Memorandum

To: CleanAir Laboratory Personnel

From: Jim Wright

Date: 6/24/2003

Re: Ether Dangers and Handling Procedures

Ethyl ether (a.k.a. diethyl ether) presents an extreme fire hazard. It is highly volatile and has a flash point of -49°F and a lower explosive limit of only 1.9% by volume in air. An open beaker of ether on a lab bench next to an ignition source (e.g., spark from wall outlet, oven relay, etc.) will ignite. Its density is 2.5 times that of air; therefore, ether vapors can "fall" from a lab bench to the floor and travel to a spark source which can result in a flashback to the source. Also, vapors can easily accumulate in sufficient concentration in a closed space (e.g. refrigerator) to explode with the slightest spark (e.g. refrigerator condenser comes on). Refrigerated storage does not suppress the formation of ether vapors.

More important to consider is the fact that, upon exposure to air and light, ether tends to form unstable peroxides. These compounds will concentrate by evaporation of the ether and may detonate with a violent explosion when disturbed by shock or friction. The friction produced by simply unscrewing the cap of a container of peroxidized ether may cause an explosion. One incident that I know of involved an "empty" 250-cc bottle which had held ethyl ether that exploded when the lid was loosened.

Some brands of ether are "stabilized" by the manufacturer. This will be stated on the label. As long as they are unopened, stabilized containers of ether are usually OK for about 1-2 years. Once exposed to the air, however, the ether may form peroxides within a matter of a couple of months. Unstabilized ether may form peroxides in less than two weeks and must be handled with extreme care. There is no evidence that refrigerated storage will prevent formation of peroxides.

To prevent fire and explosion hazards associated with ethyl ether, follow these precautions:

1. Purchase ether in a quantity that can be used within 12 months.
2. Date the ether to indicate the date received and the date the container was opened.
3. Dispose of any ether that is older than one year.
4. Dispose of ether remaining in squeeze bottles that has not been consumed after 2-3 days.

5. Keep unused ether in a metal can or amber glass bottle to prevent its exposure to light.
6. Store bottles or cans of ether only in approved explosion-proof flammable cabinets.
7. Dispose of unused unstabilized ether within 2-3 days after opening container.
8. Do not store ether in the laboratory fume hood or in a household style refrigerator or freezer.
9. Always use ether in a properly functioning chemical fume hood.
10. Make sure there are no open flames or ignition sources present when ether is in use.

If you are ever interested in determining if ether contains peroxides, you can test it as follows:

- Add 1 ml of freshly prepared 10% potassium iodide solution to 10 ml of ethyl ether in a 25 ml clear glass- stoppered flask that has been wrapped to protect it from light.
- Shake for one minute, then let it stand for one minute.
- Unwrap the flask and view against a white background.
- Yellow color indicates the presence of peroxides.