August 31, 2016 -Comments to Subcommittee budhix@iglou.com

"The biodigester regulations ignore the impact of new industrial scale emissions of carbon dioxide in the urban heat island and will not promote public health, safety and general welfare"

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Metro Council needs to study the impact of biodigester emissions on the urban heat island and ozone standard non-compliance. This regulatory action permitting biodigesters to be operated in Metro Louisville— especially West Louisville– is incomplete and insufficient and will cause ozone excellencies to increase and public health to suffer above current impacts. Merely establishing setbacks will not remove the harmful digester emissions from the urban area. Rule 4.2.63 does not require capture of CO2 ad there is no rule to monitor, limit or capture fugitive methane emissions. Even if restricted to M-3 zoned areas the CO2 emissions argue for banning biodigesters in Jefferson County.

Metro Louisville is covered by a carbon dome of high carbon dioxide concentrations.

> *"Evidence (e.g.Idso, Idso et al. 2002; Jacobson 2010) suggests urban CO2 domes exist over many large cities and that they are site and time dependent (Nasrallah, Balling Jr et al. 2003). Ziska, Gebhard et al (2003) showed that air temperature and atmospheric CO2 are significantly higher in urban compared to rural areas. Patterns of urban development and transportation can significantly impact emissions considering the fact that nearly 40% of total U.S. carbon emissions are associated with residences and automobiles (Glaeser and Kahn 2010)."*
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> "Per unit area, annual CO2 exchanges measured in urban areas **greatly exceed those from nearby natural ecosystems**: average annual CO2 release in Helsinki is forty times larger than the uptake by a nearby wetland and eight times larger than the uptake by aboreal forest (J€arvi et al., 2012)."
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> Ward et al, **Effects of urban density on carbon dioxide exchanges: Observations of dense urban, suburban and woodland areas of southern England,** Environmental Pollution 198 (2015) 186e200.

High urban carbon dioxide concentrations cause increased ozone formation in given sunlight and volatile chemical concentrations.

> **On the causal link between carbon dioxide and air pollution mortality** Mark Z. Jacobson, GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L03809
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> Here, it is shown that increased water vapor and temperatures from higher CO2 separately increase ozone more with higher ozone; thus, global warming may exacerbate ozone the most in already polluted areas. A high-resolution global-regional model then found that CO2 may increase U.S. annual air pollution deaths by about 1000 (350–1800) and cancers by 20–30 per 1 K rise in CO2-induced temperature. About 40% of the additional deaths may be due to ozone and the rest, to particles, which increase due to CO2-enhanced stability, humidity, and biogenic particle mass.

Biodigesters emit on average 40 % carbon dioxide as a total component of biogas. The gaseous products of anaerobic digestion are 40 % carbon dioxide 49 % methane and 10% ammonia. These regulations simply ignore the CO2 component--its not even in the definitions.

The implications of half the biogas being CO2 have not been discussed in the regulatory analysis by Planning and Zoning—nor have ambient concentrations been referred to or measured by Air Pollution Control District. The University of Louisville invested $ 40 million in efficiency studies and then decided to completely eliminate UofLs carbon dioxide emissions by 2050. The college is going one way— Metro Council is going the opposite direction.

> *University of Louisville Emissions Inventory 2006-2010* Page 5
> For fiscal years 2006 through 2010, the University of Louisville produced annual average net emissions of **200,414 metric tons** of carbon dioxide equivalent (MT CO2e) from all sources.

Urban CO2 ambient concentrations are a concentration flux that depends on absorption by trees and vegetation and the volume of emissions by transportation, residential and industrial sources. Louisville's low tree canopy metric, high concrete pavement area and the observed heat island indicate that we have a very high carbon flux imbalance— a huge concentrated carbon dome.

Bourbon production and biodigestion on an industrial scale bring huge new sources of carbon under the Louisville CO2 dome in the form of feedstock grains from outside rural areas, which are then converted to methane and carbon dioxide Downtown, or the West Louisville area and discharged into the local -high carbon dioxide- atmosphere.

In other cities that have studied carbon flux —ambient concentrations of 500 ppm or 100 ppm over rural background levels have been measured. Louisville no doubt meets or exceeds these readings on particular days.

Louisville's urban heat island has temperature increases of between 5-12 degrees over background rural areas outside the city. Ozone has exceeded the 8 hour limit more than 30 times this year and on 14 full days.

Sunlight, the Ohio Valley stagnant air mass, the massive tonnage of emissions already in the air make Louisville under the carbon dome the wrong place for new sources of industrial scale carbon dioxide tonnage. The public health and Clean Air Act compliance affecting federal transportation funding hinge on this action. Proponents of this regulation do not know and have not measured the actual impacts of industrial scale biodigesters and their carbon emissions in an urban heat island impacted city—this regulation should be tabled until those impacts are accurately measured and modeled. Once you start emitting tons of new CO2 under the dome it will be impossible politically to shut it down.

Louisville Metro Air Pollution Control District, Ozone Advance Program, Path Forward July 11, 2013

Much of the air pollution problems are due to unfavorable meteorological conditions and air mass stagnation in the Ohio River Valley. Climatological data analysis has shown that when days are sunny and sultry and combined with a stagnant air mass in the Ohio River Valley, it creates optimum conditions for ozone formation. Those conditions were abnormally frequent during 2012. The National Weather Service (NWS) determined that Louisville's temperatures were the hottest on record with an average of 2.6°F above normal (official) and 3.2°F above normal near the Cannons Lane monitoring site.

To reiterate, Louisville's climatological data analysis shows that during the summer of 2012 high ozone readings and exceedances were monitored on days that were sunny, sultry, and combined with a stagnant air mass in the Ohio River Valley.

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Interestingly, a large number of ethanol fugitive emissions originate from three bourbon aging facilities in the county. LMAPCD has no jurisdiction over them because those emissions do not count toward the 100 tpy applicability threshold for the Clean Air Act Part 70 operating permit program. Jefferson County VOC emissions in 2008 were 3,734 tons per year (tpy) and increased to 4,430 tpy in 2011. There are several similar DAQ permitted facilities in the ozone maintenance area that contribute nearly that amount of fugitive emissions. Like LMAPCD, DAQ has no authority to include bourbon aging fugitive emissions in the facilities' inventories. Combining both counties' fugitive emissions is equivalent to approximately 30% of the all of the VOC emissions inventory in Jefferson County. Unfortunately, these emissions contribute to the area's VOC emission total and to ozone formation.

Evidence (e.g.Idso, Idso et al. 2002; Jacobson 2010) suggests urban CO2 domes exist over many large cities and that they are site and time dependent (Nasrallah, Balling Jr et al. 2003). Ziska, Gebhard et al (2003) showed that air temperature and atmospheric CO2 are significantly higher in urban compared to rural areas. Patterns of urban development and transportation can significantly impact emissions considering the fact that nearly 40% of total U.S. carbon emissions are associated with residences and automobiles (Glaeser and Kahn 2010).

Nasrallah, H. A., R. C. Balling Jr, et al. (2003). **"Temporal variations in atmospheric CO2 concentrations in Kuwait City, Kuwait with comparisons to Phoenix, Arizona, USA**." Environmental Pollution **121**(2): 301-305.

Glaeser, E. L. and M. E. Kahn (2010). "**The greenness of cities: Carbon dioxide emissions and urban development."** Journal of Urban Economics **67**(3): 404-418.

Louisville Urban Heat Management Study 33-34 impervious ground surface
Urban Climate Lab of the Georgia Institute of Technology for the Louisville
Metro Office of Sustainability

Drawing on page 8 shows the effect of green house gas blanket over Louisville

As consistent with the spatial pattern of warming, Louisville's most densely developed areas tend to be found in the downtown district, immediately to the west, in relatively dense and poorly vegetated residential areas, and then to the south and west across heavily industrial zones situated along the Ohio River. The lowest late afternoon temperatures tend to be found in the agricultural zones to the east and within grid cells located in the Ohio River.

On many days during the 2012 summer, for example, the difference between the hottest and

coolest areas of Louisville was found to be in excess of 12°F.
Likewise, on many days throughout the summer of 2012, daily high temperatures exceeded 100°F. Areas found to average daily high temperatures in excess of 88°F over the period of May through September experienced a very hot summer.

Effects of urban density on carbon dioxide exchanges: Observations of dense urban, suburban and woodland areas of southern England
H.C. Ward a, c, *, S. Kotthaus a, b, C.S.B. Grimmond a, A. Bjorkegren b, M. Wilkinson d, W.T.J. Morrison a, J.G. Evans c, J.I.L. Morison d, M. Iamarino e

Per unit area, annual CO2 exchanges measured in urban areas greatly exceed those from nearby natural ecosystems: average annual CO2 release in Helsinki is forty times larger than the uptake by a nearby wetland and eight times larger than the uptake by a boreal forest (J€arvi et al., 2012).

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The distribution of points in Fig. 12b highlights the need for more observations in very densely urbanised areas. The two studies with the largest fluxes and highest population densities took place in London. The central London annual carbon release measured in this study is the largest to date, corresponding to the site with the highest population density and low vegetation cover. The second largest emissions are also from London, and are associated with a slightly higher vegetation fraction and slightly lower population density (Helfter et al., 2011). These measurements were made at a height of 190mand so had a much larger footprint than the present study. Highly-vegetated low-density suburban Baltimore has the smallest FC of the urban sites of 0.361 kg C m_2 yr_1 (Crawford et al., 2011).

University of Louisville Emissions Inventory 2006-2010 Page 5
For fiscal years 2006 through 2010, the University of Louisville produced annual average net emissions of **200,414 metric tons** of carbon dioxide equivalent (MT CO2e) from all sources.

The University is committed to greater energy conservation and expects to see significant reductions in our carbon footprint in coming years thanks, in part, to a nearly $40 million investment in efficiency through a performance contract with Siemens. This represents a large step for UofL in emissions reduction, but it is only the first of many laid out in our Climate Action Plan.
UofL's target goals for reductions in greenhouse gas emissions (from our 2008 benchmark estimate of 192,788 MT CO2e) are summarized below.

By 2050 UofL wants to eliminate all CO2 metric ton emissions on campus

Jacobson, M. Z. (2008), On the causal link between carbon dioxide and air pollution mortality, Geophys. Res. Lett., 35, L03809, doi:10.1029/2007GL031101.