



## Collapsing Refrigerator Shelving

### Lessons Learned

An incident on campus involving refrigerator storage of chemicals provides a valuable lesson as to why it is important to maintain proper inventory and control over the contents.

**Incident Description:** Shelving units inside a refrigerator collapsed causing the door to open and some of the contents to spill on the floor (see *Figure 1*). This resulted in the breakage of two glass chemical bottles containing chlorotrimethylsilane – a volatile, flammable, corrosive, toxic liquid; and cyanuric chloride – a solid, toxic powder. The incident occurred during off-hours when no laboratory staff was present and was discovered by a member of the custodial staff. The UW Police Department responded to the scene as did the Madison Fire Department. Adding to the confusion was the fact that the refrigerator was in a common space so the owner was unknown and could not be notified. As bad as this looked the end result was very fortunate – there were no reported exposures, injuries, or property damage.

While removing the remaining chemicals from the refrigerator it was observed that many of these containers were poorly sealed, had discolored labels, were very old, and were stored near other chemicals with which they were incompatible (flammables, pyrophorics, and oxidizers stored near each other). Had these containers been shattered there was the potential for far greater impact.

**Causes of Incident:** The direct cause of the spill was corrosion of the shelving units in the refrigerator. The corrosion was extensive enough to effect the structural integrity of the shelves. In fact, corrosion over most of the metal surfaces was observed. In the most probable scenario the chlorotrimethylsilane was slowly hydrolyzed by the presence of atmospheric moisture which generated the highly corrosive hydrogen chloride gas. Furthermore, the refrigerator may have itself failed, accelerating the process as it warmed. A contributing factor to the incident was the long-term storage of chemicals within the unit. It was estimated that the refrigerator itself had not been accessed in over 6 months. The chemicals which were likely responsible had likely been in there significantly longer. The root cause of the incident was the lack of inventory



*Figure 1: Corroded refrigerator causes chemical spill*

management. In fact, a review of refrigerators and freezers located in the same area found common examples of poor inventory control, including freezers that had not been accessed in over 10 years (see *Figure 2*) and were frozen shut.

**Lessons Learned:** While these may represent extreme cases, examples of poor inventory management are not uncommon. In order to prevent further incidents of this nature the following actions should be taken:

- Make sure that the refrigerator/freezer unit is designed to handle the material. Flammables can only be stored in a refrigerator/freezer that is specifically rated to handle these materials.
- Segregate chemicals based on compatibility. Use secondary containment to contain and separate.
- Periodically defrost your freezer units to prevent ice buildup.
- Do routine check of the unit's content.
  - Remove old containers or container whose contents are known to be unusable.
  - Turnover is often high so have any students or staff dispose of materials or allocate to another member of the lab staff before leaving.
  - Check packaging. Is it water reactive? Can pressure build up? Should it be stored under dry/inert conditions?
- Check the functioning of the unit. If a refrigerator failure can have adverse safety consequences, then this should be monitored and alarmed.
- When a refrigerator or freezer is in a common space make sure the unit is labeled with appropriate and up-to-date contact information.



*Figure 2: Abandoned chemical freezer frozen over*

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