

REFRIGERATOR EXPLOSION in GILTNER HALL

What happened—and how to prevent it

Q: What caused the explosion in Giltner Hall?

A: A container of flammable liquid stored in a household refrigerator found an ignition source inside of the unit. The refrigerator door was blown across the room, windows broken, and the contents of the fridge scattered. University laboratories across the country have experienced this phenomenon; MSU has now also had its own incident of a vapor explosion inside a household refrigerator. Fortunately, no one was in the lab at the time of the accident.

Q: Why did it explode?

A: Household refrigerators and cold rooms contain lights, fans, thermostats and other electronics within the storage compartment of the refrigerator that generate ignition sources to spark vapors. When flammable chemicals are stored in a household fridge or cold room, the vapors can eventually find their way to these ignition sources – with dramatic, unintended results.

It doesn't take a lot of vapors to ignite and create an explosion. These explosions have demolished laboratories, blown out windows, and sent debris flying greater than 20 feet. In some cases, explosions started a secondary fires, causing additional damage.

Even closed containers can create enough vapors to cause an explosion. No volume of flammables can be considered safe to store in a household-type refrigerator or cold room.

Q: What are the alternatives?

A: Fortunately, flammable-safe refrigerators and freezers can be purchased for laboratories that must store flammable chemicals in a refrigerated environment.

Flammable-safe refrigerators and freezers are constructed so that all static/spark producing elements are housed on the outside of the unit and out of the storage compartment. This makes them safe to store volatile flammable chemicals inside.

Flammable-safe refrigerators will be UL listed, and bear a label stating "FLAMMABLE STORAGE - KEEP FIRE AWAY". While more costly than household type refrigerators, their design and construction will prevent the unintended ignition of flammable vapors stored inside of it.

Another type of specialty refrigerator, called an **explosion-proof refrigerator**, is constructed in such a way that no sparks or static charges are generated either on the inside or the outside of the unit. Explosion-proof refrigerators are used in specialized facilities such as solvent dispensing rooms, paint booths, etc. In general, explosion-proof refrigerators are not necessary for ordinary laboratory-type environments; their high cost is also prohibitive.



Flammable vapors spark a fridge explosion in Giltner Hall on July 10, 2015

Q: Can we modify the refrigerator or cold room we have?

A: Unfortunately, no. Household refrigerators and cold rooms are constructed so that it's virtually impossible to retrofit them into flammable-safe units. IPF will not accept work requests to retrofit a household refrigerator into a flammable-safe refrigerator. Lab staff should not attempt such work, nor should they send household units out to have such service performed.

Q: How do we know what can and can't go in a household refrigerator or cold room?

A: Chemicals with a flashpoint of less than 100°F (38°C) cannot be stored in a household refrigerator or cold room. Information about a particular compound's flashpoint can be found on the (M)SDS for the product, or by querying ChemSpider to determine its flashpoint.

Here is a list of commonly used flammable solvents and their flashpoints:

Chemical	Flashpoint
Acetone	1°F -17°C
Ethanol	55°F 13°C
20% Ethanol	97°F 36°C
Isopropanol	53°F 12°C
Methanol	54°F 12°C
Ethyl Ether	-49°F -45°C
Isopentane	-60°F -51°C

Mixtures and solutions of flammable solvents often retain their low flashpoints, even when diluted. Before placing solutions prepared with flammable chemicals into a refrigerator or cold room, DO YOUR RESEARCH and know what the flashpoint is before you store it. Always err on the side of flammable-safe storage if you cannot confidently determine the flashpoint of a mixture or solution!

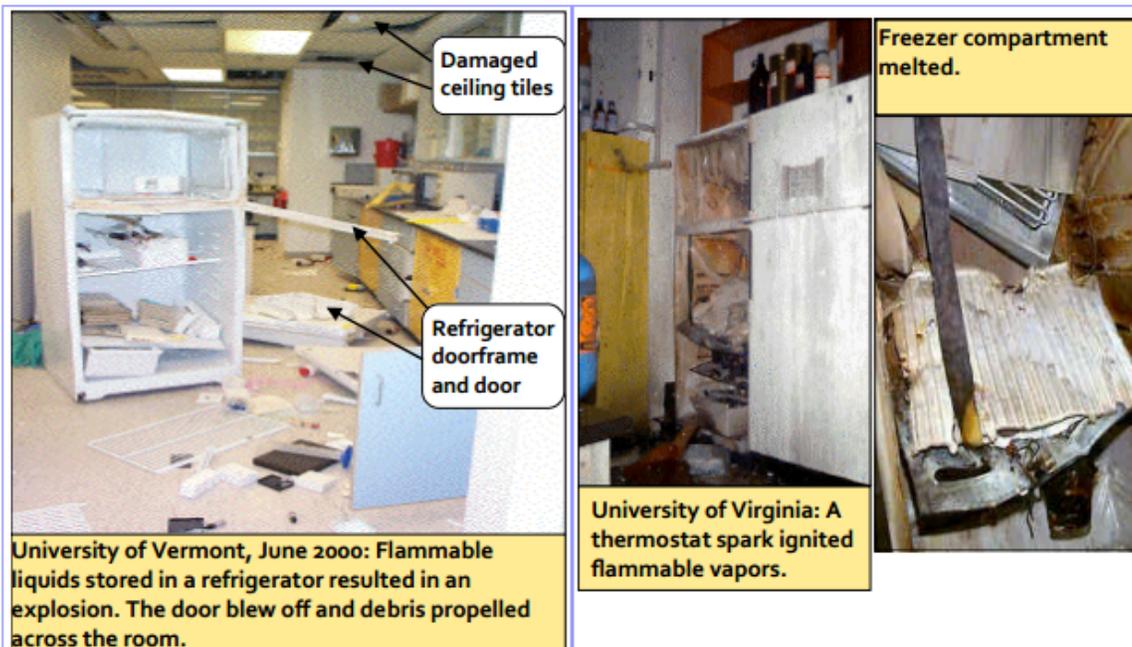
Q: Can we still use household fridges for non-flammables?

A: It is OK to use household refrigerators in your lab, if only non-flammable, non-volatile chemicals and solutions are stored in them. Low hazard, non-flammable chemicals are OK for cold rooms, too.

Flammable-safe refrigerators can look similar to household-type refrigerators, so make sure flammables go in the correct refrigerator. Flammable-safe refrigerators are marked with the words "FLAMMABLE STORAGE KEEP FIRE AWAY", and household-type refrigerators should be labeled indicating they are not safe for flammable storage. These labels are available at no cost via MSU EHS – go to the MSU EHS website at ehs.msu.edu for more information and a link to our online label ordering service.

Q: Flammable-safe refrigerators are expensive!

A: MSU EHS recognizes the cost of flammable-safe refrigerators is considerably more than regular household-type refrigerators. However, the potential for serious injury and property damage from these events has been demonstrated time and again – the risk



is simply too great to not invest in this equipment if necessary for your lab operations.

Rick Hopkins, Contract Manager at MSU University Services Purchasing, can assist individuals and departments in making the most of MSU's supplier discount—contact him at 517-884-6157 for more information.