



NIH Ultra-Low Temperature (ULT) Freezer Management Program

Jaroslav Sebek

Environmental Engineer

Division of Environmental Protection

Office of Research Facilities

October, 2019

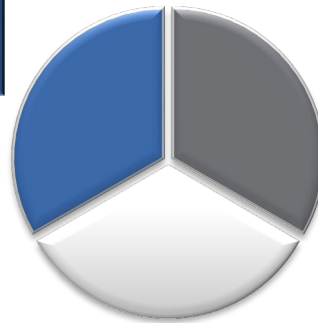
Presentation Overview

Introduction

- Why ULT Freezers?
- Factors Affecting Energy Consumption

Freezer Policy

- Selection
- Maintenance
- Inspections



Freezer Challenge

- 2019 Freezer Challenge
- 2020 Freezer Challenge

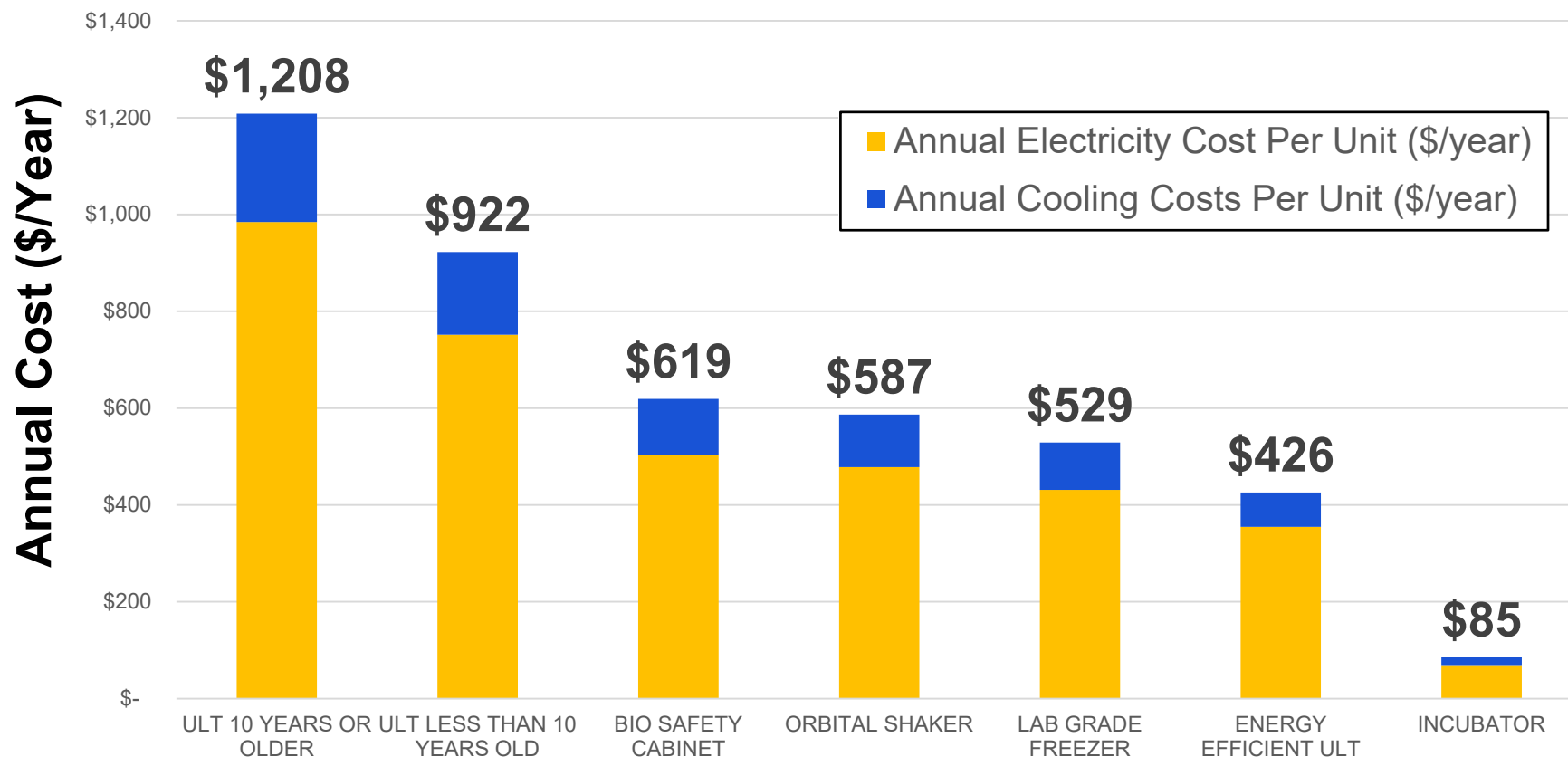
Introduction

- Why ULT Freezers?
- Factors Affecting Energy Consumption

Why Ultra-Low Temperature Freezers?

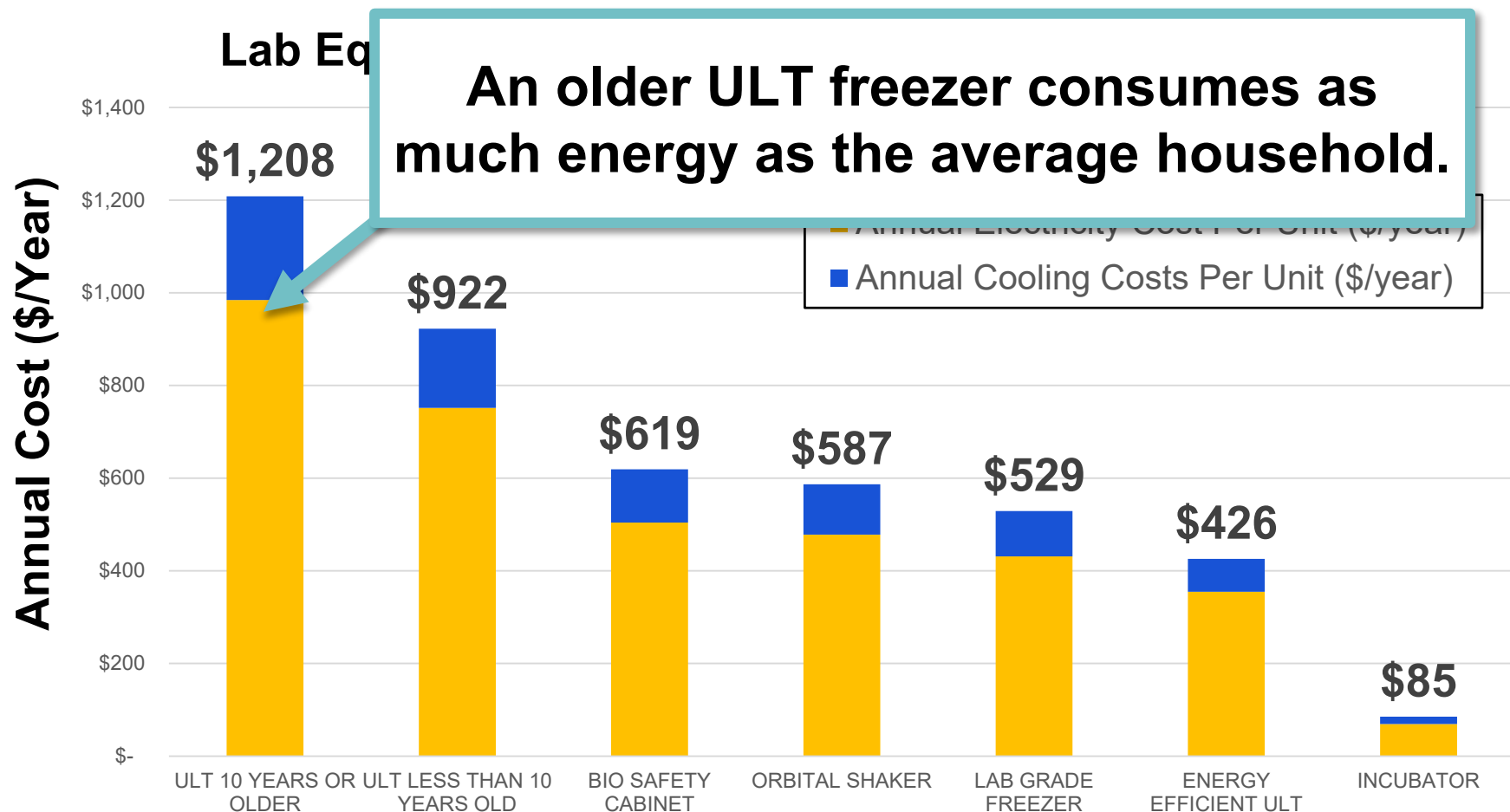
There are $\approx 3,400$ Ultra Low Temperature (ULT) freezers in service at NIH.

Lab Equipment Electricity and Cooling Costs



Why Ultra-Low Temperature Freezers?

There are $\approx 3,400$ Ultra Low Temperature (ULT) freezers in service at NIH.





Factors Affecting Energy Consumption of ULT Freezers

NIH measured the electricity consumption of ULT freezers under testing conditions and in laboratory settings. The following factors affect the electricity consumption of ULT freezers.

- **Baseline energy consumption**
- **Age**
- **Ambient temperature**
- **Ventilation**
- **Dust on the filter/condenser coil**
- **Ice buildup**

The NIH Freezer Policy

- Selection
- Maintenance
- Inspections



The NIH Freezer Policy

The NIH released an Ultra-Low Temperature (ULT) freezer management policy, Manual Chapter 26101-16, to increase the reliability and reduce energy consumption of ULT freezers at the NIH.

SECTION	SECTION SUMMARY
SELECTION	When replacing, select an Energy Star Certified Model.
INVENTORY	All ULT Freezers must be listed in the property database.
PLACEMENT	Place ULT freezers with sufficient ventilation and cooling.
MAINTENANCE	Conduct preventative maintenance every six (6) months.
INSPECTIONS	Perform annual compliance inspections.
DISPOSAL	Dispose of ULT Freezers properly.
RESPONSIBILITIES	Maintain electronic records of maintenance and inventory.



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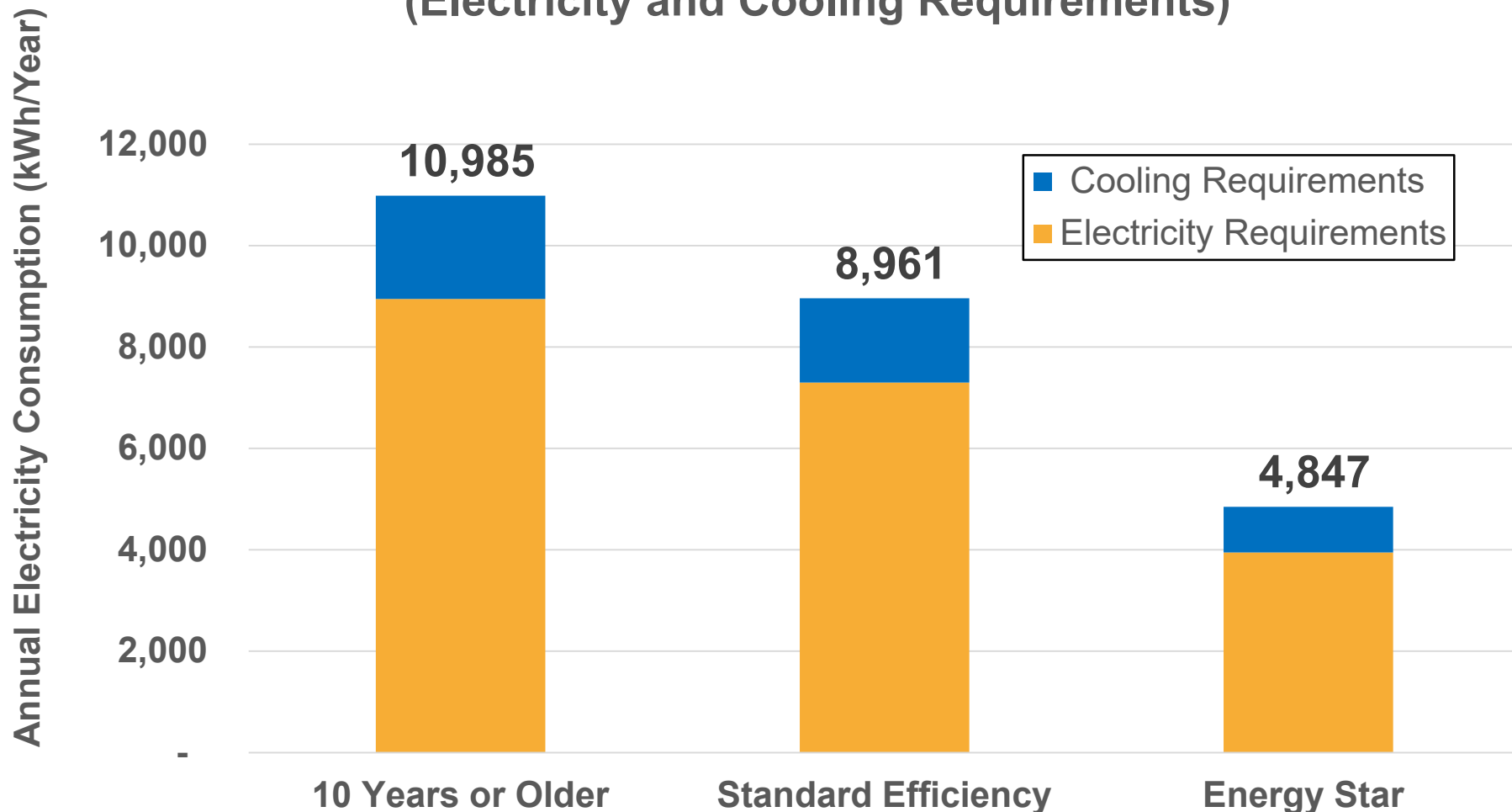


Section 1: New Freezer Selection

- Section 1 requires new ULT freezer purchases to be energy efficient.
- When the NIH policy was first implemented there were no EPA or DOE designated energy-efficient ULT freezers.
- The NIH conducted freezer tests and set an NIH standard that new freezers must consume no more than 17 kWh/day.
- On May 18, 2017, the US Environmental Protection Agency added ULT freezers to the Energy Star Program.
- The NIH now requires that new ULT freezers are Energy Star Certified.

Energy Star Certified ULT Freezers

Ultra-Low Temperature Freezers (Electricity and Cooling Requirements)





Energy Star Savings

By April 2019, the NIH purchased 165 Energy Star Certified ULT freezers through the NIH central purchasing program.

This amounts to energy savings of approximately:

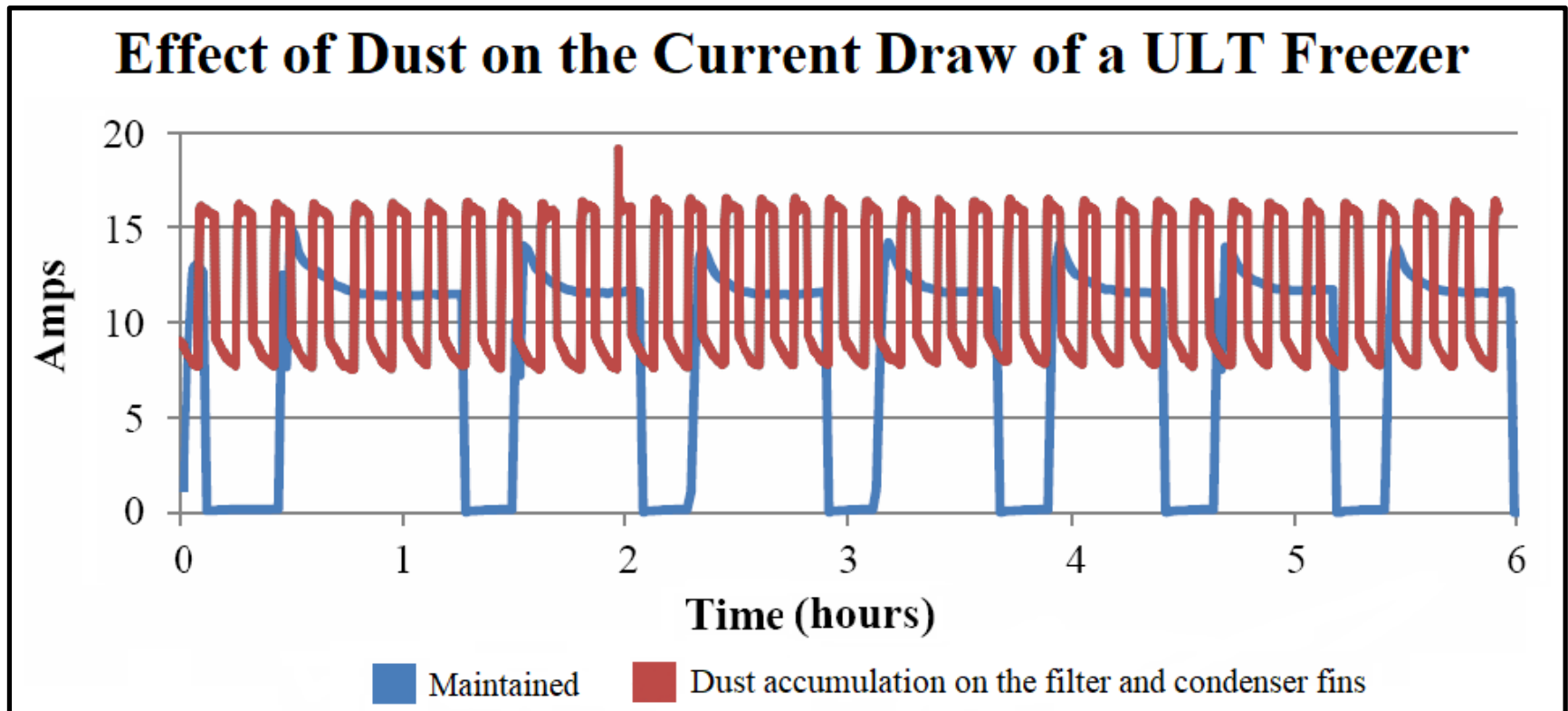
679,000 kWh/year

At the NIH Utility Rate of \$0.11, equaling a savings of approximately:

\$74,651/year

Section 4: Preventative Maintenance

- The NIH measured the effects of preventative maintenance on the energy consumption of ULT freezers.
- Maintenance issues, such as dusty filters and ice build up, cause a freezer to operate at a higher duty cycle.





Preventative Maintenance

- Conducting regular Preventative Maintenance (PM) on ULT freezers can reduce energy consumption by 25%.
- NIH Manual Chapter 26101-16 requires that all freezers have a PM every 6 months.
- Inspections at the NIH Clinical Center found 40% of ULT freezers did not have PM within the last 6 months.



NIH ULT Preventative Maintenance Video

The NIH released a video that shows how to perform a basic user level PM on ULT freezers.

NIH ULT Freezer PM Video

https://www.youtube.com/watch?v=RCxcx_Qm2X8&feature=youtu.be

Section 5: Inspections

ULT FREEZER INSPECTION CRITERIA

- Two PMs/Year
- Filters
- Ice
- Ventilation
- Location
- Utilization
- Ambient Temperature
- Remote Monitoring
- Listed in the Inventory

Clogged/Broken Filters



Broken Filter



Clogged Filter



Clogged Filter



Missing Filter

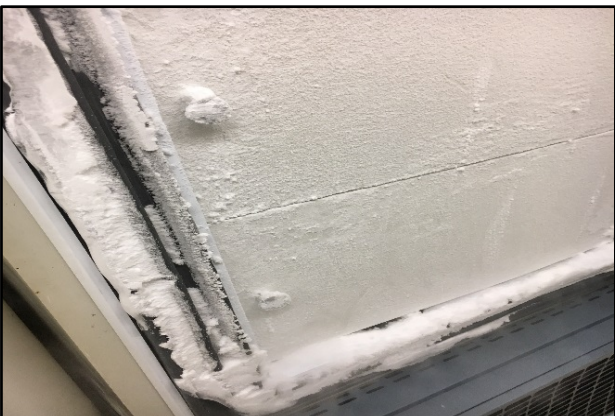
Heavy Ice/Broken Gaskets



Broken Gasket, Ice



Heavy Ice



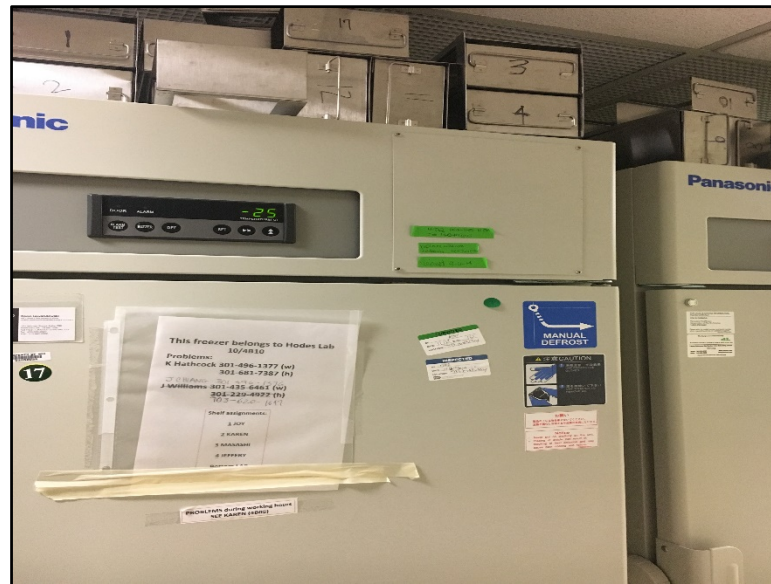
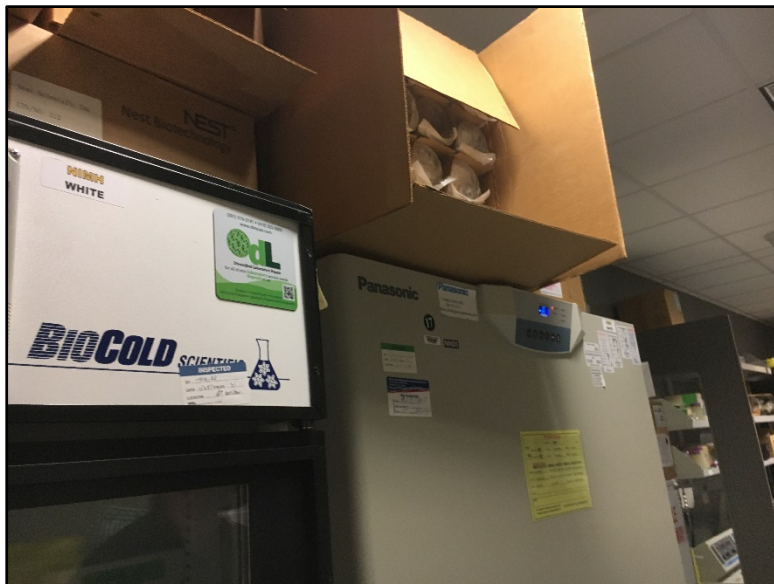
Heavy Ice



Heavy Ice

Ventilation

The photos below show freezers with minimal ventilation.



The NIH Freezer Challenge

- 2019 Freezer Challenge
- 2020 Freezer Challenge



2019 NIH Freezer Challenge

The NIH conducted a Freezer Challenge for labs to go beyond the NIH Freezer Policy to increase reliability and decrease energy consumption.

- The NIH Freezer Challenge was based on the International Institute for Sustainable Laboratories (I2SL) Freezer Challenge.
- The results of the challenge were submitted to I2SL.
- The 2019 NIH Freezer challenge was from Jan 1st to April 1st.
- Participants included 8 labs and 1 biorepository.
- Participants had 123 ULT freezers and 86 lab grade freezers.

2019 NIH Freezer Challenge

Each laboratory chose which initiatives their lab undertook.

Challenge Initiatives:

- Defrost Freezers
- Set Temperatures to -70 °C
- Transfer Samples to LN2
- Share Freezer Space
- Electronic Sample Inventory
- Discard Samples
- Retire Unnecessary Freezers



2019 NIH Freezer Challenge Results

CHALLENGE INITIATIVES	TOTAL
Freezer temperature changed from -80 to -70	18
Freezer defrosts conducted	26
Freezers Retired	3
Unnecessary Samples Discarded	11,749
Samples Transferred to LN2 freezers	20,521
Consolidated Samples	1,003



2019 NIH Freezer Challenge Annual Savings

2019 NIH Freezer Challenge Annual Savings			
Challenge Initiatives	Energy (kWh/year)	Energy Cost (\$/year)	GHG Emissions (MTCO2e/year)
Temperature Tuning to -70	41,063	\$ 4,517	17
Freezer Defrosts (-80)	43,344	\$ 4,768	18
Freezer Defrosts (-20)	3,194	\$ 351	1
Retired Freezers	27,375	\$ 3,011	12
Total	114,975	\$ 12,647	48



2020 NIH Freezer Challenge

The NIH will conduct another freezer challenge in 2020.

2020 Freezer Challenge Goals:

- Increase overall participation
- Increase percentage of freezers that are set to -70

2020 Freezer Challenge Sign Up

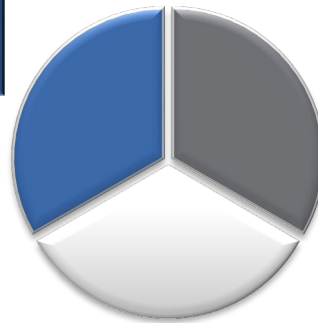
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Thank you!

Questions?

Jaroslav Sebek

jaroslav.sebek@nih.gov



Backup Slides



Energy Star ULT Freezers

To receive Energy Star Certification, a ULT freezer must consume less than or equal to 0.55 kWh/ft³/day, as verified by a third-party testing facility.