Abstract

Laboratory ventilation comprises a significant amount of energy due to extra ventilation requirements and special laboratory equipment, such as fume hoods, for maintaining a safe laboratory environment. This thesis focuses on laboratories in an academic institution, specifically with an emphasis on 41 Cooper Square, although the methodologies presented are applicable to any institution seeking to reduce energy costs associated with laboratory ventilation. The objective of this thesis is to contribute to the existing understanding of laboratory ventilation systems by providing 1) a methodology to quantify fume hood user behavior and laboratory ventilation costs and 2) two case studies at the fume hood and laboratory scales investigating safety implications of lowering exhaust air volume and ventilation rates. This master's thesis develops an automated tool to assess current fume hood usage patterns and identify unused and mismanaged fume hoods at Cooper Union. More importantly, according to the cost analyses presented in this thesis, decommissioning unused fume hoods at 41 Cooper Square can potentially lead to nearly $40,000 in annual savings. Computational fluid dynamics analyses revealed that the laboratory air change rates may be unnecessarily high and that supply air flow rates could be safely reduced saving significant energy costs (potentially up to $100,000 per year), without compromising lab safety, which remains the top priority.