

Laboratory Ventilation Energy Conservation Measures

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Introduction

One of the largest sources of energy consumption in an academic research building is the laboratory ventilation systems. Laboratories require extra ventilation compared to classrooms and offices in order to maintain a safe environment. This project analyzes 41 Cooper Square's laboratory ventilation systems and investigates energy saving opportunities.

Ventilation System

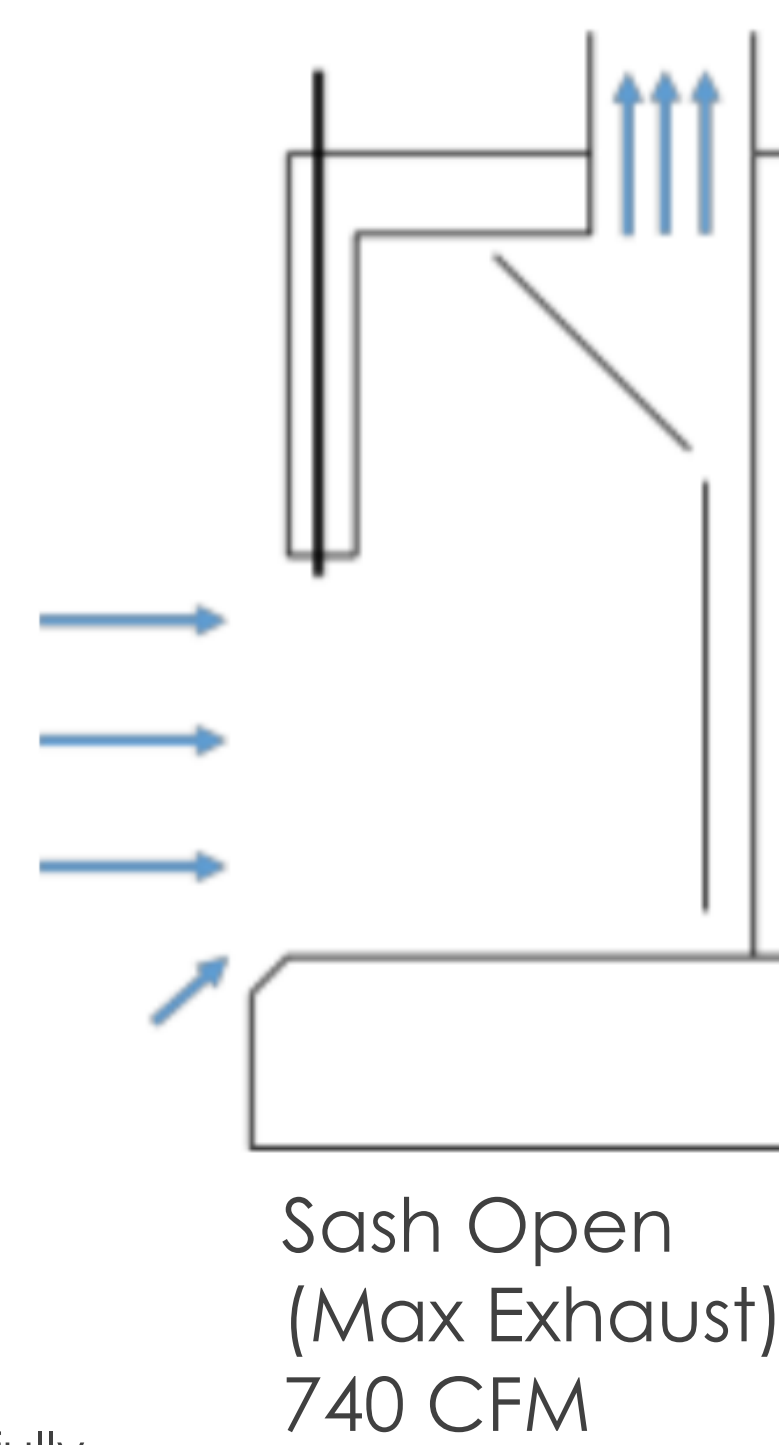
41 Cooper Square is an academic research building that consists of 33 fume hoods. In addition to fume hood exhaust, laboratories have a general exhaust. Laboratories must always be under greater exhaust than supply to exhaust contaminants. Air exhausted via the laboratory general exhaust and fume hood are expelled from the building through the 21 roof top exhaust fans.

Fume Hoods

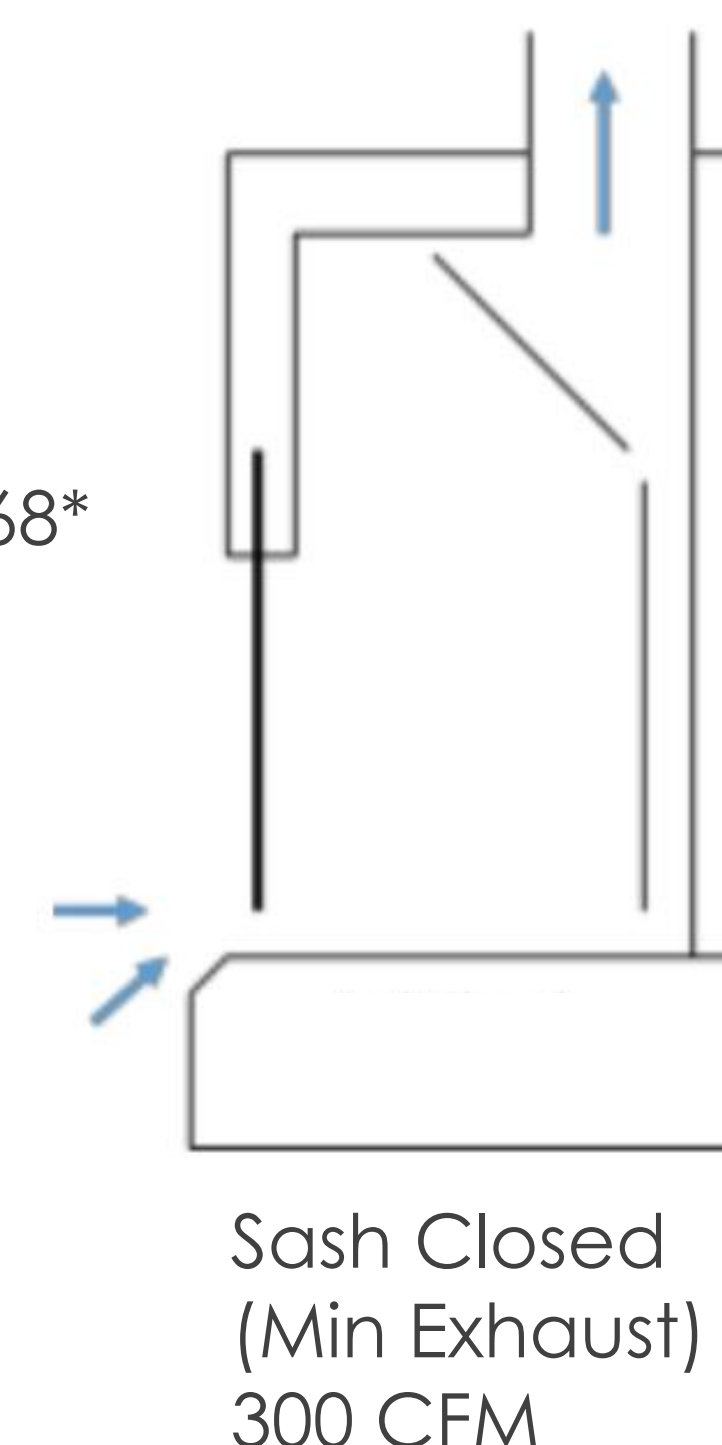
A laboratory fume hood is a ventilated enclosure designed to contain and exhaust hazardous chemical vapors safely out of a building. Fume hoods require large amounts of airflow increasing the size and cost of central heating, ventilation and air-conditioning systems. 41 Cooper Square contains 33 fume hoods with at least 8 confirmed unused fume hoods.



To the left is an image of a fully closed fume hood.



The cost per fume hood in the fully opened position is approximately \$6,068* a year.



The cost per fume hood in the fully closed position is approximately \$2,460* a year.

Decommissioning of 8 unused fume hoods could lead to a potential savings of \$19,680 per year.

Fume hood analysis source: John Han, M.Eng Thesis, 2016 *Cost calculated assuming \$8.20/CFM/Year

Laboratory Supply Air

Laboratory Supply Air Minimum

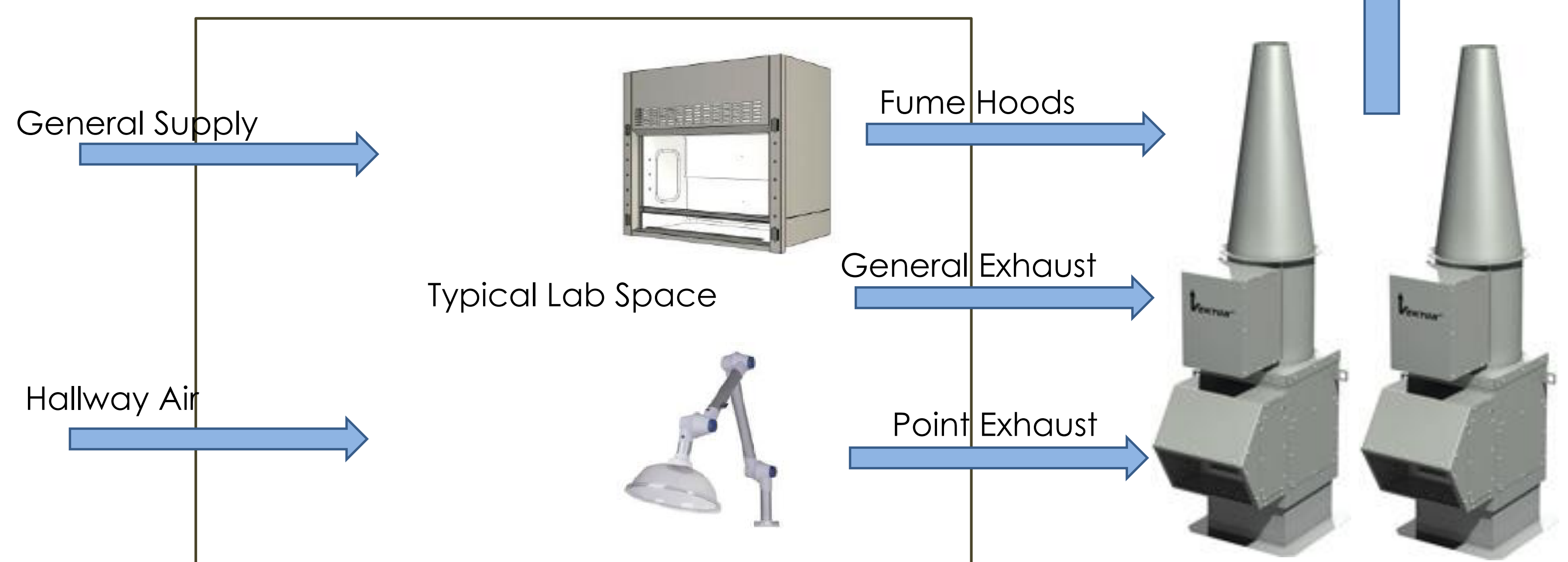
NFPA* 45, ASHRAE*, OSHA* standards, and the NYC Building Code provide guidelines for the minimum required supply air into laboratories.

Laboratory Differential Set point

Labs must always exhaust more air than supply in order to match the differential set point and to expel any potential contaminants.

Laboratory Reclassification

Many rooms classified as laboratories in 41 Cooper Square are physical labs and could be reclassified as non-laboratory spaces. This allows a reduction in minimum supply air and exhaust air flow rates. Reducing supply air by each CFM saves \$8.20/CFM/year.



Laboratory Ventilation Flow

General supply air enters the room from the ceiling panels. General exhaust air is also removed through ceiling fans. The fume hoods constantly exhaust air. All the exhaust air flows to the roof top exhaust fans.

*NFPA: National Fire Protection Association; ASHRAE: American Society Heating Refrigeration Air Conditioning Engineers; OSHA: Occupational Health and Safety Association

Reclassification Case Study

Reclassify

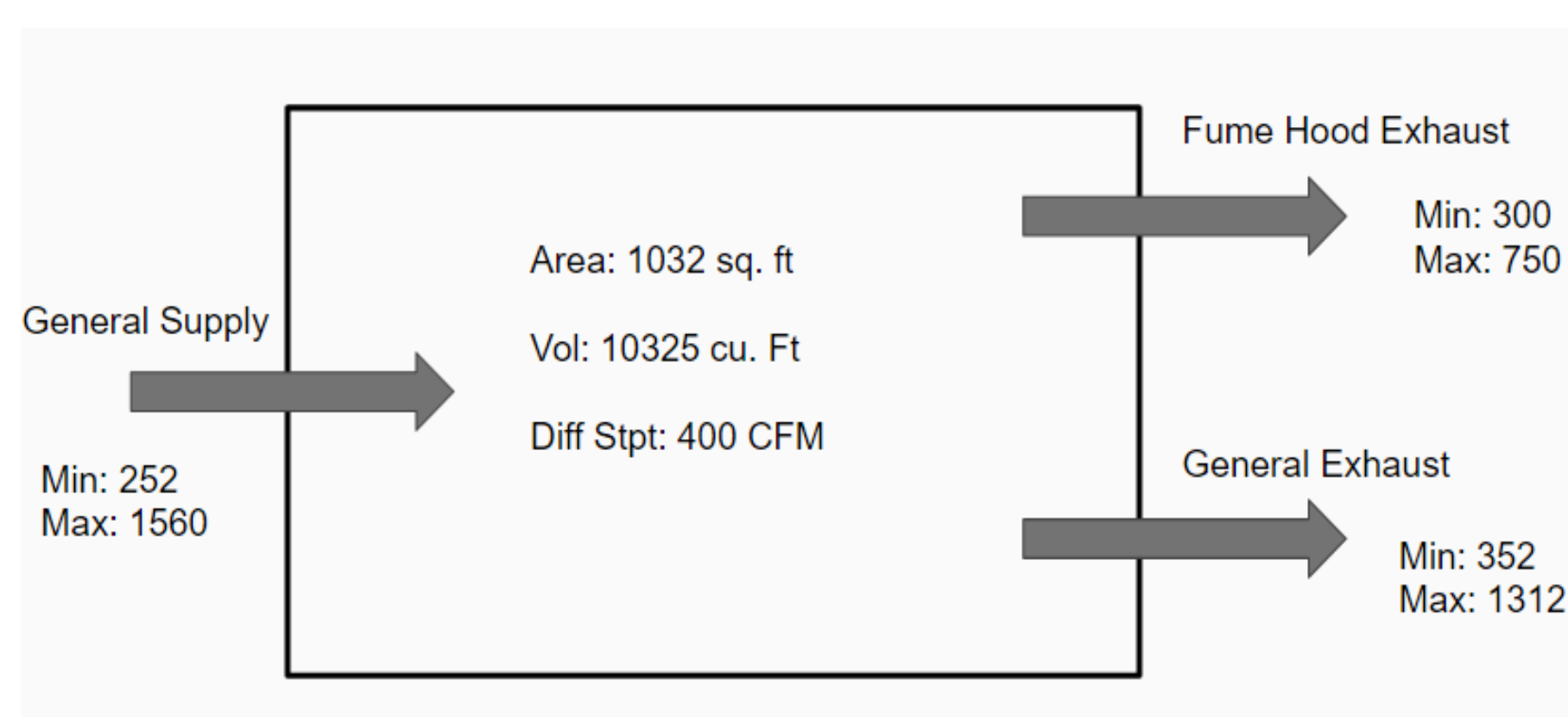
Based on the usage of Room 706, the ME Materials Lab, it can be reclassified as a classroom. There are no chemical experiments and the space is used more so as a teaching classroom or space for hands on activity.

Reevaluate

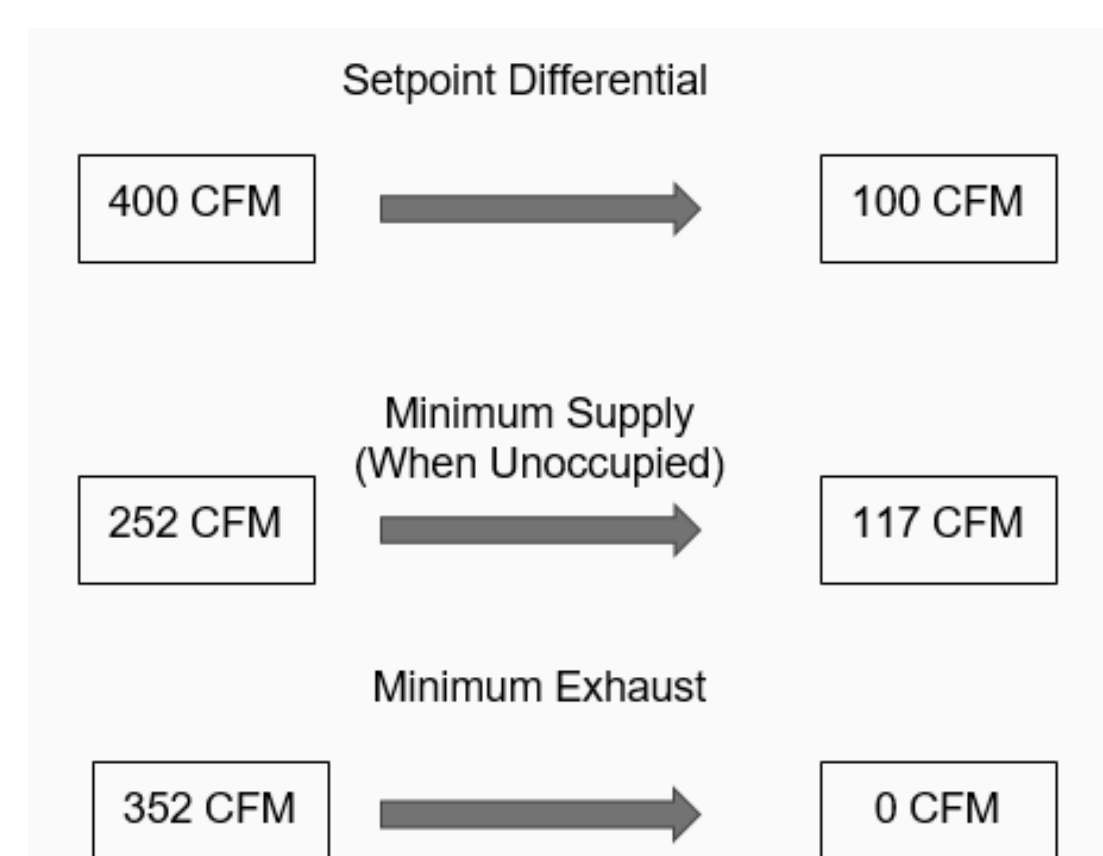
The exhaust and supply air flow set points will be reevaluated based on the new occupancy classification. A reclassification from a laboratory to a classroom typically reduces the minimum required air flow to that room.

Modify

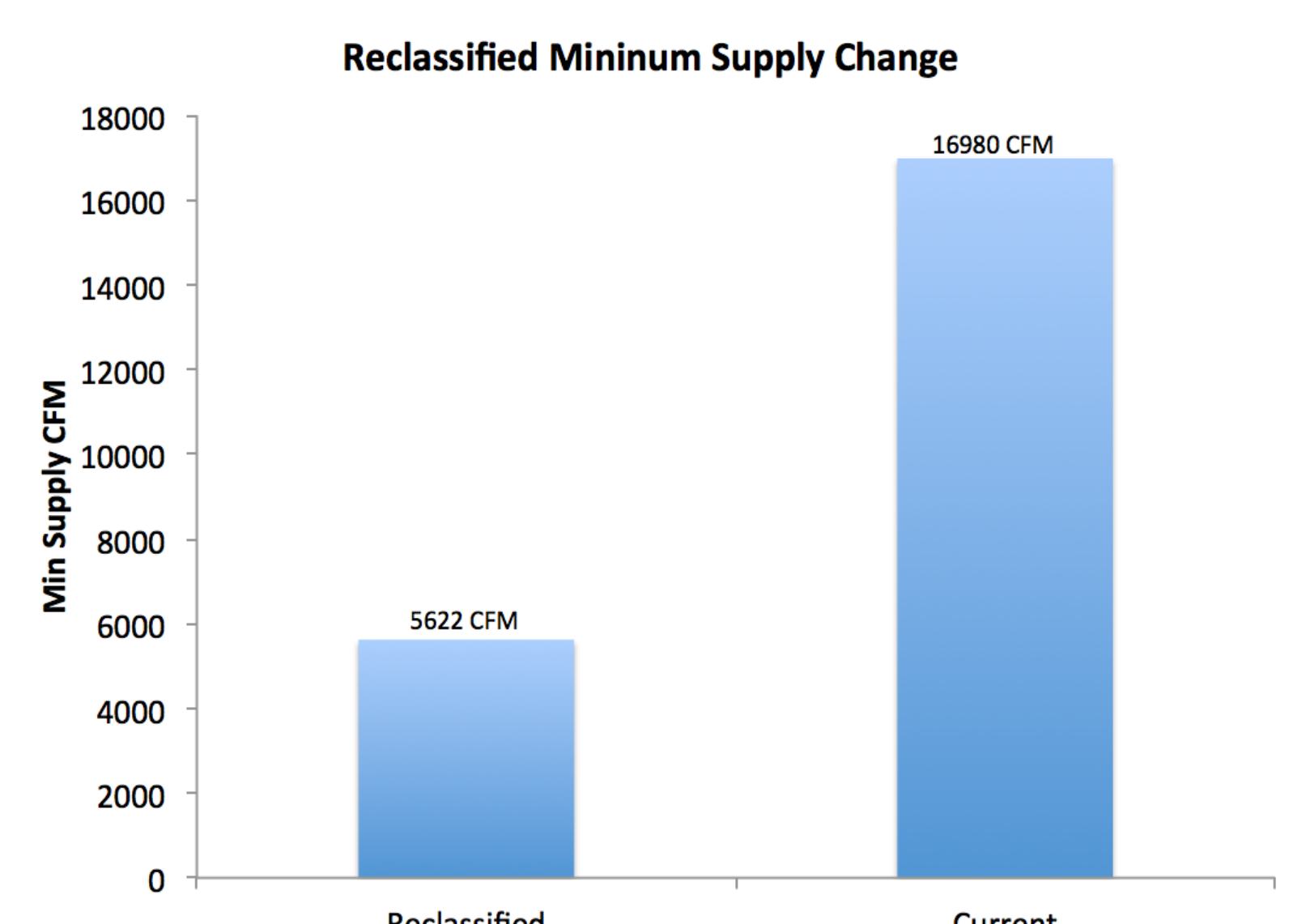
After calculating the new set point values based off the NYC Building Code, and all values have been verified, the set points can be modified in the BMS.



Differential Set point in room 706 is extremely high and the total exhaust is very high because of the high general exhaust minimum and fume hood exhaust minimum.



All set points adjusted to meet NYC building code minimum requirement and lower differential set point. 135 CFM saved, which is about \$1107 of monetary savings per year.



With reclassification applied across all laboratories, there is a potential to save 11358 CFM. This equates to about \$93131 per Year.