THE UNIVERSITY *of* EDINBURGH

Sustainable Labs Steering Group

15:00 – 17:00, Monday 21st May 2018

Cuillin Room, Charles Stewart House

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 15th January 2018

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

SUBSTANTIVE ITEMS

4 Freezer inventory **B**
To receive a paper from the SRS Project Coordinator – Labs describing the outputs from a survey of University of Edinburgh ULT freezers

5 Freezer internship
To receive a verbal update from the SRS Project Coordinator – Labs describing the upcoming internship which will help labs to inventory their freezer contents and undertake basic maintenance.

6 SLSG Programme Plan progress update **C**
To receive a paper from the SRS Project Coordinator – Labs, describing progress against the SLSG Programme Plan

7 Sustainable Lab Ventilation Policy update **D**
To review and if appropriate approve the policy from the SRS Project Coordinator – Labs.

8 Sustainable Cold Storage update **E**
To review and if appropriate approve the policy and best practice guidelines from the SRS Project Coordinator – Labs.

9 Lab equipment re-use/re-sale procedure consultation update **Verbal**
To review the latest draft of the procedure document from the Procurement Category Manager (Laboratories and Medical)

10 Lab Energy Engagement and Monitoring Expansion **F**
To receive a paper from the SRS Project Coordinator – Labs recommending further energy engagement and monitoring projects (similar to last year's successful project at IGMM)

11 Recommendations from Case Studies in Sustainable Development groups **G**

To receive a paper from the SRS Project Coordinator – Labs, describing the outputs from recent studies into two topics: glass vs plastic in labs; and certification schemes for sustainable construction materials

ROUTINE ITEMS (verbal)

12 Any Other Business

To ***consider*** any other matters from Group members.

A

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MINUTE OF A MEETING *of the Sustainable Laboratories Steering Group held in Room 1.07 at the Main Library on Monday 19 March 2018.*

Members: Dave Gorman, (Convener), Director of Social Responsibility and Sustainability
Andrew Arnott, SRS Projects Coordinator - Labs
Graham Bell, Depute Director - Estate Development
Michelle Brown, Head of SRS Programmes
Martin Crawford, Controls Manager
Joanne Dunne, Early Stage Researcher
Grant Ferguson, Head of Estates Operations
Kate Fitzpatrick, Waste & Recycling Manager
Val Gordon Technical Officer, Institute for Education, Teaching & Leadership
David Gray, Head of the School of Biological Sciences
Sharon Hannah, Bioquarter Campus Operations Manager
Yuner Huang, Early Stage Researcher
Angela Ingram, Service Manager, IGMM
David Jack, Energy Manager
Andy Kordiak, Equipment Procurement Manager, CMVM
Julia Laidlaw, Estate Development Manager, Bioquarter
Sandra Lawrie, Technical Services & Estates Manager, School of Biological Sciences
Chris Litwiniuk, SRS Engagement Manager
Guy Lloyd-Jones, Forbes Chair of Organic Chemistry
Robert MacGregor, AECOM & Estates
Stewart McKay, Technical Services Manager, IGMM
Brian McTier, Easter Bush Campus Facilities and Services Manager
Colin Miller, Roslin Procurement Manager
Lee Murphy, Genetics Core Manager
Janet Philp, Joint Unions Liaison Committee
Candice Schmid, Occupational Hygiene and Projects Manager
Matthew Sharp, Operations Manager CBS

Apologies: Graham Bell; Martin Crawford; Grant Ferguson; Kate Fitzpatrick, Val Gordon; David Gray; Sharon Hannah; Angela Ingram, Andy Kordiak; Julia Laidlaw; Sandra Lawrie; Robert MacGregor; Janet Philp

1 Minute **A**

The Convener welcomed attendees to the tenth meeting of the Group.

The minute of the meeting held on 15 January 2018 was approved as a correct record.

Actions Carried Forward

Action – RM to send SM current Estates guidelines on air changes.

Action – AK to circulate updated lab equipment re-use/re-sale procedure draft.

Action – DJ to share current controls programme schedule with AA.

2 Gap analysis in lab engagement **B**

This paper had been requested following previous discussion of varying levels of engagement across different lab locations. It provided figures and analysis, based on distribution of awards teams and energy coordinators, to help identify areas where engagement was lacking. Widespread engagement was important for six of SLSG's seven outcome objectives.

Analysis showed 43 lab buildings (defined in Appendix 1), 26 of which had an energy coordinator (60% coverage). One aim of the Group was to have a lab-based energy coordinator in each building, and further work was needed to identify where these coordinators were based. 14 buildings participated in the Awards (33% coverage), though not all teams covered whole buildings.

The table showed areas where further action was required. Buildings highlighted in red had no energy coordinator and no awards team. Those is orange had one of the two. Next steps included further data gathering to identify lab-based energy coordinators, identifying key contacts, arranging meetings and agreeing future activities.

Action – All members with contacts in targeted areas to help promote participation.

Members felt the paper provided a helpful baseline, and that lab engagement was progressing well overall, though the School of Engineering should be targeted for closer working on lab sustainability.

Action – MB to follow up with Engineering on Energy Coordinators.

Action – AA to include building numbers to help with inclusion of energy data.

SLSG noted that Engineering labs in Sanderson, AGB and William Rankine were under the same lab manager and should not be considered separately. Their situation was more complex than for Schools with more consolidated building stock.

3 Freezer replacement fund review **C**

Uptake was currently low and the intention was to reduce the fund, but an initial check with the Group was needed to ensure that the criteria were not excessively tight. Members noted that nearly all freezers available now were A-rated, and that funding would need to be nearer to 100% of costs to motivate replacement. It may be better to approach this as a one-off campaign, if the financial and carbon savings stacked up. Estimated energy cost savings should be substantial.

SLSG agreed to reduce the fund to £10K and explore launching a wider replacement campaign, following assessment of cost to carbon saving, and future compliance and maintenance issues.

4 SLSG Programme Plan progress update **D**

The SRS Project Coordinator – Labs reported on progress against the agreed 3 Year Programme Plan. The Gantt chart on p.25 showed timelines for all actions, with those not due for completion in grey. There were none at red status, and only three at amber. There had been no action as yet on sharing good management processes. This would be in a better position once the equipment flowchart had been finalised.

Engaging with lab users on development of lab design guidelines was slightly delayed. The labs section was relatively complete, but the overall Estates guidelines project - updating T46 Sustainability Strategy and applying it retrospectively to the Usher Institute project - was at amber, looking at completion in Q4 of 2017/18. The final version would come to the Group once available.

Action – AA to resend the labs section to the Group.

Recruitment of paid interns to carry out freezer audits over the summer was delayed. This project was on a larger scale than expected, with it taking two interns a week to audit one freezer. Plans would be broken down to focus on key labs and freezers. If the interns were recruited through internal University systems, the role would need to be enhanced to include a broader portfolio of tasks and responsibilities, providing a more valuable experience for the intern.

Action – AA to put together a proposal to share with the Group.

5 Sustainable Lab Ventilation Policy consultation update

The policy, which was broadly supported, was still going through consultations, and would come back to the Group for review before going on to Health & Safety Committee and Estates Management Group.

6 Sustainable Cold Storage consultation update

The guidelines were still out for consultation, but had met with widespread support, with a few details still to be tweaked. The Project Coordinator – Labs would bring it back to the Group in due course.

7 Lab contributions to Sustainable Campus Fund projects

The Head of SRS Programmes updated SLSG on the fund, approved by Estates Committee nearly two years ago as an internal investment vehicle for sustainability projects generating cost and carbon savings. 44 lab-related projects had been approved and allocated financing, including fume cupboard replacements, helium recovery, lighting, equipment and micro-projects. The labs element represented 45% of funding allocated (approx. £413K), over 50% of annual cost savings, and over 60% of annual carbon savings.

The Scottish Funding Council had committed additional financing, particularly for solar projects. Financing through the campus fund was still available if members were aware of any further opportunities. A request had been made for additional funding to help identify opportunities. There was one potential project looking at ventilation at Joseph Black, arising from recommendations in the KJ Tait report, offering savings of £160K p.a. The proposal would be circulated to the Group for review before going on to the Utilities Working Group.

Action – YH to pass on to AA details of potential savings in the waste space from Engineering projects.

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

This item was carried forward to the next meeting on 21st May.

Action – CM to follow up with AK on progress.

9 Polystyrene waste avoidance

The Roslin Procurement Manager updated members on progress. The key was avoiding polystyrene coming on site in the first place. 25% of landfill volume was polystyrene waste. Using SciQuest to consolidate orders had been extended campus-wide. The Campus Facilities and Services Manager was looking into the energy implications of polystyrene chippers, to reduce the overall volume. Some suppliers offered mail-back programmes. Discussions were ongoing with a void fill company based in Penicuik to take Roslin's polystyrene waste. A supplier conference was planned for this year to discuss sustainability issues with key users. The Sustainable Public Procurement Prioritisation Tool (SPPPT) for labs would be redone this summer, offering a further opportunity to look at packaging. Work was ongoing with Sharon Hannah at Little France to introduce the order consolidation process.

Action – MB to follow up with BM on a possible case study around engaging with suppliers to reduce polystyrene packaging.

This discussion was felt to be timely as UoE's Waste Policy was currently being reviewed, and there was increased awareness and interest in plastic waste. The Group would think further about how to usefully contribute, as well as assessing the environmental and energy impact of alternatives.

10 Sustainability Awards Ceremony

This year's event would be held on 29th March, with lunch from 12.30pm, the ceremony running 1-3pm, and workshops being held for an hour afterwards. All were welcome to attend.

11 Technician Commitment

SLSG noted that Val Gordon had been seconded for 10 hours a week to work with HR to develop a plan to achieve the requirements of the four strands of the Commitment. Val was working with the Technicians Support Steering Group and IAD to develop and submit a plan for Year 1 by September, as well as another covering Years 2 & 3. UoE was to set its own goals and self-report. The aim was to set sensible, achievable, impactful goals. A first draft had been developed and would be reviewed by the Technicians Group this week.

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B

Sustainable Laboratories Steering Group

21st May 2018

Results of freezer survey

Description of paper
This paper provides the results of a recent survey to attempt to identify the number of Ultra Low Temperature (ULT) freezers across the University of Edinburgh estate.

Action requested
SLSG are asked to review and acknowledge the results of this survey.

Recommendation
A comparable follow up survey should be undertaken every 2 years to ascertain any change to the freezer population.

Background and context
ULT freezers are vital for a variety of scientific disciplines as they can store materials at temperatures between -50 and -86°C. However they also consume a substantial amount of energy to do so, with typical annual energy costs per freezer ranging from c.£500 for a new efficient model in a well ventilated space, to £1,000 for an older model or one operating in a poorly ventilated space. They have a knock-on effect on building heat gain and cooling loads too. Thus it is important that the University of Edinburgh has a reasonably good understanding of how many ULT freezers are operating on its estate, and to use this baseline to ascertain whether the number of freezers is changing significantly over time (with associated impact on energy, cost and carbon).

Discussion
The results of the survey are below:

Location	**Number of ULT freezers**
University of Edinburgh TOTAL	**587**
WGH TOTAL	**82**
IGMM North	32
IGMM South	17
IGMM West	18
JHB Lab	7
Wellcome Trust CRF	8
Little France TOTAL	**198**
SCRM	30
Chancellor’s	41
QMRI	127

Easter Bush TOTAL	**175**
Block F	10
Roslin Institute	100
Other areas combined	65
Central TOTAL	**28**
1 George Square	4
Hugh Robson Building	24
KB TOTAL	**104**
JCMB	8
Joseph Black	7
Swann	34
Ashworth	20
Waddington	6
Rutherford	12
Roger Land Building	14
Peter Wilson Building	1
Alrick Building	1
John Murray Building	1

Resource implications
Assuming an average annual energy cost of £650 per ULT, the University of Edinburgh's fleet of 587 ULT freezers will have combined energy costs of over £380,000 annually. This energy consumption results in over 1,460 tonnes of CO_2e annually. Additional energy is consumed via the heat expelled from freezers adding to the cooling load of buildings.

A biannual survey, such as was conducted in March and April 2018 to gather this baseline data, takes around 1-2days of staff time in total.

Risk Management
There is a risk of rising energy costs and carbon emissions if the fleet of ULT freezers increases. Understanding the distribution of ULT freezers across the University of Edinburgh can help to inform strategic decisions around cold storage.

Equality & Diversity
No impacts are anticipated.

Next steps/implications
It is recommended that the survey be repeated every 2 years and trends in the data analysed to inform strategic approaches to cold storage.

Consultation
This was completed in cooperation with local facility managers, lab managers and other colleagues with responsibility for or knowledge of freezers across the University of Edinburgh.

Further information

Author and Presenter
Andrew Arnott
Department of Social Responsibility and Sustainability

Freedom of Information

This is an open paper.

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C

Sustainable Labs Steering Group

21st May 2018

SLSG Programme Plan update (March – May 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.

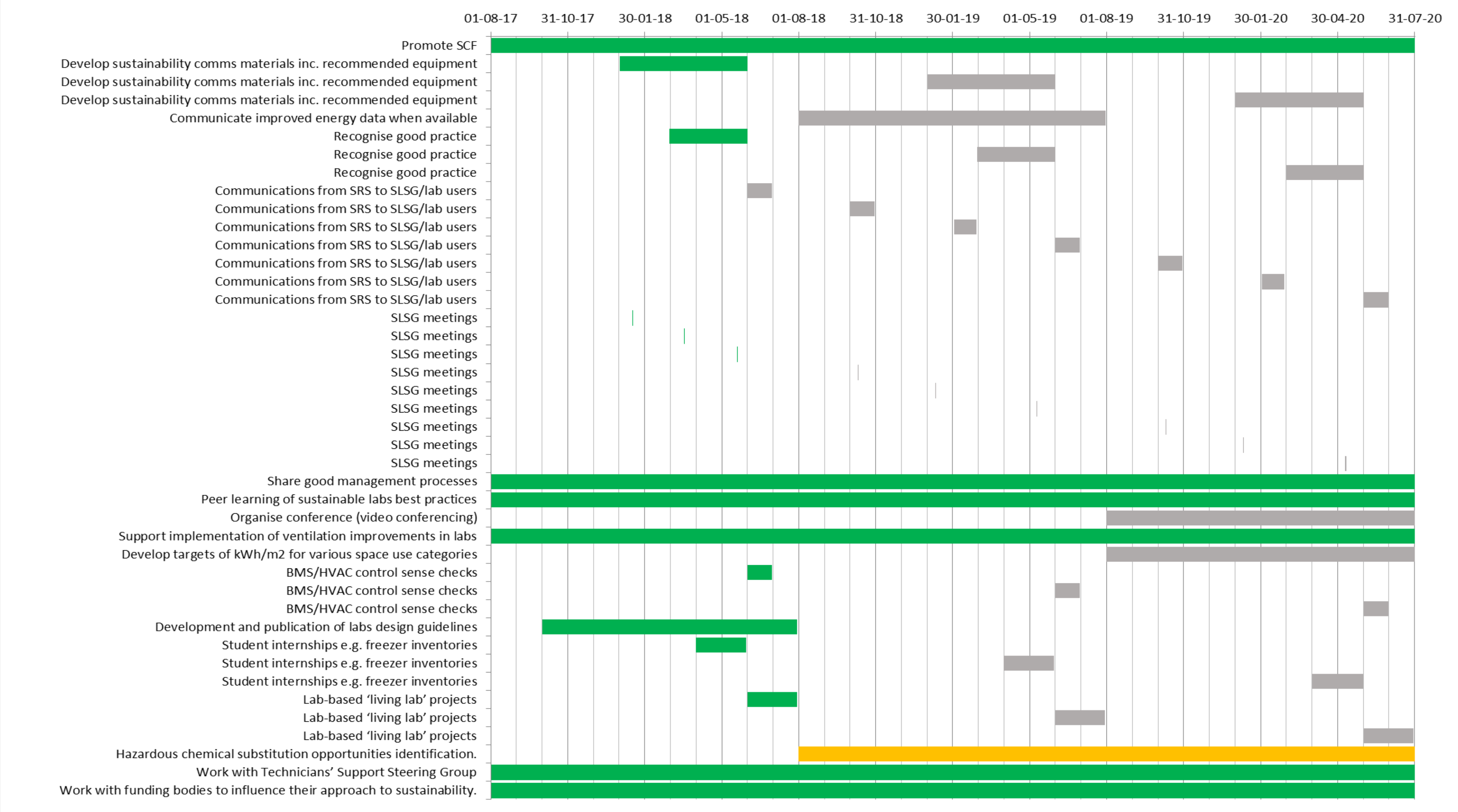
Background and context

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

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 • Close to 50% 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: • Work to develop policies/guidance around ventilation and cold storage will feed into this project, and • Work to determine 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 available) – e.g.	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 Roger Land) the energy data has been a useful communication and engagement tool.	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
communicating the data, setting targets				
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	• Awards ceremony held 29th March • 14 Buildings have lab awards teams (although not all teams cover a whole building) equating to around 33% 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 informal mailing lists	
SLSG meetings (strategic direction, project support and progress reporting)		• SLSG members	• Suitable scheduling of meetings is taking place	
Share good management processes – e.g. equipment sharing	2. Lab equipment reuse and sharing increased	• Lab Users	• No specific promotion of this has taken place yet • Future promotion should incorporate the guidance on cold storage good practice and equipment re-sale/re-use which hopefully will be approved for publication soon	
Peer learning of sustainable labs best practices (via	1. 10% reduction in energy consumption.	• Lab Users	• Awards audits have taken place with peer auditors	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
awards, workshops, campus meetings) – including recruitment of awards teams and energy coordinators.	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.		• Awards ceremony held 29th March • 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 • 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. • 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) • Feasibility work assessed Wind Responsive Ventilation –reported in March 2018. Proposal is £1m cost and 8 year payback. Current thoughts are to split into phases to reduce disruption. • Policy Statements and guidance notes are being developed	
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	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
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	• Plans in place to trial a draft of the Edinburgh Standard on the Easter Bush Centre Building, developing an alternative design and modelling the impacts. Due to commence May/June 2018	

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	• Job advertised 30th April • Interviews 29th May • Start date 4th June for 8 weeks	
Support lab-based 'living lab' sustainability	1. 10% reduction in energy consumption.	• Lab Users • Estates	• Scheduled for action each summer 2018, 2019 and 2020. • Discussions have started around DNA storage	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
projects (DNA, lighting, freezers)	2. Lab equipment reuse and sharing increased 3. Reduced consumption of materials, especially hazardous materials.		• Long-term cold storage project (-60, -70 and -80) is ongoing (expected publication 2020) • Energy efficient equipment replacements (SCF) are being monitored • An intern is being recruited to support improvements in freezer and sample management summer 2018 • 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	• Originally Scheduled for action commencing in 2018-19, and continuing in 2019-20. o Suggest changing to Q2 2018-2019 to align with Andrew Arnott's parental leave.	

Technical Staff

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
Work with Technicians' Support Steering Group to improve CPD, career development and community	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	

Activity	Associated Outcome	Colleagues supporting	Comments	RAG
cohesion of technical staff.				

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
Michelle Brown – Head of Programmes - Department for Social Responsibility and Sustainability

Chris Litwiniuk – Engagement Manager - Department for Social Responsibility and Sustainability

Further information
Author and Presenter
Andrew Arnott
SRS
May 2018

Freedom of Information
This is an open paper.

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D

Laboratory Ventilation Policy

Purpose	1. The purpose of this policy is: 1.1. To enable energy, cost and carbon savings while maintaining or improving safety and compliance within University of Edinburgh laboratories 1.2. To standardise good practice in the design and operation of the various ventilation systems within University of Edinburgh laboratories.
Overview	2. Lab ventilation is highly energy intensive due to the expulsion of heated or cooled air from the building, requiring fresh 'make-up' air to be heated or cooled as it enters the building. Air change rates for rooms, and flow rates for localised extract ventilation (e.g. fume cupboards, downdraught tables, biological safety cabinets, extract snorkels, etc.) are a major determinant of lab energy consumption, and should be set based on evidence. Safety of occupants must be prioritised, but should be achieved with the lowest energy consumption possible. 3. This policy seeks to ensure provision of adequate, flexible and safe ventilation, including avoiding operating ventilation systems at a fixed rate which is designed to cope with a 'worst-case-scenario' chemical spill all the time. This is an inappropriately crude approach to the issue of safe and sustainable ventilation, and results in unnecessary consumption of energy and resources.
Scope	4. For the purposes of this policy, the term "laboratory" refers to "wet labs" but could also include clinical areas. The following areas are considered within this policy: 4.1. The frequency of air changes per hour (ACH) generated by air handling systems supplying air to laboratory rooms, and how to reach a safe and comfortable minimum ACH. 4.2. The speed (face velocity in m/s) and therefore also volume of air being drawn through fume cupboards, and how to reach a safe minimum face velocity. 4.3. The frequency of air changes per hour (ACH) generated by air handling systems supplying air to animal housing facility rooms, and how to reach a safe and compliant minimum ACH. 4.4. The use of individually ventilated cages in animal housing facilities, and how this interacts with room ventilation systems. 4.5. The speed (and control thereof) of fume cupboard exhaust air as it exits the exhaust stacks.
The Policy	5. The overarching principles of the policy aim to reduce the 'consumption' of heated or treated air within University of Edinburgh science buildings, and associated energy, carbon and cost implications, whilst in no way compromising safety and health.

6. Appropriate ventilation shall be provided for each scenario across the University of Edinburgh in order to deliver appropriate conditions for the safety and comfort of occupants and effective operation of equipment.
7. An evidence-based approach should be used to ensure ventilation rates should be set as to the lowest safe level (for both general lab room ventilation and fume cupboard ventilation).
   7.1. With appropriately designed sills fume cupboards can often operate safely at 0.35m/s face velocity. Higher face velocities may be required for highly hazardous materials such as radio-isotopes. Face velocities should be checked annually and must be within ±10% of the commissioning velocity.
   7.2. In a non-responsive system general lab ventilation should set-back to 4 air changes per hour (ACH) outside of working hours and should aim for as low as possible to achieve safety during working hours. Numerous labs[1] have adopted 6ACH when occupied, others 8ACH. Evidence of need should be provided if a lab is to be ventilated at a rate exceeding 12ACH.
   7.3. All tasks undertaken in a lab should be risk assessed (details provided in supporting Lab Ventilation Guidance). This will determine the level of ventilation and control measures such as fume cupboards required to ensure tasks are undertaken safely.
      7.3.1. Guidance on risk assessments is available on the Health and Safety website at https://www.ed.ac.uk/health-safety/online-resources/risk-assessments.
      7.3.2. All risk assessments should be undertaken by 'competent persons' – more details on this is given in the University Health and Safety Policy, Framework: Arrangements Section 18 Risk Assessments, http://www.docs.csg.ed.ac.uk/Safety/Policy/Framework_-_Arrangements.pdf
      7.3.3. Current risk assessments will need to be reviewed in light of the use of lower velocity fume cupboards.
      7.3.4. Particular focus needs to be given to the appropriate control measures for higher risk activates to ensure safety is not compromised.
8. Where suitable, control equipment should be installed to vary the ventilation rate in response to varying requirements. Supply air should be controlled to modulate in line with varying extract air rates. Examples include;
   8.1. VAV fume cupboards with automated sash closers
   8.2. Demand controlled room ventilation systems (e.g. Aircuity)
   8.3. Wind responsive fume exhaust (via stacks)
9. Within animal laboratory and holding facilities the volume of highly conditioned air required (i.e. tightly controlled for temperature and humidity), should be minimised.

[1] E.g. Harvard, Stanford, Cornell

	9.1. E.g. through technology such as individually ventilated cages where this is compatible with the practices of the facility users/demands of science. 10. Where a relative difference in air pressure with neighbouring spaces is required air pressures should be monitored and maintained at the design pressure by a Building Management System, and checked every 3 years and/or whenever any structural or procedural changes have occurred within the area to ensure the pressure is ±10%[2] of the design pressure.

Date approved	
Approving authority	
Consultation undertaken	Health and Safety Manager for each School Sustainable Laboratories Steering Group (January and May 2018) Assistant Director of Estates and Head of Estates Operations Occupational Hygiene and Projects Manager – Health and Safety Director – Health and Safety Health and Safety Officer - Central Bioresearch Services Deputy Director - Central Bioresearch Services Departmental Operations Manager – Central Bioresearch Services Chief Technical Officer - Central Bioresearch Services School Facility Unit Officer – Central Bioresearch Services Zebrafish Unit Manager – Central Bioresearch Services CBS/IGMM Operations Manager - Central Bioresearch Services Director – Veterinary Scientific Services
Impact assessment	
Date of commencement	
Amendment dates	
Date for next review	TBC – 12 months after commencement
Section responsible for policy maintenance and review	Health and Safety, Estates, SRS With additional input sought from lab users.
Related Policies, Procedures, Guidelines & Regulations	• University of Edinburgh Estates Mechanical Engineering Guidelines • University of Edinburgh Climate Strategy “Zero by 2040” • Health and Safety at Work Act 1974 • Control of Substances Hazardous to Health Regulations 2002 • Provision & Use of Work Equipment Regulations 1998 • Electricity at Work Regulations 1989 • BS 7258, Parts 1, 2, 3 and 4 – which apply to fume cupboards installed in the work place prior to 2004, and

[2] (Jan 2018: this is currently being queried with a lab ventilation contractor to ascertain if this is suitable or not)

	• BS EN 14175, Parts 1, 2, 3, 4, 5 and 6 for fume cupboards installed from 2004 • Maintenance, Testing and Examination of Local Exhaust Ventilation, HSG37, 1993. HSE publication. • Controlling Airborne Contaminants at Work, HSG258. 2011. HSE publication. Clearing the Air, INDG408, 2011. HSE Publication. • Control of Animal Allergens, EH76, 2011. HSE publication • Animals (Scientific Procedures) Act 1986
Policies superseded by this Policy	

Appendix:

Laboratory Ventilation Policy Guidance

1. Introduction

This Laboratory Ventilation Policy Guidance has been produced in order to provide guidance on **how** to implement the Laboratory Ventilation Policy and sources of supporting information regarding best practice. This Guidance supplements the Laboratory Ventilation Policy adopted by the University of Edinburgh in [insert date]. Both the Laboratory Ventilation Policy and the Guidance document are available on the University of Edinburgh website [insert link].

2. Background

The University of Edinburgh has stated its commitment to reduce carbon emissions resulting from its operations in the Climate Strategy, with a target of becoming zero-carbon by 2040. To achieve this target all areas of the University of Edinburgh will need to look for ways to reduce their energy consumption and associated carbon emissions.

Lab ventilation is highly energy intensive due to the expulsion of heated or cooled air from the building, requiring fresh 'make-up' air to be heated or cooled as it enters the building. Air change rates for rooms, and flow rates for localised extract ventilation (e.g. fume cupboards) are a major determinant of lab energy consumption, and should be set based on evidence. Safety of occupants must be prioritised, but should be achieved with the lowest energy consumption possible.

Currently some University of Edinburgh ventilation systems operate at a fixed rate which is designed to cope with a 'worst-case-scenario' chemical spill all the time. This is an inappropriately crude approach to the issue of safe and sustainable ventilation, and results in unnecessary consumption of energy and resources.

The introduction and adoption of the Laboratory Ventilation Policy will assist in reducing energy, cost and carbon emissions while maintaining or improving safety and compliance within University of Edinburgh laboratories. It will also serve to standardise good practice in the design and operation of the various ventilation systems within University of Edinburgh laboratories.

3. Legislative Framework

The key pieces of legislation related to this policy area are listed below:

- Health and Safety at Work Act 1974
- Control of Substances Hazardous to Health Regulations 2002
- Provision & Use of Work Equipment Regulations 1998
- Electricity at Work Regulations 1989
- BS 7258, Parts 1, 2, 3 and 4 – which apply to fume cupboards installed in the work place prior to 2004, and

- BS EN 14175, Parts 1, 2, 3, 4, 5 and 6 for fume cupboards installed from 2004
- Animals (Scientific Procedures) Act 1986

4. Targets

In implementing this Policy, the following targets are proposed:

- All new fume cupboards should be 'low flow' (c. 0.35m/s face velocity) unless site or activity specific circumstances require otherwise (e.g. radio-isotopes)
- All new fume cupboards should be VAV controlled and fitted with absence detection sensors connected to auto-sash closers
- Annual fume cupboard testing to ensure face velocities are ±10% of design
- All lab ventilation either be fitted with responsive controls or be risk assessed, and the ACH adjusted accordingly, including opportunities for night set-back
- All new animal facilities consider options for IVCs, and where IVCs are installed the general room ventilation be adjusted accordingly
- Three-yearly checks of lab air pressure differentials to ensure ±10% of design
- Where appropriate wind responsive controls should be fitted to exhaust stacks
- Where 24/7 ventilated storage is required this should be provided on a separate system from the fume cupboards, to allow fume cupboards to be switched off when no activity is taking place.

University of Edinburgh Climate Strategy

- Reduce emissions of carbon per £million turnover by 50% from a 2007/8 baseline year by 2025
- Return our carbon emissions to 2007/8 baseline year levels by 2025
- Become net zero carbon by 2040

5. Policy Objectives

Appropriate ventilation shall be provided for each scenario across the University of Edinburgh in order to deliver appropriate conditions for the safety and comfort of occupants and effective operation of equipment.

An evidence-based approach should be used to ensure ventilation rates should be set as to the lowest safe level (for both general lab room ventilation and fume cupboard ventilation).

5.1. Fume Cupboards

5.1.1. Purchasing preference should be for new and replacement fume cupboards to be "low flow" fume cupboards with appropriately designed sills which can operate safely at 0.35m/s face velocity.

5.1.2. Higher face velocities may be required for highly hazardous materials such as radio-isotopes.

5.1.3. Face velocities should be checked annually and must be within ±10% of the commissioning velocity.

5.1.4. Fume cupboards should be fitted with VAV controls and automated sash closers

5.1.5. Where technically and financially feasible exhaust stacks should be fitted with wind responsive controls to modulate e-flux velocity in line with measured wind speed.

5.1.6. Where 24/7 ventilated storage is required this should be provided on a separate system from the fume cupboards, to allow fume cupboards to be switched off when no activity is taking place.

5.2. General Lab Room Ventilation

5.2.1. Where suitable, demand responsive control equipment should be installed to vary the general room ventilation rate in response to changing ventilation requirements. Supply air should be controlled to modulate in line with varying extract air rates.

5.2.2. In a non-responsive system all tasks undertaken in a lab should be risk assessed. This will determine the level of ventilation and control measures such as fume cupboards required to ensure tasks are undertaken safely.

5.2.2.1. Guidance on risk assessments is available on the Health and Safety website at https://www.ed.ac.uk/health-safety/online-resources/risk-assessments.

5.2.2.2. All risk assessments should be undertaken by 'competent persons' – more details on this is given in the University Health and Safety Policy, Framework: Arrangements Section 18 Risk Assessments, http://www.docs.csg.ed.ac.uk/Safety/Policy/Framework_-_Arrangements.pdf

5.2.2.3. It is recommended that risk assessments should be undertaken by collaborative work between the lab user and their local/school health and safety advisor/manager.

5.2.2.4. Current risk assessments will need to be reviewed in light of the use of lower velocity fume cupboards.

5.2.2.5. Particular focus needs to be given to the appropriate control measures for higher risk activates to ensure safety is not compromised.

5.2.3. In a non-responsive system general lab ventilation should set-back to 4 air changes per hour (ACH) outside of working hours and should aim for as low as possible to achieve safety during working hours.

5.2.4. In a non-responsive system 6-8ACH should be targeted during occupied periods

5.2.5. Evidence of need should be provided if a lab is to be ventilated at a rate exceeding 12ACH.

5.3. Within animal laboratory and holding facilities the volume of highly conditioned air required (i.e. tightly controlled for temperature and humidity), should be minimised.

5.3.1. E.g. through technology such as individually ventilated cages where this is compatible with the practices of the facility users/demands of science.

5.4. Where a relative difference in air pressure with neighbouring spaces is required air pressures should be monitored and maintained at the design pressure by a Building Management System, and checked every 3 years and/or whenever any structural or procedural changes have occurred within the area to ensure the pressure is ±10%[3] of the design pressure.

[3] (Jan 2018: this is currently being queried with a lab ventilation contractor to ascertain if this is suitable or not)

Appendix A – Reference Documents and Information Resources

Legislation

- Health and Safety at Work Act 1974
- Control of Substances Hazardous to Health Regulations 2002
- Provision & Use of Work Equipment Regulations 1998Electricity at Work Regulations 1989
- BS 7258, Parts 1, 2, 3 and 4 – which apply to fume cupboards installed in the work place prior to 2004, and
- BS EN 14175, Parts 1, 2, 3, 4, 5 and 6 for fume cupboards installed from 2004
- Maintenance, Testing and Examination of Local Exhaust Ventilation, HSG37, 1993. HSE publication.
- Controlling Airborne Contaminants at Work, HSG258. 2011. HSE publication. Clearing the Air, INDG408, 2011. HSE Publication.
- Control of Animal Allergens, EH76, 2011. HSE publication
- Animals (Scientific Procedures) Act 1986

Related University of Edinburgh Policies and Strategies

- University of Edinburgh Estates Engineering Guidelines
- University of Edinburgh Climate Strategy "Zero by 2040"
- University of Edinburgh Health and Safety COP P5CL3
- University of Edinburgh Design Guides (draft)

Websites

- http://www.kcl.ac.uk/governancezone/Estates/Fume-Cupboard-Management-Policy.aspx
- http://studylib.net/doc/7172434/general-fume-cupboard-requirements
- https://www.ehs.washington.edu/fsodesignrev/s3labventilation.pdf
- https://sp.ehs.cornell.edu/lab-research-safety/chemical-safety/lab-ventilation/Documents/LVMP%202017_Gap%20Analyses_1_2017.pdf
- http://www.ucl.ac.uk/medicalschool/msa/safety/docs/fumecupboard.pdf
- http://www.ucl.ac.uk/estates/contractors-and-designers/documents/sustainability/SKA%20Labs%20Template%20v2.xlsx
- https://www.ehs.harvard.edu/sites/ehs.harvard.edu/files/EHS%20Guidelines%20for%20Design%202017_0.pdf
- https://ehs.stanford.edu/manual/laboratory-standard-design-guidelines/general-ventilation-considerations
- http://ehs.yale.edu/sites/default/files/files/laboratory-design-guidelines.pdf
- http://dcm.ucdavis.edu/cdg/documents/2017/iii-construction-divisions/div_11_equipment_15.pdf
- http://www.nerc.ac.uk/about/policy/safety/procedures/guidance-laboratories/
- http://ehs.colorado.edu/wp-content/uploads/2014/11/Fume-Hood-QandA.pdf
- http://www.research.northwestern.edu/ors/forms/chemical-fume-hood-handbook.pdf
- http://www.forensic-applications.com/hoods/face.html#2

- http://www.escoglobal.com/resources/pdf/guide-fumehoods.pdf
- http://ateam.lbl.gov/PUBS/cec/Appendix/doc/EE_FumeHoods.pdf
- http://www.waldner-inc.com/portals/11/secuflow-usa_2014.pdf
- https://www.aiha.org/aihce07/handouts/po110smith.pdf
- https://sp.ehs.cornell.edu/lab-research-safety/chemical-safety/lab-ventilation/Documents/LVMP%202017_Gap%20Analyses_1_2017.pdf
- https://cds.fs.cornell.edu/file/230540_Laboratories.pdf
- https://acsdchas.files.wordpress.com/2015/06/a-strategy-with-lab-ventilation-management-to-enhance-sustainability.pdf
- https://www.ehs.harvard.edu/sites/ehs.harvard.edu/files/EHS%20Guidelines%20for%20Design%202017_0.pdf
- http://www.nerc.ac.uk/about/policy/safety/procedures/guidance-laboratories/
- http://www.inive.org/members_area/medias/pdf/Inive%5Cclima2007%5CA09%5CA09F1245.pdf
- https://engineering.purdue.edu/~yanchen/paper/2012-7.pdf
- http://www.egnaton.com/LinkClick.aspx?fileticket=vnKIU2JGm30%3D&tabid=80
- http://www.sciencedirect.com/science/article/pii/S1871553209000024

Journals

- ASHRAE Report Number 2438 RP 70, K.J. Caplan and G.W. Knutson, 1978
- Bell, G. and Dale Sartor, “ASHRAE 110 Tracer Gas Containment Report-SDSU: Berkeley hood; Labconco Prototype, Alpha VersionRev. 2.” Lawrence Berkeley National Laboratory Report LBID-2456
- Jin, M. et al, “Experimental study of ventilation performance in laboratories with chemical spills” Building and Environment, Volume 57, November 2012, Pages 327–335,
- Memarzadeh, F., “Effect of reducing ventilation rate on indoor air quality and energy cost in laboratories” Journal of Chemical Health and Safety, Volume 16, Issue 5, September–October 2009, Pages 20–26
- Klein, R.C. et al. “Laboratory air quality and room ventilation rates,” Journal of Chemical Health and Safety (2009)

Design Guides

- Sustainable Design of Research Laboratories: Planning, Design, and Operation By Kling Stubbins, 2011, p135
- Crane, J.T. "Biological laboratory ventilation and architectural and mechanical implications of biological safety cabinet selection, location, and venting." ASHRAE Transactions: 1994, Vol.100, Part 1.
- ACGIH (American Conference of Governmental Industrial Hygienists) Industrial Ventilation Handbook
- https://www.wbdg.org/building-types/research-facilities/animal-research-facility

Appendix B – Lis of Abbreviations of Common Laboratory Ventilation Related Terms

ACH	Air Changes per Hour
BSC	Biological Safety Cabinet (see MSC)
CAV /CV	Constant (Air) Volume
DBV / DCV / DRV	Demand Based Ventilation / Demand Controlled Ventilation / Demand Responsive Ventilation
FC	Fume Cupboard/Fume Cabinet
LEV	Localised Extract Ventilation
MSC	Microbiological Safety Cabinet (see BSC)
VAV	Variable Air Volume

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Cold Storage Facility Policy

Purpose	The purpose of this policy is: • To enable energy, cost and carbon savings while maintaining or improving sample safety, security and integrity within University of Edinburgh facilities housing cold storage (i.e. ULT freezers). • To standardise good practice in the design and operation of cold storage facilities at University of Edinburgh.
Overview	ULT freezers expel a lot of heat and, as such, the rooms in which they are held can heat up very quickly if not well ventilated. As the room becomes hotter the strain on the ULT freezers' compressors increases, which increases energy consumption and the likelihood of failure (risking potentially irreplaceable biological samples). Currently some freezers are located in facilities which have poor natural ventilation, resulting in excessive energy requirements to maintain the appropriate room temperature with fans and air conditioning, and excessive strain and energy consumption of the ULT freezers. The design of facilities to house scientific cold storage equipment can be a major influence on the energy consumption of that equipment and also the energy consumption of building ventilation and cooling services. A well-designed facility will provide more favourable ambient conditions and put less strain upon the components of individual ULTs, reducing risk of failure and associated risk of damage to samples and other freezer contents. Facilities with good natural ventilation, such as the facility at the Roslin Institute, maintain lower room temperatures with very low fan and air conditioning energy consumption. This has a positive compounding effect of lower ULT freezer energy consumption and reduced strain on the compressors, reducing the risk of failure and sample losses.
Scope	For the purposes of this policy, the term "ULT freezer" refers to specialist laboratory Ultra Low Temperature freezers designed to operate at temperatures between -50 and -90^{0}C. Commonly ULT freezers are held at a set point temperature of -80^{0}C, leading to them also being known as "minus eighties". ULT freezer facilities are deemed to be spaces specifically used to house multiple ULT freezers as the primary purpose of the space. Typically numbers of freezers in these spaces is over 10, but can reach over 100. The following areas are considered within this policy: • The air handling mechanisms for maintaining appropriate room temperatures in ULT freezer facilities[1]
The Policy	The overarching principles of the policy aim to maximise the free cooling available from natural ventilation and reduce the energy

[1] Other areas relating to freezer and sample management will be covered in the best practice guide

	consumption of fans and air conditioning in ULT freezer facilities and associated energy, carbon and cost implications. • Natural ventilation should be maximised by fitting substantial controllable openings/grilles/louvers to opposing external walls. When fitted to opposing (rather than adjacent) walls the cold external air can easily enter via one wall, travel through the facility gathering heat, and exit via the opposite wall. • The prevailing wind direction is south westerly so new buildings should maximise their natural ventilation cooling functionality by having the opposing ventilated walls of the freezer facility orientated south west – north east (however, west – east or south – north would also suffice in most scenarios – local wind modelling may be appropriate in highly built-up areas). • To maximise wind speeds available for natural ventilation freezer facilities should be located in as high a location as possible – ideally in a roof-top location, with large lift access to allow easy movement of new/old freezers as well as personnel and samples. • The ambient room temperature should be measured at a suitable number of positions within the room, feeding into the Building Management System (BMS). This should be arranged with the Controls Team within the Energy Office. • The natural ventilation should be designed with 3 escalating functions which should be controlled by Building Management Systems: 1. In cool weather the louvers in the walls should be open to allow cool outside air to flow through the facility 2. In warm weather the louvers should remain open but the air speed should be artificially increased through the use of fans (fans should be fitted to the same walls as the louvers and should move air in the direction of the prevailing wind (i.e. south west to north east, or west to east, or south to north). 3. In hot weather the louvers in the walls should be closed to create a good thermal and draught-proof seal and air conditioning units should be switched on within the facility to control air temperatures. • Temperature sensor(s) should be installed for monitoring and alarm purposes. Careful consideration should be given to the sensor location(s) • Alternative designs which also maximise natural free cooling through other methods may also be acceptable (including, but not limited to: agricultural shed designs, external compressor system, or thermal labyrinth cooling). • It is recognised that retrofitting these design principles into existing freezer facilities may require alternative designs (such as open windows with security grilles fitted if required).

	• All designs should demonstrate that they have prioritised free cooling/avoidance of heat build-up first, then forced air (fans), then air conditioning as a last resort. • A suitable route must be in place between the site of possible freezer deliveries, and the freezer room location. This route should ensure that lifts/elevators have sufficient size and lifting capacity, and each door encountered along the route (including in lifts/elevators) has sufficiently large dimensions to allow for the passage of freezers. • Walls and floors/ceilings between the freezer room and adjoining spaces within the building should be insulated and draught proofed to the same standards as if they were external walls, in order to accommodate the potential temperatures within the freezer room matching outdoor air temperatures on cold windy days.

Date approved	
Approving authority	
Consultation undertaken	Sustainable Labs Steering Group members (January to May 2018) - Including representatives from Medical School, Veterinary School and Roslin Institute, School of Biological Sciences, Estates Development, Estates Operations, SRS, Procurement, Health and Safety Technical Manager, QMRI Health and Safety Manager, Little France Campus Buildings Manager, Little France Campus Centre Technical Manager, SCRM Technical Officer, Chemistry CIP Centre Manager Technical Services Manager, Chemistry
Impact assessment	TBC
Date of commencement	
Amendment dates	
Date for next review	This policy will be reviewed every two years by university-wide stakeholders including SRS, Estates and lab users to ensure it continues to meet the needs of our lab-based community and university-wide stakeholders.
Section responsible for policy maintenance and review	Estates (Estates Development), SRS With additional input sought from lab users.

Related Policies, Procedures, Guidelines & Regulations	• University of Edinburgh Estates Mechanical Engineering Guidelines • University of Edinburgh Climate Strategy “Zero by 2040” • Health and Safety at Work Act 1974 • Control of Substances Hazardous to Health Regulations 2002 • Provision & Use of Work Equipment Regulations 1998
Policies superseded by this Policy	

Appendix: Cold Storage Best Practice Guide

Cold Storage Best Practice

Executive Summary

This paper summarises the findings of research undertaken by the University of Edinburgh's Department for Social Responsibility and Sustainability into best practice in Ultra Low Temperature (ULT) freezer management. It incorporates international best practice from various research institutions, as well as information gained through lab sustainability and energy efficiency audits across the University of Edinburgh. The term "ULT freezer" refers to specialist laboratory Ultra Low Temperature freezers designed to operate at temperatures between -50 and -90°C. Commonly ULT freezers are held at a set point temperature of -80°C, leading to them also being known as "minus eighties".

This document describes a number of actions and the potential savings, including:

Replace old freezers (up to £400/year saving per freezer)

Regular defrosting and maintenance of freezers (around £200/year saving per freezer)

Save space by clearing out old samples (save up to £1,000 per year for every ULT freezer you can retire)

Run your freezers a little warmer (up to £300/year saving per freezer changed from -80 to -70°C)

Out with the old, in with new…

The problem:

Older freezers can use as much as £1000 annually in 'plug load' electricity (i.e. not including their impact on room air cooling systems) while new freezers can use less than £600 plug load annually. Investigations at the National Institutes of Health in the United States of America have indicated that for every year of a ULT freezer's life its energy consumption increases by 3%[2].

The solution:

The University of Edinburgh's Sustainable Campus Fund[3] can contribute to the costs of upgrading old freezers.

The Roslin Institute has an ongoing replacement of their oldest ULT freezers, with a requirement that new purchases are energy efficient. This is also an approach being taken by the National Institutes of Health in the USA.

[2] Gumapas & Simons, World Review of Science, Technology and Sustainable Development, Vol 10, No.s 1/2/3, 2013

[3] www.edin.ac/fund

Choked up with ice and dust…

The problem:

Freezers which are not regularly defrosted accumulate frost and ice, reducing internal space (and thus exacerbating the problem of a continual demand for more and more ULT freezers, filling up valuable space in science buildings). In addition to reducing the available space for sample storage, poorly defrosted ULT freezers use more energy to operate as often seals around doors do not operate as effectively. Investigations at the National Institutes of Health in the United States of America have indicated that there is a difference in annual operating costs of the equivalent of around £160 between an ice-free freezer and a severely iced up freezer[4].

Freezers draw air through a filter to cool condenser fins and heat exchange coils, helping the removal of heat from the internal space. If 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. Investigations at the National Institutes of Health in the United States of America have indicated that there is a difference in annual operating costs of the equivalent of around £230 between a freezer with clean filters and fins and a freezer with severely dusty filters and fins[5].

The Solution:

Other than staff time and a little planning, freezer defrosting and cleaning filters and fins requires no additional resources.

Site visits and auditing for the Edinburgh Sustainability Awards indicated that most of the labs involved outsource mechanical maintenance of freezers. Lab groups should check which actions are included in their maintenance contracts to ensure filters, fins and heat exchange coils are cleaned. If not, the lab personnel should include this in their own regular maintenance work.

The awards audits also showed that good defrosting practices were in place at The Roslin Institute, the Biology Teaching Organisation, the Wellcome Trust Clinical Research Facility, SynthSys labs, and the Institute of Genetic and Molecular Medicine. Typically these labs undertake regular and planned defrosting schedules, and/or audits from senior lab staff.

[4] Gumapas & Simons, World Review of Science, Technology and Sustainable Development, Vol 10, No.s 1/2/3, 2013
[5] Ibid.

Best use of valuable space…

The problem:

ULT freezers are expensive to purchase and have high operational costs due to their plug-load and air conditioning energy consumptions. However the number of ULT freezers across the University of Edinburgh is growing, adding strain to departmental budgets and diverting money away from other uses.

The solution:

Lab users/lab groups should ensure they only use ULT freezers to store items which absolutely must be stored at these temperatures. There are three factors to consider here:

Firstly, do you need to keep all of those samples?

If you are a lab user who stores samples in ULT freezers you can help to reduce significant departmental costs of purchasing and running ULT freezers by regularly checking the samples you are storing and removing those which are now redundant/no longer needed. ULT freezer storage, of course, does not stop sample degradation - it merely slows it down - so those samples you have been holding onto for years and years may not even be of any scientific use to you if you did decide to use them again.

N.B.: unless there is absolute certainty regarding the contents of sample containers, they should be handled, managed and disposed of with some caution in case they are more hazardous than they seem.

A well maintained database of the freezer contents can also help lab users find their samples quickly and easily rather than searching for a long time with the door open, risking warm air entering and damaging freezer contents and excess energy consumption to draw the temperature down again once the door is closed.

Secondly, do your samples need to be stored in ULT freezers?

There is a growing body of evidence which suggests that some sample types can safely be stored in non-ULT freezers (i.e. at -40^{o}C, -20^{o}C, +4^{o}C or even room temperature)[6] [7] resulting in significant energy savings. Stanford University found that up to 25% of their biological samples (DNA/RNA/bacteria) could be stored at room temperature after a successful trial.[8] The University of Colorado - Boulder and University of California - Davis have developed a freely accessible database of over 200 biological sample types which they are storing at -70^{o}C or warmer [9] with no ill effects. More details on this later in this document. Have a look for yourself!

Typically the suitability of a temperature for sample storage depends on the length of the storage time - if you are storing samples for only a short amount of time it may be safe to store them at a

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[6] Colins et al, (1993), "Storage temperature and differing methods of sample preparation in the measurement of urinary albumin" Diabetologica, vol 36, issue 10, pp 993-997

[7] http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/ulf_freezer_user_guide.pdf (U.S. Dept of Energy "Store Smart" ULT freezer guide)

[8] http://www.goodcampus.org/uploads/DOCS/106-case_10_-_uni_california_final_25_2_11.pdf and http://sustainable.stanford.edu/sites/default/files/documents/Stanford_Room_Temp_Pilot_May09.pdf

[9] https://docs.google.com/spreadsheets/d/13UvBeoXAhwSHshSYoUDHwcxWiW7qYLnUb-eLwxJbCYs/pubhtml

higher temperature. Freeze-thaw cycles may be more important than the storage temperature for degrading samples[10] [11] [12] [13].

If samples are valuable and vulnerable enough to require ULT freezer storage the freezer should also be fitted with additional temperature sensors linked to an alarm system which would alert individuals in the event of rising internal temperatures. Careful consideration should be given to the sensor location(s) to ensure it is representative of the conditions surrounding the samples, and not impacted by localised conditions.

Some collection tubes are designed for room temperature storage such as saliva collection kits from Isohelix or DNA Genotek, used for extracting DNA. This means they can be stored and shipped at room temperature without the need for using dry ice.

Thirdly, are you making best use of storage space?

Efficient use of space in ULT freezers can help to reduce the demand for additional units. Ensuring that your samples are neatly stored in appropriate storage solutions (racks/boxes) for the type and size of material will allow more items to be stored in the existing number of freezers. Where possible try to avoid storing bulky items in freezers if you can divide them up into more easily stored small samples/aliquots. An example might include extracting DNA from tissue and storing only the DNA, rather than a large bulky tissue sample. Storing your samples in racks/boxes can also make them easier to quickly transfer in the event of a freezer failure.

Best practice would be to use high quality steel racking as this makes best use of space and retains cool surface temperatures better. This is better for samples and ensures freezers warm up more slowly when users open the door. When purchasing a new freezer you should budget for spending about the same amount on racking as you do on the freezer.

Good practice has been observed around the University of Edinburgh including:

Hugh Robson Building charge for space in the Hotel Freezer.

BTO consolidate their materials into fewer fridges/freezers over the summer holiday and switch off extraneous ones.

Wellcome Trust Edinburgh Clinical Research Facility have good racking to make best use of space, and control samples using a LIMS (providing Biobank storage for researchers).

IGMM consolidated the contents of c.40 small LN2 storage tanks into 2 large ones saving c.£18k annually in LN2 refill costs.

The mass spectrometry facility at the IGMM have a very good database of their ULT freezer contents.

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[10] http://bitesizebio.com/19700/freeze-thaw-cycles-and-why-we-shouldnt-do-it/

[11] M. S. Charde et al. (2014) "Review: The procurement, storage and quality assurance of frozen blood and tissue biospecimens" International Journal of Pharmacological Research Volume 4 Issue 2 (2014)

[12] Brand, J.J., "Cryopreservation of Cyanobacteria" http://www-cyanosite.bio.purdue.edu/protocols/cryo.html

[13] B. L. Mitchell et al., (2005) “Impact of Freeze-thaw Cycles and Storage Time on Plasma Samples Used in Mass Spectrometry Based Biomarker Discovery Projects”, Cancer Informatics 1(1): 98–104.

SynthSys allocate specific shelves/space in ULT freezers to lab groups.

QMRI biobanking is done on a 'cost recovery' basis.

Chancellors' Building are investigating room temperature storage of DNA.

Space to breathe…

The problem:

ULT freezers operate by removing heat from inside the freezer cabinet and expelling it (usually through heat exchangers at the back of the freezer). In an enclosed space this quickly results in the air temperature of the room rising to temperatures which are uncomfortable for the users and cause the freezer to work harder to maintain a set internal temperature ("Each 1°C drop in ambient temperatures from 32°C lowers the energy consumption for a ULT freezer by approximately 2%"[14]). To counteract this, energy intensive air cooling/mechanical ventilation equipment is installed and operated, adding to the energy consumption of operating freezers.
Some ULTs do not have enough space around them for air to circulate adequately (i.e. they are up against a wall and/or have boxes on top of or around them). This reduces the ability of the freezer to dissipate the heat from inside to outside.

Some labs keep numerous ULT freezers in the lab or in surrounding corridors. Sometimes the air handling and natural ventilation options in these areas are not able to deal effectively with the extra heat gain from the ULT freezers, leading to overly warm spaces which are uncomfortable to work in and also increase the strain on the ULT freezers (increasing energy consumption and wear and tear on components).

Some labs keep ULT freezers adjacent to heat sources such as radiators, drying ovens, incubator shakers, etc. This increases the strain on the ULT freezer, and can also speed up the process of ice accumulation, leading to more work for those responsible for de-icing the unit and a greater threat of freezer failure.

The solution:

Dedicated spaces with abundant natural ventilation have been constructed at the Roslin Institute to house the majority of their ULT freezers. These spaces have large louvered vents and fans which allow external air to be used either passively (fans switched off, air moves with convection and pressure differentials/wind) or actively (fans switched on to drive air through the space) to remove hot air from the freezers. If external air temperature rises above a certain level the louvers are closed and the room cooled with air conditioning. This is currently not required very often in the Edinburgh area but climate change forecasts suggest more frequent warm weather. This design significantly reduces the amount of air conditioning required to keep the air temperature of the freezer space at a level which allows the freezers to operate safely and with low energy consumption. Designs incorporating methods for free cooling and more 'passive' design while incorporating active cooling for when required will be better able to adapt to future climate changes.

[14] Gumapas & Simons, World Review of Science, Technology and Sustainable Development, Vol 10, No.s 1/2/3, 2013

Freezers (especially ULT freezers) should have 15cm space on the back, sides and top. When checked, some freezers will need to be pulled out away from walls in order to achieve this. No objects should be stored on top of the freezer.

Freezers should not be located in large numbers in labs or corridors. One or two in a large lab or corridor may be acceptable, but this is not ideal - locating the freezer in a dedicated facility would have substantial benefits in terms of energy consumption and freezer failure rates.

Where a ULT must be kept within a lab or corridor it should always be located in the coolest point of the room, away from heat sources such as radiators, drying ovens, incubator shakers, etc.

Too Cool…?

The problem:

Fifteen or twenty years ago the lowest temperature achievable by most lab freezers was -70^{o}C. Technology improved and newer freezers were able to achieve temperatures of -86^{o}C. The lower temperature (often -80^{o}C) was then adopted by many lab users/groups as a new standard operating practice. The technological advance which led to freezers achieving lower temperatures came at a price - higher energy consumption in terms of both plug-load and impact on air conditioning loads.

The solution:

There has so far been little evidence produced which shows that operating ULT freezers at -80^{o}C has substantial benefit for lab research, in fact some sources show that a variety of samples are stable at

-70°C[15] [16] [17] [18] [19] [20] [21] [22] [23]. The University of Boulder Colorado and University of California - Davis have developed a database which details a wide variety of samples being stored at -70°C[24]. Some samples will benefit from being stored at -80°C so it is worth checking the literature first, or even doing your own tests. Even if your samples do benefit from being stored at -80°C it is a good idea to run your back-up freezers ("hotel freezers") at -70°C or even -60°C to reduce energy consumption, and then adjust them to -80°C when required. Many freezers around the campus have temperature monitors connected to remote alarms which are activated if the temperature rises above a threshold and alerts a nominated member of staff. This reduces the need to store samples at a lower temperature in order to have a 'buffer' to give more time between a freezer failure and the internal freezer temperature exceeding a threshold temperature.

Running a freezer at -70°C instead of -80°C can produce almost 30% plug-load energy savings[25] equating to **up to £300 annually**, as well as further savings on room air conditioning. A number of lab users around the University are running freezers at -70° including Roslin, IGMM and BTO.

[15] http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/ulf_freezer_user_guide.pdf (U.S. Dept of Energy "Store Smart" ULT freezer guide)
[16] Tedeschi, R. & De Paoli, P; (2011) "Collection and Preservation of Frozen Microorganisms"; Methods in Molecular Biology Volume 675, pp 313-326
[17] Marino, D, (2013) "Best practices for storing biological samples in ULT freezers" http://www.biocompare.com/Bench-Tips/137747-Best-Practices-for-Storing-Biological-Samples-in-ULT-Freezers/
[18] Colins et al, (1993), "Storage temperature and differing methods of sample preparation in the measurement of urinary albumin" Diabetologica, vol 36, issue 10, pp 993-997
[19] De Paoli, P, (2005) "Biobanking in microbiology: From sample collection to epidemiology, diagnosis and research", FEMS Microbiology Reviews 29 897–910 and Reimer, L. and Carroll, K. (2004) Procedures for the storage of microorganisms In: Manual of Clinical Microbiology (Murray, E., Baron, E., Pfaller, M., Tenover, F. and Yolken, R., Eds.), pp. 67–73. ASM Press, Washington, DC
[20] De Paoli, P, (2005) "Biobanking in microbiology: From sample collection to epidemiology, diagnosis and research", FEMS Microbiology Reviews 29 897–910 and Michel, C. and Garcia, C. (2003) Virulence stability in Flavobacterium psychrophilum after storage and preservation according to different procedures. Vet. Res. 34, 127–132.
[21] De Paoli, P, (2005) "Biobanking in microbiology: From sample collection to epidemiology, diagnosis and research", FEMS Microbiology Reviews 29 897–910 and Harbec, P.S. and Turcotte, P. Preservation of Neisseria gonorrhoeae at 20 C. J. Clin. Microbiol. 34, 1143–1146.
[22] De Paoli, P, (2005) "Biobanking in microbiology: From sample collection to epidemiology, diagnosis and research", FEMS Microbiology Reviews 29 897–910 and Sebire, K., McGavin, K., Land, S., Middleton, T. and Birch, C. (1998) "Stability of human immunodeficiency virus RNA in blood specimens as measured by a commercial PCR-based assay". J. Clin. Microbiol. 36, 493–498. And Winters, M.A., Tan, L.B., Katzenstein, D.A. and Merigan, T.C. (1993) "Biological variation and quality control of plasma human immunodeficiency virus type 1 RNA quantitation by reverse transcriptase polymerase chain reaction". J. Clin. Microbiol. 31, 2960–2966.
[23] Mitchell, B.L. et al, (2005) "Impact of Freeze-thaw Cycles and Storage Time on Plasma Samples Used in Mass Spectrometry Based Biomarker Discovery Projects" Cancer Informatics 98–104
[24] https://docs.google.com/spreadsheets/d/13UvBeoXAhwSHshSYoUDHwcxWiW7qYLnUb-eLwxJbCYs/pubhtml
[25] Farley M., et. Al., (2013) "Freezer Energy Consumption Report"

Sharing has benefits for all…

The problem:

Where freezers are individually owned and space is not shared this can lead to scenarios where a large ULT freezer may not be full of useful samples, and may have empty space, but this space is not made available to neighbouring scientists. The neighbouring scientists are then required to purchase and operate an additional ULT freezer - doubling the cold storage energy consumption.

This problem is facilitated by individual ownership of ULT freezers. Where individual freezer ownership is the model this can encourage those with small ULT storage needs to purchase a small under-bench ULT freezer. These types of ULT freezers have the highest energy consumption per volume of cold storage space, and can use almost as much energy as a unit twice their size (9kWh/day[26] for a new 100litre underbench unit, versus c.12-15kWh/day for a new 600-800 litre unit[27]).

The solution:

Sharing freezer space, combined with maintaining a good database of freezer contents and regularly throwing out redundant samples can lead to great cold storage space efficiencies, reducing the need to purchase additional ULT freezers, saving capital and operational costs as well as freeing up space within the lab making it a more pleasant space to work in.

Where the ULT freezers are owned by the institute and cold storage space allocated to lab groups on a needs-assessed basis (possibly involving re-charging) better sample storage and inventorying practices are encouraged and rewarded.

Under bench ULT freezers should be avoided and discouraged unless absolutely necessary, due to their high energy consumption per cold storage volume.

Medium and large institutions across the University of Edinburgh should be aiming to move towards a model where the institute provides the cold storage facilities to the scientists rather than having private ownership of individual ULTs.

Hotel/Spare freezers should be shared among multiple users (and set to a higher temperature, e.g. -60degreesC, when empty. Modern ULT freezers advertise that they can pull down from +20°C to -80°C in c.5hours. Pulling down from -60°C to -80°C would take substantially less time than this.)

Alternative technologies

The Problem:

Standard ULT freezer design expels heat into the room in which the freezers are located. This heats up the room putting a strain on the compressors of the ULT freezers and also adding load to building air conditioning and ventilation systems in an effort to maintain a stable room temperature.

[26] https://labcold.com/wp-content/uploads/2016/04/Labcold-ULT-FreezerLULT80100-1.pdf
[27] https://www.thermofisher.com/uk/en/home/life-science/lab-equipment/cold-storage/lab-freezers/ultra-low-temperature-freezers-minus-80.html

The Solution:

A new design of cold storage device exists, branded as 'Nordic'[28] and sold in the UK via LabMode. Nordic consists of terraces of highly insulated cabinets which are served with cooling from a compressor held in a different room/outside the building. The terracing of the cabinets leads to reduced heat gain as the ratio of internal volume to external surface is improved. The location of the compressor away from the temperature sensitive materials removes a degree of risk from cold storage. In addition, the insulated cabinets can be built within the room and configured to make best use of the room space and height, and thus there may be potential to increase the cold storage capacity of the room. Finally, energy savings advertised for this technology are very substantial at well over 50% - these are achieved by reducing or eliminating the need for air conditioning, and ensuring the compressor is situated in a well ventilated room without heat sources (unlike the situation with multiple freezer compressors within a standard ULT freezer facility). With multiple freezer-sized cabinets served by the same compressor there is the concern of impact of compressor failure – this is countered by the system having 2 separate compressors with 2 separate pipe-runs in order to insure against the failure of either system.

The Nordic system is quite expensive, and also requires a fairly expensive maintenance contract, and as such it was not found to make financial sense for a retrofit project (i.e. getting rid of the ULT freezers in an existing freezer facility and replacing them with Nordic). However, it may be a more attractive financial option when compared to the costs of setting up a new freezer facility from scratch (comparing against the cost of purchasing new ULT freezers).

[28] https://www.youtube.com/watch?v=USVCJdyVyYA

Appendix

Lab contacts who can help you with these projects:

Freezer replacement

Andrew Arnott, Department for Social Responsibility and Sustainability, andrew.arnott@ed.ac.uk

Brian McTeir, Roslin Institute, brian.mcteir@roslin.ed.ac.uk

Defrost and maintenance

Brian McTeir, Roslin Institute, brian.mcteir@roslin.ed.ac.uk

David Hills, Biology Teaching Organisation, david.hills@ed.ac.uk

Lee Murphy, Wellcome Trust Clinical Research Facility, Lee.Murphy@ed.ac.uk

Eliane Salvo-Chirnside, SynthSys labs, Eliane.Chirnside@ed.ac.uk

Stewart McKay, Institute of Genetic and Molecular Medicine, Stewart.McKay@igmm.ed.ac.uk

Efficient use of space

Carol Wollaston, Hugh Robson Building, C.Wollaston@ed.ac.uk

Lee Murphy, Wellcome Trust Clinical Research Facility, Lee.Murphy@ed.ac.uk

Stewart McKay, Institute of Genetic and Molecular Medicine, Stewart.McKay@igmm.ed.ac.uk

Jimi Wills, IGMM Mass Spec facility Jimi.Wills@ed.ac.uk

Eliane Salvo-Chirnside, SynthSys labs, Eliane.Chirnside@ed.ac.uk

Moira Nicol, QMRI, Moira.Nicol@ed.ac.uk

Steve McLean, QMRI, Steven.Mclean@ed.ac.uk

Heather Anderson, Chancellors' Building, Heather.Anderson@ed.ac.uk

Reducing the requirement for air con in freezer rooms

Brian McTeir, Roslin Institute, brian.mcteir@roslin.ed.ac.uk

Running freezers at higher temperatures (e.g. -70^{0}C)

Brian McTeir, Roslin Institute, brian.mcteir@roslin.ed.ac.uk

Stewart McKay, Institute of Genetic and Molecular Medicine, Stewart.McKay@igmm.ed.ac.uk

Useful links and resources

Impact of age, dust, ice, freezer temperature set point and size on energy consumption of freezers

Gumapas & Simons, World Review of Science, Technology and Sustainable Development, Vol 10, No.s 1/2/3, 2013 http://www.inderscience.com/info/inarticle.php?artid=50786

Impact of ventilation on freezer energy consumption

http://www.triplered.com/downloads/pdf/Sterling%20Freezer%20Efficiency%20paper.pdf

General energy consumption of freezers and impact of ambient air temperature

www.eventlink.org.uk/.../103-Arthur_Nicholas_-_Cold_Storage_at_the_University_of_Manchester

Pardise, A. et al., "Ultra-Low Temperature Freezes: Opening the door to energy savings in laboratories", Centre for Energy Efficient Laboratories

Freezer energy savings

http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/ulf_freezer_user_guide.pdf (U.S. Dept of Energy "Store Smart" ULT freezer guide)

Impacts of cold storage conditions on sample integrity

De Paoli, P, (2005) "Biobanking in microbiology: From sample collection to epidemiology, diagnosis and research", FEMS Microbiology Reviews 29 897–910

Mitchell, B.L. et al, (2005) “Impact of Freeze-thaw Cycles and Storage Time on Plasma Samples Used in Mass Spectrometry Based Biomarker Discovery Projects” Cancer Informatics 98–104

Colins et al, (1993), "Storage temperature and differing methods of sample preparation in the measurement of urinary albumin" Diabetologica, vol 36, issue 10, pp 993-997

Tedeschi, R. & De Paoli, P; (2011) "Collection and Preservation of Frozen Microorganisms"; Methods in Molecular Biology Volume 675, pp 313-326

Marino, D, (2013) "Best practices for storing biological samples in ULT freezers" http://www.biocompare.com/Bench-Tips/137747-Best-Practices-for-Storing-Biological-Samples-in-ULT-Freezers/

Wu, J et al., "Stability of Genomic DNA at Various Storage Conditions", International Society for Biological and Environmental Repositories (ISBER) 2009 Annual Meeting, Poster QAC 03

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Sustainable Labs Steering Group

21st May 2018

Lab Energy Engagement and Monitoring Expansion

Description of paper
This paper describes the potential routes to build upon previous successful lab energy engagement and monitoring campaigns, as well as the potential resource implications

Action requested
SLSG is asked to note the findings of this paper and provide comment.

Recommendation
It is recommended that these projects be continued between once and three times per year - depending on SRS and Estates staff time, equipment availability, and the availability of new volunteering host labs. (If equipment availability were identified as a limiting factor, the University of Edinburgh may wish to consider purchasing additional equipment).

Background and context
In summer 2016 and summer 2017 projects were undertaken at Horsfall Labs (Roger Land Building, King's Buildings) and IGMM (Western General Hospital) respectively to monitor the relative impacts of different energy engagement techniques (specifically: printed materials versus face-to-face presentations). Energy consumption was monitored at the project sites to observe changes in consumption following energy engagement. The 2016 project data was incomplete due to faulty monitoring equipment. Better monitoring equipment was purchased by estates and installed for the 2017 project, which showed small energy reductions following engagement with printed materials and larger energy reduction following face-to-face engagement.

Discussion

Overview
The 2017 IGMM project showed good energy reductions. These were monitored again in December 2017 and found to still be in place. This is a great success which should be replicated elsewhere in the University of Edinburgh. This paper will describe how that replication might occur, the potential scale of it, and the resource requirements.

Action	Person(s) responsible	When (and time required)
1a) Recruitment of new labs to monitor. Ideally looking for labs with lots	SRS Project Coordinator – Labs	May 2018 (up to 3 days)

of benchtop equipment who have not received SRS energy engagement previously. Suggestions below: - Swann - Engineering - SCRM - Chancellor's - QMRI - Hugh Robson Building	SLSG members with contacts in these areas to recruit a lab/labs	
1b) Planning the monitoring programme with the lab and writing up a project plan including an energy monitoring plan.	SRS Project Coordinator – Labs Host Lab representative Estates/Energy Office (e.g. Robert MacGregor)	June 2018 (up to 1.5 days of SRS time) (up to 0.5 days each for Host Lab rep and Estates/Energy Office contact)
1c) Install monitoring devices	SRS Project Coordinator – Labs Host Lab representative Estates/Energy Office (e.g. Robert MacGregor)	July 2018 (up to 0.5 days each)
2a) Collecting and analysing the data	SRS Project Coordinator – Labs Estates/Energy Office (e.g. Robert MacGregor)	July and August 2018 (up to 1 day per week – SRS) (up to 0.5 days per week - Estates)
2b) Undertaking energy engagement activities	SRS Project Coordinator – Labs Host Lab representative	Late July and August 2018 (up to 1 day each)
3a) Reporting	SRS Project Coordinator – Labs	September 2018 (up to 1 day)

Risk Management
Little contingency is built into the above timings. It is possible time demands could be greater, although the proposed times are thought to be the most likely scenario.

Future projects may become harder and more time consuming to recruit for, as there is a finite supply of enthusiastic volunteer labs who might benefit from this type of project (labs already following good practices, or already familiar with good practices may not show much of an energy saving).

Equality & Diversity
The only equality issue which might be described is that, based on our experiences with past projects, it can be stated that the bulk of work to be undertaken by the host lab is undertaken by technicians/technical staff, rather than shared equally between technical and academic staff. However, given the voluntary nature of this project this is not thought to be a particular concern as long as the member of staff to undertake the work volunteers for it.

Next steps/implications
SRS Project Coordinator – labs to identify further lab(s) to undertake engagement and monitoring projects in.

SRS Project Coordinator – labs to check availability of energy and other monitoring equipment. If equipment is not available, consider the business case for purchasing more, based on possible savings.

Consultation
This paper has been reviewed by Chris Litwiniuk –Engagement Manager, and Michelle Brown, Head of Programmes (both within the Department for Social Responsibility and Sustainability).

Further information
<u>Author</u>
Andrew Arnott
SRS Engagement Team
April 2018

Freedom of Information
Open paper.

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Sustainable Labs Steering Group

21st May 2018

Recommendations from CSSD groups
(Construction Materials Accreditation; and Glassware vs Plasticware in Labs)

Description of paper
The purpose of this paper is to inform the SLSG of recommendations made by two groups of students on the Case Studies in Sustainable Development course in April 2018. The groups were investigating two topics: What are the barriers and benefits to changing from single-use plasticware to reusable glassware in laboratories?; and, Describe the relative merits of the different environmental accreditation schemes for construction materials.

Action requested
The SLSG is asked to note the recommendations and suggest future actions where appropriate. The section on construction materials is not within the remit of the SLSG and has been included for interest and information only. This section will be discussed with Estates and others involved in drafting new design guidelines for University of Edinburgh.

Recommendation
It is recommended that the findings of the glass vs plastic investigation form the basis of an engagement campaign, focussed around reducing plastic waste from labs. It is recommended that the “Edinburgh Standard” bespoke design guidelines developed for the University of Edinburgh should incorporate the recommendations on accreditation schemes for construction materials.

Background and context
The Case Studies in Sustainable Development course runs annually in Geosciences at Masters level. It has been supported by SRS for a number of years, through suggestions of useful ‘living labs’ topics for the students to investigate, and provision of mentoring through the investigation. Students were presented with a range of topics they could choose to investigate in small groups of c. 4-6 students. In 2018 their investigations lasted c.10 weeks from January to April.

The SRS Project Coordinator – Labs suggested two topics in 2018:

“What are the differences between sustainability certification schemes for building materials and which ones are most suitable for use by the University?”

“Which has a lower lifecycle carbon impact: single-use plasticware or reusable glassware for lab work?”

The latter topic was adjusted part way through the investigation to cover barriers and benefits of any change to glassware, with an overarching view of reducing plastic waste from labs.

Discussion

Certification schemes for construction materials

Recommendations were based on specific construction materials:

- Timber products should be accredited to UK Woodland Assurance Standard, and in addition the timber production company should be accredited to ISO 14001 and the Woodland Carbon Code which focuses on carbon sequestration.
- Steel products should be accredited to UK CARES Sustainable Construction Steel scheme. UK CARES is an independent not-for-profit certification body and the only certification body in the UK that is UKAS accredited for product certification for reinforcing steel and associated products.
- Concrete should be accredited to UK CARES Steel for the Reinforcement of Concrete (see above)
- Glazing products should be chosen for their in-use performance, and thus the Passivhaus scheme is recommended.
- Fit-Out materials should be accredited to SKA H.E.

Glass vs Plasticware in labs

- Plasticware has much higher greenhouse gas emissions per weight (taking carbon conversion figures from Dept. BEIS).
- 'typical lab' generates 1-10 bags per day of plastic waste, at approx. 4.6kg per bag = 77kgCO_2e/day
- 'typical lab' generates1 box of glass waste per year, at approx. 10kg per box = 0.04kgCO_2e/day
- Substantial amounts of confusion among lab users about what lab plastic waste
    - many believe it must all be designated as hazardous if it has entered the lab, whereas the advice from the Waste Office is that all non-contaminated plastics should be recycled.
    - Many believe waste lab plastic is heat-treated then recycled, incinerated or landfilled, whereas actually waste is heat-treated and recycled or incinerated (not landfilled)
- Barriers to using more glassware
    - Safety – concerns of broken glass (especially if working with human cells)
    - Quality of science – perception (no evidence cited) that plasticware is more sterile
    - Lack of awareness/motivation among lab users to make sustainability changes
    - Wide variety of labs across the University of Edinburgh, makes it harder to generate practices which are appropriate for all
    - Time – quicker to use single-use plastic items for some high-throughput activities
- Barriers to recycling plastic waste
    - Much of it is hazardous/clinically contaminated
    - Some recycling schemes are restrictive (i.e. may only take one type or one brand, which may not be the lab's preferred brand)

    - Space for another waste stream bin (although volume of waste would remain the same, so the bin which was previously used could be reduced in size)
- Recommendations:
    - Confirm, and then communicate to lab users, what happens to lab plastic waste
    - Clarify, and then communicate to lab users, that non-contaminated lab plastics should be placed in recycling stream (see Appendix 1)
    - Undertake a scientific comparative study to show if re-usable glassware has comparable sterility to single-use plasticware
    - Negotiate with waste contractor to take broken glass (they take sharps already, so a similar system could be implemented to handle broken glass safely).
    - Produce lab-specific waste data and communicate it to lab users to motivate change
    - Implement bulk ordering to reduce packaging plastic waste
    - Findings of case study at UCL cell biology lab (see Appendix 2):
        - Plastic falcon tubes can be replaced with glass
            - Particularly for molecular biology
            - Spin at 4000rpm, wash, autoclave, reuse
        - Plastic pipettes can be replaced with glass
            - Use metal boxes for racking safely
            - Wash and autoclave
        - Purchase bagged rather than racked new plastic falcon tubes when needed
        - Glass flasks are too difficult and expensive to substitute
        - Core staff are very important to this strategy

Resource implications
There may be a higher cost for purchasing sustainably accredited construction materials, however this should be offset against lower operating costs for the building in some cases. In other cases this cost will not be offset, but aligns with the University of Edinburgh’s commitments around sustainable purchasing.

Labs who choose to substitute glass for plastic will have greater upfront costs, but should have lower running costs to compensate for this. Time resources may be required from Waste and SRS to undertake communications with labs. Time resources may be required from a lab/labs to undertake a study into the comparative sterility of glassware versus plasticware.

Risk Management
Choosing appropriately accredited construction materials reduces reputational risks to the University of Edinburgh.

Substitution of glassware with plasticware should only be undertaken after appropriate risk assessments have been undertaken and approve the substitution.

Equality & Diversity
No impacts are foreseen.

Next steps/implications
It is recommended that the findings relating to construction materials be incorporated into the new Edinburgh Standard for sustainable design and construction.

The findings relating to glassware and plasticware present a programme of work which should be judged for prioritisation and incorporated into the work of SRS and Waste if deemed a priority.

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

Further information
Author and Presenter
Andrew Arnott SRS Projects Coordinator - Labs
Department for Social Responsibility and Sustainability
May 2018

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APPENDIX 1 - University of Edinburgh waste disposal guidance. Information gathered by CSSD group.

Waste Type	Guidelines
Glass (Green, Clear, Brown)	**Recyclable** via designated glass caddies
Glass (Broken, ceramic, pyrex)	**Non-recyclable:** packaged and disposed in general waste
Laboratory Glass ("toughened" glass?)	**Non-recyclable:** contact W&R for disposal
Plastics (Recycling # 1,2,3,4,5)	**Recyclable** via dry recycling bin
Laboratory Plastics (Anything clearly from a laboratory - uncontaminated)	**Unclear:** laboratories state they must go in hazardous waste, waste department states recyclable through dry recycling bin
Other plastics (polystyrene, recycling # 6,7)	**Non-recyclable:** disposal in general waste
Hazardous	**Non-recyclable, non-reusable:** anything (glass, plastic, or otherwise) that has been in contact must be disposed of through hazardous waste guidelines

APPENDIX 2 – Specific recommendations for substitution. Information gathered by CSSD group.

Type of material (type of lab)	Recommendation for substitution	Rationale and source
Plastic Falcon tubes (Biology, other)	Glass tubes	Greatly reduces usage of disposable falcons; comparable for growing yeast and bacteria, spin at 4000rpm without issue; wash and autoclave necessary; baskets recommended for storage and autoclave (Source: CA)
Plastic pipettes when “not completely sterile” (Biology, other)	Glass pipettes	Can be substituted whenever complete sterile procedure is not necessary (e.g. benchwork); must wash and autoclave; metal boxes necessary for storage and sterilization; come in 1, 5, 10, 25ml volumes (Source: CA)
Racked falcons (Biology, other)	Bagged falcons	Greatly reduces polystyrene packaging waste; reduces need to dispose of polystyrene (Source: CA)
Single-use plastics when concerned with plastic-derived leachates and/or loss of assay reagents due to adhesion or infusion	Glass alternative	Negates concern over additive leachate from plastics; still must consider leachate of ions and adhesion to glass (Source: Olivieri et al., 2012)
Single-use gloves	Recyclable gloves	Scheme in school of chemistry to recycle gloves (Source: Recycling in labs blog - see website in references)
Single-use plastic coming from a “recycled” source when concerned about leachate	Virgin plastic items	Virgin, or newly created, plastic items are recommended when leachate is a concern because the additives can be guaranteed (Source: Olivieri et al., 2012)