-Supplementary Information-

Aerosol Dynamics Modeling of Sub-500 nm Particles During the HOMEChem Study

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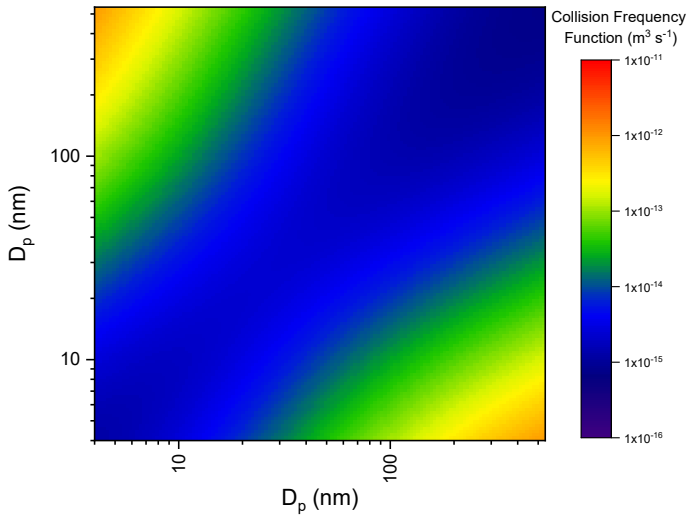

Figure S1. Collision frequency function

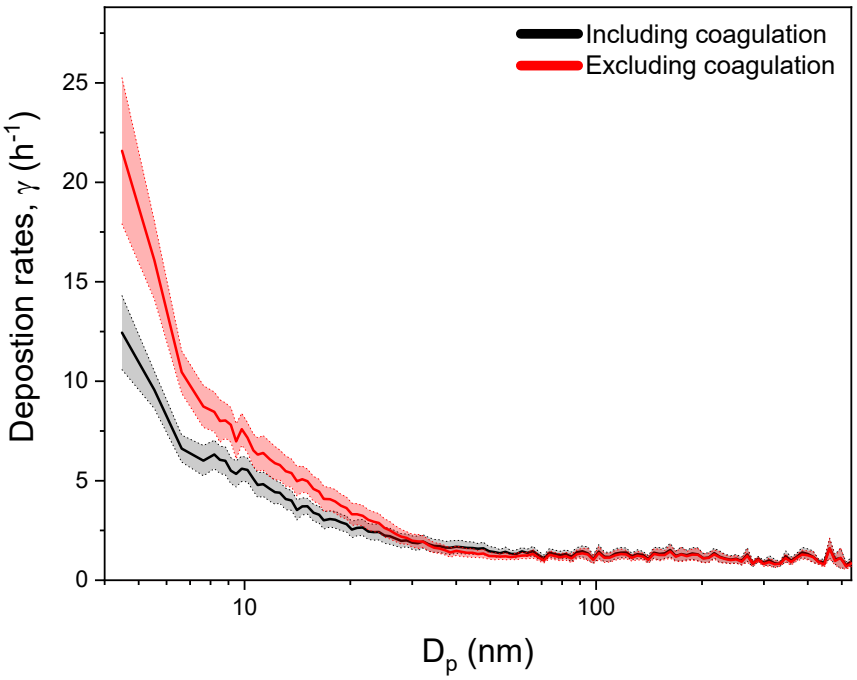

Figure S2. Size-resolved deposition rates calculated both including coagulation and excluding coagulation. Excluding coagulation resulted in overestimated deposition rates for sub-20 nm particles.

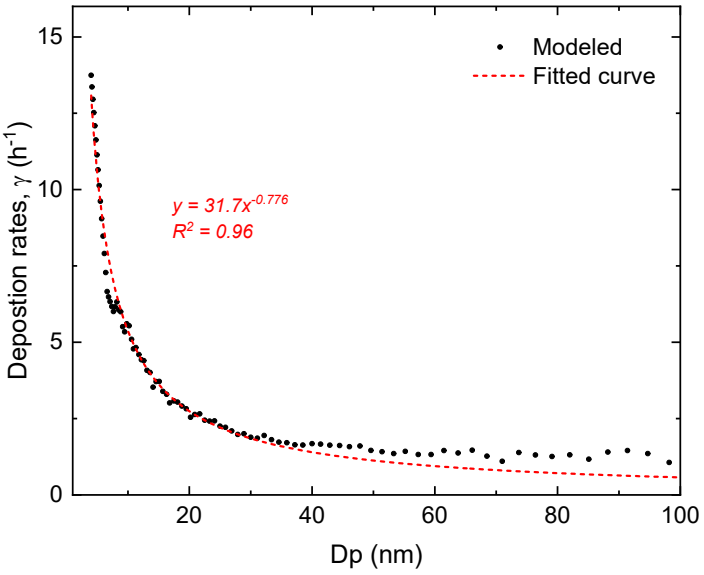

Figure S3. Curve fitting analysis performed on the calculated deposition rates for sub-100 nm particles.

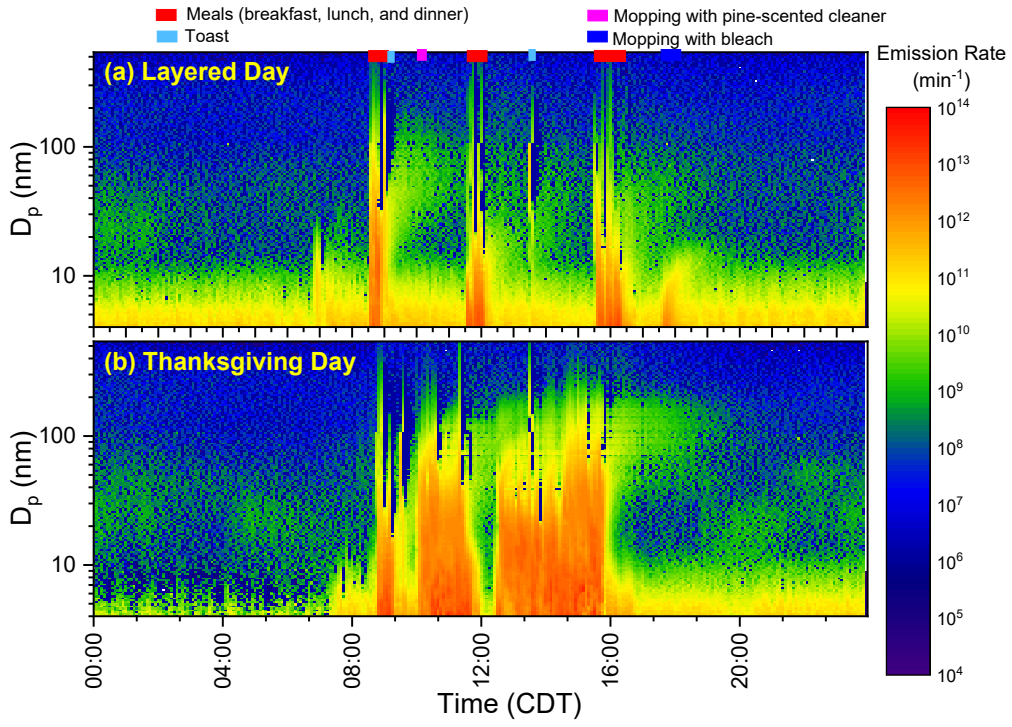

Figure S4. Estimated size and time-resolved emission rates over the 24-h duration on one of the (a) Layered Day and (b) Thanksgiving Day experiments.

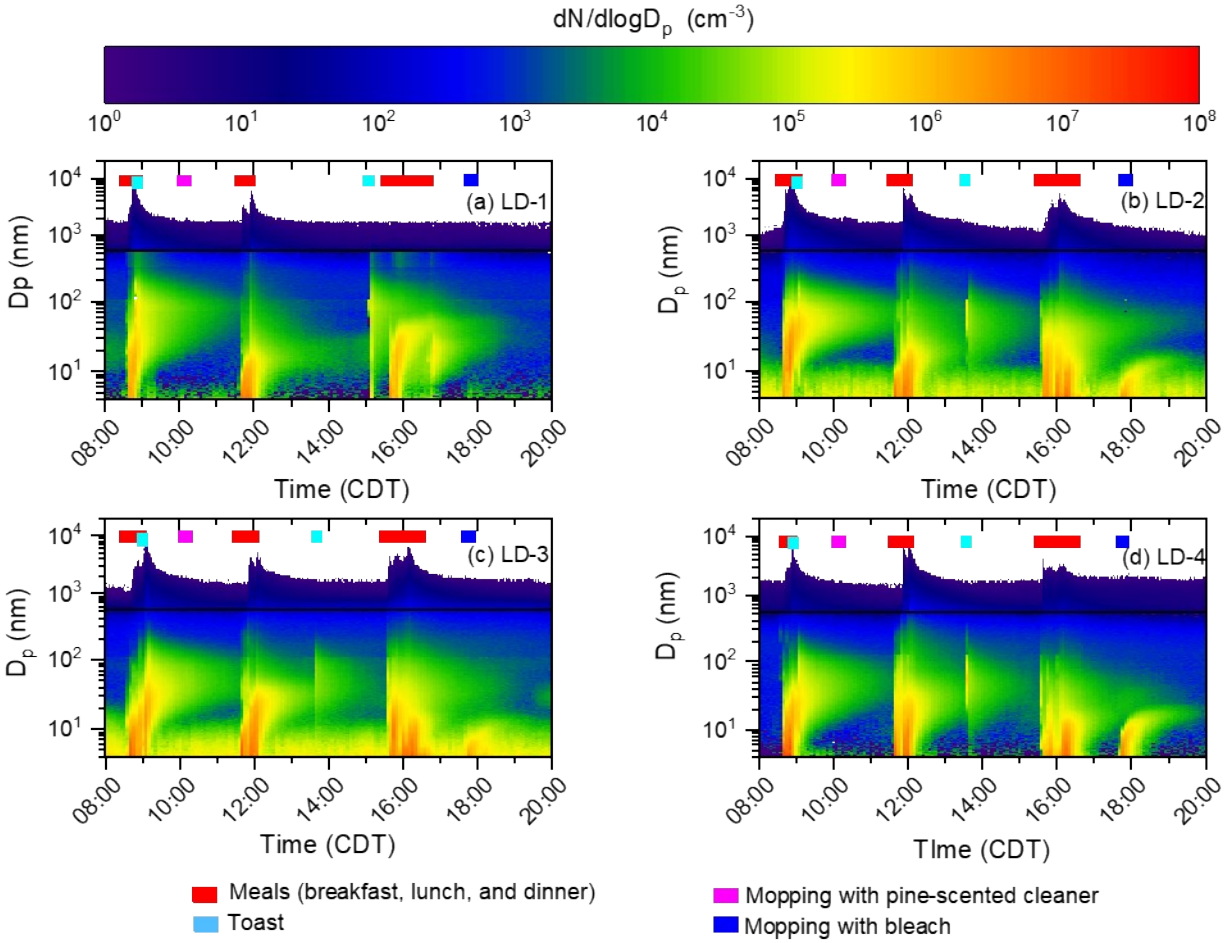

Figure S5. Temporal evolution of particle number size distribution inside the test house during the four Layered Day experiments coded as LD-1, LD-2, LD-3, and LD-4. Compared to LD-1 and LD-4, high concentrations of sub-15 nm particles were recorded during the periods of no activity or non-cooking periods during LD-2 and LD-3 (panels b and c), which can be attributed to pilot lights. Note that this figure also includes data from a TSI aerodynamic particle sizer (>500 nm) which is discussed in detail elsewhere.[1,2]

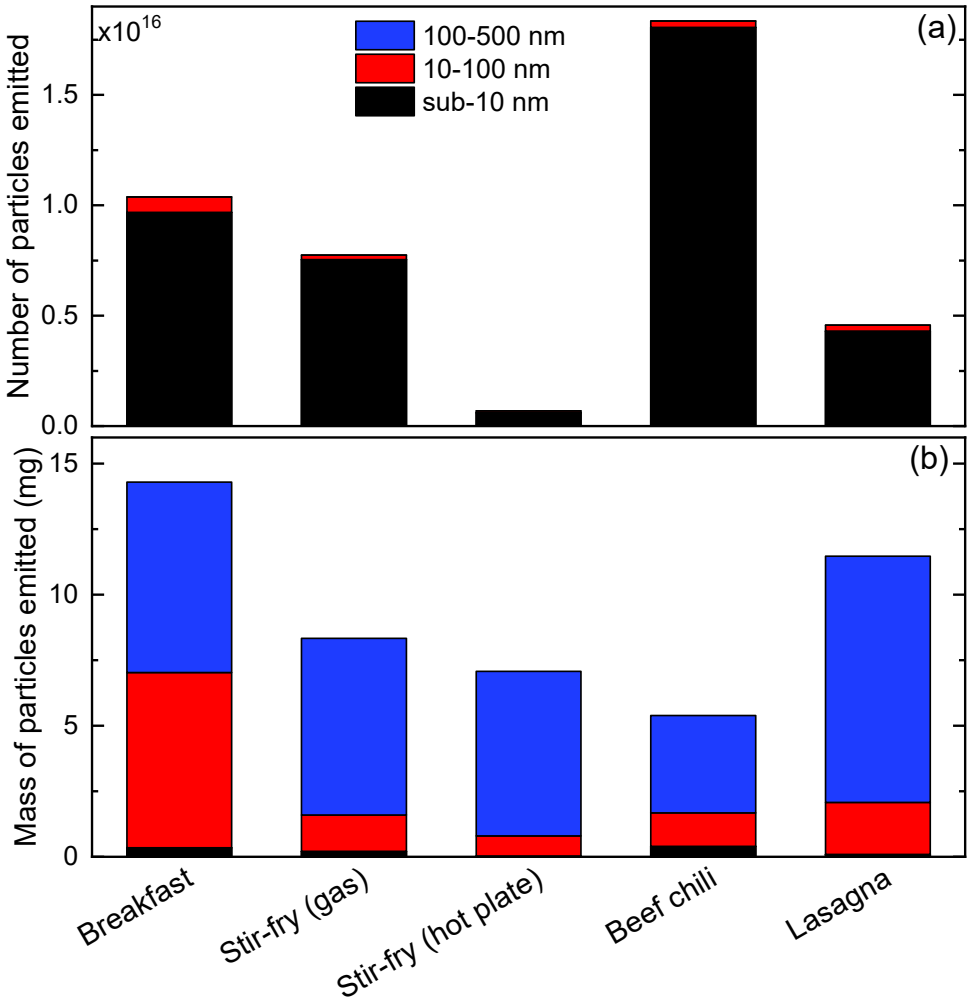

Figure S6. Size-segregated (sub-10 nm, 10-100 nm, and 100-500 nm) average (a) number and (b) mass of particles generated over the cooking duration of different meals. Data corresponding to this figure is available in Table S6.

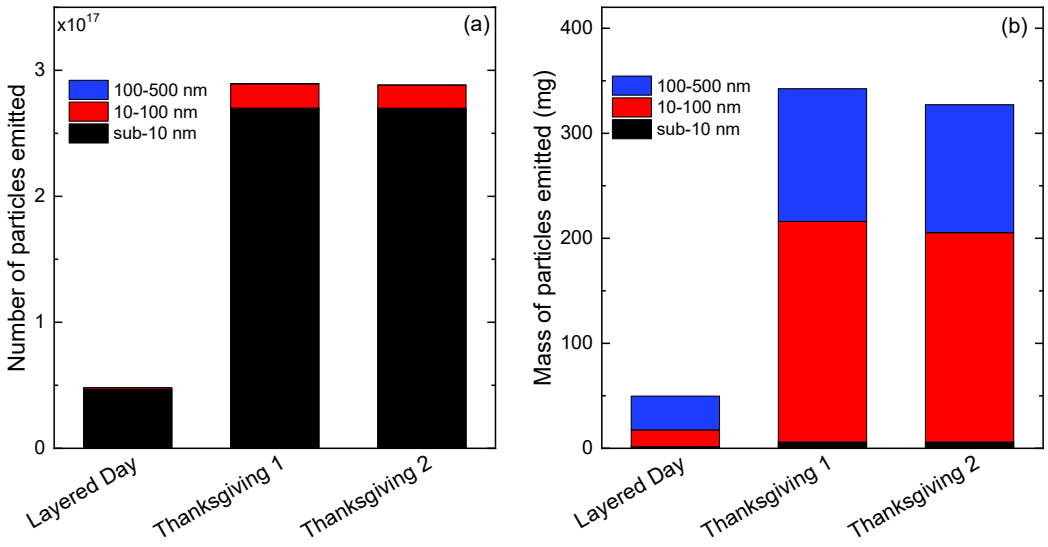

Figure S7. Size-segregated (sub-10 nm, 10-100 nm, and 100-500 nm) average (a) number and (b) mass of particles generated over 12 hours (8:00 AM – 8:00 PM) on Layered Day and Thanksgiving Day experiments. Data corresponding to this figure is available in Table S6. For Layered Day, average across the four replicates is presented.

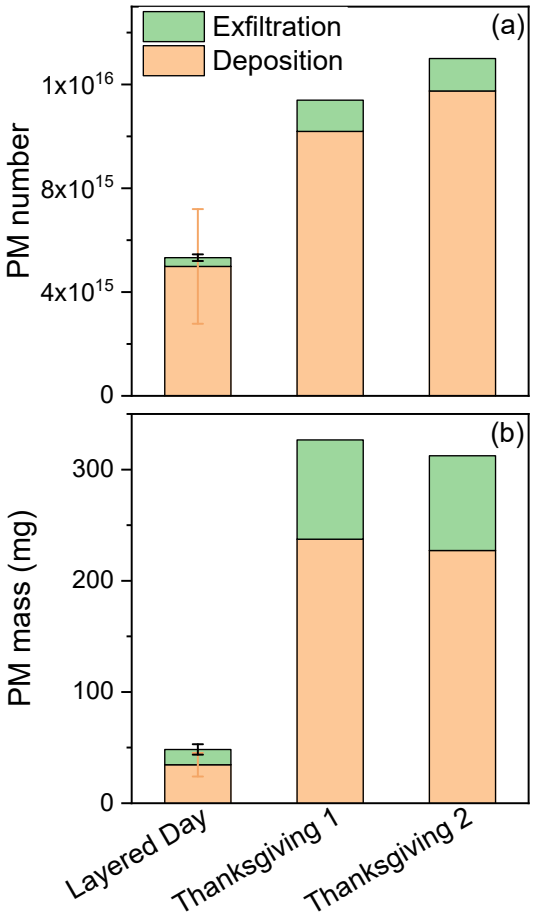

Figure S8. Total (a) number and (b) mass of sub-500 nm particles lost via exfiltration and deposition over a duration of 12 hours (8 am – 8 pm) during the Layered Day and Thanksgiving Day experiments. For Layered Day, average and standard deviation across the four replicates are presented.

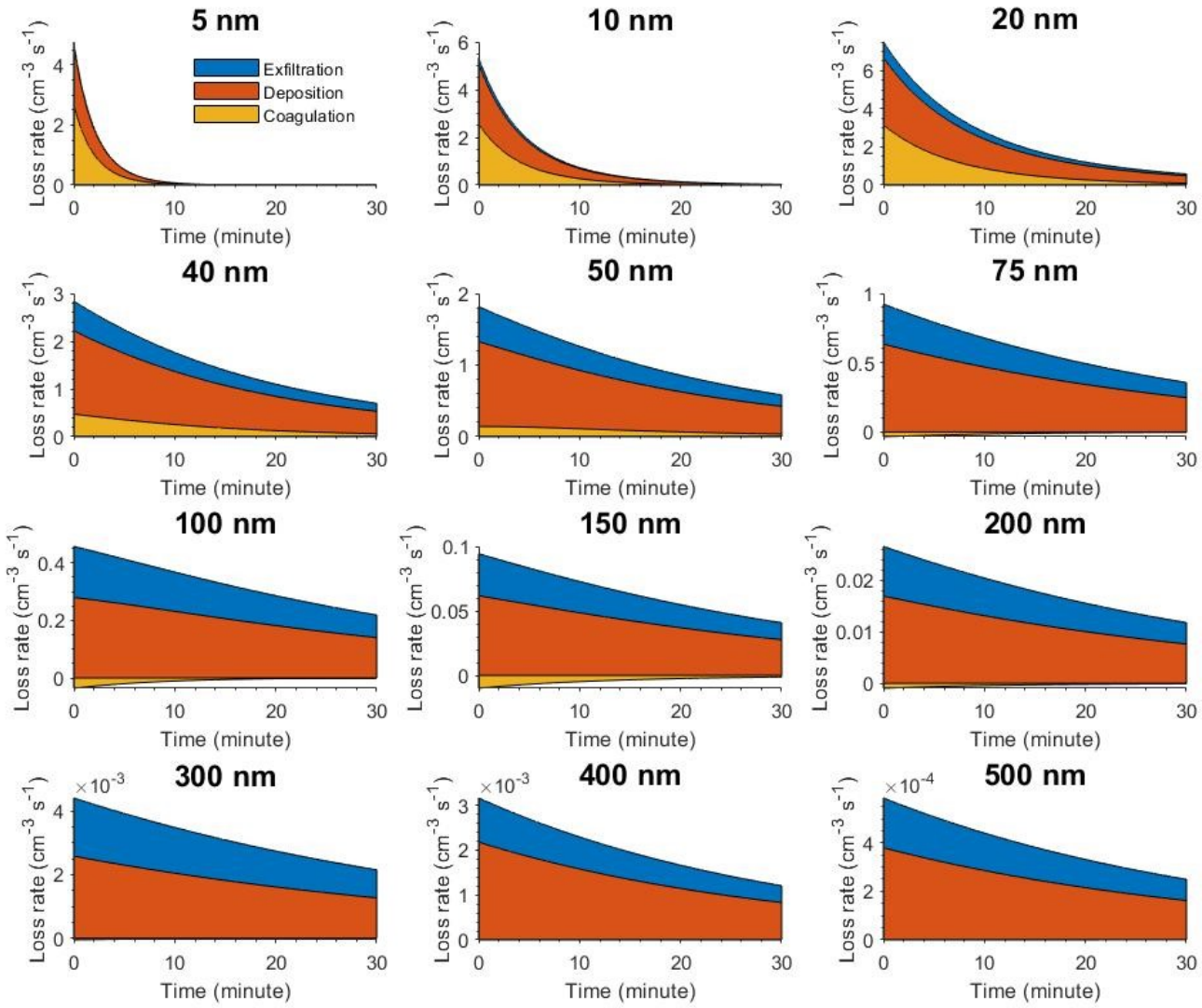

Figure S9. Time and size-resolved loss rate of particles via exfiltration, deposition, and coagulation during the first 30 minutes of the post-cooking decay phase following the breakfast on the fourth Layered Day experiment. The contribution of coagulation in the overall loss rates decreases with increasing particle size. The negative loss rate via coagulation for some size-bins (75 nm, 100 nm, 150 nm, and 200 nm) is due to the formation rate via coagulation being higher than loss rate via coagulation for these sizes.

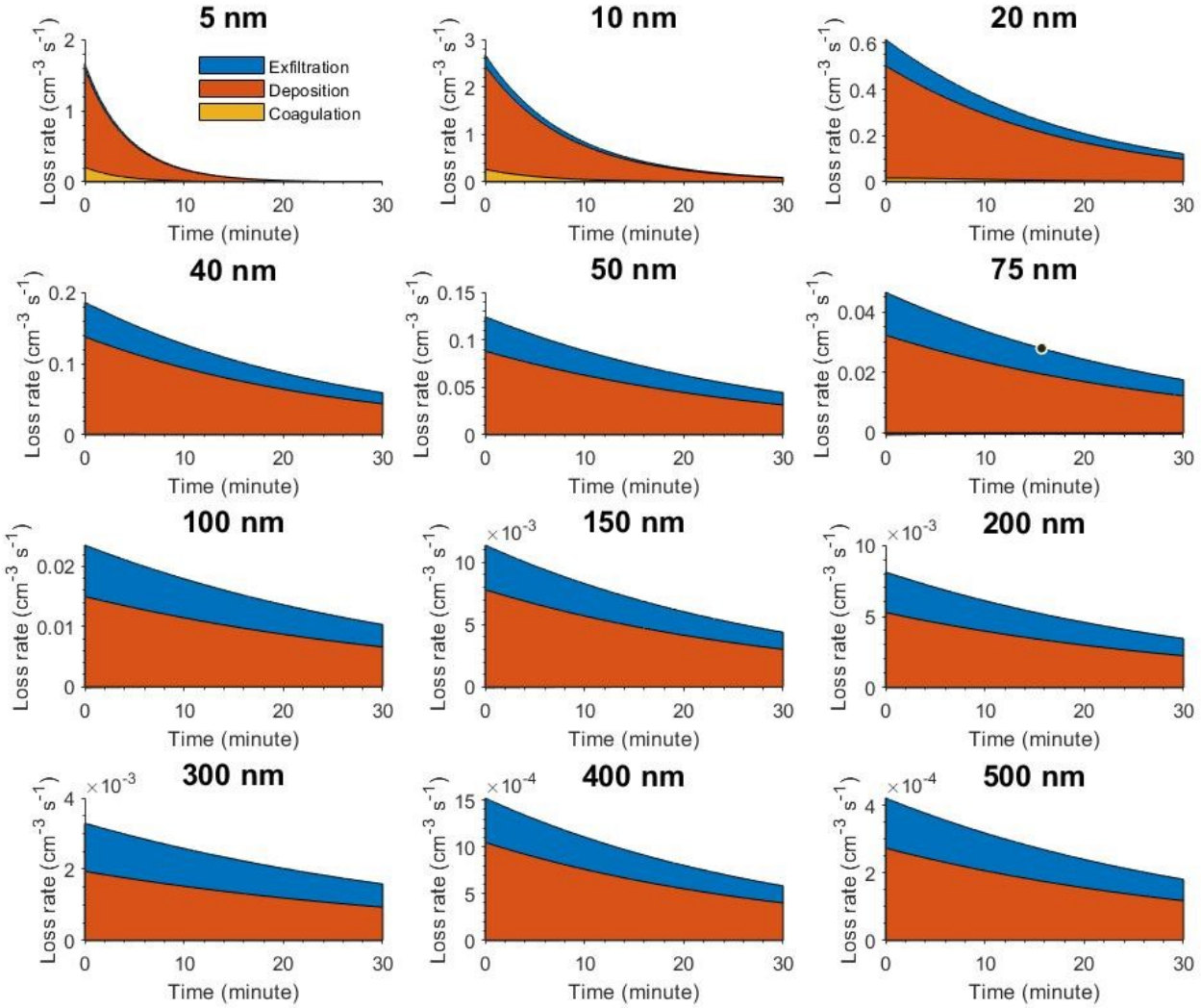

Figure S10. Time and size-resolved loss rate of particles via exfiltration, deposition, and coagulation during the first 30 minutes of the post-cooking decay phase following the chili on the fourth Layered Day experiment. The contribution of coagulation in the overall loss rates decreases with increasing particle size.

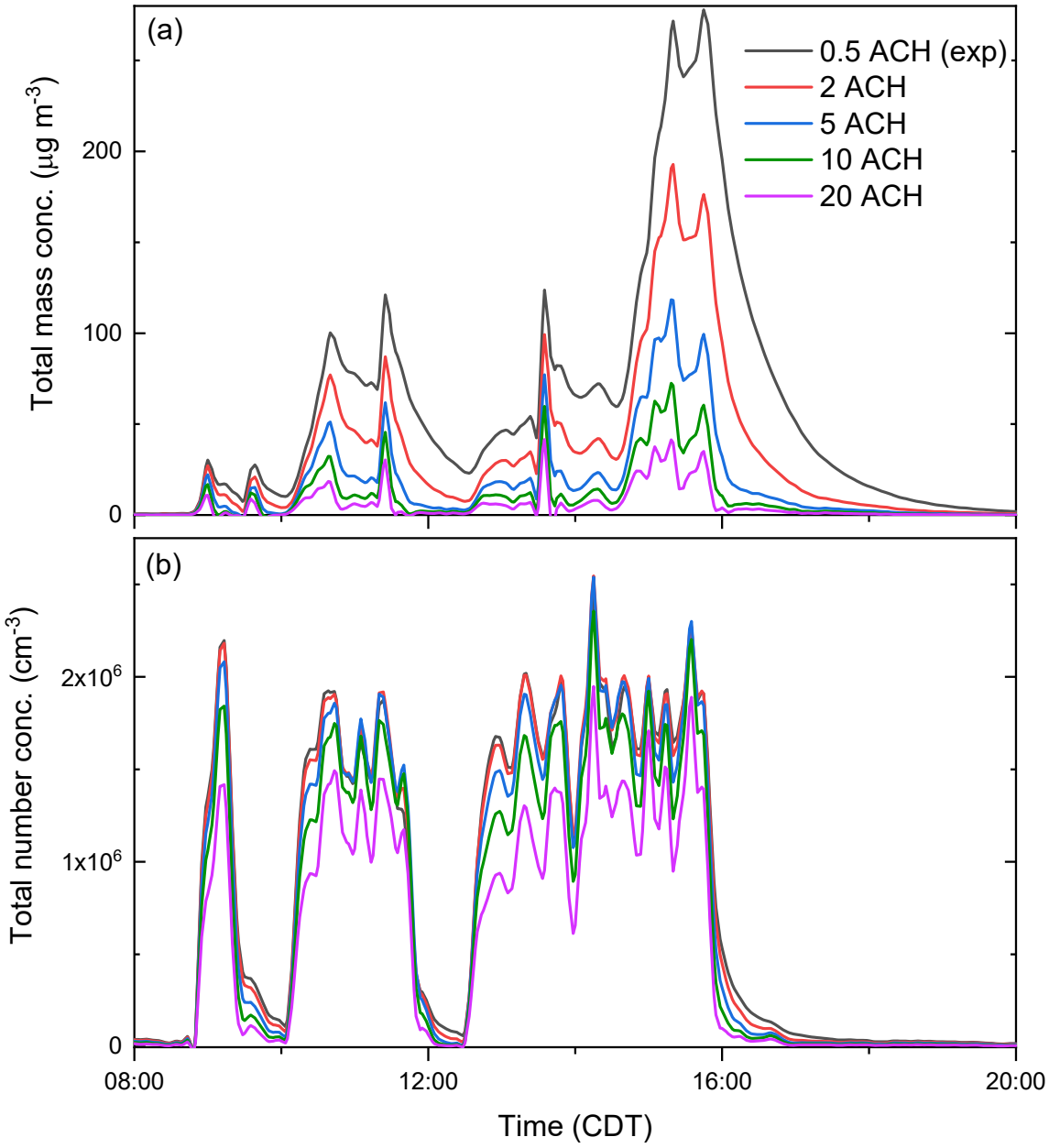

Figure S11. Effects of varying air exchange rates (equivalent to 2 ACH, 5 ACH, 10 ACH, and 20 ACH) on simulated (a) total mass concentration and (b) total number concentration inside the test house on one of the Thanksgiving Day experiments. Data corresponding to 0.5 ACH represents measured mass and number concentrations. ACH: air changes per hour.

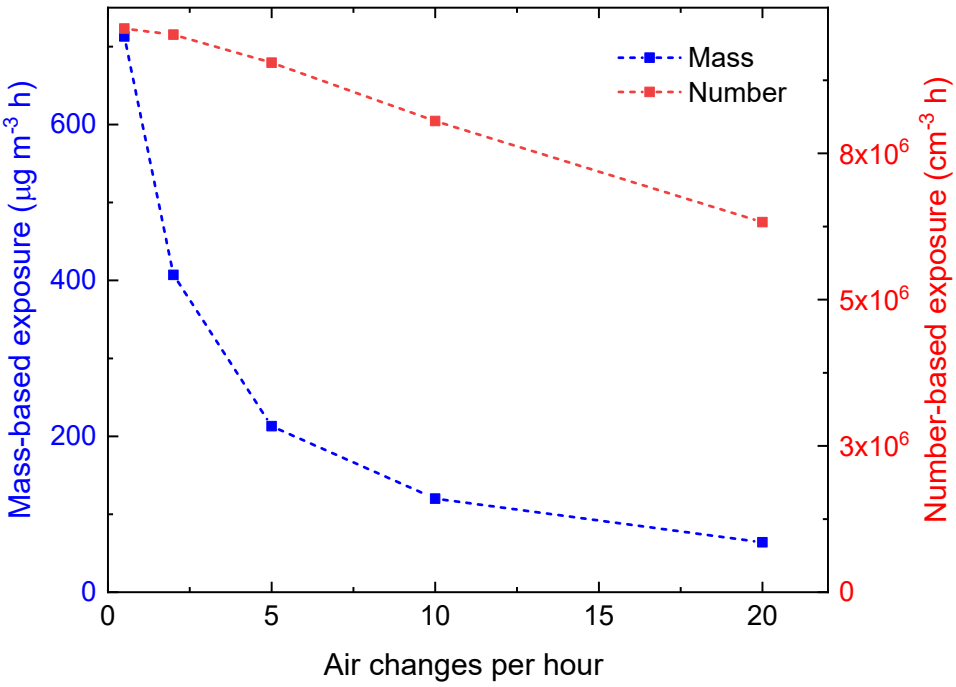

Figure S12. Simulated total 12-h PM number and mass exposure as a function of increments in ACH.

Table S1. Activity schedule for one of the Sequential Stir-fry experiments

Time (CDT)	Scheduled activity
08:25 AM	Volunteers enter the house.
08:35 AM	Cook stir fry for three on the hotplate, following instructions. Eat stir fry + rice; put leftovers in the plastic container and take it out. Load dishes in the dishwasher. Wash pots. Wait to start dishwasher until the end of the day. Clean the kitchen counters with a wet paper towel or soap.
10:35 AM	Turn off AC at the thermostat. Open doors and windows. Occupants minimized.
11:05 AM	Turn AC system on (ensure the thermostat is set at 76 °F) Close windows and doors. No occupants allowed in the house.
12:25 AM	Volunteers enter the house.
12:35 PM	Cook stir fry for three with the cast-iron pan on the stove, following instructions. Eat stir fry + rice; put leftovers in the plastic container and take it out. Load dishes in the dishwasher. Wash pots. Wait to start dishwasher until the end of the day. Clean the kitchen counters with a wet paper towel or soap.
02:35 PM	Turn off AC at the thermostat. Open doors and windows. Occupants minimized.
03:05 PM	Turn AC system on (ensure the thermostat is set at 76 °F) Close windows and doors. No occupants allowed in the house.
04:25 PM	Volunteers enter the house.
04:35 PM	Cook stir fry for three on the stove, following instructions. Eat stir fry + rice; put leftovers in the plastic container and take it out with you. Load dishes in the dishwasher. Wash pots. Wait to start dishwasher at the end of the day. Clean the kitchen counters with a wet paper towel or soap. Leave the house quickly.
08:25 PM	Volunteers enter the house.
08:35 PM	Cook stir fry for three on the stove, following instructions. Eat stir fry + rice; put leftovers in the plastic container and take it out with you. Load dishes in the dishwasher. Wash pots. Wait to start dishwasher at the end of the day. Clean counters with wet paper towel or soap. Leave house quickly with one short door-opening; minimize open door time

Table S2. Activity schedule for one of the Layered Day experiments.

Time (CDT)	Scheduled activity
08:25 AM	Volunteers enter the house.
08:35 AM	Cook breakfast for three (eggs, sausage, toast, cooked tomato, coffee). Load dishes in the dishwasher (run at the end of the day). Wash pots and pans.
10:05 AM	Prepare solution for mopping: 1/4 cup pine-based cleaner + 1 gallon water. Mop the kitchen and living room floors. Once done, weigh bucket + solution + mop.
11:35 AM	Cook stir fry for three on the stove, following instructions. Eat stir fry + rice; put leftovers in the plastic containers. Load dishes in the dishwasher. Wash pots.
12:35 PM	Wipe all countertops and tables with chlorine wipes.
01:05 PM	Make a pot of coffee (3 cups).
01:35 PM	Make two slices of toast.
03:35 PM	Cook chili.
05:05 PM	Kitchen cleanup. Load dishes in the dishwasher. Run dishwasher.
05:35 PM	Mop floors with chlorine-based cleaner: Prepare solution: 1/2 cup bleach + 1 gallon water. Weigh bucket + solution + mop. Mop the kitchen and living room floors. Once done, weigh bucket + solution + mop. Everyone leaves the house. House stays unoccupied.

Table S3. Activity schedule for one of the Thanksgiving Day experiments.[a]

Time (CDT)	Turkey	Sides dishes and dessert	Other activities
08:25 AM			Four volunteers enter the house
08:35 AM			Start cooking breakfast for 4
10:05 AM		Peel and cut sweet potatoes	Preheat oven; pies into the oven
11:05 AM		Boil sweet potatoes	
11:10 AM		Make cranberry sauce	
11:25 AM		Remove pies from the oven	
11:40 AM		Remove sweet potatoes	
12:25 AM			Reset oven to 450 °F
12:35 PM	Start roasting turkey 450 °F		
01:05 PM	Baste		
01:10 PM		Brown butter and sage cooked on the stove	
01:35 PM	Baste		
01:55 PM		Stuffing into oven	
02:05 PM	Baste		
02:35 PM	Remove turkey from oven		
02:40 PM		Sweet potatoes into the oven Brussels sprouts into oven	
03:15 PM		Make gravy on the stove	
		Brussels sprouts out of the oven	
03:35 PM			Guests arrive. Sit, eat.
04:35 PM			Dinner cleanup. Load dishes in the dishwasher, wash large pots and pans, wipe kitchen counters and tables with a chlorine-based disinfecting wipe.
05:05 PM			End of experiment. Run dishwasher. Occupants leave the house. Measurements continue throughout the night.

[a] Not all activities performed are included here.

Table S4. Cooking duration of different meals prepared during the HOMEChem study

Meal type	Cooking duration (min)
Breakfast	34 ± 10
Stir-fry (gas stove)	37 ± 10
Stir-fry (hot plate)	52 ± 6
Chili	68 ± 3
Lasagna	75

Table S5. Power consumption (with and without air conditioning) at different air exchange rates

Air changes per hour	Equivalent flow rate ($m^3\ s^{-1}$)*	Power consumption without air conditioning (kW)#	Power consumption with air conditioning (kW)^
0.5	0.03	0.02	0.3
2	0.14	0.07	1.3
5	0.35	0.17	3.2
10	0.69	0.35	6.4
20	1.39	0.69	12.8

*test house volume is 250 m^3

#assuming a constant pressure drop of 250 Pa and a fan with 50% efficiency

^outdoor air (30°C, 70% RH); indoor air (25°C, 60% RH); coefficient of performance (COP) of the air conditioning unit = 3

Table S6. Total PM number and mass emitted during different cooking activities

	Number emission			Mass emission (mg)		
	Sub-10 nm	10-100 nm	100-500 nm	Sub-10 nm	10-100 nm	100-500 nm
12-hour totals						
Layered Day	4.6×10^{16}	1.5×10^{15}	1.3×10^{13}	1.46	16.06	32.18
Thanksgiving Day	2.7×10^{17}	1.9×10^{16}	8.0×10^{13}	5.93	210.11	126.45
	2.7×10^{17}	1.8×10^{16}	7.8×10^{13}	5.91	199.45	121.88
Meal-wise (total over the cooking duration)						
Breakfast	9.7×10^{15}	7.0×10^{14}	4.1×10^{12}	0.35	6.69	7.27
Stir-fry (gas stove)	7.5×10^{15}	2.0×10^{14}	1.5×10^{12}	0.21	1.39	6.74
Stir-fry (hot plate)	6.1×10^{14}	8.6×10^{13}	1.1×10^{12}	0.02	0.77	6.28
Chili	1.8×10^{16}	2.9×10^{14}	9.8×10^{11}	0.40	1.27	3.72
Lasagna	4.3×10^{15}	2.7×10^{14}	1.0×10^{12}	0.09	1.99	9.39

References

(1) Patel, S.; Sankhyan, S.; Boedicker, E. K.; DeCarlo, P. F.; Farmer, D. K.; Goldstein, A. H.; Katz, E. F.; Nazaroff, W. W.; Tian, Y.; Vanhanen, J.; Vance, M. E. Indoor Particulate Matter during HOMEChem: Concentrations, Size Distributions, and Exposures. *Environ. Sci. Technol.* **2020**. https://doi.org/10.1021/acs.est.0c00740.

(2) Tian, Y.; Arata, C.; Boedicker, E.; Lunderberg, D. M.; Patel, S.; Sankhyan, S.; Kristensen, K.; Misztal, P. K.; Farmer, D. K.; Vance, M.; Novoselac, A.; Nazaroff, W. W.; Goldstein, A. H. Indoor Emissions of Total and Fluorescent Supermicron Particles during HOMEChem. *Indoor Air n/a* (n/a). https://doi.org/10.1111/ina.12731.