

Managing Fume Hood Inventory From Outside the Lab

Utilities and Energy Services Energy Efficiency Teams
and Fume Hood Management & Consumption

[B4 System Optimization](#)

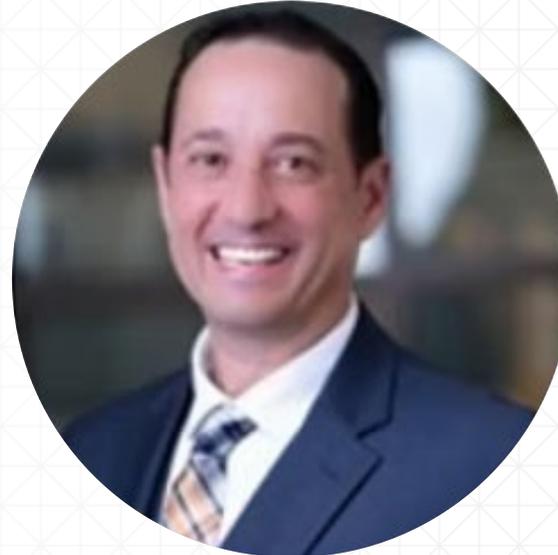


UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Today's Speakers



Sarah Grady
**Siemens Smart
Infrastructure Buildings**



Paul Foote
**F&S Utilities and Energy Services
University of Illinois Urbana Champaign**



Learning Objectives

Learning Objective 1: Learn how to use fume hood control systems to minimize hood and lab airflow.

Learning Objective 2: Gain an understanding of use/occupancy changes, planning/follow-up and system performance are directly impacting energy efficiency/conservation reflecting deviations from lab design.

Learning Objective 3: Learn proven techniques for interacting with the research community to accomplish these airflow reductions.

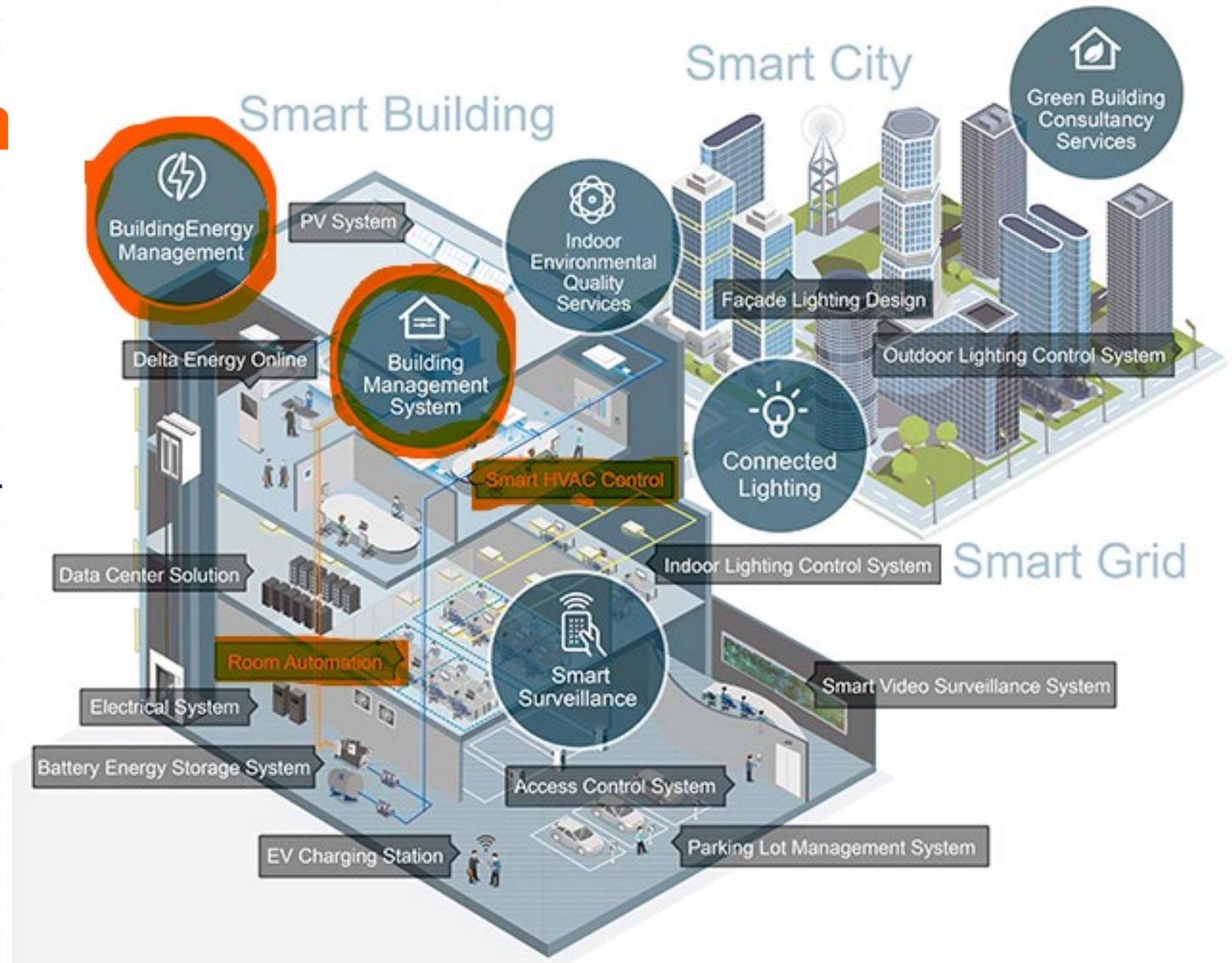
Learning Objective 4: Gain insight in to how hibernating, decommissioning and/or deenergizing fume hoods and adjusting lab airflows, cultivates relationships with the lab users and builds trust, also known as organizational “Magic”!



Building Automation System (BAS)

Electrification, monitoring and remote access linked to computer-controlled devices, now easier and more efficient.

Schedules, set points, max & min airflows, occupancy and CO2 sensors, day light harvesting and dimming automation, room level changes when you need them.



<https://blog.amerlux.com/5-reasons-you-should-invest-in-a-building-automation-system/>



Lab Building HVAC System

SOLAR INSTALLATIONS

Two utility-scale solar farms produce more renewable power than all but two university campuses in the country. Additionally, several campus buildings feature rooftop installations.

WIND POWER PURCHASE AGREEMENT

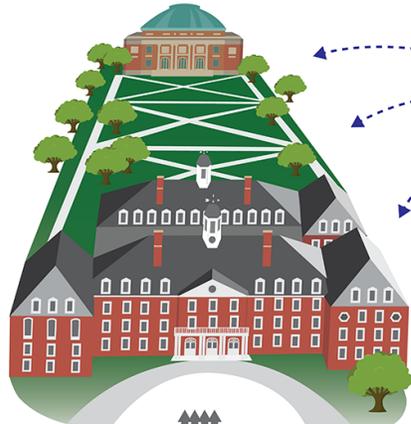
The university purchases six percent of its annual electrical demand from Rail Splitter Wind Farm, LLC, located north of Lincoln, Illinois.

ENERGY MARKET PARTICIPANT

The university purchases additional electricity from the MISO regional market to meet campus demand through Prairieland Energy, Inc.

ABBOTT POWER PLANT

The state-of-the-art co-generation power plant produces steam and electricity simultaneously, supplying approximately 85 percent of the energy for campus.



ENERGY MANAGEMENT CONTROL CENTER

Operators manage integrated data and control systems to create accurate demand and consumption forecasts. System displays aid in discovering inefficiencies, diagnosing problems, and dispatching corrective work.



THERMAL ENERGY STORAGE TANK

The campus chilled water system produces chilled water at night when electric rates are typically the lowest. The water is stored in a 6.5 million gallon tank and used to provide cooling during the day when electric rates are higher.



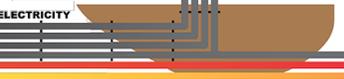
CAMPUS CHILLED WATER SYSTEM

A central distribution system uses water from regional chilled water plants to provide cooling for the majority of buildings on campus.



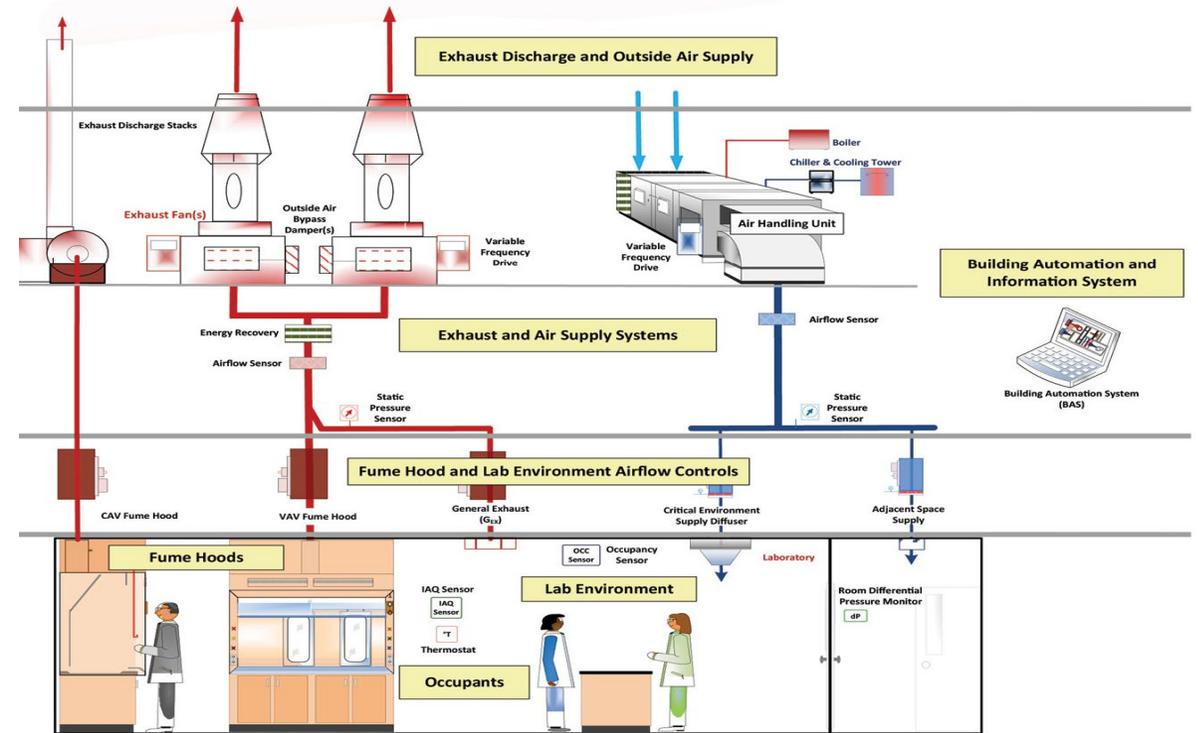
CAMPUS ELECTRICAL DISTRIBUTION SYSTEM

Utilities distribution maintains 71 miles of transmission lines which deliver electricity to campus. Most equipment is underground.



NATURAL GAS

Supplied from outside of campus.



<https://publications.aisa.org/202308-laboratory-ventilation>

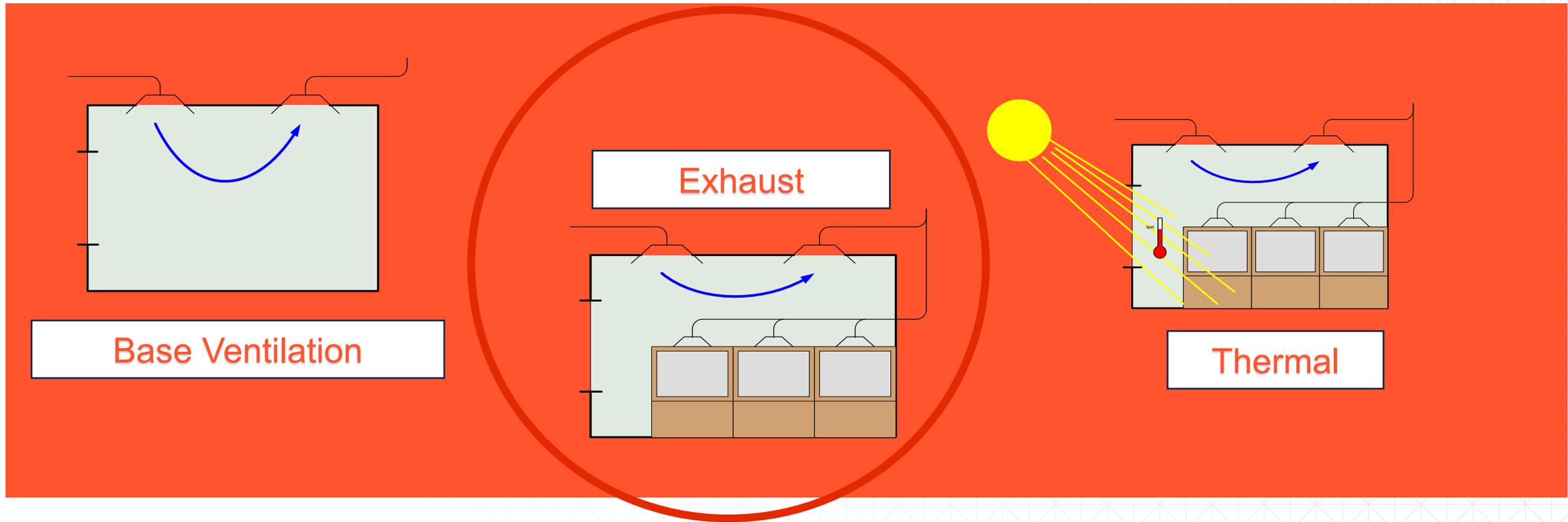
Graphic created by Thomas C. Smith

Connecting the end user to the rest of the system- production, distribution, building level and room level equipment.



Ventilation Drivers in Laboratories

Three Common Air Volume Drivers
Air volume drivers = Energy drivers



Getting Started, Connect with...

Facilities Systems and Controls- which houses many specialists- Direct Digital Control, installers, troubleshooters and programmers.

Retrocommissioning, Recommissioning teams & HVAC trades departments- sheet metal, pipefitters, refrigeration, steam and electrician shops etc.

Researchers, EHS/DRS & Faculty- Gain understanding of how the building HVAC and automation systems operate.

How new/old are they?

Do they have pneumatic or digital controls?

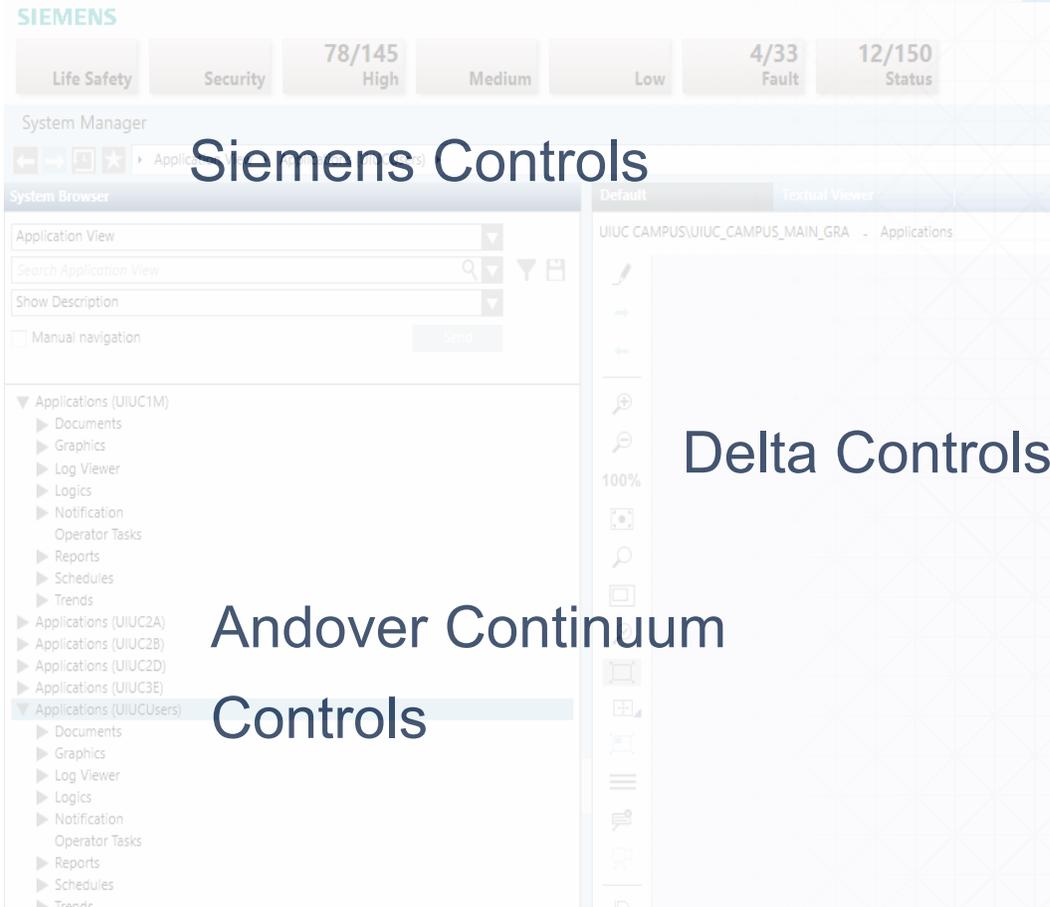
What type of AHU"s, supply and exhaust system is present?

Are the lab spaces tied into the rest of the building or are they separate?

Are there specialty systems present such as radiation isotopes, perchloric acid, safety cabinets for various Biosafety levels



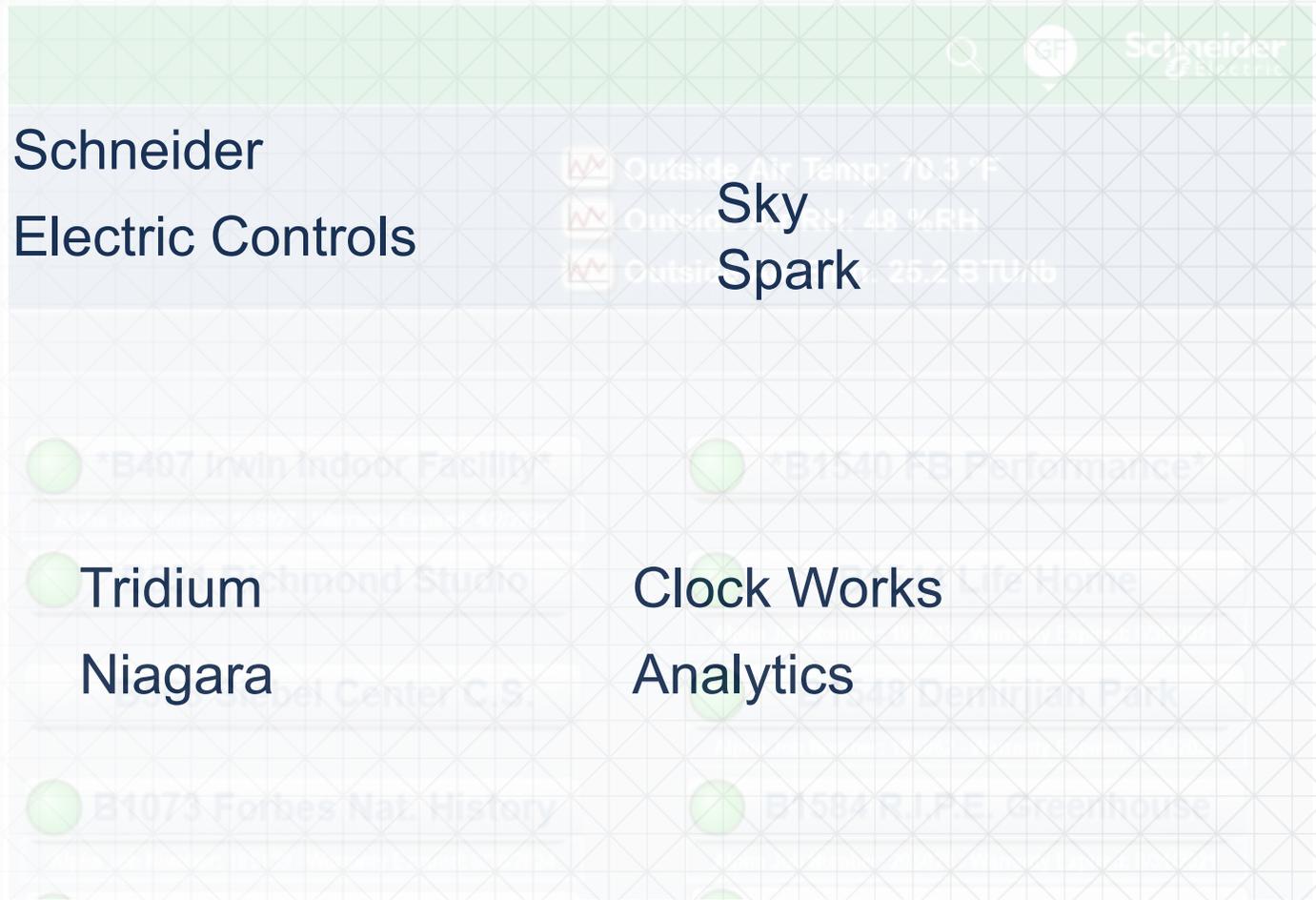
Building automation system companies



Siemens Controls

Delta Controls

Andover Continuum
Controls



Schneider
Electric Controls

Sky
Spark

Tridium
Niagara

Clock Works
Analytics

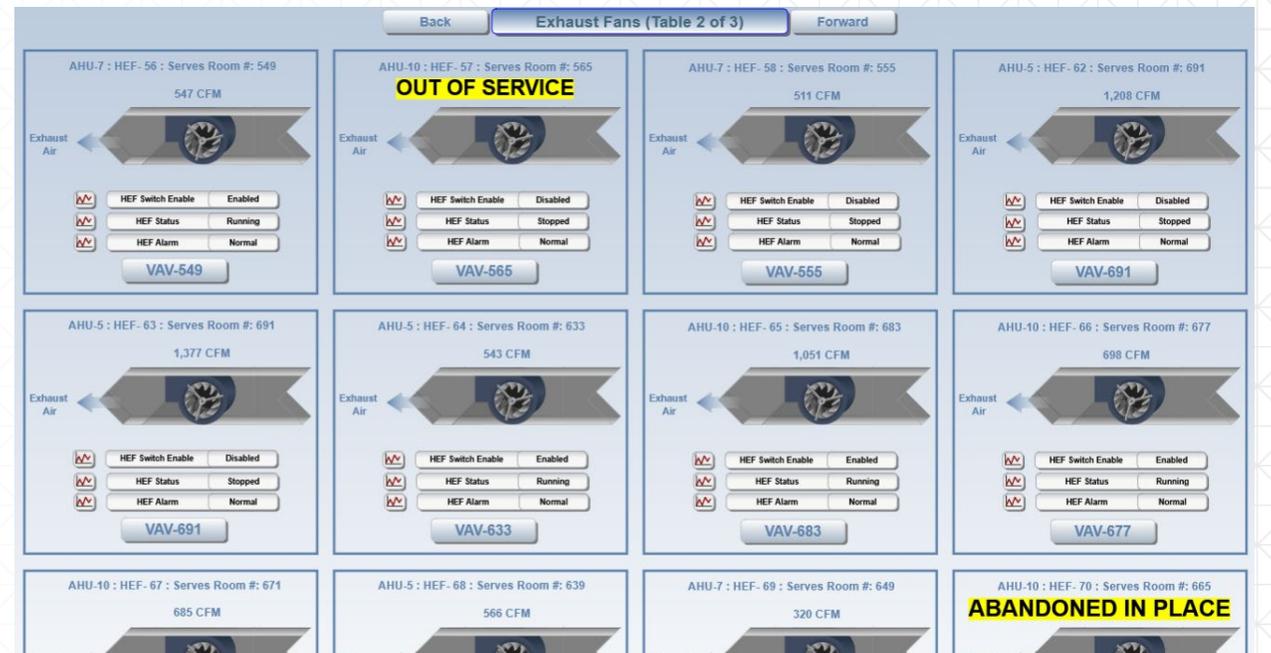


BAS software graphics pages

Top image reflects 3 high plume exhaust fan system, which operate any 2 at a time, alternating for wear and tear and utilizing the third for increased demand if necessary.

Bottom image

Individual exhaust fans per hood/snorkel exhaust



Decommissioning & Upgrading Dinosaurs



Abandoned in place- this hood was completely removed new PI does not need a hood.



Ancient hood lab now computational research



Decommissioning & Upgrading Dinosaur's

2021 Fume Hood Survey Results - SIB								
Morrill Hall								
Room	Location	Inspection Width	Inspection Height	Previous Face Velocity (LFPM)	Current Face Velocity (LFPM)	Status	Comments	Penny's working comments
65A	NE Corner	43	18	82	0	Not Tested	Penny Ok'd to deenergize	
65C	NE Corner	43	18	95	93	Pass	Penny is checking on status	are using it periodically, can turn off via
133	NE Corner	43	18	104	102	Pass	Penny sent email Nov 23rd	they feel the snorkel can decommission
139	NE Corner	43	18	90	92	Pass	Penny Ok'd to deenergize	
149	NW Corner	43	18	80	85	Pass		waiting for usage status
155	NE Corner	43	18	109	107	Pass	computational research OK'd to deenergize	
165	SE Corner	38	18	101	98	Pass	Penny Ok'd to deenergize	one of these
171	SW Corner	38	18	106	102	Pass	Penny Ok'd to deenergize	
183	SW Corner	43	18	89	89	Pass	Penny Ok'd to deenergize	
204	SE Corner	49.5	18	99	113	Pass		wip
215	East Wall	38	18	96	112	Pass		retired end of Dec
215	West Wall	38	18	82	94	Pass		retired end of Dec
216	West Wall South	37	18	100	115	Pass		wip
216	West Wall North	37	18	84	100	Pass		wip
233	NE Corner	43	18	98	91	Pass	Penny Ok'd to deenergize	
239	NE Corner	43	18	105	105	Pass		infrequent use, new researcher may use
249	NW Corner	43	18	87	82	Pass	Penny sent email Nov 23rd	occasional use, can turnoff when not in
255	NE Corner	43	18	108	105	Pass	?????	mix cyanide in this space without the fe
283	SW Corner	43	18	94	106	Pass	Penny sent email Nov 23rd	wip
303	NE Corner	50	18	90	102	Pass		infrequent use and turn off with working
315	South Wall	44	18	107	108	Pass	volatile reagents for microscopy	will shut off hood
317	West Wall	38	18	-	-	Not Tested	Not Balanced	
339	NE Corner	43	18	101	105	Pass	can be de-energized	de-energize
349	North Wall West Hood	43	18	97	97	Pass	chemical storage ???	
349	North Wall East Hood	43	18	97	100	Pass	switches need connected	is willing to use 349's hood when needed
355	NE Corner	43	18	91	0	Fail	Penny sent email Nov 23rd	de-energize
417	NW Corner	38	18	-	-	Not Tested	Not Balanced	
420A	NW Corner	38	18	116	93	Pass		
433	NW Corner	43	18	88	92	Pass		
439	NE Corner	43	18	92	103	Pass		
449	NW Corner	43	18	103	107	Pass	Mostly in IGB Penny will ask about frequency	
455	NE Corner	43	18	101	105	Pass	Mostly in IGB Penny will ask about frequency	
465	SE Corner	43	18	103	109	Pass	looking into chemical storage	mostly chemical storage
471	SW Corner	43	18	110	113	Pass	wants switches and target for replacement	
477	SE Corner	43	18	110	112	Pass	wants switches and target for replacement	
483	SW Corner	43	18	111	111	Pass		
505A	East Wall	38	18	114	111	Pass		
518	West Wall	50	18	118	111	Pass		
633	NW Corner	43	18	92	87	Pass	pouring solvents, check on scheduling	
639	NE Corner	43	18	85	88	Pass	targeted upgrade	
649	NW Corner	43	18	-	-	DeEnergized	Penny sent email Nov 23rd	
655	NE Corner	43	18	118	109	Pass	occasionally, switch needs to work	connect switches
665	SE Corner	43	18	107	0	Fail	Penny Ok'd to deenergize/ dept. will remove this hood	
671	SW Corner	43	18	93	0	Not Tested	Room Being Renovated	
677	SE Corner	43	18	97	116	Pass	Penny looking for new hoods	
683	SW Corner	80	18	82	102	Pass	6' hood that can be reduced to 4'	
691	SE Corner	80	18	114	117	Pass	may be able to reduce to one hood	storage options ???
691	NE Corner	80	18	102	120	Pass	may be able to reduce to one hood	storage options ???



Decommissioning & Upgrading Dinosaur's

Morill Hall	MCB									
Room	Location	Inspection Width (inches)	Inspection Height (inches)	Previous Face Velocity (LF/ft)	Current Face Velocity (LF/ft)	Status		Comments	Dennis' working comments	
15i	SE Corner	39	18	98	115	Pass		Awaiting response	Can turn off at the switch, use	
16	NW Corner	38	18	97	111	Pass		Awaiting response	New PI moves in or research	
103	East Wall	38	18	80	102	Pass		In use		
104	East Wall North Hood	50	18	106	106	Pass		In use		
104	East Wall South Hood	50	18	92	110	Pass		In use		
116	SW Corner	62	18	75	94	Pass		In use		
365	SE Corner	43	18	111	107	Pass		Dennis Ok'd waiting on chemicals removed		
371	SW Corner	43	18	101	101	Pass		very active		
533	NW Corner	43	18	-	-	Not Tested		Blocked deenergized Ok'd by Penny/Dennis		
539	NE Corner	43	18	-	-	Not Tested		Broken/ Blocked	can be de-energized per Dennis	
549	NW Corner	43	18	93	91	Pass		switch inoperable could be off		
555	NE Corner	43	18	93	98	Pass				
565	SE Corner	43	18	87	92	Pass		Dennis Ok'd waiting on chemicals removed		
583	SW Corner	43	18	87	89	Pass		In use		
591	West Wall	38	18	89	109	Pass		In use		
606	SW Corner	60	18	103	104	Pass		In use		
615	West Wall	62	18	101	104	Pass		In use		
618	West Wall	38	18	98	102	Pass		In use		
383	SW Corner							remodeled hood removed theoretical lab only	theoretical lab hood not going	
377	SE Corner							Peter Yau very active lab, change room exhaust to separate, then hood use can be reduced considerably		



Decommissioning & Upgrading Dinosaur's

This project was slated to replace existing standard fume hoods which use from 550 to 1200 cfm's of air and upgrade them to a lower flow requirement type hood that operates from 350– 550 cfm of airflow.

The portion of the project that was completed was able to remove 8 fume hoods and/or snorkel devices from operation.

We estimate 1 fume hood uses approximately \$7000 in energy which yields removal of potential annual reduction of \$56k just on these 8 removals.

The extensive research, collaboration and planning that was required to execute this unprecedented project caused a 2.5-year long delay in completion to this point. If the faculty and college are still on board and operating in similarly, I suspect we would be able to pick up where we left off quickly and execute the rest of the project within the upcoming year to 18 months.

\$325k secured in funding, spent \$70k in removing 8 hoods replacing bench tops, sinks, capping all duct work and decommissioning exhaust fans, etc..



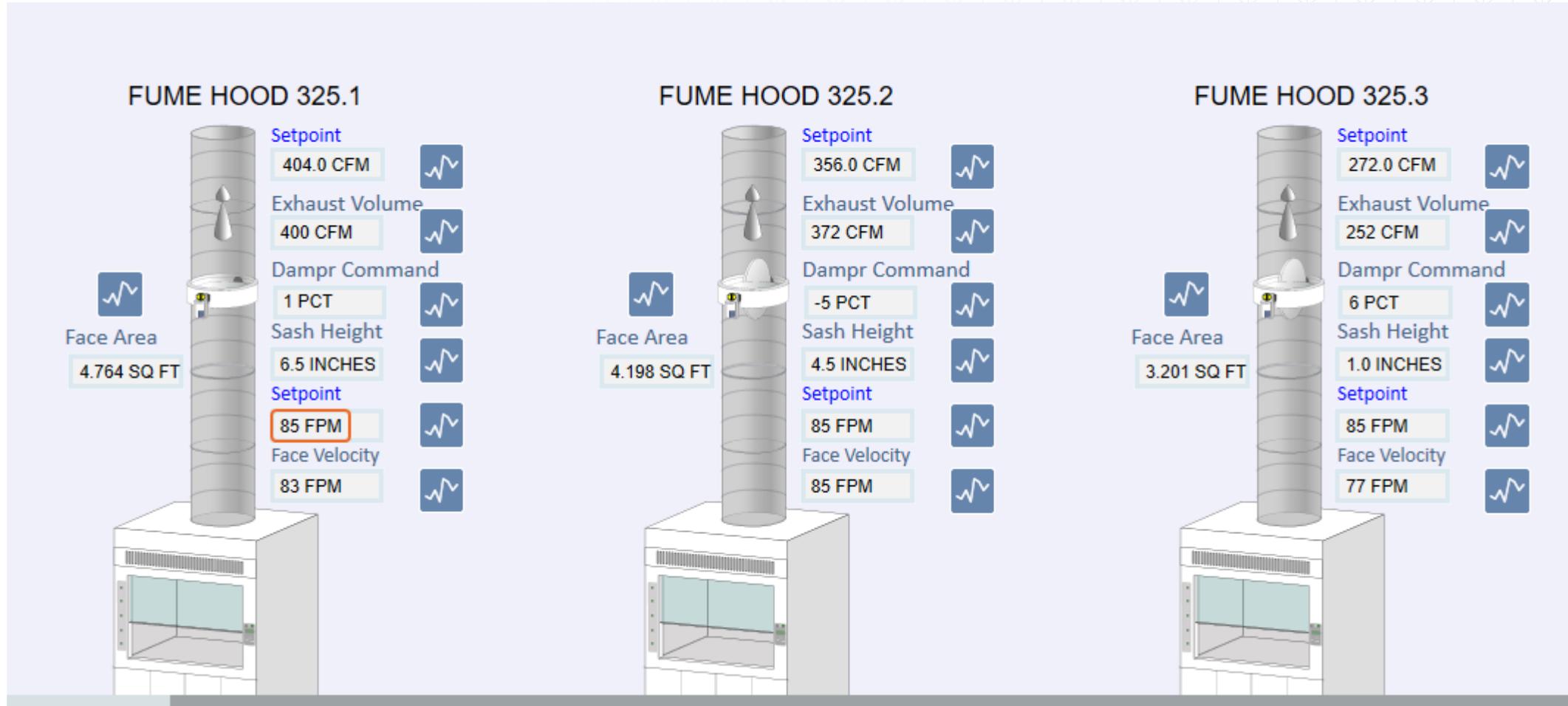
Monitoring and Troubleshooting

Fume Hood	Sash Position	Face Area	Face Vel	Damper	Exh Flow	Low Alarm	Emer Alarm	Trends	A/A/O	D/D/O
A303	1 INCHES	3.1 SQ FT	128.0 FPM	0.0 %	388 CFM	NORMAL	ALARM			
A307.1	3 INCHES	3.8 SQ FT	84.0 FPM	0.0 %	320 CFM	NORMAL	NORMAL			
A314	3 INCHES	3.6 SQ FT	84.0 FPM	0.0 %	308 CFM	NORMAL	NORMAL			
A323.1	11 INCHES	3.9 SQ FT	85.0 FPM	4.0 %	312 CFM	NORMAL	NORMAL			
A323.2	1 INCHES	2.0 SQ FT	84.0 FPM	0.0 %	172 CFM	NORMAL	NORMAL			
A323.3	2 INCHES	2.3 SQ FT	85.0 FPM	0.0 %	196 CFM	NORMAL	NORMAL			
A325.1	4 INCHES	4.1 SQ FT	125.0 FPM	2.0 %	500 CFM	NORMAL	ALARM			
A325.2	2 INCHES	3.5 SQ FT	80.0 FPM	6.0 %	276 CFM	NORMAL	NORMAL			
A325.3	4 INCHES	4.1 SQ FT	78.0 FPM	4.0 %	332 CFM	NORMAL	NORMAL			
A327.1	6 INCHES	4.6 SQ FT	83.0 FPM	1.0 %	396 CFM	NORMAL	NORMAL			
A327.2	18 INCHES	8.2 SQ FT	77.0 FPM	14.0 %	604 CFM	NORMAL	NORMAL			
A329.1	8 INCHES	5.2 SQ FT	84.0 FPM	1.0 %	440 CFM	NORMAL	NORMAL			
A329.2	5 INCHES	4.4 SQ FT	83.0 FPM	2.0 %	364 CFM	NORMAL	NORMAL			
A329.3	7 INCHES	4.9 SQ FT	83.0 FPM	2.0 %	412 CFM	NORMAL	NORMAL			
A329.4	27 INCHES	12.1 SQ FT	52.0 FPM	5.0 %	636 CFM	ALARM	NORMAL			

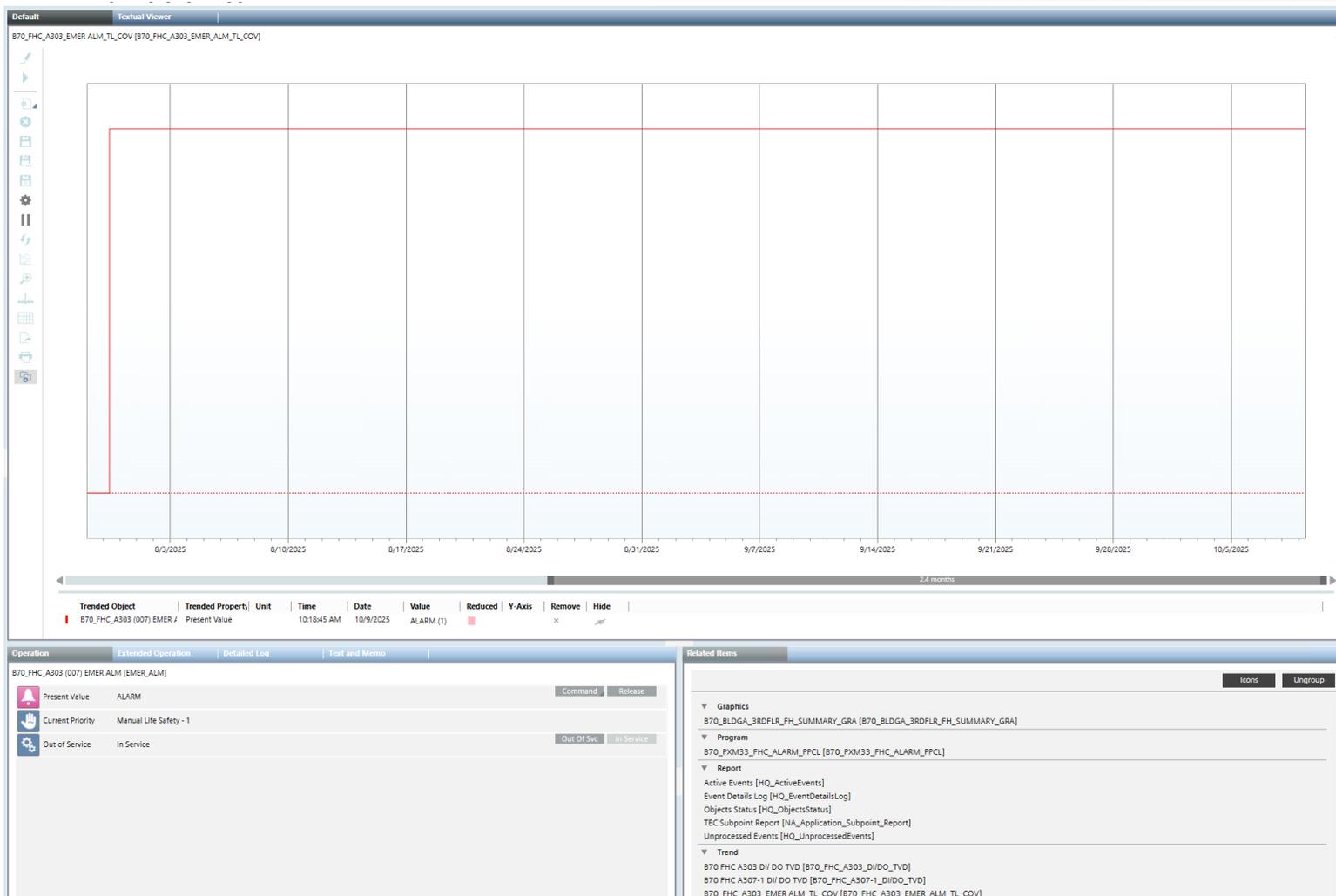
One Fume Hood in override can equate to \$1000 annually



Monitoring and Troubleshooting



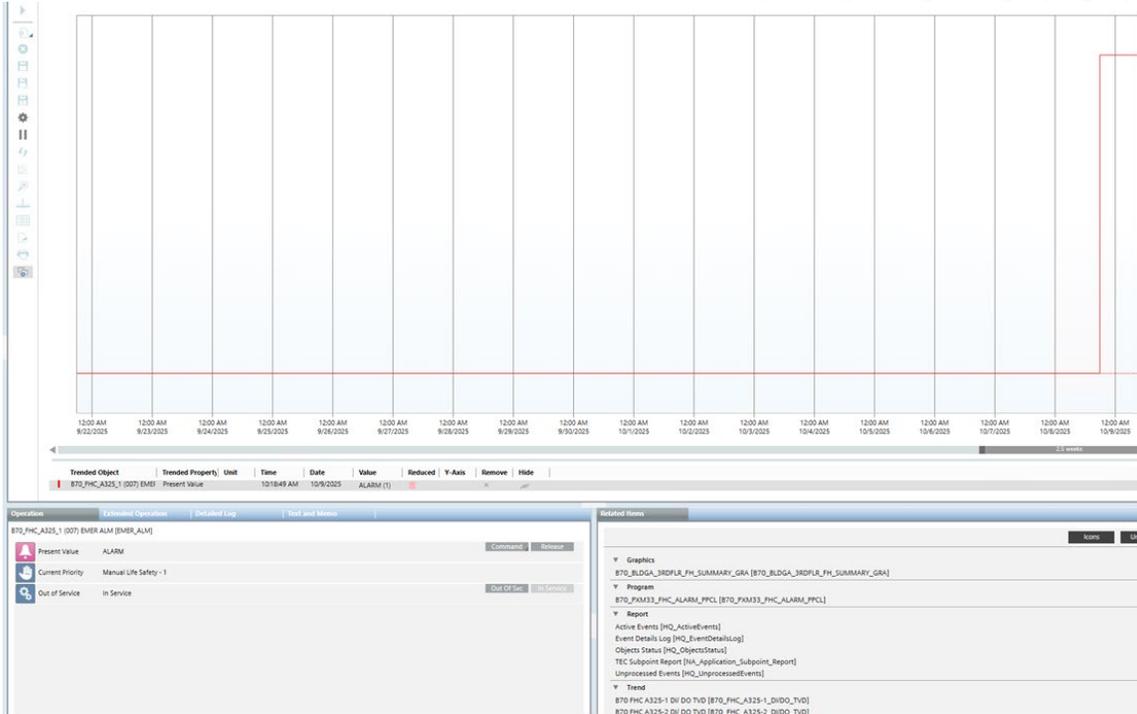
Monitoring and Troubleshooting



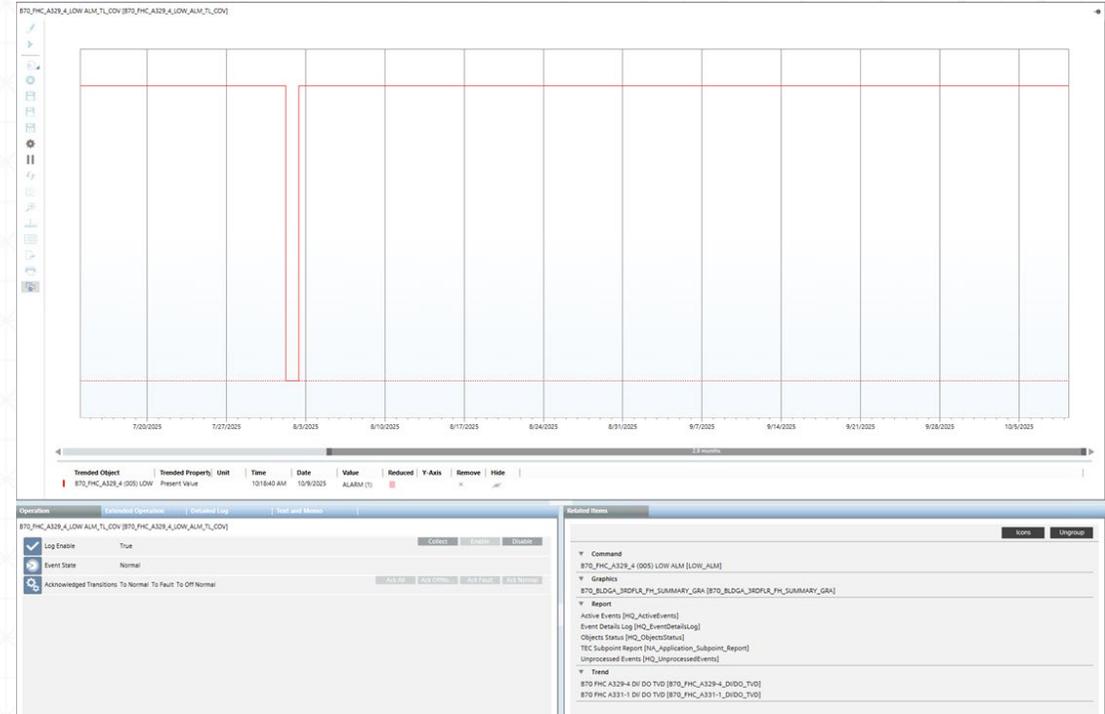
Alarmed in emergency override since 8/2/25



Monitoring and Troubleshooting



Only in emergency alarm since 10/08/2025



Low flow alarm and excessive sash height since mid-July 2025



Monitoring and Troubleshooting



Sash position sensor or user error open for months at 23 inches, this is a constant volume hood.



Sash position sensor or user error open since Nov 1st at 26 inches, this is a VAV hood running at 100% open damper position and fluctuating from 640- 820CFM.



Research Safety, Associate Director of Facilities & Safety, Control Center Collaboration

My Update email: @ 9:08 AM

“Please find the latest fume hood readings for Chem Life A building. I realize the sensors and graphics may be out of calibration, so let me know if you feel this is a human or instrumentation error?”

Director Facility Manager to Lab Safety Coordinator: @ 9:10 AM

“When you have a moment, would you stop by and look at this? If you need to grab Jay on the way, please do.”

Lab Safety Coordinator: @ 9:19 AM

“It appears that A303 and A325 were accidental activations, so I have put those back into normal operation. We need to get someone out to investigate sensor for A329.4. Changing the sash positions did nothing to move the hood out of "low alarm" status.”

Control Center Technician: @ 9:40 AM

“Thank you for the account number, I’ll put in a work request.”



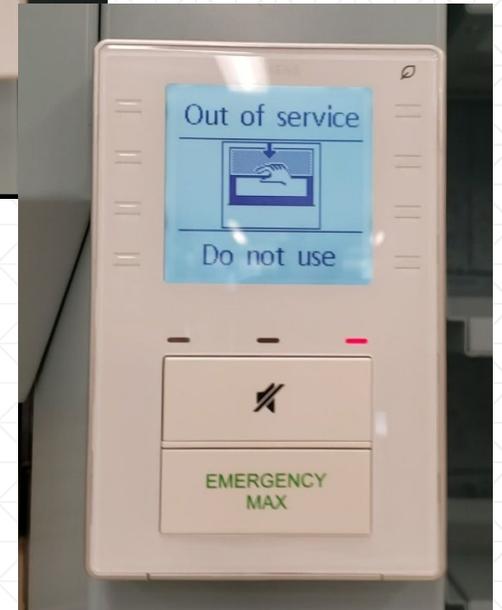
Hibernation Hydro-systems Lab



Classroom/Lab



Reduced
400 CFM
per hood
and fan
energy by
50%



**Collaborated with PI,
facility manager and EHS to reduce total airflow from both hoods.**



BAS Hibernation Mode

Hydro-systems Lab

BACnet Objects

▲ WARNING			
	<p>Setting for Fume hood administrative mode</p> <p>FhAdmMod = 4:Startup during setup and commissioning. This keeps audible alarms off.</p> <ul style="list-style-type: none"> After startup FhAdmMod must be set to Normal so that alarms are audible. 		
Description	Object	Type	Default value
<p>Fume hood administrative mode</p> <p>► Defines the administrative / operational state of the fume hood.</p> <p>1:Normal 2:Decommission 3:Nonfunctional decommission 4:Startup</p> <p>Note</p> <p>In Decommission the controller is functional but the flow setpoint is 0 and alarming is limited (P87 ODP displays "Out of service" and "OFF"). If the sash is opened, control returns to the hood and FhAdmModEff (Fume hood effective administrative mode) changes to Violated decommission; P87 still displays Out of service, but not OFF.</p> <p>Nonfunctional decommission is similar to Decommission except that nothing changes if the sash is opened.</p> <p>To enter fume hood administrative modes 2 and 3 the fume hood sash(es) must be in closed position, and:</p> <p>FhFaceArea < UcdAlrtArea, or FhSashPos < UcdAlrtPos.</p>	FhAdmMod	MCnfVal	4:Startup

Start-up/Decommission Mode

The Fume Hood Controller contains different modes controlled by STARTUP MODE (default = 3). These modes of operation allow the controller to be started up without nuisance alarms being sounded at the hood. These modes are useful at different stages of construction and after decommissioning.

The FHC also contains decommission modes and allow some or all of the functionality of the controller to be turned off.

The modes are described as an enumerated point:

STARTUP MODE	Mode	Description
0	Normal	The controller is fully functional
1	Decommission	The controller is fully functional, except the flow setpoint is set to 0, alarming is limited and the ODP displays "Out of service" and "OFF". If the sash is opened, control is returned and the user is notified that the hood is "Out of service".
2	Non-functional Decommission, closed	The controller is fully functional, except the flow setpoint is set to 0, alarming is limited and the ODP displays "Out of service" and "OFF". If the sash is opened, nothing changes.
3 (default)	Non-functional Startup	The controller is fully functional, except alarming does not work and the ODP displays "Controller - Startup" and "OFF".

To enter modes 1 and 2 the fume hood sashes must be in the closed position, FACE AREA must be smaller than UN ALRT AREA.



Chemistry Teaching Lab Operating Parameters

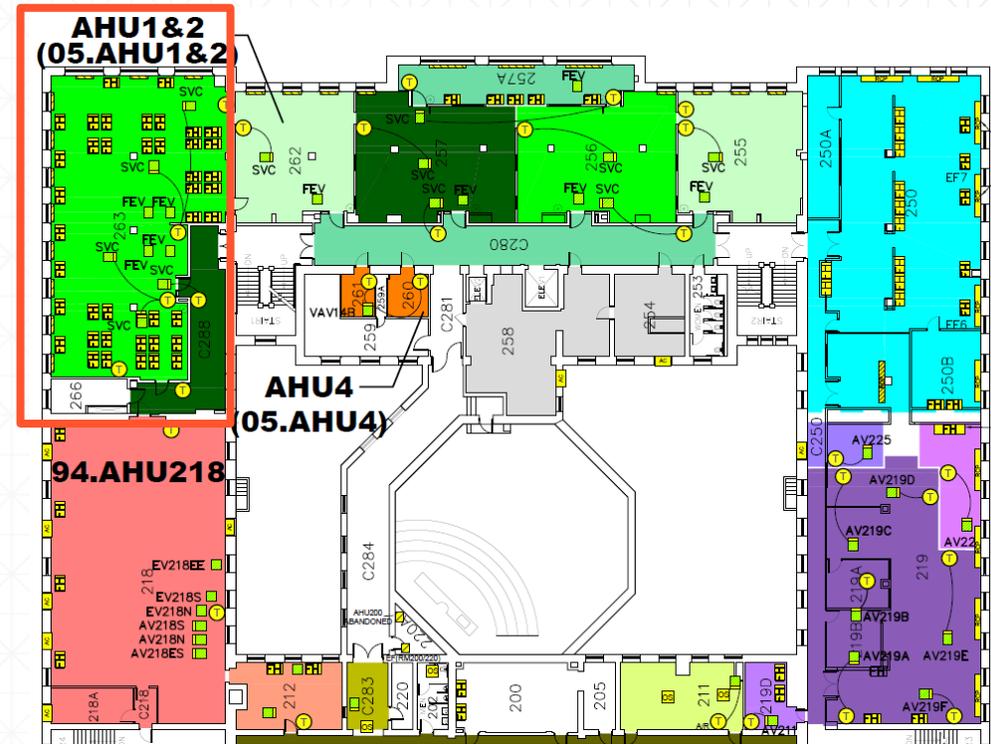
ORIGINAL TEACHING LAB UNDERGRADS

Lab 263- 40 fume hoods (25000 cfm)

Room level Vav boxes controls

- 1) **Occupied mode:** Lab supply and exhaust VAVs - airflow is increased from unoccupied set points to occupied set points over 10 minutes.
- 2) **Unoccupied mode:** Lab supply and exhaust VAVs - airflow is reduced from occupied set points to unoccupied set points over 10 minutes. Unoccupied mode is the SETBACK mode in the scheduling software, and *results in ~25% exhaust flow.*
- 3) **Vacant mode:** During breaks when chemicals are cleared – Zero ventilation for labs 255-263 except prep-lab 257A. 500 cfm supply air to Lab 255 and 263 to avoid air in the labs to become stale.

Vacant mode results in 0 exhaust flow to the rooms FEmin drops to 0.



Chemistry Teaching Lab Operating Parameters

New Lab renovation Grads & PHD's

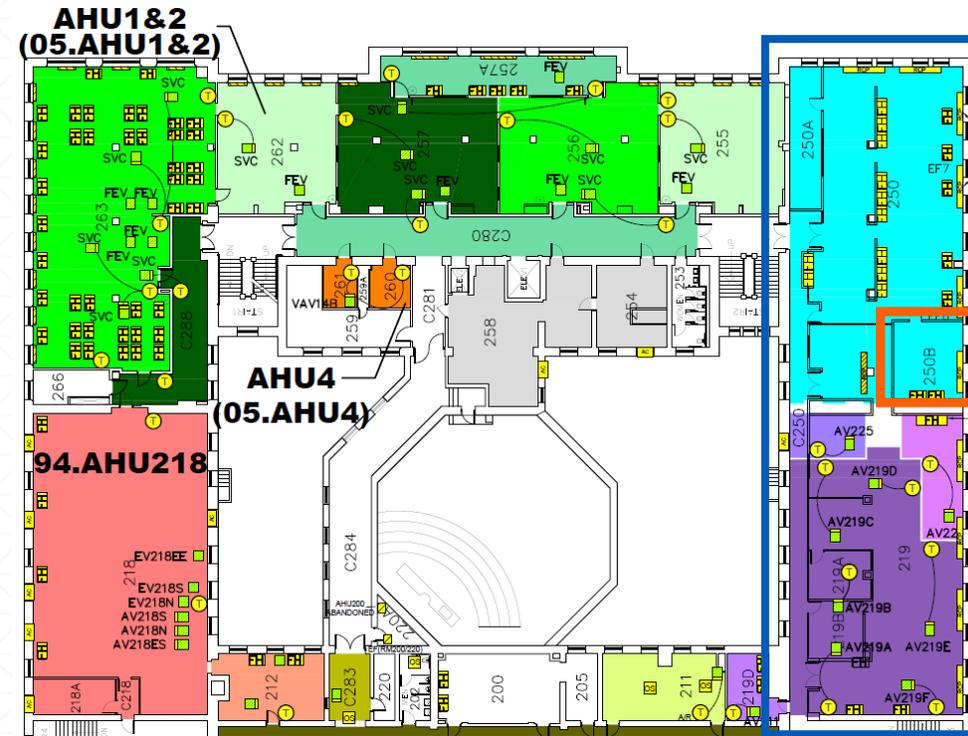
Lab 219/250- 24 new fume hoods

New AHU, DDC controlled VAV boxes and occupancy sensors.

Chemical storeroom with 2 hoods for chemicals

The screenshot displays a control interface for HVAC and exhaust systems. It is divided into several sections:

- AIR HANDLING UNITS:** A list of units (AHU-1 through AHU-12) with columns for Schedule Status and Equipment Status. For example, AHU-1 and AHU-2 are ON, while AHU-DX22 has SETBK OFF.
- UTILITIES - HEATING & COOLING SYSTEMS:** Includes a 'HEAT RECOVERY SYSTEM FOR STUDENT LABS'.
- EXHAUST SYSTEMS:** Includes 'FUME HOOD EXHAUST LABS 255 - 283'.
- FLOOR PLANS:** A vertical list of floors from BASEMENT FLOOR to ROOF FLOOR.
- SUMMARY VIEWS:** A grid of buttons for various summary reports, such as 'AHU-4 DXR VAV SUMMARY', 'AHU-10 DXR VAV SUMMARY', and 'DXR LAB SUMMARY'.

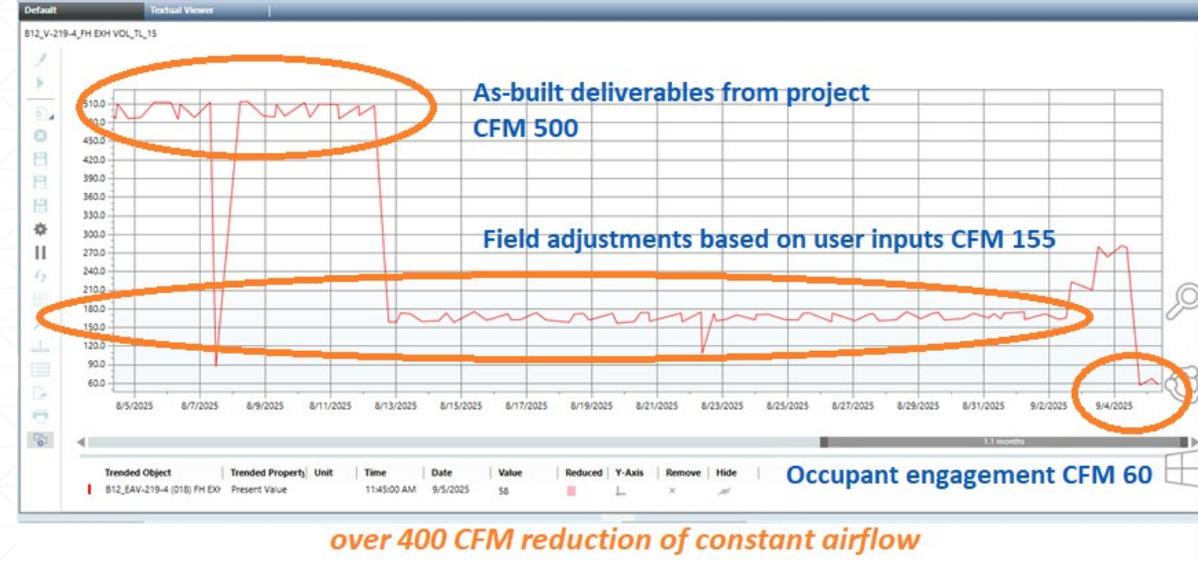


PROGRAMMING ENGINEER “ THEY PAID TENS OF THOUSANDS OF DOLLARS FOR THIS SPECIALIZED HVAC & DDC EQUIPMENT, THEY MIGHT AS WELL USE IT TO REDUCE THEIR ENERGY BILL AND SPEND THAT MONEY ON OTHER RESEARCH STUFF”



New Lab Renovation 24 hoods in two teaching labs

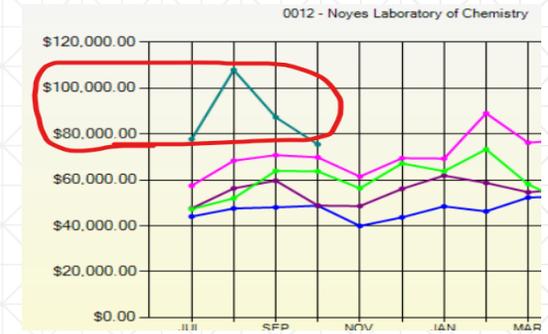
Fume hood width	Fume Hood working area all 2.5 ft deep	Fume hood area with sash at 28"	Fume hood area with sash at 18"	Min AF w/ Campus Std. at 25 CFM per sft @ 18"	8/5/2025 actual air flow	Min AF w/ Campus Std. at 25 CFM per sft @ 28"	Min AF w/ Campus Std. at 25 CFM per sft @ 18"	Forecasted Savings	Readings per Siemens Graphics Sept 5th 2025	Readings per Siemens Graphics	Readings per Siemens Graphics	Airflow difference
Outside width	total working area sqft	total working area sqft	total working area sqft	min airflow CFM	actual air flow	min airflow CFM	min airflow CFM	Air flow reduction	actual air flow	actual air flow	actual air flow	Airflow difference
5'	10.625	9.91667	6.375	159.375	254	247.917	265.625	200	532	256	350	84
5'	10.625	9.91667	6.375	159.375	254	247.917	265.625	200	252	252	351	85
5'	10.625	9.91667	6.375	159.375	256	247.917	265.625	200	537	253	345	79
5'	10.625	9.91667	6.375	159.375	254	247.917	265.625	200	541	256	350	84
5'	10.625	9.91667	6.375	159.375	257	247.917	265.625	200	533	250	350	84
5'	10.625	9.91667	6.375	159.375	254	247.917	265.625	200	547	255	347	81
5'	10.625	9.91667	6.375	159.375	248	247.917	265.625	200	533	246	353	87
5'	10.625	9.91667	6.375	159.375	249	247.917	265.625	200	538	255	347	81
5'	10.625	9.91667	6.375	159.375	256	247.917	265.625	200	440	251	338	72
5'	10.625	9.91667	6.375	159.375	255	247.917	265.625	200	258	252	352	86
5'	10.625	9.91667	6.375	159.375	255	247.917	265.625	200	474	255	346	80
5'	10.625	9.91667	6.375	159.375	257	247.917	265.625	200	255	253	340	74
5'	10.625	9.91667	6.375	159.375	251	247.917	265.625	200	255	258	353	87
8'	17.9167	16.7222	10.75	268.75	335	418.056	447.916667	300	350	346	344	-104
6'	12.9167	12.0556	7.75	193.75	302	301.389	322.916669	375	428	300	350	27
6'	12.9167	12.0556	7.75	193.75	327	301.389	322.916669	500	554	294	339	16
						6295.14		5,707		6,990	8,749	1,565
						2,454		3,042			1,759	
						28%	% reduction	35%	% reduction		20%	% reduction
					8/5/2025						7/30/2025	
						\$7.00	energy cost per cfm of ventilation per year					
						\$39,949.00	total annual savings with 24/7 setbacks					
						\$19,974.50	12 hours per day setback					
						\$29,961.75	18 hours per day setback					



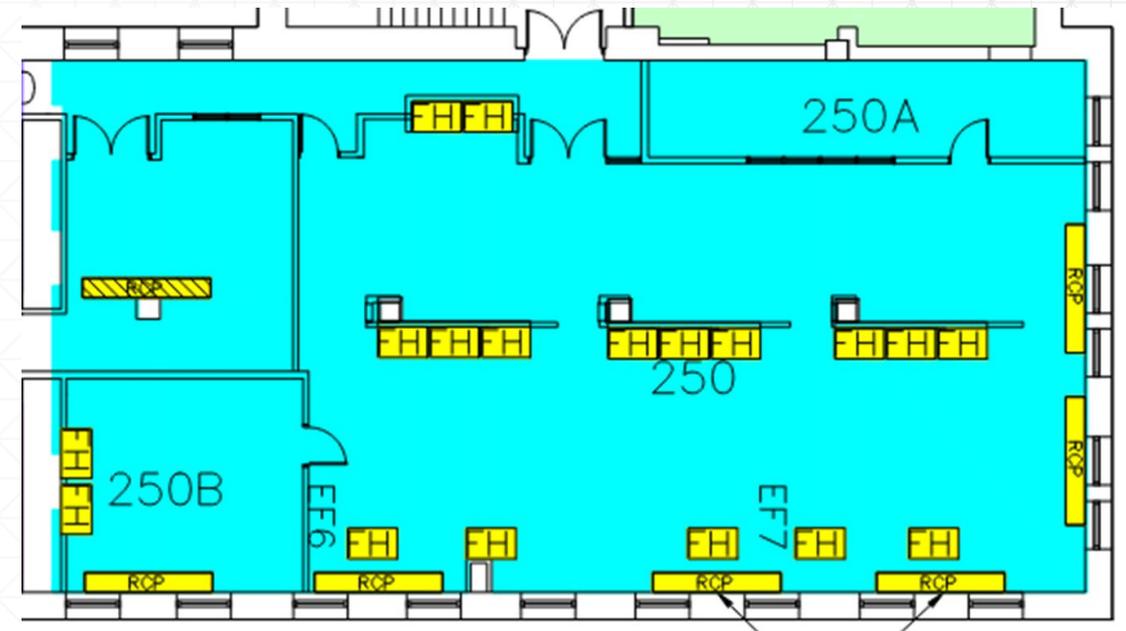
over 400 CFM reduction of constant airflow

6 Snorkel exhaust system

Potential hibernation exhaust flow reductions, energy and dollars savings, classes only 4 days for 6 hours in the afternoon.



Hibernating Fume hoods during Long Vacancy Periods



Ideal for fume hood driven spaces with longer empty periods

- Can reduce exhaust driven spaces down to the baseline
- Noyes Building Example:
 - Operates well above the baseline required by EHS
 - During the summer, FHs are placed in a hibernated mode, where they are reduced down to zero exhaust, and the room will operate at the established base ventilation rate

At \$5/CFM, hibernating over the summer will save over \$3000 in just this lab alone



Peer Institutions Successfully Creating similar situations in Teaching Labs

MIT and Cornell University have had various degrees of success with similar adjustments in teaching labs

MIT's "fume hood hibernation" is a system that puts fume hoods in a low-power mode when not in use to save energy and reduce carbon footprint. It involves automatically reducing airflow to hoods when they are unoccupied, such as overnight or on weekends, based on the lab's ventilation control system. This has resulted in significant energy and cost savings for the university, like the estimated \$21,000 saved per year by the undergraduate teaching lab, by lowering the air change rate from 11 to 7 per hour.

[https://chemistry.mit.edu/chemistry-news/chemistry-undergraduate-teaching-lab-hibernates-fume-hoods-drastically-reducing-energy-costs/#:~:text=Chemistry%20Undergraduate%20Teaching%20Lab%20hibernates%20fume%20hoods%2C,saving%20MIT%20an%20estimated%20\\$21%2C000%20per%20year.](https://chemistry.mit.edu/chemistry-news/chemistry-undergraduate-teaching-lab-hibernates-fume-hoods-drastically-reducing-energy-costs/#:~:text=Chemistry%20Undergraduate%20Teaching%20Lab%20hibernates%20fume%20hoods%2C,saving%20MIT%20an%20estimated%20$21%2C000%20per%20year.)

Cornell University's EHS had some very well thought out, trial and error results to share with us regarding airflow reductions in teaching labs, minimum airflow exhaust, fume hood driven labs, and safety concerns yet, still were able to reduce energy consumption, albeit not as much as they would have liked.



Lab Building HVAC Systems

“Now you know
the rest of
the story
—Paul Harvey

<https://www.linkedin.com/pulse/7-favorite-paul-harvey-quotes-gary-j-lanham>



**Thank you!
&
Questions**

