the PAFI or EAGLE/PAFI efforts which has failed to produce a viable candidate fuel. GAMI’s independently developed and funded solution represents true American capitalism at work. We are glad to have successfully brought the high octane, unleaded G100UL through its rigorous FAA certification and can now turn our attention to producing and deploying the G100UL. We are highly engaged with the first few producers and distributors of the G100UL and hope to have significant volumes of G100UL flowing to the west coast early in 2024. STCs are available on our [www.G100UL.com](http://www.G100UL.com) website.”

ABS Air Safety Foundation will continue to monitor developments, ask questions, provide meaningful updates, and participate in the process of the unleaded fuel transition to the extent the ASF mission and resources dictate.

### Unleaded Fuel and Valves

Reported by AVWeb November 9, 2023,  
written by Paul Bertorelli:

“After an extensive trial, the University of North Dakota’s flight school has dropped Swift UL94 [94 octane unleaded avgas] and resumed use of 100LL. The school said ongoing maintenance monitoring of aircraft using UL94—almost exclusively Lycoming-powered Piper Archers and Seminoles—resulted in measurable exhaust valve recession. The school made the switch back to 100LL on Oct. 27.”

UND “switched to Swift Fuel’s ASTM-spec UL94 in late June. In four months of flying totaling 46,000 hours, the school found evidence of significant valve recession in some of the Archers. The school’s director of maintenance, Dan Kasowski, told AVweb [November 8] that the total number of aircraft impacted isn’t known yet because the data is still being collected. The data is being forwarded to Lycoming for analysis. ‘The fuel is on-spec, so that’s not a problem. I don’t want to speculate on what it could be. We’re waiting for Lycoming to tell us,’ Kasowski said.

“Valve seat recession was a known problem when unleaded fuels were introduced in the automotive market starting in the 1970s.... The precise mechanism is debatable, but hardened valve seats and cylinder heads tamped down recession damage. Lycoming addressed this issue in its cylinders during the 1990s and was believed to have valve seats and guides suited for unleaded fuels. Lycoming said it was “proactively evaluating” the data received from UND and would provide appropriate guidance based on its analysis.... Swift’s Chris D’Acosta confirmed that Lycoming is looking at materials, pilot operating methods, flight telemetry, and additional data to understand the findings at UND. ‘The comment attributed to equivalent spark plug fouling and replacement vs 100 LL is generally not consistent with our own experience with UL94. This may be an indication of different operating methods at UND than elsewhere,’ D’Acosta said. UND’s Jeremy Roesler said...’when we started finding these issues, we needed to ask ourselves how bad does it have to get before we switch back to 100LL? We’re big on how it affects our students. It is causing some delays. So it’s not in our best interest to accelerate back to UL94....”

UND has “conducted regular compression checks on its fleet...and also did the so-called ‘dry tappet’ check. This involves removing and cleaning the tappets and reinstalling them with the pushrods in place. The clearance between the rocker arm and the valve stem is then checked. If the valve seat is recessing, this clearance will progressively diminish as the valve recedes farther into the cylinder head. Kasowski said the Lycoming specified minimum clearance is 0.028 inch and some of the cylinders exceeded this limit. If the recession is deep enough, the valve won’t close against the seat and power loss or burned valves can result. Recession was measured only on exhaust valves, not intake valves.”

For the full AVWeb report and any updates see [www.avweb.com](http://www.avweb.com).

## **AOPA Uses Beech Baron to Test Unleaded Avgas**

Reported by AOPA’s Dave Hirschman  
November 3, 2023

“The idea couldn’t be simpler: To learn about the real-world performance of unleaded aviation fuels, AOPA will measure them against leaded avgas in a twin-engine airplane. The unleaded fuel will go in the left wing and feed the left engine. Leaded avgas (100LL) will go in the right wing and feed the right engine.

“AOPA is now demonstrating the first 100-octane unleaded formula to gain an FAA supplemental type certificate. The demonstration began October 31 in a Beechcraft Baron dispatched to Ada, Oklahoma, where General Aviation Modifications Inc. (GAMI) produces its G100UL. Additional demonstration flights will be scheduled. GAMI is currently working toward commercializing its fuel in order to distribute it more widely. As other 100-octane unleaded fuels come online and are authorized for use by the FAA, AOPA intends to demonstrate them as well.

“‘We want to get some actual experience with 100 octane unleaded fuel in the kinds of airplanes and engines that our members own and fly,’ said AOPA President Mark Baker. ‘This fuel has been tested extensively in labs and received an STC. Should the FAA authorize additional fuels, we’ll test them, too, so we can see what they’re like to use out on the airways.’

“AOPA is leasing a newly refurbished 1966 Beechcraft Baron C55 from Greg Herrick of Wyoming for \$1 a year to monitor the unleaded fuel demonstration that is expected to last up to two years. Donor Dan Shewmaker will offset operational costs.”

In a news release AOPA added: “Mike Busch, founder of Savvy Maintenance and an AOPA *Pilot* magazine columnist, will analyze engine data from the Baron....”

For the full AOPA report and updates see [www.aopa.org](http://www.aopa.org).

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**CATEGORIES:**

Air Safety Foundation

American Bonanza Society  
3595 N. Webb Road Suite 200  
Wichita, KS 67226  
316.945.1700 | [info@bonanza.org](mailto:info@bonanza.org)