



UNIVERSITY OF LEEDS

SUSTAINABILITY

# Freezer Guidance Document

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## INTRODUCTION

A 2011 S-Labs audit paper stated that on average 5% of all laboratory energy consumption is due to cold storage<sup>1</sup> with additional energy required to cool workspaces from the heat generated.

As part of the University of Leeds commitment to sustainability, in 2013 the Sustainable Labs Working Group was established to look at the impacts that we have as a research intensive institution. It was agreed that ultra-cold and general freezers are a large impact in terms of energy consumption, especially in the Faculty of Biological Science (FBS). In response this paper has been commissioned to offer university wide guidance on sustainable freezer maintenance and will be annually reviewed and updated in line with new advice and technology

## BEST PRACTICE

### INCREASE IN TEMPERATURE

A study by the University of Harvard demonstrated that antibodies, antigens and nucleic acids can be stably stored for at least 20 years at a temperature of -70°C.

Recently at The University of Leeds, FBS have begun the process of increasing the temperature of their ultra-cold storage freezers from -80°C to -70°C. This will save energy and also conserve the life of the freezer compressor. We recommend this voluntary increase as there is no basis for the majority of samples to be at -80°C. If you believe there is a need then please contact [sustainability@leeds.ac.uk](mailto:sustainability@leeds.ac.uk). This move is also being replicated by colleagues across the sector.

### INVENTORY

Knowing what is in your freezers and what shouldn't be is key to achieving an effective freezer inventory. By keeping an accurate and up-to-date record of what is in the freezer and where, sample access is quicker, which saves both time and energy. Unnecessary or old samples can also be identified and correctly disposed of, saving space, reducing the need to purchase additional freezers. Furthermore, being aware of what samples you have stored can allow for correct freezer management techniques (such as increasing the temperature) to be implemented.

There are different methods of maintaining a freezer inventory. This can either be a sheet on the front of the freezer – but preferably an excel spreadsheet on the shared drive (e.g. N drive) or Dropbox / Google Docs that can be accessed by all users. Novel chemical inventory software such as LabCup (<http://www.labcup.net>) can also be useful in some circumstances. Make sure you find a system that works for your research group and notify all users on the chosen method.

Finally, if a lab member's employment terminates, ensure that policy is in place for researchers to clear their samples or pass on an inventory to another researcher of what samples they have.

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### ANNUAL DEFROSTING AND CLEAR OUT

Aim to defrost freezers at least once a year; this will allow for more efficient use of the freezer and allow proper temperature storage of samples. An indicator to arrange to defrost your freezer can be when ice builds out to a level greater than 2cm. Here are some steps to help facilitate a defrost session;

1. Ensure **all** in a research group are aware in advance of the date of the defrosting and where they can relocate their samples, allowing them to plan their time effectively.
2. Create a schedule for each researcher to participate in the clear out, one shelf at a time, to reduce excess warming.
3. Before unplugging the freezer remove as much ice build-up as possible with a cloth and rubber mallet to prevent excessive pooling.
4. Unplug the freezer, open the door and wait for the ice to melt. In order to accelerate the process leave a pot of hot water inside and close the door.
5. Place caution signs around the freezer if water begins to pool.
6. Once thawed out, remove any pools of water and wipe the internal surfaces and doors dry. Check all doors, door clips, hinges and seals are in good condition to help reduce the build-up of ice. Report any faults to the lab manager.
7. Switch the freezer back on and allow 24 hours for the freezer to chill down and stabilise to the desired temperature before putting it back to use.
8. All samples that are kept should be properly labelled and entered into an inventory.
9. Keep a record of what freezer was defrosted, when and who took part.

When the clear out is complete fill any space with either bubble wrap, or bottles of water to help the freezer maintain its temperature.

### EFFICIENT SAMPLE STORAGE

Ensure that all samples are correctly labelled, dated and associated with a researcher.

In order to maximise storage space and air circulation make sure efficient racking is in place that is applicable to the samples being stored. These can be bought from multiple suppliers in order to fit your particular freezer unit.

**Ensure samples are stored at the correct temperature.** Does the sample need to be stored at  $-80^{\circ}\text{C}$ ? The University of Colorado have been working to assess the correct temperatures that biological samples should be stored at. See the list [here](#).

It may also be more appropriate to store items that are less frequently accessed together to prevent disturbance to their freezer temperature during accessing samples. You can also consider using existing technologies that allow you to store dehydrated DNA and RNA at room temperature for extended periods of time without degradation, instead of cold storage.

Finally, think about having a sample storage map on the outside of your freezer which will allow quicker access to your samples, leaving less time with the door open. This will ensure less sample degradation by reducing the time for the temperature inside the freezer to increase.

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### MAINTENANCE

Enquire about the policy for freezer maintenance in your department. In some departments preventative maintenance is the responsibility of the research group or lab, but in other areas groups have a contract where a 3rd party company come in to inspect the freezers for signs of wear and tear and address any problems that might impact the freezer's efficiency and reliability.

There are some simple steps to ensure your freezer is operating at maximum efficiency:

- Check door seals regularly and ensure that ice does not build up excessively, preventing proper door closure.
- Clean the filters that protect the condenser coils; this will allow more efficient air flow:

#### How to Clean Condenser Coils

1. Disconnect the power.
  2. Locate the coils. Condenser coils are thin, tube-like pieces that are connected with fins. For upright -80°C freezers, condenser coils are normally located at the bottom front of the freezer, or mounted on the rear of the freezer. You may need to remove a covering panel or grill. Otherwise you will find the coils behind the freezer's access panel. You will need to remove the access panel, usually by unscrewing each corner.
  3. Go over the coils with a vacuum to remove any dust.
  4. Brush away stubborn dirt using a coil brush or a narrow paint brush.
  5. If there are remaining build-ups on the coils, wipe them away with a rag dampened with warm, soapy water and then dry.
  6. Replace any grills or panels, and plug the freezer back in.
- Make sure your freezer is reaching its set temperature. If the compressor is constantly running, or if the freezer is set for -80 but only reaches -79, be sure to have the unit looked at immediately.

### ALARM SYSTEM

Ensuring your freezer is alarmed will enable you to be notified if the door is left ajar and drops below a certain temperature. If your freezer model does not come fitted with an alarm, consider purchasing a supplementary alarm device to safeguard not only your samples but also excessive energy usage in cooling.

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## RESPONSIBLE PURCHASING

Can you avoid buying an extra freezer? There may be potential to clear space from an existing unit or share within the lab or research cluster, saving valuable lab space, energy and cost.

If it is absolutely necessary to purchase a new freezer, or if you are replacing an out of date inefficient model, ensure that you are opting for the highest energy efficient unit financially possible. The University of Newcastle discovered old freezers may have had three times the energy consumption than the current efficient models installed, which save an estimated £360 per annum, per unit. For more information click [here](#).

Look for energy efficiency information on the product's technical specifications and compare this against other models. The majority of ultra-cold freezer manufacturers are realizing that energy efficiency is an increasing area of concern for consumers and is being reflected in product design features offering low energy alternatives.

New products, such as the Stirling Ultra-cold system (<http://www.stirlingultracold.com/home>), are changing the way ultra-cold freezers are manufactured with dramatic savings. Contact [sustainability@leeds.ac.uk](mailto:sustainability@leeds.ac.uk) for more information.

<sup>1</sup>Hopkinson L., James P., Lenegan N., McGrath T. and Tait M., 2011. Energy Consumption of University Laboratories: Detailed Results from S-Lab Audits. July 2011. Available at [www.goodcampus.org](http://www.goodcampus.org).