

# Radboudumc



## Freezer Challenge 2020

The Radboudumc Freezer Challenge is a cold storage competition for laboratories. It is a local initiative in the tradition of the international Freezer Challenge that announces its winner in the journal [Nature](#). The aim of the Radboudumc Freezer challenge is to optimize freezer practices and management to improve sustainability, reduce energy costs while maintaining research quality.

### Why care about freezer maintenance?

Ultra-low temperature (ULT) freezers, often called minus-eighties, are among the most energy-intensive pieces of equipment in laboratories. At Radboudumc, the number of ULT-freezers has grown considerably over the years; at the moment there are approximately 190 ULT-freezers in use. This not only reflects increased (academic) activity but also a reluctance to discard samples that are no longer needed. Clean-out studies often find that 10-30% of materials in ULT freezers are no longer needed. ULT-freezers may have an energy consumption that exceeds that of entire households. The actual energy use is strongly influenced by the ULT-freezer model, age on duty, capacity, ambient temperature, ice, dust and the way freezer content is organized. Extensive experience of the technical support team at Radboudumc indicates that ULT-freezers older than 8 years are prone to give problems that can jeopardize the stored materials. Extensive testing of freeze-thaws and door opening further indicates that filling of ULT-freezer is a major determinant of temperature stability, energy use and the speed at which temperatures rise with door openings or power cuts. A largely empty or partially filled freezer is much more prone to temperature fluctuations, warms up much quicker and uses more energy than a completely full freezer. Newer ULT-freezer models maintain more constant temperatures and are considerably more energy efficient. An older generation ULT-freezer set at  $-80^{\circ}\text{C}$  may use 21.4kWh/day (€1172 in electricity use per year) whilst the latest models use only 7.7kWh/day (€422 per year). Partially for this reason, Radboudumc has an attractive offer where groups can replace their old freezers. Despite this offer, still approximately half of all ULT-freezers at Radboudumc are older than 10 years, likely to be energy inefficient and vulnerable to breakdown in the near future. With the Radboudumc offer, two old freezers can be exchanged, free of charge for one energy efficient new freezer. Details are found [here](#).

### Why care about freezer temperatures?

Before 1980, ULT-freezers used to be set at  $-70^{\circ}\text{C}$ . Then manufacturers marketed ULT-freezers that could reach even colder temperatures ( $-80^{\circ}\text{C}$  or  $-86^{\circ}\text{C}$ ) without solid evidence of benefits for sample storage. In this document, scientific data and expert opinion is summarized on why  $-70^{\circ}\text{C}$  is the appropriate temperature for short and long-term storage of the majority of samples. Many labs, among which groups at Harvard School of Public Health, Imperial College, Wageningen University, the London School of Hygiene & Tropical Medicine, the Centers for Disease Control and more than a hundred other labs, have already changed the ULT-freezer temperatures back to  $-70^{\circ}\text{C}$ . Changing ULT-freezer temperatures to  $-70^{\circ}\text{C}$  will prolong the freezer's lifetime, save up to 30% energy (or ~€250 in electricity per year) and reduce CO<sub>2</sub> emissions by ~1000 kg of CO<sub>2</sub> per freezer per year.

## How does the freezer challenge work?

The Freezer Challenge started on the 1<sup>st</sup> of September 2020 and will run also into 2021 and 2022. To support labs and groups that are interested to participate (and keep track of progress), we ask them to send an email to [greenlabinitiative@radboudumc.nl](mailto:greenlabinitiative@radboudumc.nl). This email should include:

- Your group/lab name
- The number of ULT-freezers you have in your group/lab
- An email address of the contact person of the group/lab.

You will then receive detailed information and a sheet that you can fill to indicate your progress. Although there are no prizes to be won at the moment, we will continue to showcase our success and the contribution of the different groups.

Once you have subscribed, we challenge you to consider the following points:

### **MINIMIZE:**

1. Check what is in your freezers and discard any materials that are no longer of use. In the process, make sure you store samples at high density and avoid half-filled boxes. Keep track of the boxes you discard for points!
2. After this clean-up, consider whether it is possible to more efficiently store your materials, ensuring freezers are full. This may involve sharing freezers with other groups and thereby reducing the numbers of freezers that are in use. Also within your lab, there may be possibilities to retire old freezers. Where appropriate, make use of the unique offer to replace two old freezers (however old!) with one new energy-efficient freezer free of charge. Details can be found [here](#).

### **RATIONALIZE:**

3. For the ULT-freezers still in use: change the temperature to -70°C unless there are very good reasons to keep it at -80°C. We can offer support in changing the temperature and alarm settings (-65°C as lower limit in the alarm settings is recommended).

### **OPTIMIZE:**

4. Develop or optimize your sample inventory system to improve the efficient storage and retrieval of samples. We also recommend you make use of the Radboudumc support team for annual freezer maintenance.