



Modernize Laboratory Fume Hoods

SUSTAINABILITY COMMITMENT(S) THIS INITIATIVE SUPPORTS

- 1 - Decarbonization
- 5 - **Energy Efficiency**

INITIATIVE ALIGNMENT WITH THE CHARGE

- **Eliminate Emissions:** by modernizing fume hoods, this initiative will directly aid in the university's goal of being carbon neutral by 2040.
- **Be Actionable:** The initiative includes specific, actionable plans to reduce fume hood energy use and associated carbon emissions.
- **Be Data Informed:** Based on historical and future data, this initiative prioritizes action in high resource utilization and inefficient research operations that can be the most cost- and time-effective at achieving the resource use and emissions reduction goals.
- **Inspire Adaptive Management:** This initiative encourages entities within the University of Arizona research enterprise to continually improve fume hood utilization and management to reduce resource use and associated emissions in sustainable and innovative manners.
- **Demonstrate Leadership:** Building on the university's research expertise, innovation, and knowledge, this initiative will enable the university research enterprise to be a leader in minimizing research resource use and emissions.

INITIATIVE DETAILS

Initiative Summary

This initiative proposes to modernize and improve the University of Arizona's fume hood efficiency, which are significant contributors to energy use, noise pollution, and greenhouse gas emissions. With over 1,600 fume hoods on campus and many outdated and lacking energy-saving features, the goal is to replace or update these hoods to meet energy efficiency standards and incorporate better design practices. Additionally, new and renovated construction must ensure that future fume hoods are energy-efficient and accessible for all users. Actionable items include:

- Conduct an inventory of all fume hoods on campus and replace or update those that do not meet current energy efficiency standards.
- Revise campus building guidelines to require energy-efficient, safe, and accessible fume hood designs for new research buildings and major renovations and ensure that researchers adhere to these standards when making purchasing decisions.
- Launch a campaign to educate lab users about the importance of closing fume hood sashes when not in use, potentially using hood sash stickers as reminders.

Proposed Initiative & Background

University of Arizona research is a world-class, innovative enterprise with more than \$824 million in expenditures per year in activities spanning all campus colleges and research centers. However, with this scale comes large resources and energy use. Current researchers have noted significant water utilization, waste generation, inefficient energy use, and greenhouse gas emissions generated in the research process.

A fume hood is an enclosure that safely contains and ventilates hazardous fumes, vapors, gases, and dust generated by chemical processes performed in the fume hood. Sometimes called a chemical hood or a lab hood, a fume hood protects workers from inhalation of hazardous substances. With more than 1,600 fume hoods on campus, many old and without the ability to turn off, fume hoods result in significant energy use and noise pollution for lab workers. Modernizing fume hoods and educating users about best practices can lead to reduced costs and a better work environment.

University Facility Services should inventory fume hoods across campus and replace or update existing lab fume hoods to ensure they meet a minimum standard of energy efficiency, have the ability to turn off where appropriate for safety, invest in energy-saving functions like variable air volume (VAV), and emphasize/provide significant resources and authority to assist in a behavioral change campaign to require lab users to close the hood sash when not in use.

A co-benefit will be reduced noise for lab users when hoods are modernized, maintained, and can be turned off when appropriate. It would be valuable to create hood sash stickers to remind people to close fume hoods when not in use. The university should update the Design & Specification Standards (DSS) to incorporate energy-efficient and safe fume hood design for all new buildings and any major renovations in existing buildings. Researchers must be required to always follow the DSS when involved in purchasing decisions as researchers sometimes purchase units that are not up to university code for various reasons (e.g., save money, personal preferences). This also relates to BE 30 “Create a Dedicated Sustainable Design and Construction Standard”. The university should also consider fume hood and lab designs that are accessible and designed with a variety of users in mind, such as for users in wheelchairs, and ensure accessibility for related safety components as well.

UFS and PDC will likely be seriously impacted by this initiative, both from a personnel and financial standpoint. Departments or researchers may also be impacted, as fume hood replacements are often purchased by the researcher now despite being considered part of the building (provided by UFS or PDC originally). The money must be provided to them for this, as this would be cost-prohibitive to anyone otherwise.

All researchers that interact with fume hoods would be impacted while changes were ongoing, as this could displace laboratories or cause entire buildings to be temporarily shut down. This would take significant coordination to ensure the continuity of research projects and the continued safety of researchers. See above regarding PIs and departments or colleges being expected to pay, which would likely preclude this from happening:

1. Discussions with UFS/PDC on feasibility and financial support from the institution.
2. Consultation with RLSS to ensure this will not negatively impact our regulatory compliance and lab worker safety.

3. Consult with RMS to ensure this will not negatively impact our regulatory compliance.

The university would need to ensure that resources (i.e., lab and research space) are allocated fairly during construction or renovation, including ensuring that displaced labs have appropriate and equitable substitute spaces to continue working. It is important to avoid situations where certain departments or researchers receive preferential treatment in terms of space and resources and ensure there is robust and equitable communication about these changes.

Data Analyses to Support Initiative

- VAV systems result in a 30-50% reduction in energy use annually
<https://www.labconco.com/articles/reducing-fume-hood-energy-consumption>;
<https://www.nationallaboratorysales.com/blog/saving-energy-fume-hood/>.
- Harvard saved an estimated \$200,000 per year in energy costs by starting a "Shut the Sash" campaign
<https://www.nationallaboratorysales.com/blog/saving-energy-fume-hood/>
- VAV systems can come with engineering controls to ensure proper usage by researchers (<https://www.labconco.com/articles/reducing-fume-hood-energy-consumption>), which could take some of the personal behavior change concerns out of the picture.
- University Facility Services (UFS) has a robust preventive maintenance (PM) system to track fume hoods and other ventilated devices on campus. This may or may not list the age of systems, but this should be investigated. Further, the building automation team is charged with controls that have an impact on VAV systems, and an investigation would need to be made into what resources would be needed to upgrade/retrofit/change systems such that VAV could be utilized across campus.

Resource Requirements & Return on Investment

Resource Requirements

- The ultimate cost to enact this change is unknown at this time, as it would take significant scoping from UFS as well as contractors. This would likely require HVAC system upgrades, new fume hoods (each between \$8-16K), and more.
- These changes should be made when either new lab spaces are built, or old lab buildings are undergoing major retrofits.

Return on Investment

- With proper preparation and energy savings, the return on investment is likely to be significant, such that this initiative pays for itself within a few years.
- Reprogramming older lab spaces during a renovation could lead to a reduction of total fume hoods, as space could be optimized to limit the number of required hoods. This would save money on the total number of hoods that need to be replaced, while being replaced with more

energy efficient options that can also benefit the heat recovery operations that are outlined in the Decarbonization Subplan.

Potential Funding Sources

- These changes should be made during capital renovations, or during new capital construction. Those costs are accounted for during the university Capital Planning efforts. Project managers and designers will need to budget for these equipment costs as part of the design process.
- Replacing fume hoods as a stand-alone project would require funds to be raised by departments. This could come from existing budgets, donors, or grants.
- In later years, there could be an energy efficiency programming budgets within UFS could provide funds for these types of retrofits as well.

Accountable Division(s) & Department(s)

- Planning, Design & Construction (PDC)
- University Facility Services (UFS)
- Research Laboratory & Safety Services (RLSS)
- Risk Management Services

Partners & Collaborators

- All researchers that interact with fume hoods
- All research departments and colleges

Implementation

Length of Time to Implement

- Less than one year
- One to five years
- More than five years

Difficulty of Implementation

- Low
- Medium
- High
- Extremely High

Relative Timing

- Begin within two years

- Begin in three to five years
- Begin in six years or later

Metrics for Success

- Number of fume hoods updated
- Energy savings - dollars per year
- Building Energy Use Intensity (EUI)
- Greenhouse gas emission reductions annually
- Number of fume hoods being open when not in use during RLSS inspections
- Percentage of fume hoods complying with revised DSS or other university Sustainable Design Standards