

Guidelines for Minimizing Toxic Air Contaminant Emissions in Laboratories

Introduction

In 1995 the Bay Area Air Quality Management District (BAAQMD, the District) adopted new regulations and formulated a set of Responsible Laboratory Management Practices (RLMPs) designed to minimize the emission of toxic air contaminants (TACs) from laboratory operations.

The University of California, Berkeley, is committed to protecting the local community and the environment and to complying with the laws and regulations governing emissions of TACs. In response to the new requirements, the campus Laboratory Operations & Safety Committee, together with the Office of Environment, Health & Safety (EH&S), has developed a program to help laboratories comply with federal, state, and local TAC regulations and incorporate the RLMPs into their work. These guidelines are a part of that program. They are based on federal and state law, BAAQMD regulations, and on the procedures set forth in the National Research Council publication *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals* (National Academy Press Washington DC, 1995).

What are TACs?

TACs are those chemicals “that may cause or contribute to an increase in mortality or in serious illness, or may pose a present or potential hazard to human health” when they are present in the atmosphere (California Health and Safety Code §39655). The California Air Resources Board (ARB) designates which chemicals are TACs. BAAQMD estimates that the following laboratory TACs pose the greatest health hazards:

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| benzene | 1,3-butadiene |
| carbon tetrachloride | chloroform |
| 1,4-dioxane | ethylene glycol butyl ether
(butyl cellosolve) |
| ethylene glycol monoethyl ether
(cellosolve) | ethylene glycol methyl ether
(methyl cellosolve) |
| formaldehyde | methanol |
| methyl chloroform (1,1,1-TCA) | methylene chloride |
| perchloroethylene | toluene |
| trichloroethylene | xylenes |

Typical laboratory operations or conditions leading to TAC vapor emissions include:

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| chromatography | distillation |
| refluxing | heating solvents |
| handling or pouring of chemicals | untrapped rotovaps |
| uncovered beakers | any operation involving open
containers of TACs |
| uncapped solvent bottles | |



What are the dangers of TACs?

Most laboratory operations that use TACs are performed in fume hoods to protect people in the laboratory from exposure to hazardous vapors. TAC emissions are first diluted in the fume hood. Then the fume hood exhaust is emitted and disperses into the atmosphere.

TAC emissions degrade overall air quality by contributing to increased cancer risk and to ground-level ozone formation. (Ozone is a regulated air pollutant.) Children and people with respiratory diseases are particularly sensitive to any exposure to TACs. In addition, occupants of buildings where TACs are in use may be at special risk for exposure through the recapture of the building or fume hood exhaust into the building's air supply. Maintenance personnel, working on or near fume hood or building exhaust vents, are also at increased risk from exposure to TAC emissions.

BAAQMD "RLMPs"

Regulating TAC emissions in the Bay Area air basin is the responsibility of the BAAQMD. (This basin covers nine counties: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco.) To minimize emissions of TACS, the District requires laboratory facilities to either demonstrate that the health risk resulting from emissions of TACs is less than one additional cancer risk in one million or follow the Responsible Laboratory Management Practices (RLMPs) outlined below. Because of the varied nature of research, estimating TAC emissions and demonstrating low risk is difficult while following the RLMPs is fairly straightforward. Moreover, the RLMPs are based on risk analyses using information from Stanford University and the University of California, San Francisco.

Minimizing emissions of TACs

Follow these guidelines when using, storing, or disposing of TACs to prevent air pollution and to ensure compliance with federal, state, and local requirements as well as campus policy.

Use and Storage of TACs

- Scale down experiments.
- Substitute less volatile chemicals for TACs where possible.
- Avoid experimental procedures using open containers of TACs.
- Trap vapors from any process that evaporates a solution containing TACs.
- Avoid storing open containers of TACs. Cap solvent containers, such as beakers and unwanted solvent collection bottles (no open funnels).

Technological controls such as filters and scrubbers are available to abate emissions of toxic air contaminants and should be considered when designing experiments.

Disposal of TACs

Evaporating unwanted solvents is prohibited. Collect all unwanted TACs for pickup by EH&S. See EH&S's Fact Sheet "Hazardous Waste Management" for more information.

Training



All laboratory employees who handle hazardous materials must be trained on minimizing TAC emissions. These guidelines are designed to meet training requirements and should be provided to all laboratory staff, including incoming students and visiting scholars.

Fume Hood Labeling

Fume hoods must be labeled with information reminding laboratory personnel to minimize TAC emissions. EH&S checks for labels during its annual fume hood inspections.

Chemical Inventory Requirements

All hazardous chemicals, including TACs, must be inventoried both annually and when quantities change significantly. Include your estimated annual usage of TACs in the inventory. See EH&S's Fact Sheet "Chemical Inventory" for more information. Labels and inventory instructions are available from your Department Safety Coordinator or EH&S.

