A sustainability guide for nutrition, food science, and sensory science laboratories

Nutrition, Food Science, and Sensory Science laboratories play an essential role in advancing food product development, promoting public health, and understanding human sensory perception. However, such labs typically operate with high energy demands, significant material consumption, and substantial waste generation. Studies show that laboratories can consume up to five times more energy per square metre than standard office spaces due to their specialised equipment, controlled environments, and strict safety requirements (University of California Berkeley, 2020). Additionally, food testing, sensory evaluations, and chemical analyses generate diverse waste streams, including single-use plastics, food scraps, chemical reagents, and disposable sensory materials (Mulder, Steenhuis & Snow, 2021).

This guide outlines practical, evidence-based strategies to enhance sustainability across clothing and equipment, food and materials, energy and resources, and community and administrative practices. It draws on peer-reviewed research and aligns with relevant international environmental standards such as ISO 14001, ISO 22000, and ISO 14064, ensuring compatibility with best practice frameworks.

Sustainability challenges in food-related laboratories

1. Energy consumption

Laboratory freezers, ovens, incubators, sensory booths, and HVAC systems require continuous operation. Ultra-low temperature freezers alone can consume as much energy as an average household (Cummings, Wilhelm & Arvizu, 2017). Food preparation equipment such as hobs, fryers, dehydrators, and mixers also contributes to high energy loads.

2. Material and plastic waste

Single-use gloves, disposable pipettes, sensory cups, plates, and packaging are used frequently because of hygiene requirements. However, the majority of these materials cannot be recycled due to contamination (Mulder et al., 2021).

3. Food waste
Food laboratories generate unavoidable waste from test batches, sensory samples, and spoilage. Without structured waste segregation and composting systems, food waste contributes directly to landfill emissions (Papargyropoulou et al., 2014).

4. Water and Chemical Use
High cleaning and sanitation requirements lead to substantial water usage, while nutrient analysis and microbiology activities produce chemical and biological waste requiring specialised disposal.

Clothing and equipment sustainability

1. Eco-friendly laboratory clothing

- Select lab coats and uniforms made from organic, recycled, or sustainably produced fibres.
- Prioritise suppliers certified under environmental standards such as ISO 14001 or programmes like Oeko-Tex.

2. Extending garment lifespan

- Repair damaged lab coats rather than discarding them.
- Donate wearable uniforms to training programmes or textile recycling schemes.

3. PPE reuse where safe

- Reuse washable PPE such as lab coats instead of relying on disposable alternatives.
- Avoid unnecessary use of single-use gowns unless required for safety or contamination control.

4. Sustainable procurement

- Collaborate with procurement teams to source greener alternatives.
- Evaluate suppliers' sustainability credentials and carbon reporting practices (ISO 14064).

Food and materials sustainability

1. Use of reusable and compostable items

- Replace disposable cutlery, plates, and cups with reusable stainless steel, glass, or durable plastic options.
- For sensory testing, opt for reusable or compostable tasting cups instead of single-use plastics.

2. Food waste segregation

- Install compost bins for fruit and vegetable scraps.
- Recycle paper, cardboard, glass, and packaging wherever possible.

3. Waste auditing and reduction strategies

- Conduct routine food waste audits to track types and volumes of food discarded.
- Map laboratory preparation processes to identify inefficiencies.
- Order ingredients in quantities that match actual consumption needs to minimise spoilage.

4. Evidence-based approaches

Research demonstrates that structured food waste audits can reduce waste by up to 30% and improve ordering efficiency (Papargyropoulou et al., 2014).

Energy and resource management

1. Efficient use of laboratory equipment

- Switch ovens, hobs, dehydrators, fryers, and processing machinery on only when needed.
- Use energy-saving modes (e.g., standby) where available.

2. Behavioural Interventions

- Place green signage or stickers near lights, equipment, and sinks to remind users to switch off or conserve resources.

3. Automation and timers

- Install outlet timers to automatically power down non-essential items after hours.
- Ensure sensory booths and controlled environments operate on optimised schedules rather than continuous runtimes.

4. Maintenance for efficiency

- Regularly service freezers, ovens, mixers, and HVAC systems.
- Properly maintain fryers, including using correct oil temperatures, filtering oil, and recycling used oil through accredited schemes.

5. Water and consumables

- Encourage the use of refillable water bottles instead of bottled water.
- Install low-flow tap fittings where appropriate.

6. Shared inventory systems

- Implement lab-wide systems for equipment and consumable sharing to reduce duplication and over-ordering.

Community, office, and transportation sustainability

1. Food redistribution

- Donate safe, unopened surplus food and ingredients to local charities, community kitchens, or food banks.

2. Sustainable transport

- Encourage public transport use, carpooling, or combining multiple fieldwork trips into fewer journeys.

3. Office resource reduction

- Reduce printing and switch to digital workflows where practical.
- When printing is necessary, choose FSC-certified, recycled, or chlorine-free paper.

Alignment with ISO environmental standards

ISO 14001 – Environmental Management Systems
Supports structured environmental planning, impact assessment, and continual improvement in lab practices.

ISO 22000 – Food Safety Management Systems
Provides frameworks for safe food handling that integrate well with sustainable practices such as reducing contamination-related waste.

IISO 14064 – Greenhouse Gas Accounting
Helps laboratories measure, report, and reduce emissions from energy, transport, and procurement activities.

Adopting these standards provides a strong foundation for environmental accountability and helps laboratories benchmark progress against international expectations.

Conclusion

Nutrition, Food Science, and Sensory Science laboratories have unique sustainability challenges due to their specialised equipment, rigorous hygiene requirements, and diverse material uses. However, by adopting environmentally responsible clothing, reducing waste, improving energy efficiency, engaging in sustainable procurement, and aligning operational practices with ISO environmental standards, these labs can significantly reduce their ecological footprint. Implementing these strategies not only benefits the environment but also reduces costs, increases operational efficiency, and strengthens the social responsibility profile of research institutions and organisations.

Reference list

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University of California Berkeley (2020) *Lab energy assessment report: energy use patterns in scientific laboratories*. UC Berkeley Office of Sustainability.

Sustainability checklist for nutrition, food science and sensory science laboratories

1. Clothing and equipment

Sustainable clothing

- Purchase lab coats/uniforms made from eco-friendly or recycled fabrics.
- Choose suppliers certified under environmental standards (e.g., ISO 14001).
- Repair torn/damaged lab coats before replacing them.
- Donate wearable uniforms to training or textile recycling schemes.

PPE use & reuse

- Use washable, reusable PPE (e.g., lab coats) instead of single-use when safe.
- Avoid unnecessary use of disposable gowns unless required for contamination control.
- Ensure PPE procurement options include green/low-impact alternatives.

Sustainable Procurement

- Work with procurement to select low-carbon, low-waste suppliers.
- Prioritise suppliers using ISO 14064 emissions reporting.
- Avoid over-ordering by reviewing stock levels before purchasing.

2. Food and material management

Reusable and compostable Items

- Use reusable cutlery, plates, glassware, or cookware.
- For sensory testing, choose compostable or reusable tasting cups.
- Reduce or eliminate single-use plastics.

Food waste management

- Separate food waste: compost, recycling, general waste.
- Compost fruit and vegetable scraps.
- Recycle paper, cardboard, bottles, and packaging.

Waste reduction planning

- Conduct regular food waste audits.
- Track volumes and types of food/materials discarded.
- Map preparation processes to identify inefficiencies.
- Order only ingredients needed.
- Buy materials in bulk when possible.

3. Energy and resource efficiency

Equipment Operation

- Switch equipment on only when needed.
- Enable energy-saving/standby modes.
- Batch-cook or batch-process where possible.

Lighting and electrical reminders

- Display signage reminding users to turn off lights/equipment.
- Switch off sensory booths and prep room lighting when not in use.
- Turn off fume hoods where safe.

Timers and automation

- Use outlet timers for after-hours power-downs.
- Schedule sensory booth ventilation and lighting.

Maintenance and efficiency

- Clean freezers, ovens, and hobs regularly.
- Maintain freezer coils for energy efficiency.
- Reuse fryer oil safely and recycle spent oil.

Water use

- Use low-flow taps.
- Avoid running water unnecessarily.
- Use refillable water bottles.

Inventory Management

- Maintain a shared equipment and consumables inventory.
- Check inventory before ordering.
- Avoid duplication of tools/equipment.

4. Community, office and transport practices

Food redistribution

- Donate unopened surplus food to charities, food banks, or community kitchens.
- Follow food safety rules for redistribution.

Transport and fieldwork

- Combine field trips to reduce mileage.
- Encourage carpooling, cycling, and public transport.
- Use virtual meetings when possible.

Office resource use

- Reduce printing; use digital signatures and PDFs.
- Use FSC-certified or 100% recycled paper.
- Print double-sided and in black and white.

5. ISO alignement checklist

ISO 14001 – Environnemental Management

- Identify environmental impacts (energy, water, waste).
- Maintain a sustainability action plan.
- Conduct annual environmental performance reviews.

ISO 22000 – Food Safety Management

- Integrate sustainability into food handling practices.
- Ensure waste reduction aligns with HACCP.
- Document procedures for surplus food redistribution.

ISO 14064 – Greenhouse Gas Accounting

- Reduce printing; use digital signatures and PDFs.
- Use FSC-certified or 100% recycled paper.
- Print double-sided and in black and white.

About the author

Dr Paula Conroy (BSc, PhD, RNutr) is a Lecturer in the Department of Sport, Exercise & Nutrition at Atlantic Technological University (ATU) in Galway, Ireland, where she teaches undergraduate and postgraduate courses in public health nutrition, sport and exercise science, and sports nutrition.

Dr Conroy graduated with a BSc in Nutritional Science from University College Cork and completed a PhD examining sensory decline associated with ageing, bridging nutrition and sensory science research. She is a registered Nutritionist with the Association for Nutrition (AfN) and brings extensive experience in both academic and applied research, including sensory analysis, data analysis, and qualitative research methods.

Dr Conroy is the Programme Coordinator for the blended MSc in Nutrition and Food Sensory Science at ATU, a pioneering postgraduate programme designed to equip graduates with advanced skills in nutrition, sensory evaluation, and food science. You can find full details of the programme here: https://www.atu.ie/courses/master-of-science-nutrition-and-food-sensory-science.

Her research interests include women's health, ageing, nutrition and sensory science, and she actively contributes to research projects and academic collaborations that span both national and international scientific communities.

She is delighted to be part of ATU Green Labs and to be working with My Green Labs to support sustainability initiatives in food, nutrition, and sensory science laboratories, strengthening environmental responsibility alongside scientific excellence.