



City of Pensacola
ENVIRONMENTAL ADVISORY BOARD
Agenda

October 7, 2021

2:00 pm

Hagler/Mason Conference Room,
2nd Floor

Members of the public may attend the meeting in person. City Council encourages those not fully vaccinated to wear face coverings that cover their nose and mouth.

1. Call to Order/Quorum
2. Approval of Meeting Minutes:
 - a) September 2, 2021
3. Presentation:
 - a) Pensacola Energy
4. Update: Sustainability Coordinator Mark Jackson
5. Discussion Items:
 - a) Comprehensive Review of the Tree Ordinance--
Review of Sections 1 - 4
 - b) RePlant Species -- Member Blase Butts (*background information on 9/2 EAB Agenda*)
 - c) Review of Power Point Presentation made by Assistant City Attorney Heather Lindsay (*previously distributed*)—Member Kyle Kopytchak
 - d) Referral from City Council—Environmental Impact of the Use of two-stroke gas leaf blowers on greenhouse gas emissions
 - e) Integrated Pest Management
6. Board Member Comments/Updates, Reports and Announcements
 - a) Single Use Products on Public Property—Member Blase Butts (*background information on 9/2 EAB Agenda*)
7. Public Comments—Open Forum
8. Adjourn

MEMBERS OF THE PUBLIC MAY ATTEND AND PARTICIPATE VIA LIVE STREAM AND/OR PHONE.

To watch the meeting live visit: cityofpensacola.com/Video.

To provide input:

- For Open Forum, for items not on the agenda: citizens may submit an online form here: www.cityofpensacola.com/EABInput **beginning at 11 A.M. until 2 P.M.** only on the day of the meeting to indicate they wish to speak during Open Forum **and include a phone number. Staff will call the person** at the appropriate time so the citizen can directly address the Environmental Advisory Board using a telephone held up to a microphone.
- For agenda items: citizens may submit an online form here: www.cityofpensacola.com/EABInput **beginning at 11 A.M. on the day of the meeting until that agenda item has been voted upon** to indicate they wish to speak to a specific item on the agenda and **include a phone number. Staff will call the person** at the appropriate time so the citizen can directly address the Environmental Advisory Board using a telephone held up to a microphone. **Any form received after an agenda item has been voted upon will not be considered.**

The City of Pensacola adheres to the Americans with Disabilities Act and will make reasonable accommodations for access to City services, programs and activities. Please call 435-1606 or TDD 435-1666 for further information. Requests must be made at least 48 hours in advance of the event in order to allow the City time to provide the requested services.



City of Pensacola
ENVIRONMENTAL ADVISORY BOARD

Minutes

September 2, 2021	2:00 pm	Hagler/Mason Conference Room, 2 nd Floor
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Members Present: Kristin Bennett, Chair, Neil Richards, Katie Fox, Alex Kozmon
Jay Massey

Members Absent: Michael Lynch, Blase Butts, Kelly Hagen, Kyle Kopytchak

Others Present: Don Kraher, Council Executive, Mark Jackson, Sustainability
Coordinator, Bill Kimball, Program Manager, Parks and Recreation,
Eve Herron, Logan McDonald, Christian Wagley

1. Call to Order/Quorum

The meeting was called to order. A quorum was established.

2. Approval of Meeting Minutes:
a) August 5, 2021

Member Richards moved for approval of the minutes of August 5, 2021.
Member Massey seconded the motion and it carried 5 – 0 with four members
absent from the meeting.

3. Presentation:
a) Logan McDonald, Community Outreach Coordinator
Pensacola/Perdido Bay Estuary Program

Chair Bennett introduced Logan McDonald, Community Outreach Coordinator for the Pensacola/Perdido Bay Estuary Program.

Logan McDonald gave an update on the Pensacola/Perdido Bay Estuary Program and the new rebranding of the program and logo as they have been developing their comprehensive conservation and management plan that will serve as a blueprint for the

restoration of the bays. They have held tailored workshops around specific stressors, things that impact the systems through the technical and education and outreach committees. They have also held workshops on what are the different indicators to look at for measurable change over time as they tackle the various stressors. They put out a community value survey, and had over 700 responses about what they value in the systems, what they are concerned about and why it matters to them.

They received state appropriation funds the last fiscal year and were able to use those funds to scale up the monitoring in the area. One of those efforts was the national coastal condition assessment that is a nationwide survey conducted every five years in association with the EPA. They added an additional 24 sites to the survey. The survey looks at water and sediment quality and authentic communities that live on the floor of the bays, as well as fish tissue contaminants.

In addition, there is the national wetland condition assessment that focuses on estuary sites that are fresh water and salt water mixed. They surveyed 30 sites and looked at wetland vegetation, hydraulic conditions, soil parameters and water quality.

She provided an update on the oyster mapping in East Bay and Escambia Bay and the recent trash free waters event at Jones Creek and the deployment of a litter capture boom which is a floating boom that collects trash as it flows down the creek. Volunteers will assist them with emptying the booms as well as taking data on them to determine if there are specific sources contributing to the litter in the creeks.

There will be a clean up tentatively set for October 2 at Carpenters Creek, in conjunction with Emerald Coastkeepers. They have already installed a litter capture boom there. They are also partnering with the City of Pensacola to put on Oar Fest to get out and try the paddle craft sport and learn about why the environments are so important and the many ways they add to our lives and communities. They have also had volunteers out at various boat ramps to educate boaters about manatee safety and going slow where sea grass is below.

They also have a community grant program and she provided highlights of some of the projects funded and also mentioned the various events and programs planned to celebrate National Estuaries Week.

She also mentioned several partnerships on NOAA projects regarding sea grass restoration, looking at resiliency to climate stress through genetic variation, a NOAA sea level rise grant, and a national academy of sciences grant, assisting with the University of Auburn with a Pensacola/Perdido Bay land use workshop.

The Pensacola/Perdido Bay Estuary Program will be expanding their team to include an Environmental Scientist and an Outreach Assistant.

Board members had several questions with regard to environmental and/or economic benefit of the oyster programs, some of the survey sites in Perdido Bay and Carpenters Creek with regard to pollution sources, and debris recovered in clean up efforts.

Chair Bennett indicated that there were some people present and some that were going to call in during Open Forum and asked the Board's indulgence to allow the Open Forum portion of the meeting to be moved ahead of the other items on the agenda. There was no objection

7. Public Comments – Open Forum:

Ms. Eve Herron, 1900 East LaRua Street addressed the Board regarding the harmful effects of two stroke gas powered leaf blowers used throughout the community. Commercial over use of these machines is having an adverse effect on the environment in the residential neighborhoods. There are several ways the City can work together to reduce the carbon footprint. She asked that letters be sent to the City Council concerning overuse of two stroke leaf blowers in neighborhoods, recommend the City calculate attainable carbon emission reductions of these machines and to review the science and research from other cities about these obsolete machines. She pointed out three major effects—pollution, public health issues, and noise level. She proposed three “D’s” for commercial landscaping—days, duration, and device. Days—Monday thru Friday for commercial leaf blowers; duration—30 minutes, hours from 8 – 5 and seasonal restrictions; device—65 decibels or less and a gradual shift to battery powered blowers. Educate the public and landscape companies on best landscape practices and to encourage the City to include these provisions in the noise ordinance.

Ms. Phyllis Bardin, 1409 East Gadsden Street encouraged amendment of the City's noise ordinance to address the use of leaf blowers, days and times of use for both landscape companies and homeowners. She pointed out the health problems that are associated with the use of gas leaf blowers on law care crews as well as the effects of the gas emissions on birds and pollinators.

Mr. David Anderson, 1871 East LaRua Street made brief comments about neighborhood noise. He mentioned studies made by the American Heart Association, the Harvard School of Public Health and the medical school with regard to health issues

associated with blowers. There is a clear need for policy to reduce noise exposure. One third of the fuel from a two stroke engine goes directly into the air. A professional landscape magazine recommends to never run a leaf blower before 8 a.m. or after 5 p.m. and never use a blower on Sundays or holidays.

Mr. John Herron, 1900 East LaRue Street requested the Board review the science and research from other cities about the pollution from these obsolete two-stroke gas engine leaf blowers and to write the City Council members to express concern as the Council considers the noise ordinance later this month. From an environmental and public health perspective, continued use of gas engine leaf blowers, trimmers, and similar machines is an anomaly that needs to be addressed. He mentioned several cities in Florida who have done great work in this area and he encouraged the Board to embrace their work and improve upon it and to convey their concerns to the City Council. He's reviewed the draft noise ordinance, that essentially copied Coral Gables model; however, it substantially increased hours for use of outdoor landscape equipment and it exempts the City. The two stroke gas powered engine on landscape equipment is a high polluter and particularly loud.

Chair Bennett asked for clarification and background information on this issue and what the role of the Environmental Advisory Board would be.

Council Executive stated that what Mr. Herron was referring to is that he sent him a draft copy of an amendment to the current noise ordinance that City Council will be looking at probably at their next workshop. City Council has not weighed in on this subject. It is a starting point for Council to take the steps to adjust it in any way they deem appropriate. The Environmental Advisory Board will have an opportunity to review and weigh in on the draft amendment once presented to City Council at their workshop and prior to it being adopted.

Member Richards mentioned the issue of blowing yard debris into the street, which is in violation of an existing city ordinance and the impact it has on the stormwater drains.

After further comments and discussion, Chair Bennett thanked individuals for coming down and indicated that if it is something the Board would like to add to the agenda, it would fall within the Board's authority and is something to be aware about.

4. Update: Sustainability Coordinator Mark Jackson

Sustainability Coordinator indicated he is putting together a solar feasibility study and has requested to use ARPA funds for that as well as using ARPA funds for Solar United Neighbors to have them come and do a co-op here. The Arborist position has been posted and will close on September 10th. Yesterday, they did an EV demonstration and learning event at City Hall and the Greenhouse Gas Inventory Report will be available for the second City Council meeting in September. They have had some discussions about the recommendation the EAB made regarding a Sustainability Committee. With some transition changes and new staffing coming in the administration, it is not the right time, but it is something that they will keep in mind. They are discussing appropriate times and when to do it. He handed out an application about a Native Plant grant application for the Board's information.

Further comments were made with regard to the EV demonstration, the solar canopy and charging station, the Co-op with Solar United and the feasibility study to look at City buildings to see if they have roof-top availability, can the roof handle the extra weight of the solar panels, and what electrical upgrades will need to be made. They will also look at three parking lots as well. The feasibility study will help with assessing reaching the 30% reduction goal by 2030. It will provide a good starting point and will provide a plan of action to begin budgeting for the projects to accomplish the reduction goal.

If the Council approves the use of ARPA funds for the Co-op with Solar United, he will work with them to come here, probably after the first of the year. One of the things still to be worked out is whether to work with Escambia County or would it just be for the City. They could do a remote presentation. Their website does have a lot of information.

5. Discussion Items:

- a) Comprehensive Review of the Tree Ordinance
Jonathan Bilby, Inspections Services Director
Bill Kimball, Parks Superintendent, Parks and Recreation

Council Executive indicated that unfortunately, Mr. Bilby was unable to attend the meeting, however Bill Kimball, Parks Superintendent, Parks and Recreation is available.

Bill Kimball, Parks Superintendent, stated that he handles the tree permit process for already developed, residential and commercial property. Not much changed in the revised tree ordinance with what he deals with. One of the things that changed was the size of the trees that make a tree become heritage. If someone wants to take down a

diseased or hazardous heritage tree, Parks Department will go out and inspect the tree and issue the permit to remove the tree. An application is submitted for removal and the Parks Department goes out to inspect. The tree has to meet one of the six removable guidelines. They first check the species of tree and size of tree to see if it requires a permit and if it does, it has to meet one of the six removable guidelines. Ninety-five percent of what they deal with is residential property, someone wants to take a single tree down in their yard. They are exempt from posting a sign.

Member Kozmon inquired if there was an inspection 100% of the time.

Bill Kimball said they visually inspect all permits that come into his office 100% of the time. Sometimes it is a drive by, if the tree is visually dead. Sometimes they do have to measure and sometimes, the tree is located in the back yard and the homeowner is not available but they do a visual inspection.

He does receive messages from people concerned about someone taking a tree down. The first thing they do is check to see if they have a permit for that address. If they don't, then they send someone out and 95% of the time the tree is undersized or not a protected species so they are taking a tree down without having to have a required permit. If it is not one of the 27 protected species, a property owner can take that tree down without a required permit needed. A water oak is not one of the 27 protected species. Laurel Oak is a protected tree.

The property owner is responsible for obtaining the permit and any liabilities of fines. A lot of times, some of the larger tree removal companies will inform the property owner of this requirement.

Member Kozmon asked how the arborist will be part of the permitting and enforcement process.

Sustainability Coordinator indicated the intent would be that the arborist would be part of this process of where or when and in conjunction with Parks and Recreation. Initially, it would be a hand in hand effort and in some point in time a team effort.

Chair Bennett did a word search of the tree ordinance and designated arborist is mentioned 31 times, or appropriate city staff. There are requirements stated in the ordinance of what the arborist is required to do. So as the Board looks at proposed revisions to the ordinance, may need to look at what makes sense for who is doing what. There has to be some kind of balance.

Sustainability Coordinator also pointed out the plan review process and the amount of time that is needed to review plans for approval and the time restrictions placed by the State on issuing building permits. Hopefully, the Inspections Services Director will be able to attend the next meeting to answer any questions.

Council Executive asked Bill to forward any concerns with the process not working or are troublesome to him so that he can inform the EAB so that the document created is logistically and functionally efficient.

Christian Wagley asked how often a permit has to be denied and how often they have to do enforcement on a tree that was removed.

Bill Kimball answered that there were several permits that were denied and several that were turned over for enforcement of tree removal. For the most part, tree companies apply for the permit for the property owner and are aware of the requirements. However, there are instances where trees were cut down without a permit being issued. If it is a heritage tree, even if it is a dead heritage tree, a \$75 permit fee is required. There is no mitigation fee for a dead heritage tree. They can avoid the \$75 permit with a certified letter from an arborist or landscape architect. However, most of the tree companies obtain the permit. It is actually listed as an "inspection fee".

b) RePlant Species -- Member Blase Butts

Member Butts was unable to attend the meeting. This information will be added to the agenda for discussion next month.

c) Review of Power Point Presentation made by Assistant City Attorney Heather Lindsay—Member Kyle Kopytchak (previously distributed)

Council Executive stated that this was written in response to a specific question or a specific action that was being taken possibly in response to a lawsuit the City was involved in regarding a tree at the time. He expressed caution in using something that was written for a specific purpose as this is how it covers everything.

d) Determine Process

Chair Bennett asked how the Board wanted to proceed with the process of reviewing the tree ordinance. Member Massey suggested having individual board members red-line the document for discussion purposes. Member Kozmon asked if the Minutes of the Environmental Advisory Board

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City had a project manager that could possibly help the Board develop a process for undertaking the task.

Council Executive indicated the City Project Manager is now the Interim Public Works Director and will soon be the Assistant City Administrator. The existing tree ordinance document is the framework. The process of having individual members red-line and bring in for discussion has not been overly successful. Staff and the public need to be included as part of the process. This is a time consuming process. There are certain parts that the Board will not have a problem with. For each meeting, the Board could identify one or two sections to discuss and the Board comes into the meeting prepared for the discussion process. He hoped that the Environmental Advisory Board would work through the document, with staff and the public and prepare something that would then be sent to the City Council for their referral to the Planning Board.

Member Richards suggested there may be a better format for the tree ordinance. He looked at the City of Gainesville. To him, simpler is better. The tree ordinance is thick and so detailed that it is easy to become confusing. He has also heard other comments that Fairhope also has a good one.

Member Fox liked the idea of identifying sections to review. Orlando is also pretty progressive in their efforts.

Christian Wagley suggested looking at various cities that are celebrated for their trees, like Savannah, with their tree canopy and the city's investment in trees. There are three things that are the crux of the tree ordinance. The definition of a protected tree, that involves the species, the size. The standards which you allow a protected tree to be cut with a permit. Does that list need to be expanded or retracted or adjusted in some way. Mitigation—which is mainly commercial. What does the City require to be planted back either on site or in lieu of, pay fees to the City to plant trees. In those three issues, the Board needs to come up with what are the problem areas, what needs to be improved.

Chair Bennett liked the suggestion of identifying sections and with the expertise of the individual board members, productive discussion could take place, similar to the process that took place with identifying the Board's priorities. The map of the zoning districts was provided to the Board, since there was a reference to the various zoning districts in the ordinance. She suggested reviewing sections 1 – 4 for discussion at the next meeting and reading the entire ordinance in context.

6. Board Member Comments/Updates, Reports and Announcements

a) Signage—12th Avenue Tree Tunnel—Member Kyle Kopytchak

Council Executive provided an update on the signage for the 12th Avenue Tree Tunnel. It is being done. They will be putting signs at the front of the tree tunnel and the end of the tree tunnel.

b) Single Use Products on Public Property—Member Blase Butts

Information from Member Butts was included in the agenda packet. This item was not discussed, since Member Butts was absent.

Member Fox inquired about where the Board was on their other priorities and in particular, mentioned the IPMA Plan as it relates to all city properties, not just athletic fields and includes properties that they sub out to other contractors to manage.

Further discussion occurred on the priorities and Chair Bennett indicated she would ask the Council Executive to send out the list of priorities so the Board could focus on that.

Member Kozmon mentioned with the resurgence of COVID, is it reasonable to undertake a discussion on the meeting schedule and alterations to it. Does the Board want to continue meeting monthly, or every other month or quarterly?

Council Executive indicated that they have to have a physical quorum in attendance at the meeting. Previously remote participation was allowed because the Governor had an executive order to allow it. That has expired. The Board can discuss items, they just can't vote on anything without a quorum being present. Social distancing of the board can take place with additional tables. Remote participation can be arranged, as long as there is a quorum present at the meeting. Remote participation is allowed basically, if you have COVID, are quarantined, or have a fear of it because of your family situation. It can't be used for convenience.

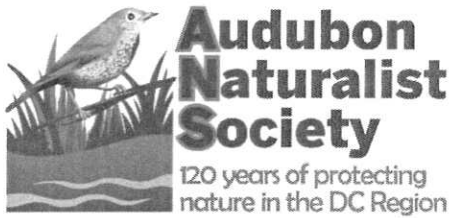
Chair Bennett made further comments about the Oar Event at Bayview Park on October 22 from 10 a.m. to 2 p.m.

7. Public Comments—Open Forum

There were no other public comments.

8. Adjourn

There being no further business to come before the Board, the meeting was adjourned at 4:17 p.m.



June 28, 2018

Testimony to the Washington, DC Council on Bill 22-234, the “Leaf Blower Regulation Amendment Act of 2017”

Submitted by Eliza Cava (Audubon Naturalist Society Director of Conservation), Janet Bogue (ANS Member & Volunteer), and David Cottingham (ANS Member & Volunteer).

Presented at July 2nd hearing by David Cottingham.

Thank you for the opportunity to submit testimony to the Council on Bill 22-234, the “Leaf Blower Regulation Amendment Act of 2017.” The Act would ban the sale or use of gasoline-powered leaf blowers in the District of Columbia beginning in 2022.

On behalf of our over 10,000 members and supporters in the greater Washington, D.C. region, the Audubon Naturalist Society (ANS) hereby submits testimony on the aforementioned bill. ANS commits itself to inspiring residents of the greater Washington, D.C. region to appreciate, understand, and protect their natural environment through outdoor experiences, education and advocacy. The history of our organization is grounded in the Audubon movement of the late 1800s, and many of our members are dedicated birders and naturalists. Because of this commitment, **our staff and supporters support Bill 22-234 for the reasons described below.**

Washington’s parks, gardens and rivers host 340 species of birds. From Mister President and The First Lady, the iconic bald eagle pair nesting at the National Arboretum, to DC’s official bird, the Wood Thrush, singing on summer nights in Rock Creek Park, Washington’s birds are gifts to our eyes and ears. They are also essential to healthy ecosystems, not least as pollinators and dispersers of plant seeds and a check-and-balance on insect populations, including pest species.

Birds vocalize to warn of danger, recognize their own species, defend their territories, find mates, stay in contact with their young, and find their way during migration. Birds also need to hear predators coming, and some birds, such as owls, use sound to find prey. This dependence on sound makes birds especially vulnerable to acoustic impacts. Recent peer-reviewed scientific studies have shown that where there is loud, human-caused noise, many bird species suffer. Struggling to hear and be heard, they are less protected from predators and less able to find mates. Their stress hormones are elevated, with poor consequences for their health and reproductive success. Research has found that many species of birds have tried to change their voices to be heard above the roar of human activities -- or simply have abandoned noisy environments.

Woodend Sanctuary | 8940 Jones Mill Road, Chevy Chase, Maryland 20815 | 301-652-9188

Rust Sanctuary | 802 Childrens Center Road, Leesburg, Virginia 20175 | 703-669-0000

anshome.org

Scientists have documented declines in bird numbers, bird diversity and bird nesting success in environments with elevated, non-natural noises.¹

When we drive out and drown out birds, we suffer, too. It would be hard to imagine a hearing at which residents complained about too much birdsong. In fact, some schools in Britain use recorded birdsong to enhance students' concentration, while a children's hospital in Liverpool uses birdsong – what the poet Shelley called “a rain of melody”²– to reduce stress for their young patients.³ If we reduce unnecessary noises like those of gas-powered leaf blowers, birds and people will share the benefits.

The National Park Service, a critical District landowner and stakeholder, provides the following information on the impacts of noise on other non-bird wildlife on their website at

https://www.nps.gov/subjects/sound/effects_wildlife.htm:

Research shows that males of at least one frog species are adapting to traffic noise by calling at a higher pitch.⁴ This could be problematic for the females, because they prefer lower-pitched calls, which indicate larger and more experienced males. Human-caused noise has produced similar results in multiple bird species.⁵

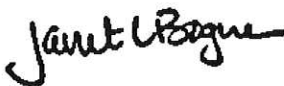
In general, a growing number of studies indicate that animals, like humans, are stressed by noisy environments.⁶ The endangered Sonoran pronghorn avoids noisy areas frequented by military jets; female frogs exposed to traffic noise have more difficulty locating the male's signal; gleaning bats avoid hunting in areas with road noise.⁷

For these reasons, Audubon Naturalist Society supports the passage of Bill 22-234 and urges the Council to also support this legislation.

Sincerely,



Eliza Cava
Director of Conservation
Audubon Naturalist Society



Janet Bogue
Member & Volunteer
3601 Connecticut Ave., NW
Apt. 506
Washington, DC 20008



David Cottingham
Member & Volunteer
2914 Kanawha St NW
Washington, DC 20015

¹ Catherine P. Ortega, “Effects of Noise Pollution on Birds: A Brief Review of Our Knowledge,” *Ornithological Monographs* No. 74, The American Ornithologists’ Union, 2012; and Nathan J. Kleist et al., “Chronic Anthropogenic Noise Disrupts Glucocorticoid Signaling and Has Multiple Effects on Fitness in an Avian Community,” *Proceedings of the National Academy of Sciences*, 2017.

² Percy Bysshe Shelley, “To a Skylark”

³ Marc Henshall, “Can Birdsong Really Help You Relax and Concentrate?” *soundmattersblog.com*, 2016; and Stephen Moss, “Birdsong: The Cure for All Ills?” *The Guardian*, August 24, 2010.

⁴ Parris, K. M., M. Velik-Lord, and J. M. A. North. 2009. Frogs call at a higher pitch in traffic noise. *Ecology and Society* 14(1): 25. [online] URL: <http://www.ecologyandsociety.org/vol14/iss1/art25/>

⁵ Barber, J. R., Crooks, K. R., & Fristrup, K. M. (2010). The costs of chronic noise exposure for terrestrial organisms. *Trends in ecology & evolution*, 25(3), 180-189.

⁶ Shannon, Graeme, et al. "A synthesis of two decades of research documenting the effects of noise on wildlife." *Biological Reviews* 91.4 (2016): 982-1005.

⁷ Id at 5.

LANDSCAPING

Clean & Quiet

Spring is in the air...and we are grateful commercial landscapers keep our neighborhoods beautiful, but remember great neighborhoods are quiet too. Please follow 'best practices' for commercial use of gas powered leaf blowers and other two-stroke machines. Doing this minimizes environmental impacts and protects worker and public health.

- Follow professional guidelines for commercial use: operate leaf blowers only at reasonable times. Avoid commercial leaf blower use on weekends.
- Respect the community: avoid using more than one blower at a time in residential areas, and limit blowing to thirty minutes. Realize some residents may work from home, raise children at home, or want to enjoy the peace and quiet of their home.
- Minimize noise: always run a leaf blower at the lowest possible throttle speed for the task and minimum amount of time.
- Be careful: stay alert when people or pets, especially children and older adults. Dust and pollutants from blowers cause harm.
- Think twice: Sweep and rake where possible.
- Personal safety matters: ensure workers wear approved hearing protection. Leaf blower noise is rated fifty feet away, but noise energy inside fifty feet is much higher.
- Battery Powered leaf blowers get results: technology has improved and they're much quieter.

Get charged up!

We can all work together to make our neighborhoods a better place to live.

We appreciate your work, the jobs you provide, and the contributions to the aesthetics of our neighborhoods. We hope you take the time to read these best practices and implement them into your business practices.

Thank you

Quiet Pensacola

To learn more, visit www.quietpcola.com

Best practices obtained from the Stihl BR 900 Instruction Manual, Echo PB-8010 Operator's Manual, RedMax EBZ8500 Owner's / Operator's Manual and the Stihl Guide to Safe and More Courteous Use.





City of Pensacola

Item 5 (d)

222 West Main Street
Pensacola, FL 32502

Memorandum

File #: 21-00825

City Council

9/23/2021

ADD-ON LEGISLATIVE ACTION ITEM

SPONSOR: City Council Member Sherri Myers

SUBJECT:

REFERRAL TO ENVIRONMENTAL ADVISORY BOARD - ENVIRONMENTAL IMPACT OF THE USE OF TWO-STROKE GAS LEAF BLOWERS ON GREENHOUSE GAS EMISSIONS

RECOMMENDATION:

That City Council refer to the Environmental Advisory Board for review and recommendation - Analyzing the impact of lawn management practices of city property and the use of two-stroke gas leaf blowers on greenhouse gas emissions in the city and suggestions for lowering any emissions associated with two-stroke blowers.

HEARING REQUIRED: No Hearing Required

SUMMARY:

The City of Pensacola maintains many acres of parks, athletic fields, right of ways, golf course and other green spaces. The maintenance often requires the use of leaf blowers that are typically two stroke gas blowers that are known to produce high volume of greenhouse emissions. The city has an interest in reducing greenhouse emissions to address climate change and to demonstrate good stewardship of the environment.

The city's Environmental Advisory Board has the interest and expertise to assist the city in developing practical solutions to the use of two stroke gas leaf blowers

PRIOR ACTION:

None

FUNDING:

N/A

FINANCIAL IMPACT:

None

National Emissions from Lawn and Garden Equipment

Jamie L Banks, PhD, MS*

Quiet Communities, Inc., PO Box 533, Lincoln, MA 01773

Robert McConnell, Environmental Engineer

US Environmental Protection Agency, Region 1, 5 Post Office Square, Boston, MA 02109

Abstract

Background: The contribution of gasoline-powered lawn and garden equipment (GLGE) to air pollutant emissions in the United States has not been extensively studied. **Goal:** Our goal is to provide annual US and state-level emissions estimates of volatile organic compounds (VOC): criteria pollutants (carbon monoxide [CO], nitrogen oxides [NO_x], particulate matter [PM] <10 microns, including PM < 2.5 microns [PM₁₀, PM_{2.5}]; and carbon dioxide (CO₂) from GLGE, with a focus on 2-stroke engines.

Methods: Pollutant emissions data were extracted from the Environmental Protection Agency's (EPA) 2011 and 2018 modeling platform (version 6), for GLGE (Source Code Classifications 2260004021–2265004071), and equipment population data were obtained from the EPA's nonroad model. Data were sorted by equipment type and characteristics. Aggregate and equipment-specific emissions were calculated and compared with emissions from all gasoline-fueled nonroad equipment. Results are presented as descriptive statistics. **Results:** In 2011, approximately 26.7 million tons of pollutants were emitted by GLGE (VOC=461,800; CO=5,793,200; NO_x=68,500, PM₁₀=20,700; CO₂=20,382,400), accounting for 24%–45% of all nonroad gasoline emissions. Gasoline-powered landscape maintenance equipment (GLME; leaf blowers/vacuums, and trimmers, edgers, brush cutters) accounted for 43% of VOCs and around 50% of fine PM. Two-stroke engines were responsible for the vast majority of fine PM from GLME. State data (California, New York, Texas, Illinois, and Florida), 2018 projections, and additional comparisons are presented. Methodological issues are discussed. **Conclusions:** GLGE accounts for a major portion of US nonroad gasoline emissions. Two-stroke engines are an important source of VOCs and criteria pollutants.

*Corresponding Author: jamie@quietcommunities.org

INTRODUCTION

Gasoline-powered lawn and garden equipment (GLGE) ranging from string trimmers to stump grinders and tractors is a source of high levels of localized emissions that includes hazardous air pollutants, criteria pollutants, and carbon dioxide (CO₂).¹⁻⁴ Workers using commercial equipment are exposed when they are close to the emitting sources several hours each day, several days a week in seasons of use. Other members of the public, including children, may also be exposed to high levels of emissions from commercial landscape maintenance equipment (GLME) such as leaf blowers, trimmers, and mowers, used routinely around residential neighborhoods, schools, parks, and other public spaces. The commercial landscape maintenance industry has experienced strong growth over the last 15 years and depends largely on gasoline-powered equipment for most tasks once performed manually. These factors are raising concerns about the health impacts of GLGE emissions on workers and the public.

Extensive evidence exists on the adverse health effects of exhaust emissions and other fine particulates which include cardiovascular disease, stroke, respiratory disease, cancer, neurological conditions, premature death, and effects on prenatal development.⁵⁻¹³ Short term and long term exposures are implicated. However, GLGE as a source of these emissions has received little attention. Understanding the characteristics of GLGE and GLME emissions can help estimate potential health impacts of these close-to-the-source emissions.

The goal of this study was to characterize annual emissions from GLGE at the national level and in selected states and to estimate the contribution of GLME to those emissions. Special attention is paid to 2-stroke GLME engines. The emissions contributions from the four of the five most populated states are derived from the NEI, and for California, from the emissions inventory of the California Air Resources Board (CARB).

METHODS

Study Design

The GLGE emissions analyzed are total volatile organic compounds (VOC) and individual VOCs (benzene, 1,3 butadiene, acetaldehyde, formaldehyde); criteria pollutants (carbon monoxide [CO], nitrogen oxides [NO_x], particulate matter [PM] <10 microns, including PM < 2.5 microns [PM₁₀, PM_{2.5}]); and carbon dioxide (CO₂). Equipment pollutant data were extracted from SCC summary reports from the EPA's 2011 and 2018 modeling platform (version 6), and equipment population data were obtained from the Nonroad model. GLGE included the equipment in **TABLE 1** and identified by Source Code Classifications 2260004021–2265004071. The GLME subset is defined as leaf blowers/vacuums; trimmers/edgers/brush cutters; and mowers. Groupings of equipment, eg, leaf blowers/vacuums, were predefined by the NEI.

“All Emissions” are defined as all emissions from stationary and mobile sources, excluding biogenic and naturally occurring emissions. “All Nonroad Emissions” are defined as all emissions from the equipment types accounted for within the Nonroad model; note that this does not include emissions from commercial marine, rail, and aircraft sources. “Gasoline Nonroad Emissions” are defined as emissions from gasoline fueled equipment accounted for within the Nonroad model. National emissions were analyzed by type of equipment and engine configuration as shown in **TABLE 1**. All results are presented as descriptive statistics.

Table 1. Categorization scheme for analysis of GLGE emissions

Type of Equipment	Engine Configuration
<i>GLME</i>	
Leaf Blowers/Vacuums	2 stroke, 4 stroke
Trimmers/Edgers/Cutters	2 stroke, 4 stroke
Mowers	4 stroke
<i>Other GLGE</i>	
Chain Saws	2 stroke, 4 stroke
Rotary Tillers	2 stroke, 4 stroke
Snowblowers	2 stroke, 4 stroke
Turf Equipment	2 stroke, 4 stroke
Chippers/stump grinders	4 stroke
Tractors	4 stroke
Shredders	4 stroke
Other	4 stroke

Analyses

All analyses except for the 2018 projections represent 2011 estimates.

Equipment Populations

The national populations of all types of GLGE were obtained from the Nonroad model. The contribution of each type to the whole population was determined.

Contributions of All Nonroad and GLGE Sources

All Nonroad Emissions were compared to All Emissions. GLGE emissions were then calculated and compared with All Nonroad Emissions and All Emissions.

Contribution of Landscape Maintenance Equipment to GLGE Emissions

GLME emissions and their contribution to GLGE and All Nonroad Emissions were analyzed. Additional analyses were conducted to examine the relative contributions of 2-stroke GLME engine emissions.

Projected Growth of GLGE Emissions: 2011–2018

GLGE emissions projected for 2018 were obtained from the EPA's 2018 modeling platform, version 6, and compared with 2011 emissions.

GLGE Emissions in the Five Largest States

State level emissions data from the five most populated states (US Census) – California, Florida, Illinois, New York, and Texas – were extracted and analyzed. Estimates of GLGE emissions for Florida, Illinois, New York, and Texas were based on 2011 data from the EPA's 2011 modeling platform, version 6. Estimates of GLGE emission for California were based on data from the CARB's OFFROAD2007 Model and estimated for 2012. No adjustments were made for potential differences in annual emissions between 2011 and 2012 California data. The program structure of the OFFROAD2007 Model provides a general overview of the methodology used to estimate emissions from off-road sources (http://www.arb.ca.gov/msei/offroad/pubs/offroad_overview.pdf).

Each state's contribution to national GLGE Emissions was calculated and compared with its contributions to the US landscape maintenance labor force and the US population. Labor force statistics were sourced from the Bureau of Labor Statistics, May 2013 reports (www.bls.oes) and population data from the 2011 US Census.

Nonroad Air Emissions Model

EPA developed a nonroad air emissions model in the 1990s to provide estimates of emissions from most types of nonroad equipment, including construction equipment, recreational marine vessels, and lawn and garden equipment (LGE). The model is referred to simply as the "Nonroad" model, and it has been updated a number of times since its creation. Documentation for the model exists as a number of technical reports available on EPA's website (<http://www.epa.gov/otaq/nonrdmdl.htm>). Total emissions are determined by summing the exhaust and evaporative emission components.^{14, 15} The preponderance of emissions from Nonroad equipment occurs as exhaust emissions due to the combustion of fuel. The methodologies for determining exhaust emissions are summarized below.

Exhaust Emissions from Nonroad Engines

The Nonroad model uses the following equation to calculate exhaust emissions from nonroad engines (ref: Median):

$$\text{Emissions} = (\text{Pop}) \times (\text{Power}) \times (\text{LF}) \times (\text{A}) \times (\text{EF})$$

Where Pop = Engine population

Power = Average Power (hp)

LF = Load factor (fraction of available power)

A = Activity (hrs/yr)

EF = Emission factor (g/hp-hr)

The derivation of the default model data for each factor from the above equation is discussed below.

a. Equipment populations and average power (horsepower)

The technical report titled "Nonroad Engine Population Estimates"¹⁶ indicates that equipment population data for most types of equipment were obtained from Power Systems Research, an independent marketing research firm, although in some instances other data source were used. Of interest for this analysis, for many LGE categories EPA used sales data obtained from equipment manufacturers during the development of its Phase 1 emission standards for small (less than 25 hp) gasoline fueled nonroad engines. This was done for the following LGE categories: lawn mowers, trimmers/edgers/brush cutters, leaf blowers/vacuums, and chainsaws. The report notes that an equipment population base year of either 1996 or 1998 was used for the LGE types.

Once estimates of equipment populations were derived, information obtained by the state of California was used to divide the equipment between the residential and commercial sectors. This step was needed because of the large difference in usage patterns between these two sectors. **TABLE 2** below contains an extract of data from Table 3 of the Nonroad Engine Population report mentioned above, and illustrates how the split between residential and commercial equipment was apportioned for a number of LGE types.

Table 2. Percentage split between residential and commercial equipment

SCC code	Application	Horsepower categories	Residential (% of equipment population)	Commercial (% of equipment population)
22xx004010 22xx004011	Lawn mowers	All	96.3	3.7
22xx004025 22xx004026	Trimmers/edgers/cutters	0-1 hp	100	0
		1-3 hp	85.3	14.7
		> 3 hp	0	100
22xx004020 22xx004021	Chainsaws	0-1 hp	100	0
		1-3 hp	97.0	3
		> 3 hp	0	100
22xx004030 22xx004031	Leaf blowers/vacuums	0-1 hp	100	0
		1-3 hp	92.5	7.5
		> 3 hp	0	100

i. Geographic allocation of residential LGE Populations (except snowblowers)

The Nonroad model uses US Census data on one and two unit housing to allocate national equipment populations to the county level. The population documentation report mentioned above notes that other variables are likely to also affect the distribution of LGE population, such as average yard size. However, no consistent, reliable data surrogates could be found to apportion the national level equipment populations based on these alternative factors, and so the model relies solely upon US Census data on one and two unit housing to allocate national LGE population data to the county level.

ii. Geographic allocation of commercial L&G Equipment Populations (except snowblowers)

The Nonroad model uses the number of employees in the landscaping services industry to disaggregate national level LGE population data to the county level. This was accomplished using data from the North American Industry Classification System (NAICS); specifically, for NAICS code 561730, landscaping services.

iii. Equipment population projections

The Nonroad model enables the user to obtain estimates of emissions for years other than the base year used for equipment populations. This is accomplished by the development of processes to handle the growth in equipment populations due to the purchase of new equipment as years pass, and adjustments made to account for the scrappage of old equipment. The reader is referred to the EPA technical reports “Nonroad Engine Growth Estimates,”¹⁷ and “Calculation of Age Distributions in the Nonroad Model – Growth and Scrappage”¹⁸ for further information on these topics. Both of these reports are available on the EPA website (<http://www.epa.gov/otaq/nonrdmdl.htm>).

b. Activity levels and load factors.

Equipment populations and horsepower levels alone are not sufficient for determining emissions from nonroad equipment; assumptions about frequency and patterns of use must also be made. The EPA report, “Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling”¹⁹ describes how the Nonroad model assigns default activity levels, in hours per year, and

load factors in performing its calculations. Load factors are needed to account for the fact that equipment is not typically used at full power 100% of the time; load factors reflect that and are presented in terms of average percent of full power for the equipment as it is used. The activity levels and load factors for small (< or = to 25 hp) spark-ignition engines for many LGE types was taken from data supplied to EPA during the comment period for the regulation of these engines. **TABLE 3** below contains an extract of the default activity data, in annual hours of equipment use, and load factor data, expressed as fraction of full power, taken from Table 6 of the above mentioned report.

Table 3. Example default activity levels and load factors for LGE

Equipment type	Use	Activity level (Annual hours)	Load factor (fraction of full power)
Lawn mowers	Residential	25	0.33
	Commercial	406	0.33
Trimmers/Edgers/Cutters	Residential	9	0.91
	Commercial	137	0.91
Leaf blowers\Vacuums	Residential	10	0.94
	Commercial	282	0.94
Chainsaws	Residential	13	0.70
	Commercial	303	0.70

c. Emission factors

EPA's documentation for the source of the emission factors used within the Nonroad model are contained in the following two reports: "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling: Compression-Ignition"²⁰ and "Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition."²¹ Information pertaining to LGE contained in the latter report is discussed below.

Emission factors for spark-ignition engines rated at less than 25 hp were segregated into 5 engine classes based on primary use of the engine (handheld vs. non-handheld), and engine size according to engine displacement. Beginning in 1997, engines designed for both handheld and non-handheld applications became subject to several phases of regulation geared towards reducing fuel consumption (expressed in terms of brake-specific fuel consumption [BSFC]) and producing fewer air emissions in the combustion process. **TABLE 4** below contains an extract of information from Table 1 of the Exhaust Emissions 2010 report, and shows the impact of EPA's regulation on one such class of engines: small, hand-held, gasoline fueled two-stroke engines.

Table 4: Impact of regulation on small*, hand-held, gasoline fueled two stroke engines

Engine Tech Type	HC (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	PM (g/hp-hr)	BSFC (lb/hp-hr)
Baseline	261.00	718.87	0.97	7.7	1.365
Phase 1	219.99	480.31	0.78	7.7	1.184
Phase 2 (with catalyst)	26.87	141.69	1.49	7.7	0.822

BSFC: Brake-specific fuel consumption; CO: carbon monoxide; HC: hydrocarbon; NOx: nitrogen oxides; PM: particulate matter

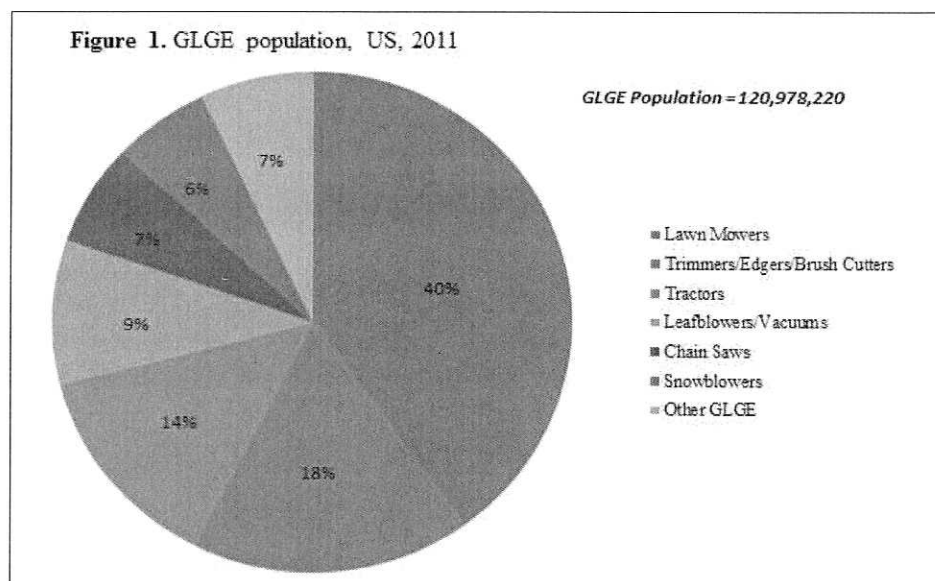
* These emission factors are for engines sized from 0 to 1 hp.

Other factors also influence the combustion related exhaust emissions from nonroad engines, such as fuel type, ambient temperature, and deterioration of equipment with age and use. The reader is referred to the EPA web-site (<http://www.epa.gov/otaq/nonrdmdl.htm>) for additional information on these topics.

RESULTS

Equipment Populations

Approximately 121 million pieces of GLGE are estimated to be in use in the United States (**FIGURE 1**). GLME accounts for two-thirds of all GLGE of which lawn mowers are the most numerous, followed by trimmers/edgers/ brush cutters, and then leaf blowers/vacuums. Projections from 2011 indicate a 13% increase across all equipment types after the combined effect of new equipment purchases and scrappage of old equipment are evaluated, resulting in an estimated 136 million pieces of GLGE in use by 2018.



Contribution of Nonroad Emissions to All Emissions

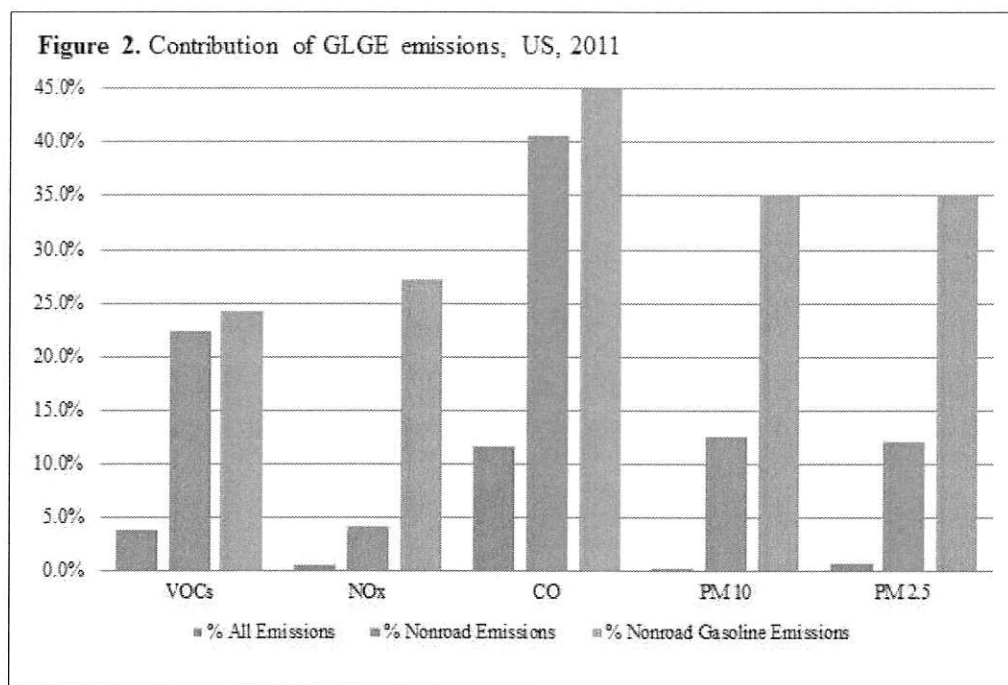
All Nonroad sources account for approximately 242 million tons of pollutants each year, accounting for 17% of all VOC emissions, 12% of NO_x emissions, 29% of CO emissions, 4% of CO₂ emissions, 2% of PM₁₀ emissions, and 5% of PM_{2.5} emissions.

All Nonroad Emissions account for a substantial percentage of All Emissions of benzene (25%), 1,3 butadiene (22%), CO (29%), PM₁₀ (2%), and PM_{2.5} (5%). Because of the relatively small contribution of GLGE CO₂ to All Emissions (0.3%), it is not further considered in this report.

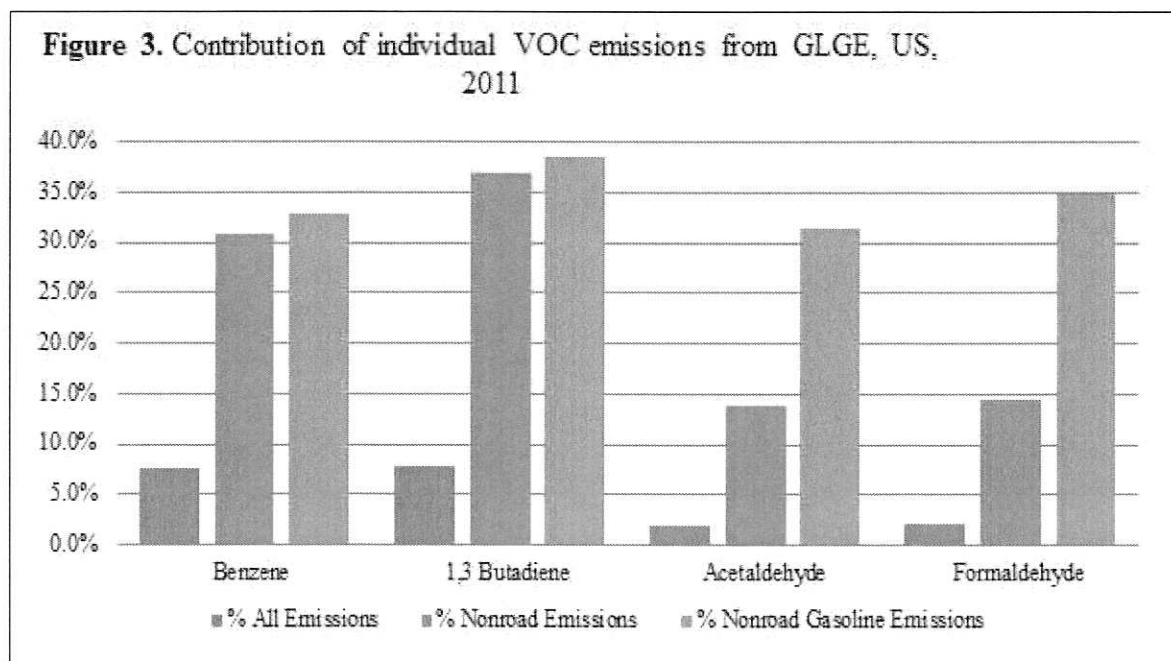
Contribution of GLGE to All Emissions and Nonroad Emissions

GLGE emitted approximately 6.3 million tons of VOCs (461,800) and criteria pollutants (CO=5,793,200; NO_x=68,500, PM₁₀=20,700 [19,000 of which is PM_{2.5}]), and 20.4 million tons of CO₂ in 2011. GLGE represented nearly 4% of All Emissions of VOCs and 12% of All Emissions of CO

(FIGURE 2). GLGE fine PM emissions constitute a fraction of a percent of All Emissions of fine PM, but is a major Nonroad source, accounting for nearly 13% of All Nonroad Emissions of fine PM and more than one-third of Gasoline Nonroad Emissions of fine PM.



Analysis of individual VOC emissions shows that GLGE contributes nearly 8% of All Emissions of both benzene and 1,3 butadiene (**FIGURE 3**). Within All Nonroad Emissions and Gasoline Nonroad Emissions, GLGE accounts for nearly one-third or more of benzene and 1,3 butadiene emissions, and also becomes a major source of aldehyde and formaldehyde emissions from Gasoline Nonroad sources.



Contribution of GLME to GLGE Emissions

Compared with the GLGE contributions of Nonroad Gasoline Emissions shown in **FIGURE 2**, contributions of VOCs and fine PM emissions from GLME are disproportionately high, and for NO_x and CO, are disproportionately low (**FIGURE 4**). Small GLME engines account for more than 40% of VOC emissions and one-half of PM₁₀ and PM_{2.5} emissions from GLGE. Close to 90% of fine PM emissions from GLME come from 2-stroke engines (**FIGURE 5**).

Figure 4. Contribution of GLME to GLGE emissions, US, 2011

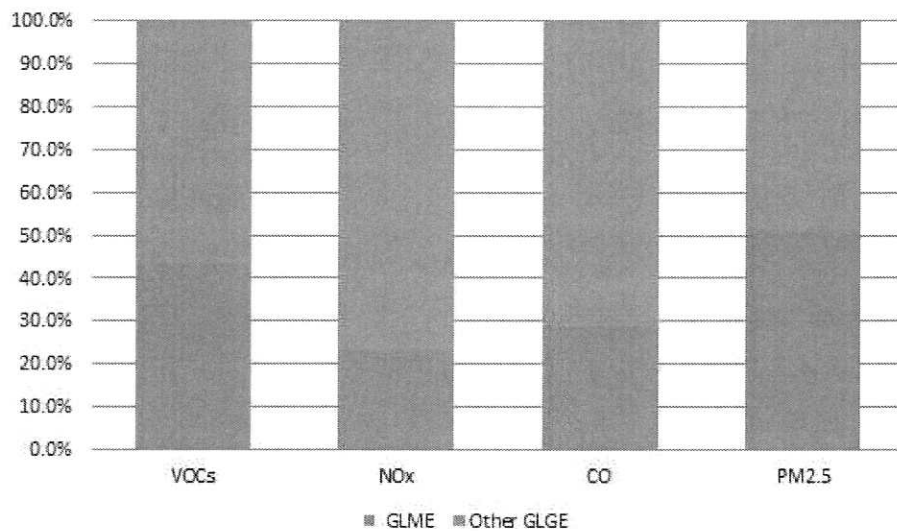
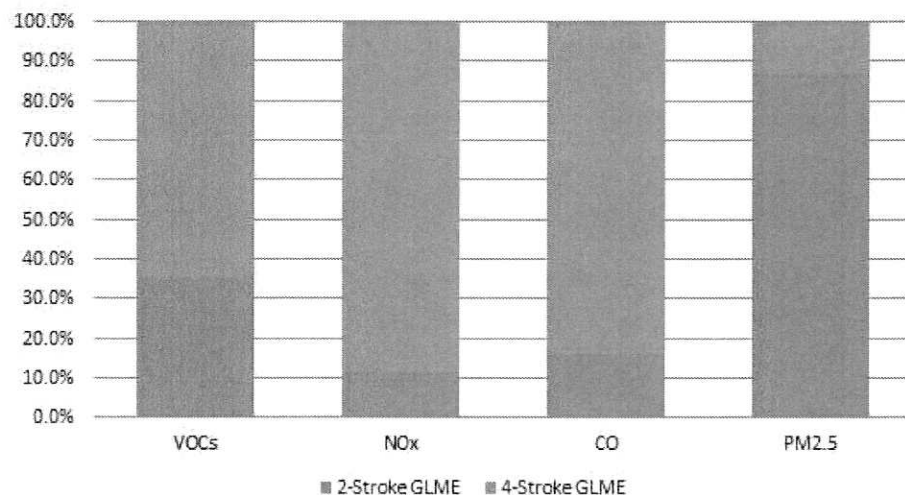


Figure 5. Contribution of 2-stroke engines to GLME emissions, US, 2011



Projected Growth of GLGE Emissions: 2011–2018

By 2018, the annual tonnage of ozone precursors, VOCs and NO_x, emitted by GLGE is projected to decrease substantially from 2011, as more of the in-use fleet becomes represented by equipment built to meet EPA nonroad emission standards. CO emissions remain comparable to 2011 levels, while CO₂ and fine PM emissions are projected to increase modestly.

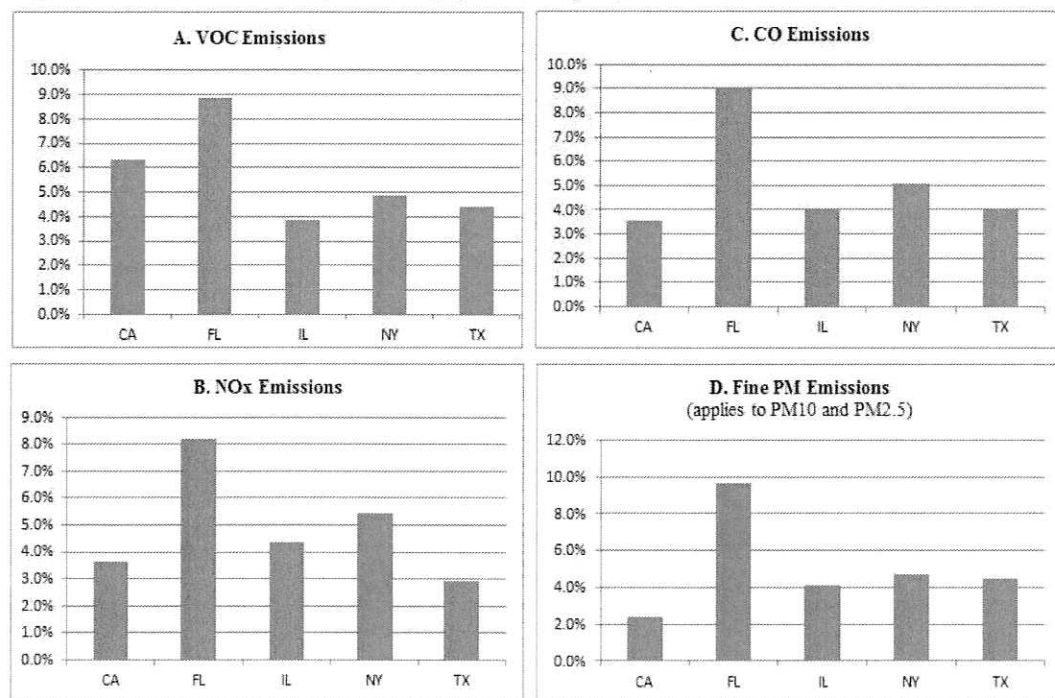
Table 5: Estimated Change in GLGE Emissions, 2018 vs 2011

Emissions	% Change
VOCs	-20.9%
NO _x	-31.1%
CO	-4.9%
CO ₂	12.3%
PM 10	8.2%
PM 2.5	8.4%

GLGE Emissions in the Five Most Populated States

When considered together, GLGE emissions from California, Florida, Illinois, New York and Texas constitute approximately one-quarter of national GLGE emissions.

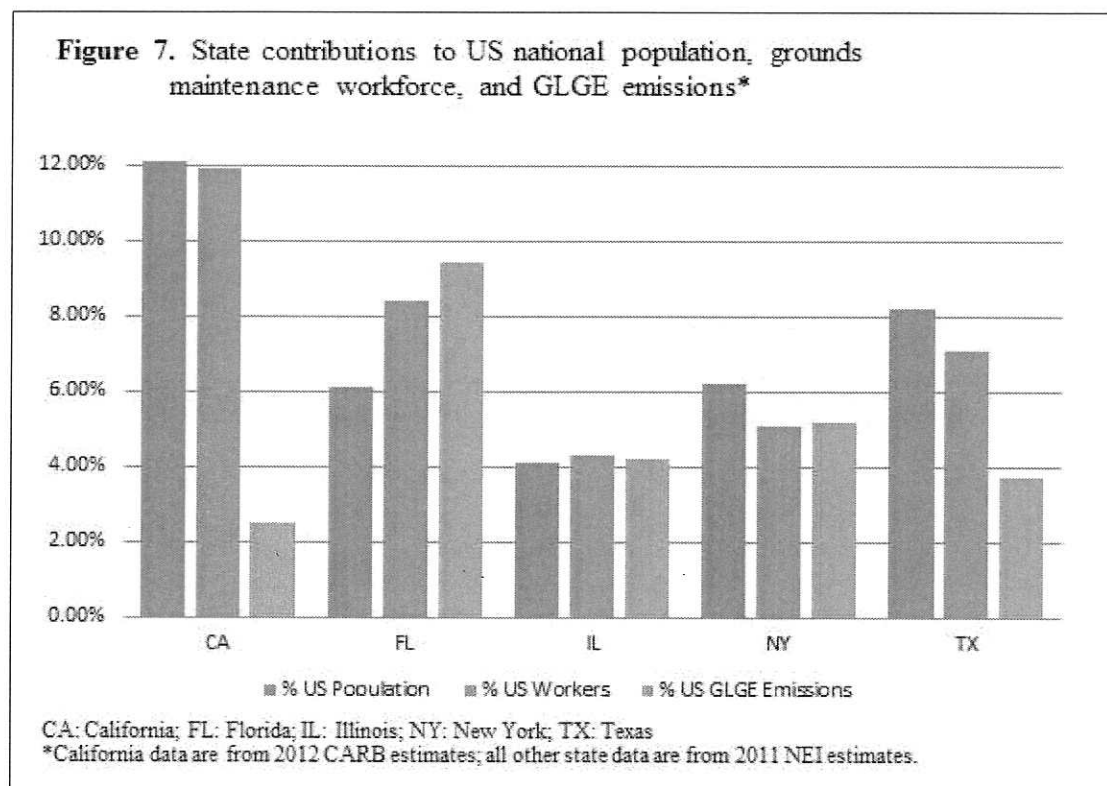
Figure 6. Emissions contributed by the 5 most populated states, US, 2011*



CA: California; FL: Florida; IL: Illinois; NY: New York; TX: Texas
*California data are from 2012.

Florida's GLGE emissions were 1.4 to 2.1-times higher compared with emissions in states having the next highest level of emissions in each GLGE pollutant category, and 2.2 to 4.4-times higher compared with emissions in states having the lowest level of emissions in each GLGE pollutant category (**FIGURE 6**).

For Florida, Illinois, and New York, state-specific contributions of GLGE emissions compared to the national total were relatively consistent with their contributions to the national population and the national grounds maintenance workforce. For California, its GLGE emission contribution was one-fifth that of its contribution to the national population and to the national grounds maintenance workforce. For Texas, its GLGE emission contribution was 40%–50% that of its contribution to the national population and to the national grounds maintenance workforce (**FIGURE 7**).



DISCUSSION

The main findings of this study are: 1) GLGE is a prevalent source of toxic and carcinogenic emissions; 2) GLGE contributes substantially to nonroad emissions of benzene, 1,3 butadiene, formaldehyde, CO, and fine PM; 3) GLME accounts for a disproportionately large share of VOC and fine PM emissions; 4) 2-stroke engines account for most fine PM emissions from GLME; 5) VOCs and NO_x are projected to decrease substantially by 2018; CO emissions remain comparable to 2011 levels; and CO₂ and fine PM emissions are projected to increase modestly; and 6) the GLGE emissions contributions from the the largest states are not always consistent with contributions to national population and national grounds maintenance workforce.

The large volume of emissions from GLGE found in this study is consistent with findings previously reported by the EPA¹ and from other studies.²⁻⁴ The very substantial contribution of VOC, in particular benzene and 1,3 butadiene, deserves attention especially because of their localized nature.

While VOC emissions are expected decrease 21% on average by 2018, the rates of equipment replacement on which those projections are based are only approximated.

Adverse health effects from the GLGE emissions are well known. Benzene, 1,3 butadiene, and formaldehyde are listed among the four top ranking cancer-causing compounds.²² They cause lymphomas, leukemias, and other types of cancer (International Agency for Research on Cancer, World Health Organization).^{23, 24} Ground level ozone (formed by VOCs and NO_x in the presence of sunlight) and fine PM cause or contribute to early death, heart attack, stroke, congestive heart failure, asthma, chronic obstructive pulmonary disease, and cancer.⁵⁻¹¹ Growing evidence suggests these pollutants also contribute to developmental and neurological disorders, including autism.^{7-9, 12, 13} The mounting evidence on the dangers of short term exposure are especially concerning.^{7, 9, 11}

The high levels of VOCs and fine PM from GLME are health risks for workers and other members of the public close to the emitting source. Although no studies of grounds maintenance workers were found, studies of gas station workers have shown that regular exposure to gasoline vapors can produce hematological and immunological abnormalities and elevate the risk of cancer.²⁵⁻²⁷ In addition, children, seniors, and persons with chronic illnesses are especially vulnerable to the negative health impacts of GLME emissions.²⁸ Routine use of GLME in the vicinity of residential neighborhoods, schools, parks, and other public spaces may be exposing the public to unnecessary and preventable health risks. New equipment standards do not affect fine PM emissions; in fact, those emissions are expected to increase.

School buses represent another example of a close-to-emitting source in which children are subjected to increased exposure from diesel exhaust.²⁹ Tests of school buses found that diesel exhaust entering through the front door of the bus results in elevated levels of PM over time. When queuing, PM built up rapidly in the bus cabin when the front doors were open.

The variation in emissions levels observed among the five most populated states should be explored further. The reasons for the high emissions contribution from Florida and relatively low emissions contributions from Texas and California are not clear. Differences between CARB data and NEI data may account for some of the difference between California and other states. For example, the NEI baseline equipment population data are older compared with those of CARB. Other factors that may be involved include but are not limited to emissions estimation procedure, geographic and climate factors, regulations and their effectiveness, and efforts to promote cleaner alternatives.

This study has several limitations. Not all potentially harmful emissions were characterized; for example, polycyclic aromatic hydrocarbons. Other limitations concern the source data. Although the NEI is a comprehensive source of GLGE emissions data, the accuracy of the reported data is uncertain. Baseline equipment population data for the Nonroad model is 15–20 years old and does not account for growth of the commercial industry. This older population data supplies emission estimates to NEI, which in turn is used to create EPA's 2011 and 2018 modeling platforms. Although the residential and commercial CARB inventories and activity data are newer, they depend largely upon telephone survey data.^{30, 31} Methodological weaknesses with the commercial survey data are discussed in the survey report.³¹ For both data sources, the rates of replacement of older equipment by newer, cleaner equipment that meets the newer Phase 3 standards³² can only be approximated.

CONCLUSIONS

GLGE is an important source of toxic and carcinogenic exhaust and fine particulate matter. Improved reporting and monitoring of localized GLGE emissions should be implemented. Medical and scientific organizations should increase public awareness of GLGE and GLME and identify GLGE as an important local source of dangerous air pollutants. Communities and environmental, public health, and other government agencies should create policies and programs to protect the public from GLGE air pollutants and promote non-polluting alternatives.

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