April 1, 2024

Office of Pesticide Programs
Environmental Protection Agency Docket Center (EPA/DC), (28221T)
1200 Pennsylvania Ave. NW
Washington, DC 20460-0001

**RE: EPA's Preliminary Supplemental Consideration of Certain Issues in Support of its Interim Registration Review Decision for Paraquat, January 30, 2024; Docket ID: EPA-HQ-OPP-2011-0855.**

The National Agricultural Aviation Association (NAAA) appreciates the opportunity to comment on EPA's preliminary supplemental consideration of certain issues in support of its interim registration review decision for paraquat.

U.S. Aerial Application Industry Background: NAAA represents the interests of the 1,560 aerial application industry owner/operators and 2,028 non-operator agricultural pilots throughout the United States licensed as commercial applicators that use aircraft to enhance the production of food, fiber and bio-energy; protect forestry; protect waterways and ranchland from invasive species; and provide services to agencies and homeowner groups for the control of mosquitoes and other health-threatening pests.

Within agriculture and other pest control situations, manned aerial application is an important method for applying pesticides, for it permits large areas to be covered rapidly—by far the fastest application method of crop inputs—when it matters most. It takes advantage, more than any other form of application, of the often too-brief periods of acceptable weather for spraying and allows timely treatment of pests while they are in critical developmental stages, often over terrain that is too wet or otherwise inaccessible for terrestrial applications. It also treats above the crop canopy, thereby not disrupting the crop and damaging it. Aerial application has greater productivity, accuracy, speed, and is unobtrusive to the crop compared to ground application[1]. Although the average aerial application company is comprised of but six employees and two aircraft, as an industry these small businesses treat nearly 127 million acres of U.S. cropland each season, which is about 28% of all cropland used for crop production in the U.S. In addition to the cropland acres, aerial applicators annually apply to 5.1 million acres of forest land, 7.9 million acres of pasture and rangeland, and 4.8 million acres for mosquito control and other public health concerns.

While there are alternatives to making aerial applications of pesticides, aerial application has several advantages. In addition to the speed and timeliness advantage aerial application has over

[1] Kováčik, L., and A. Novák, 2020. "Comparison of Aerial Application vs. Ground Application." *Transportation Research Procedia* 44 (2020) 264–270.

other forms of application, there is also a yield difference. Driving a ground sprayer through a standing crop results in a significant yield loss. Research from Purdue University[2] found that yield loss from ground sprayer wheel tracks varied from 1.3% to 4.9% depending on boom width. While this study was conducted in soybeans, similar results could be expected in other crops as well. Data from a Texas A&M University economics study[3] and the 2019 NAAA industry survey[4] were used to calculate that the aerial application industry is directly responsible for the production of 1.69 billion bushels of corn, 199 million bushels of wheat, 548 million pounds of cotton, 295 million bushels of soybeans, and 3.33 billion pounds of rice annually that would be lost every year without the aerial application of pesticides. The value in additional crop yield that the aerial application industry brings to farmers, input suppliers, processors, and agricultural transportation and storage industries for corn, wheat, cotton, soybean, and rice production in the U.S. is estimated to be about $37 billion[5].

Research summarized by the University of Minnesota[6] describes how soil compaction from ground rigs can negatively affect crop yields due to nitrogen loss, reduced potassium availability, inhibition of root respiration due to reduced soil aeration, decreased water infiltration and storage, and decreased root growth. Aerial application offers the only means of applying a crop protection product when the ground is wet and when time is crucial during a pest outbreak. A study on the application efficacy of fungicides on corn applied by ground, aerial, and chemigation applications[7] further demonstrates that aerial application exceeds ground and chemigation application methods in terms of yield response. The aerial application of crop protection products results in greater harvest yields of crops. This in turn results in less land being used for agricultural production, preserving more wetlands for natural water filtration, forest ecosystems for carbon sequestration and habitat for threatened and endangered species.

The Texas A&M[4] study revealed that the total area of cropland needed to replace the yield lost if aerial application was not available for corn, wheat, soybean, cotton, and rice production is 27.4 million acres, an area roughly the size of Tennessee. Aerial applicators seed 3.8 million acres of cover crops annually[5]. This means that aerial applicators are responsible for helping to sequester 1.9 million metric tons of CO2 equivalent annually, which according to the EPA would be the equivalent of removing approximately 412,000 cars with carbon-combustion engines from the roads each year.

The aerial application industry is also actively involved in education and research efforts to improve the accuracy and safety of aerial applications. The National Agricultural Aviation Research and Education Foundation (NAAREF) is a non-profit organization dedicated to

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[2] Hanna, S., S. Conley, J. Santini, and G. Shaner. 2007. "Managing Fungicide Applications in Soybean." Purdue University Extension Soybean Production Systems SPS-103-W. https://www.extension.purdue.edu/extmedia/sps/sps-103-w.pdf

[3] Dharmasena, S. 2020. "How Much is the Aerial Application Industry Worth in the United States?" Research presented at the 2020 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2020aatresearchpapers

[4] National Agricultural Aviation Association. May 2019. "2019 NAAA Aerial Application Industry Survey: Operators." https://www.agaviation.org//Files/Comments/NAAA%202019%20Operator%20Survey.pdf

[5] Dharmasena, S. 2021. "Value of the Agricultural Aerial Application Industry in the United States" Research presented at the 2021 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2021aatresearchpapers

[6] University of Minnesota. "Soil Compaction." Accessed April 29, 2021. https://extension.umn.edu/soil-management-and-health/soil-compaction

[7] Thomas, D. 2009. Unpublished research results submitted to EPA. https://www.agaviation.org//Files/Comments/Fungicide%20efficacy%20results.pdf

promoting research, technology transfer and advanced education among aerial applicators, allied industries, government agencies and academic institutions. NAAREF's Professional Aerial Applicators' Support System (PAASS) program is a four-hour course offered annually at all state and regional agricultural aviation association conventions. The curriculum is brand new every year and a minimum of one hour of PAASS is focused on environmental professionalism. This ensures aerial applicators are kept up to date on the latest information related to making accurate applications and drift mitigation. Nozzle selection, buffer zones, inversions, precision application technology, dissection of real-life drift incidents, and proper spray boom setup are some of the environmental professionalism topics that have been covered in PAASS.

Five years after PAASS became part of the aerial application annual curriculum in 1999, there was a 26% drop in drift incidents according to Association of American Pest Control Officials drift surveys. In addition, ag aircraft accidents have also significantly declined. From 1999 to 2010, the accident rate per 100,000 hours flown dropped by 21.6% compared to pre-PAASS accident rates. From 2011 to 2019, the accident rate dropped even more—30.8%—compared to pre-PAASS accident rates. Each year we continue to see a drop in our accident rate since pre-PAASS days, but now it declines more incrementally. While aviation safety is the domain of the FAA and not the EPA, the reduction in accidents proves PAASS has had, and continues to have, a significant positive impact on the aerial application industry.

Another NAAREF program is Operation S.A.F.E. (Self-regulating Application & Flight Efficiency). The primary component of Operation S.A.F.E. is a fly-in clinic. At a S.A.F.E. fly-in, aerial applicators can have their aircraft calibrated and application patterns (both liquid and dry) measured and evaluated for accuracy and uniformity. Spray droplet size is also measured at a fly-in to ensure the agricultural aircraft is creating the droplet size required by the labels for products to be applied by the aircraft. Many of the concepts used mitigate the risk of drift from agricultural aircraft have originated from ideas first tested at Operation S.A.F.E. fly-ins.

Just last year, NAAA created a professional certification program for the aerial application industry named C-PAASS for Certified Professional Aerial Application Safety Steward. To be certified under C-PAASS aerial applicators must take the PAASS program annually and Operation S.A.F.E. biennially, in addition to belonging as a member to their state/regional agricultural aviation association and the NAAA. C-PAASS professionals are also required to take and be tested on additional aviation safety and environmental stewardship curriculum offered on-line through a learning management system software NAAA installed. The purpose of C-PAASS is to enhance professionalism in the aerial application industry as our statistics show that those that participate in our educational programs are safer from both an aviation and environmental perspective.

## Comments

NAAA agrees with EPA's conclusion that the methodologies used by the agency to consider the risks and benefits of paraquat during the registration review process are protective, appropriate, and in accordance with their FIFRA mandate. NAAA greatly appreciates EPA's efforts to conduct a thorough review of paraquat so the agency could issue the 2021 interim decision (ID) with confidence. In particular, NAAA supports EPA's decision to allow aerial application to be used for cotton and soybean desiccant applications with no daily acreage limitations.

In the closing paragraph of the supplemental consideration for paraquat, EPA welcomed comments relevant to, among other things, benefits of paraquat for consideration of potential additional paraquat mitigation. To that end, NAAA requests EPA consider allowing aerial applications of paraquat as an herbicide to greater than 350 acres a day per aerial applicator. NAAA suggests the daily acreage limitations per pilot for aerial applications of paraquat for herbicidal purposes given in the table below. They are based on application rate and inhalation margins of exposure (MOE) taken or calculated using data from the 2021 ID (LOC = 100). NAAA focused on inhalation MOEs based on the 2021 ID and the supplemental consideration which both indicated inhalation is the risk of concern for aerial applicators making paraquat applications.

| Application Rate | Applicator Inhalation MOE | Daily acreage limit |
|---|---|---|
| 0.25 lb ai/A | 141.5 | No limit* |
| 0.5 lb ai/A | 70.7 | No limit* |
| 0.75 lb ai/A | 70.7 | 800 acres |
| 1.0 lb ai/A | 121.3 | 350 acres |

* Inhalation MOE for 1,200 acres as per EPA protocol

For application rates of 0.25 and 0.5 lb ai/A, allowing unlimited daily acreage for aerial applications of paraquat as an herbicide presents no higher risk to an aerial applicator than allowing the same rates for desiccant applications to cotton and soybeans. The inhalation MOE for 800 acres at an application rate of 0.75 lb ai/A is identical to the inhalation MOE for 1,200 acres at 0.5 lb ai/A. The acreage limitation for 1.0 lb ai/A would remain unchanged from the 2021 ID.

EPA allowed unlimited daily acreage for aerial applications of paraquat as a desiccant at lower application rates because they recognized how critical this type of application is for cotton and soybean production, particularly in the southern part of the United Sates. NAAA is requesting EPA make the above suggested changes to acreage limitations for the same reason – herbicidal aerial applications of paraquat are essential for numerous crops, most critically in the south.

There are numerous weeds species that have developed herbicide resistance throughout the United States, with pressure from many of these weeds particularly high in the southern part of the country. For many weed control situations, paraquat is one of the few remaining options growers have left to control resistant weeds[8,9,10,11]. When herbicides fail to control weeds,

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[8] Sosnoskie LM, A.S.Culpepper. 2014. "Glyphosate-Resistant Palmer Amaranth (Amaranthus palmeri) Increases Herbicide Use, Tillage, and Hand-Weeding in Georgia Cotton." *Weed Science*. 2014;62(2):393-402.
[9] Crow, W. D., L. E. Steckel, R. M. Hayes, T. C. Mueller. 2015. "Evaluation of POST-Harvest Herbicide Applications for Seed Prevention of Glyphosate-Resistant Palmer amaranth (Amaranthus palmeri)." *Weed Technology*, 29 (3): 405-411.
[10] Loux, M. 2017. "Rethinking Gramoxone at a reduced price." Corn Newsletter. Ohio State University Extension. https://www.paraquat.com/en/news/us-farmers-rely-paraquat-manage-glyphosate-resistant-weeds
[11] Calhoun, J. S. 2021. "Mitigation of herbicide resistance development among weed species in cotton and peanut." Mississippi State University Theses and Dissertations. 5374. https://scholarsjunction.msstate.edu/cgi/viewcontent.cgi?article=6330&context=td

growers will need to resort to conventional tillage, which poses a threat to soil conservation[12]. Paraquat is often applied in the early spring in the south as a burndown application before planting[13,14]. As soils are frequently wet during this time of the season, aerial applications are often required to ensure timely and effective paraquat applications.

When the conditions that require growers to utilize aerial applications of paraquat exist, many acres need to be treated in a very short period of time. The current 350 acre per day limitation is restrictive and prevents many growers from making treatments that can provide optimum control. While they may be able to make applications later once the soil has dried out, many weeds have progressed to a stage where they will be much harder to control and increase the spread of resistant weeds.

For example, the ideal size for control of palmer amaranth with a post emergence herbicide is 2-4 inches in height at the time of application, with plants taller than 6 inches being only partially controlled or not controlled at all[15]. Palmer amaranth grows 2-3 inches per day[16]. Assuming a grower in the southern United States notices an infestation of palmer amaranth the day after emergence at 2 inches in height, a delay of spraying with a ground rig of seven days caused by a substantial spring rain event[17] could allow the palmer amaranth to grow to a minimum height of 16 inches. This is well beyond the point where control is possible.

The letters submitted with these comments from growers in the south and the Arkansas Agricultural Aviation Association further highlight the urgent need for aerial applications in the southern states to battle herbicide resistant weeds. Aerial applications of paraquat in the southern states primarily occur between the beginning of September and the end of February. Applications in September and October are primarily for desiccation. Herbicidal aerial applications of paraquat occur November through February. Because of this, NAAA would be willing to work with EPA and paraquat registrants to establish geographical and temporal restrictions for the above proposed acreage increases for aerial applications of paraquat as an herbicide.

In addition to the request to increase acreage allowances for aerial applications of paraquat for herbicidal purposes, NAAA also requests unlimited acreage for desiccation applications of paraquat at a rate of 0.5 lb ai/A or less for all other crops, not just cotton and soybeans. In terms of safety, the risk to a pilot making an application at 0.5 lb ai/A to cotton is no different than the

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[12] Shaw, D. R., S. Culpepper, M Owen, A. Price, R. Wilson. 2012. "Herbicide-resistant Weeds Threaten Soil Conversation Gains: Finding a Balance for Soil and Farm Sustainability". CAST Issue Paper Number 49. https://www.cast-science.org/wp-content/uploads/2018/12/CAST_Issue_Paper_49_web_optimized_FA63E1281F440.pdf

[13] Bond, J. 2017. "Control Palmer Amaranth Early." https://www.mississippi-crops.com/2017/03/23/control-palmer-amaranth-early/. Assessed March 13, 2024.

[14] Cahoon, C. 2018. "Planning for 2019: Preemergence Herbicides." https://cotton.ces.ncsu.edu/2018/11/planning-for-2019-preemergence-herbicides/. Accessed March 13, 2024.

[15] Legleiter, T. 2020. "Palmer Amaranth and Waterhemp Control in Corn and Soybean." http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR260/AGR260.pdf. Assessed March 14, 2024.

[16] USDA NRCS. 2017 "Palmer Amaranth". https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/archived-fact-sheets/palmer_amaranth_nrcs_national_factsheet.pdf. Accessed March 14, 2024

[17] Holloway, G. Operator and Chief Pilot of G3 Flying, LLC; 2024 NAAA Vice President. Personal Conversation March 14, 2024.

risk to a pilot making the same application to a different crop. Crops other than cotton and soybeans also rely on aerial applications of paraquat as a desiccant. For example, sunflower growers utilize aerial application when they need to apply paraquat for desiccation purposes because the crop is too tall for ground sprayers.

Regarding the inhalation concerns to aerial applicators, NAAA feels that modern agricultural aircraft provide sufficient protection of pilots from pesticide exposure. Cockpits of modern agricultural aircraft are designed to protect the pilot from a multitude of occupational risks, including chemical exposure. The pilot sits in an enclosed cockpit located high on the aircraft, well above and slightly forward of the spray booms. The airflow over the wings pushes the spray droplets downward and away from the cockpit.

The cockpit is equipped with a recirculating air conditioning system with a foam sandwich air filter and only takes air from inside the cockpit itself. At the pilot's option, a fresh air vent can be opened to provide positive pressure ventilation to the cockpit. The intake for this fresh air vent is located high on the aircraft behind the cockpit where it is most likely to receive fresh air. With the doors and vents closed, the cockpit is sealed from direct entry of chemicals into the cockpit.

In addition to all of these protections, the high speed of an agricultural aircraft means it is constantly and rapidly moving away from the spray it is releasing. The only potential chance for the cockpit exterior to enter a spray cloud would be during an inversion which prevented fine droplets from being diapered. Because all new pesticide labels, including paraquat, will prohibit applications during an inversion, the risk for this exposure is eliminated.

According to the March 1, 2013 EPA memorandum "Subject: Review of Agricultural Handler Exposure Task Force (AHETF) Monograph: Closed Cockpit Aerial Application of Liquid Sprays", inhalation exposure for aerial applicators was measured in the AHEFT studies using an OSHA Versatile Sampler (OVS) tube worn throughout the day. The OVS would therefore be collecting samples during a variety of other aerial applicator duties besides making the application in the enclosed cockpit, including but not limited to aircraft inspections, oversight of mixing and loading, refueling, and spray system maintenance. All of these additional activities will take place on the loading pad in the same vicinity as the mixing and loading activities. While NAAA admits to having no data, it hypothesizes that much of the inhalation exposure to aerial applicators comes from these activities, as opposed to the actual aerial application in the enclosed cockpit. To reduce inhalation exposure to pilots when they are performing these duties outside of the aircraft, NAAA recommends EPA require aerial applicators to wear a PF10 respirator when working outside of the aircraft on the mixing and loading site while paraquat is being mixed and loaded.

Furthermore, 38% of the monitoring units (MU) included in the AHEFT monograph involved ultra-low volume (ULV) applications[18]. ULV applications rely on small droplet size in order to be effective[19]. These smaller droplet sizes could potentially increase the risk of inhalation to aerial applicators. This could have increased the overall inhalation unit exposure value

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[18] Barnekow, D. AHETF Administrative Chair. Personal Conversation March 21, 2024.
[19] Bonds, J. A. S. 2012. "Ultra-low-volume space sprays in mosquito control: a critical review". *Medical and Veterinary Entomology*. Volume 26, Issue 2 p. 121-130.
https://resjournals.onlinelibrary.wiley.com/doi/10.1111/j.1365-2915.2011.00992.x

determined by the AHEFT compared to if MUs were only from low and conventional application volumes. This possibility is supported by data from EPA's 2013 memorandum, which shows that the study with ULV applications had a higher average inhalation unit exposure than the other two recent studies. The only study with a higher average unit exposure than the ULV study was a much older study conducted in 1991, and all MUs in that study used the same type of aircraft[18], a model that is no longer in production and of which only 13 are currently being used in the U.S.[20] Since ULV applications of paraquat are prohibited, the AHEFT data does not likely accurately reflect inhalation exposure levels aerial applicators experience when making aerial applications of paraquat.

As an additional mitigation, NAAA also recommends EPA increase the minimum required droplet size spectrum for all aerial paraquat applications from medium to coarse. A reduction in fine droplets means fewer droplets small enough to be a concern for inhalation risks as well as a reduced risk of drift.

## Conclusion

NAAA requests EPA consider increasing the daily acreage limitations for aerial applications of paraquat based on the application rate in order to help growers control resistant weeds, particularly in the southern United States.

Thank you for this opportunity to comment.

Sincerely,

Andrew D. Moore
Chief Executive Officer

[20] Federal Aviation Administration Aircraft Registry. https://registry.faa.gov/aircraftinquiry/Search/MakeModelInquiry. Accessed April 1, 2024.