

## Lessons Learned: The Importance of Knowing the Differences between Laboratory (chemical) Hoods, Clean Benches (laminar flow hoods) and Biosafety Cabinets

### Background

Although chemical hoods, tissue culture hoods, clean benches, and biosafety cabinets can look similar, they have very different uses and limitations on what operations may safely be conducted in each.

- A **chemical hood** is designed to contain hazardous vapors and gases and exhaust them outside the building.
- A **clean bench or tissue culture hood** is designed to protect the materials in the hood from contamination by bathing the work area with a laminar flow of air free of particulate contamination. Because these devices force air out across the work surface and toward the worker they protect only the specimen, not the user.
- A **biosafety cabinet** provides biological protection for both specimen and user. A laminar flow of HEPA-filtered air is passed down from the top of the hood and across the work surface, and is exhausted or recirculated without entering a worker's breathing zone. The air is then re-filtered before being exhausted, usually back into the laboratory. This filtration only removes particulates and aerosols, not gases and vapors. Because all clean benches and most biological safety cabinets exhaust air back into the work area, they cannot safely be used with hazardous gases and vapors. Only Class II Type B2 (total exhaust) biosafety cabinets can be used with significant quantities of volatile hazardous chemicals

### Description of Incident

An employee opened a 100 ml bottle of hydrochloric acid in a clean bench. The employee was wearing standard laboratory PPE, i.e., gloves, safety glasses and a lab coat. When the employee twisted the cap to open the bottle, he heard a hissing sound and alleged detecting a pungent odor not present prior to this event. (The bottle had been refrigerated and the contents apparently pressurized slightly during warming after removal from the refrigerator.) The employee also alleged a burning sensation in the nose and throat and chest tightness persisting for an hour or so after the incident. This led the employee to believe he may have inhaled hydrochloric acid vapors. The employee was sent for medical evaluation, where no evidence of chemical exposure was noted by the treating physician.

### Root Cause Analysis

The employee conducted this work in a clean bench, which blows air out into the breathing zone, instead of using a laboratory hood in the adjacent space. Signage on the clean bench stated the device is not for use with volatile chemicals or toxic gases; however the employee did not recognize that concentrated acids can give off irritating

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vapors. In addition, the employee was concerned about maintaining cleanliness due to the sensitivity of the assays conducted in the lab.

### **Corrective Actions Taken**

- The MSDS for hydrochloric acid and the way a clean bench operates were reviewed with the affected employee. In addition, employees in this lab were advised to use a chemical hood for all chemical manipulations that require control of vapors, mists, dusts, fumes, aerosols, etc.
- Pertinent information on the differences in operation and protections afforded by clean benches, lab hoods and biosafety cabinets will be incorporated in annual laboratory safety classes.
- The lab safety committee will review the signage language used on biosafety cabinets and clean benches to determine if changes should be made to the verbiage 'volatile chemicals and toxic gases'.
- A Lessons Learned was developed for distribution to the lab safety committee and laboratory PIs who have clean benches and/or biosafety cabinets in their lab spaces. The Lessons Learned will also be posted on the Institute's Lessons Learned web page.