Life Cycle Assessment of washable and disposable cages

Marcel GYGER (1), Xavier WAROT (1), Violaine MAGAUD (2)
(1) Center of PhenoGenomics, School of Life Sciences, EPFL, Lausanne, Switzerland
(2) Quantis, EPFL Innovation Park, Lausanne, Switzerland
Contact persons: xavier.warot@epfl.ch; violaine.magaud@quantis-intl.com

PD12

Introduction

In the name of sustainability, a Organization **Life Cycle Assessment** (LCA) of the EPFL animal facility was performed in collaboration with Quantis (www.quantis-intl.ch). LCA is a multi-stage approach from the cradle to the grave. It is also a multi-criteria approach, allowing for impact assessment on **climate change** and other environmental indicators such as **human health** and **ecosystem quality**. One of the purposes of LCA is to avoid displacing environmental impacts (between life cycle stages, geographic locations, environmental compartments, impact categories or generations).

The first goal of the study was to evaluate the environmental impact of our facilities and to identify how to reduce those impacts (See Poster 143). The second step was then to evaluate one of the identified potential reduction area: the replacement of all washable cages currently used by disposal ones.

EPFL animal facilities assessed

Washable cages (reference scenario)
- One species: mice (9'000 individually ventilated cages)
- Specified pathogen free, conventional, phenotyping units, P1 & P2 activities
- Cage and rack washing & autoclaving

Disposable scenarii, based on reference scenario
- V1: same disposable cage change frequency of 10 days as for washable cages
- V2: longer disposable cage change frequency of 2 weeks (cage bottom) and 1 month (lid &feeder)

Which activities were monitored?

The monitoring of the EPFL animal facility during 2012 included the following activities (the ones adapted for the disposable scenarii are labelled in **bold**):
- Administration and back office (building and energy, commuting and business travels)
- **Mice husbandry** (cage & rack production and distribution, litter and feeding, building and energy consumption)
- **Cage, rack and other material washing & disinfection**
- Ventilation
- Import and export of animals (transportation)
- Scientific procedures (material, building and energy)
- **Waste management**

Compared to the washable scenario the disposable ones :
- **Consume 3 times less gas for the autoclaves**
- **Require 15 to 30 times more material for cage production**

Environmental impact indicators

Climate change from:
- Global warming

Human health from:
- Human toxicity
- Ionizing radiation
- Respiratory effects
- Ozone depletion
- Photochemical oxidation

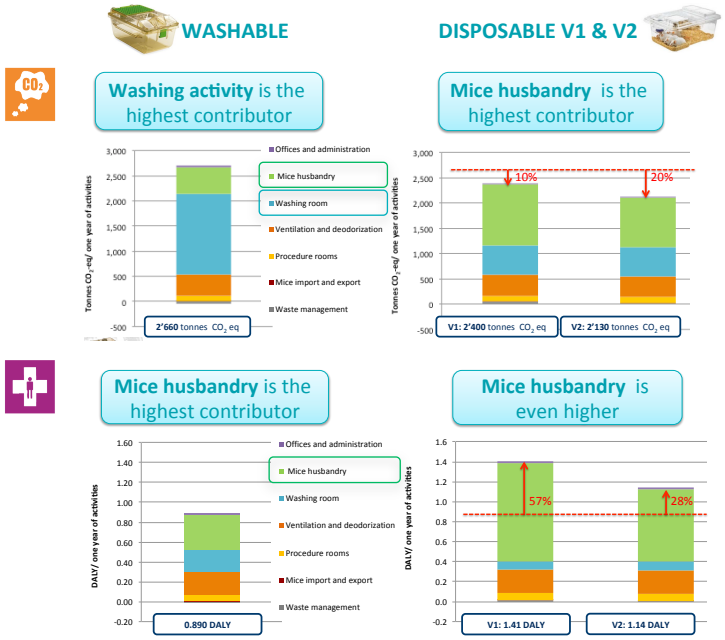
Ecosystem quality from:
- Aquatic acidification
- Aquatic ecotoxicity
- Aquatic eutrophication
- Terrestrial acidification/ nutrification
- Terrestrial ecotoxicity
- Land occupation

Results

Results are limited to the objectives, goal and scope and assumptions defined in this study, and are **valid only for the specific case of the EPFL animal facility**.

	Washable cages	Disposable cages
CO_2	2'660 tonnes CO_2-eq Impact of ~**230** average Europeans per year	2'130 to 2'400 tonnes CO_2-eq Impact of ~**185** to **210** average Europeans per year
Human health	0.890 DALY Impacts of ~**125** average Europeans per year	1.140 to 1.400 DALY Impacts of ~**160** to **200** average Europeans per year
Ecosystem quality	334'185 PDF.m².yr Impacts of ~**24** average Europeans per year	356'050 to 388'750 PDF.m².yr Impacts of ~**26** to **28** average Europeans per year

As it is difficult to conclude on the differences for the indicator "ecosystem quality" (high uncertainty), the detailed results are presented only for "climate change" and "human health"



Key findings on climate change and human health

For **all indicators**, **washing activities** and **mice husbandry** are the main contributors.

✓ *Climate change*:
- Globally, **climate impact is lower for disposable cages** than for washable cages
- For **washable cages, washing is the main contributor**, mainly due to the steam production by gas.
- For **disposable cages, mice husbandry is the main contributor**. This is mainly due to energy consumption for air moistening, heating and rack ventilation (similar as washable cages) and to cages production and distribution. Mice husbandry has much higher impact than for washable cages, due to the much higher amount of cages produced.

✓ *Human health*:
- Globally, **human health impact is higher for disposable cages** than for washable cages.
- For **washable cages, mice husbandry is the main contributor**, mainly due to cages production (materials + manufacturing), and to the energy consumption for air moistening, heating and rack ventilation.
- For **disposable cages, mice husbandry has even higher impact than for washable cages**, due to the higher amount of cages to produce and distribute.

Conclusion: How to choose the alternative with the lowest impact?

For the specific case of the EPFL animal facility, there is no clear best environmental option between washable and disposable cages. This conclusion is only valid for this study, and could be different depending on the settings of the animal facility considered (e.g., cage change frequency, weight and material of cages, optimization of washing and sterilisation process, etc…)

To reduce the animal facility environmental impacts, better try to **reduce the impact of each alternative** rather than changing the alternative (washable or disposable)

✓ **Washable cages**: decrease the **primary energy** for washing the cages

✓ **Disposable cages**: increase the **life span** of disposable cages