Case Study:
The Center for Infectious Disease Research

This is a case study written by Tim Dawe, LATg, ILAM, and is the vivarium manager of the Center for Infectious Disease Research located in Seattle, WA.

BACKGROUND

The Center for Infectious Disease Research (formerly Seattle BioMed) is Seattle's first global health organization and is the largest independent, non-profit organization devoted solely to infectious disease research. With about 300 staff members, we tackle the world's most devastating diseases and focus on developing new solutions.

The mission of the vivarium is to provide SPF rodents with the best environment possible, as-well-as provide workspace, training and technical support to aid researchers on their ongoing projects.

THE CHALLENGE

Built in 2004, the main vivarium was designed to house up to 2,000 mouse cages. Cage sanitation was conducted using a pass-through cabinet washer. Cages, bedding and water bottles were sterilized in an adjacent laboratory glass processing area. In 2009 an ABSL-3 vivarium and laboratory space was added. In 2011, due to a lack of space, the Institute's breeding program was contracted to another institution for housing and management. In addition, an IVIS rodent imaging system was required to be housed on the floor above the vivarium due to lack of space near the animal holding rooms. Its location required transporting animals out of the main vivarium thus potentially adversely affecting the biosecurity of the central vivarium.

"Switching to the Innovive disposable caging system provided a better environment for the animals and reduced the labor by approximately three FTE's while eliminating the need to expand mechanical cage washing capacity."

In 2012 it was determined that existing facility operations and research support capacity was limited by lack of space, inadequate cage sanitation capacity as well as insufficient physical infrastructure to support expanding animal use procedures and imaging.

The existing Individual Ventilated Cage (IVC) system was aging and in need of replacement. Cage bottoms and water bottles were changed weekly while the tops and wire tops were changed every other week. Standard soiled caging was required to be handled five times prior to ending up on the clean side and ready to be used again. Contaminated cages from the ABSL-3 were required to be handled nine times from Biosafety Cabinet to being ready for reuse. This included bagging, autoclaving, dumping bedding and presoaking cages, scraping, washing cages in the cabinet washer and sterilizing cages prior to use. Similar decontamination and preparation procedures were required to process drinking water bottles.

All caging was autoclaved prior to use and the water bottles were filled by hand. This process was very labor intensive and made more difficult by the lack of an adequately sized mechanical cage washer and cage processing area.

A large area – 17% of the main vivarium – was taken up by the clean and dirty sides of the cage washroom. The cabinet washer was reaching its maximum capacity as cage numbers increased. On the dirty side of the washroom the capacity of the cabinet washer was causing a backup of dirty caging limiting the number of staff able to work in the area and hindered staff movement. On the clean side, space was limited due to the required amount of clean caging that needed to be staged for set up and autoclaving. Autoclaved equipment had to be stored in the hallway making them very difficult to navigate by researchers, vivarium staff and carts.

THE SOLUTION

Several systems were evaluated and it was determined that converting to disposable caging from Innovive was ideal for our situation. Switching to the new system provided a better environment for the animals and reduced the

Image (large) – New Procedure / IVIS room, formerly the clean side of the cage wash room

Image (inset) – New Supply room, formerly the dirty side of the cage wash room

labor by ***approximately three FTE's*** while eliminating the need to expand mechanical cage washing capacity.

The initial delivery of Innovive racks was used in our ABSL-3 facility in January of 2013. The disposable caging and water bottles only requires bagging, autoclaving and being placed in the dumpster for disposal. In addition to reducing biosafety concerns associated with processing cages from this facility, there was a significant reduction in the labor required of at least .5 FTE weekly to dispose of cage waste from the ABSL-3 facility.

By June 2013 all animals had been transferred to the Innovive caging system. The move to 100% disposable caging allowed for the removal of the cage washer and freeing up space to expand research support capacity.

Part of the recovered space was converted to a new procedure room to house the IVIS system thus improving biosecurity of the colony by reducing the movement of animals in and out of the vivarium. The compactness of the disposable caging reduced the storage space required for cage processing by approximately two thirds and eliminated the storage of cages in the hallway.

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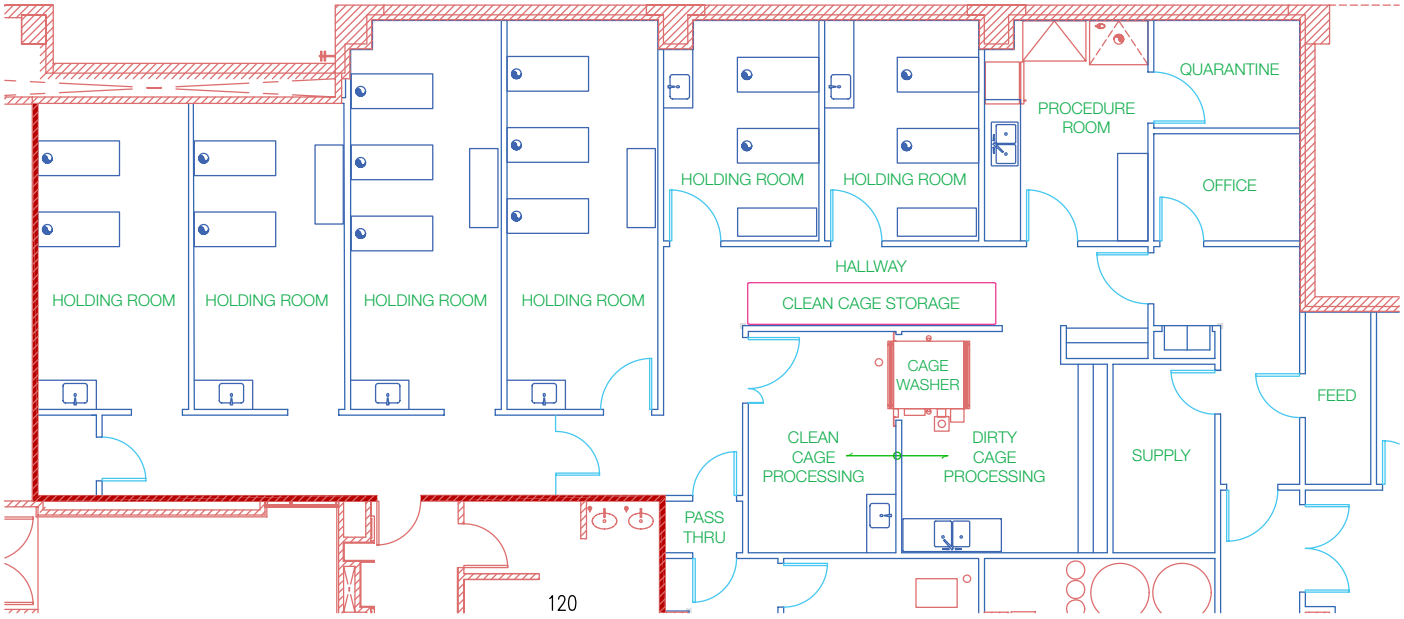
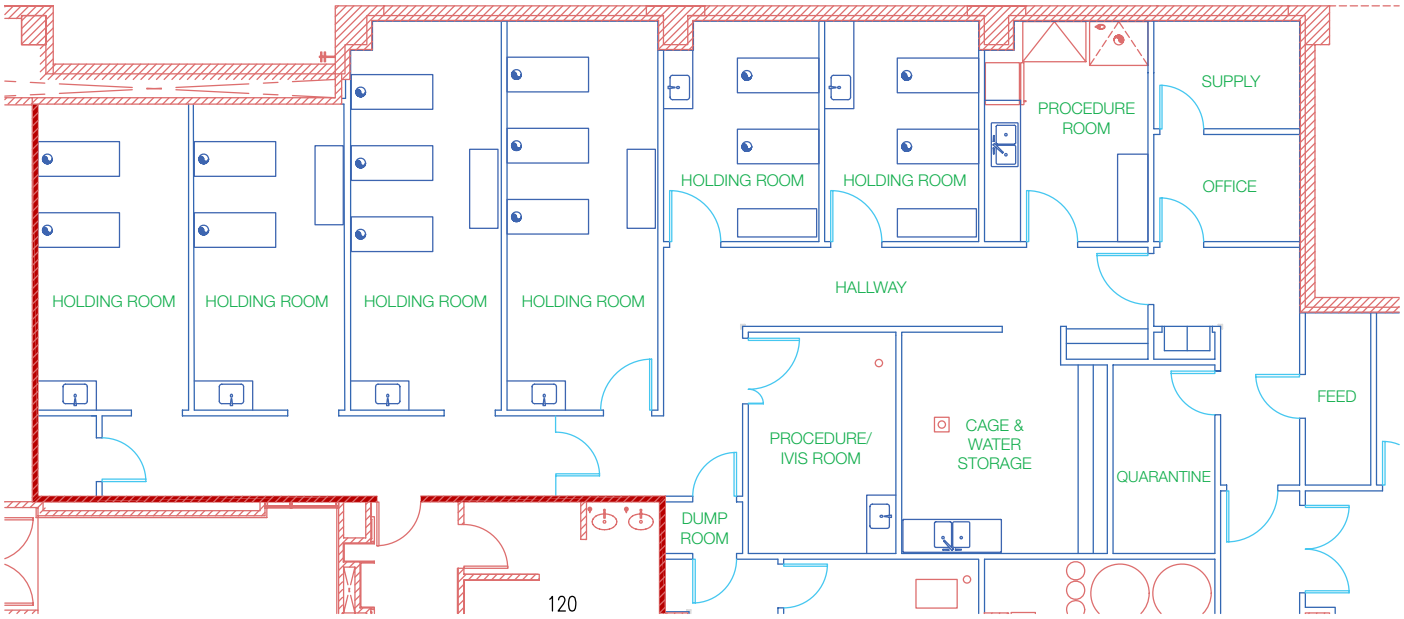
A small room was used as an airlock to move caging from the vivarium, next door to autoclaves that are operated by a different department. Switching to prebedded, irradiated disposable caging made this operation no longer necessary. The airlock was enlarged and is now used for processing dirty cages in a new NuAire AllerGard ES (Energy Saver) NU-607 Class I Animal Bedding Disposal Station. Bedding is removed from soiled cages and bagged for disposal. Used caging is stacked, condensed and placed in bags the caging arrived in. The empty caging and dirty bedding can then be moved to the recycle and trash bins located on the loading dock without having to pass through the vivarium.

It was desirable to bring the colony back to our facility to reduce costs, increase colony biosecurity, and provide increased oversight of the colony. Shell space on the second floor near the ABSL-3 facility was available for this purpose. Construction of a 542 ft^2 animal holding room and a 248 ft^2 anteroom/office space started in September of 2013 and finished in early December.

Image (below) – New Breeding room, formerly outsourced.



Original Center for Infectious Disease Research floor plan, using washable caging

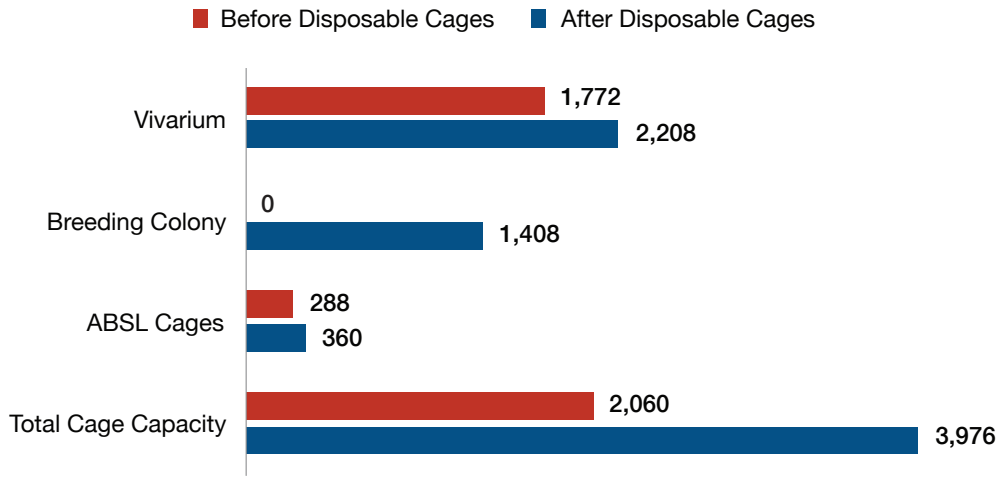


Renovated Center for Infectious Disease Research floor plan, using disposable caging

THE RESULTS

We worked with Innovive, Inc to implement the change over from standard caging to disposable caging. The change forced a complete redesign and streamlining of facility workflows and patterns. The use of the disposable caging reduced the number of FTE's required by 3, and we were able to increase cage numbers by 93% without hiring additional staff. Overall capacity of the existing vivarium increased from 2,060 to 2,568 cages with the Innovive IVC's utilizing the same footprint as the old IVC system. The new breeding room added capacity of 1,408 cages in 542 square feet.

Cage Capacity



All caging is received double bagged and sterilized in packages of 25. The design of the disposable caging takes up much less room as compared to standard caging. A stack of 25 cage bottoms is only 18 inches tall as compared to a stack of 25 standard caging that is over 5 feet tall. The space savings was significant and 2-3 weeks of caging can easily be stored in a single room and is not stored in the hallways. Sterile pre-filled water bottles are received from Innovive. A pallet of pre-filled water bottles fits on a standard heavyduty 4' x 2' movable cart. This is a significant reduction in storage space required for standard refillable water bottles. The small packages of 12 are more ergonomic and reduce the risk of injury to the staff as compared to the stainless steel racks of filled water bottles.

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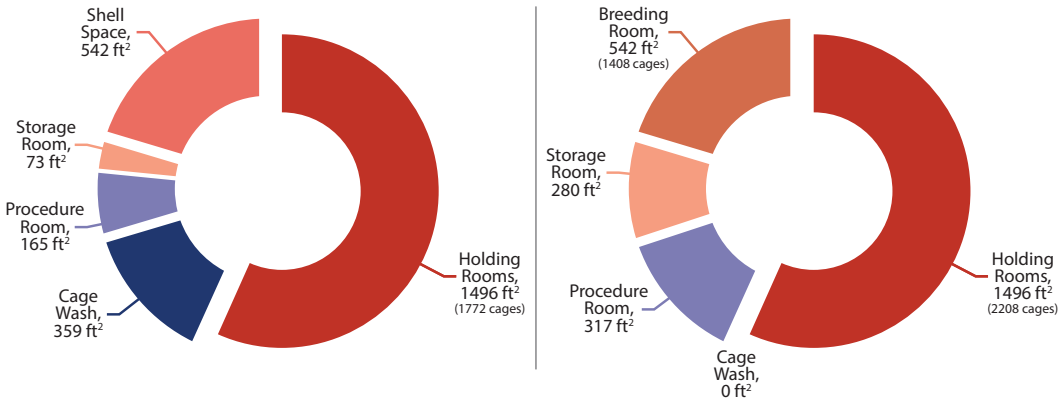
Reduction of FTEs

	Before Disposable Caging	After Disposable Caging	Net Change
FTEs	9	6	-33%

Vivarium Square Footage

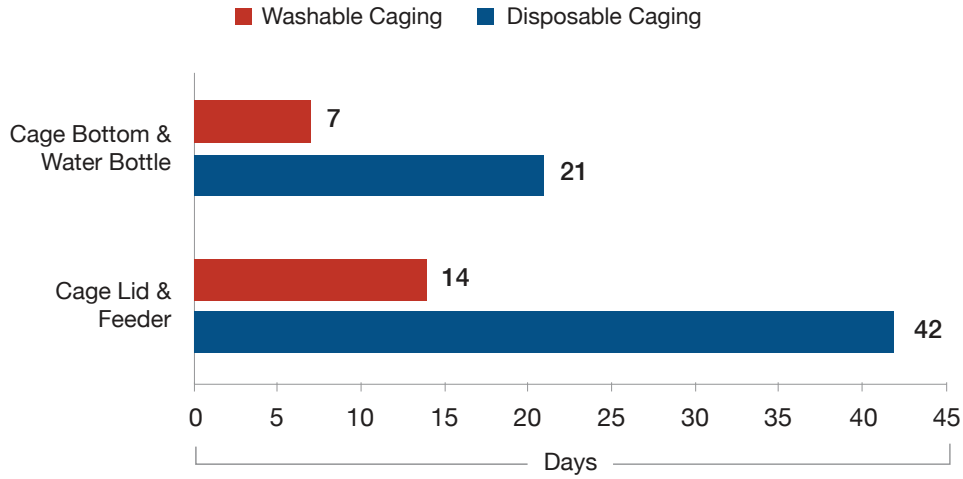


Before Disposable Caging *After Disposable Caging*

Extended cage change

Further savings were realized by extending the standard change interval for water bottles, cage bottoms, tops and feeders. The Center for Infectious Disease Research performed several microenvironmental studies to determine the best interval for changing caging and water bottles. The testing verified the adequacy of changing cage bottoms and water bottles to once every 21 days and changing cage tops and feeders to once every 6 weeks. The testing results and expanded changing intervals were reviewed and approved by the Institutional Animal Care and Use Committee (IACUC). This has resulted in a significant savings in labor, caging costs and amount of material placed into the recycling or garbage disposal stream.

Cage Change Frequency



"[Extending the cage change intervals have] resulted in a significant savings in labor, caging costs and amount of material placed into the recycling or garbage disposal stream."

Change stations

The change stations in all animal rooms were replaced with the NuAire AllerGard ES (Energy Saver) NU-619 Innovive® Edition Animal Transfer station. The change station has a larger work surface than our previous stations and is designed to store the Innovive caging supplies. This allows for greater efficiency when changing cages and all required supplies can fit into the station at one time. The ability to raise and lower the change

station using the hydraulic lift system makes it more ergonomic for the user, lowers the fatigue level and reduces the risk of injury.

Decreased movement of mice in and out of vivarium

The IVIS imaging system was located on the floor above the vivarium. After the remodel of the cage wash area a new procedure room was completed to house the IVIS imaging system. This decreased the movement of animals outside of the facility and the associated risk of cages moving in public spaces and potentially compromising the rodent biosecurity program.

Reduction of waste and energy costs

The change over to the Innovive disposable caging system has significantly reduced the use of water required to prepare caging. The number of autoclaved loads per week has been reduced from 40-55 loads to 1 load per week in the main vivarium and from an average of 7 loads per week to 3 loads per week in the ABSL-3 facility. The associated utilities that provided steam to the autoclaves also dropped proportionally. The resulting decrease in autoclave use will prolong the life of the autoclaves and lower the long-term maintenance requirements.

Reduction of Waste and Energy Costs

Autoclaved Loads	Before Disposable Caging	After Disposable Caging	Net Change
Main Vivarium	40-55 loads / week	1 load / week	-98%
ABSL3 Facility	7 loads / week	3 loads / week	-57%

As part of the decision to change to a disposable caging system, the King County Solid Waste division was contacted and verified that all caging materials are recyclable. The bedding is still dumped from each cage prior to recycling as was done with standard caging. The disposable caging does not require scraping or rinsing with water as did the standard caging. The bedding goes into the regular trash.

Reduction in PPE use

Once the project was completed, it was the ideal time to review the personal protective equipment (PPE) used in the main vivarium. The literature was reviewed on PPE effectiveness and it was determined to no longer require shoe covers, bonnets or surgical masks to enter the animal holding areas. We determined that each of these items did little to decrease the risk of infection of the animals when proper cage handling and workstation SOP's were followed. Decreasing the PPE's requirements had a positive effect in lowering operating costs and amount of material put into the waste stream. No changes were made to the ABSL-3 PPE requirements.

AAALAC Accreditation

Once the remodel and reconfiguration was completed and occupied, it was possible to request our first accreditation site visit by AAALAC in November 2013. The changes made to the facility reduced the need for storing caging in the hallway, and possibly having to replace or modify the cage washer to achieve accreditation. In March of 2014 we were granted full accreditation.

Conclusion

By switching to the Innovive disposable caging system, we were able to remove the cage washer and install a new procedure/IVIS room and supply room, increase the vivarium cage capacity by 25%, reduce FTE needs, improve employee ergonomics, and reduce utility and caging costs. We also installed a rodent breeding room, which increased colony oversight and biosecurity, as well as reduced costs. With these improvements, we were able to streamline our workflow patterns, simplify our PPE requirements, and achieve AAALAC accreditation without expanding our physical footprint.

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