

Hi my name is Kevin Lee and I live at 3 Shepard St. I have been a resident of Cambridge for 12 years. I am writing to support the policy order regarding the health impacts of commercial wood-fired ovens in Cambridge. I came to speak in person on October 17th. Tonight will be my 2 year old's first Halloween so unfortunately I can not be there tonight.

I have a 2 year old at home, and since the wood burning started, we have been forced to keep our windows closed every night. Any time we have tried to open them, the wind direction in our neighborhood is random enough that we always get hit with gusts of smoke and odor that blow into our house. During summer months, even with the windows closed, smoke sometimes blows through our window AC unit forcing us to turn off the air conditioner, seal it shut with paper or plastic wrap and leave the house to avoid the heat. Even outside of the house, on bad nights the smoke settles and concentrates in our driveway, forcing us to run from the car into the house so that we don't smell like smoke for the rest of the night. The smoke occurs so frequently that my 2 year old now will even tell me when it smells bad outside.

I have been living with commercial wood smoke in my neighborhood for 16 months now. My house is less than 50 feet from a chimney that vents smoke from a commercial wood fire pit. This is not just an oven, it is also an open fire vented directly out a chimney that is 50 feet from the windows of my condo as well as the windows of other nearby residents. Since the distances are so close, it is not just a small number of residents who are over sensitive to the smell complaining, it is almost **every single** permanent resident adjacent to the restaurant that has been actively complaining about the pollution since the first day the restaurant opened. One family has already moved out and I am now also actively looking for a new house. With the current regulations in Cambridge, there are no rules regulating how much wood can be burned or even where the chimney is in relation to the surrounding residents. In the case of our neighborhood, the distances are equivalent to your next door neighbor lighting an open wood fire in their backyard and blowing it straight at your house every single night.

Harmful exhaust is a major issue not just for wood burning, but for chemical processing as well. In the case of the later, the OSHA technical manual Section III Chapter 3 states that chimney must be greater than 10 ft higher than any roof line or air intake within 50 ft [1]. This is for chemical fume exhaust where usage quantities are already restricted to prevent release into the environment and the concentration of the chemical that is being used **MUST** be factored into and reported in the design of the exhaust system. No such usage restrictions or maximum output concentrations exist for wood burning which can release many times more toxic and carcinogenic compounds even with just single burned log [2]. While OSHA regulations require employers to protect their adult employees from breathing in these emissions, residents in the City of Cambridge, including infants and children who are even more susceptible, currently have no such protections.

Just as an example calculation, the EPA estimates that Polycyclic Aromatic Hydrocarbons (PAH), the main carcinogens in wood smoke, are released 365 mg/kg of wood burned [2]. For an average night of a restaurant burning 15 logs, this is 65.7 milligrams a night [3]. To put this in perspective, a single cigarette contains in the worst case 12.7 micrograms of PAH [4], meaning that the restaurant would be emitting over **5000 cigarettes a night** just of carcinogens! If we get even more specific, the numbers become much worse. Benzo(a)Pyrene, a chemical found in both wood smoke and cigarettes that has been shown to cause a 4-fold increase in attention problems and 2.6-fold increases in attention/hyperactivity problems and anxiety problems in children [5], would be the equivalent of over **200,000 cigarettes each hour for 8 hours a night**.

But what does this actually mean for the restaurant since it is blowing this pollution out into the air? If we were to draw a 100 foot radius circle around the restaurant that was 100 feet high (roughly the height from the ground to the chimney) and distribute all of the carcinogens evenly (a day with no wind), the average

concentration of PAH at the end of the night would be 0.2 mg/m³, which is the OSHA **maximum** exposure limit for PAH in an 8 hour work day [6]. Unfortunately, the concentrations of PAH that have been shown to cause health effects in children and pregnant mothers are as low as 2.26 ng/m³ (88 million times lower) [7], leading to children with lower IQ scores versus unexposed children. If we then add the wind, this blast of carcinogens gets concentrated and blown right at an unsuspecting home each night.

But what about technical solutions to the problem? There are many things that can be done to reduce the wood smoke problem such as high chimneys and scrubbers, but even when all of them are implemented, at the cost of over \$100,000, it still is not enough to protect the residents from the smoke and odor. This is not the first example of a wood burning restaurant unable to fix neighborhood pollution even after spending over \$100,000 on wood smoke and odor mitigating equipment. A similar french open wood fire restaurant, Mas la grillade, was attempted in New York in 2014 [8], but the wood fire cooking was ultimately stopped because the residents could not handle the smoke and odor, even after all of the technological improvements were added.

Why is it that chimneys and scrubbers are not good enough?

Chimneys are fine, as long as they are high enough and far enough away from adjacent air intakes, as I referenced earlier in the OSHA technical manual. If you look at MIT and Harvard, you will notice that all of their chimney and fumehood exhausts are placed at the top of very tall buildings. However, in Cambridge, with business and residents so close together, it is sometimes impossible to meet the OSHA minimum requirements. In our case, when the restaurant first opened with a short chimney, the residents living on the first and second floors adjacent to the restaurant were smoked out. Since raising the chimney, ground level residents fair a bit better, but now the second and third floor residents adjacent to the restaurant are strongly affected. Even worse, the single story restaurant is less than 50 ft from a 6 story tall apartment complex and there is no way to build a chimney tall enough to dissipate the smoke above the apartment.

But Scrubbers must eliminate all of the smoke right?

While scrubbers seem to be a most agreed upon solution, they still let at least 5% of particles through and 50% of the smell - numbers taken from the manufacturer's website [9]. Additionally, scrubbers have **little to no effect** on the toxic/carcinogenic PAH present in wood smoke since PAH compounds do not don't dissolve in water. A study published in the Journal of Hazardous Materials showed only a 0.837-5.89% reduction in PAH at the stack output when using wet scrubbers[10]. Therefore almost ALL of the PAH carcinogens are getting through the scrubber system and being released into the outside air.

As an example of the scrubber not being good enough for either particles or carcinogens, I personally walked to where the exhaust from the stack was being directed by wind at ground level and stood there for 5 minutes a few nights ago when a considerable fire was burning. Besides the noticeable thick odor, when I got home my hair and clothes still smelled of wood smoke, indicating that there are still enough particles being emitted from the chimney to stick to people walking by. Now imagine the wind changes direction and blows that smoke directly to a resident's window for 8 hours straight.

Wood smoke emits much higher concentrations of carcinogenic chemicals than cigarette smoke and leads to significant health problems in the community, but there are currently no regulations in place to protect Cambridge residents from wood burning. In the worst case, another wood fire restaurant could open with a wall shared by an apartment building and vent smoke directly into the apartment without the resident knowing until it's too late, causing a likely **fatal** situation. Our neighborhood is not the first affected in this way (Ristorante Marino in Cambridge, Yakitori Zai in Boston, Roadhouse in Brookline) but we hope it can be the last. I support the Policy Order to try to find a permanent solution to neighborhood smoke and protect unsuspecting residents from any future harm.

- [1] https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_3.html#5
- [2] <https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s10.pdf>
- [3] Attached excel sheet
- [4] https://profiles.nlm.nih.gov/NN/B/B/X/Y/_/nnbbxy.pdf
- [5] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3385432/>
- [6] <https://www.atsdr.cdc.gov/csem/csem.asp?csem=13&po=8>
- [7] <http://pediatrics.aappublications.org/content/124/2/e195>
- [8] <https://www.dnainfo.com/new-york/20140808/west-village/neighbors-fury-about-wood-fired-grill-smoke-forces-village-eatery-close>
- [9] http://smokiusa.com/maxi_grill
- [10] <https://www.ncbi.nlm.nih.gov/pubmed/19272707>

[3]Chemicals from burned wood

<https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s10.pdf>

<http://www.woodweb.com/cgi-bin/calculators/calc.pl>

<http://www.bellforestproducts.com/info/popups/average-dry-weight/?s=6>

Chemical	lb/ton
Ethane	1.47
Methyl Ethyl Ketone	0.29
Acetylene	1.124
Propane	0.358
Propene	1.244
i-BUtane	0.028
n-Butane	0.056
Butenes	1.192
Pentenes	0.616
2,5-Dimethyl Furan	0.162
Carcinogens	
Ethylene	4.49
Benzene	1.938
Toluene	0.73
Furan	0.342
2-Methyl Furan	0.656
Furfural	0.486
o-Xylene	0.202
Polycyclic Aromatic Hydrocarbons	0.73
total carcinogens per ton of wood	9.574 lbs
cedar dry weight 8% water content	30 lbs/ft ³
volume of a 6 inch diameter 1 ft long log	0.2 ft ³
logs per night	15 logs
total weight of wood per night	0.045 tons/night

pounds carcinogens per night	0.43083 pounds	
pounds carcinogens per week	3.01581 pounds	
total PAH per night	0.03285 lb/night	14.9 g/night
BaP released per night by restaurant	0.08165 g/night	
BaP in a cigarette	4.90E-08 grams	2.08E+05 Cigs/Hour