STANDARD DEVIATIONS: Air Handling Blows

Greetings,

My evaporative (swamp) cooler started making a funny noise.

And then The Boss started making a noise.

And not a funny one.

So, I climbed up on a hot asphalt roof and took apart the only barrier between almost-comfortable and extra-crispy. Luckily for me it was an easy fix with the inlet tubing. I avoided the scalding heat from the sun and a scalding scolding from my wife.

This little unit atop my hovel is the **engineering control** for our home's air cooling. It is simple, yet efficient. I rarely give it a second thought but it is a critical device in controlling the environment in my home. It keeps the temperature of the house and spouse at *nearly* tolerable levels.

And engineering controls make our hospitals and laboratories safe and comfortable, too.

The importance of our air handling engineering control is hard to overstate. We build these controls into the fabric of our work space to protect the staff and patients.

The air handling at Utah's Public Health Laboratory is pretty serious stuff compared to the dilapidated box struggling to keep The Boss cool. As a matter of fact, the high cost of running the UPHL building (one the most expensive in the State) is due to the air handling.

Most of our fourth floor is just moving air through the rest of the box. If you look around, you'd find a similar system in your facility. It sounds pretty simple. Just pull air into the building, filter it, make it the right temperature and humidity, push it through every room in one direction and pull it out another, and then filter it again and dump it back outside. Easy-peasy, right?

Our air intake rooms are huge, noisy fan/filter banks that pull constantly. The outside air is "conditioned" with water cooling to a set humidity range before entering the interior airflow. A complicated network of plumbed ventilation partitions the "freshened" air through the registers of every room at certain flow rates depending on the needs of areas for air exchange. The air is pulled through the building by the several B2 type biosafety cabinets of the BSL-3 testing space. These cabinets exhaust 100% of all the air through the roof vent where it is HEPA filtered before release to the atmosphere.

Our airflow is unidirectional and no air is re-circulated within the facility. The nature of this controlled breeze explains astronomical cost of running this UPHL building safely.

{One of the intake walls. Fans are drawing air through the grills.}

Pulling air into the building requires a huge amount of negative pressure that is created by banks of fans in an intake room isolated from the interior. That isolation is essential because the intake air must be treated, first.

Incoming air is filtered before being pushed around. The walls of this huge space are covered with heavy-duty filters. These filters must be replaced often because the incoming air is not as clean and pure as you might think.

{Intake filter wall. These are as white as the lattice at installation and these shown are only a couple weeks old.}

Filtered intake is cooled and humidified with water in a separate, enclosed room before moving onto the circulation. This is monitored with the flow of air mixing with the water.

Different areas of buildings may require different air handling. The air exchange rate is a regulated component of laboratory safety. Labs require a higher air change than administrative offices and it makes economical sense to control how much is pushed to certain areas of a huge facility. Air exchange ensures that the laboratory air is continually replaced, preventing an increase of air concentrations of toxic or hazardous substances.

Typically, 4-12 room air changes/hour are adequate. The variation is dependent on the type of work performed. It is important to realize that the process is one of dilution not extraction. The size of the room, the amount of stuff in the room, and the placement of the registers are factors affecting not only the rate of change but the quality of the change, as well.

So, pushing the right amount of air through a number of different spaces requires sophisticated plumbing and modulation.

{Differential pressure controls allow unique flow to different areas. This fan is controlling distribution flow. Treated air is pushed to each area at specific rates.}

Now most buildings use fans to push the air around; re-circulating air through several rooms and areas. Not us. At UPHL the air is moving through the building just once. Our BSL-3 biosafety cabinets are B2 behemoths that constantly pull room air and discharge 100% of their intake to exhaust. Our cabinets are pulling <u>everything</u> outside. The A2 cabinet you depend on for safely handling your flu and COVID-19 testing is recirculating some of the air right back into the lab. The B2 flushes everything it pulls outside the building.

{B2 biosafety cabinets exhaust 100% of the air to the outside. UPHL has several.}

Even though the exhaust from a B2 cabinet is HEPA filtered before venting from the cabinet, all of the air from UPHL is HEPA filtered again before release to the environment. The exhaust is sent through some massive filters on the roof that ensure any air vented from UPHL is better than the air that we pulled in.

{Air exhaust is diverted though two HEPA filtration units before discharge to the atmosphere.}

Now, keep in mind that redundancy is required. Everything seen here has a backup. That protective duplication is a constant for our facilities staff just as it is for the lab's bench instrumentation. And just like the Sysmex (or whatever breaks most for your lab) these things break down, wear out, and require TLC.

Preventive maintenance is a continuous and ongoing process of parts replenishment and testing. Filters require monitoring and change. Water must be checked for contamination. Pumps need calibration. Backups need to be tested and maintained. The air handling and supply are too important to ignore even though we hardly think about it.

Air handling is one of those background systems that we may take for granted but are vital to healthcare and the safe and proper conditions for lab science. Besides providing a stable and clean atmosphere for patients, air handling protects the laboratorian with directional airflow, sufficient air exchange, and controlled humidity. Knowing how it controls and protects your environment is an important piece of your safety understanding.

Have a great week and be safe,

Bryan