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# Ultra cold freezer storage

Risk management guide for research materials



# An education establishment's research can underpin their financial strength and reputation

Grants worth millions of pounds are often at stake.

Many of these research programmes involve the use of biological materials that require storage at very low temperatures in order to be preserved. Storage at such temperatures over the duration of the project is crucial for samples to remain viable. Research materials can be accumulated over a considerable length of time with many hundreds of hours of research time spent on the production of such samples. Some research samples may be irreplaceable or extremely difficult to obtain once lost.

If the power supply to a freezer fails and the temperature rises, research samples could be lost causing significant delays and increased costs. Loss of such biological materials, especially in the latter stages of a long project, can be costly in terms of delays to research publications and the time spent in replicating the collection and analysis of samples.

Replacement costs for the contents of each freezer can vary considerably but in Zurich Municipal's experience, values between £50,000 and £500,000 are fairly typical. From the researcher's perspective the most damaging aspect to be considered is the delay to the project due to time needed replicating the samples if they are replaceable.

## What can go **wrong**?

Freezers can fail for a number of reasons including:

**Accidentally switching off the power supply to the freezer**

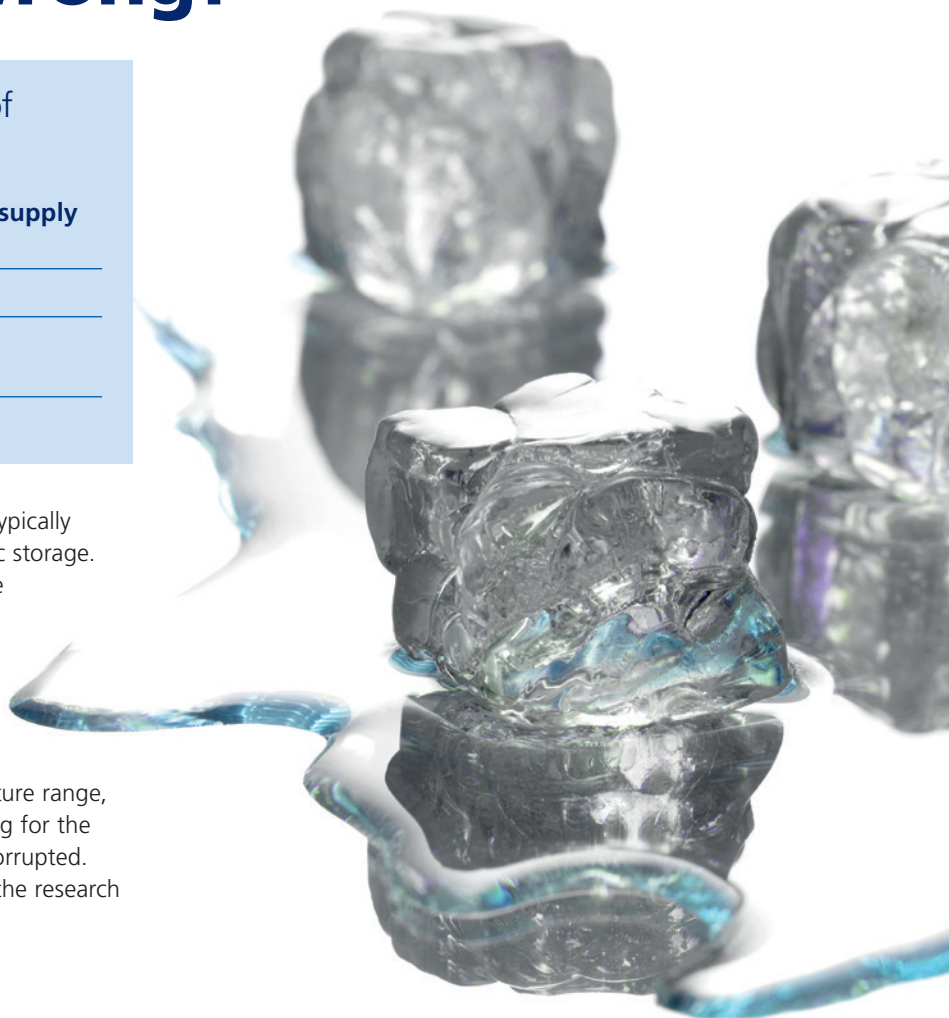
**An electrical power outage**

**Mechanical fault such as failure of the compressor**

**Failure to shut the door properly**

Freezers for the storage of biological samples typically range from -20°C to -80°C along with cryogenic storage. Such freezers are well insulated and can survive short term interruptions to power supplies provided the freezer doors are not opened during this period.

Whilst studies may require constant temperature monitoring to demonstrate continuous storage within the correct temperature range, temperatures do not need to rise above freezing for the value of samples to be lost, contaminated or corrupted. A sufficient rise in temperature may invalidate the research data despite samples retaining residual value.



# Risk management recommendations

The risk of incurring a loss can be minimised by implementing good risk management precautions.

One of the primary goals of risk management is to ensure that any failure of a freezer containing critical research samples is communicated to the appropriate persons as soon as the freezer fails. The most important action is therefore fitting a temperature monitoring device which includes a robust form of remote signalling.

## Freezer audit

It is essential to understand the potential exposure of research samples within a particular freezer to ensure a commensurate level of protection is in place. This can be achieved by carrying out an audit of all freezers containing research samples. You can do this using our freezer content assessment. When assessing the reinstatement value of the freezer samples the following two elements must be included in the calculation:

- The cost of buying the base products such as tissue samples, proteins or cell lines
- The staff costs involved in replicating the research work

In many cases the staff costs involved in replicating the research far exceed any costs in acquiring the base materials. When calculating the reinstatement values consideration should also be given to the value of the research grant involved.

As previously stated, replacement costs for freezer contents do vary and values over £1,000,000 per freezer are not uncommon.

The freezer audit should identify the individual freezer and its location plus the risk management precautions which are currently in place. To assist you in this Zurich can provide a freezer audit template if required.

Zurich Municipal insurance does not require an exact calculation regarding the freezer content values. It is acceptable for researchers to provide approximate values given that such samples will change over time. The calculation, however, needs to represent the maximum likely values of the stored samples.

 [Freezer content assessment](#)



# Freezer risk management

The freezer risk management guidance has been divided into the following key areas:

- Freezer temperature monitoring devices with remote signalling
- Dedicated bulk freezer storage rooms
- Emergency planning and precautions
- Management issues and controls

## 1. Temperature monitoring

It is considered that freezers which contain samples with a combined reinstatement value in excess of £100,000 are classed as high value. For freezers containing high value samples the most critical risk management precaution is to install a temperature monitoring device with remote signalling. This will ensure that the appropriate people can be alerted so that prompt remedial action can be taken. It is essential that a robust and reliable system is selected to ensure it will function in the event of a freezer failure.

Without such monitoring in place any failure of a freezer when the building is unoccupied, especially at weekends, will result in the loss of freezer contents.

It is critical that a robust temperature monitoring system is chosen with a reliable means of transmitting the temperature alarm. There have been several losses involved where the alarm signal was not transmitted due to a failure of the remote signalling system.

When selecting and maintaining a temperature monitoring system please consider the following:

- Does the device have a standalone power source which is not dependent upon the same power supply as the freezer?
- Third party off-site monitoring of the freezer temperature is preferable to systems which only provide a SMS or text alert.
- Are all mobile phone numbers regularly updated?
- Is the remote monitoring checked at least quarterly?
- Will nominated duty staff and back-up staff always be available to attend the site if an incident occurs?
- Can the on-site security guarding service be used 24/7?
- Have staff received adequate training regarding action to take in the event of an emergency?

### 1.1 Cryogenic/Liquid Nitrogen Freezers and Dewars – Temperature monitoring including remote monitoring

Cryogenic freezers are considered less prone to failure than conventional -20C or -80C freezers, provided the liquid nitrogen cooling is kept topped up. For very high value cryogenic freezers it is advised that a temperature monitor with remote signalling is installed. If this isn't possible, there will need to be suitable back-up procedures regarding the topping up of the refrigerant.



## 2. Additional freezer risk management guidance

**The following risk management guidance for freezers has been divided into three key areas.**

- 2.1 Dedicated bulk freezer storage rooms
- 2.2 Emergency planning and precautions
- 2.3 Management issues and controls

### 2.1 Dedicated bulk freezer storage rooms

The demand by researchers for storage of samples within low temperature freezers appears to be increasing. Space within buildings is often limited which has the potential for freezers to be located in inadequately designed rooms which can increase the risk of freezer failure.

Purpose designed bulk freezer stores can have the benefit of ensuring bespoke facilities for the optimum storage of freezers. A joined up approach between estates, facilities and researchers may be needed to ensure that all aspects of the freezer store are correctly designed.

#### **Key areas to consider for bulk storage rooms:**

- Adequate air-conditioning capacity including contingencies in case one air-con unit fails.

- Use of optical smoke alarms for automatic fire detection as heat detectors are unlikely to respond quickly enough in the event of a fire to allow salvage of the samples.
- Good compartmentation including fire doors with hot and cold smoke strips plus good fire stopping of any mechanical and electrical services.
- Access control and physical security to the room.
- When designing the electrical systems it is advised that each freezer has its own miniature circuit breaker. This will ensure that any fuse tripping on the main fuse board for an individual freezer will not cut out the power to all the freezers within the room.

### 2.2 Emergency Planning

Freezers can fail for a number of reasons and therefore a number of different strategies are required to prevent or minimise the risk that research samples will be lost. The following action is therefore advised:

- Place warning notices on the freezer to include action to take in the event of a loss e.g. not opening the freezer door, out of hours emergency contact numbers for key staff, freezer service company or an electrician competent to deal with research freezers.
- Provide a spare back-up freezer. It is recommended that this is padlocked shut to prevent unauthorised usage although out of hours access must also be taken into account.
- If possible, split vital samples between more than one freezer.
- A dedicated back-up generator will greatly improve the probability that freezers will have power at all times. A generator will require regular maintenance and testing scheme to be reliable.
- Carbon dioxide back-up cylinders can maintain the required temperature for up to 24 hours in the event of a power failure. The installation of such cylinders should be carried out by a competent contractor in accordance with the manufacturer's instructions.
- There are third party companies who can provide off-site freezers which can be made available in the event of an emergency. When assessing a company to use for holding research samples offsite it is essential to ensure that they have the necessary site security, capacity, back-up systems and 24/7 availability to provide you with a low risk back-up option.

### 2.3 Management issues and controls

- During the normal five yearly fixed wiring inspection of the building it is likely that the power to the lab will be turned off and freezers unplugged. It is important that the estates team, electrical contractor and lab managers are directly involved in discussing any power outage to the lab and the turning of freezer power back on. Risk assessments need to be provided which include action to take in the event of an emergency e.g. an individual freezer will not switch back on. A representative from the lab should be present to ensure all freezers are switched back on and are working correctly prior to leaving site.
- Portable appliance testing (PAT) for freezers needs to be carefully controlled. The PAT tester must understand the value of the freezer, and checks by the lab staff need to take place to ensure that the freezer is plugged back in and working correctly.
- Any contractors who have access to labs which contain freezers must receive induction training to ensure that they understand that such equipment cannot be unplugged.
- Maintenance of the freezer will ensure it continues to function e.g. cleaning of filters.
- If a fuse to a freezer plug blows it is important that the cause of the failure is found out. Replacing the fuse without determining the underlying cause could mean that the freezer will shortly fail again.
- A socket protection device can be used which is a plastic cover which fits over a socket and prevents the plug from being removed but access to the power switch is still possible.
- Hard wiring of freezers directly into the power supply via a switched fused spur. The freezer unit can still be switched off but it removes the possibility of the freezer being accidentally unplugged.

# Further guidance

For further risk management guidance, please visit our website:

**[zurichmunicipal.co.uk](http://zurichmunicipal.co.uk)**

**On our website, we also have a range of other risk management publications providing advice and guidance for customers, including:**

-  **Freezer content assessment**
-  **Risk reduction checklists**



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