Forgot to add Elliott here ☹

Elliott: please see below/attached.

<2020_10_24_PM ratio-brs.xlsx>
<2020_10_31_ions concentration-brs.xlsx>

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On Nov 3, 2020, at 9:24 AM, Brent Stephens <brent@iit.edu> wrote:

Thanks Yicheng for the usual 8 am follow up! :)

Excellent to know the outside chamber ion concentrations. I thought they were indeed quite a bit lower than the ~1600 #/cc that was recorded inside the chamber with ionizer OFF, just prior to turning ionizer ON during experiments. I'm not sure why they were high then — it might be as simple as the device not being well grounded once in the chamber (although I'm happy to see 300 ions/cc reported this time — any reason why the difference that you can think of?). (I've attached some minor calculations added to your ions spreadsheet).

Regardless, I think our story is strong now — we have a chamber sitting in a lab being delivered lab air at about 1.2 ACH, single pass through. And in the lab area (the source of chamber air) without the ionizer on, ions are around 300-800 ions/cc. Inside the chamber you get 300 ions/cc or so. Then when we turn on the ionizer the chamber ion concentration increased to ~1900-2000 ions/cc, which means we're increasing between perhaps 3x and 6x over background. And those ion concentrations are consistent with what our engineers tell us the company tells them is appropriate for indoor spaces. So it seems realistic. Thanks for following up on these. And therefore, I think we should have no worries on the recirculation configuration. I don't think we need it — I think our current setup is generally good for representing realistic scenarios.

I'm copying my colleague Elliott Gall at Portland State here because we had a discussion about ion concentrations and representativeness yesterday. He's done some upstream/downstream VOC sampling as well on a GPS BPI unit, so we want to combine our results together in a paper.

On the initial PM I/O data — thanks. I like your approach to average 1-min concentrations across 20-min sample intervals (and then compare to the same average across the previous 20-mins with the sampler outside the chamber). Please see attached revision of your spreadsheet. I think one issue was there was an error in OPS mass concentration calculations, showing them to be in the hundreds of µg/m3. Way too high to be realistic. I compared to how we calculated previously from some OPS data a couple years ago and changed the formulate. *Please double check and check units.* But I think this is accurate now.

Using those data, I am trying to parse out a story but it's not super easy to see in my opinion. For one, outside chamber PM concentrations changed a lot during testing, and the chamber wasn't perfectly filtered, so whatever happens inside is not only a function of ionizer operation but also what's happening outside the chamber. If you look at inside chamber PM concentrations (e.g. PM1) on a mass basis or even Total SMPS on a number basis (which btw I limited to <116 nm because I don't trust those larger bins), it seems indoor concentrations were indeed lower during ionizer on. But if you look at PM1 outside the chamber, you also see that the outside chamber concentrations were higher with the ionizer off (both before and after). So it's hard to know if the indoor reductions are really due to the ionizer or due to ambient outside chamber conditions changing. So if you use the I/O ratio comparison, comparing each 20-min interval average to its prior 20-min interval average outside (due to the switching valve), then the I/O ratios are pretty much the same for PM1 and maybe slightly lower for PM2.5 and PM10 (but within uncertainty of SD).

So I think these PM data are generally suggestive of not much of an effective. It will be great to do the injection and decay analysis to see if we see the same thing or different with much higher inside chamber concentrations.

Thanks!

Brent

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On Nov 3, 2020, at 8:00 AM, Yicheng Zeng <yzeng15@hawk.iit.edu> wrote:

Hey Professor,