EMPOWERING EH&S

THE SECRET MVP OF LABORATORY SUSTAINABILITY

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SMITHGROUP

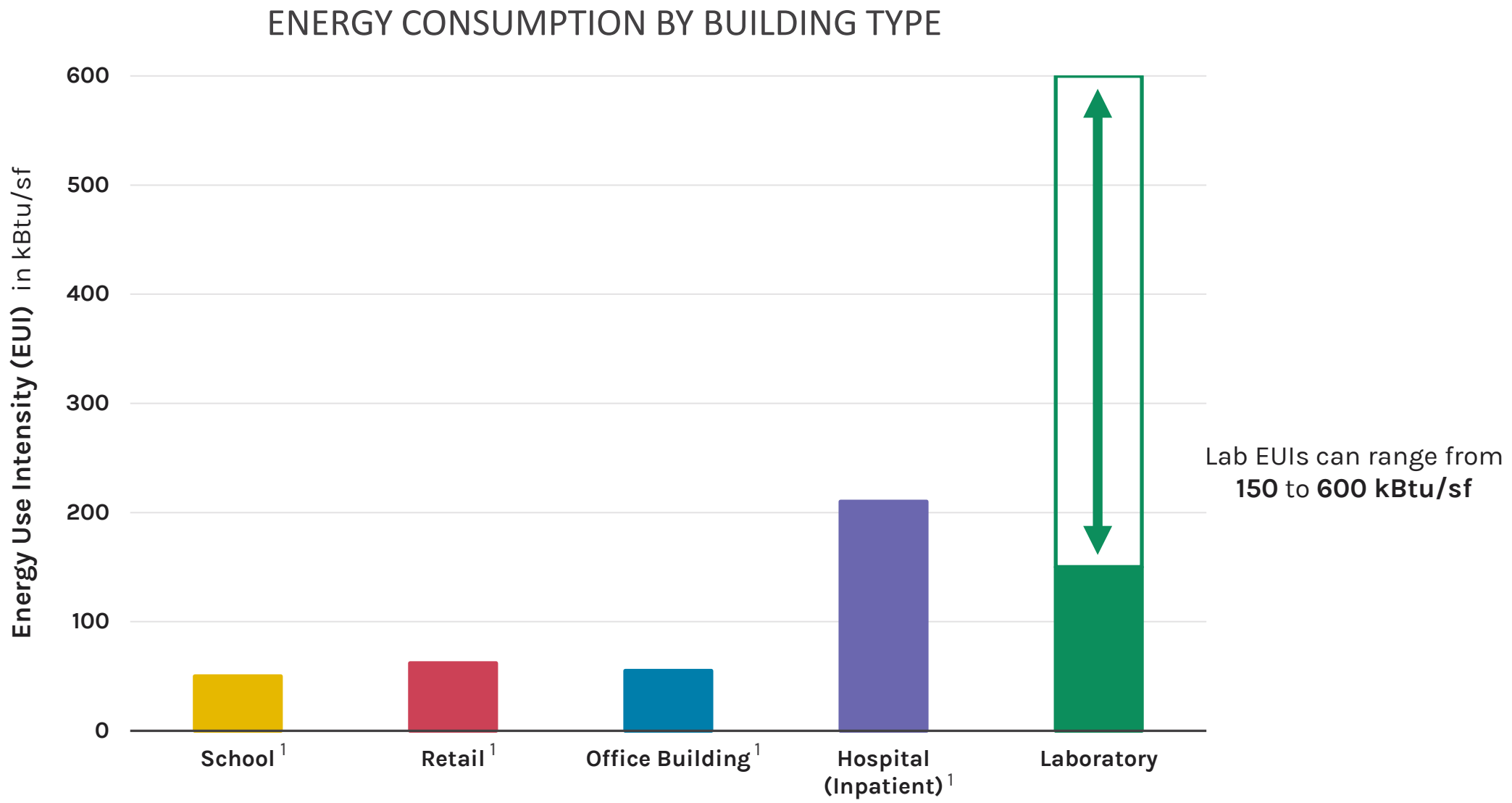
LEARNING OBJECTIVES

- Laboratory ventilation parameters dictated by Environmental Health and Safety (EH&S) departments can have an outsized impact on laboratory energy usage.

- Many systems do not match projects' active hazard levels with appropriate ventilation parameters, resulting either in risk to researchers or over-expenditure of energy.

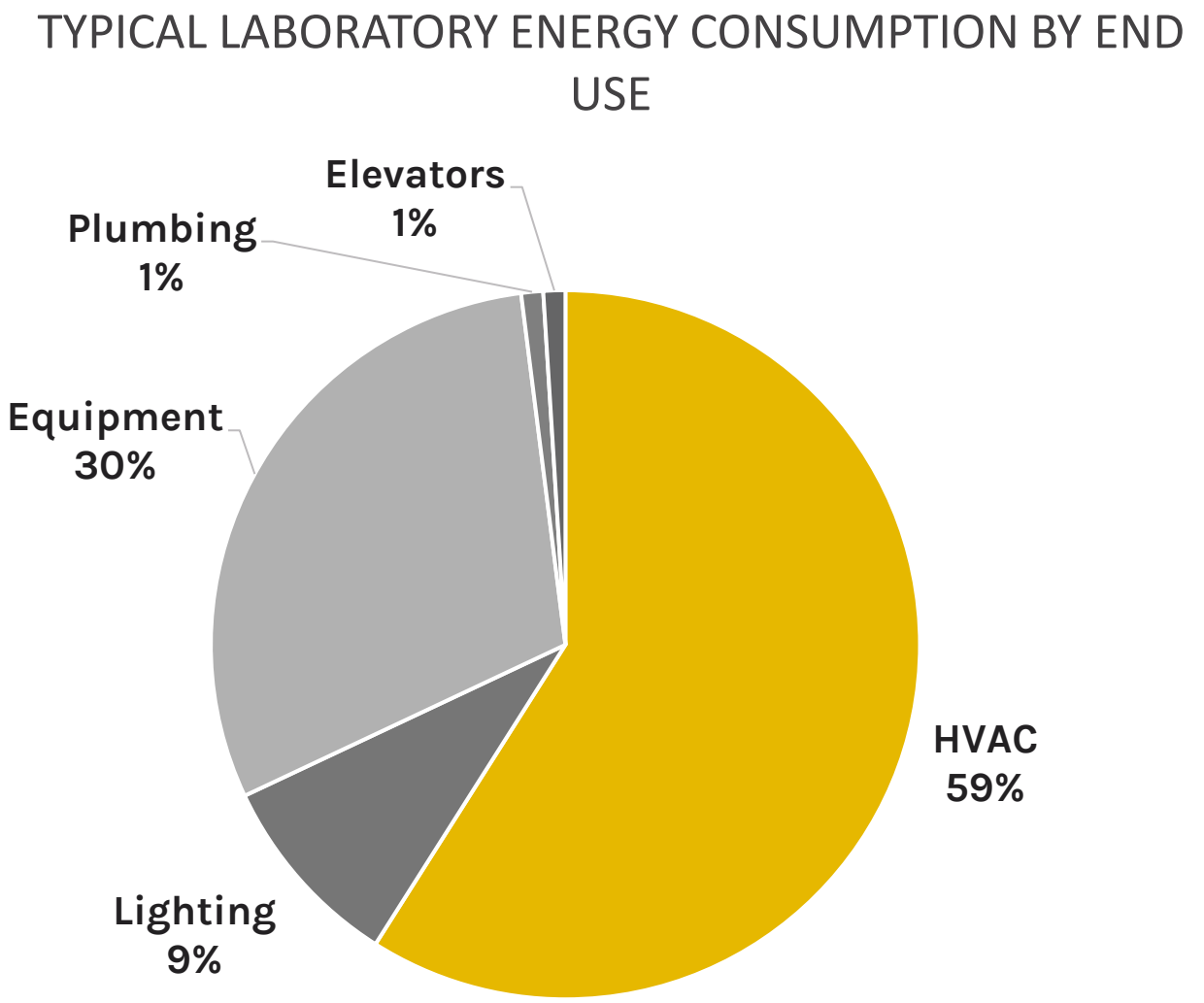
- Systems that are designed with EH&S in mind allow for flexible control of ventilation parameters, resulting in laboratory ventilation that is tailored to the active hazard level of a project.

LABORATORY HVAC AND ENERGY



1 – From CBECS 2018

LABORATORY HVAC AND ENERGY



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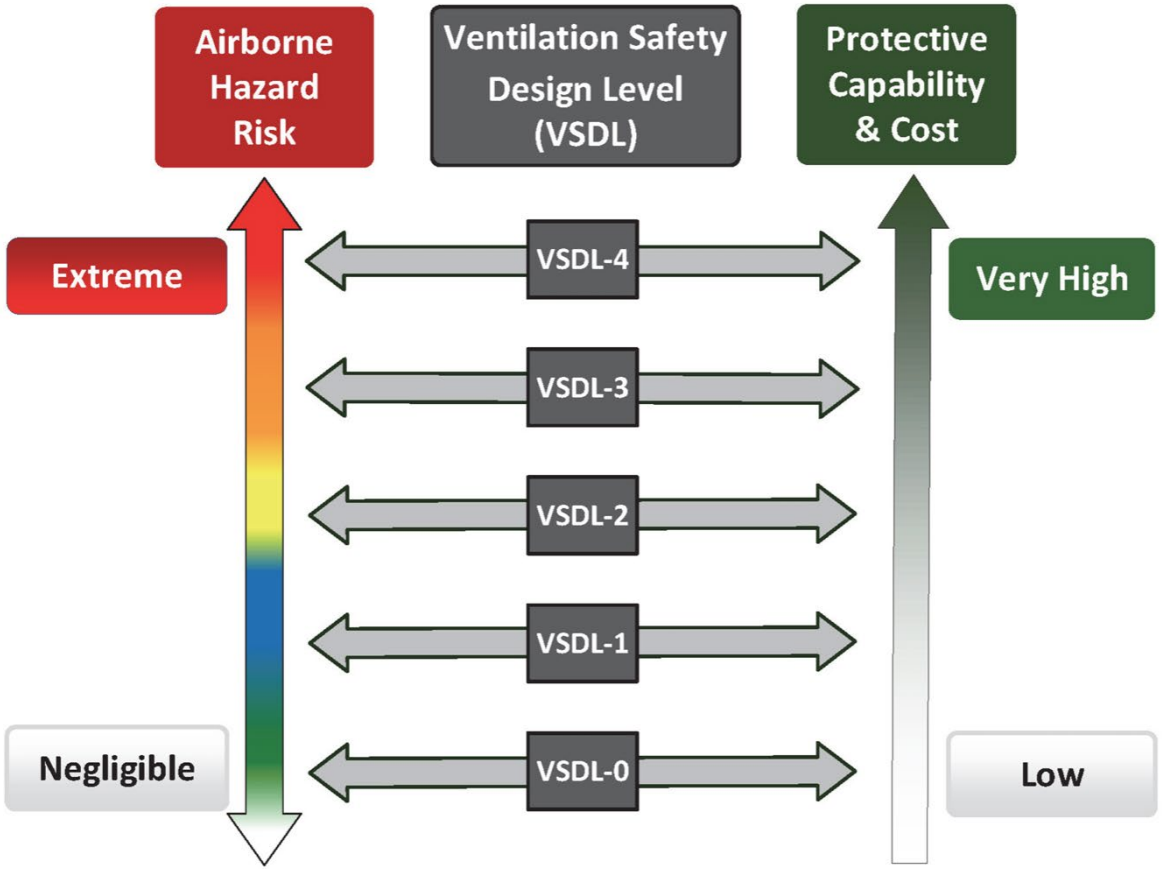

Risks associated with airborne hazards and the levels of protection associated with the range of LVDLs.

Figure from ASHRAE Classification of Laboratory Ventilation Design Levels (2018)

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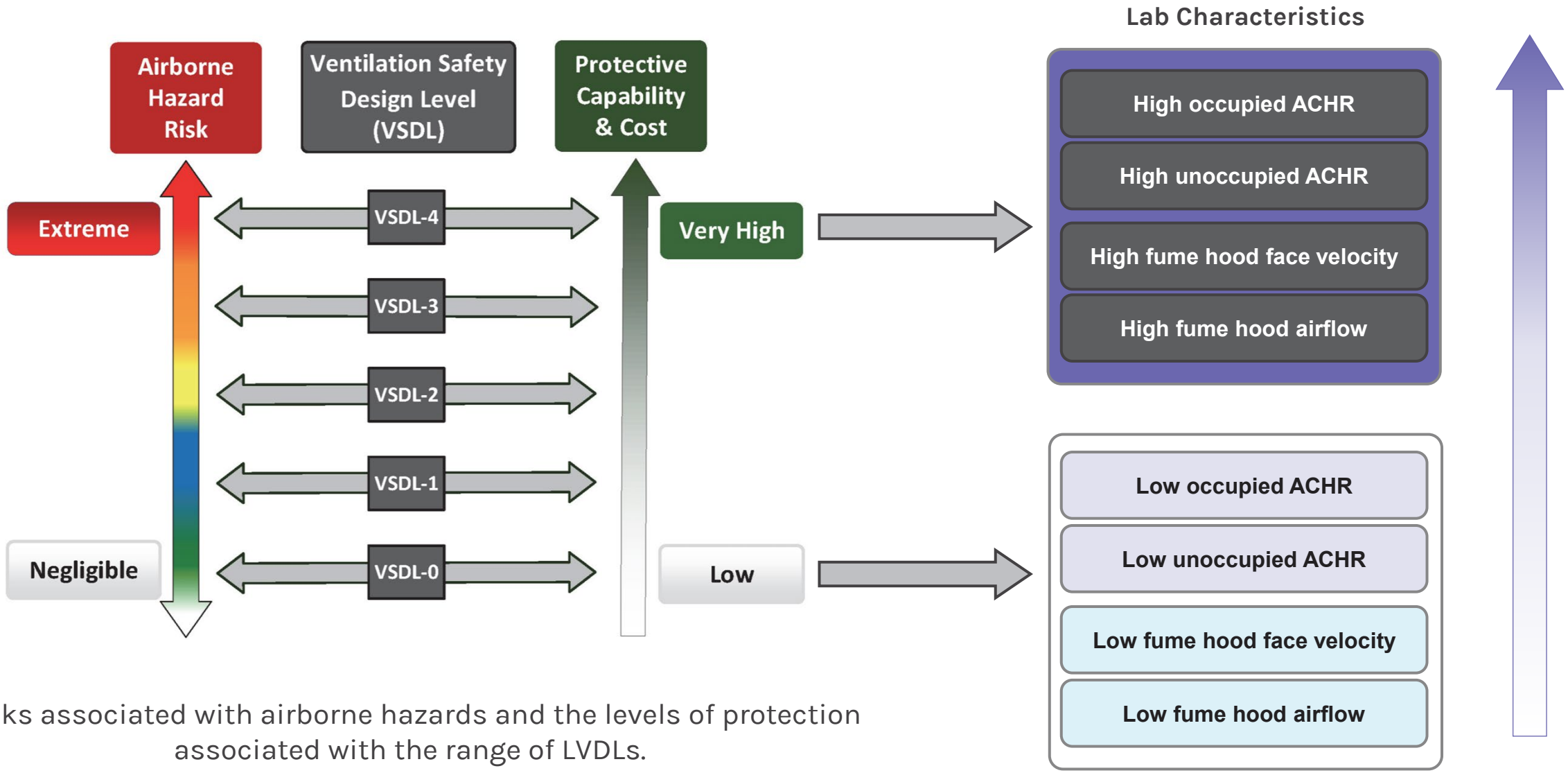

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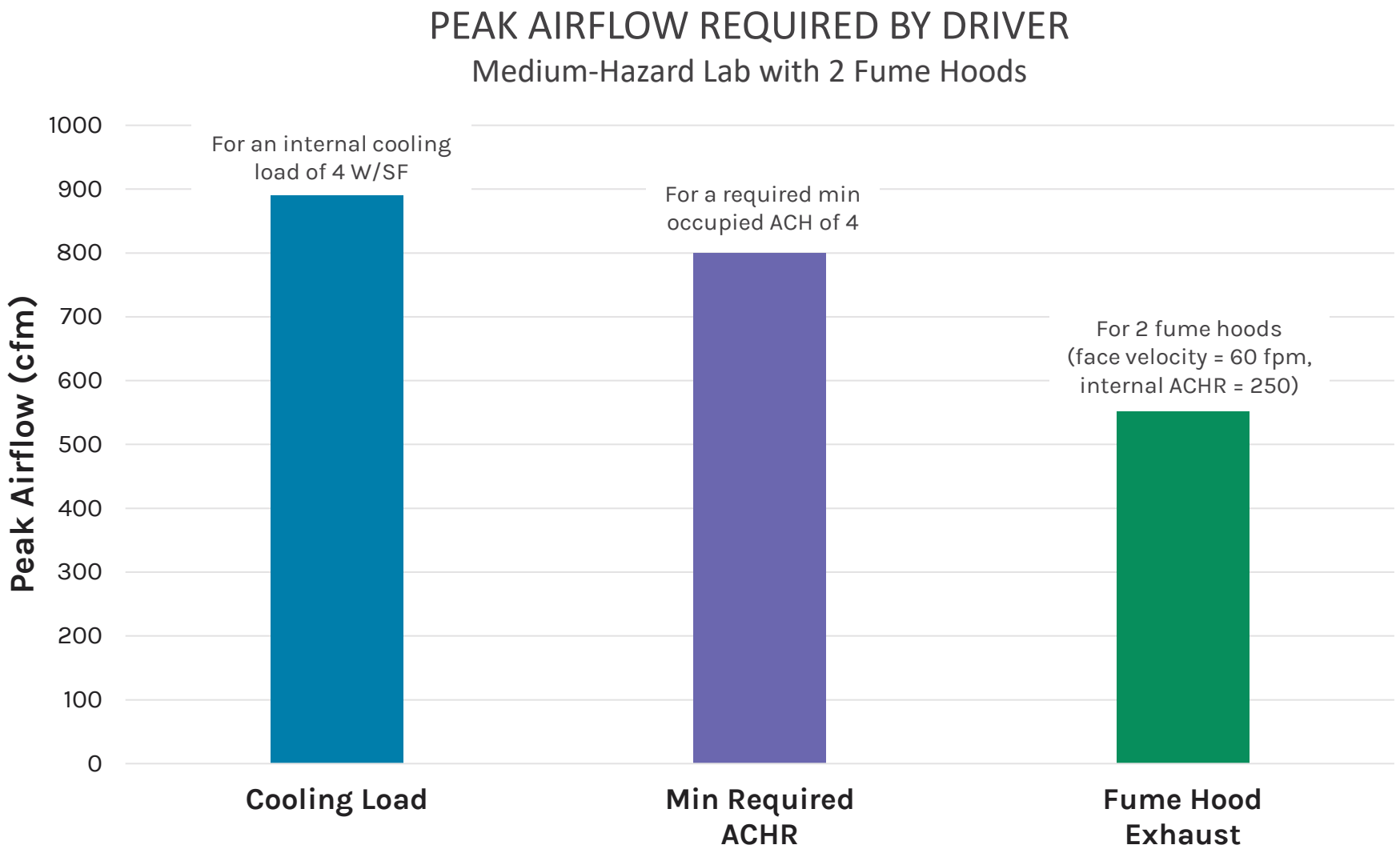
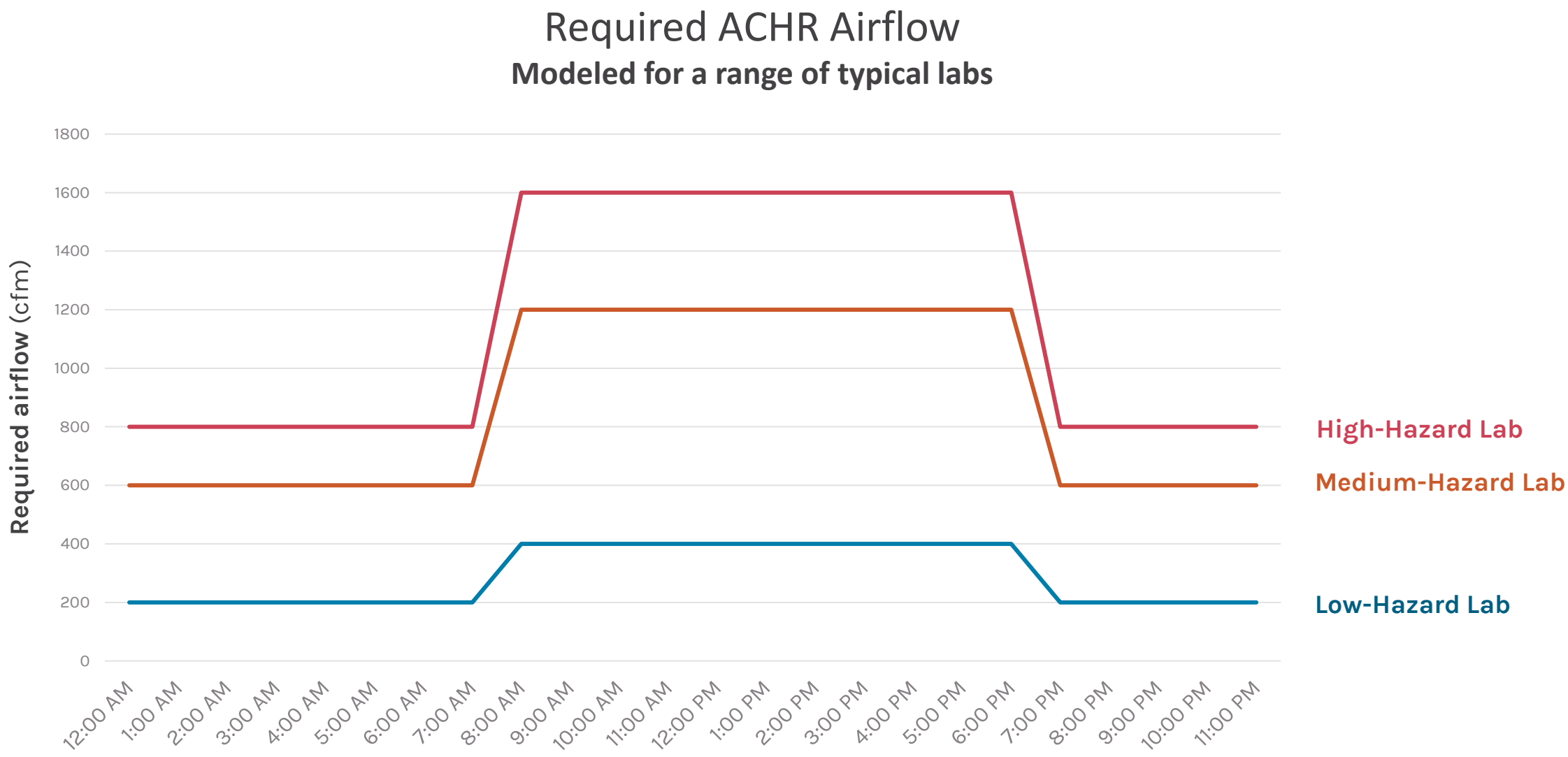
AIRFLOW DRIVERS



Modeled for a typical medium-hazard 1200sf lab with 2 fume hoods

AIRFLOW DRIVERS

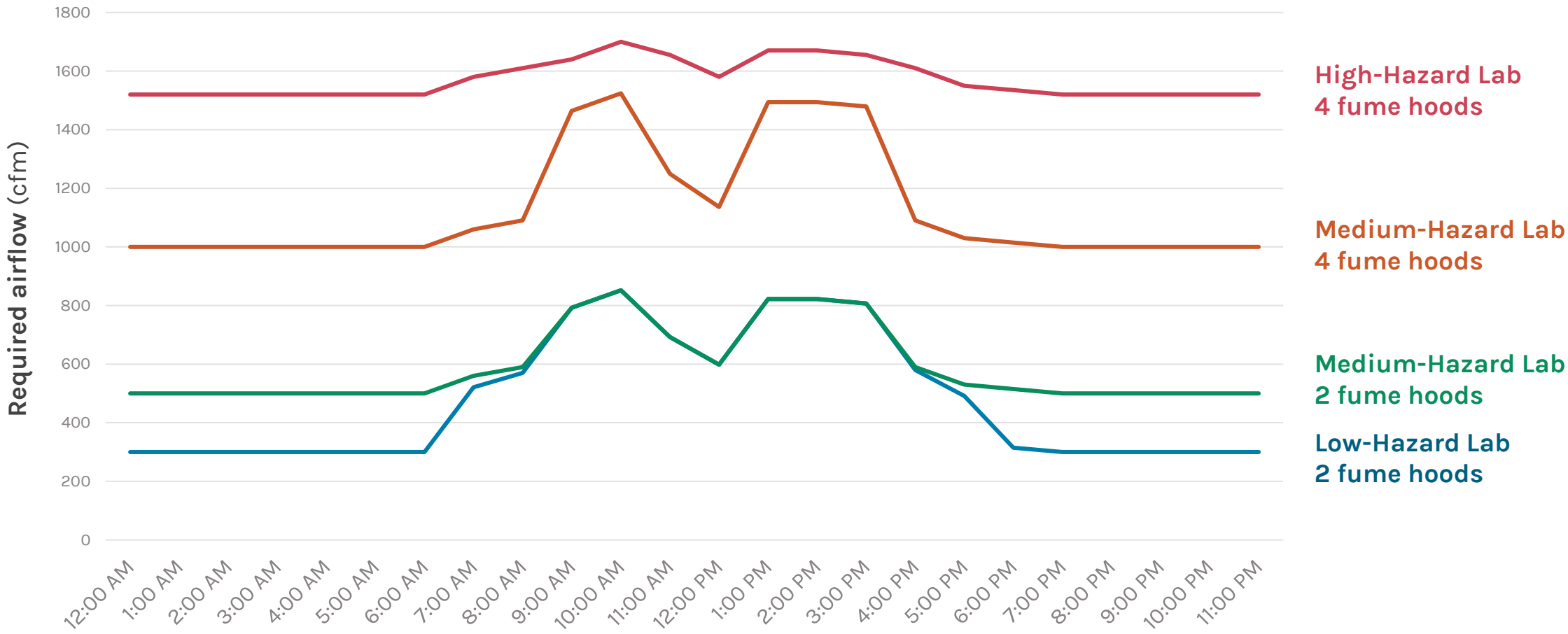


Modeled for typical 1200sf labs.
Hazard corresponds to ACH requirements, as well as other ventilation design parameters.

AIRFLOW DRIVERS

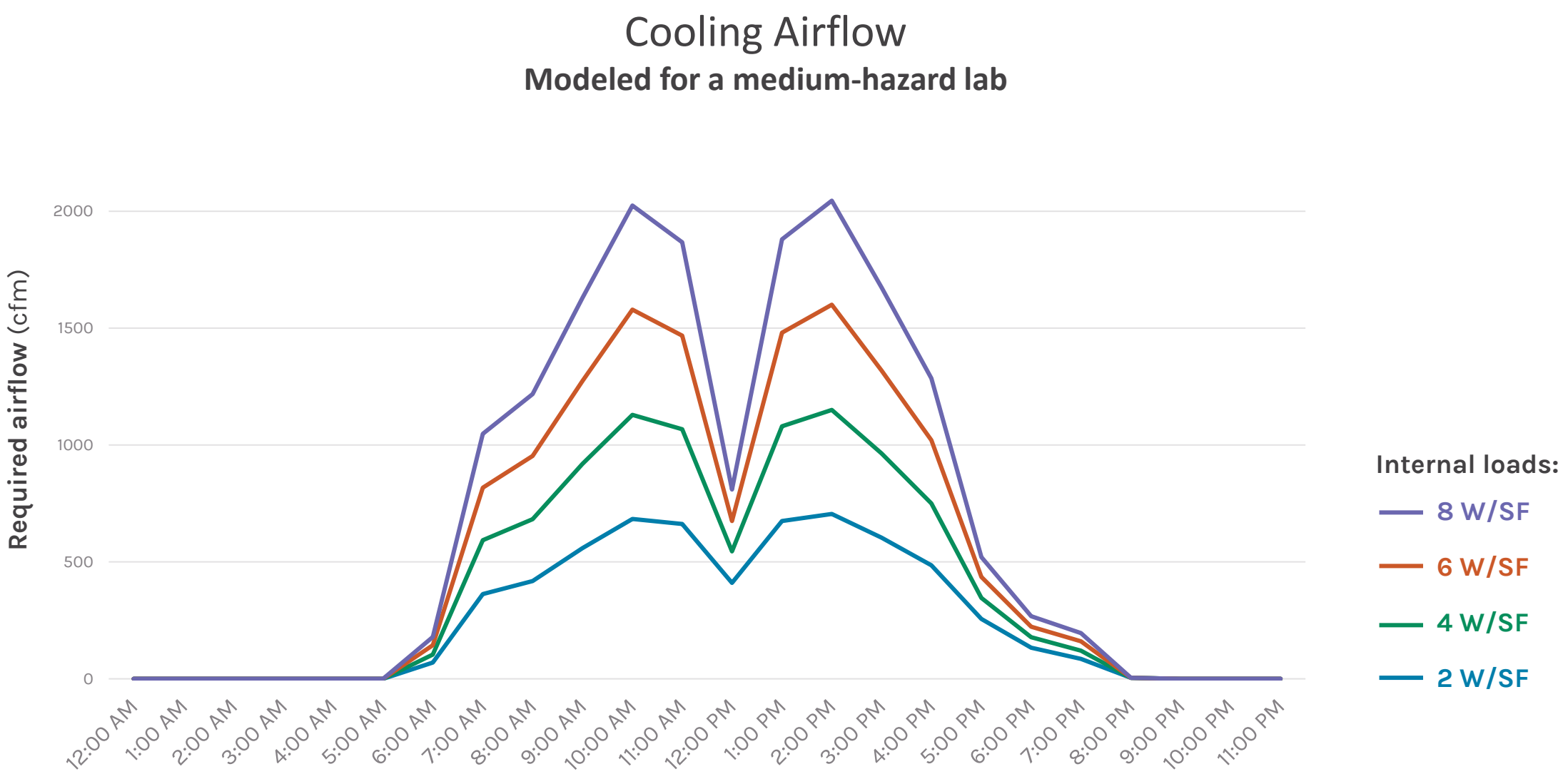
Fume Hood Makeup Airflow

Modeled for a range of typical labs



Modeled for typical 1200sf labs with moderate FH usage.
Hazard corresponds to fume hood parameters, as well as other ventilation design parameters.

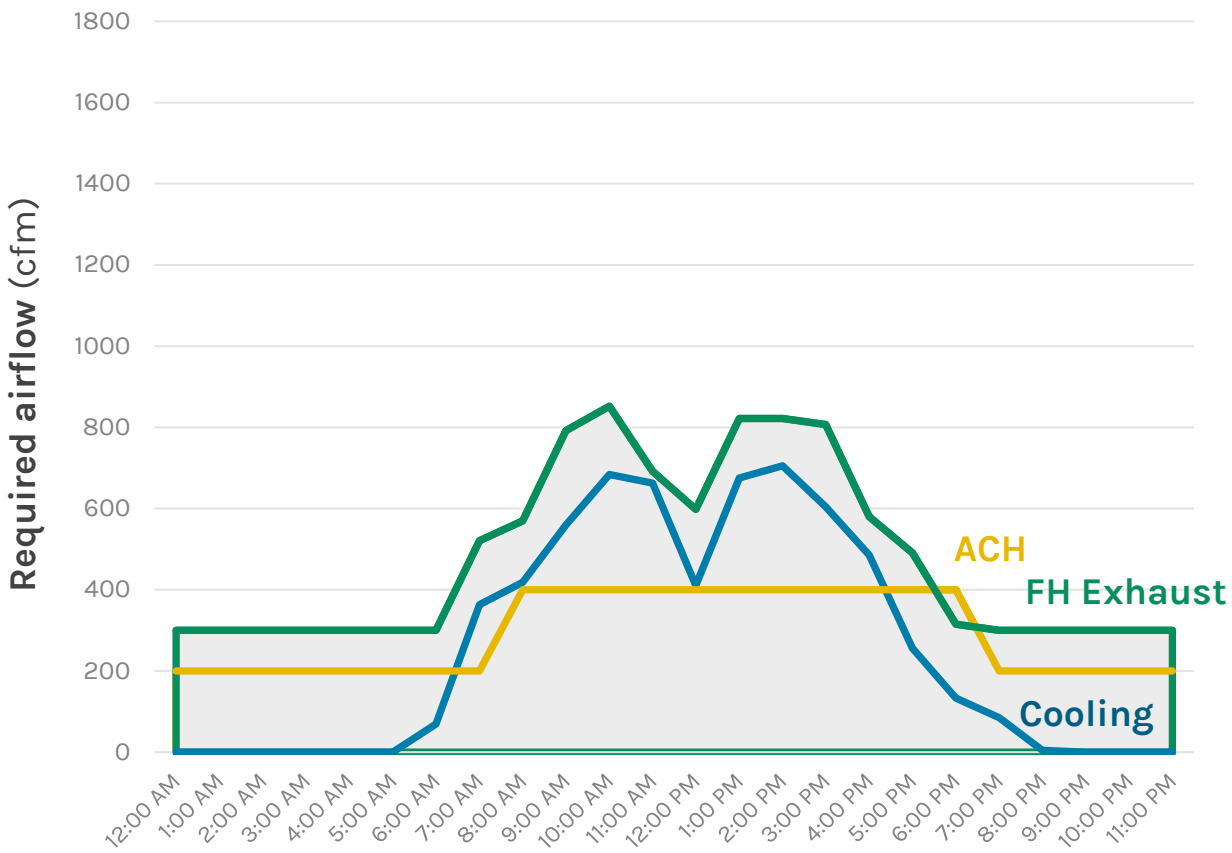
AIRFLOW DRIVERS



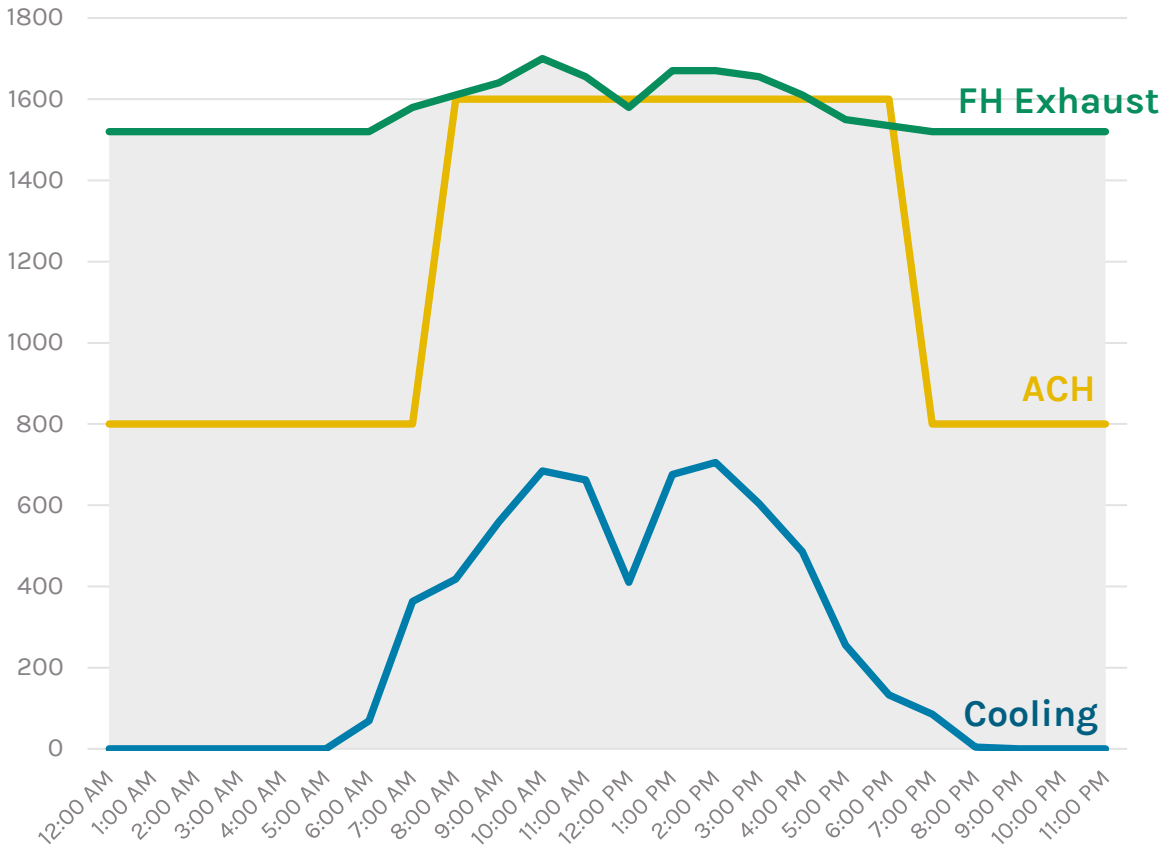
Modeled for typical 1200sf labs.

AIRFLOW DRIVERS

Low-Hazard Lab with 2 Fume Hoods

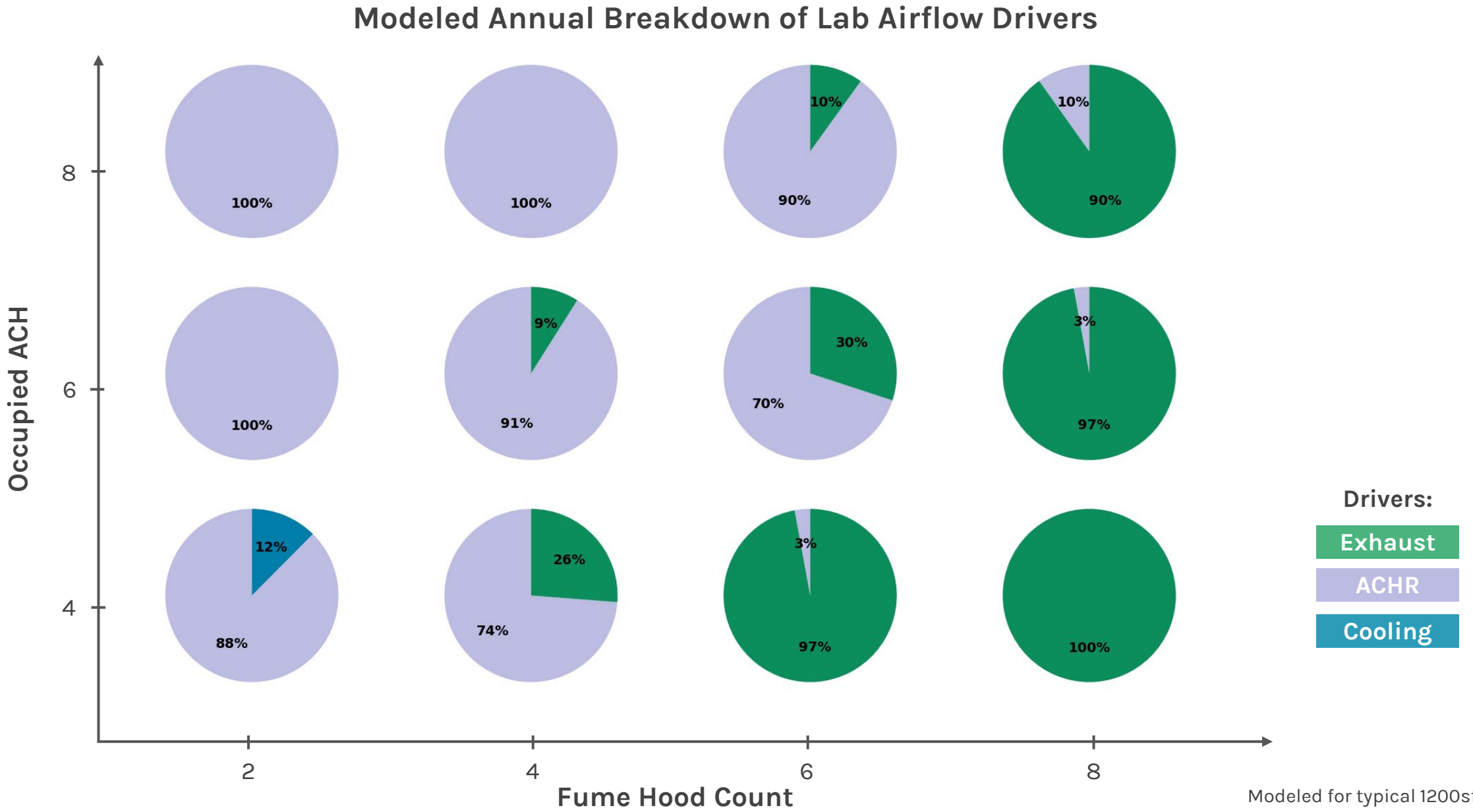


High-Hazard Lab with 4 Fume Hoods



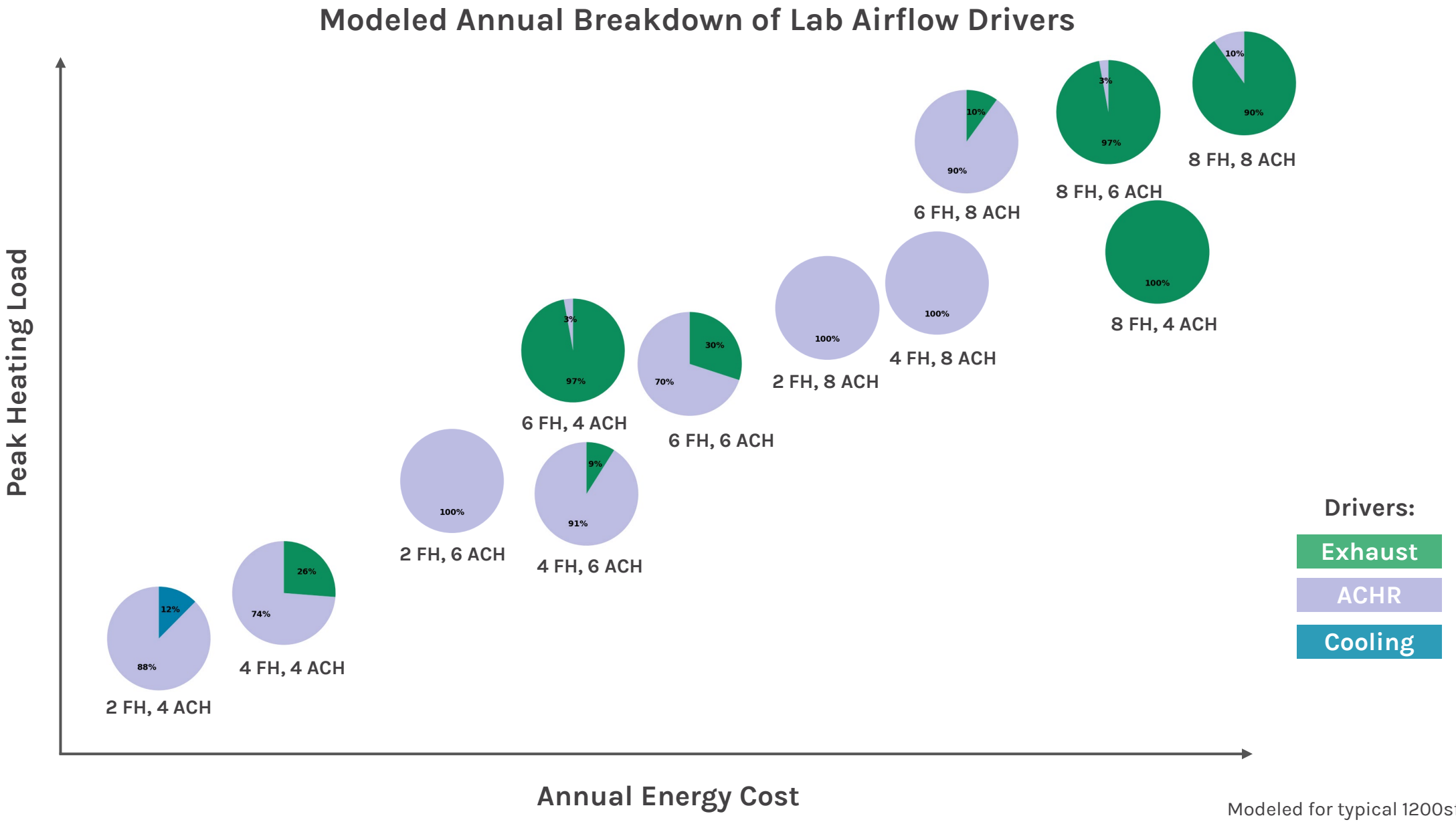
Modeled for two typical 1200sf labs

AIRFLOW DRIVERS



Modeled for typical 1200sf labs.

AIRFLOW DRIVERS



Modeled for typical 1200sf labs.

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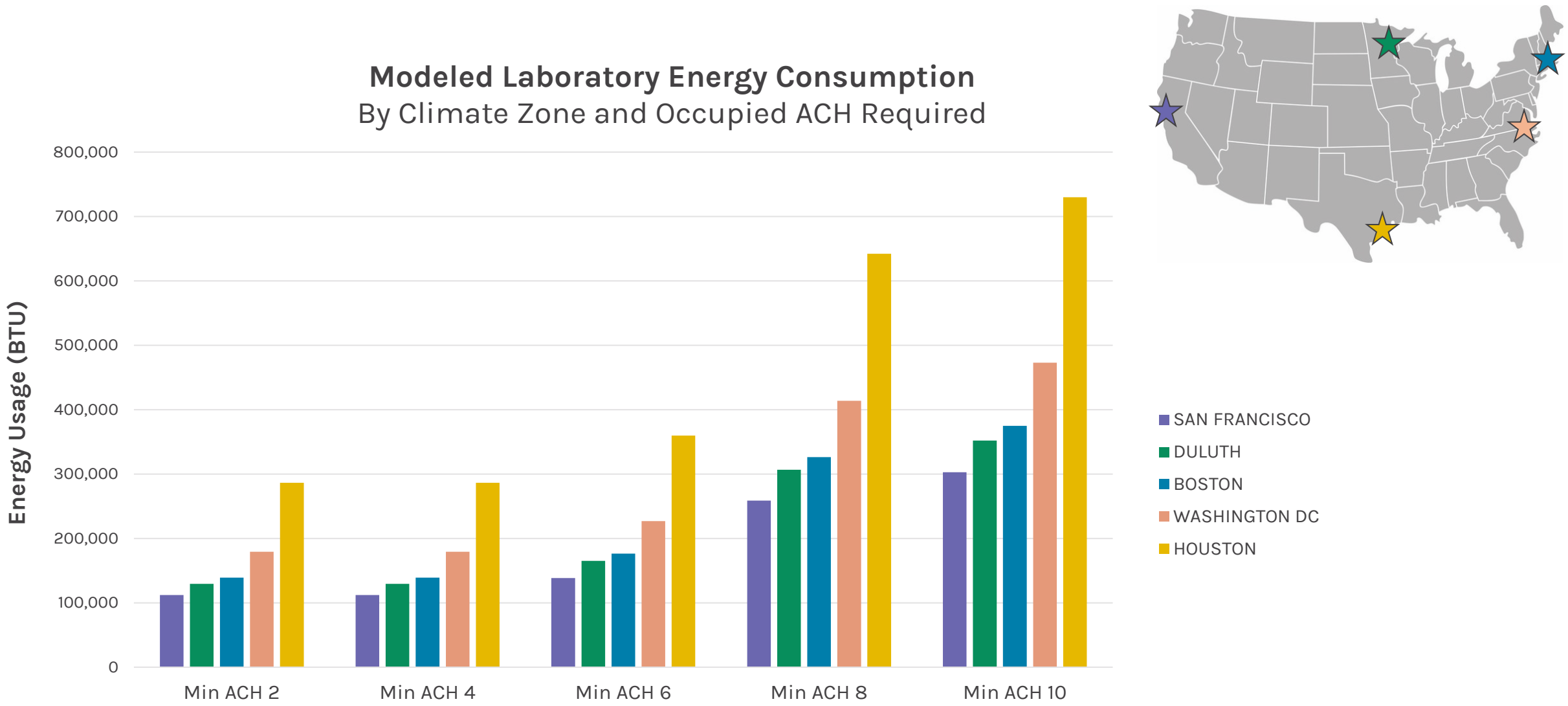


Modeled for typical 1200sf labs.

THE ROLE OF EH&S IN LABORATORY VENTILATION

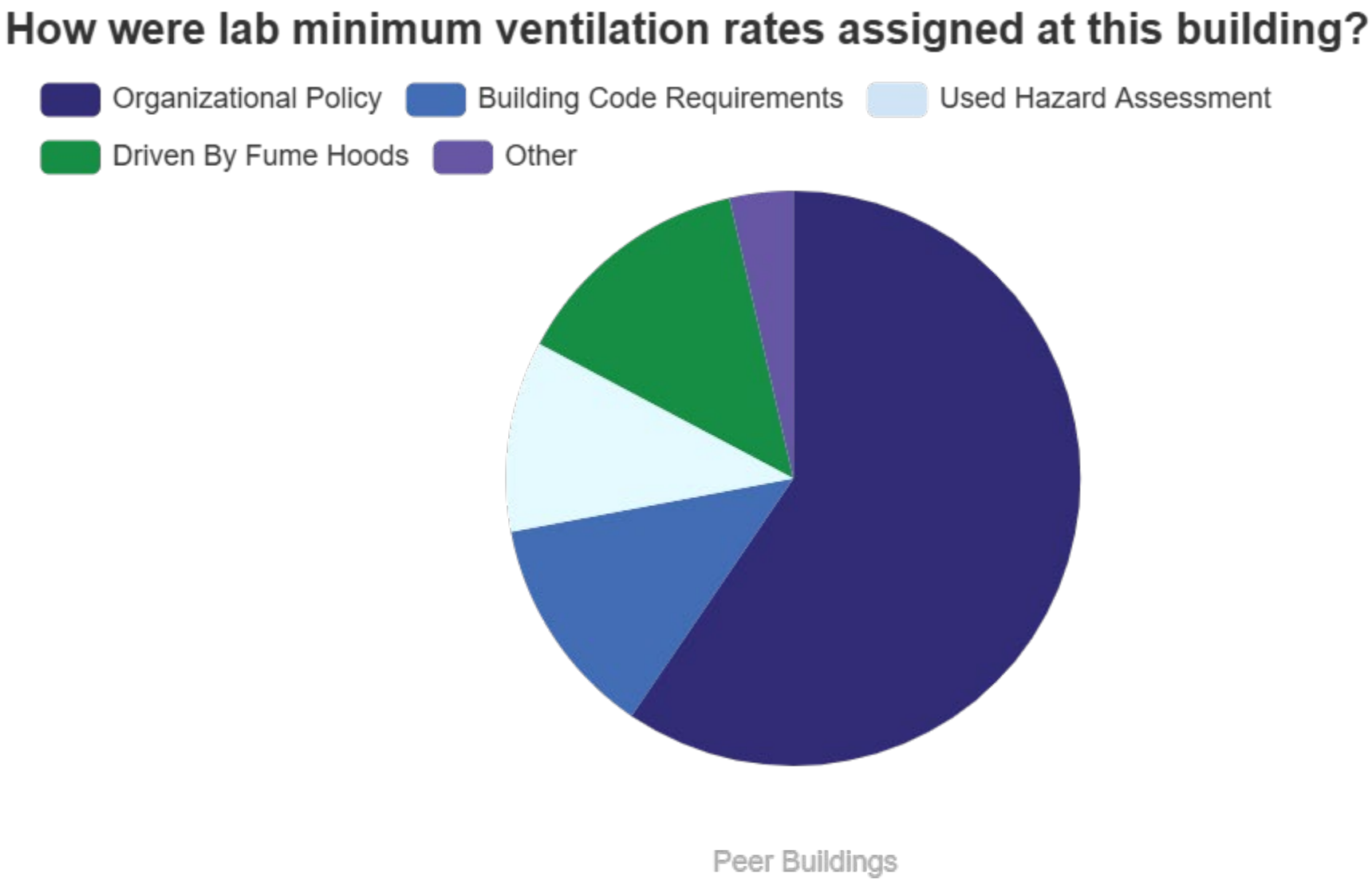
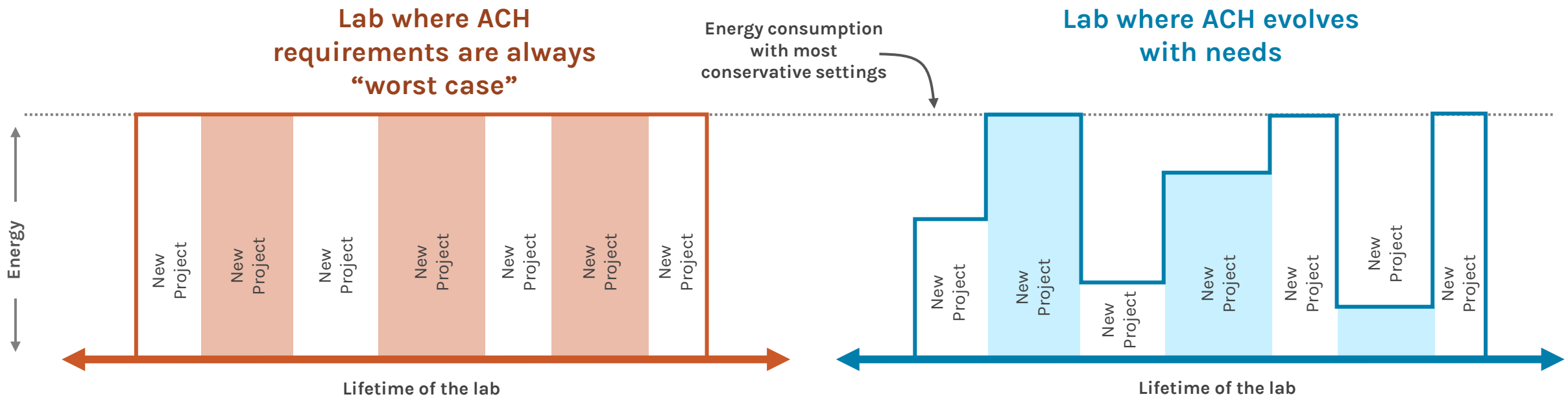


Figure from I2SL Benchmarking Tool

THE ROLE OF EH&S IN LABORATORY VENTILATION



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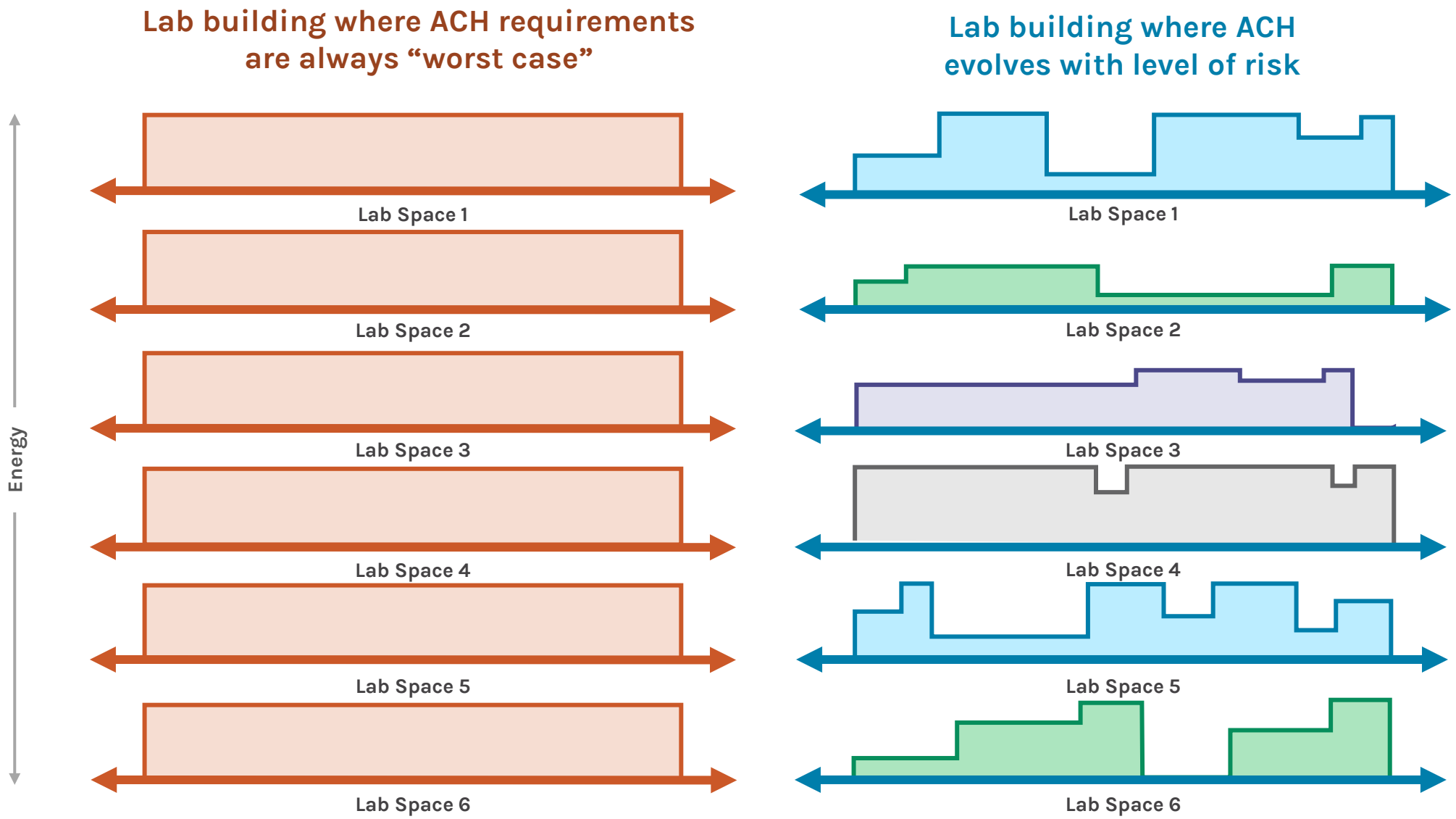


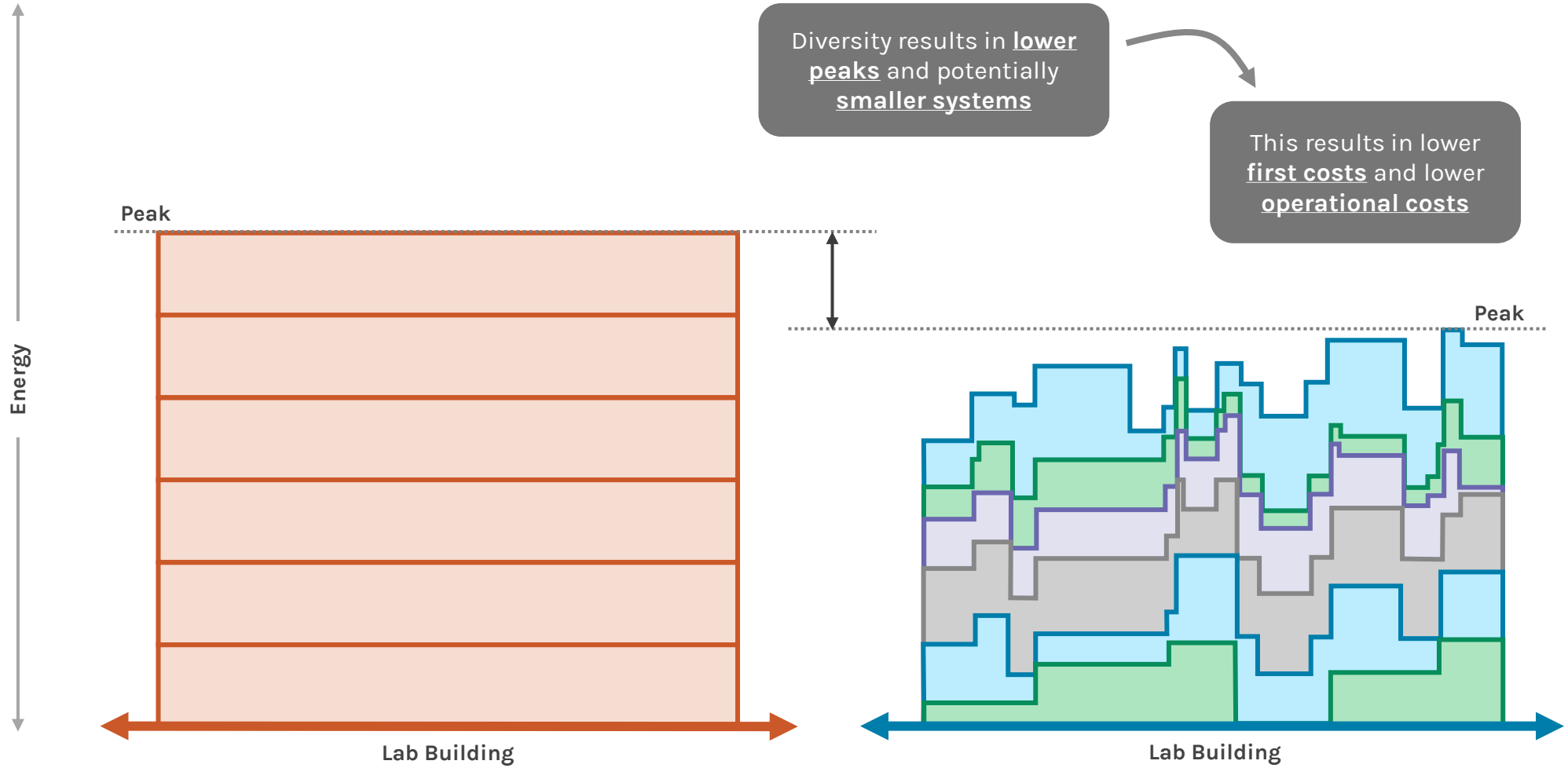
THE ROLE OF EH&S IN LABORATORY VENTILATION

Lab building where ACH requirements are always "worst case"

Lab building where ACH evolves with needs

Diversity results in **lower peaks** and potentially **smaller systems**

This results in lower **first costs** and lower **operational costs**

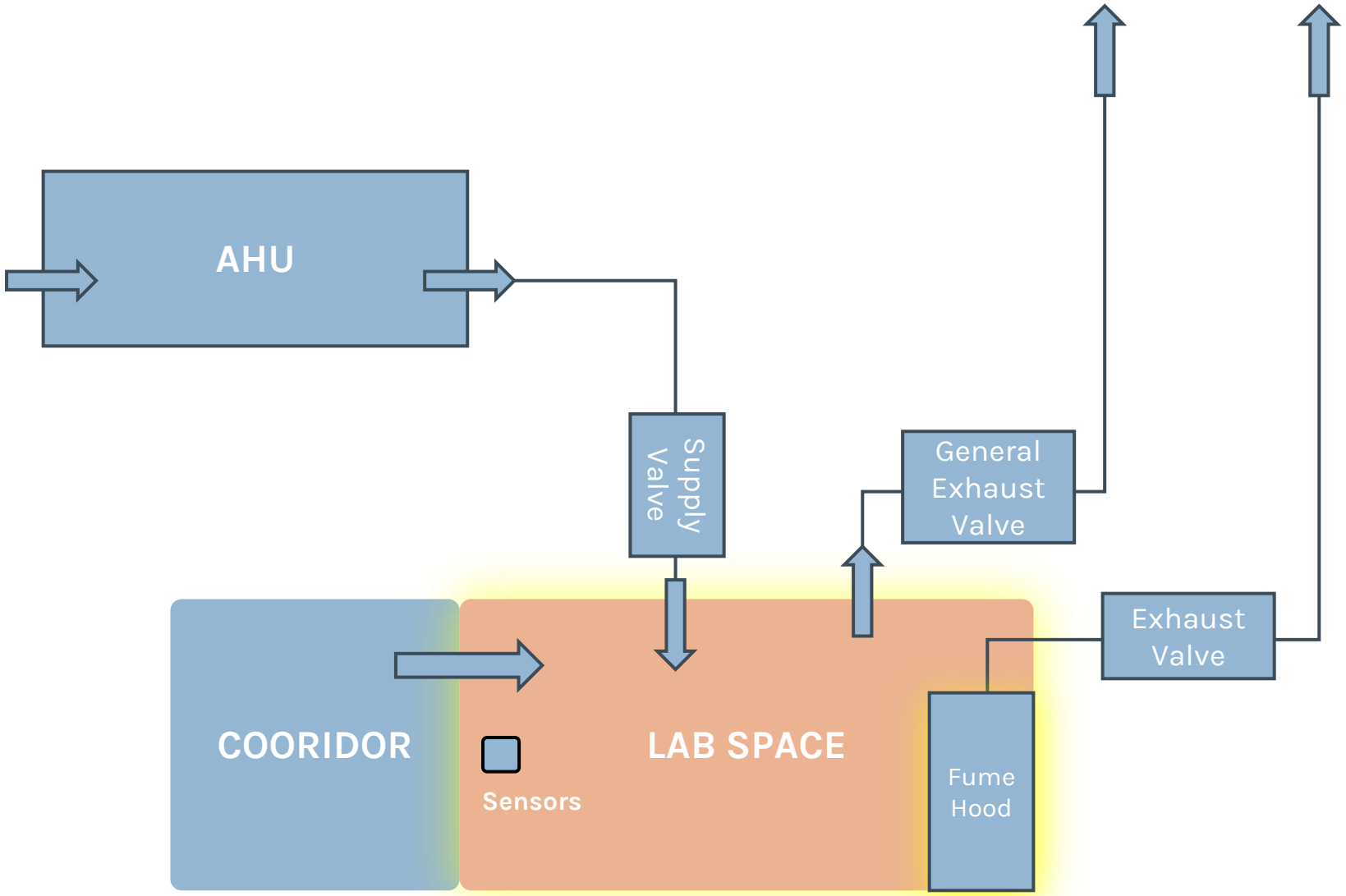


SIZE FOR FLEXIBILITY, CONTROL FOR SPECIFICITY

GOAL
Design the building system to:

(1) Accommodate max and min of lab safety parameters.

(2) Be easy to adjust as lab use changes.



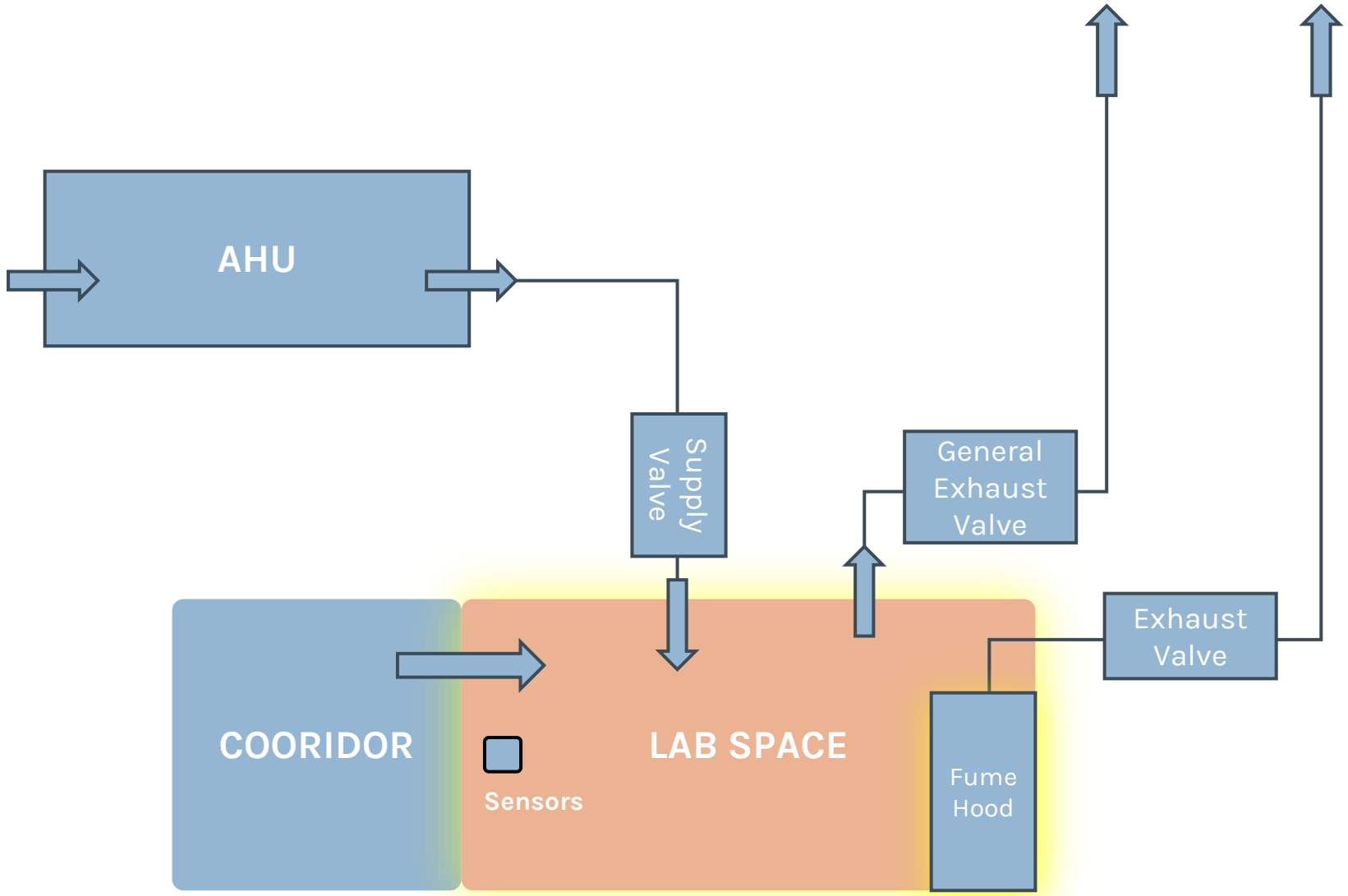
SIZE FOR FLEXIBILITY, CONTROL FOR SPECIFICITY

STEP 1
For each lab space:

- Define max and min hazard levels
- Define max and min # of active fume hoods

*** The more tightly you can limit the ranges, the less oversizing will happen.**

*** Teams typically consider future fume hood additions, but not future fume hood removal/hibernation.**



SIZE FOR FLEXIBILITY, CONTROL FOR SPECIFICITY

STEP 2

For supply valves and ductwork:

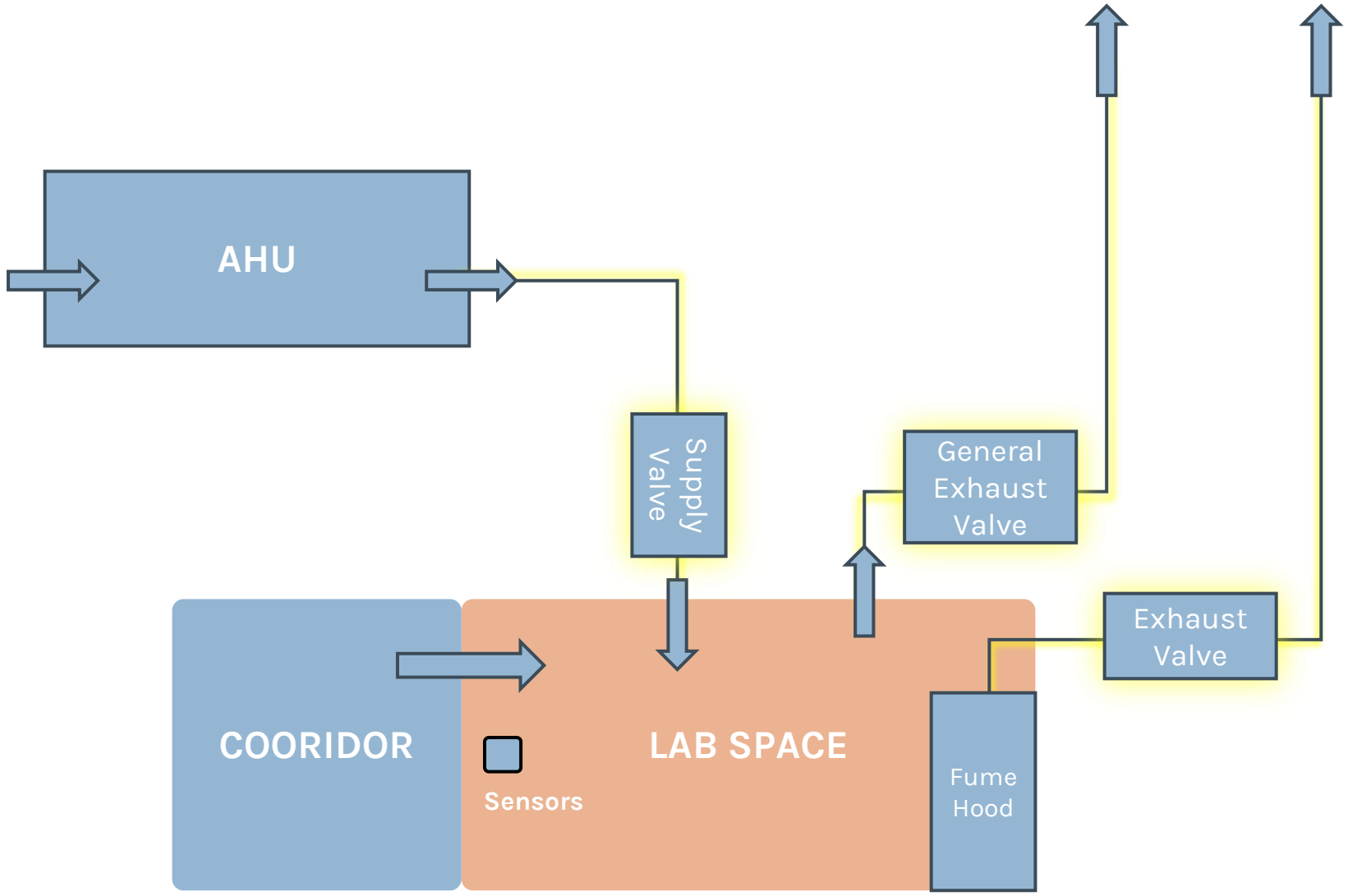
- Size for max # of fume hoods and max hazard level
- Evaluate turndown for min # of fume hoods and min hazard level.

For exhaust valves and ductwork:

- Size for max # of fume hoods

For general exhaust valves and ductwork:

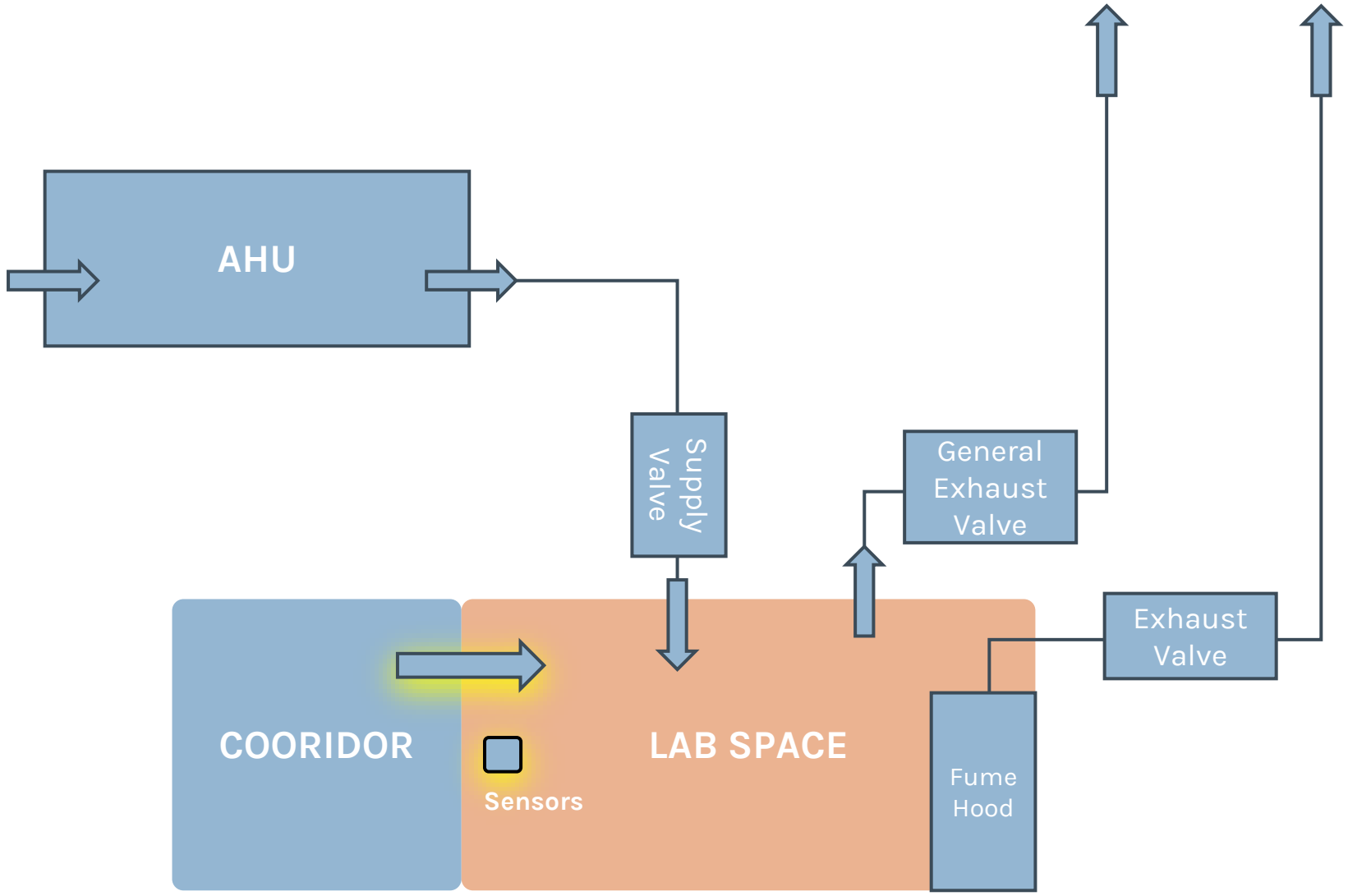
- Size for max hazard level, max cooling load, and min fume hood quantity.



SIZE FOR FLEXIBILITY, CONTROL FOR SPECIFICITY

STEP 3
For controls:

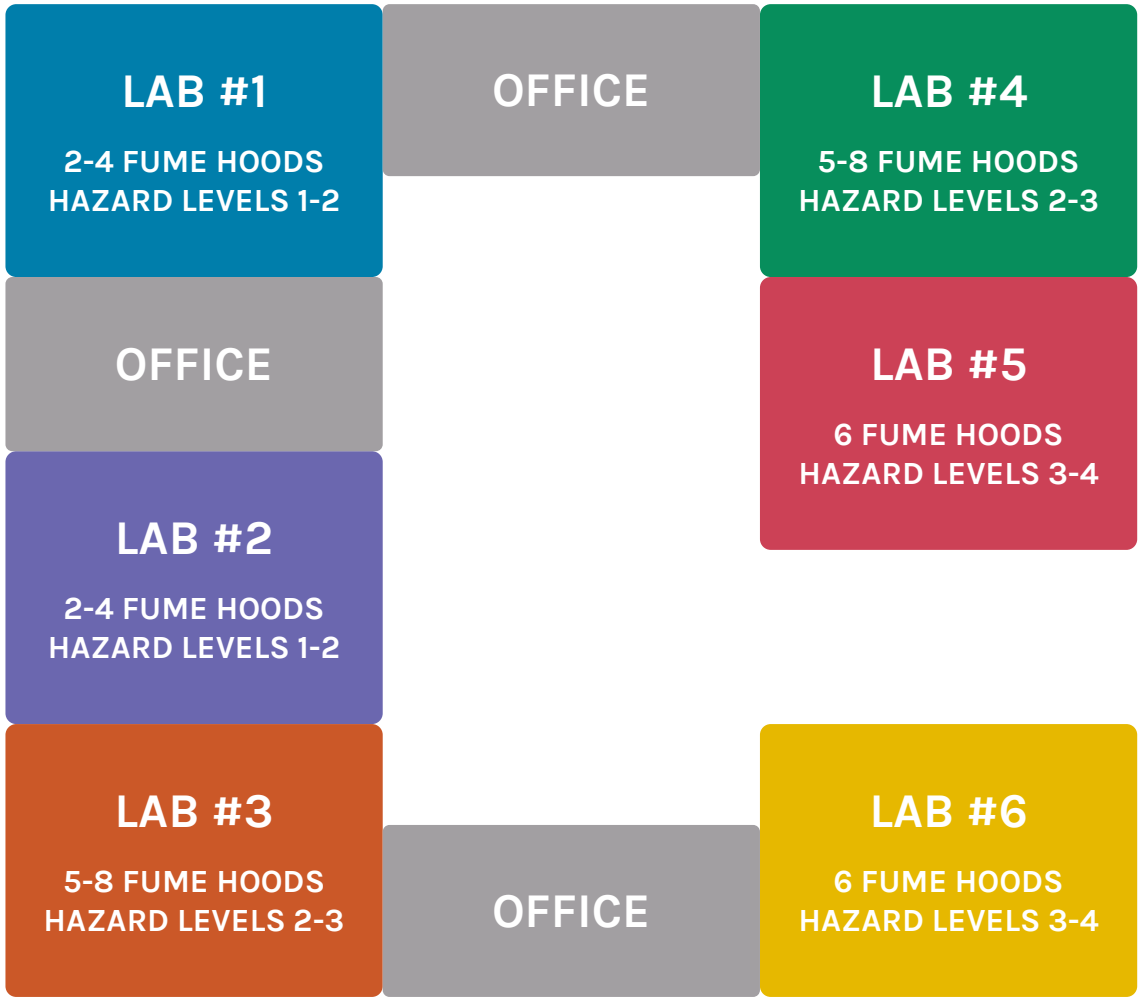
- Use room differential pressure sensors to confirm pressurization
- Configure the BAS to easily accept changes to the following inputs from the interface:
  - **Air Change Rate**
  - **Fume Hood Air Change Rate**
  - **Fume Hood Face Velocity**
- Configure the BAS to calculate the airflow from the above inputs.



SIZE FOR FLEXIBILITY, CONTROL FOR SPECIFICITY

STEP 4:
In building documents:

- Create a plan documenting which spaces are sized for which ranges in parameters.



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EXAMPLE PROCEDURE FOR FLEXIBILITY

New project activities identified

STEP 1
PI and EH&S identify # of fume hoods and hazard level required for the project.

STEP 2
EH&S confirms this is within acceptable range for the space.

STEP 3
EH&S uses established hazard level protocol to determine required ACH and parameters for active fume hoods.

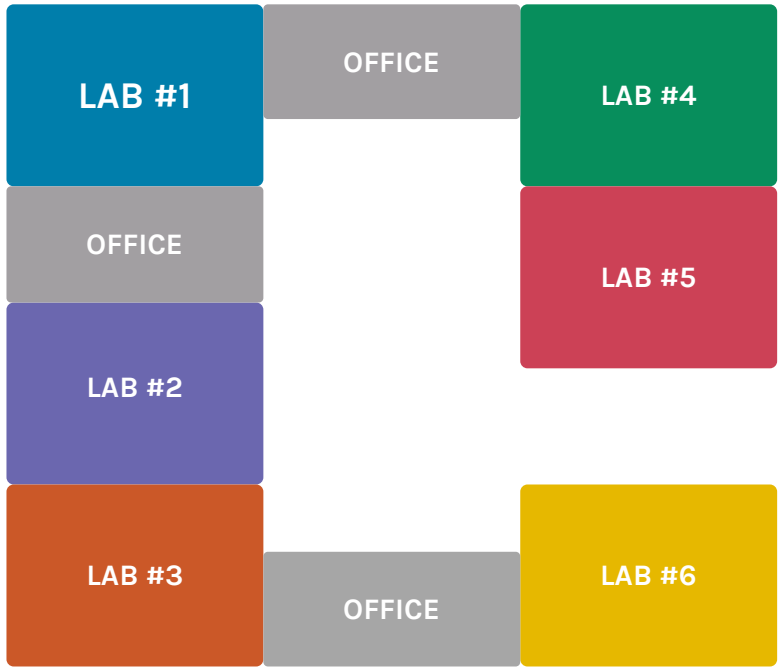
STEP 4
EH&S enters new ACH and fume hood parameters into the BAS interface.

STEP 5
EH&S sets 2 fume hoods into hibernation mode and clearly labels them as not for use.

Project proceeds safely and efficiently!

SCENARIO:
New project starts.

Lab #1 moves from **4 FHs to 2 FHs**, and from **Hazard Level 2 to Hazard Level 1**.



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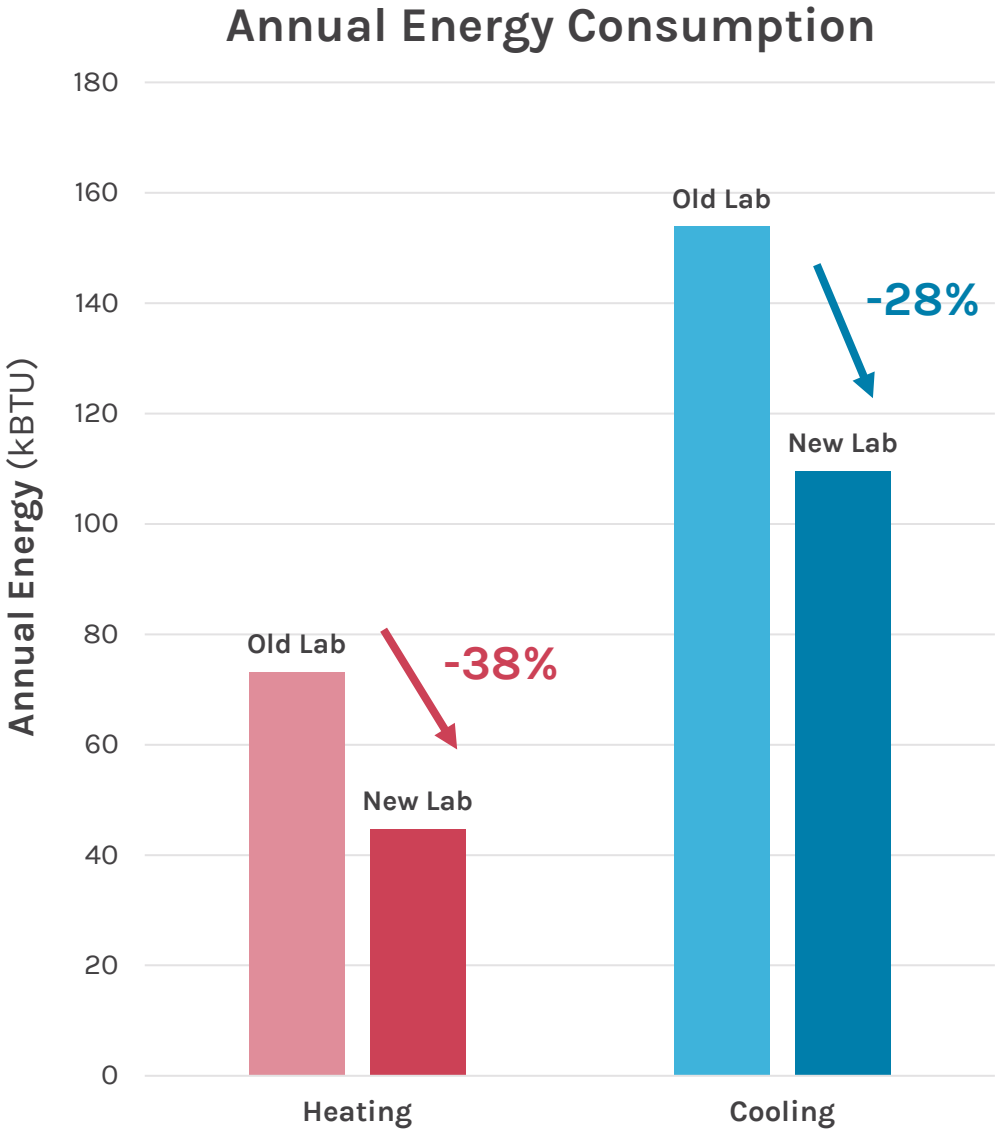

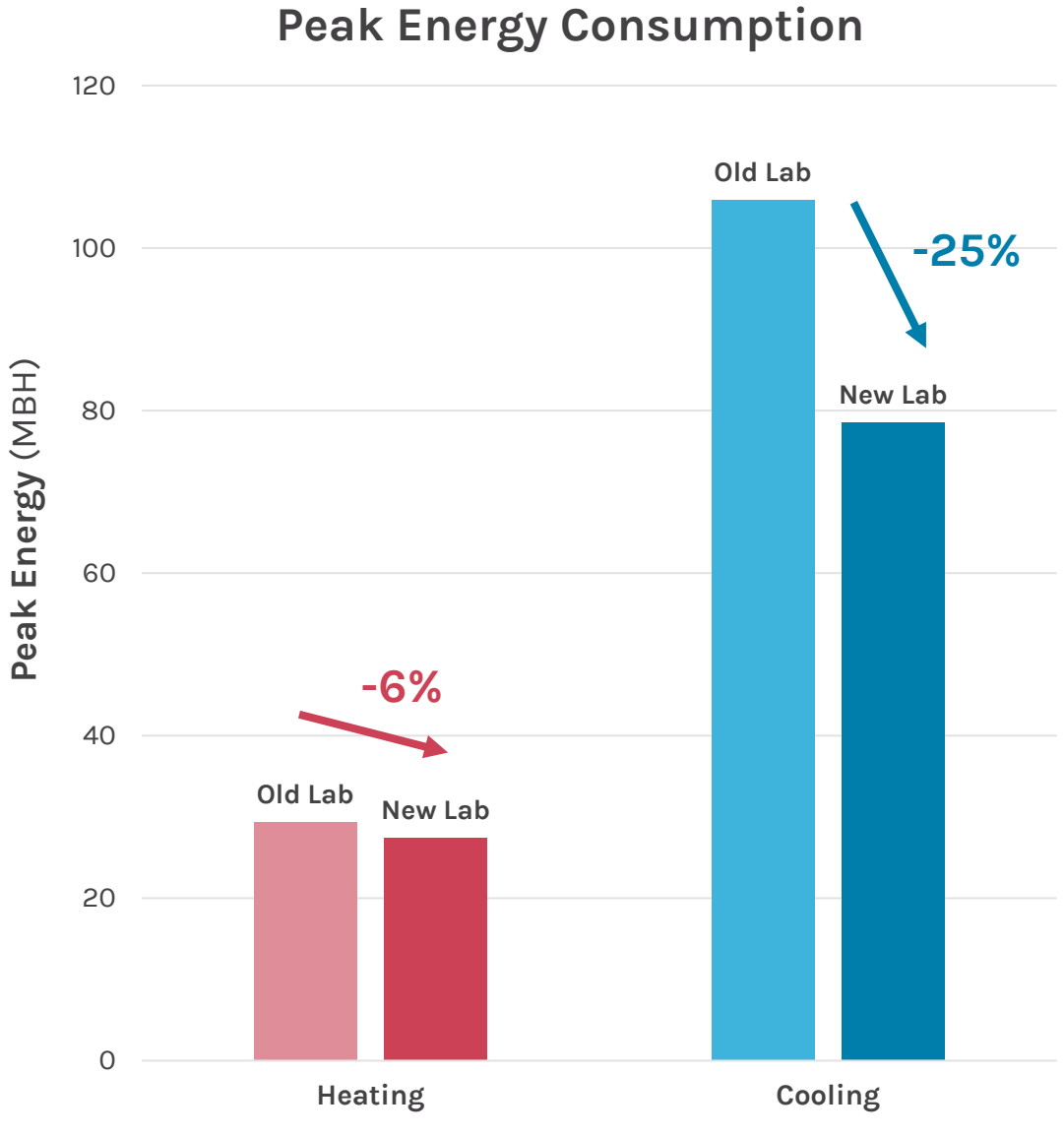

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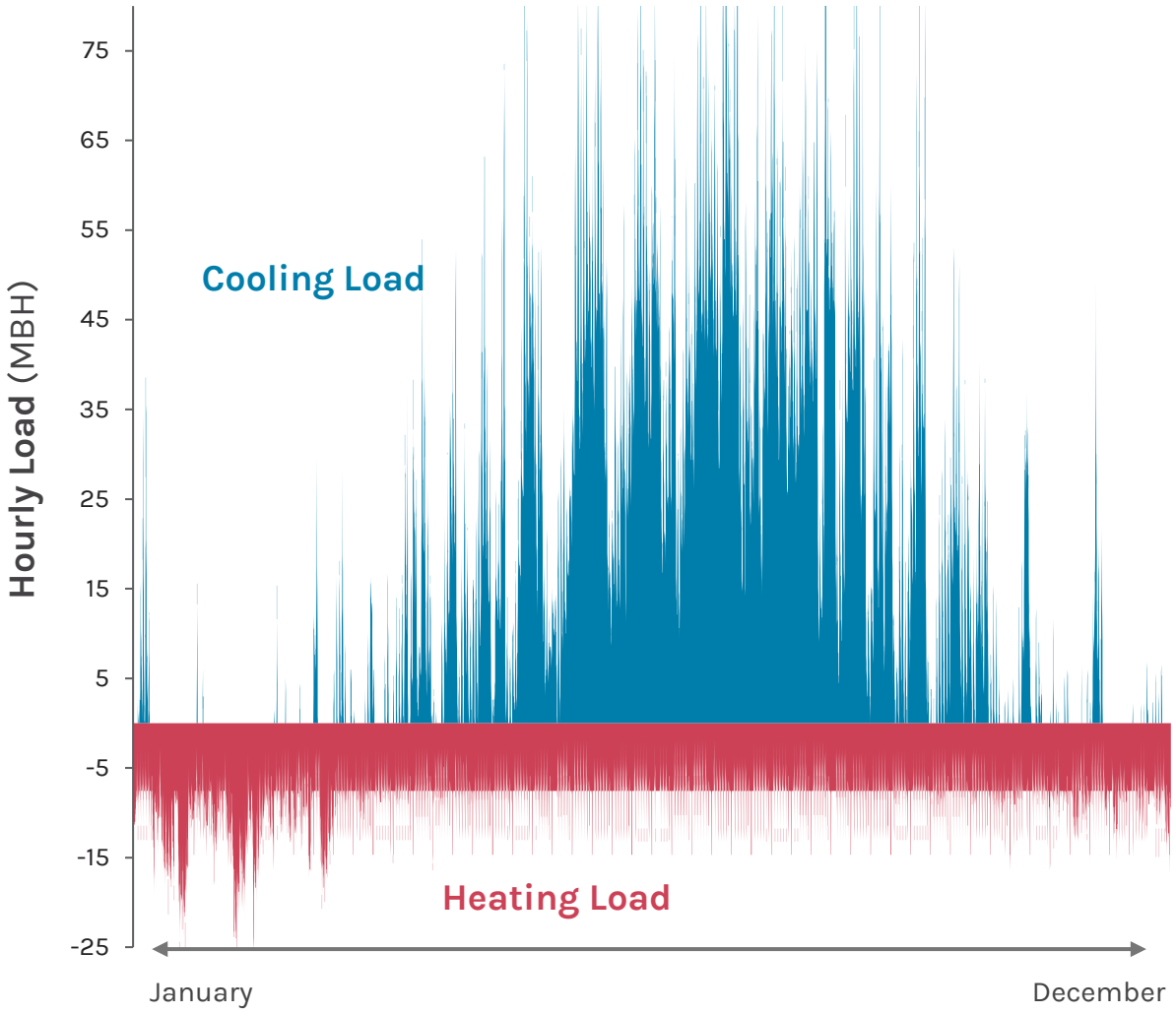
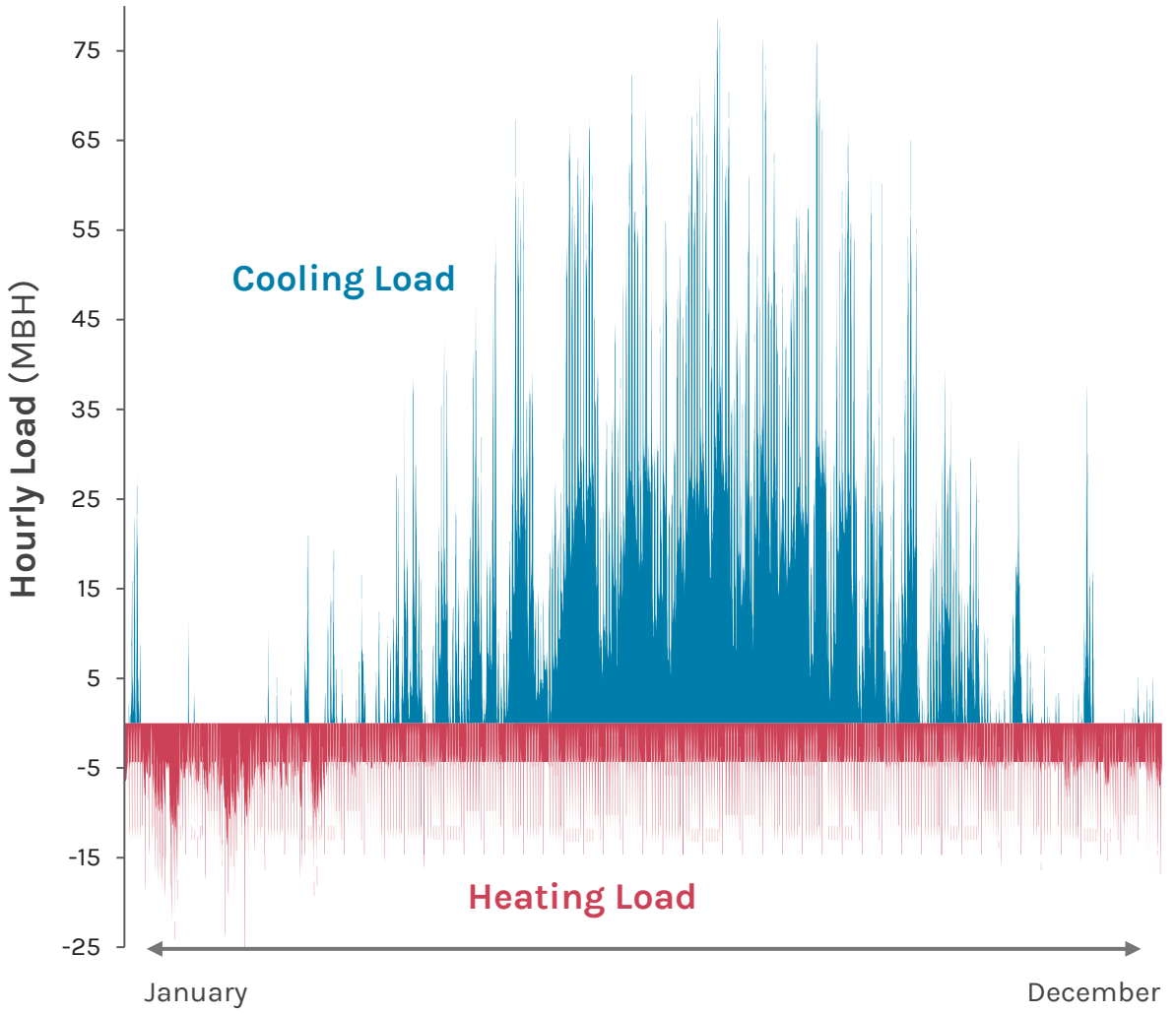
EXAMPLE PROCEDURE FOR FLEXIBILITY

Medium Hazard Level, 4 Fume Hoods



Low Hazard Level, 2 Fume Hoods



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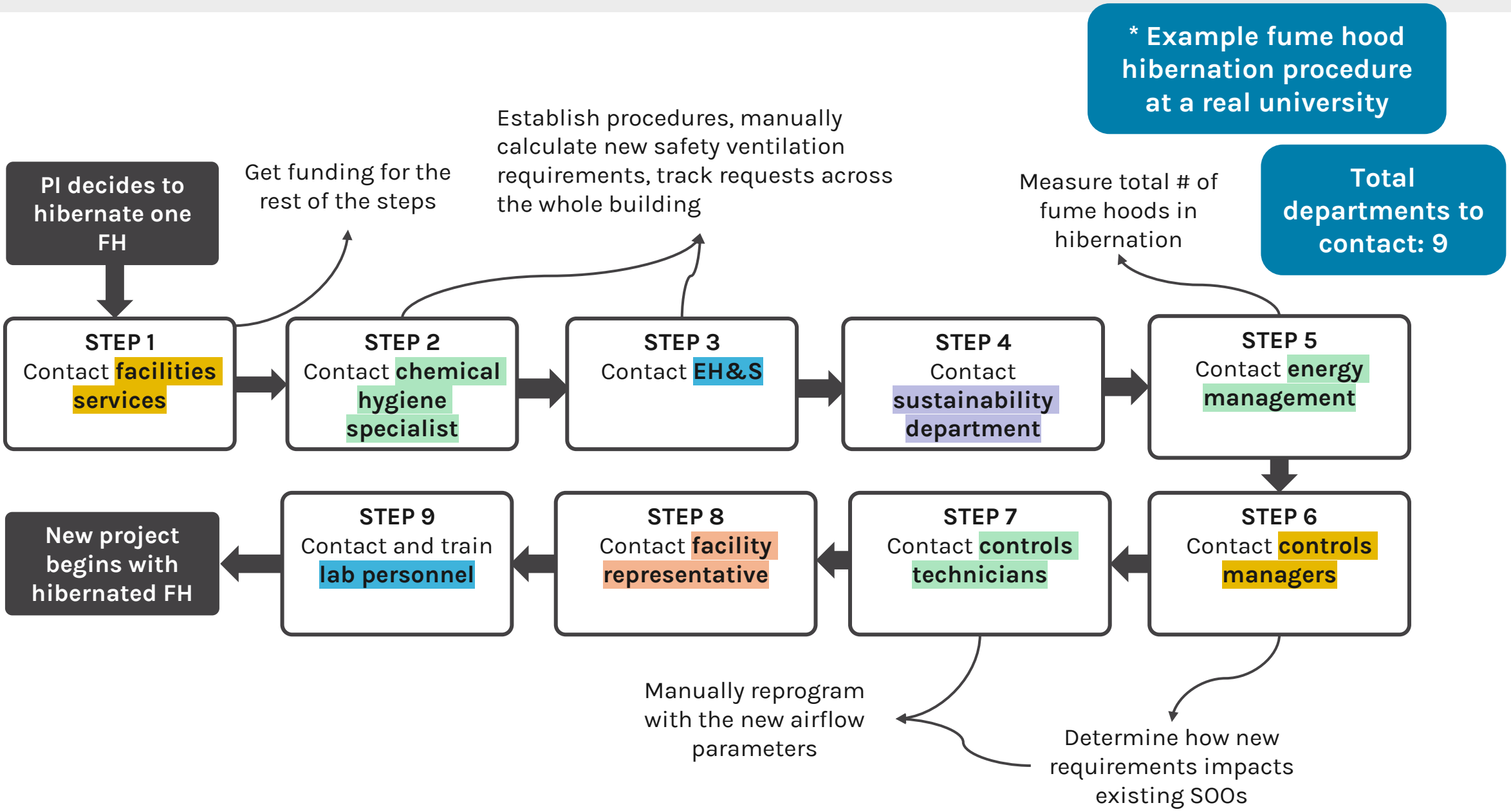

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Project proceeds safely and efficiently!

At your institution, how easy is it to...

...determine safe lab airflow parameters?

...change hazard-related parameters in the BAS?

...hibernate a fume hood?

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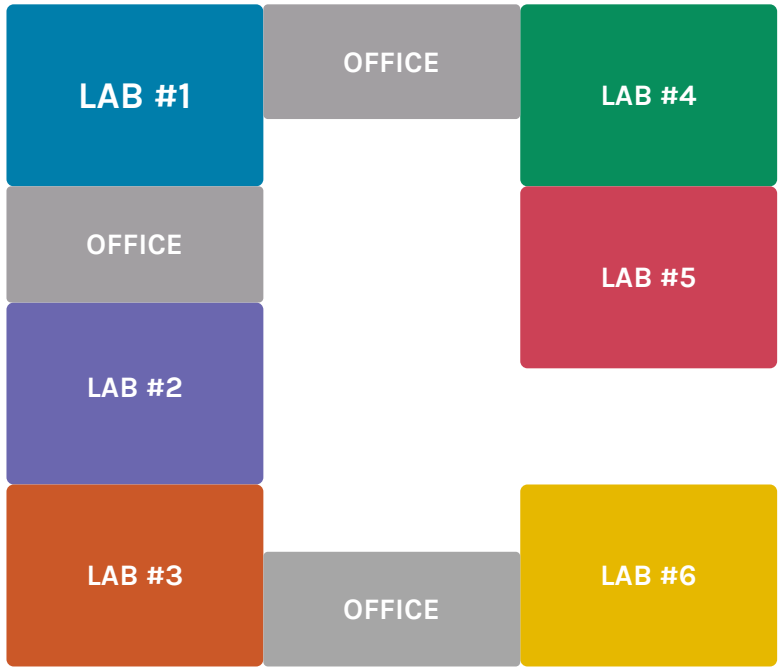

THANK YOU

QUESTIONS?

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Grace Turner – grace.turner@smithgroup.com