



UNIVERSITY OF  
BIRMINGHAM

## Sustainable Laboratory Guidance

### Sustainability and Good practice of Ultra Low Temperature (ULT) freezers

The following document aims to set out the methods of good practice that laboratory users can follow, ensuring the maximum working life span out of their Ultra Low Temperature freezer units.

As well as good practice measures the guidance will include ways in which research groups can work more sustainability in respect to their freezers.

If you wish to find out more information after reading this document please make enquiries to Sustainable Office in the Estates Department:

[\(Sustainable labs email address\)](#)



# University of Birmingham Sustainable Labs:

## *Guidance document on sustainability for Ultra Low Temperature (ULT) freezers*

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### INTRODUCTION

The University is responsible for campus wide biological research using living tissues, DNA samples etc. These samples are highly valuable often coming with strict regulations and handling procedures. The nature of these materials requires Ultra Low Temperature storage to preserve them for as long as possible and in order to achieve this University of Birmingham and others around the world utilise ULT Freezers.

These are refrigeration units capable of achieving temperatures of  $-86^{\circ}\text{C}$  and maintaining this temperature 24/7, 365 days a year. Researchers working with Biological samples use these freezers to indefinitely store their samples for use later or for archiving purposes in clinical trials. These units are highly energy intensive, it is common for a **standard ULT freezer running at  $-80^{\circ}\text{C}$  to consume as much energy every year as 1 UK family home**. Operators of ULT units can be impacted by poor ULT management and maintenance. If not properly cared for, ULT's have a higher risk of breaking down potentially destroying hundreds of valuable samples and impacting important research. Poor ULT management also impacts research day to day efficiency as researchers struggle to find correct samples, or fit as many samples into their ULT's.

This guidance document aims to help users of ULT's understand the benefits of implementing better management systems for their freezers. It is also a tool for those interested in working sustainably, describing sustainable measures that can be taken in relation to ULT freezer operation.

### COMMON ISSUES FACED WITH ULT FREEZERS

As many users of ULT's will be aware, issues can arise from the constant operation of these units. In relation to experiences on University of Birmingham's campus the following issues were reported:

- **BUILD UP OF DIRT, DUST IN FILTERS**
- **ACCUMULATION OF ICE AROUND SEALS**
- **OCCUPIED STORAGE SPACE WITH OLD SAMPLES**
- **SAMPLES NOT BEING LABELLED**
- **FREEZER ROOM GETTING VERY WARM**
- **FREEZER BREAKING DOWN**



## ● **KEEP YOUR FILTERS CLEAN (KEEP 'EM CLEAN TO GO GREEN)**

- ULT's work by drawing in the air from around them, if the filter is blocked by dirt this restricts air flow into the condenser unit which reduces its ability to dissipate heat. Also if any dust or dirt gets carried by air flow and deposited on the condenser, this will cause the freezer to work harder!
- By ensuring that you regularly clean your ULT filters you are prolonging its working life as it doesn't need to work as hard, this also means they can reach temperatures a lot quicker!

## ● **DEFROST YOUR FREEZER**

- Freezers running continuously at low temperatures can suffer from Ice build-up on their evaporator coils, around the door seals and within internal spaces. This will reduce amount of storage space available and make it difficult to shut the door!
- By routinely defrosting your freezer, it's a positive for your research. Simply use rubber chisels/ mallet to remove any built up hard ice and then a soft cloth/brush to remove loose ice.

## ● **BACK UPS AT -60°C (I'LL BE BACK...AT -60°C)**

- Many freezer rooms will utilise a backup or decant freezer that is usually kept empty and is used if one of the main ULT's fails. Typically these freezers are kept at the same temperature as the rest of the ULT's!
- One quick and easy method for good ULT practice is to increase the temperature of your backup freezer to -60°C. Research conducted by various universities shows that it only takes on average 2 hours for your freezer to get back down to -80°C if it is required. This way your group can contribute to sustainability at no expense to your work!

## ● **PROPER SAMPLE MANAGEMENT (THE CAN OF BEANS DILEMMA!)**

- Think about your cupboards at home, more often than not you'll find an old dusty can of





- This ones an easy one! Maintenance is key to almost every piece of scientific equipment we have on campus. They all cost a lot of money and so we want to keep them working in top condition to ensure the best outcomes from our work!
- Quite simply if you ensure that your ULT is maintained with regular service visits from the company it will not only last you a lot longer (which means spending less money) but it will greatly contribute toward energy and carbon savings on campus!

## WAYS TO IMPROVE SUSTAINABILITY OF ULT'S

The good practice measures suggested above focus on ways that our experience with freezers can be improved and how our research can benefit from these suggestions. Now it's time to briefly talk about how we can all contribute to benefits for both our campus and the planet!

Sustainability is a key focal point for many higher education institutions, University of Birmingham included! However it was noticed that the main areas responsible for kicking out tonnes of carbon into the atmosphere and costing millions to run were our labs!

As many of us know by now our ULT's are energy intensive and as such are contributing to our total CO2 emissions on campus. **Long story short the following can be assumed:**

- 1 ULT at -80°C emits 2 tonnes CO2 per year
- University of Birmingham has a minimum of 200 ULT's on campus in 24/7 operation
- That means we are emitting **400tonnes CO2/year** just from ULT's alone!

We can all agree this needs to stop, so below are the Sustainable Labs office's suggestions for making your ULT's more sustainable!

### ● MONITOR THE ENERGY OF YOUR FREEZER

- A simple way that anyone interested in sustainability can help is by monitoring the energy consumption over a time period. This way groups or individuals build up a better picture of just how much power their freezer is using. The results will shock you, considering the figures mentioned above were monitored on a brand new freezer whose door wasn't opened during the monitoring!



## **PURCHASE/REPLACE FOR ENERGY EFFICIENT MODEL**

- The final sustainable point you can do yourselves is thinking about purchasing a more energy efficient model of freezer. When it comes time to replace your old ULT or even if you require a new one due to expanding research, you are urged to contact the sustainable labs office for information on energy efficient models of freezer. These will perform to the same standards you're used to historically, they just use less energy therefore emitting less carbon!

