THE UNIVERSITY of EDINBURGH

Sustainable Labs Steering Group

14:00 – 16:00, Tuesday 9 October 2018

Room 3.04, Charteris Land

AGENDA

1 Welcome, Introductions, Purpose and Aims of Meeting
The Director of SRS will outline the programme for the session

2 Minute **A**
To *approve* the minute of the previous meeting on 21 May 2018

3 Matters Arising
To *raise* any matters arising not covered on the agenda or in post-meeting notes

SUBSTANTIVE ITEMS

4 SLSG Programme Progress update **B**
To *receive* a paper from the SRS Project Coordinator

5 Freezer internship Summary and Report **C**
To *receive* an update from the SRS Project Coordinator

6 LEAF Tool Summary and Pilot Proposal **D**
To *receive* a paper from the SRS Project Coordinator

7 Sustainable Campus Fund update **E**
To *review* an update from the SRS Engagement Manager

8 Feedback from the Bristol S-Labs Conference **F**
To *receive* and *discuss* an paper Energy Manager, Estates Department

VERBAL UPDATES

9 Hugh Robson Building Energy Engagement and Monitoring update
To *receive* an update from the SRS Project Coordinator

10 Labs Awards update
To *receive* an update from the SRS Project Coordinator

11 Wind responsive ventilation project - Joseph Black building update
To receive an update from the SRS Project Coordinator

12 TSSG update
To receive an update from Laboratory Technician

13 Any Other Business
To *consider* any other matters from Group members.

UNIVERSITY OF EDINBURGH **A**

MINUTE OF A MEETING *of the Sustainable Laboratories Steering Group held in Room 1.07 at the Main Library on Monday 21 May 2018.*

Members:

Gorman Dave, (Convener), Director of Social Responsibility and Sustainability
Michelle Brown, Head of SRS Programmes
Chris Litwiniuk, Engagement Manager
Andrew Arnott, SRS Projects Coordinator - Labs
Lee Murphy, Genetics Core Manager
David Gray, Head of the School of Biological Sciences
David Jack, Energy Manager
Robert MacGregor, Energy Engineer, Estates
Stewart McKay, Technical Services Manager, IGMM
Candice Shmid, Occupational Hygiene and Projects Manager
Valerie Gordon, Laboratory Technician
Sharon Hannah, Bioquarter Campus Operations Manager
Rachael Barton, Engagement Co-ordinator, Labs & Awards
Janet Philip, Joint Unions Liaison Committee
Matthew Sharp, Operations Manager CBS
Kate Fitzpatrick, Waste & Recycling Manager
Guy Lloyd-Jones, Forbes Chair of Organic Chemistry
Yuner Huang, Early Stage Researcher

Apologies: Grant Ferguson, David Brown, Angela Ingram, Sandra Lawrie, Brian McTier, Andrew Kordiak, Joanne Dunne, Sandra Lawrie, Julia Laidlaw, Simon Santamaria Garcia

1 Minute **A**

The Convener welcomed attendees to the eleventh meeting of the Group. The minute of the meeting held on 19 March 2018 was approved as a correct record. There were no matters arising not covered on the agenda or in post-meeting notes.

2 Freezer inventory **B**

Group members were presented with the results of a recent survey which attempted to identify the number of Ultra Low Temperature (ULT) freezers across the University estate. SLSG were asked to review and acknowledge the results of this survey which was recommended to be undertaken every 2 years to identify any changes to the freezer population and together with a baseline would allow for trend monitoring and planning for potential actions. The group agreed the recommendation.

Action: CL to embed a repeating freezer inventory into a bi-annual cycle.

3 Freezer internship

SLSG noted that the SRS department would host an intern for 8 weeks in support of the freezer inventory. An offer for the intern to visit locations had been circulated. The intern would be asked to ascertain the age of machines so inefficient, older machines may be proposed to the sustainable campus fund.

Short listing was taking place that week with the intention for the intern to start early June, before AA would go on paternity leave for 6 months.

The group noted a proposal that waste from freezers be considered, particularly how it might be dealt with and the associated disposal costs, estimated at between £50-£240 per unit. The group discussed the need for an asset list with a notification process where individuals would be notified when old machines were replaced for new. Currently, the Waste department would only be told when old machines needed disposing, rather than of new purchases.

Action: KF to discuss asset register options with counterparts at the following asset management meeting and report back to the group.

5 SLSG Programme Plan progress update

The group received an update on progress against the Sustainable labs plan. All areas were currently progressing, with the exception of one amber related to the promotion of 'Green Chemistry' and substitutition of hazardous chemicals. That area would not be achievable before AA would take parental leave. This was proposed to be postponed until Jun 2019 and the group agreed.

The group were updated with AA's replacement as SRS Engagement Co-ordinator Rachael Barton who would take over some aspects of the role in the interim.

Action: AA to define when a location is a lab, to assist in identifying whether targets were being met for 100% of labs partaking in the sustainability awards.

6 Sustainable Lab Ventilation Policy update **F**

The tabled version incorporated the two rounds of feedback for the policy. The separation of the guidance was recognised as much clearer and the group were happy for the policy to go to SSAG for approval.

Action: VM to add this to SSAG agenda for feedback from Estates as they have representation there and could provide approval.

Action: RM to liaise with consultants on the Joseph Black project to get some feedback on the basis that this was still a draft policy.

7 Sustainable Cold Storage update

The policy section had been circulated twice for email consultation and SLSG was presented with the final draft incorporating comments.

Action: AA to update the name 'CIP' to CDBS, Centre for Discovery Brain Science.

The group agreed the policy could go to SSAG.

Action: VM to add this to the next SSAG agenda.

AA thanked the group and all involved for all the support and feedback. The Chair thanked AA for his efforts on the policy.

8 Lab equipment re-use/re-sale procedure consultation update

The consultation was set up to create a procedure for labs to be able to reuse equipment. The group were presented with a flow chart which had been created in order to ensure the consultation asked the right questions.

The group agreed that it would be useful to get a standardised approach and a suggestion that guidance would be written so members of staff would have the

information to hand and not continue to contact Finance for an explanation on the process. Smaller items such as microscopes were felt best to go through the Waste department.

Action: KF would discuss with AK that the new proposed programme would be out with the existing Waste programme.

Action: AA to liaise with KF on promoting the scheme.

9 Lab Energy Engagement and Monitoring Expansion

SLSG noted a paper on energy usage monitoring at University labs. Distribution board monitoring allowed baselines to be recorded. Posters and stickers were issued as well as face to face presentations on good energy practices in labs. Measures across four different circuits showed a 12-40% reduction in energy use. Though impact was significant, the paper highlighted that more could be done.

The Hugh Robson labs were proposed and accepted as the next location for the measures.

Action: AA to liaise with Hugh Robson to arrange suitable timelines, , RB and CL to take it further.

AA welcomed other suggestions and asked group members to email him.

To encourage attendance, the group was informed that lunch could be provided during AA's sustainable labs presentations.

10 Recommendations from Case Studies in Sustainable Development groups

Students studying sustainable development in the School of Geosciences were provided a topic by selected staff within SRS. AA mentored two students and two topics- materials in construction, and glassware versus plastic in labs.

The case study for glassware versus plastic addressed greenhouse emissions and what the psychological barriers are for converting to glassware in labs. One of the findings was that communication was seen as not good enough.

Action: AA to investigate further the idea of improving communication about which plastic can be recycled and others to be incinerated.

Action: KF to liaise with BIFFA for clarification on whether they accept broken glass for recycling.

The Clinical and Biological waste policy was in progress and the group queried whether plastic and glassware would be included so that one policy captured all the areas required. AA suggested the main messages would be clearer if there was guidance on glass recycling and what users would do with uncontaminated plastic.

Action: KF would include high level information on glass and plastic.

KF would be emailing two distribution lists with suggestions who to include from AA to follow after the meeting.

A further suggestion was an inventory for chemicals across all schools/labs. Audits were suggested to be required so lab users could use chemicals from another lab.

SLSG discussed the materials in construction case study and the aim of the study was to accept useful suggestions so these would filter into the design guides with Estates.

Action: AA to send DJ the presentation and the written report when available.

THE UNIVERSITY of EDINBURGH

B

Sustainable Labs Steering Group

9th October 2018

SLSG Programme Plan update (May – October 2018)

Description of paper

This document is intended to give an update on progress against the objectives of the 2017-20 Sustainable Laboratories Steering Group Programme, which was drawn up to provide a structured approach to improving sustainability within laboratories at the University of Edinburgh over that time period, with a view to achieving wider University goals such as the Zero by 2040 target within the Climate Strategy. A Gantt Chart using a traffic-light colouring system (Red/Amber/Green) has been used to communicate quickly and clearly the progress which has been or is being made. In general this is taken to mean: green = on track, amber = delayed or problematic, red = objective is in danger of not being met, and grey = action scheduled for future work. Further details on the progress against each individual action is included within a table. This document will be updated prior to each meeting of the Sustainable Laboratories Steering Group.

The purpose of this report is to report against progress in relation to activities with further thought on monitoring of outputs and outcomes to be considered. The outcome objectives of the 3 year plan are noted below:

Action requested

SLSG is asked to note the progress described in this paper and provide any advice or guidance for further improvement.

Background and context

At the October 2017 meeting of the SLSG this 2017-2020 programme plan was presented and approved. This report notes the progress against this 3-year plan.

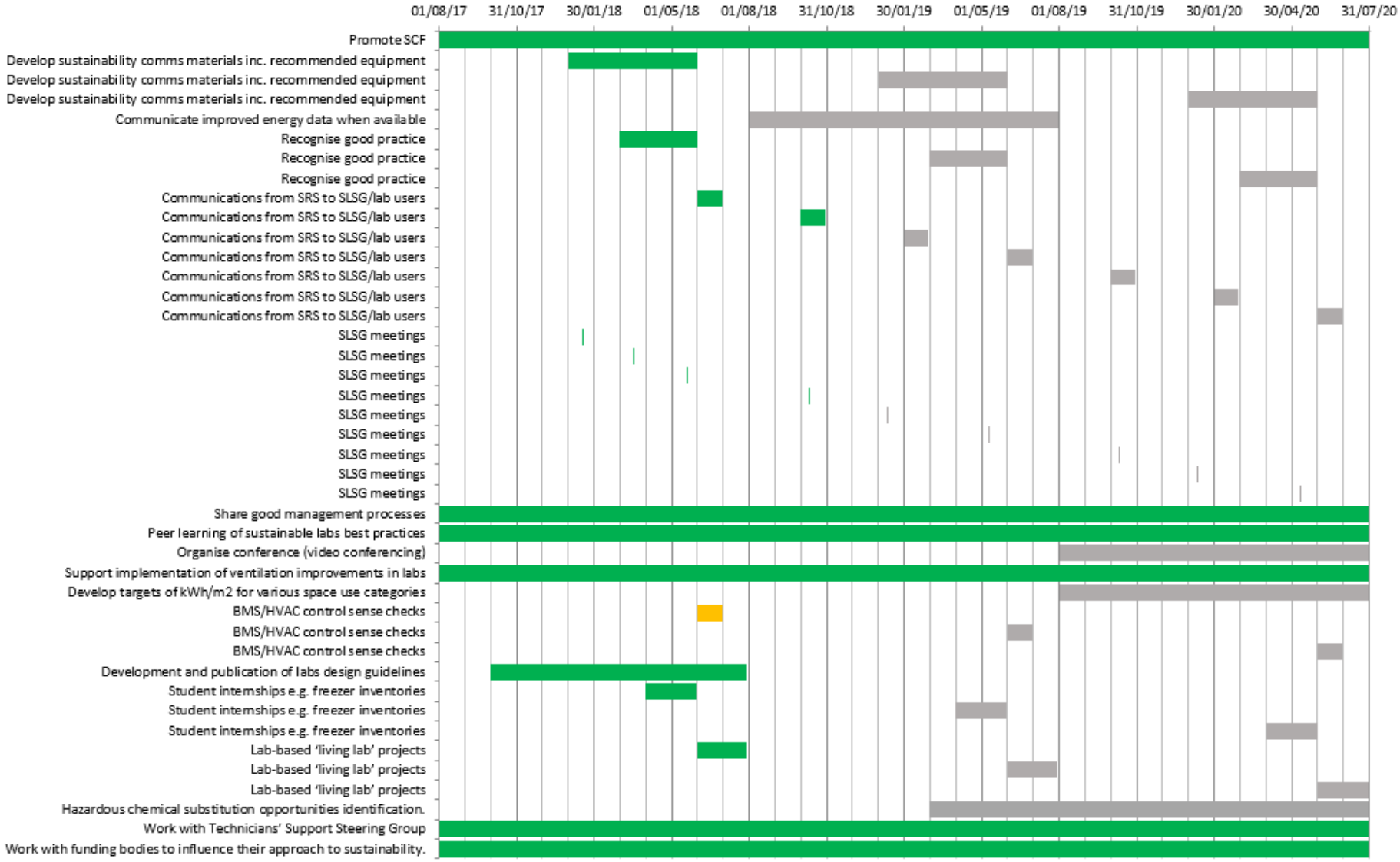
Outcome objectives:

1. 10% reduction in energy consumption.
2. Lab equipment reuse and sharing increased
3. Reduced consumption of materials, especially hazardous materials.
4. Enable culture of sustainable working through provision of support and training for lab technicians.
5. Adoption and use of sustainable building design guidelines (incorporating labs) and Soft Landings or similar approach.
6. 100% of labs covered by Edinburgh Sustainability Awards teams

By 2020 every building with labs will have an energy coordinator who is lab-based.

THE UNIVERSITY of EDINBURGH

RAG Progress Reporting



Communications and Engagement

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Promote use of the Sustainable Campus Fund	1. 10% reduction in energy consumption 3. Reduced consumption of materials, especially hazardous materials	• Robert MacGregor (seconded) • Energy Office • Estates Small Works Team	• Emails sent promoting the fund • Verbal communications with colleagues, including via Sustainability Awards teams • Over 34% of all SCF projects are lab projects	
Develop further sustainability communications materials for use by non-SRS staff including persuasive body of evidence to influence academics and lab users, as well as lists of recommended items of lab equipment (based on verified sustainability credentials)	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials. 6. 100% of labs covered by Edinburgh Sustainability Awards teams 7. By 2020 every building with labs will have an energy coordinator who is lab-based.	• Lab Users	• No publications yet but: • Approved best practice guidance around ventilation and cold storage is currently being developed into published communications materials, which are due for publication in Q1 2018-19 • Research (living labs) into effective communication methods (e.g. energy monitoring) will feed into this • Work to develop processes for equipment re-sale/re-use will also feed into this	
Work with lab users/building managers to make use of improved energy data (when	1. 10% reduction in energy consumption	• Energy Office • Lab Users	• Improved data has not yet been made available, but this is not yet considered to be delayed • Where short term localised energy monitoring projects have been undertaken (e.g. IGMM and	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
available) – e.g. communicating the data, setting targets			Roger Land) the energy data has been a useful communication and engagement tool • Energy data may be available for the Geoscience labs in High School Yards in Q1 or Q2 2018-19, with the labs in George Square following in Q2 or Q3 2018-19	
Recognition of good practice via awards and/or other communications.	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials. 6. 100% of labs covered by Edinburgh Sustainability Awards teams	• Lab Users	• Eight teams are actively taking part in the Lab Awards in 2018-2019, with four teams taking a break year and remaining accredited from last year • 17 Buildings have lab awards teams (although not all teams cover a whole building) equating to around 40% of lab buildings participating or partially participating in the lab awards	
Regular communications between SRS and SLSG/lab users (e.g. newsletter or emails)			• Established communications via Technicians' Group • Regular communications via contacts lists, e.g. lab and/or building managers • All SLSG are encouraged to sign up to SRS newsletter for departmental news and events	
SLSG meetings (strategic direction, project support and progress reporting)		• SLSG members	• Suitable scheduling of meetings is taking place • Attendance is good	
Share good management	2. Lab equipment reuse and sharing increased	• Lab Users • SRS Comms • Waste Dept	• No specific promotion of this has taken place yet • However, the final report from the Cold Storage internship was circulated with internal and	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
processes – e.g. equipment sharing		• Procurement Dept.	external networks. The report made recommendations including consolidation of ULT freezers • Future promotion (Q1 2018-19) will incorporate the guidance on ventilation and cold storage good practice and (hopefully) lab waste clarification and equipment re-sale/re-use	
Peer learning of sustainable labs best practices (via awards, workshops, campus meetings) – including recruitment of awards teams and energy coordinators.	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials. 6. 100% of labs covered by Edinburgh Sustainability Awards teams 7. By 2020 every building with labs will have an energy coordinator who is lab-based.	• Lab Users	• A summer 2018 workshop was held for Lab and Office Awards teams in July, with representatives from six labs attending • SRS continue to offer support and encouragement to confirmed and prospective teams through Q4 2017-18 and Q1 2018-19 • Audits are in the process of being scheduled for November 2018 • Some awards teams are recruiting additional teams • C.60% of lab buildings have an energy coordinator based on recent analysis, however it is currently unknown if these energy coordinators are lab based	
Encourage and support organisation of a prestigious conference over video conferencing, potentially with support from The Wellcome Trust		• Lab Users • Academics • Funders	• No specific action has been taken on this yet • Potential to harmonise/merge with work on Business Travel pilots being conducted by SRS • Proposed for 2019-20 academic year	

Utilities, Waste and Carbon

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Support implementation of ventilation improvements in labs	1. 10% reduction in energy consumption.	• Health and Safety • Energy Office • Estates small works team	• Some potential concern around the fume cupboard upgrade project at Joseph Black (already approved by for SCF funding) as heat monitoring data indicates lower savings possible (extending payback period to c.8 years) • Potential major refurbishment at Chemistry building planned in 3-5 years, so currently uncertain what activities might take place beforehand • Feasibility work assessed Wind Responsive Ventilation – reported in March 2018. Proposal is £1m cost and 8 year payback. Current proposal is to split into phases to reduce disruption and incorporate into the above noted major refurb at Chemistry • Further clarification was expected following the Estates Committee meeting in September 2018, however the project was not included on the agenda. A potential schedule of work and breakdown of finances is being prepared for presentation at the October Utilities Working Group meeting, to allow progression • Still, many practical projects are in development/implementation phases (e.g. Demand Based Ventilation, fume cupboard upgrades, ensuring efficient new fume cupboards in new labs, chemical store upgrades)	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
			• Policy Statement was approved at May 2018 SLSG, and will be escalated to other committees for formal adoption by UoE. • Guidance notes were approved by May 2018 SLSG meeting and will be published in Q1 2018-19	
Develop targets of kWh/m2 for various space use categories	5. Adoption and use of sustainable building design guidelines (incorporating labs) and Soft Landings or similar approach.	• Estates Development • Estates Operations • Contractors (Cundalls and Henry Gun-Why)	• Due for action 2019-20	
BMS/HVAC control sense checks programme extended to further lab spaces (incorporating checks of biohazard category activities)	1. 10% reduction in energy consumption.	• Energy Office (controls) • Lab Users	• Scheduled for action each summer 2018, 2019 and 2020. • No action taken yet – SLSG to suggest best building(s) to investigate	
Engage with lab users on development and publication of labs design guidelines	5. Adoption and use of sustainable building design guidelines (incorporating labs) and Soft Landings or similar approach.	• Lab Users	• A draft of the Edinburgh Standard was trialled on the Easter Bush Centre Building in September 2018. The trial allowed the Estates group to develop an alternative design and model the impacts.	

Living Labs projects

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Recruitment and implementation of student (paid) interns for freezer inventories and/or other laborious semi-skilled work.	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials.	• Lab Users	• Internship commenced on schedule on the 4th June, and concluded on the 27th July • By the internship's conclusion, there had been very little agreement to dispose of any samples • Lots of recommendation for each lab – almost always including better sample labelling and cataloguing • Defrosting and filter cleaning has been comprehensively done on 11 ULT freezers, saving £1,700 - £2,400 annually in total • A final report was produced outlining the intern's recommendations and these have been compared to existing Cold Storage guidance to determine if any updates are required ahead of publication	
Support lab-based 'living lab' sustainability projects (DNA, lighting, freezers)	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials.	• Lab Users • Estates	• Scheduled for action each summer 2018, 2019 and 2020 • Discussions have started around DNA storage • Long-term cold storage project (-60, -70 and -80) is ongoing (expected publication 2020) • Energy efficient equipment replacements (SCF) are being monitored for actual energy performance • An intern was in place June and July, to support improvements in freezer and sample management summer 2018	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
			• Case Studies in Sustainable Development students investigated and reported on glass vs plasticware in labs (whole life costing) and comparison of the various sustainable product accreditation schemes available for construction projects	
Hazardous chemical substitution opportunities identification.	3. Reduced consumption of materials, especially hazardous materials.	• Lab Users	• Now scheduled for action commencing in Q2 2018-2019	

Technical Staff

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Work with Technicians' Support Steering Group to improve CPD, career development and community cohesion of technical staff.	4. Enable culture of sustainable working through provision of support and training for lab technicians.	• Technical Staff • Technical Managers • IAD • HR • Academics	• University of Edinburgh has signed up to the Technician Commitment • The TSSG is working with Val Gordon (seconded to work on Technician Commitment for 10h/wk) to develop and implement an Action Plan incorporating a website, events, CPD, Professional Registration, newsletters, emails • TSSG met with the Principal on 29th August 2018	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
			• Technician Commitment launch event at McEwan Hall organised for the 5th Dec 2018 (including a speech by the Principal)	

Funders

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Work with funding bodies to influence their approach to sustainability.	1. 10% reduction in energy consumption. 2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials. 4. Enable culture of sustainable working through provision of support and training for lab technicians. 5. Adoption and use of sustainable building design guidelines (incorporating labs) and Soft Landings or similar approach.	• Lab Users	• SRS department personnel are involved in discussions with Wellcome Trust on a bilateral and multilateral (via the UK-wide Lab Efficiency Action Network) basis • No firm progress yet but our suggestions have been well received	

Resource implications
No resource implications are related to reporting on progress against this plan. Implementation of the plan will have wider resource implications, which have been detailed elsewhere.

Risk Management
No risks associated with reporting on progress against this plan. No items on the plan are currently at risk of failure (red graded).

Equality & Diversity
No foreseen impacts.

Next steps/implications
A further progress report will be provided at the next SLSG meeting by the SRS Project Coordinator – Labs (or appropriate substitute). During that time further actions will be taken towards the outcome objectives of the plan.

Consultation
This document has been reviewed by:
Director – SRS
Head of Programmes – SRS
Engagement Manager – SRS

Further information
Author and Presenter
Rachael Barton SRS Projects Coordinator
Department for Social Responsibility and Sustainability
October 2018

Freedom of Information
This is an open paper.

THE UNIVERSITY of EDINBURGH

C

Sustainable Labs Steering Group

9th October 2018

Freezer Internship Summary and Recommendations

Description of paper

This paper provides a summary of and the recommendations from the Freezer Internship carried in June and July 2018. Any impacts on the existing Cold Storage Policy and Guidance are also considered.

Action requested

The SLSG is asked to note the recommendations and suggest future actions where appropriate. Suggestions for which labs could host future interns is also requested.

Recommendation

A follow up survey/interview with the four host labs should be carried out between 3-6 months after the conclusion of the internship to assess if the intern's recommendations are still being implemented in the long-term. Given the value of the intern to the host labs, a similar project should be carried out within other labs to provide one to one guidance on best practice. Additional engagement with labs on cold storage best practices should be undertaken with the support of lab managers. It is also recommended that two additional suggestions be considered for inclusion in the Best Practice Guidance.

Background and context

Storage of life science samples and other materials at very low temperatures has a substantial energy impact. Ultra Low Temperature (ULT) freezers are ubiquitous and necessary in life-science research, but consume a large amount of energy (up to £1000 annually) in order to maintain samples at a safe temperature.

This project was developed to help University of Edinburgh research lab staff to improve the energy efficiency of their cold storage practices. To minimise the impact on staff time and resources, an intern (Belén Fernández Prado) was recruited for eight weeks over summer 2018 to assist Life Science labs. The intern supported four host labs at the Western General Hospital and Little France Campuses.

The aim of the project was to identify best practices in ULT freezer management which will achieve reductions in energy consumption.
Key objectives were to:

- Assess current freezer management practices.
- Carry out freezer management actions agreed with lab users (defrosting freezers and cleaning filters/fins).
- Carry out audits of samples stored in freezers (cataloguing and safely disposing of unnecessary samples when possible).
- Report findings and provide recommendations to the Department for Social Responsibility and Sustainability and host laboratories on best practices.

Belén provided a written report of her findings and recommendations which has been circulated to internal and external lab networks.

Discussion

Summary of the final internship report

The intern successfully completed the eight week freezer internship, which commenced on the 4th June.

Four labs volunteered to host Belén, which included:

- Wellcome Trust Clinical Research Facility (WTCRF)
- Institute of Genetics and Molecular Medicine (IGMM)
- Division of Infection and Pathway Medicine (DIPM)
- Hepatology Laboratory

Across the four labs, Belén carried out comprehensive defrosting and filter cleaning on 11 out of 12 ULT freezers, which will result in savings of £1,700 - £2,400 annually in total. An additional ULT freezer was assessed but had recently undergone similar maintenance.

An overall inventory of the contents taken for each freezer and where possible, samples were also catalogued. After completing the inventory, host labs were then asked if any samples were redundant and able to be disposed of. All of the labs were reluctant to dispose of samples, in case they turned out to be required at a later date. Thus redundant samples were only able to be removed from 2 out of 12 ULT freezers, equivalent to approximately 5% of the space in each freezer.

Belén made observations of and discussed current cold storage practices with lab users, identifying a number of recommendations to improve energy efficiency and sample safety.

Internship Recommendations

Overall, the intern found that the labs had similar cold storage management practices, with some labs performing better in certain areas than others.

As many of the observations and issues were common to all of the labs investigated, Belén reported that it may be worthwhile to undertake a wide-spread communications campaign, including face-to-face workshops to highlight the issues to lab staff and the actions they can take.

She recommended that the following three main actions be implemented:

- Establish a schedule for defrosting freezers once per year and cleaning filters/fins twice per year.
- Implement a procedure to standardise recording and labelling of samples, including use of printed sticky labels.
- Invest in racks and adequate containers to store samples inside the freezers.

Following discussions at the end of the internship, the Department for SRS recommends following up with the host labs 3-6 months after the project to assess the longer term impacts generated.

Internship impact on Cold Storage Policy and Best Practice Guidance

All three recommendations above complement the existing advice described in the Cold Storage Policy and Best Practice Guidance. These documents have already been approved for publication and dissemination at previous SLSG meetings.

The internship raised two additional suggestions which are not already covered by the policy and guidance documents. Belén noted that it is important to ensure that the rooms in which freezers are housed are cleaned regularly, to help minimise the level of dust becoming trapped in freezer fins/filters. Also, damage to or physical deterioration of freezers should be regularly checked for, especially when a full defrost is undertaken and the freezer is empty.

It is the recommendation of the Department for SRS that these additional two suggestions be considered for inclusion in the Best Practice Guidance.

Feedback on the Internship

From the Intern - An exit interview was completed with the intern at the end of the internship. Belén commented that she found the internship to be an excellent learning experience, found the training from Andrew Arnott very useful, and felt that she had made an impact. On reflection there were several areas of improvement which should be considered before establising any similar internships in the future. These focused around Health and Safety, and communication within the host labs:

- Belén raised concerns during the placement that she did not feel that she was being given enough information about the types of samples she was handling. From a Health and Safety perspective she was unclear what all of the freezer samples were and whether they posed any risk. She would have liked this information to be provided by lab staff from the outset to make sure she was taking all precautions necessary. She wore gloves at all times while working.

- During one induction she was asked by the host lab to read H&S documents which stated that all lab users should have certain immunisations, but was told verbally by staff that this was unnecessary. This left her confused as to what was correct practice.

- Support from the labs was mixed. The main contacts were very supportive, tried to help and responded to her asking for help promptly. However, a few other lab users who were her day to day contacts were unsure of how to help or what she was supposed to be doing. She would have liked to see better communication between the main host organisers and the freezer owners to ensure everyone knew who she was.

Details of these issues have been passed to the appropriate managers for follow up.

From the Host Labs – All of the Host labs had positive feedback for Belen, stating that she was an excellent intern, thorough and a great help to the teams.

Some of the host labs had additional suggestions for the scope of future internships:

- To look at more thorough inventories of freezers
- Creating a good practice guide and a consistent template for recording sample information
- Researching products such as labels
- Looking at being able to purchase storage racks through the Sustainable Campus Fund

Resource implications
This internship was offered through the Bright Green Business Environmental Placement Programme. As such the internship incurred a cost of £3360 +VAT which included the intern's allowance and an administration fee. A further £45 was contributed towards a pool of prize money for the annual National Final Awards Ceremony. A total of 11 staff days were required by the SRS Projects Coordinator – Labs to support the internship.

A similar resource requirement should be expected for any future internship, allowing for a rise in allowance value and fees.

Risk Management
For future internships it will be vital to consider the feedback from the intern, especially concerning Health and Safety, and make improvements before the start.

Equality & Diversity
No impacts are foreseen.

Next steps/implications
It is recommended that the internship's findings relating to cold storage management are included in the existing best practice guidance documentation prior to publication. A follow up survey/interview with the four host labs should be carried out between 3-6 months after the conclusion of the internship. The feasibility of carrying out a further cold storage internship in the summer of 2019 should be discussed and potential host labs identified.

Consultation
This document has been reviewed by:
Director – SRS
Head of Programmes – SRS
Engagement Manager – SRS

Further information
Author and Presenter
Rachael Barton SRS Projects Coordinator
Department for Social Responsibility and Sustainability
October 2018

Freedom of Information
Open paper.

THE UNIVERSITY of EDINBURGH

D

Sustainable Labs Steering Group

9th October 2018

Summary of LEAF Tool and Proposed Pilot

Description of paper

This paper provides a summary of a new tool developed by University College London (UCL) targeted at improving sustainability in labs, and compares the framework with the existing Edinburgh Sustainability Awards Lab Awards (ESA Lab Awards). A proposal to participate in the UK-wide pilot of the Laboratory Efficiency Assessment Framework (LEAF) is detailed.

Action requested

The SLSG is asked to note the summary and recommendations, and approve the pilot project. Also to suggest future actions where appropriate.

Recommendation

It is recommended that the University of Edinburgh participates in the LEAF pilot. The Department of SRS would work alongside volunteer labs within the School of Chemistry to lead the pilot.

Background and context

The SRS Projects Coordinator - Labs (and their current replacement) is a member of the Laboratory Efficiency Action Network (LEAN), a UK wide group of Sustainability professionals based at Universities who are involved in Sustainable Labs projects. The group regularly shares innovations and best practice to prompt improvements in lab sustainability.

The LEAF tool has been developed by UCL and all member institutions of the LEAN group have been invited to provide feedback on and pilot the tool to assess its usefulness as a practical engagement method. The LEAF tool is based on the Green Impact Labs scheme, and incorporates learnings from living lab projects in Universities as well as being based on evidence within the literature. The tool was developed to take into account up-to-date recognised best practice and to potentially provide a standardised framework which allows comparable assessments of University labs.

The University of Edinburgh currently uses the ESA Lab Awards to engage with and encourage labs to embed sustainability in their daily work. The Lab Awards provide a set of criteria over three levels for labs to complete, and are well regarded by lab teams. There is potential for the Lab Awards to grow in participation rates and impact, and there is an internal review of the entire Sustainability Awards currently underway which will identify opportunities to make improvements.

A pilot of the LEAF tool will link in with the review and allow any improvements which can be implemented at the University of Edinburgh to be identify and next steps proposed.

Discussion

Summary of the LEAF tool

LEAF provides a standardised format for lab groups to take part in a structured Awards scheme and be able to record measurable impacts from their actions.

There are 2 elements to the tool:

- Calculators which measure the impact of lab equipment by looking at energy use by equipment, waste produced and CO_2e emissions.
- A set of actions/criteria to complete in an Award format over three progressive levels.

There is a calculator for each of the main types of lab equipment and waste which is used to record a lab's baseline usage, subsequent improvements and the total lab savings. Covered by individual calculators are: waste, fume cupboards, safety cabinets, IT and cold storage.
The calculator's accuracy depends on the lab being able to determine a number of constants and assumptions including but not limited to: the cost of electricity, DEFRA CO_2 factor for Grid Electricity, the unit price of a ULT freezer etc.

There is also a section to record purchases and other initiatives which demonstrate a commitment to sustainability in procurement and other areas not covered by the calculators.

Overall, the LEAF tool is similar to the exiting Lab Awards, in terms of aim and what is asked of lab users, however is more condensed and incorporates a method to record quantitative impacts.

Comparison of LEAF with the ESA Lab Awards

Participation accessibility:
LEAF may allow more types of labs (such as engineering labs) to participate to higher levels, as the criteria are broader and there are fewer criteria which may not be applicable to them (several N/A criteria would make a team ineligible for the award in ESA Lab Awards).

Topics:
The two assessment schemes broadly cover the same topics and require labs to carry out similar actions.

The current ESA Lab Awards cover nine topics, while the new LEAF tool covers eight topics. The topics covered by the two schemes are roughly equivalent as detailed in the table:

The current ESA Lab Awards cover 9 topics:	**The new LEAF tool equivalent topics:**	**LEAF topics with no clear match**
Fume cupboards and biosafety cabinets (BSC)	Ventilation	Research Quality
Cold storage	Equipment	People

Chemicals and gases	Sample & Chemical Management	Procurement
Scientific equipment	Equipment	IT
Water		
Waste and recycling	Waste	
Heating, ventilation and air conditioning (HVAC)	Ventilation	
Lighting		
Awareness and training		

Criteria:
The ESA Lab Awards for the most part has communication focused criteria such as putting up posters and stickers within Bronze level, then more infrastructure and process changes (and more personal commitment from individuals) at Silver level. At Gold level the actions are more advanced and involve external groups such as Estates more, there is also more of a time demand.

The LEAF tool takes a roughly similar approach to building the commitment through Bronze/Silver/Gold but there appears to be a need for more Estates involvement from Bronze Level. For example, Bronze requires that: “The lab is aware of any negative (or positive) pressure required and these are correctly maintained. Users have reported any issues with pressures, excess heating or cooling, or any other relevant issue to estates.”

Number of criteria:
The number of criteria in the ESA Lab Awards is much higher than in the LEAF tool, and LEAF is overall a condensed version of the ESA scheme. Many of the LEAF criteria are covered by multiple ESA criteria, e.g. the LEAF Bronze criteria 'All samples and chemical containers are legible, or there is a system in place to ensure that going forward all samples will be consistently labelled.' is covered by 4 separate ESA Gold criteria. This could be more user friendly and reduces the repetition within ESA but means less detail is provided to clarify the requirements in LEAF.

Each level in the two schemes have the following number of criteria:

Scheme	**Bronze**	**Silver**	**Gold**	**Total**
ESA Lab Awards	16	25	37	78
LEAF	16	16	12	44

Criteria focus:
LEAF does not contain criteria which specifically focus on Health and Safety actions (such as COSHH and spill training) and is less specific about requiring maintenance. LEAF instead requires actions on Research Quality and IT, which the ESA Lab Awards does not.

Main gaps in each scheme which are covered by the other:

Not covered by ESA Lab Awards	Not covered by LEAF
Research Quality	Health and Safety (COSHH and spills)
Sharing of samples and chemicals externally	Evidence of regular equipment and fume hood maintenance
Reduction in total waste produced/improved recycling rates	Disposal via drains
Reducing travel by lab staff	Water efficiency (although it covers chiller recirculation)
IT	Safe Chemical storage
	Sharing freezer space and replacing inefficient freezers
	Ice machines
	Lasers
	Plastic waste recycling

Evidence Requirements:
The ESA Lab Awards are very clear and specific about what actions to take and what type of evidence is used to assess each criteria. The LEAF scheme is less explicit and takes a more flexible approach to documentation/evidence - where teams are told what to achieve and they must decide what the right approach is. This could be beneficial to teams as they are worried less about finding evidence, but could mean they are unsure what actions to take.

User support:
There are detailed descriptions of how to use each scheme available, including what details are required to complete each calculator in LEAF. Both LEAF and the Lab Awards provide a good explanation of why each criteria is important and what it achieves in terms of sustainability.

Pilot Proposal
It is recommended that the University of Edinburgh participated in the LEAF pilot project to continue to demonstrate its leadership in the area of sustainable labs.

The proposal for the pilot is to trial the tool in several host labs within the School of Chemistry. The SRS Projects Coordinator would work closely with Stewart Franklin, who is already familiar with the School's participation in the ESA Lab Awards, to introduce the labs to the LEAF tool and support them in its completion. Baseline measurements will be taken with the help of lab users and all data recording and feedback will be the responsibility of the SRS Project Coordinator. The Coordinator will regularly liaise with the LEAN group to share learnings and receive additional support for the pilot.

The pilot will commence in October/November 2018 and run for 3 – 12 months depending on the availability of the host labs and changing resource requirements.

Data and feedback from the trial will provided to all members participating in the trial and the outcomes will be disseminated back to the host labs, the SLSG and other internal lab networks.
Any recommendations or learnings arising will be considered to determine future steps and any improvements to the Lab Awards at Edinburgh.

Resource implications
No additional financial or staff time resources are expected to undertake the pilot project as it will be carried out under staff days already allocated to carry out the ESA Lab Awards.

Risk Management
There is a reputational risk to the University if it does not participate in a project which is seen to be new and innovative within the Sustainable Labs sector, and where the University aims to be world leading.

There is low-risk to the project itself as it is a temporary pilot. However the pilot will need to be carefully communicated to labs given its differences to previous Awards schemes, to maintain engagement and maximise the probability of success.

UCL who have developed LEAF have required a Licence Agreement to be signed prior to commencing the pilot and receiving the project materials. A request was made to Legal Services to review the agreement and provide advice before it was signed and returned.

Equality & Diversity
No impacts are foreseen.

Next steps/implications
Carry out the proposed pilot project within the School of Chemistry and regularly feedback on its impact and findings to the SLSG. On conclusion of the project, any recommendations to adopt or eschew the LEAF Tool will be considered.

Consultation
This document has been reviewed by:
Director – SRS
Head of Programmes – SRS
Engagement Manager – SRS

Further information
Author and Presenter
Rachael Barton SRS Projects Coordinator
Department for Social Responsibility and Sustainability
October 2018

Freedom of Information
Open paper.

THE UNIVERSITY of EDINBURGH

E

Sustainable Labs Steering Group

9th October 2018

Sustainable Campus Fund in University Labs

Description of paper
This paper describes uptake of Sustainable Campus Fund within University labs.

Action requested
The Group is asked to review and comment on the paper.

Recommendation
Increase engagement within labs around the use of sustainable campus funding and investigate potential new opportunities.

Background and context
- In May 2016, the Estates Committee approved a Sustainable Campus Fund (SCF, £2.75M over 3 years) as an internal investment vehicle that provides financing to parties within the University for implementing energy efficiency, renewable energy and other sustainability projects that generate cost and carbon savings.
- Estates and SRS are working to identify suitable projects for the Fund as well as other opportunities for savings (behaviour change, labs interventions, IT, continuation of energy efficiency in business as usual operations, and in refurbishments and developments).
- In December 2017, the University was awarded £5M funding for energy efficiency and sustainability projects from the Scottish Funding Council. This is a zero interest loan.
- Estates Committee has approved a further extension of the Fund to 5 years and £4.75M in total in May 2018.
- To date, 64 projects with a total value of £1,264k were approved.

Discussion
The Utilities Working Group has discussed the merits of proactively identifying packages of funding for specific themes or activities across the University. Such an approach could be extended to include laboratories. If that were done, advice would be welcome on the level of achievable annual spend for labs that should be allocated.

Overall, projects related to labs are responsible for ca. £440k spend, which represents 34% of total spend.

The distribution of spend is uneven, with School of Chemistry receiving a lion's share (£230k, 58%) of the funding, followed by IGMM at 26% (£102k), see Figure 1 below.

SRS would welcome applications and ideas from other Schools. Projects should be related to sustainability, generate energy, resource or waste savings and pay back within 8 years.

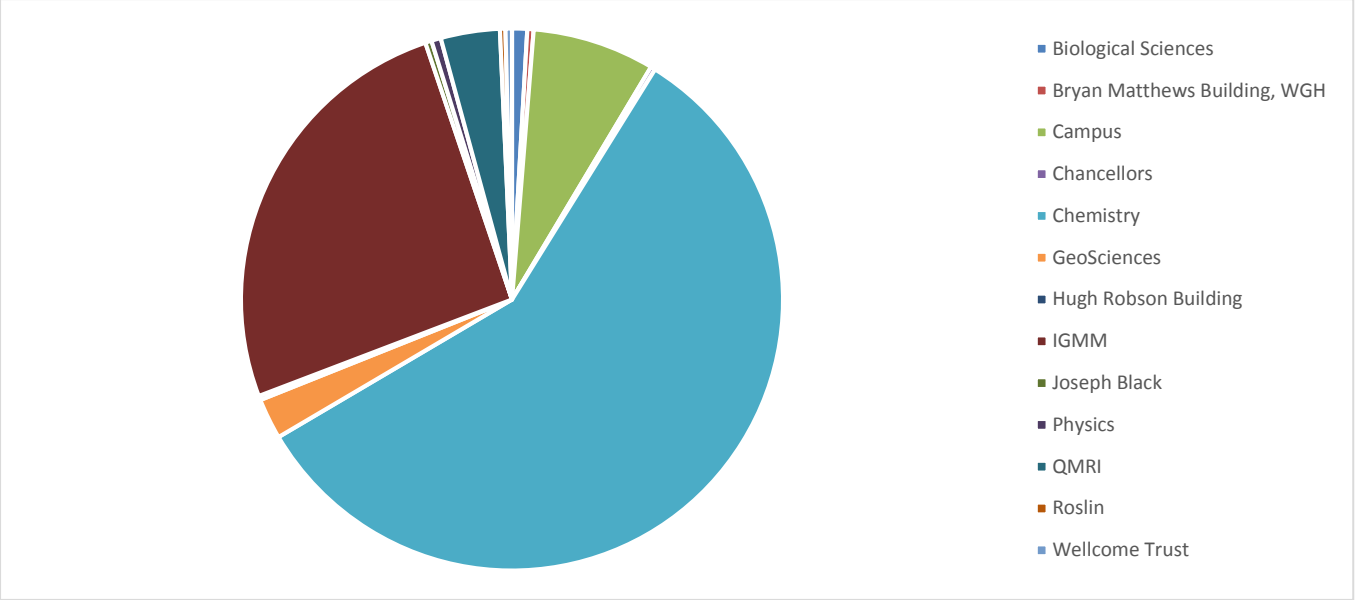


Figure 1. Distribution of lab-related sustainable campus funding

Examples of projects funded so far

The Fund has supported a wide variety of projects, not all of which were focusing on energy efficiency. Some examples include:

- LED Dissection lamps in Hugh Robson Building. In addition to environmental benefits, users reported that it helped them free up space, reduced risks of damaging samples, improved workspace quality and saved time.
- Recirculated water chillers. Multiple chillers were installed in a few batches in Joseph Black Building. They save huge volumes of water, however the goal was also to help promoting environmental consciousness of the School of Chemistry to students learning there.
- Modernise magnetic susceptibility equipment in James Clerk Maxwell Building (Physics). New equipment is significantly more energy efficient, users were also worried about the perception that students were using equipment older than themselves.
- Helium Recovery in School of Chemistry. Project installed equipment capturing helium boil-off. This allows recycling of a non-renewable resource, with the added benefit of ensuring sustainability of research equipment by guaranteeing future helium supply, regardless of market conditions.

There are also systems in place enabling quick support for smaller projects, e.g. plug-in timers for equipment, support in purchasing ULT freezers (new or replacements) or drying ovens. SRS is very happy to provide support in development, from idea through to funding.

Several larger, more complex projects are also currently being investigated:

- Individually ventilated cages for CBS new-builds. Potential for large energy savings on ventilation and tighter control of conditions for animals.

- LN2 facility upgrade in Ashworth Labs. Improving the way liquid nitrogen is transported and stored should yield savings on procurement and improve safety.
- Overhaul of ventilation in Joseph Black. Potential for large energy savings on ventilation and ensuring modern ventilation and exhaust standards are being met.

Resource implications
No additional resources are required.

Risk Management
No inherent risk other than not taking advantage of all potential opportunities.

Equality & Diversity
Equality and Diversity were considered when setting up the fund.

Next steps/implications
SRS will communicate the opportunities around Sustainable Campus Fund to lab users.

Further information

Author	Presenter
Chris Litwiniuk	Michelle Brown
Engagement Manager	Head of SRS Programmes
October 2018	October 2018

Freedom of Information
This is an open paper.

THE UNIVERSITY of EDINBURGH

F

Sustainable Labs Steering Group

9th October 2018

S-Labs Bristol – Lab Excellence – Best Practice Design, Operation and Management + Smart Ventilation Workshop – 17 / 18 September 2018

Introduction

Around 300 attendees for the main conference and 50 for the workshop. 40 presentations covering lab design (many on ventilation), example projects, energy saving opportunities, data management, sustainability and circular economy approaches and facility tours at University of Bristol.

Programme and presentations available from:

https://www.dropbox.com/sh/od4g6ujr6ubxo9p/AACDs3J-IoA0U336SWoJar0ya?dl=0

Smart Ventilation Workshop (University of California, Irvine; Aircuity; CPP Wind Engineering)

Summary:

- Good design of ventilation systems with demand control can provide major energy savings with good financial returns (<5 years in many examples); possible for new build or retrofit

Key points:

- Labs are major energy consumers and ventilation is major part of this, usually 50 - 80%
- New technologies and data management allow precise demand control which can give safer, more comfortable spaces and major energy savings
- Detailed understanding of requirements plus zoning of plant and suitable controls needed
- Effective management approaches required to operate systems and achieve benefits
- Potential to recover costs from additional sensors and controls through applying diversity to plant sizing reducing required capacity and cost
- Guidelines starting to suggest fixed ACH rate is not the way to achieve safe conditions and real time sensing of contaminants can provide energy savings; labs now operating safely at baseline rates of 2 – 4 ACH where able to respond to demand
- Research showing that high, fixed ACH rates are counter-productive and do not lead to more effective removal of contaminants
- There is a risk of night set back on ventilation, if people attend unexpectedly and also it may take 1 hour to clear contaminants once ventilation comes on or ramps up at the start of the day.
- Good design of ventilation systems based on achieving low pressure drops and dynamic control of ventilation rates give the energy savings

- Considering air change, heating and cooling loads separately can lead to savings, e.g. use chilled beams or direct cooling of process rather than high ventilation rates
- Opportunities on exhaust systems around duct design and control of fan speeds
- University of California have achieved 50% energy reduction on new build labs and up to 80% on retrofit projects
- University of California approach based on dynamic, demand based ventilation, exhaust fan control, low pressure drop design, fume hood flow optimisation, proper commissioning, monitoring of systems (all points every 5 seconds) and reducing heat gain through LED lighting
- Biggest savings are on reheat of supply air
- Significant additional benefits which were not required in the business case, e.g. energy savings allowed deferred maintenance backlog to be cleared, better comfort conditions and colour rendering of lighting welcomed by researchers, improved air quality through higher spec filters also providing research benefits
- Achieved this through focussed effort, strong processes, engagement and right attitude across team

Main Conference

Plenary (University of California, Irvine; Met Office; University of Bristol)

- University of California have made significant and cost effective energy savings through their Smart Labs programme

UCI Smart Labs™ Initiative

UCI | Southern California Edison, An Edison International Company | Better Buildings Challenge, U.S. Department of Energy

Laboratory Building		BEFORE Smart Lab Retrofit			AFTER Smart Lab Retrofit		
Name	Type	Estimated Average ACH	VAV or CV	More efficient than code?	kWh Savings	Therm Savings	Total Savings
Croul Hall	P	6.6	VAV	~ 20%	40%	40%	40%
McGaugh Hall	B	9.4	CV	No	57%	66%	59%
Reines Hall	P	11.3	CV	No	67%	77%	69%
Natural Sciences 2	P,B	9.1	VAV	~20%	48%	62%	50%
Biological Sciences 3	B	9.0	VAV	~30%	45%	81%	53%
Calit2	E	6.0	VAV	~20%	46%	78%	58%
Gillespie Neurosciences	M	6.8	CV	~20%	58%	81%	70%
Sprague Hall	M	7.2	VAV	~20%	71%	83%	75%
Hewitt Hall	M	8.7	VAV	~20%	58%	77%	62%
Engineering Hall	E	8.0	VAV	~30%	59%	78%	69%
Averages		**8.2**	**VAV**	**~20%**	**57%**	**72%**	**61%**

Type: P = Physical Sciences, B = Biological Sciences, E = Engineering, M = Medical Sciences

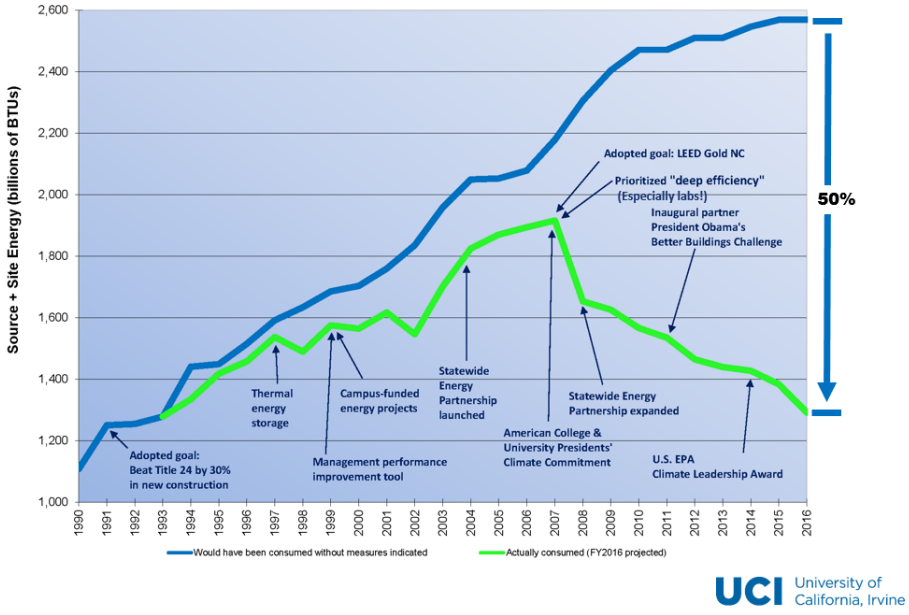
8 UCI

Smart Labs Life-Cycle Costs and Benefits

Cost Factors and Derived Benefits	New Construction		Smart Labs Retrofit	
	Costs	Derived Benefits	Costs	Derived Benefits
"Smart Lab" systems/components/installation	$12.50/GSF		$18.75/GSF	
Deferred maintenance problems addressed		N/A		$1.90/GSF
Reduced energy expense		$43.20/GSF		$52.70/GSF
Safety specialist to evaluate and manage laboratory air-change settings	$4.10/GSF		$4.10/GSF	
Extended equipment lifespan		$2.50/GSF		$2.50/GSF
Maintenance expense increase for controls	$9.25/GSF		$9.25/GSF	
Avoided re-commissioning every 5 years		$23.50/GSF		$23.50/GSF
Avoided carbon costs		$4.60/GSF		$4.60/GSF
Capital cost avoidance due to smaller chillers and boilers		$6.10/GSF		
Capital equipment capacity freed-up due to reduced chiller and boiler central plant load				$6.10/GSF
50-YEAR TOTALS	$25.85/GSF	$79.90/GSF	$32.10/GSF	$91.30/GSF

UCI

25 Years of Energy Efficiency



UCI University of California, Irvine

Session E2 – Design options for end of life labs

The University of Bristol Queens Building – Faculty of Engineering

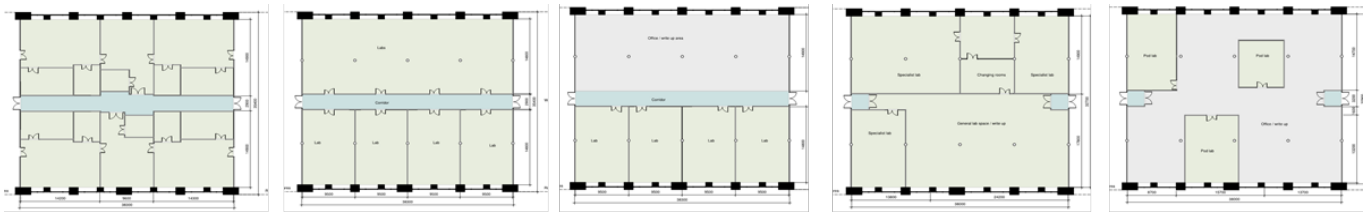
- £7.2m research and teaching space for the UoB Faculty of Engineering
- 2,500m² mix of new build extension and retrofit existing laboratories which includes:
  - Central design office / lecture theatres
  - Break-out and event space
  - Engineering laboratories
  - Post-graduate offices
  - Propulsion laboratory
  - NDT laboratories
  - Bookable and study spaces
- Major infrastructure diversions within the new-build footprint
- Existing engineering building used for teaching throughout construction period
- BREEAM Very Good and 20% carbon reduction targets

Queens Building | Overview of scheme

ARUP

	Simple lab space simple engineering				Complex lab space complex engineering
	Base Case	Opt 1	Opt 2	Opt 3	Opt 4
Refurbishment cost £/m²		750-800	800-850	1,000-1,050	1,300-1,400
Energy improvement %	Base Case	40%	49%	35%	45%
Carbon emissions improvement %	Base Case	30%	40%	32%	36%

Changes to previous option	12 ACH, manual lights	6 ACH, LED lighting, increased CHW distribution	2 ACH – offices; 6 – 10 ACH labs with VAV; absence detection on lighting	12 ACH + HEPA filters + additional cooling specialist labs; 4 ACH normal labs; daylight control on lighting	4 ACH



base case option 1 option 2 option 3 option 4

Session B3 – Lab Improvements at University of Bristol

Biomedical sciences building – 23,000m^2; 1,500 students & staff; £761k utility spend

Achieved £85k annual savings

Why? How? What?

- Using the extensive technical structure and individual floor teams as sustainability champions we have been able to implement a number of green lab initiatives
- Green Impact lab accreditation and associated spin-off projects
- Equipment inventory, sharing and re-use initiative
- Equipment replacement (drying ovens, ULT freezers, class II cabinets)

University of BRISTOL
26 September 2018

Final thoughts…

Utilising technical staff as sustainability champions

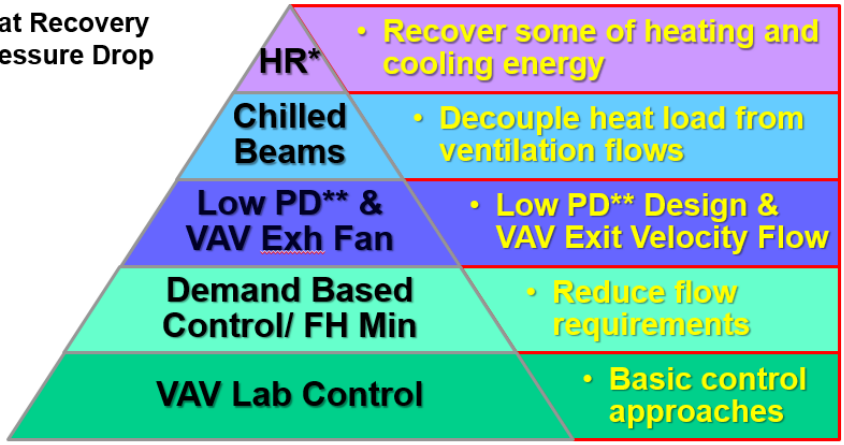
Making incremental changes that add up to big differences across the whole building

However small the change, it's important in the bigger picture

Holistic Strategies for Increased Savings

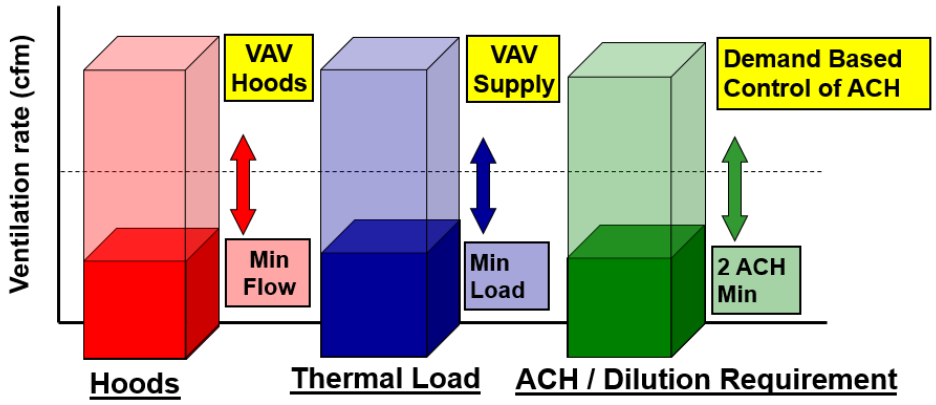
- Individually evaluating systems is suboptimal
  - ✓ DBC, chilled beams, hoods & heat recovery all interact
- To optimize lab safety, first cost & energy:
  - ✓ Combining systems based on analysis of ***Net*** benefits
  - ✓ Also use a layered or pyramid approach:

*Heat Recovery
**Pressure Drop



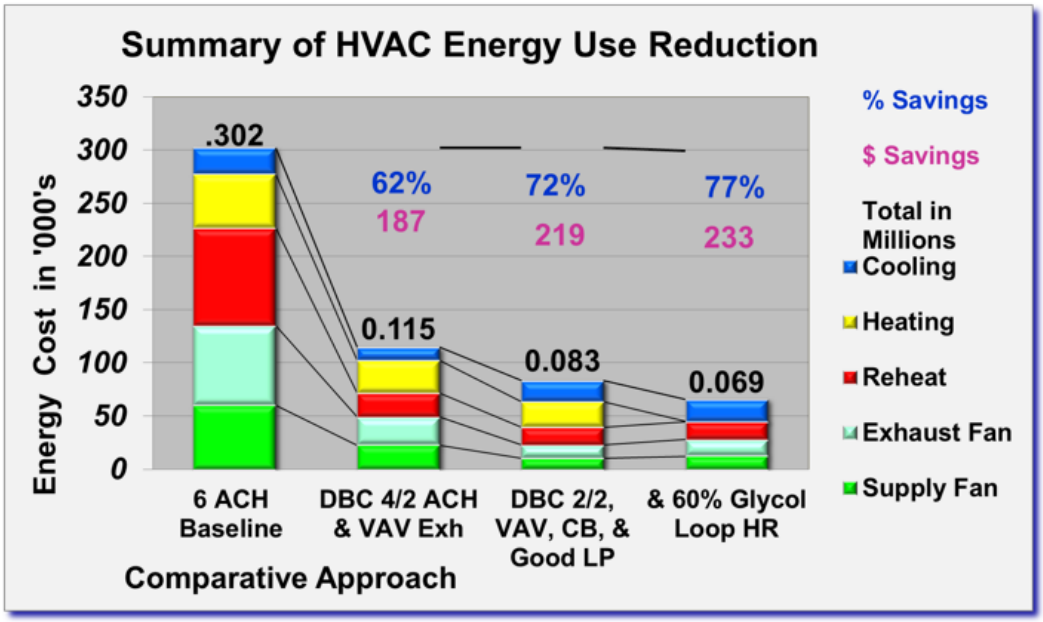
Achieving Down to 2 ACH Safely in Labs

- Goal: Achieve 2 ACH day/night or 3-4 day/2 night
- What are the drivers of lab airflow that affect this?
  - ✓ Hood flows, thermal loads & ACH rates



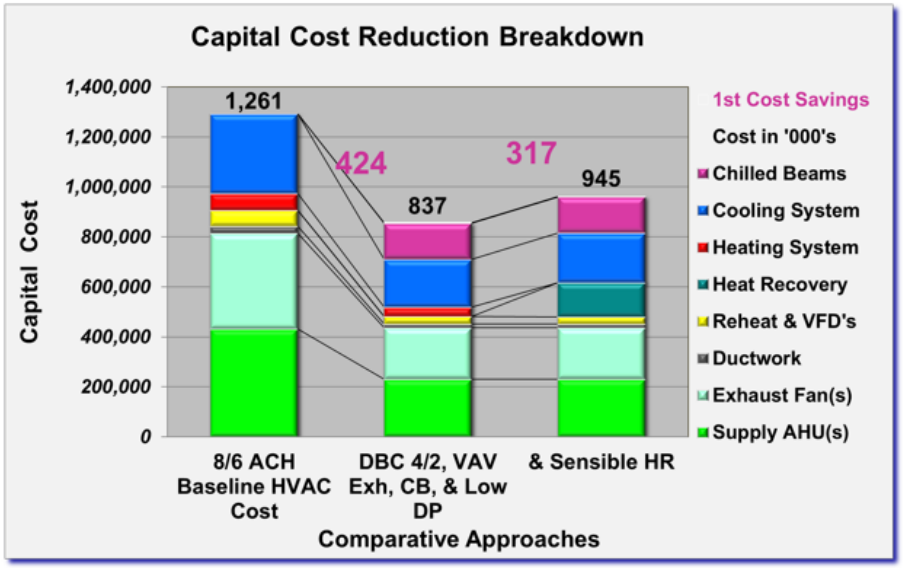
To achieve lab flows down to 2 ACH to reduce energy & 1st cost, *all* flow requirements need to be reduced

Summary of Using All Savings Approaches vs. 8/6 ACH



Total HVAC energy reduction w/o Sensible HR is 72% or with sensible HR total HVAC savings is 77%!

Right Sized HVAC Pays for All Savings Approaches



Total Capital Savings of £317K including cost of CB & HR just pays for DBC giving a neutral impact for 77% savings! Without HR, savings is 72% & cost is reduced by ~ £100K!

Cold Storage Sustainability Project

Prepared by Belén Fernández Prado.

THE UNIVERSITY of EDINBURGH

Social Responsibility and Sustainability

Cold Storage Sustainability Project

Executive Summary

The Department for Social Responsibility and Sustainability's (SRS) Sustainable Laboratories Programme, aims to improve the sustainability of research and teaching labs across the University.

Labs are typically more energy intensive than the equivalent area of office space, and cold storage facilities significantly contribute to lab energy consumption.

A number of Cold Storage projects have been undertaken by the SRS department, and to build on existing Cold Storage policy and guidance, an internship to assess current freezer management practices in labs was developed.

An intern was recruited for eight weeks to audit and work with four Life Science labs across the University, aiming to observe current freezer management practices and make recommendations for improvements.

The project was able to assess 12 ultra-low temperature (ULT) freezers, with similar practices observed in all labs. Based on the project's findings, the following three recommendations have been proposed:

- Establish a schedule for defrosting freezers once per year and cleaning filters/fins twice per year.
- Implement a procedure to standardise recording and labelling of samples, including use of printed sticky labels.
- Invest in racks and adequate containers to store samples inside the freezers.

The findings and recommendations have been discussed with each host lab and will be used to influence the current Cold Storage policy and guidance, and future engagement projects.

Contents

1. Introduction to the project

The University of Edinburgh is committed to making a significant, sustainable and socially responsible contribution to Scotland, the UK and the world. To achieve this, the University is working towards embedding sustainability across operations, research, learning and teaching.

The University's Department for Social Responsibility and Sustainability, through the Sustainable Laboratories Programme, aims to improve the sustainable practices of research and teaching labs across a range of target areas.

The Cold Storage Sustainability Project is a new engagement initiative focused on reducing the energy consumption associated with Cold Storage facilities in Life Science Labs.

To minimise additional demands on staff time, an intern was recruited to assist life science research laboratories to undertake vital work to improve the efficiency of storing samples.

Storage of life science samples and other materials at very low temperatures has a substantial energy impact and this work has been done to ensure that the University of Edinburgh maximizes opportunities to reduce this energy consumption.

Ultra Low Temperature (ULT) freezers are ubiquitous and necessary in life-science research, but consume a large amount of energy (up to £1000 annually) in order to maintain samples at a safe temperature. This project has involved working in partnership with University of Edinburgh research lab staff to improve the energy efficiency of their cold storage practices.

2. Project approach

The aim of the project was to identify best practices in ULT freezer management which will achieve reductions in energy consumption.

Key objectives were to:

- Assess current freezer management practices.
- Carry out freezer management actions agreed with lab users (defrosting freezers and cleaning filters/fins).
- Carry out audits of samples stored in freezers (cataloguing and safely disposing of unnecessary samples when possible).
- Report findings and provide recommendations to the Department for Social Responsibility and Sustainability and host laboratories on best practices.

The project was undertaken at the Western General Hospital and Little France campuses, where there is a high concentration of life science labs. Four labs volunteered to participate in the eight week project:

- Wellcome Trust Clinical Research Facility (WTCRF)
- Institute of Genetics and Molecular Medicine (IGMM)
- Division of Infection and Pathway Medicine (DIPM)
- Hepatology Laboratory

The number of freezers assessed in each lab is shown in Table 1. Each freezer was fully defrosted, with its filters and fins cleaned, and an overall inventory of the contents taken (where possible samples were also catalogued). Potentially redundant samples from each freezer were also identified.

Table 1. Total of freezers managed in each laboratory.

Host Laboratory	WTCRF	IGMM	DIPM	Hepatology Lab
Freezers	3xULT + 3x-20^{o}C	4xULT	4xULT	1xULT

3. Findings and recommendations

This section will discuss what was observed in relation to freezer management in the participating labs. There were many similarities between the labs, and so the findings and recommendations have been grouped into five key areas as follows. Some individual labs maintained better sustainability practices than others but there are opportunities for improvement at each lab studied.

Each finding will initially discuss the observed issues, followed by the recommended actions to improve and follow best practice.

3.1. Freezers conditions

Issue

In general, the freezers in all labs were snowy and icy. This is problematic as poorly defrosted ULT freezers use more energy to operate as often seals around doors do not operate as effectively. Some freezer doors were unable to shut properly as ice had distorted the frame alignment and seals.

The filters and fins of almost all freezers were dusty/dirty. When these filters and/or fins are dusty the removal of heat is less effective and the compressor mechanisms for heat removal need to work harder. This results in overall greater energy consumption by the freezer.

See Figure 1 for before and after examples.

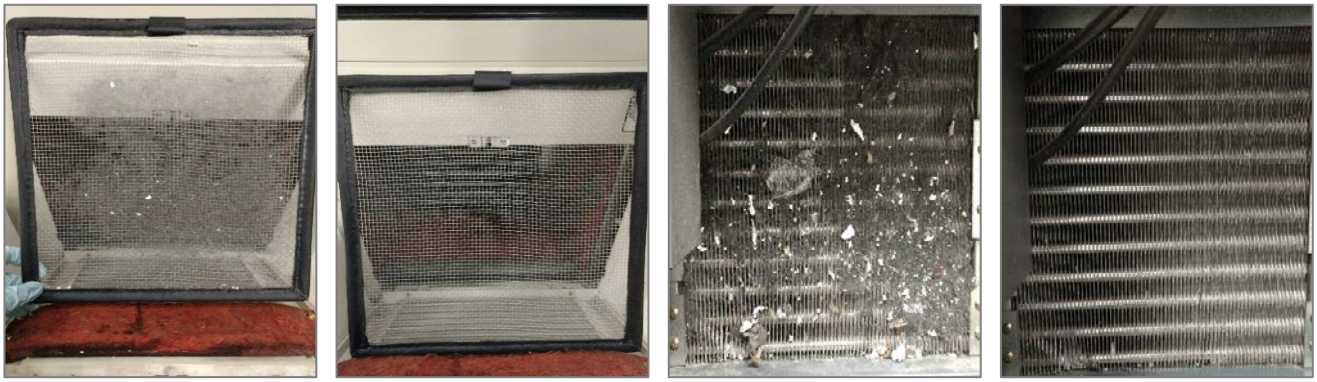


Figure 1. Before and after of defrosting/cleaning freezers.

Recommendation

Defrosting and filter/fin cleaning was comprehensively carried out on 11 ULT freezers, with expected energy cost savings of £1,700 - £2,400 annually in total.

Based on this potential impact, it is recommended that labs implement a rota to ensure defrosting the cabinet occurs once per year and cleaning the filters/fins occurs twice per year. These actions can save up to £200/year and £250/year (1), respectively.

When planning to defrost a freezer there are two requirements to ensure the defrost takes place efficiently:

- A spare freezer – In order to store the contents of the defrosted freezer while working.
- Two days – In order to let the freezer reach the set (correct) temperature after being defrosted.

Cleaning the filters and fins takes less than 30mins to carry out and no specialist equipment other than a clean cloth or vacuum cleaner.

3.2. Freezers maintenance

Issue

When inspecting the freezers after they had been fully defrosted, some maintenance issues were discovered (Figure 2.). This included: doors not closing correctly, holes in the cabinets, broken door seals and damaged frameworks.

Figure 2. Examples of poor maintenance in freezers

Recommendation

Check the interior of the freezer when defrosting and carry out any maintenance required.

During daily working, more careful usage practices should be considered to avoid causing damage, and to keep the equipment running effectively and efficiently. This should also reduce the need to purchase new ULT freezers to replace damaged freezers.

3.3. Freezer rooms

Issue

On multiple occasions it was observed that items were being stored on top of the freezers, which could impair the ventilation of the freezer. The floors of these freezer rooms were often found to be dirty and appeared to be cleaned less frequently than other rooms (Figure 3.).

Action was taken to remove items from the tops of freezers, however, some items were on top of the freezers again the following day. Along the same lines, filters were cleaned but some became clogged in less than 24 hours due to the dirty floors.

Figure 3. Observed lack of organisation in freezer rooms

Recommendation

Communications highlighting the importance of keeping at least 15cm of clear space around the sides, back and top of the freezer should be disseminated, to ensure proper ventilation is maintained. Installing shelves or cupboards to help with storage in the freezer rooms could be a solution for this issue.

A cleaning rota for the freezer rooms should be initiated or an agreement reached with the building's cleaning staff to ensure the rooms are cleaned once per week.

3.4. Storage inside the freezer

Issue

One of the key issues preventing staff applying good freezer management in the labs, is the lack of organisation of samples within the freezer. It was observed that most freezers do not make enough use of racks or appropriate internal storage, with many samples being stored in various sizes and shapes of boxes or in bags.

Further investigations discovered other poor storage practices including: storing samples as loose tubes, not using storage boxes correctly (some boxes becoming overly full and others less than half full), storing tubes without caps, and keeping samples which could be stored at -20 ^{o}C instead (Figure 4.). Boxes and samples

trays are currently the main method used to store samples inside the freezer. However bags are also in use, which greatly reduces the space available and also hinders the search of samples.

Figure 4. Examples of poor storage practices

Recommendation

When storing samples, lab staff should plan ahead and consider the most efficient way to store samples according to their shapes and temperature requirements before storing them. This will not only reduce the time spend looking for samples at later, but will help reduce the chance of losing samples or damaging them through poor storage practices.

It is recommended that labs invest in purchasing additional racks in order to keep freezers organised. This will allow lab users to find their samples more quickly, reducing the time freezer doors are kept open and thereby minimising a rise in freezer temperature. Also, by maximising the space and filling freezers to capacity, there will be less space inside the freezer for warmer air to circulate when the doors are open.

3.5. Labelling and recording

Issue

There are currently no standardised protocols for recording samples across the labs. Consequently, more freezers do not have a clear or consistent database of their contents.

The WTCRF displays some good labelling practices as they use the Laboratory Information Management System (LIMS) to keep track of their samples. However, in most labs, freezer users follow the example of their colleagues and if there is no clear procedure to follow, then samples are unlikely to be labelled and recorded consistently.

In addition to this, inadequate methods of sample labelling risk other lab users being unable to tell what the samples are. Hand written labels, samples with only minimal information about the contents, and a lack of labels on some samples all prevent other freezer users being able to identify the contents. When tracking or looking for samples, such poor labelling slows the process greatly, wastes time and potentially results in errors.

Most of the labs stated that they do not regularly remove unnecessary samples from ULT freezers. When defrosting the freezers, an inventory of the samples contained in each was made. Host labs were then asked if any were redundant and able to be disposed of. All of the labs were reluctant to dispose of samples, in case they turned out to be required at a later date. Thus redundant samples were only able to be removed from 2 out of 12 ULT freezers, equivalent to approximately 5% of the space in each freezer.

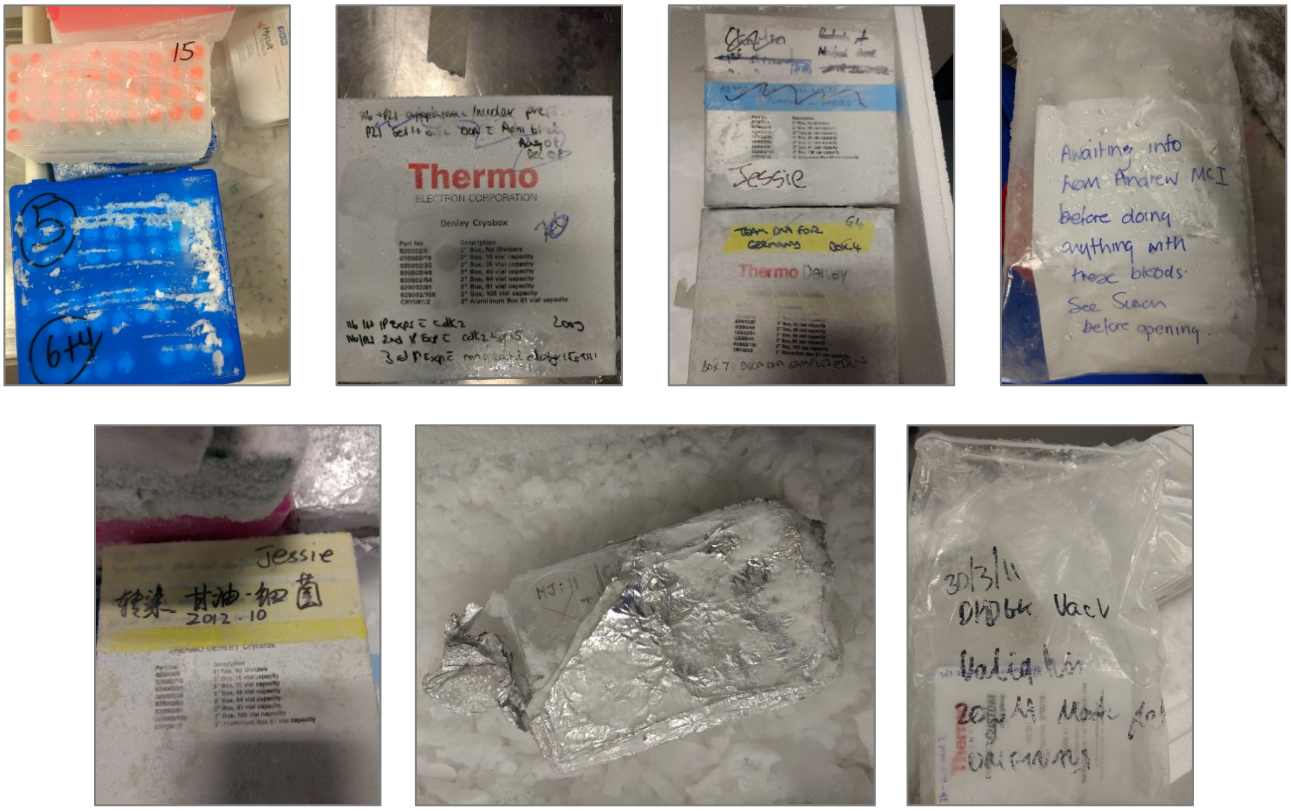


Figure 5. Examples of poor labelling

Recommendation

Good organisation minimizes the risk of exposing samples to fluctuating temperatures, as for every minute a freezer door is open, it takes around 10 minutes for the freezer to recover to its set temperature (2). If freezer doors are open for a shorter length of time, this will also help reduce the energy demand to bring it back to the correct set temperature.

To help improve freezer organisation and speed up locating samples, a standardised and consistent labelling system appropriate for each lab should be implemented.

Implementing a unique system – like a software package - for all the samples stored would be extremely helpful, and should include printed high quality and easily legible sticky labels bearing the following details:

- Information about the sample (possibly a code)
- Date (when the sample came in and when it expires)
- Owner of the sample and project/group

In the same way, it might be useful for the lab staff to have a poster detailing and mapping the contents of the actual freezer in order to make searching for samples easier. This could be placed on the outside of the freezer and in offices.

Labs are also strongly recommended to review their freezer contents every 6 months to a year, to assess if any samples are unnecessary and able to be removed. It may be possible to remove samples if a member of staff leaves the group, or if samples are required infrequently and could be moved to archive type shared storage. This would increase the space available within the freezer and avoid the need to buy new freezers.

4. Conclusions

This project has helped identify how life science research laboratories across the University of Edinburgh are utilizing their cold storage equipment like ULTs.

As many of the observations and issues were common to all of the labs investigated, it may be worthwhile to undertake a wide-spread communications campaign, including face-to-face workshops to highlight the issues to lab staff and the actions they can take.

It is recommended that the following three main actions be implemented:

- Establish a schedule for defrosting freezers once per year and cleaning filters/fins twice per year.
- Implement a procedure to standardise recording and labelling of samples, including use of printed sticky labels.
- Invest in racks and adequate containers to store samples inside the freezers.

Additional actions which will contribute to improved best practice are ensuring physical maintenance of the freezers is carried out properly and regularly cleaning freezer rooms.

These finding and recommendations have been presented to and discussed with each of the four participating labs. Each lab has committed to discussing the findings with their lab users and there is a high level of interest and motivation to make improvements to freezer practices.

References

1. *Factors affecting the performance, energy consumption, and carbon footprint for ultra low temperature freezers: case study at the National Institutes of Health.* **Gumapas, Leo Angelo M. and Simons, Glenn.** 2013, World Review of Science, Technology and Sust. Development, Vol. 10, pp. 129-141. 1/2/3.

2. **Ackerman, Ryan, et al.** Cold Storage Resource Guide. *Lab Manager.* [Online] 2018.

This publication can be made available in alternative formats on request.

Email: SRS.Department@ed.ac.uk

Phone: 0131 650 4065