

## REFRIGERATORS & FREEZERS IN LABORATORIES

### The Purchase and Use of Laboratory Refrigerators & Freezers with Flammable Liquids

pub# CSU6

**If flammable liquids and solvents must be stored below ambient temperature, refrigerators/freezers designed for this purpose must be used.**

If not, the potential exists that an electrical spark from a light switch, motor, or other source could result in an explosion. Below is a description of the uses and limitations of the three types of units used at UCSF.

A flammable liquid is defined by the National Fire Protection Association (NFPA) as a liquid having a flash point below 100½ degrees Fahrenheit (37.8½ degrees Centigrade) and having a vapor pressure not exceeding 40 psia (2068 mm Hg) at 100½ Fahrenheit (37.8½ degrees Centigrade). Review the Material Safety Data Sheet (MSDS) for information on a chemical's flammability characteristics.

#### Domestic refrigerators and freezers

- ◆ These are common household appliances available from local department stores which **do not have special protection to prevent ignition of flammable vapors**. For example, the light switch inside the storage compartment can cause an electric arc every time the door is opened and closed. The temperature control, or thermostat, arcs each time it starts or stops the refrigerating system (usually several times an hour).

If flammable liquids were stored in this appliance and an accidental spill occurred in the storage compartment or if bottles were stored with loose or otherwise improperly sealed tops, flammable vapors could be produced that when coupled with an ignition source could result in a powerful explosion.

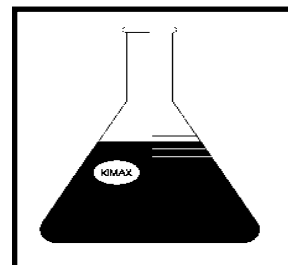
To avoid this possibility, WARNING labels reading:

**“CAUTION - UNSAFE FOR STORAGE OF FLAMMABLE LIQUIDS”**

must be affixed to the outside of the refrigerator/freezer.

- ◆ These units should not be put in a room or space where flammable vapors may be present in sufficient quantities to create an explosive atmosphere because external ignition sources are also present.

For example, the motor-compressor has a thermal overload protector that disconnects the electrical supply when there is an abnormal rise in the temperature of the compressor. When normal



temperature returns, the electrical supply is returned. There is a starting relay that arcs every time the unit recycles. Since the compressor is normally located at floor level in domestic units (unlike the old refrigerators where the compressor/motor was mounted above the box), and since most flammable vapors are heavier than air, they tend to settle at floor level, where the ignition source could ignite the vapor-air mixture. An alcohol pouring room where bulk alcohol is transferred from 55-gallon drums to 1-gallon containers might be an example of such a solution.

### **Laboratory-safe refrigerators and freezers**

- ◆ These units have been designed for laboratory purposes and are sometimes referred to as “**Flammable Material Storage Refrigerators**”. The units are designed to reduce sparking sources like those described above.

The units sometimes incorporate features such as self-closing doors, friction latches or magnetic door gaskets and special materials for the inner shell. These features are designed to control or limit damage should a reaction occur inside the unit. The compressor and its electrical circuits are located at the top of the unit to further reduce the potential for the ignition of flammable vapors at floor level.

- ◆ As with domestic units, they should not be placed in a room or space where flammable vapors may be present in sufficient quantities to create an explosive atmosphere during normal operating procedures because they are not designed to fully eliminate electrical arcing.

### **Explosion-proof refrigerators and freezers**

- ◆ These units are designed to more rigid standards than “Laboratory-Safe” units to more fully prevent arcing both inside and outside of the storage compartment.
- ◆ Explosion-proof units should be used when flammable vapors could be present in sufficient quantities to create an explosive atmosphere outside of the refrigerator during normal operating procedures.

### **Other safety-related information**

Refrigerators and freezers use chlorofluorocarbons (CFCs), such as freon, as a refrigerant. The handling of CFCs requires special knowledge. The servicing of CFC-containing equipment must be performed by a certified technician. Before discarding equipment, the CFCs must be removed. Call the Facilities Management Building Manager for assistance. Additional CFC information can be found in a separate Technical Informational Bulletin available from the Office of Environmental Health and Safety (EH&S) at 476-1300. See Pub# CSU5.

Note that all refrigerators and freezers should be properly grounded (three-prong plug) and directly connected to electrical outlets (extension cords should not be used). If you have questions regarding refrigerator or freezer matters, please feel free to contact your EH&S Department Safety Advisor.