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Tom Cole, AAP Assistant Dean  
Frank Parish, AAP Director of Facilities  
Sibley Hall

RE: Sibley Hall Digital Fabrication Lab – Health Review

At your request, we reviewed the design for the 240 Sibley Hall Digital Fabrication Lab installation encompassing 3D printers and laser cutters. The plan is to capture contaminants for both the 3D printers and laser cutters with HEPA/Organic Vapor filtration. The exhaust air pulled from the 3D printer enclosures and laser cutters will return to the lab only after it has passed through the HEPA/Organic Vapor filtration system. Therefore, the hazard is removed before it enters the interior or exterior building air.

The design exceeds applicable standards and adequately addresses health and safety issues related to 3D printers and laser cutters. Below are specific answers to questions posed by the Department of AAP:

**Question 1:** The safety data sheet for the "Stratasys" printer says that it should be used "only outdoors or in a well-ventilated area." How is your design consistent with the manufacturer's recommendation that the printer be used "only outdoors or in a well-ventilated area"?

Answer: The design goes beyond the manufacturer recommendations by providing local exhaust ventilation with HEPA/Organic Vapor filtration. Additionally, the space is "well-ventilated", see Question 2.

**Question 2:** The 2015 NYS Mechanical Code seems to require that "Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate." Your plans for 240 E. Sibley don't seem to have any mechanical ventilation system for outdoor air—only transfer grilles that pull in return air from the adjacent spaces. Where is the required outdoor air coming from for this room?

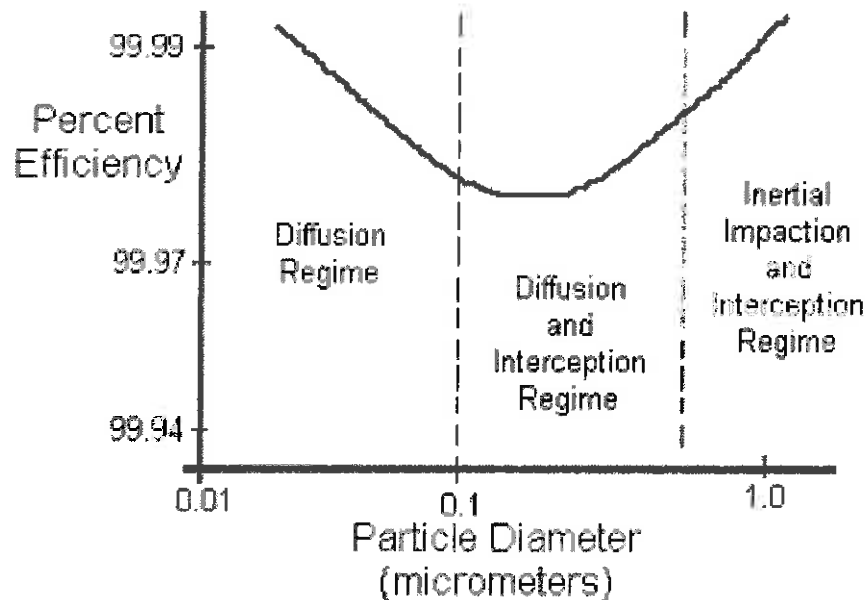
Answer: The general room ventilation system for East Sibley Hall consists of 100% outdoor air. The required outdoor air for the new Digital Fabrication Lab is being delivered by a Makeup Air Unit located in Room 200UA. The Makeup Air Unit in Room 200UA delivers fresh air to the second floor. This air is then transferred into Room 240 through grilles located at the top of the glass partition wall. There is no recirculated air associated with this section of the building. Air is brought in from the outside, conditioned, transferred through this section of the building and then exhausted outside as permitted by the code. The code requires a minimum of 0.18 cfm/ft<sup>2</sup> plus 10 cfm/lab-user of outdoor air to the new lab and the design far exceeds this requirement.

**Question 3:** How can you be sure that particulate matter containing toxic or carcinogenic byproducts from the printer will not be exhausted directly in front of the rear entrance to Sibley Hall and a short distance from the food truck?

Answer: Emissions from the 3D printers and laser cutters will be filtered using HEPA and Organic Vapor filtration before air is exhausted from Room 240 to the outdoors. The proximity of the building air intake is immaterial because the hazards are removed before building air is exhausted to the exterior.

**Question 4:** Concern that nanoparticles are so small they pass through HEPA filters.

Answer: A local exhaust ventilation system with a high-efficiency particulate air (HEPA) filter is an effective control for nanoparticles. See the National Institute for Occupational Health guidance document, *Approaches to Safe Nanotechnology - Managing the Health and Safety Concerns Associated with Engineered Nanomaterials*. According to the American Industrial Hygiene manual "The Occupational Environment: Its Evaluation, Control and Management", HEPA filters are tested and shown to be at least 99.97% efficient against monodispersed aerosols of 0.3 micron. The 0.3 micron benchmark is used in efficiency ratings, because it approximates the most difficult particle size for a filter to capture. HEPA filters are even more efficient in removing particles that are smaller than 0.3 microns and larger than 0.3 microns. The fact that a HEPA filter's removal efficiency increases as particle size decreases below 0.3 microns is counter intuitive. The graph below from *Mechanisms of filtration for high efficiency fibrous filters* published by TSI, Inc. shows the filtration efficiency as a function of particle size.



Sincerely,

Tim Fitzpatrick

Director of Occupational Health, Safety, Fire and Emergency Services

Erik Eshelman

Director of Facilities Engineering