



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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Dear Ms. Behles, Kang, Engelman Lado, Lee and Mr. Ballo:

By letter dated October 3 2006, Friends of the Earth (FoE or Petitioner) petitioned the Environmental Protection Agency (EPA or the Agency) to conduct rulemaking regarding lead emissions from general aviation aircraft. Specifically, Petitioner requests that EPA either "(1) Make a finding that lead emissions from general aviation aircraft endanger public health and welfare and issue a proposed emissions standard for lead from general aviation aircraft under § 231(a)(2)(A) of the Clean Air Act¹; alternatively (2) If the Administrator believes that insufficient information exists to make such a finding, commence a study and investigation of the health and environmental impacts of lead emissions from general aviation aircraft, including impacts to humans, animals and ecosystems, under § 231(a)(2) of the Clean Air Act, and issue a public report on the findings of the study and investigation." FoE Petition at 1.

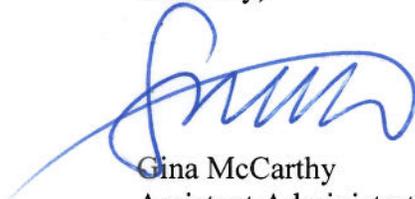
In the following memorandum, EPA provides the Administrator's response to the Petition. This response is our final decision on the FoE Petition, and to the extent the Petition requests additional or different action by EPA, we are denying it. Although we are not at this time issuing a judgment on

¹ EPA notes that the statutory language governing EPA's regulatory action regarding aircraft engine emissions provides that the EPA Administrator "shall, from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of engines which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare." Petitioner and others often use different phraseology when describing this task, but in this notice we treat all such shorthand variants as paraphrasing the statute rather than asserting that a different analysis should be conducted.

whether lead emissions from piston-engine general aviation aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, the memorandum provides our intended plan to conduct a proceeding regarding whether such emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, pursuant to section 231 of the Clean Air Act. EPA does not plan to take final action on these issues prior to going through a notice and comment process. Consequently, EPA is not prepared at this time to initiate the rulemaking to promulgate standards requested by the Petitioners. However, EPA plans to review that issue following the proceeding discussed above.

I appreciate your interest in this issue and welcome the opportunity to work with FoE and other stakeholders in addressing lead emissions from piston-engine general aviation aircraft. For further information, please contact Kathryn Sargeant at (734) 214-4441.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Gina McCarthy', is written over the typed name.

Gina McCarthy
Assistant Administrator

MEMORANDUM IN RESPONSE TO PETITION REGARDING LEAD EMISSIONS FROM GENERAL AVIATION AIRCRAFT PISTON-ENGINES

I. Introduction

A. Statutory Provisions

Under Clean Air Act (“CAA” or “the Act”) section 231(a)(2)(A), EPA shall, “from time to time, issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in [the Administrator’s] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.” 42 U.S.C. § 7571(a)(2)(A). Under section 231(a)(3), following proposal EPA is required to issue such final regulations with such modifications as the Administrator deems appropriate. 42 U.S.C. § 7571(a)(3). These provisions constitute a “both explicit and extraordinarily broad” delegation of “expansive authority to EPA to enact appropriate regulations applicable to the emissions of air pollutants from aircraft engines.” NACAA v. EPA, 489 F.3d 1221, 1229-30 (D.C. Cir. 2007).

B. Procedural History

In a 2003 letter to the EPA, Friends of the Earth (FoE or Petitioner) initially raised the issue of the potential for lead emissions from the use of leaded aviation gasoline (avgas) in general aviation aircraft using piston engines to cause or contribute to endangerment of public health or welfare. FoE Letter dated December 12, 2003, submitted to EPA Docket EPA-HQ-OAR-2002-0030. By letter dated October 3, 2006, FoE petitioned the Agency for rulemaking to do the following:

- (1) make a finding that lead emissions from general aviation aircraft engines endanger public health and welfare and issue a proposed emission standard for lead from general aviation aircraft pursuant to Clean Air Act section 231(a)(2)(A)¹; or, in the alternative,
- (2) if the Administrator believes that insufficient information exists to make such a finding, commence a study and investigation of the health and environmental impacts of lead emissions from general aviation aircraft, including impacts to humans, animals and ecosystems, under section 231(a)(2) of the Clean Air Act, and issue a public report on the findings of the study and investigation.

FoE Petition, at 1, 11.

In 2007, the EPA issued a Federal Register notice on the petition requesting comments and information related to a wide range of issues regarding the use of leaded avgas in general

¹ As indicated in section I. A., the actual language of section 231(a)(2) is different in significant ways from the language quoted from the Petition. The remainder of this response will use the language of the statute in characterizing Petitioner’s request.

aviation aircraft piston engines and potential public health and welfare exposure issues. "Petition Requesting Rulemaking To Limit Lead Emissions from General Aviation Aircraft; Request for Comments," 72 FR 64570 (Nov. 16, 2007). The comments EPA received on this notice are publicly available in the docket for this matter, Docket ID No. EPA-HQ-OAR-2007-0294, which can be found at www.regulations.gov.

In 2010, the EPA issued an "Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline; Proposed Rule," (ANPR) 75 FR 22440-68 (Apr. 28, 2010). In the ANPR, EPA described information currently available and information being collected that will be used by the Administrator to issue a subsequent proposal regarding whether, in the Administrator's judgment, aircraft lead emissions from aircraft using leaded avgas cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. In this ANPR, EPA described and requested comment on the data available for evaluating lead emissions, ambient concentrations, and potential exposure to lead from the use of leaded avgas in piston-engine powered aircraft. EPA also described and requested comment on additional information being collected that will inform any future action. EPA received comments on its ANPR through August 27, 2010, which are included in the docket (EPA-HQ-OAQ-2007-0294).

On May 26, 2011, Earthjustice, on behalf of Petitioner, notified EPA of its intent to file suit against EPA for unreasonable delay in responding to the petition. On March 7, 2012, Petitioner filed a Complaint in the U.S. District Court for the District of Columbia claiming that, among other things, EPA had unreasonably delayed because it had failed to answer the Petition and because it had failed to determine whether emissions of lead from general aviation aircraft engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare (an "endangerment finding"²). FoE Complaint at 1, 13-16. On June 1, 2012, the court issued a Scheduling Order directing EPA to file a motion for summary judgment in defense against the FoE Complaint on or before July 20, 2012. Friends of the Earth v. EPA, Civ. No. 12-0363 (ABJ).

II. Summary of Petition

The Petitioner states that studies show that lead in any quantity threatens the public welfare, and that lead emissions from general aviation aircraft engines constitute a substantial proportion of all current lead air emissions. FoE Petition at 3. The Petitioner further contends that EPA has authority under Clean Air Act section 231(a)(2)(A) to propose emission standards

² Section 231(a)(2)(A) refers to an exercise of judgment regarding whether emissions from aircraft cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. While this involves a two-step process, concerning both cause or contribution of emissions from aircraft and endangerment from air pollution, for convenience EPA refers in this document to this as an endangerment finding.

for air pollutants from aircraft engines when such emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. Id.

FoE argues that based on the facts presented in its Petition and subsequent submittals to EPA, sufficient data already exist to conclude that lead emissions from general aviation aircraft endanger the public health and welfare, thus creating a duty for EPA to propose emission standards. Id. In the alternative, FoE asserts, sufficient data regarding the dangers of airborne lead exist to support commencing a study concerning the extent of the health and environmental effects of general aviation lead emissions. Id. FoE claims that failure by EPA to do either of these would constitute arbitrary and capricious action under section 706 of the Administrative Procedure Act, 5 U.S.C. § 706. Id.

In presenting its argument, Petitioner cites numerous EPA and other agency studies regarding the adverse health effects of exposure to lead. The petitioner presents the general proposition that it is important to interdict all lead exposures. Id. at 3-4. The Petitioner continues by citing several studies to support their argument that no exposure to lead is safe, particularly in the case of children, and that to protect the public health and welfare EPA should strive to eliminate every source of lead to which the public could be exposed. Id. at 4-5.

FoE notes that “the main routes of human exposure to lead compounds at or near general aviation airports in urban areas include: (i) inhalation of airborne organic and inorganic lead, (ii) ingestion of lead contaminated dusts formed via deposition of airborne lead, and (iii) ingestion of contaminated homegrown fruits and vegetables (also via particulate deposition).” Id. at 6. FoE further notes that “in farming areas, additional exposure could result from the contamination of food animals via lead deposition onto soils, forage areas, and farm ponds.” Id. FoE notes, additionally, that “lead emissions from general aviation airports may also accumulate in local and regional surface waters and are likely to contaminate sources of drinking water and fishing resources, and could also cause various adverse ecological impacts.” Id. FoE then addresses the emissions of organic and inorganic lead compounds it argues result from the use of leaded avgas, as fueling emissions and engine combustion emissions. Id. at 5-7. FoE contends that air lead emissions from general aviation represent an increasing percentage of total mobile source air lead emissions, as other mobile source sectors continue to phase out their use of leaded fuels. Id.

Citing several sources, FoE also maintains that safe, unleaded alternatives to avgas already exist, some of which have already received approval from the Federal Aviation Administration (FAA) for use under supplemental type certificates by a substantial percentage of piston-driven aircraft. Id. at 7-9. The Petitioner argues that these unleaded alternatives could be phased into use and result in significant cost savings for general aviation pilots, along with the reduction of many tons of air lead emissions. Id. Moreover, FoE argues, numerous studies show that general aviation aircraft, including high-performance aircraft, can operate safely on unleaded fuel. Id. at 9-11.

Finally, the Petitioner concludes by asserting that EPA has the authority to adopt rules that force the use of current or developing technology to reduce air lead emissions from general aviation, and then repeats its alternative requests that EPA either find that lead emissions from general aviation aircraft endanger public health and welfare or commence a study on the impacts from such emissions and issue a public report on the agency's findings. *Id.* at 11. Failure to act on these requests, FoE contends, would constitute agency action under the Administrative Procedure Act. *Id.*

In subsequent submittals to EPA, the Petitioner notes a recent finding that blood lead levels are elevated in children who live in close proximity to general aviation airports. FoE Letter dated August 31, 2011, submitted to EPA Docket EPA-HQ-OAR-2007-0294. FoE also notes that almost all of the areas recently designated as nonattainment for the Lead National Ambient Air Quality Standards (NAAQS) are in counties that contain at least one airport where lead is emitted. FoE Letters dated February 16, 2011, and November 28, 2011 submitted to EPA Docket EPA-HQ-OAR-2007-0294.

III. Response to Requests

This document is EPA's final decision on the FoE Petition, and to the extent the Petition requests additional or different action by EPA, we are denying it. In response to Petitioners' request, EPA is not at this time issuing a judgment on whether lead emissions from general aviation aircraft piston engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, and is consequently not prepared at this time to propose standards for such emissions. However, EPA intends to initiate a notice and comment proceeding under CAA section 231(a)(2)(A) regarding whether such emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. EPA expects to undertake the endangerment proceeding in the time frame discussed below. Prior to the Administrator exercising her judgment regarding lead emissions from general aviation aircraft piston-engines, EPA is unable to commit to rulemaking with regard to controlling lead emissions from such general aviation aircraft engines.

A. Request for endangerment and cause or contribute findings

Petitioner requests that EPA make a finding that lead emissions from general aviation aircraft engines using leaded avgas cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.

In evaluating the endangerment and contribution issues related to lead emissions from piston-engine aircraft using leaded avgas, EPA is evaluating both the likelihood or risk that a harm could occur to the public health or welfare, and the severity of this harm if it were to occur. From a public health perspective, this includes, among other things, evaluating two basic issues

related to the use of avgas: (1) the ambient levels of lead in the air and the number of people, including children, who are potentially exposed to this level of lead, and (2) the nature of the health problems associated with such exposures. For piston-engine aircraft using leaded avgas, our investigation to date indicates that the levels of lead in the air at and around general aviation airports increase with proximity to the airport. There are thousands of airports where a variety of piston-engine aircraft operate for a range of purposes (e.g., passenger transport, personal transportation and business, flight training, recreational use, agricultural applications). The levels of lead in the environment at and around airports is expected to vary significantly based on factors such as the type of piston-engine planes using the airport, the frequency of aircraft take-off and landing events, the layout of the airport, and other airport-specific factors. In light of this, EPA faces a quite intensive investigation to understand the range of lead concentrations to which people are exposed from this source.

Most of EPA's evaluation to date and over the next 1 to 2 years is focused on developing basic factual information about the levels of lead in the air at and around general aviation airports, given the variation across the airports, and the numbers of people, including children, who are potentially exposed to these ambient levels of lead. There is only a very limited amount of monitoring data to date to inform this evaluation. EPA has and continues to expend significant effort to develop a robust model that can characterize the levels of lead in the ambient air at and around airports based on the factual characteristics of the airports. The model, which has already been and will be further evaluated based on monitoring data, will allow EPA to develop a credible and comprehensive characterization of ambient lead levels at and around airports, both the maximum concentrations experienced by those exposed in close proximity to aircraft emissions as well as lower exposures at greater distances from the airport. EPA will combine this information with updated demographic information to provide information on the numbers of people, including children, who are potentially exposed to lead emissions from piston-engine aircraft in the air at and around airports. To inform the question regarding the potential for harm from exposure to the ambient lead levels EPA identifies at and around airports, EPA will look to the most recent available scientific information, such as that being developed in the current Lead NAAQS assessment, as well as the risk assessment conducted by EPA in 2007 in support of the 2008 NAAQS revision (Lead: Human Exposure and Health Risk Assessments for Selected Case Studies. EPA-452/R-07-014a October 2007). This will provide a major part of the scientific basis that EPA plans to use in making a judgment on endangerment and contribution, under section 231, related to lead emissions from piston-engine aircraft using leaded avgas.

In the endangerment proceeding, EPA intends to follow a general approach similar to its recent Clean Air Act section 202(a) endangerment finding for greenhouse gas emissions from motor vehicles. See 74 FR 18886 and 74 FR 66496. The basic lines of inquiry for an endangerment finding are two-fold: (1) is the air pollution reasonably anticipated to endanger public health or welfare; and (2) does emission of the air pollutant from the subject source

category cause or contribute to the air pollution at issue? To this end, EPA will review the modeled and monitored data showing contribution of piston-engine aircraft lead emissions to local ambient concentrations and local and national lead inventories (including in nonattainment areas and areas near airports), the number of children and adults residing in close proximity to airports or attending school in close proximity to airports, the contribution of this source to lead deposition, the inventory contribution of lead emissions to areas exceeding the NAAQS for particulate matter, all data submitted to the docket, and relevant scientific and technical information related specifically to general aviation piston-engine aircraft lead emissions.

As discussed below and as summarized in the 2010 ANPR, EPA has already conducted significant work to obtain and analyze additional data and information that the Agency expects will facilitate developing a scientifically sound determination. EPA intends to continue its work in this active proceeding as described below.

In 2007, the EPA issued a Federal Register notice on the petition, requesting comments and information related to a wide range of issues regarding the use of leaded avgas in general aviation aircraft piston-engines and potential public health and welfare exposure issues. “Petition Requesting Rulemaking To Limit Lead Emissions from General Aviation Aircraft; Request for Comments,” 72 FR 64570 (Nov. 16, 2007). In this notice, EPA invited information and comments from all interested parties on the issues raised in the petition from FoE. To assist us in developing our response to the petition, EPA specifically requested information and comment on the following: information on concentrations of lead in the air, soil, surface water or other environmental media at or near airports where leaded avgas is used; information on levels of lead in indoor dust in homes in the vicinity of airports; information on blood lead levels in children and adults residing near an airport where leaded avgas is used; information on the demographics of the populations residing in the vicinity of airports; information related to supplying unleaded aviation gasoline at airports and how potential fuel distribution issues could be addressed; information on the characteristics of piston-engine general aviation operation, including annual operations by airport, information on aircraft/engine type including time aircraft spend in specific on-ground operating modes, and fuel flow rate in mode (e.g., idle, taxi, run-up and take-off). The comments EPA received on this notice are publicly available in the docket (EPA-HQ-OAR-2007-0294). EPA did not receive new information to inform the evaluation of endangerment as a result of this Notice.

In 2007 EPA also initiated an extensive update of the methods used to develop the inventory for lead emissions from piston-engine aircraft, in coordination with FAA. This work took place from 2007 – 2010 and resulted in the addition of about 16,000 airport facilities in the 2008 National Emissions Inventory (NEI). Prior to the 2008 NEI, EPA’s inventories had only

reported emissions of lead at 3,410 airports.³ While the 3,410 airport facilities are among the most active in the U.S., they comprise only a small fraction of the total airport facilities where leaded avgas is used. The approximately 16,000 facilities were added to EPA's inventory using data supplied to the FAA which provides the location of approximately 20,000 airport facilities in the U.S., the vast majority of which are expected to have activity by piston-engine aircraft that operate on leaded avgas. This update of EPA's inventory methods for lead emissions from the use of leaded avgas included several intensive data-gathering steps including the following: evaluating estimates provided for the annual volume of leaded avgas supplied and the volume of avgas consumed in order to reconcile previous discrepancies; developing methods to align airport lead inventories with those of the other criteria pollutants (this step was necessary because lead is not included in FAA's airport modeling system); estimating lead emissions in-flight; updating the manner in which EPA estimates piston-engine aircraft activity (the number of landings and takeoffs at an airport), because the activity of this fleet is reported to the FAA as general aviation or air taxi activity – categories that also include jet-engine aircraft activity; and deriving methods to estimate activity at the approximately 14,000 airport facilities that don't report activity data to FAA. EPA describes these and additional updates to the airport lead inventories in the document titled "Calculating Piston-Engine Aircraft Airport Inventories for Lead for the 2008 National Emissions Inventory" which is available in the docket (EPA-HQ-OAR-2007-0294). EPA is currently developing the 2011 NEI for airport lead, which will include soliciting state, local and tribal review of EPA estimates of aircraft activity. After review and revisions, the 2011 airport lead inventory will be used in EPA's evaluation of endangerment.

After receiving the petition from FoE in 2006, EPA networked extensively with investigators in the U.S. and abroad to identify studies (peer reviewed or in the gray literature) that would provide insight into any of the multitude of questions we had posed in the 2007 FR Notice. We identified three air quality monitoring studies reporting lead concentrations near airports, one of which we had peer reviewed.⁴ However, the current data available for ambient lead concentrations at maximum impact sites at airports is severely limited, does not allow us to quantitatively evaluate the influence of piston-engine aircraft activity on ambient lead concentrations at different distances from aircraft emissions, and cannot be used to provide robust estimates of ambient lead concentrations at other facilities across the U.S.

In 2010, the EPA issued an "Advance Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline; Proposed Rule," (ANPR) 75 FR 22440 - 68 (Apr. 28, 2010). In the ANPR, EPA described information currently

³ These 3,410 facilities are the facilities for which the FAA's Terminal Area Forecast (TAF) database provides information regarding aircraft activity. The TAF database is prepared by FAA's Office of Aviation Policy and Plans and includes information for the airports in FAA's National Plan of Integrated Airport Systems (NPIAS). One of the goals of the NPIAS is to identify airports that are significant to national air transportation.

⁴ Environment Canada (2000) Airborne Particulate Matter, Lead and Manganese at Buttonville Airport, Toronto, Ontario, Canada: Conor Pacific Environmental Technologies for Environmental Protection Service, Ontario Region.

available and information being collected that will be used to issue a subsequent proposal regarding whether, in the Administrator's judgment, aircraft lead emissions from aircraft using leaded avgas cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. In this ANPR, EPA described and requested comment on the data available for evaluating lead emissions and the lead emissions inventory, the chemical and physical properties of lead emitted by piston-engine aircraft, a summary of airport lead monitoring and modeling studies, the use of piston-engine aircraft in agriculture and the potential impacts of this aircraft application, the potential lead concentrations in fish and other aquatic organisms from the use of piston-engine float planes, deposition and run-off of lead at and near airports, lead emitted in flight, and potential exposure to lead from the use of leaded avgas in piston-engine aircraft. EPA provided a demographic analysis of the number of people residing near airports and the number of children attending school near airports. EPA also described and requested comment on additional information being collected that will inform any future action. EPA received comments on its ANPR through August 27, 2010, which are included in the docket (EPA-HQ-OAQ-2007-0294).

Prior to this in 2009, in response to an FoE letter stating that EPA should find that lead emissions from general aviation aircraft endanger public health and welfare, and initiate rulemaking procedures, EPA had informed FoE that we were developing the ANPR and conducting a modeling and monitoring study that we anticipated would provide the basis for an EPA regulatory action regarding FoE's petition. The methods development work (i.e., modeling and monitoring study) was published in the peer-reviewed, scientific literature in 2011 and the full report from this research is available in the docket (EPA-HQ-OAQ-2007-0294).⁵ This work was necessary for EPA to conduct since previous airport modeling studies had not focused on identifying near-field gradients in lead concentrations from piston-engine aircraft, or attempted to differentiate aircraft lead emissions from other sources of ambient air lead (e.g., roadways). Modeling studies of air quality near airports have typically evaluated pollutants on spatial scales of at least 200 meters or more.^{6,7} To evaluate the most highly exposed population and the potential for exceedances of the Lead NAAQS, though, it is necessary to understand changes in lead concentrations on and off airport property on spatial scales of approximately 50 meters. This is relevant both because the limited measurements of lead near airports suggest that lead

⁵ Carr, E., Lee, M., Marin, K., Holder, C., Hoyer, M., Pedde, M., Cook, R., Touma, J., 2011. Development and evaluation of an air quality modeling approach to assess near-field impacts of lead emissions from piston-engine aircraft operating on leaded aviation gasoline. *Atmospheric Environment* 45, 5795-5804.

⁶ Peace, H., Maughan, J., Owen, B., B., Raper, D., 2006. Identifying the contribution of different airport related sources to local urban air quality. *Environmental Modelling & Software* 21, 532-538.

⁷ Unal, A., Hu, Y.T., Chang, M.E., Odman, M.T., Russell, A.G., 2005. Airport related emissions and impacts on air quality: application to the Atlanta International Airport. *Atmospheric Environment* 39, 5787-5798.

concentrations increase sharply with increasing proximity to the source and many airports have dense residential neighborhoods in close proximity to piston-engine aircraft emissions.⁸

EPA's modeling and monitoring study was unique and necessary in that aircraft- and airport- specific parameterizations were used in American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) to evaluate ambient lead concentrations on and near an airport at 50-meter spatial resolution. To improve modeled estimates of ambient concentrations at near-field receptors, we developed a lead emissions inventory that was highly resolved spatially and temporally. This included developing a comprehensive lead emission inventory that incorporated sub-daily time-in-mode activity data for piston-engine aircraft,⁹ aircraft-induced wake turbulence, plume rise of the aircraft exhaust, and allocation of approach and climb-out emissions to 50-meter increments in altitude. To evaluate the modeling results from the study, ambient lead concentrations were monitored for a summer and a winter period at multiple locations both on and off airport property. Modeling results paired in both time and space with monitoring data showed excellent overall agreement, providing the basis for EPA to proceed with this modeling platform for the air quality analysis and uncertainty analysis to evaluate exposures to those living near airports across the U.S.

In late 2010 EPA initiated additional modeling that will provide the data to evaluate exposure to lead at thousands of airports where piston-engine aircraft are active in the U.S. The following components of this modeling effort are being evaluated to provide a robust dataset to extrapolate to airports nationwide: model-to-monitor comparisons to further evaluate the modeling approach used to parameterize aircraft emissions and the resulting concentrations over small spatial scales of 50 meters; evaluation of ambient lead concentrations resulting from touch-and-go operations compared with full taxi-out, run-up and take-off emissions; on-site observation of the time aircraft spend in each operation mode; and identification of individual aircraft engine type at the modeled airport to calculate fuel flow rates for each aircraft operation mode. This air quality modeling work includes analysis of uncertainty and variability in ambient air lead concentrations at and near airports resulting from the concentration of lead in the avgas supplied at airports, the duration of the run-up check emissions, and the activity of single- versus twin-engine aircraft and low wind speeds (e.g., stagnant meteorological conditions). The output of the model and uncertainty analysis will provide EPA with estimates of the air quality impact at distances from the aircraft emission locations separately for single-engine aircraft and twin-engine aircraft.

⁸ SCAQMD, 2010. General Aviation Airport Air Monitoring Study Final Report, Prepared for U.S. Environmental Protection Agency, Region IX.

⁹ To acquire this data, an on-site survey was conducted which included the collection of data on the number of take-offs and landings and the duration of the take-off and landing activities (including the taxi-out, run-up, take-off, climb-out, approach, landing, and taxi-in).

Case studies will be included in the modeling effort to evaluate the impact of 1) fly-in events on ambient air concentrations, because these events can greatly increase the number of flights at an airport in a short period of time; and 2) the lead emissions from DC-3 and DC-6 aircraft, which consume much larger quantities of leaded fuel than the aircraft typically observed at a general aviation airport (i.e., single- and twin-engine piston aircraft). These aircraft are being modeled separately because they use much more fuel than single- and twin-engine piston aircraft and are active at some airports in the U.S.

This modeling work will be completed in the fall of 2012. Subsequently, EPA will apply the air quality impact factors from the model output to the aircraft activity at airports across the country after evaluating seasonal variation in piston-engine aircraft activity and regional meteorological patterns that would determine the frequency of use of one runway end (and therefore lead concentrations downwind). Peer review of the modeling work and extrapolation of the air quality impact to airports nationwide is expected to be complete in 2013.

EPA is also searching for and in some cases collecting data to evaluate, where possible, the deposition of lead emitted by piston-engine aircraft; concentrations of lead in fish and the potential role of lead emissions from piston-engine aircraft; the potential role of weekend increases in piston-engine aircraft activity on weekend increases in ambient lead concentrations; lead concentrations reported in runoff water at airports; concentrations of organic lead in air from piston-engine aircraft emissions; and the potential impact of lead emissions from piston-engine aircraft used in the cultivation of crops for human consumption.

EPA is conducting a demographic analysis and evaluating potential issues related to environmental justice among the population residing in close proximity to airports with piston-engine aircraft activity. In the 2010 ANPR, EPA evaluated the population residing near airports using the 2000 U.S. Census data, which was the most up-to-date data available at the time. Since the development of the ANPR, the 2010 U.S. Census data has been released. EPA is now using the 2010 U.S. Census data to evaluate the population residing near airports. With the 2010 U.S. Census data EPA will be able to specifically evaluate the number of children, by age, that reside within a given distance of an airport facility. EPA will also use the most up-to-date school enrollment data available to evaluate the number of children that attend school within a given distance of an airport. Similar to the analysis conducted for the ANPR, EPA will use the school enrollment data to evaluate potential ethnic and economic disparities among children attending schools close to airports compared with the general population. In the ANPR EPA was only able to evaluate the exposure to people residing or attending school within a given distance of the centroid (a single latitude/longitude point, usually located in the center of the airport property) of an airport. In its current analysis EPA is using a graphical interface system to evaluate the exposure to people residing or attending school within specified distances of the airport runways. This approach will result in a more refined analysis of the most highly exposed population residing and attending schools near an airport.

As noted by FoE, the issues involving exposure to lead are complex, in part due to the multimedia nature of this pollutant. Exposure can occur via inhalation and ingestion, the latter pathway involving multiple media (e.g., water, food). EPA requested information on the possible impact of lead emissions from piston-engine aircraft on these exposure pathways in 2007 and 2010, and we have received no data to support an analysis of these topics and have found no data in the peer-reviewed scientific literature. Consequently, it is taking considerable time to identify possible databases to evaluate each of the questions before us regarding potential risks to public health and welfare.

EPA has also taken several significant regulatory and other actions related to lead that are an important context. In 2008, EPA substantially strengthened the NAAQS for lead, including revising the level for the standards to be 10 times tighter than that for the previous standards. 73 FR 66964 (November 12, 2008). EPA revised the level of the primary (health-based) standard from 1.5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), to 0.15 $\mu\text{g}/\text{m}^3$, measured as total suspended particles. This, in combination with the revisions to the averaging time and form, will improve health protection for at-risk groups, especially children. EPA revised the secondary (welfare-based) standard to be identical in all respects to the primary standard.

Scientific evidence about lead and health has expanded dramatically since EPA issued the initial standard of 1.5 $\mu\text{g}/\text{m}^3$ in 1978. More than 6,000 new studies on lead health effects, environmental effects, and lead in the air have been published since 1990. Evidence from health studies shows that adverse effects occur at much lower levels of lead in blood than previously thought. Children are particularly vulnerable to the effects of lead. Exposures to low levels of lead early in life have been linked to effects on IQ, learning, memory, and behavior. A threshold level of lead in the body for these effects is not evident from the health evidence.¹⁰ Thus, no safe level has been identified.¹¹

In addition to strengthening the Lead NAAQS, EPA's 2008 action also improved the existing lead monitoring network by requiring monitors to be placed in areas with sources, such as industrial facilities and airports, that emit one ton or more per year (tpy) of lead. As part of this rulemaking notice, EPA described the approach for implementing the revised standards and provided an implementation timeline. In accordance with that timeline, EPA identified 16 areas out of attainment with the NAAQS for lead on November 22, 2010 (75 FR 71033) and on November 22, 2011 (76 FR 72097), EPA identified 5 additional areas out of attainment with the NAAQS for lead.

¹⁰ U.S. Environmental Protection Agency (2006) Air Quality Criteria for Lead. Washington, DC, EPA/600/R-5/144aF Available online at: <http://www.epa.gov/ncea/>. It is worth noting that this is somewhat different from Petitioner's view, which appears to be that the evidence clearly demonstrates any level of exposure to lead is unsafe.

¹¹ Centers for Disease Control and Prevention (2005) Preventing lead poisoning in young children: A statement by the Centers for Disease Control and Prevention. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. August.

Following promulgation of the revised Lead NAAQS and monitoring requirements, the Natural Resources Defense Council (NRDC), the Missouri Coalition for the Environment Foundation, Physicians for Social Responsibility, and Coalition to End Childhood Lead Poisoning petitioned (NRDC, 2009) EPA to reconsider the lead emission rate at which monitoring is required (the “emission threshold” for required monitoring, set at 1.0 tpy by the 2008 rule). On July 22, 2009, EPA granted the petition to reconsider aspects of the monitoring requirements (Jackson, 2009). EPA reviewed the monitoring requirements, and on December 30, 2009, EPA proposed revisions to the requirements for both source-oriented and non-source-oriented monitoring for lead (74 FR 69050).

On December 14, 2010, the EPA revised the ambient monitoring requirements for measuring lead in the air based on public comments received on the December 30, 2009 proposed revisions. These amendments expanded the nation’s lead monitoring network to better assess compliance with the revised NAAQS for lead issued in 2008. EPA changed the emission threshold that state monitoring agencies must use to determine if an air quality monitor should be placed near lead-emitting sources other than airports. The new emission threshold was set at 0.5 tons of lead per year (tpy), reduced from the previous threshold of 1.0 tpy. EPA maintained a 1.0 tpy lead emission threshold for airports, acknowledging the lack of information regarding the relationship between emissions and ambient air concentrations of lead for purposes of evaluating compliance with the NAAQS for lead. However, EPA required a 1-year monitoring study of 15 additional airports (beyond those previously required to monitor at the 1.0 tpy emission threshold). The goal of the airport study is to allow EPA to determine whether airports that emit less than 1.0 tpy have the potential to cause the surrounding areas to exceed the Lead NAAQS of $0.15 \mu\text{g}/\text{m}^3$. Data from this monitoring study will be used to assess the need for additional lead monitoring at airports. The airport monitoring data from this study will also be used by EPA to evaluate the questions of endangerment. We will use these data in an integrated approach across airports to quantitatively evaluate the different factors influencing lead concentrations (e.g., types of aircraft, number of landing and take-off events, prevailing meteorology, and distance of the monitor to the maximum impact sites at the different airports). For example, these data will be used to estimate the incremental increase in ambient air lead per landing and take-off event at a specific distance from the maximum impact site. In this way, the data will benchmark our modeling approach and extrapolation of our modeling results to airports nationwide, making our final analysis more robust and dependable. Monitoring at the study airports will be largely implemented by mid-2012 and certified monitoring data is currently anticipated to be received from these airports in 2014.

In 2010 EPA began the next review of the NAAQS for lead. The current timeline for that review includes completion of the Integrated Science Assessment for Lead and the Policy Assessment in 2013, with the proposed and final rulemaking during the following year.

The EPA also updated the National Emission Standards for Hazardous Air Pollutant (NESHAP) Emissions for Secondary Lead Smelting, under CAA section 112. 77 FR 555,

(January 5, 2012). These amendments to the original maximum achievable control technology (MACT) standards apply to 16 facilities (15 existing, one under construction) nationwide that use furnaces to recover lead from lead-bearing scrap, mainly from automobile batteries. Emissions of lead and arsenic from this industry will be further cut by 68 percent from their current levels regulated by MACT. The NESHAP for Primary Lead Smelting was revised and finalized in 2011. 76 FR 70834 (November 15, 2011). This action includes revisions to the stack emission limits for lead, work practice standards to minimize fugitive dust emissions, and the modification and addition of testing and monitoring and related notification, recordkeeping, and reporting requirements.

In addition to these actions, the EPA actions listed below will reduce lead emissions among other hazardous air pollutants:

Table 1: EPA Actions Resulting in Emissions Standards for Lead from Stationary Sources

Date	Citation	Description
1/23/2007	72 FR 2930	National Emission Standards for Hazardous Air Pollutants for Area Sources: Polyvinyl Chloride and Copolymers Production, Primary Copper Smelting, Secondary Copper Smelting, and Primary Nonferrous Metals: Zinc, Cadmium, and Beryllium; Final Rule
7/16/2007	72 FR 38864	National Emission Standards for Hazardous Air Pollutants for Area Sources: Acrylic and Modacrylic Fibers Production, Carbon Black Production, Chemical Manufacturing: Chromium Compounds, Flexible Polyurethane Foam Production and Fabrication, Lead Acid Battery Manufacturing, and Wood Preserving: Direct Final Rule
12/26/2007	72 FR 73179	National Emission Standards for Hazardous Air Pollutants for Area Sources: Clay Ceramics Manufacturing, Glass Manufacturing, and Secondary Nonferrous Metals Processing; Final Rule
12/28/2007	72 FR 74088	National Emission Standards for Hazardous Air Pollutants for Area Sources: Electric Arc Furnace Steelmaking Facilities; Final Rule
1/2/2008	73 FR 225	National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries Area Sources; Final Rule
3/26/2008	73 FR 15923	Amendments to National Emission Standards for Hazardous Air Pollutants for Area Sources: Acrylic and Modacrylic Fibers Production, Carbon Black Production, Chemical Manufacturing: Chromium Compounds, Flexible Polyurethane Foam Production and Fabrication, Lead Acid Battery Manufacturing, and Wood Preserving: Direct Final Rule
7/1/2008	73 FR 37728	National Emission Standards for Hazardous Air Pollutants: Area

		Source Standards for Plating and Polishing Operations; Final Rule
7/23/2008	73 FR 42978	National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Nine Metal Fabrication and Finishing Source Categories; Final Rule
6/25/2009	74 FR 30366	Revision of Source Category List for Standards Under Section 112(k) of the Clean Air Act; National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Aluminum, Copper, and Other Nonferrous Foundries; Final Rule
9/9/2010	75 FR 54970	National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry and Standards of Performance for Portland Cement Plants; Final Rule
3/21/2011	76 FR 15704	Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Commercial and Industrial Solid Waste Incineration Units; Final Rule
3/21/2011	76 FR 15372	Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Sewage Sludge Incineration Units; Final Rule
3/21/2011	76 FR 15608	National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters; Final Rule
3/21/2011	76 FR 15554	National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters; Final Rule
4/4/2011	76 FR 18407	Standards of Performance for New Stationary Sources and Emissions Guidelines for Existing Sources: Hospital/Medical/Infectious Waste Incinerators: Final rule amendments
11/23/2011	76 FR 72508	National Emissions Standards for Hazardous Air Pollutants: Ferroalloys Production: Proposed Rule

EPA's lead-related regulatory actions, including the 2008 NAAQS revision and implementation thereof and the work conducted so far in response to FoE's Petition, have required considerable time and resources to accomplish. As discussed above, in the endangerment proceeding EPA intends to follow a general approach similar to its recent Clean Air Act section 202(a) endangerment finding for greenhouse gas emissions from motor vehicles. See 74 FR 18886 and 74 FR 66496. The basic lines of inquiry for an endangerment finding are two-fold: (1) is the air pollution reasonably anticipated to endanger public health or welfare; and (2) does emission of the air pollutant from the subject source category cause or contribute to the air pollution at issue? To this end, EPA will review the contribution of piston-engine aircraft lead emissions to local and national lead inventories, the contribution of piston-engine aircraft lead emissions to lead inventories in nonattainment areas, the contribution of piston-engine aircraft lead emissions to ambient concentrations of lead near airports (both modeled and

monitored data) and in nonattainment areas for lead, the number of children and adults residing in close proximity to airports or attending school in close proximity to airports, the contribution of this source to lead deposition, the inventory contribution of lead emissions to areas exceeding the particulate matter standards, all data submitted to the docket, as well as relevant scientific and technical information related specifically to general aviation piston-engine aircraft lead emissions.

Based on its experience, EPA anticipates that it will likely require significant Agency time and resources to develop a proposed determination regarding lead emissions from piston aircraft engines and finalize any appropriate determination. EPA also anticipates such a proposed determination will continue to generate extensive public comments from a wide range of advocacy, state and local agency, industry, and congressional stakeholders. EPA estimates that, given the expected timing for delivery of necessary modeling and monitoring information and data discussed above, it will take up to three years, or until mid- to late 2015, to develop a proposal, publish it for comment, review and analyze the extensive comments that are expected, and issue a final determination with regard to endangerment and contribution from lead emissions of piston aircraft engines. However, contingencies could arise that affect this general schedule, including but not limited to unforeseen events regarding Agency budgets or the scheduling of other regulatory actions that could also move the schedule back.

The major steps that EPA will take in this proceeding include: (1) evaluating the scientific and other information relevant to whether lead emissions from general aviation piston-engine aircraft engines cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare; (2) preparing a proposed determination; (3) conducting intra- and inter-agency review of the draft proposed determination; (4) publishing and providing the public with notice and an opportunity to comment on the proposed determination; (5) reviewing, analyzing and responding to those comments and any additional information they supply and preparing the appropriate draft final determination; and (6) conducting a final intra- and inter-agency review and issuing a final determination.

B. Request for proposal and final rule promulgating standards

The Petitioner describes existing and developing general aviation fuels and technologies which it believes can reduce lead emissions in this sector. Suggestions put forth by FoE include phasing in the use of unleaded general aviation fuels and changes in technology such as developing diesel-engine powered general aviation aircraft, which are capable of operating on jet fuel.

The 2010 ANPR issued by EPA describes considerations regarding emission engine standards and requests comment on approaches for transitioning the piston-engine fleet to unleaded aviation gasoline. EPA is currently focused on and intends to make the endangerment and cause and contribute determination as discussed above prior to engaging in any standards-

setting rulemakings. If such endangerment and contribution findings are made, EPA would then commence the rulemaking process and in that setting consider all approaches to reducing lead emissions from piston-engine aircraft available and within its statutory authority.

It is important to emphasize that EPA's technical work has very significant potential future implications. The aviation enterprise is unique and very different from any other transportation source. In the U.S. alone, there are literally millions of piston-engine aircraft operations each year from air taxis and general aviation which fly passenger and cargo over routes of various lengths, at different altitudes and with various payloads.¹² Understanding piston-engine aircraft operations and how each of the many flight-specific variables affects lead emissions through models and other investigations is essential to a successful national regulatory program. Furthermore, these aircraft and aircraft engines are machines with many critical system interdependencies. An understanding of how all of the various aircraft and aircraft engine design (for piston-engine aircraft), and aircraft fuel factors interact to affect general aviation performance and lead emissions is essential to the development of a well constructed program that achieves the desired public health and environmental outcomes.

The Petitioner emphasizes the use of alternative unleaded fuels as a means to reduce lead emissions. EPA has no direct authority on setting general aviation fuel specifications by regulation. Rather, FAA has authority to prescribe standards for the composition or chemical or physical properties of aircraft fuels to control or eliminate aircraft emissions. 49 U.S.C. 44714. However, under current practice, these specifications are not set directly by government regulation. Rather, FAA indirectly regulates aircraft fuel by specifying that fuel meeting specifications identified by the aircraft engine manufacturer as part the engine type certificate (usually ASTM D910) must be used by the operator as a condition of operating the aircraft under its type certificate.¹³ Thus, while EPA has an interest in environmentally compatible fuels, our direct role here is limited to setting an engine emission standard under CAA section 231 that can be met, within appropriate leadtime, with the development and application of requisite technology, giving appropriate consideration to the cost of compliance and to safety and noise factors.

EPA is also coordinating closely with stakeholders in Alaska because piston-engine aircraft play a critical role in transportation of goods and people to remote communities, including many Alaska Native communities in the state. Representatives from EPA traveled to

¹² See the FFA website http://www.faa.gov/airports/northwest_mountain/planning_capacity/taf_guidance/

¹³ FAA regulations require that the aircraft operator must use the fuel specified in the airplane flight manual (14 CFR 91.9) which must be supplied with the aircraft (14 CFR 23.1581). The fuel specified in the airplane flight manual is in turn specified in the engine type certificate (14 CFR 33.7). Separately from EPA's work exploring the endangerment question, in 2011 the Administrator of the FAA chartered the Unleaded Avgas Transition Aviation Rulemaking Committee (UAT ARC), to investigate issues other than endangerment that are associated with transition to an unleaded avgas. The FAA's UAT ARC issued its final report on June 26, 2012. See <https://www.faa.gov/about/initiatives/avgas>.

Alaska in 2011 to further understand the unique nature of the role of piston-engine aircraft in Alaska. Given the complexities involved for this stakeholder community, as well as communities in many other states, we are taking a deliberate and measured approach in evaluating the issues involved with respect to the use and importance of piston-engine aircraft.

If EPA's proceeding leads to an affirmative finding on endangerment and contribution, EPA would pursue the development of emissions standards and potentially other requirements regulating lead emissions from general aviation piston aircraft engines.¹⁴ It is not clear at this time exactly what schedule would be appropriate for such a rulemaking. EPA has limited resources and has concentrated its efforts on regulation of the largest point sources of lead in areas designated as not attaining the Lead NAAQS. Since issuing its final Lead NAAQS in 2008, EPA has undertaken a number of important and complex rulemakings to address the largest sources of lead, as discussed above.

EPA has been concentrating its resources on the large stationary point sources of lead emissions causing nonattainment with the NAAQS for lead in areas in the United States because these sources and ambient air concentrations near these sources are well characterized. By contrast, information regarding ambient air concentrations near locations where piston-engine aircraft operate are less well characterized at this point.

EPA will not initiate any rulemaking action at this time to establish standards concerning lead emissions from general aviation piston aircraft engines. Such action would be premature, given the lack of an affirmative endangerment or contribution finding for such emissions, the ongoing technical work EPA is currently engaged in on the subject, and EPA's current direction of its resources to regulatory action on the larger emitters of lead in areas that are designated nonattainment for the Lead NAAQS.

It is difficult to specify at this time how long the development of a proposal for lead emissions standards would take to complete. EPA would not be able to build upon involvement in a prior International Civil Aviation Organization/Committee on Aviation Environmental Protection (ICAO/CAEP) process to accelerate its work and inform judgments and facilitate decision making. Rule development would thus require original and full assessment of the technical, policy, and program design questions required under CAA section 231 and completion of appropriate studies and assessments, as well as full coordination with FAA regarding noise and safety implications. This work would be done against the backdrop of ongoing regulatory efforts within EPA related to controlling lead from source categories such as those subject to the CAA section 112 NESHAP program and section 111/129 NSPS program. If EPA's

¹⁴ In the past it has generally been EPA practice for aircraft engines to propose and finalize endangerment and gaseous emission standards simultaneously. However, in those cases the question of endangerment for the pollutants was not controversial (e.g., HC, CO, NOx) and we were adopting emission standards developed in the International Civil Aviation Organization (ICAO) process.

endangerment and cause and contribute proceeding results in affirmative findings, EPA would pursue the development of standards and potentially other requirements regulating lead emissions from general aviation piston-engine aircraft, on a timeframe consistent with its other priorities and the continuing technical activities regarding such emissions.

IV. Conclusion

For the reasons discussed above, EPA is responding to Petitioner's requests as follows. 1) EPA is not at this time issuing a judgment on whether lead emissions from general aviation aircraft piston engines cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, but EPA will continue to conduct work in developing a notice and comment proceeding to determine whether such lead emissions cause or contribute to such endangerment under CAA section 231. EPA will proceed in the time frame discussed above. 2) EPA will not initiate any rulemaking action at this time to establish emissions standards under CAA section 231 concerning lead emissions from general aviation piston aircraft engines. Such action would be premature, given the lack of an affirmative endangerment or contribution finding for such emissions, the ongoing technical work EPA is currently engaged in on the subject, and EPA's current direction of its resources to regulatory action on the larger emitters of lead in areas that are designated nonattainment for the Lead NAAQS. This response is EPA's final decision on the FoE Petition, and to the extent the Petition requests additional or different action by EPA, we are denying the Petition. However, if EPA's endangerment and cause and contribute proceeding results in affirmative findings, EPA would pursue the development of standards and potentially other requirements regulating lead emissions from general aviation piston-engine aircraft, on a timeframe consistent with its other priorities and the continuing technical activities regarding such emissions.