*Laboratory Efficiency Assessment Framework (**LEAF**) guides*

Ultra-low temperature freezers

Ultra-low temperature (ULT) freezers are incredibly energy intensive to operate, using the equivalent energy of an **entire household** every day. Employing sustainable practices reduces the energy consumption of ULT freezers, but it also improves their lifespan and temperature stability, keeping important samples safer.

Operation

Ensure freezer doors are not opened for longer than 30-45 seconds.

Allow for the manufacturer recommended space around each ULT freezer (~20cm).

Target room temperatures of 15-18°C for maximum operating efficiency.

Maximise the use of existing freezers before buying new.

Defrosting

ULT freezers gradually accumulate frost and ice, reducing their capacity to function efficiently. To ensure proper operation, it is essential that they undergo an annual defrost.

Annual defrosting can reduce the energy consumption of a ULT freezer by 10%.

Maintenance

Freezer coils and filters will accumulate dust over time, impairing freezer function. It is important they are regularly vacuumed and cleaned to reduce energy consumption.

Ensure door seals are not compromised and close securely. Carefully de-ice when needed, making sure not to puncture seals.

Organising and storing samples

Minimise accumulation of unneeded or improperly labelled samples. These are health and safety concerns as labels may fade over time.

Regularly clean out old materials and spend time cataloguing and organising samples. Unnecessary storage of samples and reagents increases a freezer's energy consumption.

Unorganised, excess samples result in freezer doors being left open for long periods of time while searching for needed samples. This creates a thaw risk for samples and strains the ULT.

Increasing freezer temperatures

Consider increasing the temperature of ULT freezers from -80°C to -70°C. This can reduce energy consumption by 30%!

- Some researchers may be hesitant to increase freezer temperatures due to the precious nature of their samples. However, **numerous publications** show -70°C to be a safe temperature for long term storage.
- Nucleic acids, microorganisms, viruses and proteins have all been shown to be stable at -70°C.
- Some universities have started **reporting** on sample types that have been safely stored at -70°C or warmer temperatures.
- A common concern is the warm-up rates for ULT freezers in the event of power disruptions or freezer breakdowns. Research from the University of Edinburgh showed that the difference in warm up times during power failures was **minimal**.
- Differences in temperature change response time can be negated by improved organisation of samples, and use of racks and insulated containers.

If suitable, consider keeping back-up freezers at -60°C to reduce energy consumption by 40%.

Increasing freezer temperatures greatly increases the lifespan of ULT freezers, ensuring samples are better protected.

Interested in a fun way to promote sustainable cold storage practices in your lab? Register a team for the **International Freezer Challenge!**

Information on sustainability considerations when purchasing ULT freezers can be found **here**.