

Episode 56GQ August 2, 2023. If PM2.5 at an indoor wood stove stack is at a certified limit, 80 feet away, E P A ambient PM2.5 is above the limit.

Since 1988, one role of the Environmental Protection Agency (E P A) has been to work with wood stove manufacturers to come up with wood stove certification PM10 emission standards which the manufacturers could conceivably attain. In 2020 the certification emissions limit for new wood stoves is listed on the E P A website as 2 grams of PM10 per hour, for cord wood, the wood most often used in indoor residential wood stoves.

This is puzzling because wood burning emissions are 90% PM2.5 which are particulates of one quarter the size of PM10. Construction dust is often of PM10 size. Was PM10 was listed for wood stove certification emissions testing in error on the E P A website? It would be more relevant for the E P A to test for PM2.5 emissions, since PM2.5 is 90% of wood burning emissions. PM2.5 is particulate matter of 2.5 micrometer size, the perfect size to infiltrate the human lung, setting off a cascade of human health problems and early deaths.

New Source Performance Standards (NSPS) for indoor residential wood stoves (wood stove certification PM limits) as set by the E P A for particulate emissions conflict with attaining current E P A National Ambient Air Quality Standards (NAAQS) for PM2.5. The current "safe" limit for NAAQS for PM2.5 is 35 micrograms per cubic meter. The calculations below show that 20 feet away from the stack of an indoor residential wood burner, if near neighbors had a PM2.5 monitor hanging from the eaves of their home, it would register PM2.5 emissions above the current E P A ambient average limit in a 24 hour period by 89.75%. The calculations below show that 80 feet away from the stack of an indoor residential wood burner, if near neighbors had a PM2.5 monitor hanging from the eaves of their home, it would register PM2.5 emissions above the current E P A ambient average limit in a 24 hour period by 10.5 %.

In real world conditions, if an indoor residential wood burner burned continuously for 24 hours with emissions of 2 grams per cubic meter, the PM2.5 emitted from the wood burners stack would exceed PM2.5 ambient air quality PM2.5 standards of 35 micrograms per cubic meter, even after it traveled to the yards of near neighbors at both 80 feet away (the 2<sup>nd</sup> nearest neighbor) and at 20 feet away (the 1<sup>st</sup> nearest neighbor). If both neighbors, the 2<sup>nd</sup> nearest at 80 feet away and the 1<sup>st</sup> nearest at 20 feet away, had PurpleAir PM2.5 monitors hanging from the eaves of their houses and kept those monitors on 24 hours a day, the online data and maps showing exceedance of PM2.5 ambient air quality limits should be similar to the calculations here.

The only way for an indoor residential wood burner to burn with emissions at 2 grams per hour without exceeding 35 micrograms per cubic meter in the yards and near the windows of near neighbors would be for the burner to not burn continuously for 24 hours at a time. If a wood stove was the only form of heat in a Wisconsin winter, wood burning doesn't seem a practical way to heat a home. To avoid exceeding ambient PM2.5 limits 20 feet away, the burner would have to burn for only 1.3 hours a day, not 24. To avoid exceeding ambient PM2.5 limits 80 feet away, the burner would have to burn only 21.5 hours a day, not 24.

RAWSEPresidents is not arguing that PM2.5 NAAQS should have higher limits or that NSPS should have higher limits. On the contrary, this exercise is intended to show that wood stove certification, even at regulated levels of 2 g per hour, is not strict enough to avoid polluting neighborhoods with "unsafe" levels of PM2.5 that can cause health problems and early deaths for near neighbors. There are alternate, low or no emission forms of heating homes in 2023, such as Heat Pumps that work down to 40 degrees below zero. Heat Pumps also cut heating bills because they heat so efficiently, and Heat Pumps can also double as air conditioners. Government programs such as the Low Income Home Energy Assistance Program (LIHEAP) can help indigent wood burners switch to cleaner and more economical forms of home heating.

The facts.

F1)2 grams per hour PM2.5 is the 2020 Environmental Protection Agency (E P A) "certification" limit for an indoor wood burning stove using cord wood (cord wood is the wood most used in indoor residential wood burning, not crib wood)

F2)35 micrograms per cubic meter is the E P A "safe" limit for ambient (outdoor air) PM2.5

F3)Wood smoke is 90% PM2.5, particulate matter of 2.5 micrometer size, the perfect size to infiltrate the human lung, setting off a cascade

of human health problems and early deaths.

F4) The real world 2<sup>nd</sup> nearest neighbor of an indoor residential wood burner lives 80 feet away from the indoor wood burning stack (10 feet from property line with nearest neighbor in the middle, 60 feet across yard of nearest neighbor in the middle, another 10 feet from the wood burner's property line to his stack).

F5) The real world 1<sup>st</sup> and 2<sup>nd</sup> nearest neighbors to the north, and, on a hill, with their properties below the indoor residential wood burner's stack.

F6) There are 35.3147 cubic feet in a cubic meter. There are 0.0283168 cubic meters in a cubic foot.

F7) There are 1,000,000 micrograms in a gram.

8/2/2023, Updated Chart: Calculations If PM2.5 emissions at an indoor wood burning stove stack is at a certified limit, but PM2.5 monitors are 20 or 80 feet away, hanging from the eaves of homes of near neighbors, E P A ambient PM2.5 limits are exceeded.

2 grams is 2,000,000 micrograms

1 cubic meter is 35.3147 cubic feet

2,000,000 divided by 35.3147 is 56633.6398157 PM2.5 micrograms per cubic foot at one foot from wood burner stack

Example 1 a neighbor with a PM2.5 monitor 80 feet from stack of indoor residential wood burner.

56633.6398157 divided by 80 is 707.920497696 PM2.5 micrograms per cubic foot at 80 feet from wood burner stack (2<sup>nd</sup> nearest neighbor's PM2.5 monitor, 80 feet from wood burner stack)

80 cubic feet times 0.0283168 (conversion from cubic feet to cubic meters) is 2.265344 cubic meters

707.920497696 divided by 2.265344 is 312.500219699 PM2.5 micrograms per cubic meter at 80 feet from wood burner stack (2<sup>nd</sup> nearest neighbor's PM2.5 monitor, 80 feet from wood burner stack)

A more realistic estimate might be PM2.5 in 8 foot wide area traveling 80 feet to the PM2.5 monitor of the 2<sup>nd</sup> nearest neighbor.

312.500219699 divided by 8 is 39.0625274623 micrograms per meter cubed.

39 micrograms per meter cubed is larger than the E P A current limit for ambient "safe" limit of PM2.5 by 4 micrograms per meter cubed.

4 divided by 39 is 10.25%, the amount the stack emissions should be reduced by.

The limit of wood stove emissions should be reduced from 2 grams per hour by 0.205 grams to 1.795 grams per hour for certified indoor residential wood stoves.

Or wood stove user should only burn 89.75 % of the time in a 24 hour period. The wood stove user should only burn 21.54 hours or 21 hours 30 minutes in a 24 hour period.

Example 2 the 1<sup>st</sup> nearest neighbor with a PM2.5 monitor 20 feet from stack of indoor residential wood burner.

56633.6398156 divided by 20 is 2831.68199078 PM2.5 micrograms per cubic foot at 20 feet from wood burner stack (1st nearest neighbor's PM2.5 monitor, 20 feet from wood burner stack)

20 cubic feet times 0.0283168 (conversion from cubic feet to cubic meters) is 0.566336 cubic meters

2831.68199078 divided by 0.566336 is 5000.00351519 PM2.5 micrograms per cubic meter at 20 feet from wood burner stack (1st nearest neighbor's PM2.5 monitor, 20 feet from wood burner stack)

A more realistic estimate might be PM2.5 in 8 foot wide area traveling 20 feet to the PM2.5 monitor of the 1st nearest neighbor.

5000.00351519 divided by 8 is 625.000439398 micrograms per meter cubed.

625.000439398 micrograms per meter cubed is larger than the E P A current limit for ambient "safe" limit of PM2.5 of 35 by 590.000439398 micrograms per meter cubed.

590.000439398 divided by 625.000439398 is 94.4%, the amount the stack emissions should be reduced by.

The limit of wood stove emissions should be reduced from 2 grams per hour by 1.89 grams to 0.011 grams per hour for certified indoor residential wood stoves.

Or wood stove user should only burn 5.6% of the time in a 24 hour period. The wood stove user should only burn 1.34 hours in a 24 hour period or only 1 hour and 20 minutes in a 24 hour period.

Would it not be less invasive to use the readings from a PM2.5 monitor hung from the eaves of a near neighbors' home to find if the wood burner is burning wood more than 1.3 to 21.5 hours a day, causing ambient PM2.5 to rise above ambient PM2.5 limit of 35 micrograms per cubic meter routinely in the yard of a near neighbor? Otherwise, if real regulation of pollution took place using wood stove certification, the wood burner, to prove compliance with "safe" limits, would have to report to the E P A the number of hours the burner burns wood, on an "honor" system of reporting the actual hours spent burning wood, rather than neighbors scientifically measuring the actual emissions entering the yard and infiltrating the home of a near neighbor.

That is one more reason why the EPA certification of wood stoves as emitting only 2 micrograms of PM2.5 per hour should be replaced by a complaint based system, in which the readings of a neighbor's PM2.5 monitor could show in real time, on online maps that are available to the general public and to government officials 24/7, with weekend and overnight readings available for download by government officials during normal governmental (probably local Health Department) normal working hours, if ambient PM2.5 limits are being exceeded because of burning in one indoor residential wood stove. During strict regulation of wood stove pollution, using only certification of wood stoves, governmental workers would have to enter the home of a residential wood burner, determine whether the stove is certified, shut it down if not certified, and ask the certified wood stove burner if they burn more than 1.3 to 21 hours per day, and rely on the wood burner's answer, on the honor system, to regulate pollution from indoor residential wood burning.

The E P A is not even complying with requests from the Office of the Inspector General in 2023 and letters from 10 state Assistant Attorney Generals in 2023 to correct "flawed" wood stove certification which allows highly polluting wood stoves to continue to be manufactured and sold in 2023. The E P A is only promising to make changes in wood stove certification in 2027, that should have been made in 2023. The last changes in wood stove certification were made in 2015, eight years ago. The E P A is required to make improvements, probably lowering PM2.5 limits, every eight years, and is now threatened with being sued by 10 state Assistant Attorney Generals in 2023 asking the E P A to comply with that 8 year requirement, among other requests.

The interested parties in the topic of indoor residential wood stove pollution include not just the manufacturers, vendors, and users of wood stoves. The interested parties in the topic of indoor residential wood stove pollution include the near neighbors of indoor residential wood stove burners, who suffer adverse health effects and early deaths because of their proximity to wood stove pollution. PM2.5 is the perfect size to infiltrate the human lung, setting off a cascade of human health problems and early deaths. PM2.5 also contributes to climate change, global warming, and the rise of wildfires, which also in a continuous loop of air pollution increase PM2.5 pollution. Canadian wildfire smoke infiltrating many areas of the United States in the last few months has educated millions of Americans about the adverse effects of wildfire smoke PM2.5, which is the same wood smoke as indoor residential wood smoke PM2.5. People were unable to commute to their jobs during these Canadian wildfire incidents. Near neighbors of indoor residential wood burners who work from home, have their work interrupted during indoor residential wood smoke incidents on a routine basis, when they have to stay inside sealed homes and run multiple air purifiers all day and night. Near neighbors also incur the expense of healthcare bills and the \$249 expense of buying PurpleAir PM2.5 monitors to hang from their eaves, in the hope that a complaint based system will replace indoor residential wood stove certification, and real regulation of pollution from wood stoves can happen. The federal government must lead from the top to ensure that state and local governments can feel they can use PM2.5 monitor data instead of wood stove certification. Wood stove vendors and wood stove users have been treated as the only interested parties on this issue, and the near neighbors must be viewed as "canaries in a coal mine" whose data must be noticed before the wood smoke pollution makes overwhelming changes to neighborhoods and the planet in ways that cannot be mitigated.