

Air Quality in Indoor Rock Climbing Facilities

Indoor rock climbing is a popular and growing sport in which participants scale short, tough bouldering “problems” without ropes or longer (higher) rope-protected “routes”. As in outdoor climbing, most climbers like to increase the friction of their hands on the holds with powdered chalk. Traditionally, the climber reaches into a bag of loose powder, or into a bag with a “chalk ball” which is a porous cloth bag containing the powder. Unsurprisingly, chalk dust enters the air when the climber is applying it to their hands (for example, see https://www.youtube.com/watch?v=K6F_pKdIOlo), and this may create an air quality problem if there is not enough ventilation. Recently “liquid chalk” has been introduced and required in some gyms to reduce levels of airborne particulate matter. Liquid chalk is essentially the chalk powder suspended in something like hand sanitizer (see for example <https://gripped.com/indoor-climbing/five-best-liquid-chalks-for-canadians/>).

Hive Climbing (<https://hiveclimbing.com/>) would like to know if the liquid chalk has improved air quality and whether in fact air quality is bad when it is not required. From past observations, it seems clear that chalk is not great for air quality, but it is not clear how much needs to be done to address the issue, or the best way to approach it.

We see this as a problem of 3 intersecting questions:

- What is in the air?
- How does the gym design including ventilation affect what is in the air?
- How do human factors play into this and what policies might be effective?

Ideally, a team of 3 students would work together on this and write their own research thesis on their own core area. One of the students, in Chemistry and supervised by Dr. Nadine Borduas-Dedekind would focus on the chemistry and composition of the air quality. Another student, in Mechanical Engineering, supervised by Dr. Rogak, would focus on the way ventilation systems affect the air quality (and how mechanical system interventions might help). The third student, in Mechanical Engineering, would be supervised by Dr. Giang and focus on the human factors of the issue (e.g., behavior, usage patterns, non-air quality dimensions such as cost, sensitive populations).

Together these students would develop a research plan to assess the current situation. The primary tools will be air quality sensors and filter samplers, combined with surveys of climber activity and the type of chalk used. Interviews with and observations of groups of climbers and staff at the Hive will be considered as well. The experimental phase of the research will take place mainly over the winter months when air quality is typically poorest (gyms are more crowded; windows are mostly closed). Following the measurements in the gym, students will analyze data in whatever way will address the key questions posed above.

The Hive will pay for reasonable expenses of the study, provide access to facilities (for example to place air quality sensors) and facilitate interactions with climbers (for example, promoting surveys to their staff and gym-users as appropriate).