Green Labs: Defining and Incentivizing Best Practices

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Sustainability: It’s in our nature.
Welcome

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# Certification Trends in Higher Ed

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>58+</td>
<td>UW, WWU, UO...</td>
</tr>
<tr>
<td>Meetings/Events</td>
<td>19+</td>
<td>ASU, Yale, UC Berkeley...</td>
</tr>
<tr>
<td>Dorm Room</td>
<td>16+</td>
<td>UW, U Alberta, Duke...</td>
</tr>
<tr>
<td>Laboratory</td>
<td>13+</td>
<td>UW, Duke, Harvard, ASU...</td>
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<tr>
<td>Greek</td>
<td>4+</td>
<td>UW, UPenn, UC Berkeley, DePauw</td>
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<tr>
<td>Classroom/Teaching</td>
<td>3+</td>
<td>Duke, UC Riverside, ASU</td>
</tr>
<tr>
<td>Spaces</td>
<td>2+</td>
<td>U Alberta, Cal Poly Pomona</td>
</tr>
<tr>
<td>Green IT</td>
<td>2+</td>
<td>U Michigan, Michigan State</td>
</tr>
</tbody>
</table>
UW’s Green Certifications

- UW Green Office Certification: September 2010 to September 2011
- UW Green Greek Certification: May 2012 to January 2013
- UW Green Laboratory Certification: January 2012 to March 2013
Why Green Labs?

• Labs use 5x more energy than an average office
• Labs use significantly more water than an office building
• Labs generate tons of waste
• Less sustainability focus in labs versus other areas of UW
• UW received $1.25 billion in research funding in 2013
• UW has more than 4,500 labs
  • 2.4 million sq ft.
  • 18% of space
Creating the Certification

Green Laboratory Committee

Project Manager: Aubrey Batchelor, ESS

Caileigh Shoot, ESS
Jennifer Perkins, ESS
John Kelly, EH&S
Doug Gallucci, EH&S
Shelly Carpenter, Oceanography
Christine Aker, Health Sciences
Claudia Christensen, Purchasing
Emily Newcomer, Recycling
Jill Stoddard Tepe, Green Lab Alliance

Stakeholders
Capital Projects Office, EH&S, Finance & Facilities, School of Medicine, School of Public Health, College of the Environment, College of Engineering, College of Arts & Sciences, Health Sciences

Resources
Universities: ASU, Colorado Boulder, Michigan, UC Davis, Harvard
Associations: I2SL/Labs21, Green Lab Alliance
Lab Suppliers: Sigma-Aldrich, VWR, Fisher, Corning, Eppendorf, Mt Baker Bio

Environmental Stewardship Committee

UW Tacoma/UW Bothell
Creating the Certification

Online form ➤

“How to” tips ➤

Three tiers ➤

Opt out ➤
Certification Results

Communication & Education
All labs that communicate are certified

Energy
58% never clean their freezer/fridge

Recycling, Compost, & Waste
44% always try to produce less waste

Chemical Usage & Disposal
47% never practice green chemistry

Purchasing
25% have energy efficient equipment

Travel & Field Work
Most use public transit or carpool

Water
59% don’t use aerators/misers
Case Study: DEOHS

Engaging laboratories in the University of Washington's Department of Environmental and Occupational Health Sciences to establish a model for environmental sustainability

PROJECT PERIOD: February 2014-January 2015

PROJECT TEAM
Jen Krenz
Chris Simpson
Nancy Simcox
Jill Stoddard Tepe
Isaac Chamberlain

COLLABORATORS
DEOHS Labs
UW Sustainability
UW EH&S
UW Recycling
UW Purchasing
WA Dept of Ecology
# Case Study: DEOHS

**Goal:** Assessment and adoption of green practices by DEOHS Labs

<table>
<thead>
<tr>
<th>Industrial Hygiene</th>
<th>Toxicology</th>
<th>Microbiology</th>
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<tbody>
<tr>
<td>Fenske</td>
<td>Costa</td>
<td>Cangelosi</td>
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<tr>
<td>Kaufman/Vedal</td>
<td>Eaton</td>
<td>Meschke</td>
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<tr>
<td>Kissel</td>
<td>Faustman</td>
<td>Roberts</td>
</tr>
<tr>
<td>Yost</td>
<td>Gallagher</td>
<td></td>
</tr>
<tr>
<td>Field Group</td>
<td>Xia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tissue Culture</td>
<td></td>
</tr>
<tr>
<td>Genetics</td>
<td>Cytometry</td>
<td></td>
</tr>
<tr>
<td>Functional Genomics</td>
<td>Mouse Behavior</td>
<td></td>
</tr>
</tbody>
</table>

**Chemistry**

Simpson  
EH/Kalman

Slide: Jen Krenz, MS MPH, DEOHS
Case Study: DEOHS

UW Green Labs Certification Application Results
Spring/Summer 2014

<table>
<thead>
<tr>
<th>Section</th>
<th>DEOHS (N=20)</th>
<th>UW (N=65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall score</td>
<td>45%</td>
<td>58%</td>
</tr>
<tr>
<td>Communication and Education</td>
<td>17%</td>
<td>36%</td>
</tr>
<tr>
<td>Energy</td>
<td>43%</td>
<td>33%</td>
</tr>
<tr>
<td>Recycling, Compost, Waste Reduction</td>
<td>44%</td>
<td>62%</td>
</tr>
<tr>
<td>Chemical Usage and Disposal</td>
<td>42%</td>
<td>46%</td>
</tr>
<tr>
<td>Purchasing</td>
<td>66%</td>
<td>56%</td>
</tr>
<tr>
<td>Work-related Travel and Field Work</td>
<td>65%</td>
<td>8%</td>
</tr>
<tr>
<td>Water Conservation</td>
<td>41%</td>
<td>49%</td>
</tr>
</tbody>
</table>

5 labs certified at the bronze level (minimum 55%, 10% in each section)

Slide: Jen Krenz, MS MPH, DEOHS
Additional Evaluation

1. Comprehensive laboratory solid waste stream audit
2. Chemical and equipment inventory
3. Purchasing record analysis
4. Work-related travel impacts
5. Energy consumption characterization
Case Study: Lab Waste Audit

MATERIALS AND METHODS

• Sorted four working days of solid waste from 20 DEOHS labs
• Estimated volume of waste types per lab
• Overall weight of waste type across the department
# Case Study: Lab Waste Audit

## DEOHS Lab Trash Sort Summary - April 23, 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>DEOHS Labs (% total volume)</th>
<th>DEOHS lab trash weight (pounds)</th>
<th>DEOHS Labs (% total weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compostables</td>
<td>35%</td>
<td>12</td>
<td>29%</td>
</tr>
<tr>
<td>Lab gloves</td>
<td>20%</td>
<td>9</td>
<td>22%</td>
</tr>
<tr>
<td>Plastic film</td>
<td>16%</td>
<td>3</td>
<td>7%</td>
</tr>
<tr>
<td>Landfill</td>
<td>10%</td>
<td>10</td>
<td>24%</td>
</tr>
<tr>
<td>Cardboard/Mixed paper</td>
<td>7%</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Other recyclables</td>
<td>5%</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Hard lab plastics</td>
<td>5%</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Drink/Food containers</td>
<td>1%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Styrofoam</td>
<td>0%</td>
<td>0.5</td>
<td>1%</td>
</tr>
<tr>
<td>E-media</td>
<td>0%</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
<td><strong>41.5</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Project lead: Jen Krenz, MS MPH, DEOHS
Case Study: Waste Audit

The UW DEOHS lab trash sort resulted in:

1. Lab **compostable** waste pilot project
Case Study: Waste Audit

The UW DEOHS lab trash sort resulted in:
1. Lab **compostable** waste pilot project
2. A new campus-wide lab recycling brochure

What can be recycled in laboratories?

**Reagent Containers**
Empty containers for the following chemicals can all be recycled on campus with the food and drink container stream on campus: Acetone, Alcohols, Hexane, toluene, xylene, Nontoxic buffers, salts, Sugars, nutrients, cleaning products.

**Plastic Film**
Plastic film such as clean plastic bags, bubble wrap, air pillows (deflated), and food-contamination free shrink-wrap can all be recycled through the Plastic Film stream on campus.

**Styrofoam/Polystyrene Blocks and Boxes**
UW Recycling accepts rigid Styrofoam/polystyrene blocks and boxes for recycling.

**Packing Peanuts**
UW Recycling has a reuse program for Styrofoam and all other types of packing peanuts.

**Hard Plastics**
Hard Plastics are defined as standard #1-7 plastics with the emphasis being on hard, rigid plastic materials that cannot be recycled in the standard UW Mixed Containers recycling stream. Common items in laboratories are: Pipette tip boxes, plastic pipes and crates, prescription bottles, etc.

**Plant and Other Compostable Materials**
Suitable plant waste can be either composted through UW's composting program or sent to the UW Farm for reuse/repurposing. Chemical soaked plant waste cannot be composted or sent to the UW Farm.

**E-Media**
E-Media including disks, zip disks, CDs, DVDs, audiotapes, and videotapes, and their cases can all be recycled on campus in the E-media bins located throughout campus.

And More!
Case Study: Waste Audit

What is it?

- Plastic Film (clean plastic bags, bubble wrap, air pillows, cellophane, and shrink wrap)
- Hard Plastic (branded #1 & #2 plastics, e.g., plastic bags, buckets, and plastic closures, prescription bottles, all Seeing, PVC film)
- Styrofoam or Polystyrene
- Packing Peanuts
- Blocks and Boxes
- Compost (This is not a self-service stream and is available throughout campus)
- Recycling (This is not a self-service stream and is available throughout campus)
- E-Media (e.g., disks, zip disks, CDs, DVDs, audiotapes, and videotapes, and their cases)
- Landfill or contact UW Recycling with questions
- Food or other Approved Compostable Materials
- Paper, Cardboard, non-rigid plastic, appropriate cans and bottles, glass containers

Recycling

- YES
  - ALL Packaging
  - Paper
  - Plastic (including IV packaging & empty containers)
  - Foil packaging
  - Tyvek
  - Blue Wrap/Kimguard
  - ALL Glass Vials
  - Empty and unbroken

NO items visibly soiled with blood or bodily fluid:
Go in GARBAGE or RED BIN if saturated

UW Environmental Stewardship & Sustainability

Harborview Medical Center
Case Study: Waste Audit

The UW DEOHS lab trash sort resulted in:

1. Lab **compostable** waste pilot project

2. A new campus-wide **lab recycling brochure**

3. Infrastructure development to divert common lab waste such as **gloves and rigid lab plastics**.
Case Study: Glove Recycling

Terra Cycle/Kimberly Clark partnership

Labs, medical facilities and food service

Barriers to implementation:
- Purchasing & disposal costs
- Decentralized purchasing
- Contamination concerns

Major private biotech companies have calculated similar results

Biodegradable options new to market
Case Study: Fume Hoods

1200 fume hoods

Energy savings and CO\textsubscript{2} reduction strategy:
Recommissioning/decommissioning, Capital Projects, Automatic Fume Hood Sashes, Behavior/Education

20\% energy reduction for existing VAV’s = $100,000
Convert constant flow to VAV = $300,000
Reduce space heat 4\% = $375,000

7,000 MtCO\textsubscript{2}e = 4\% reduction
Case Study: Faucet Aerators

Puget Sound Energy

Natural Gas power plant provides steam to campus buildings

Save water, save energy, reduce CO$_2$ emissions

2-4 gpm replaced with $\frac{1}{2}$ gpm
Reduce laboratory water usage 75%
Case Study: Green Chemistry

DEOHS study:

- Purchasing records + current inventory = Top 10 chemical list for assessment
- Chemical selection tools: QCAT + Pharos + Greenscreen

Overall UW Cert labs:

- ¼ of labs practice GC
- 23% of labs microscale
- 3 design safer chems

The big issue:
DATA GAPS
Case Study: Green Chemistry

“How can we reduce the toxicity of new chemical substances?”

Using green chemistry & engineering in rational chemical design
Linking physiochemical properties and toxicity to employ the newest strategies of computer modeling to predict toxicity and redefine guidelines for the next generation molecules.

Collaboration: Yale University, Baylor University, The George Washington University and University of Washington

http://modrn.yale.edu/
Next Steps: DEOHS

1. Quantify improvements through re-certification
2. Certification program improvement recommendations from dept-wide data analysis
3. Continuing Education Webinar Series for 2015

COMMUNICATION & EDUCATION

DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
Communication & Education

- One-day training course for 80 EH&S professionals, lab scientists, and managers.
- Hosted by UW DEOHS and King County, Seattle, WA.
- Featured laboratory sustainability leaders in academia, government, and industry.
Communication & Education

Green Chemistry and Chemical Stewardship Certificate Program

Unique, comprehensive certificate program that leverages cutting-edge UW DEOHS toxicology research and the fore-front of green chemistry techniques and development.

Partnerships:

• Paul Anastas, PI of MoDRN, Yale University, NSF
• Mike Yost, Principal Investigator, UW DEOHS, STAC-TEC, NIEHS
• UW Foster School of Business
• Lake Washington Institute of Technology

Three-course online certificate program available January 2015

1. Sustainability, Toxicology & Human Health
2. Principles of Green Chemistry
3. Assessment Tools for Safer Chemical Decisions

Offered by UW Professional and Continuing Education, Environment & Sustainability

DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
Communication & Education

UW DEOHS Continuing Education Program:

Best Practices for Transitioning to Safer Chemicals

Selection, use and design of 21st century chemicals featuring OSHA’s new toolkit

SAVE THE DATE: January 29, 2015

Collaboration with: MoDRN and STAC-TEC

Supported by:
- Northwest Center for Occupational Health and Safety
- Washington Department of Ecology
- Northwest Green Chemistry
- Sustainable Technology, Alternate Chemistry-Training and Education Center (STAC-TEC)
Public-Private Partnerships