TECNIPLAST

DVC
DIGITAL VENTILATED CAGE

Release Note DVC 6.0
&
DVC® Operator Software Manual

Please keep in mind that all the instruction manuals and release notes are available at the following web address:
https://digitalcage-tecniplast.com/en/manuals.html

RELEASE NOTE 6.0

This DVC® 6.0 is a major release because it introduces significant cosmetic changes and new manual tasks.
The most important new features are briefly listed below, together with the new DVC® Operator manual as a global and detailed reference.

Feature #1 – New Cage Label Types (Stock, Breeding, Experiment) and their new corresponding fields

Feature #2 – new manual weaning tasks (between 2 cages and between 3 cages)

Feature #3 – New Cage colour associated to the cage types (stock = green, breeding = purple, experiment = blue)

Feature #4 – Cage Add-ons (only for the experiment cage type)

Feature #5 – Treat all animals (only for the experiment cage type)

Feature #6 – Pup as animal type (only for breeding cage type)

Original instructions for use

In case of a disagreement between the translation and the original version of this manual or a notice or disclaimer, the original English version will prevail.

Technical Support

For technical support, call +390332809711 or send an email to **digilab-service@tecniplast.it**

Please refer to the link below to download Tecniplast Environmental Responsibility Policy:

http://www.tecniplast.it/en/environmental-responsibility.html

PREFACE

Dear Customer,

This manual aims to provide the user with all the information and safety standards required for the correct and safe installation, use and maintenance of the machine you have purchased.

Keep the manual in an easily accessible place, known by the Installer, the Operator, the Supervisor and the Service Technician, who should carefully read it to have a clear understanding of the installation, use, and maintenance procedures as well as hazardous applications to avoid.

This manual is an integral part of the System and should follow it, even in the event of a change of ownership, until final decommissioning.
Should the manual get damaged or lost, a copy can be requested from TECNIPLAST.

In order to receive technical assistance, spare parts or optional extras not required on order, contact TECNIPLAST and give the machine serial number, version, and year of manufacture (see label on the machine).

The Operator, the Supervisor and the Service Technician must know all the standards reported in this manual before using the machine or carrying out maintenance procedures.

COMPANY CONFORMITY TO ENVIRONMENTAL POLICIES

At TECNIPLAST, both our production facilities and our end products reflect our commitment towards environmental policies in terms of:

- Compliance with the principles and contents of current laws and regulations concerning the environment;
- Reduction of the environmental impact deriving from our activities, maintaining the right balance between environmental, social and economic responsibilities;
- On-going request for innovative applications in order to reduce the environmental impact deriving from waste materials, energy consumption and to improve the use of natural resources and raw materials.
- Preventive evaluation of the environmental impact of new plants and processes and improvement of existing ones using all possible and economically sustainable solutions to increase our environmental performances.
- Incentivisation and co-responsibility of employees towards this policy by means of adequate training
- Use of effective tools to communicate principles and goals of such an environmental policy to our dealers during meetings and training courses;
- Defining during the design and development of new products the correct use and dismantling instructions to minimize environmental impact.

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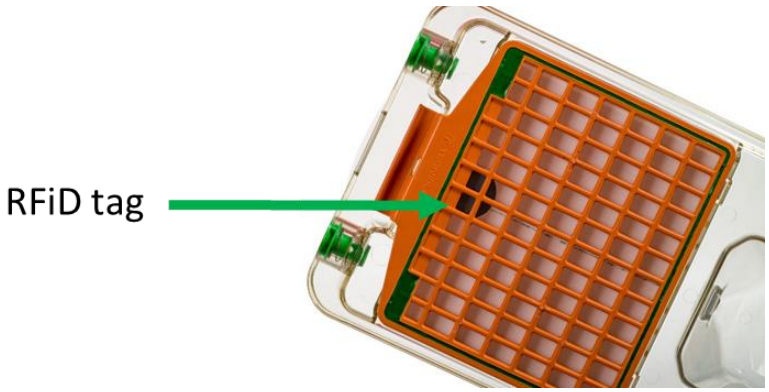
Table of Contents

1. Introduction

The DVC® System is an infrastructure consisting of several hardware and software parts linked together to provide extraordinary and revolutionary opportunities to the final user.
It is mainly designed for Facility Managers and Operators. It provides different and flexible features to improve several aspects of the Facility: from streamlining workflow management to enhance animal welfare, from real-time tracking and billing opportunity to save running costs.
This User Manual will describe the System workflow and how to perform the routinary animal facility tasks using the DVC® System.

2. System Description

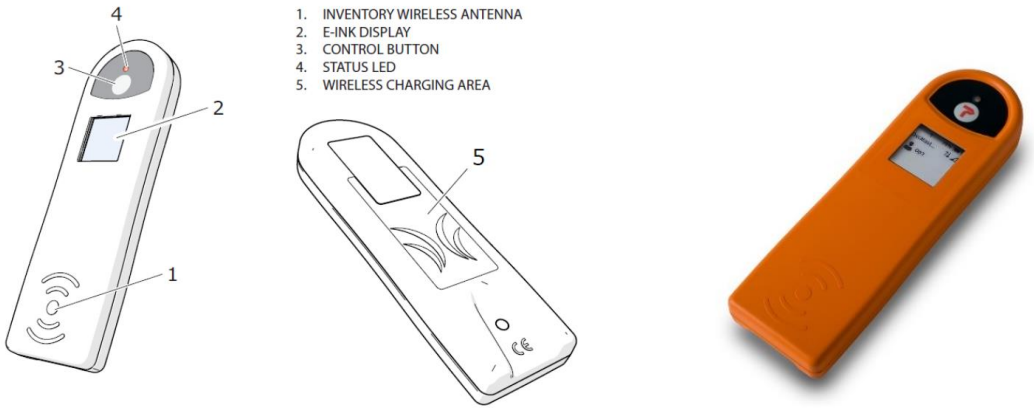
The DVC® System has been designed to track any cage in any position of the DVC® Rack in real-time, thanks to a special RFID antenna embedded into the DVC® board.
Each IVC Cage top needs to feature a unique RFID tag that uniquely identifies it in the entire Facility.
This RFID tag stuck on the microbiological filter of the cage is mandatory as the related content (Cage ID and Animal information) refers to this unique code in the DVC® System.



In order to register the information related to the Cage (Cage ID and Animal information), the RFID tag is to be read by a unique RFID Wireless Reader and the user needs to interact with the DVC® Operator Interface.

2.1 RFID wireless reader association

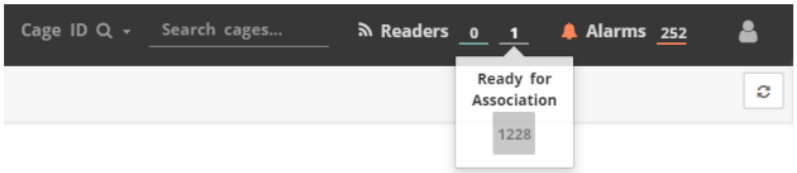
The RFID Wireless Reader is a device used to read and transfer the RFID Tag to the DVC® Master.
To accomplish the various animal Facility tasks, the RFID Wireless Reader needs to be linked to the DVC® Master and associated with a specific User every time a task (manual or planned) involves opening the IVC cage.



2.1.1 How to Switch on the RFID Reader: Ready for Association status

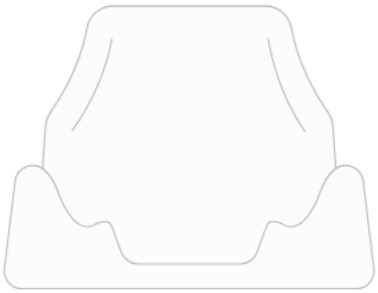
To switch on the Reader, proceed as follows:

- Press the central control button with the Tecniplast logo (3) for at least 5 seconds.
- The LED on the Reader (4) will show for about 4 seconds, and then it goes off.
- The Reader is now Ready for Association. RFID Readers Ready for Association are "visible" to the DVC® server but not physically associated with any User yet. Anyone in the Facility can use these Readers at this stage.
- The Reader now becomes Ready for Association. RFID Readers Ready for Association are "visible" to the DVC® server but not physically associated with any User yet.
- Log in with User credentials in the DVC® Operator interface.
- Check that the numerical field referred to the Reader Ready for Association increases by 1 unit.



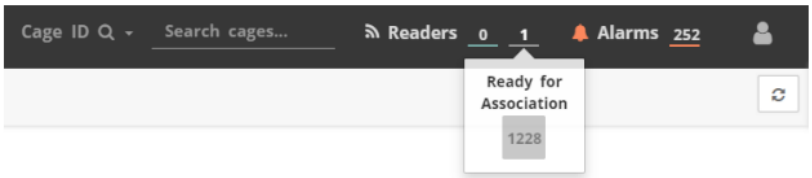
2.1.2 Reader association with a specific User

Every time the user selects a task (manual or planned) that involves opening the IVC cage, he/she needs to associate a specific RFID Reader (Ready for Association) to him/herself.

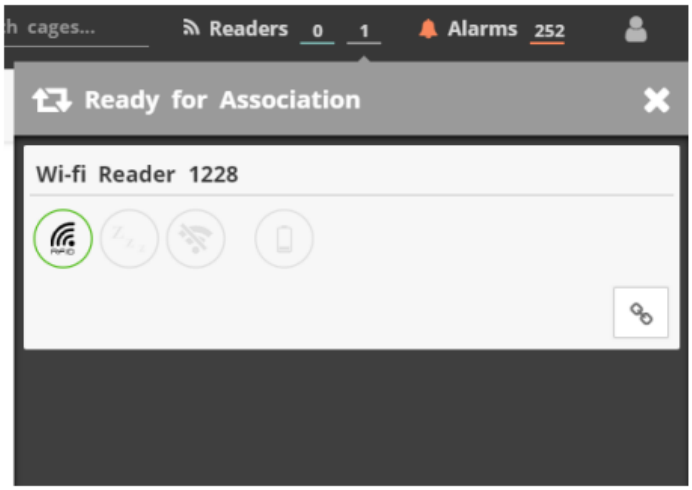


To associate an RFID Reader:

- Click on the Ready for Association numerical field: a pop-up window shows all the RFID Readers currently in the list. Please note that every RFID Reader has a unique code from the factory, also shown in the device's e-ink display.



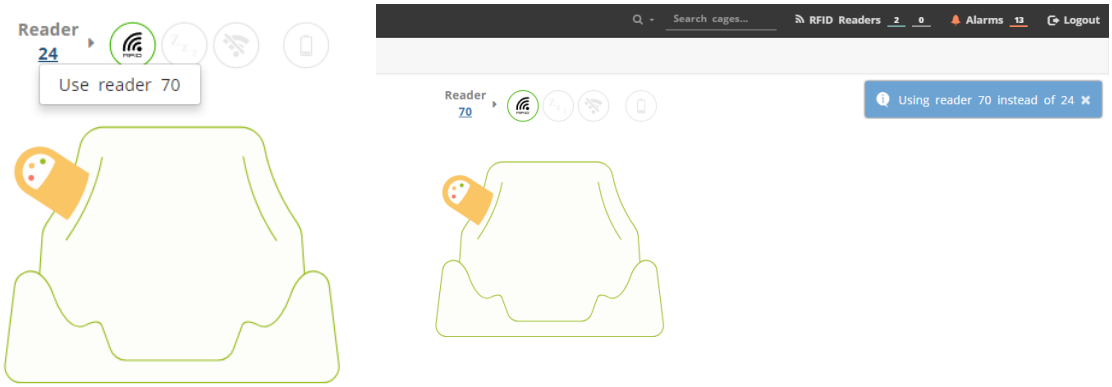
- Click on the "chain" icon (Associate to me) to manually associate the RFID Readers to yourself.



2.1.3 How to select a specific RFID Reader

If more than one RFID Reader is associated with the same user, and he/she needs to select a specific one, proceed as follows:

- Click on the number of the currently displayed RFID Readers. A label with the numbers of the other associated RFID Readers is displayed.
- Select the RFID Reader you need. A dedicated message will be displayed on the page right-hand side to confirm that the event has been successfully performed.



2.1.4 How to switch off the RFID Reader

First of all, it is not possible to completely switch off the RFID Readers,
By keeping the central control button pressed for 3 seconds, the Red LED blinks, and the device reboots.
The only proper way to keep the RFID Reader in the correct status is to place it back into the DVC® Charger at the end of the working day.
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2.2 RFID Reader status

The RFID Reader may have a different operating status indicated both by the LED on the device and by the corresponding symbol on the DVC® OPERATOR interface.

2.2.1 Normal operating status

Under normal working conditions, the status section of the DVC® OPERATOR interface shows the icon below.

2.2.2 Low Battery

When the battery of the RFID Reader is low, the low battery icon is displayed in the DVC® OPERATOR interface

To recharge the RFID Reader, put it in the DVC® Charger station for about 6 hours. While charging, the RFID Reader LED will be fixed.

2.2.3 Out Of Range

The RFID Reader has a maximum working distance from the DVC® Master, which depends on several factors like the battery's charge level, the room layout (obstacles between the RFID Reader and the DVC® Master, etc.).
If the RFID Reader maximum working distance is exceeded, the RFID Reader Status is set to out of range.
The icon shown below is displayed in the DVC® OPERATOR interface, and the RFID Reader cannot be used until it is moved back next to the DVC® Master, below the maximum working distance threshold.

2.2.4 Sleep Mode

If the RFID Reader is not used for more than 10 minutes, its status is set to Sleep mode to save battery.
The RFID Reader red LED will blink (long blink, every 3 seconds). The icon shown below is displayed in the DVC® OPERATOR interface.
To return to normal operating mode, press the central control button with the Tecniplast logo.

2.3 Cage opening procedure: Top Holder Usage

In order to ease the procedure of opening and working on a cage, Tecniplast has developed a tool called Top Holder to be used to read the RFID TAG of the IVC Cage properly.

The Top Holder features four housings for the RFID Reader.

If the cage top is placed vertically, the RFID Reader needs to be put in the side housings (either on the right or the left-hand side).

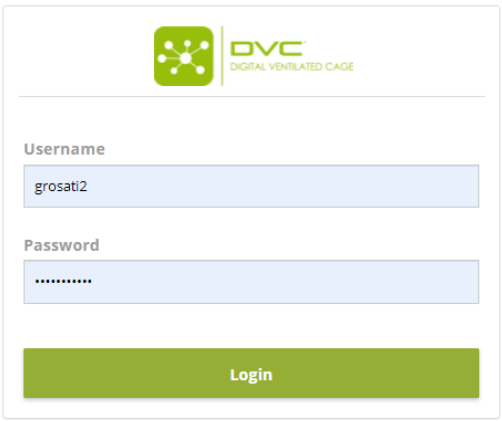
If the cage top is placed horizontally (lying on its side), the RFID Reader needs to be put in the top housings as shown.

The RED LED stays fixed as soon as the RFID Reader reads the IVC Cage top RFID tag. A window with the cage information is displayed in the DVC® OPERATOR interface (only when the RFID Reader is already associated with the user).

3. Software Manual

3.1 Login

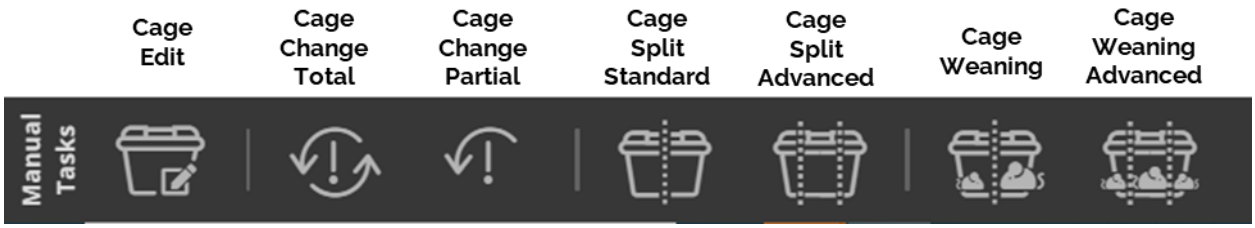
Enter your Username and Password. The System Home Page of the DVC® OPERATOR interface is displayed.



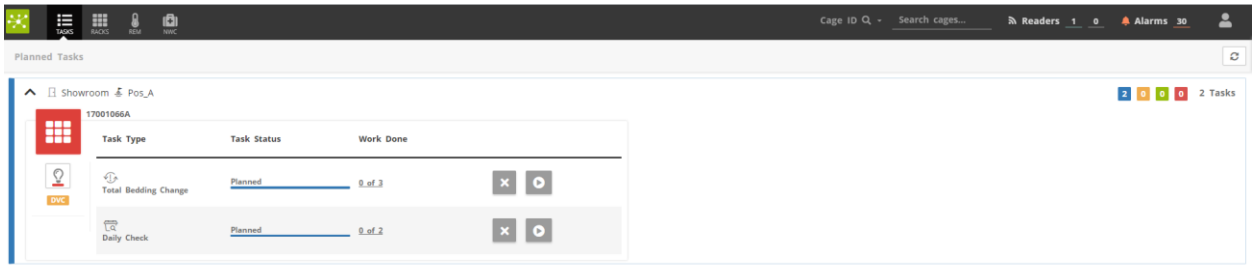
The home page is, by default, the Planned Tasks page.

3.2 Manual vs Planned tasks

In the DVC® System, tasks are considered "Manual" when chosen and performed by the user because of his/her needs.
Vice versa, (DVC®) Planned tasks are daily generated by the DVC® System and represent tasks suggested to be performed by the user.
The possible manual tasks available in the DVC® System are shown in the bottom bar



While the assigned DVC® Planned tasks are shown in the central area of the page.



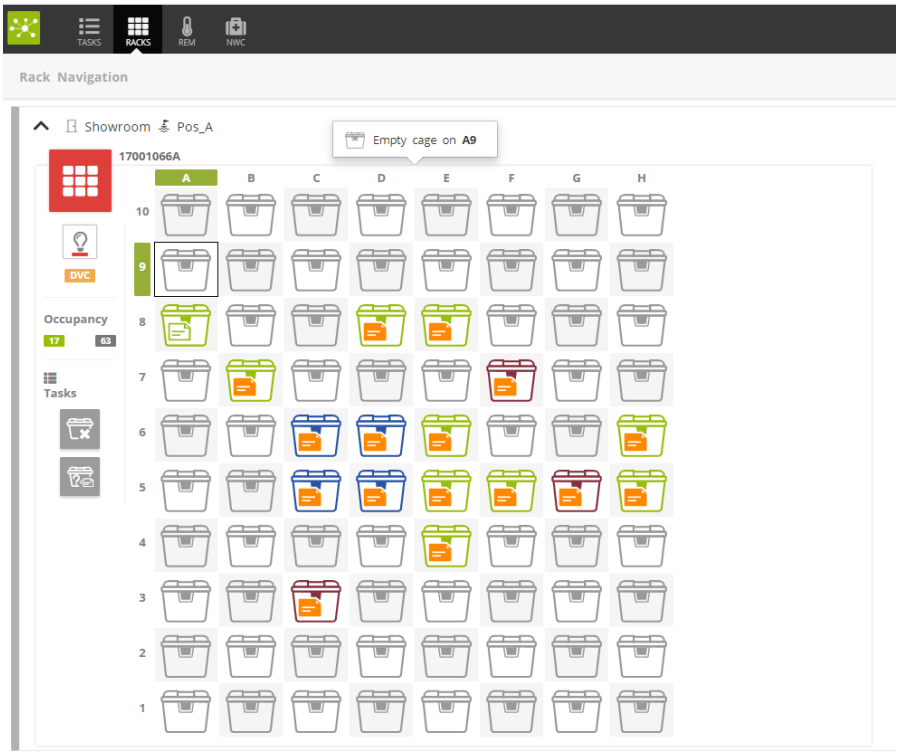
3.3 Manual Task 1: How to register a cage

It is possible to register a cage in two different ways:

- In **real-time**, while physically working with it under the changing station/working bench using the RFID Readers and clicking the "Cage Edit" icon  . The following page appears (the RFID Reader is already associated with the user in this example):

The corresponding electronic cage label appears when physically opening a clean cage following the procedure described in the previous sections.

- **Offline** by selecting it from the corresponding DVC® Rack view opened through the DVC® Operator interface. Click on the corresponding "Empty" grey Cage, and the electronic cage label appears:



In both cases, this is the electronic cage label at the beginning of the creation:

The DVC® System features three different electronic cage labels:

- **Experiment** (blue)
- **Breeding** (magenta)
- **Stock** (green)

They differ for some information that is explained in the following pages. Users can choose the right one by clicking on the "Empty" icon.
A small pop-up appears, and the cage type can be selected.

3.3.1 Register a stock cage

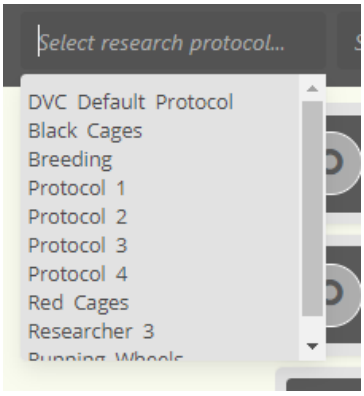
When the "Stock" cage is selected, the following page appears:

The user is requested to insert:

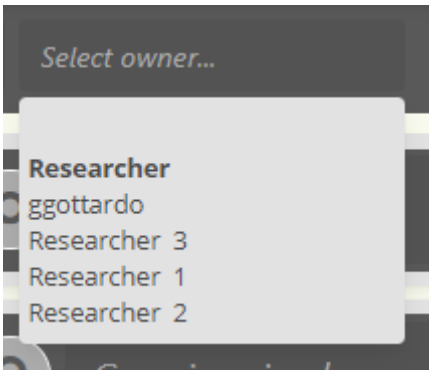
- **Cage ID** (mandatory): by typing directly in the corresponding top-left area.
- **Animal(s)**: As many as need by clicking on the corresponding icon 

Once this initial information is set, more fields appear and can be filled by the user:

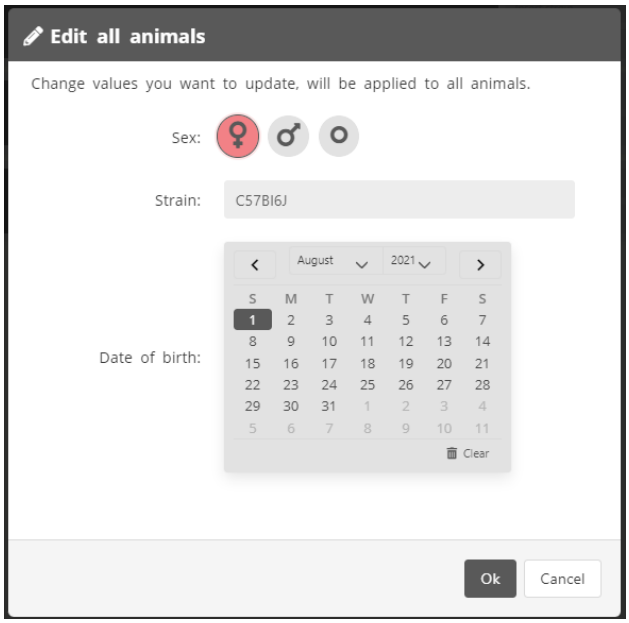
First of all, the field named "Research Protocol" is automatically filled with the "DVC Default Protocol". Therefore, if the user wants to assign a different Research Protocol, this one has to be preventively created in the DVC® Workplace Interface. Then, by clicking this field and deleting the words, all the available ones are listed, and the user can select the right one:



Same working principle for the "Owner" of the Cage (this can be a Researcher or a Group of Researchers who have been preventively created in the DVC® Workplace interface)



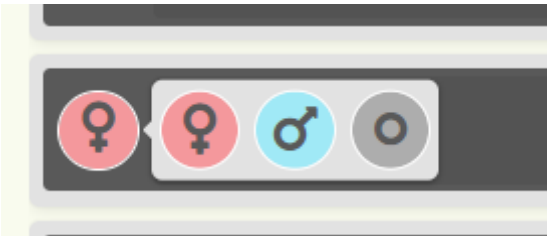
Then, if they share similar information, all the inserted animals can be edited together by clicking on the button Edit all animals.
A pop-up appears, and the animal fields can be edited (Sex, Strain and DoB):



By clicking the "OK" button, the same information is assigned to all the animals.

Please note that the field "Marking" is not included in the "Edit all animals" functionality because it cannot be the same for all the animals, but it can be manually selected and assigned.
The field "Cage Parent" can be manually assigned (if the user wants to track such information). Moreover, for clarity, this field is automatically filled when pups are weaned in a different cage.

The same information regarding animals can be edited one by one by clicking on the corresponding fields (this functionality is needed, especially when the animals are not sharing similar information).

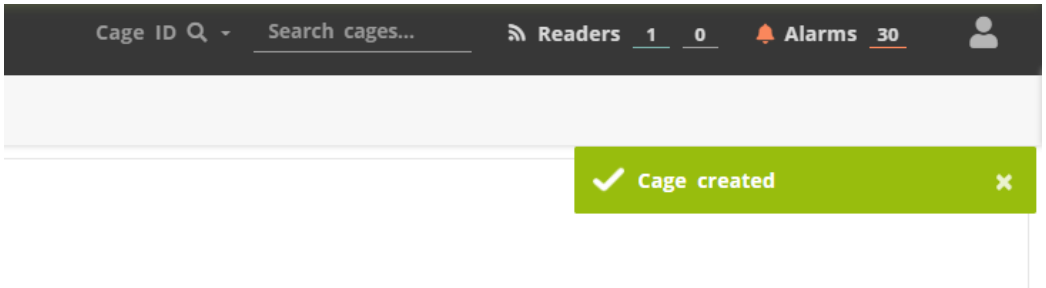


Then, by default, when an animal is added to the electronic cage label, it is defined as "Generic animal":

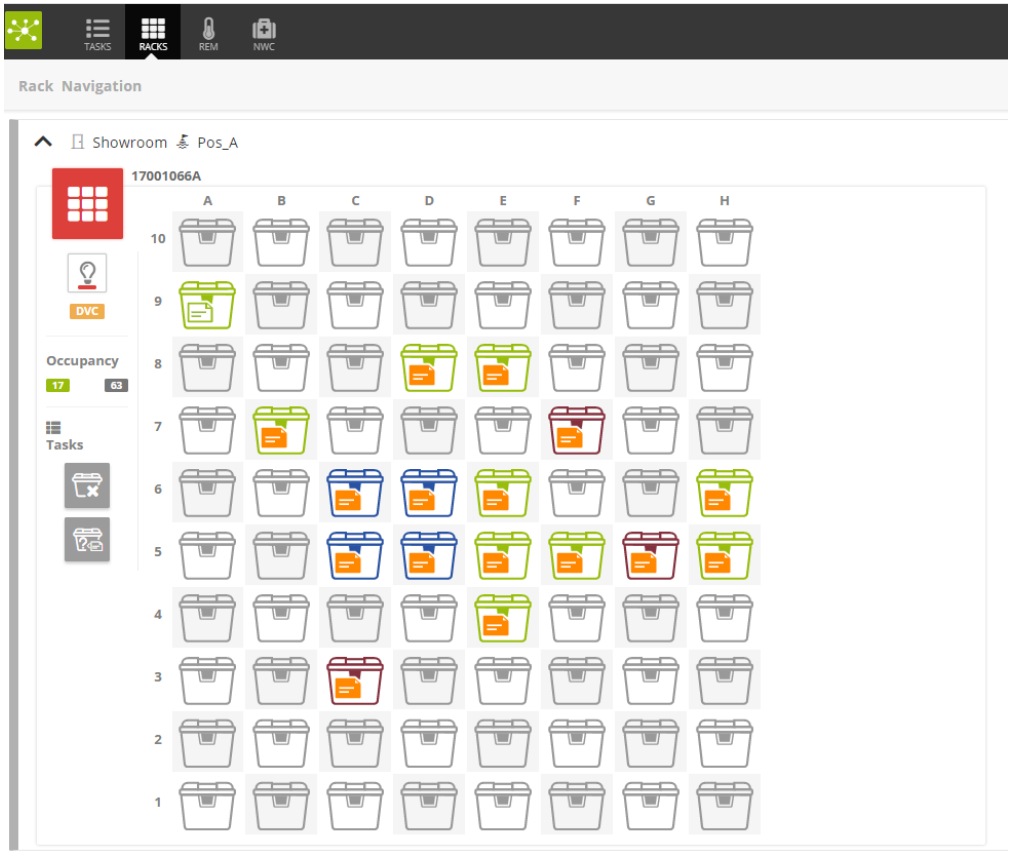
The user can assign a specific Animal ID if needed by simply clicking on the corresponding area and directly typing it:

Finally, by physically closing the cage (in case of real-time creation) or by clicking the "Save" button (in case of offline creation), all this information is assigned to the cage itself that starts being monitored by the DVC® System and generating corresponding data.

A small green pop-up, appearing on the right side of the page confirms that the cage has been successfully created:



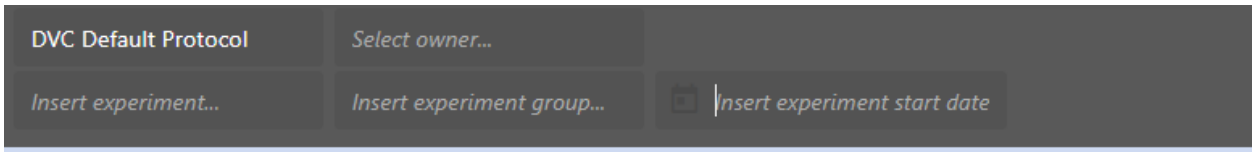
The DVC® Rack view is updated consequently:



3.3.2 Register an Experiment cage

Compared to the previous workflow, the "Experiment" cage brings more fields to be filled. More specifically, new fields refer to the cage information:

- **Experiment ID** (it can be created from scratch or picked from a list of existing ones)
- **Experiment group** (it can be created from scratch or picked from a list of existing ones)
- **Experiment start date** (by default, it is today's date, but it can be modified)

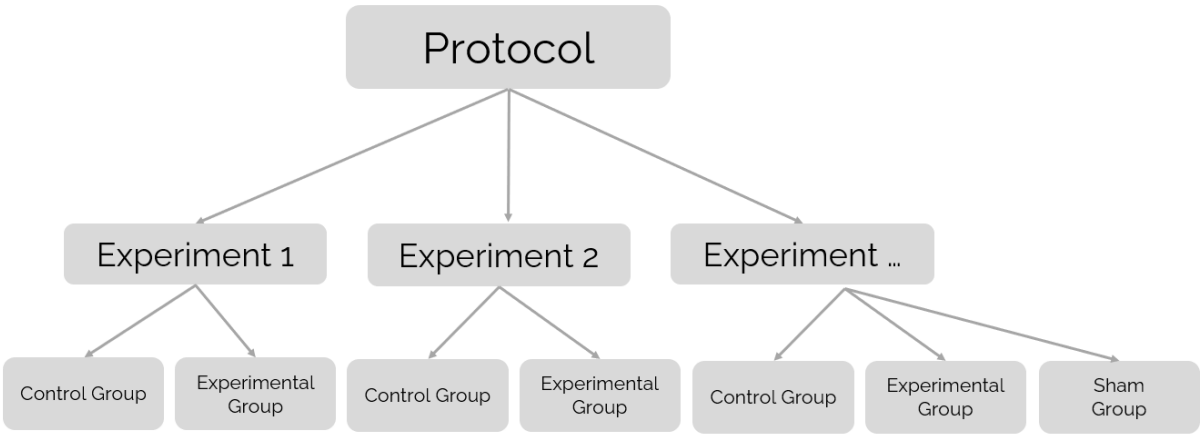


Thanks to these new fields, the hierarchy structure of any experiment is covered by this new cage label.
More specifically, for instance:

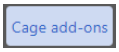
- "**Protocol**" is the highest level. Usually, it is also called License or IACUC number (in the US). It can be more generally interpreted as the ethical approval to perform several experiments.

- "**Experiment ID**" is the code assigned to the experiment under running.
- "**Experiment Group**" is the name assigned to a group of cages running the experiment. Usually, in any experiment, there should be at least a control group and an experimental group. Nevertheless, the number of groups can be, obviously, many more depending on the design of the experiment (Control, Sham, Treat 1, Treat 2, etc.)

A simple synoptic table recap is the following:

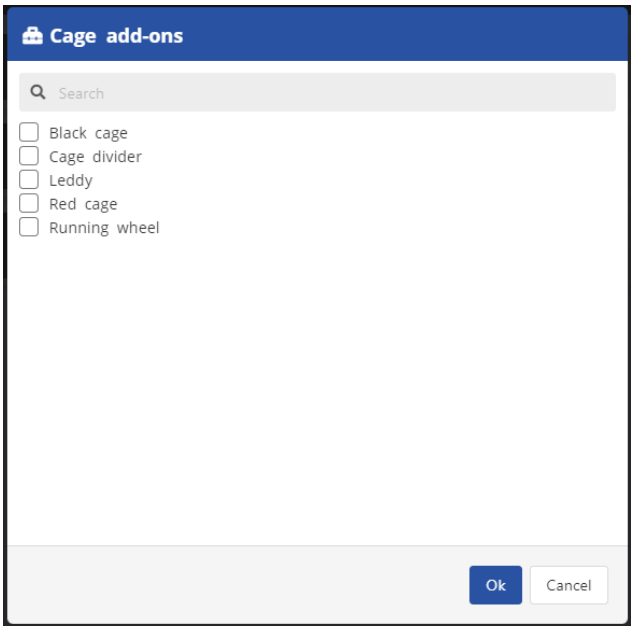


Furthermore, also new buttons appear:

- "**Cage add-ons**" 

- "**Treat all animals**" 

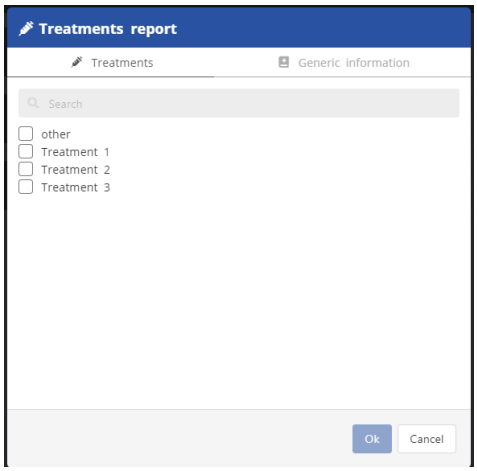
"Cage add-ons" refers to the possible types and devices inserted into the cage itself.



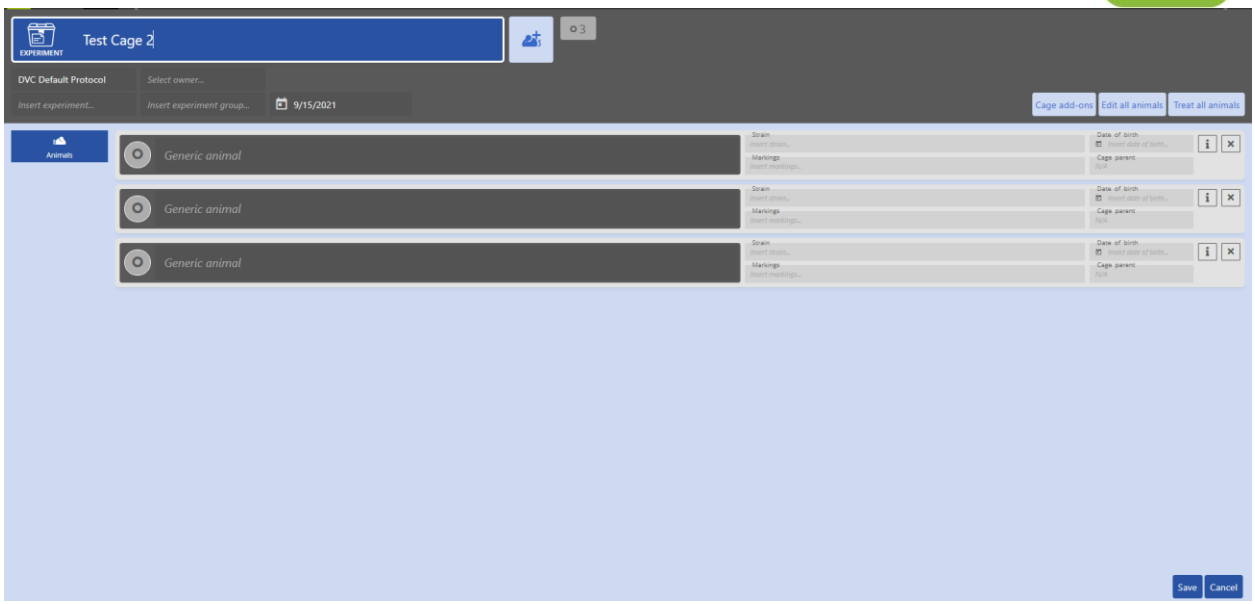
Depending on the selected add-ons, the correspondent icon appears just below the animal number.

Please pay attention that, in the case of the DVC® Running Wheel, it is mandatory to select such add-on to start generating corresponding data. Therefore, if the user forgets to select such add on, the DVC® Running wheel data are not collected adequately by the DVC® Analytics platform.

The "Treat all animals" button lists all the possible treatments preventively created in the DVC® Workplace interface, which can be assigned to all the animals at once.

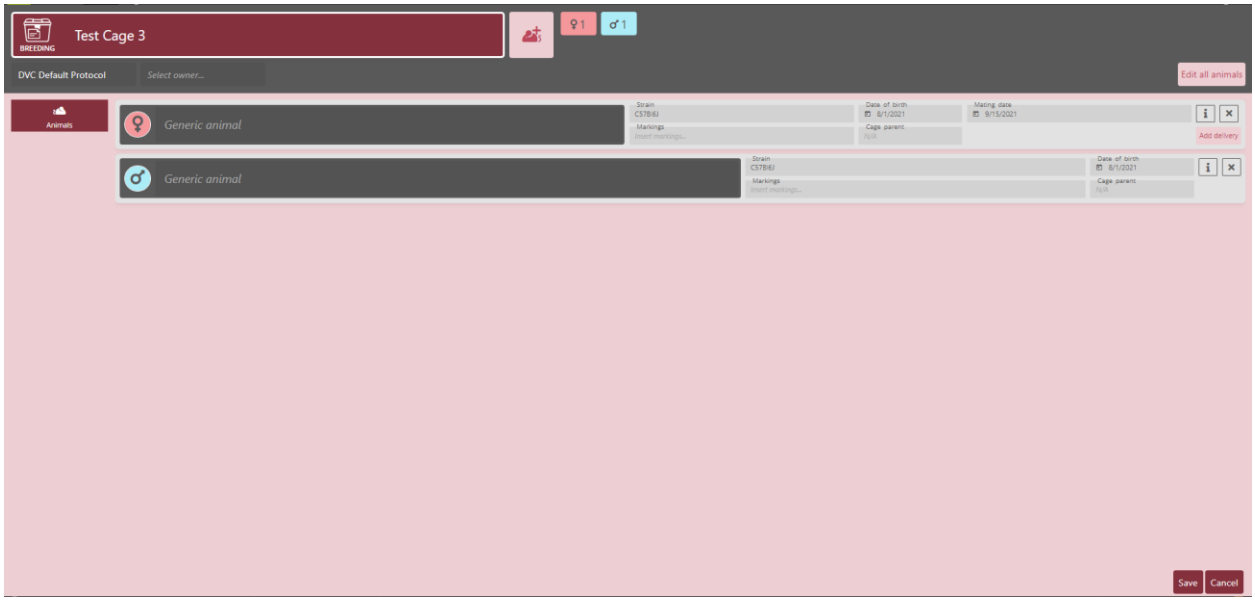


Like for the Stock cage, all this information (except "Cage add-ons") can be individually assigned to each animal by clicking on the corresponding field.

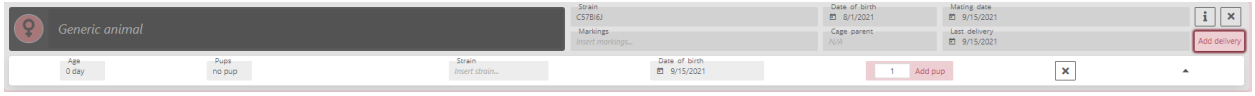


3.3.3 Register a Breeding cage

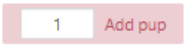
Compared to the previous types of cages, the breeding cage is the only one where pups can be managed.
More specifically, when a female animal is created in the electronic breeding cage label, an extra dedicated button named "Add delivery" Add delivery appears at the animal level.



By clicking this button (when delivery occurs and the user wants to track it), a new line is added just below the female animal:

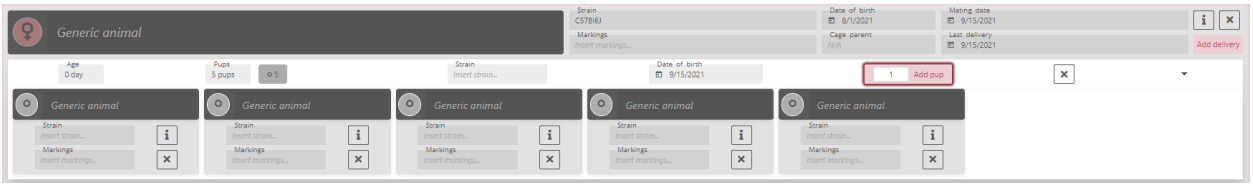


The delivery information includes:

- **Age** of the pups in days: this is automatically calculated
- **# of pups** in the delivery
- The **strain** of the pups. This information will be applied automatically to all the created pups. If the user needs to specify different strains, this is still possible, pup by pup.
- The **DoB** (automatically created by clicking the "Add delivery" button) corresponds to today's date. However, it can be changed to a past date if the delivery event is registered later in time.
- Button to **add pups** 

. This activity can also be performed days after the registration of the delivery itself.

Once ready to also add pups, as anticipated, there is a dedicated button where the number of pups can be inserted and then, by clicking it, the corresponding pups are created.



Each pup has potentially the following information to be included (all optional):

- **Sex**
- **Animal ID**
- **Strain**
- **Marking**

3.4 Manual Task 2: How to change the bedding of a cage

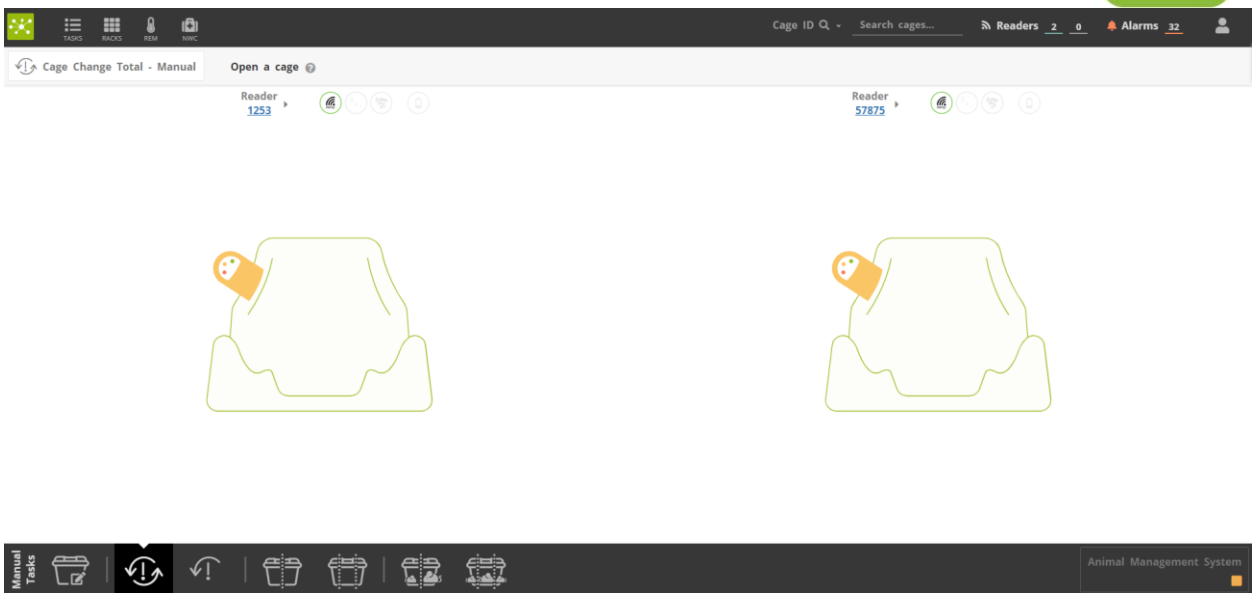
As previously anticipated, the DVC® System supports two different ways of performing dirty bedding change:

- **Cage Change Total**: dirty cage is entirely substituted by a full clean cage.
- **Cage Change Partial:** the cage top of the dirty cage is moved (shared) to the cage bottom of the clean cage.

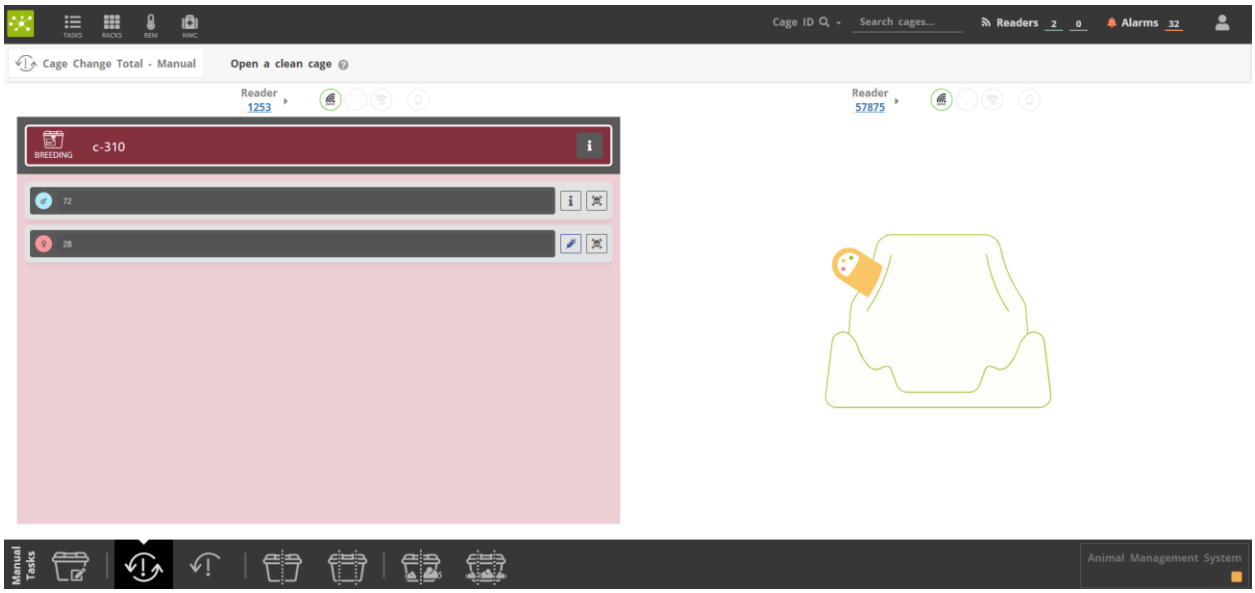
Please pay attention that correctly performing these tasks supports DVC® system algorithms to interpret better animal activity inside the cage. Therefore, also the Cage Change Partial, although it seems unnecessary (due to the fact the RFID tag remains the same with the same "content"), it is crucial to be performed (also) through the DVC® Operator interface because the specific event is tagged and managed by the DVC® system algorithms.

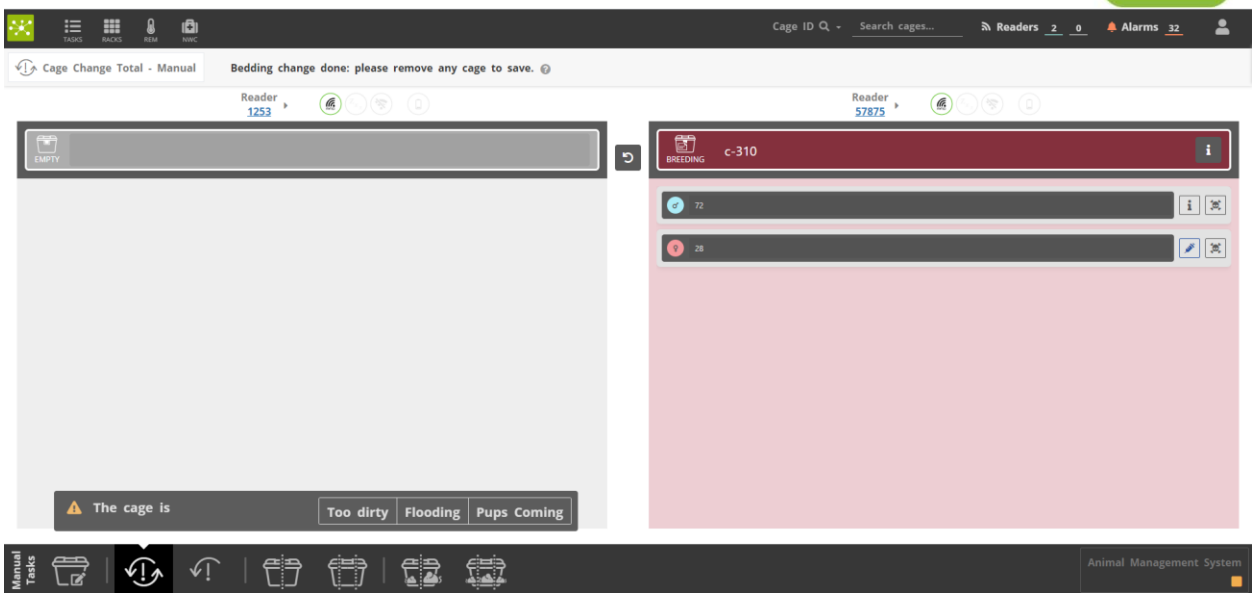
3.4.1 Cage Change Total

Clicking on the Cage Change Total button  the DVC® system shows the request to associate two different RFID Readers with the user to perform the task.



The dirty cage coming from the DVC® Rack can be opened as the first or second cage on the right RFID Reader or the left one. There is no specific requirement for this task in terms of proper cage opening workflow.
Once both dirty and clean cages are opened, the electronic cage label is automatically transferred from the dirty cage to the clean one.



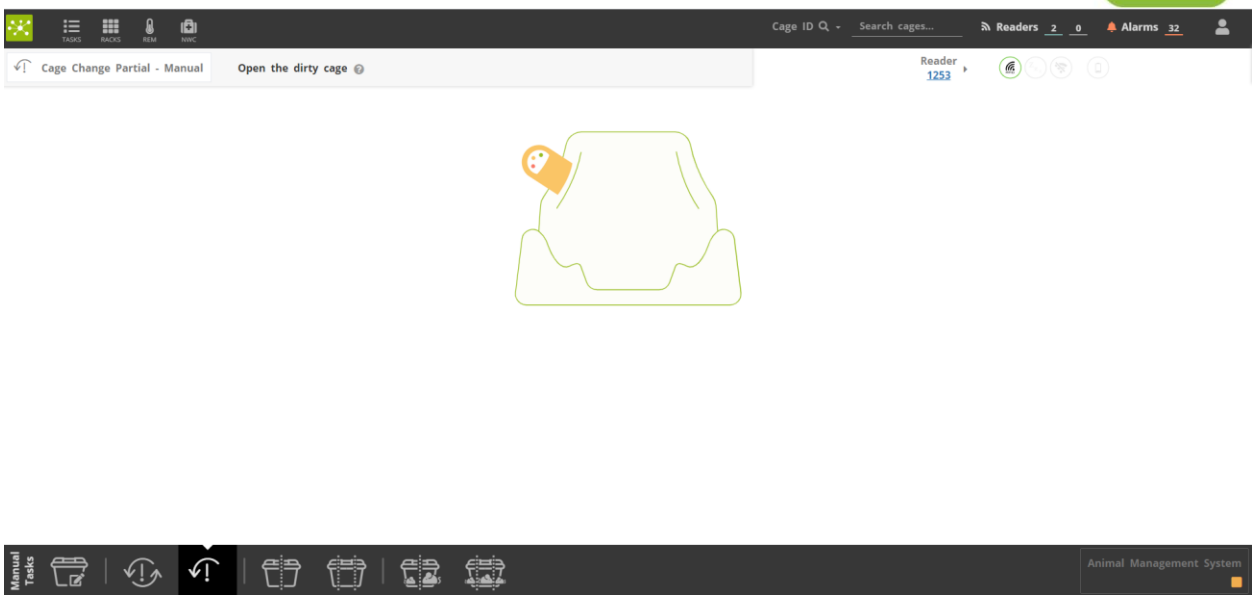


Moreover, this task should be requested by the DVC® System (as a planned task) thanks to the dedicated DVC® Bedding algorithm outcomes. If the user is performing it manually, the user can leave different potential feedback to explain better why the task has been performed manually. This feedbacks can help the Tecniplast team to refine the DVC® Bedding algorithm in the future.

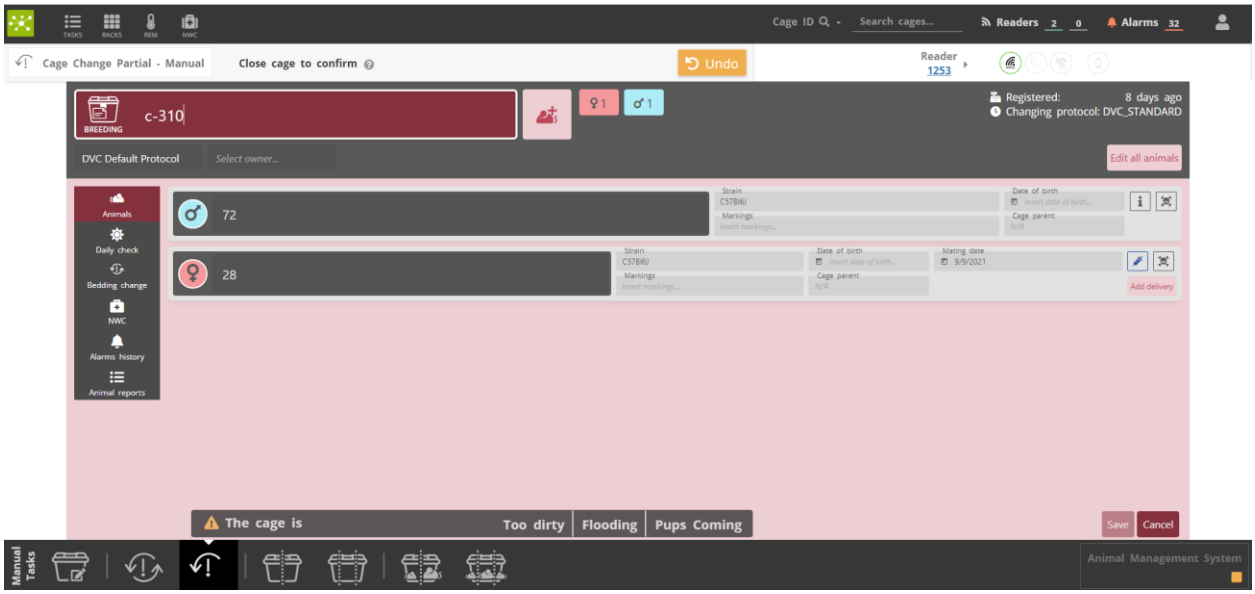
Lastly, if the user wants to undo the operation, click on the corresponding icon located between the two cage labels 

3.4.2 Cage Change Partial

If the Cage Change Partial button is selected  , the DVC® System asks to use only one RFID Reader because the System reads only the (shared) cage top of the dirty cage.



When the dirty cage is opened, the registered cage content is shown in the interface.



By simply closing the cage top over the clean cage body, the task is accomplished and tracked.

If the user wants to undo the operation, click on the corresponding icon 

3.5 Manual Task 3: How to split animals between cages

As previously described, when the user needs to move already registered adult animals from a registered cage to another, the DVC® System offers two different opportunities:

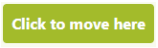
- **Cage Split Standard** where existing registered adult mice are moved between two registered cages.

- **Cage Split Advanced** where existing registered adult mice are moved between three registered cages.

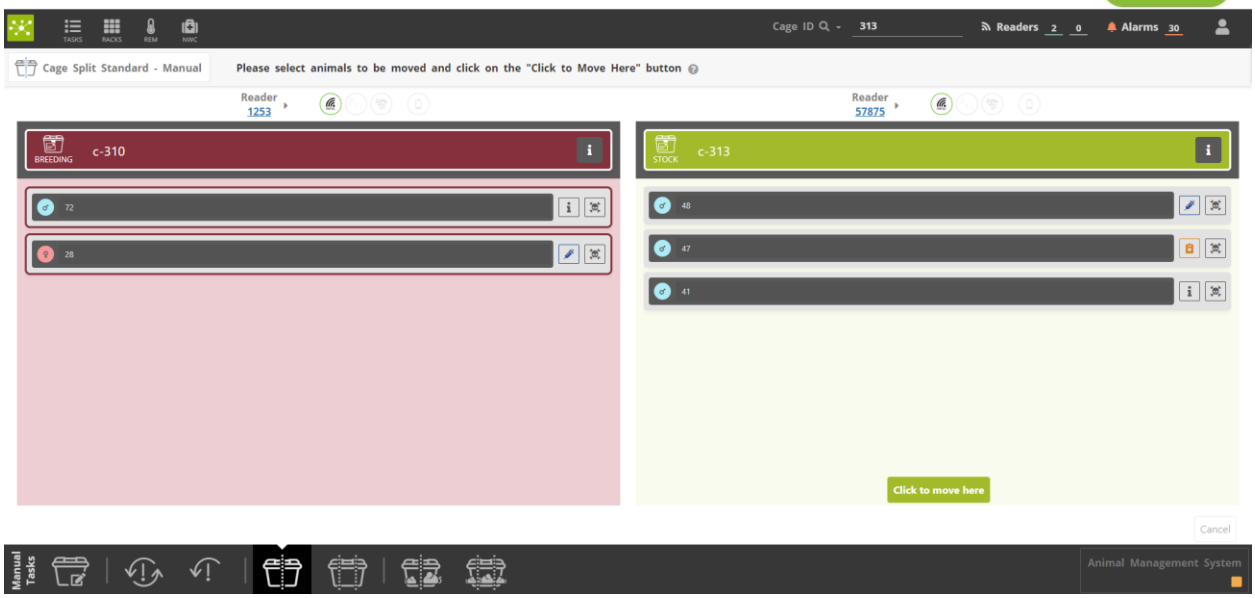
Please pay attention that it is mandatory to move animals only between previously registered cages to enable the split functionality (i.e., with a valid Cage ID already assigned).
Moreover, only adult mice can be selected and moved across registered cages. Indeed pups can be moved (most likely weaned) thanks to dedicated functionalities explained later in this manual.

3.5.1 Cage Split Standard

By clicking the corresponding button  , the DVC® System requires two RFID Readers to be associated with the user.

Then, the corresponding content (i.e., the animals) is shown by opening registered cages with animals.
To move one or more animals from one cage to another, click on it/them. The DVC® Operator interface highlights the ones selected, and a new button appears 

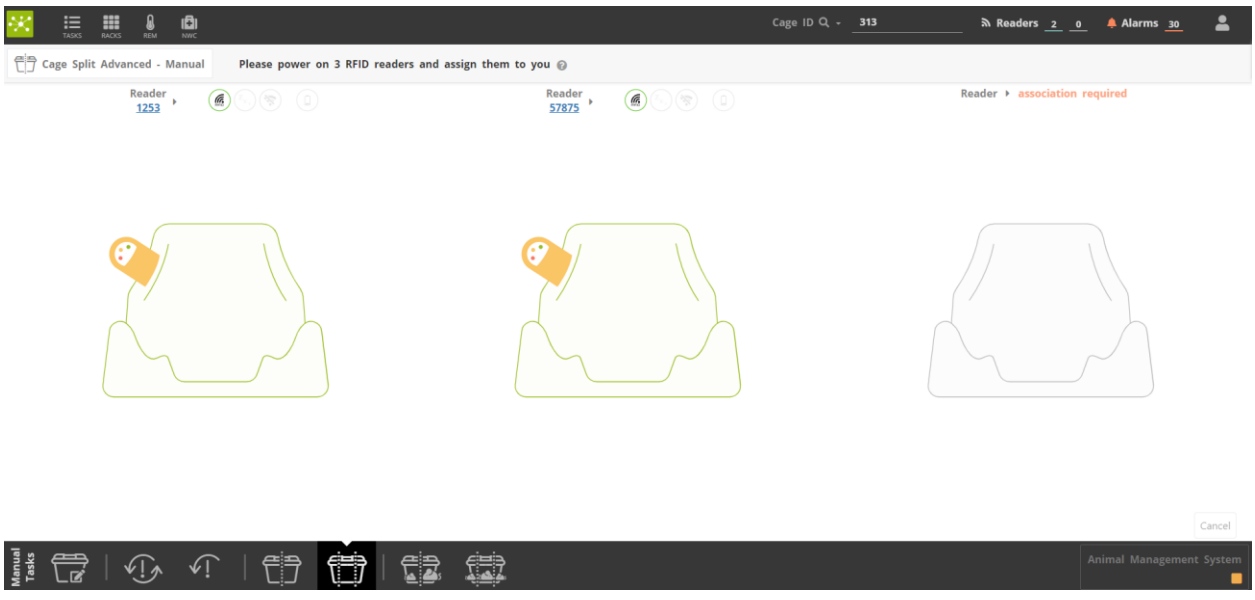
on the other cage.
Please pay attention that animals can be moved only between registered cages.
The user can easily register a new cage while performing such split task.

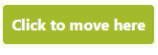


3.5.2 Cage split advanced

The same workflow can be performed by using three different RFID Readers and opening three already registered cages parallel.

By clicking the corresponding icon,  , the DVC® Operator interface shows them.



Then, the corresponding content (i.e., the animals) is shown by opening registered cages with animals.
To move one or more animals from one cage to another, click on it/them. The DVC® Operator interface highlights the ones selected, and a new button appears 

on the other cages where the animals can be moved.

3.6 Manual Task 4: How to wean pups

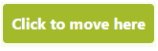
As described in the previous section for the adult mice, in case the user wants to perform and track the weaning task, the DVC® Operator interface offers two possibilities:

- **Cage Weaning** where existing registered pups mice are moved between two registered cages.
- **Cage Weaning Advanced** where existing registered pups mice are moved between three registered cages.

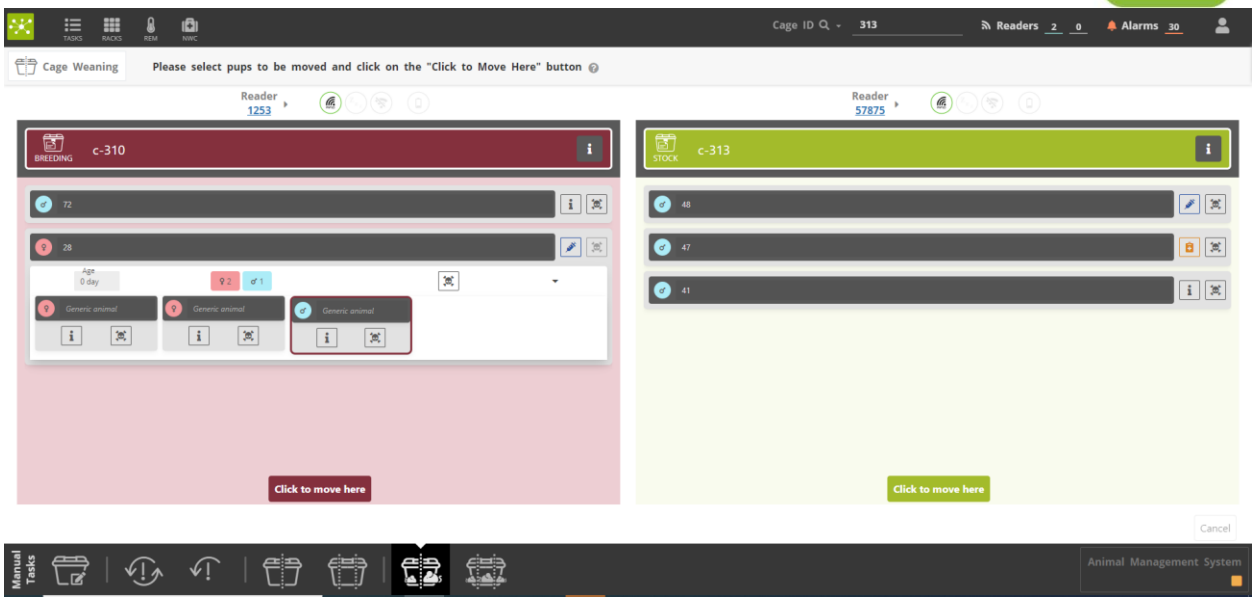
Please pay attention that it is possible to move pups only between previously registered cages to enable the weaning functionality (i.e., with a valid Cage ID already assigned).
Moreover, only pups mice can be selected and moved across registered cages. Please refer to the previous section to know how to move adult mice between registered cages.

3.6.1 Cage weaning

By clicking the corresponding button,  , the DVC® System requires two RFID Readers to be associated with the user.

Then, the corresponding content (i.e., pups) is shown by opening the registered breeding cage with pups to be weaned.
To move one or more pups from one cage to another, click on it/them. The DVC® Operator interface highlights the ones selected, and a new button 

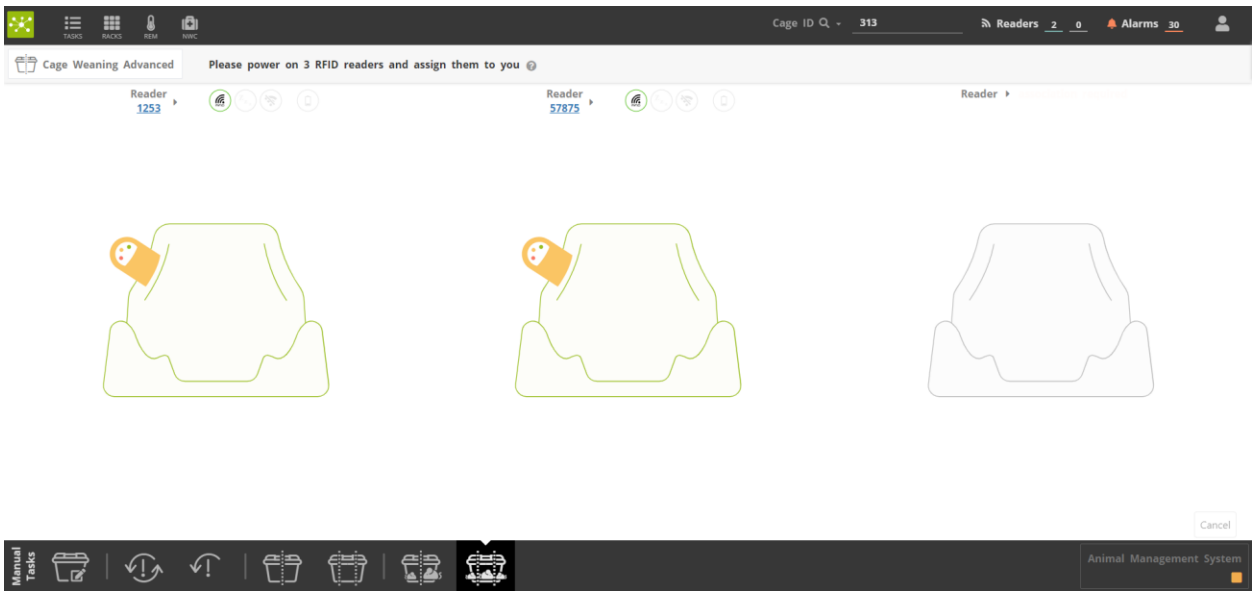
appears on both cages.
Only pups can be selected. The already existing registered adult mice cannot be selected.

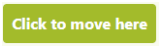


When a pup is weaned, it becomes an adult in the cage where it is moved. This action can be reversed by clicking again to the (adult) animal just weaned and move it back to the original pup status.
When the cage is saved (by closing the cage top or by clicking the "Save" button), the weaning action is saved, and the animal cannot be back as a pup anymore (user has to register it again if needed).
Please note that a pup(s) can also be weaned in the same original cage, becoming an adult mouse for that cage.

3.6.2 Cage Weaning Advanced

By clicking the corresponding button,  , the DVC® System requires three RFID Readers to be associated with the user.



Then, the corresponding content (i.e., pups) is shown by opening registered cages with animals.
To move one or more pups from one cage to another, click on it/them. The DVC® Operator interface highlights the ones selected, and a new button appears 

on the other cages.
Please note that a pup(s) can also be weaned in the same original cage, becoming an adult mouse for that cage.

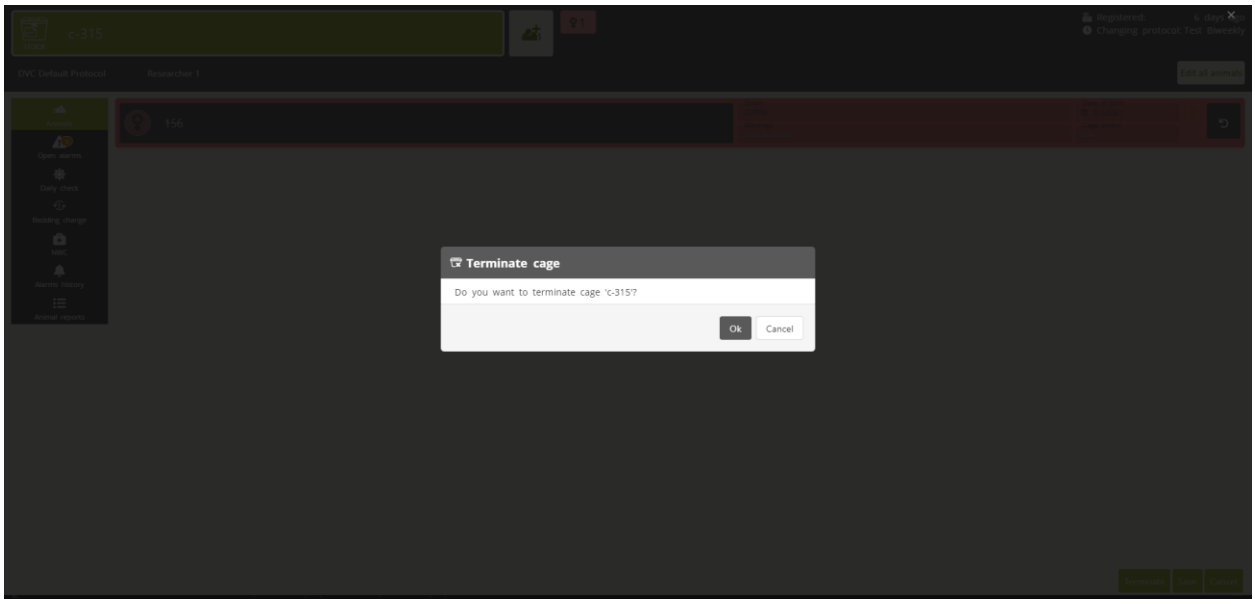
3.7 Manual Task 5: How to terminate a cage

The DVC® System offers different ways to terminate a cage:

- **Single cage termination** because all the animals have been culled/removed
- **Bulk cage termination** because the user wants to terminate multiple cages simultaneously (i.e., the experiment is completed).
- **Missing cage termination**

3.7.1 Single Cage Termination

Either the user is culling/removing animals by opening the cage top over the RFID Readers or opening the cage through the DVC® Rack interface, whenever all the animals are removed, the DVC® interface asks if also the corresponding cage has to be terminated:

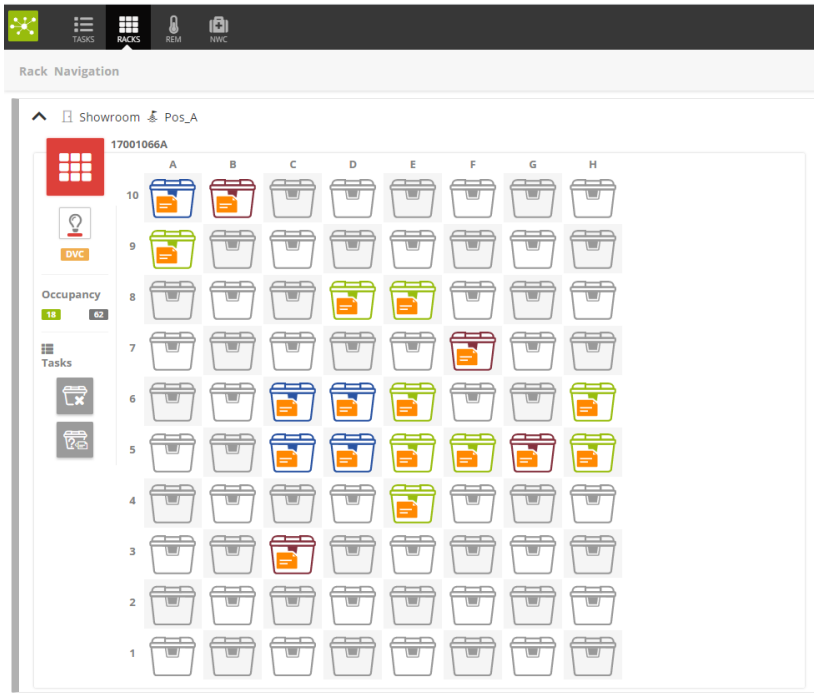


The cage is terminated by clicking “OK” and becomes empty (available again for another registration and/or cage change).

3.7.2 Bulk Cage Termination

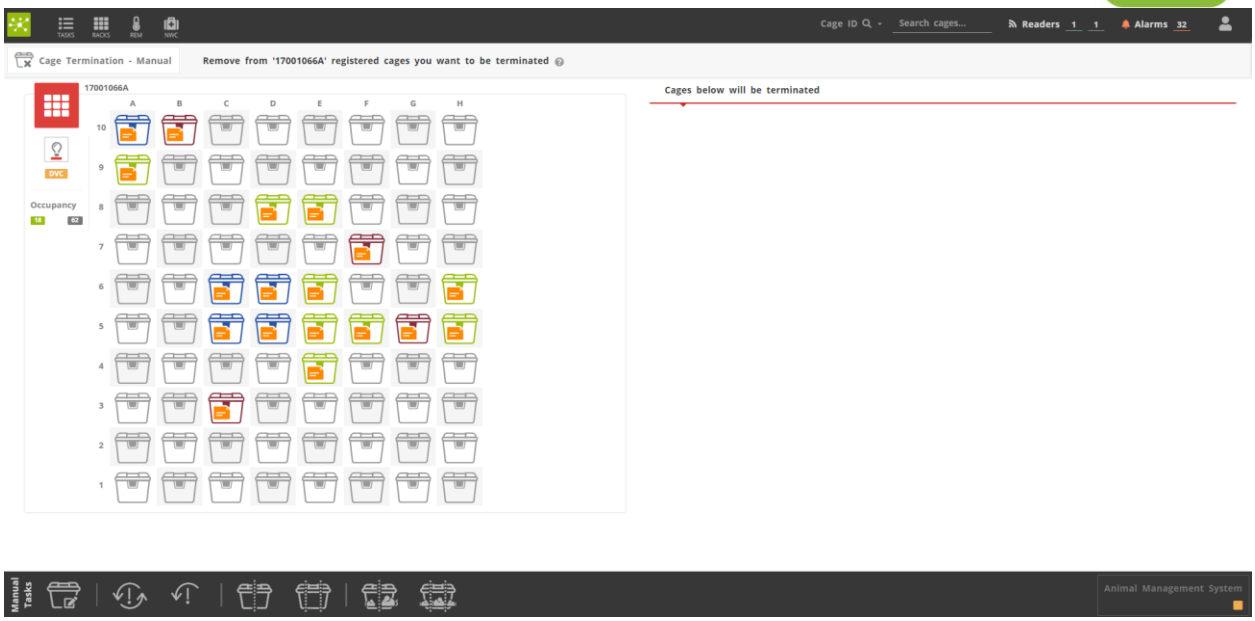
As anticipated earlier, in case the user wants to terminate simultaneously multiple cages, it is possible to do so by following the below-described procedure:

First, select the DVC® Rack where cages to be terminated are currently inserted:

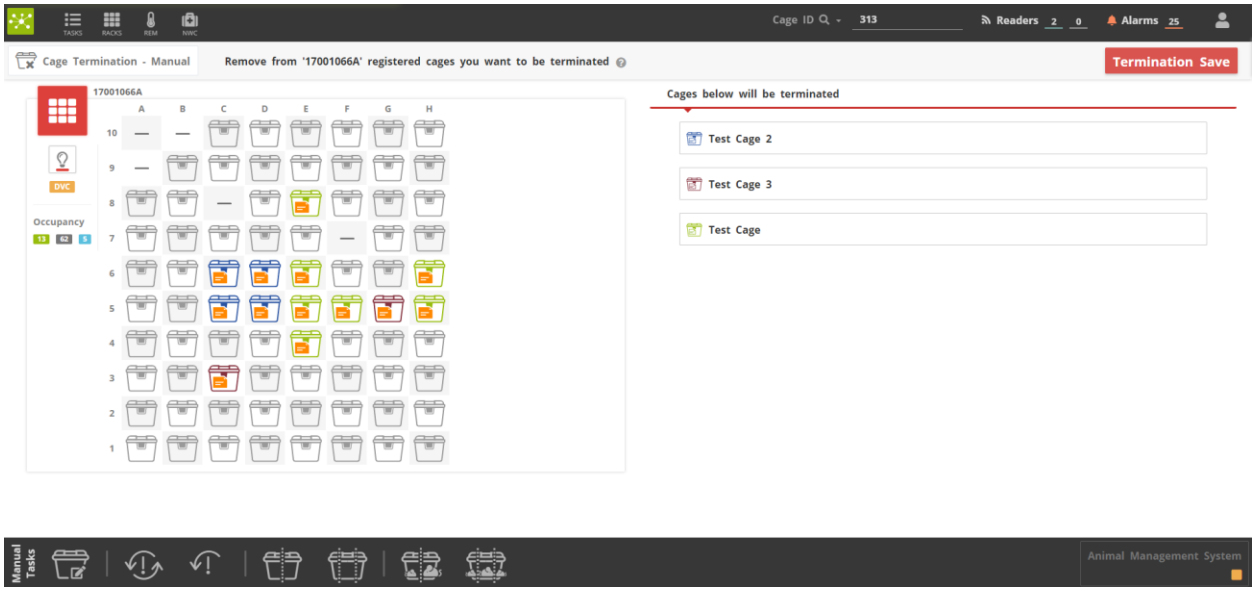


Secondly, click on the Cage Termination button.

The DVC® Operator interface changes to a specific page where the user is requested to extract physically all the registered cages which need to be terminated:



By removing, one by one, all the registered cages, these are listed on the right column to visually confirm the Cage IDs that are going to be terminated.



If a cage is removed by mistake, it can be easily inserted back and it will disappear from the left-list.
Once all the cages are removed, the user has to confirm the termination by clicking the button **Termination Save** and provide a reason for that.

Please note that the "death reasons" have to be preventively created in the DVC® Workplace interface.

3.7.3 Missing Cage Termination

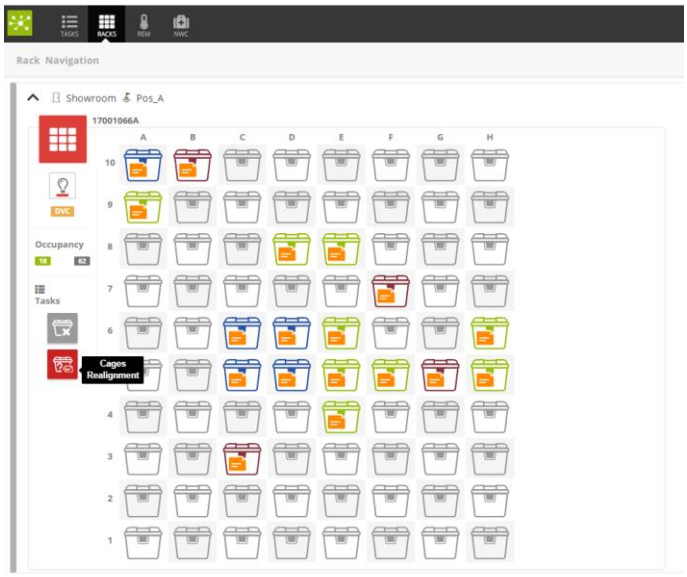
By default settings, any registered cage in the DVC® System has to be inserted in any position of any enabled DVC® Rack.
Suppose a registered cage is out of the DVC® Rack for more than 12 hrs (this default setting can be changed as needed). In that case, the corresponding cage is declared missing, and a specific alarm is triggered in the DVC® Operator and DVC® Workplace interfaces.

It is possible to terminate this cage directly from the DVC® Workplace by navigating in the Active Alarms section and then by clicking the corresponding icon.
Please refer to the DVC® Workplace manual.

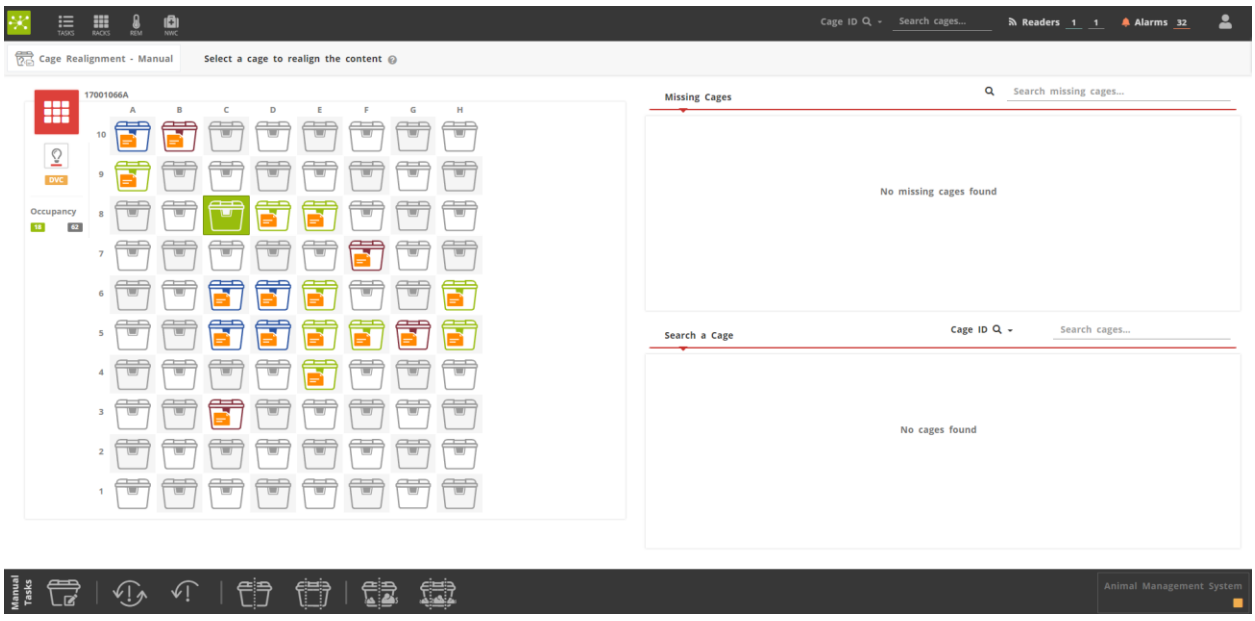
3.8 Manual Task 6: Cage Reconciliation

This feature has been implemented mainly to provide the user with a simple way to recover from misspelt cage information.
There are several reasons why a cage can have wrong or missing information.
For instance, the registered cage has been changed without adequately using the RFID Readers, and the cage content has not been moved from the dirty to the clean cage, ending up in a cage that is empty for the DVC® System, but it has animals in reality.

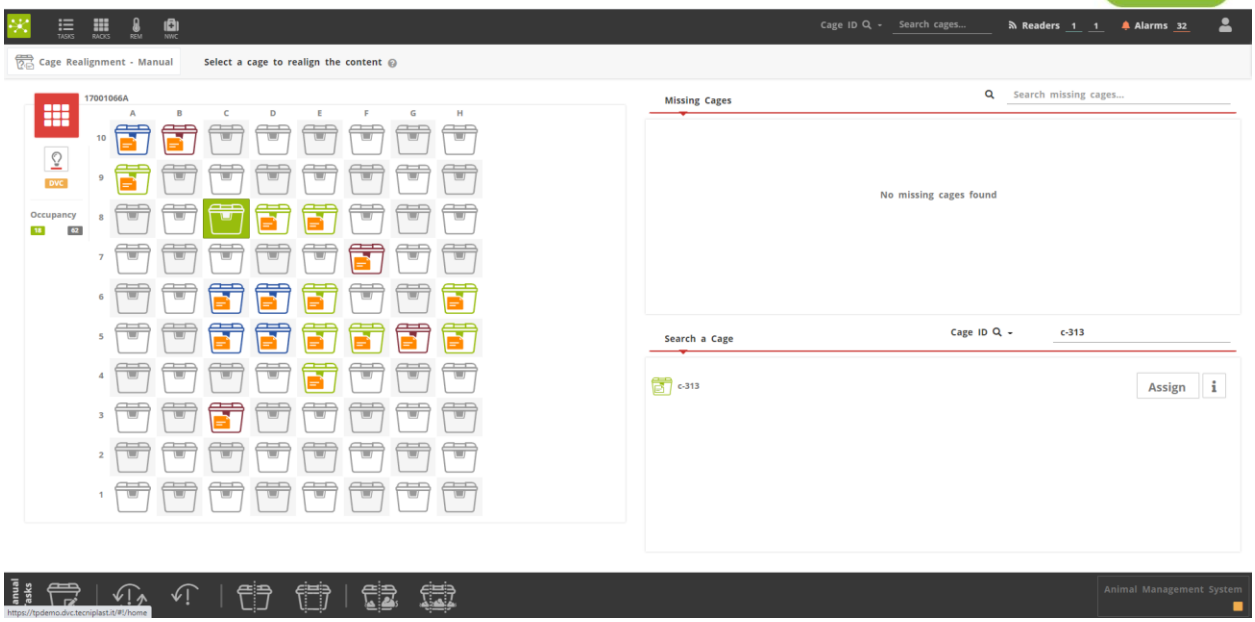
In any case, by selecting the DVC® Rack where the empty (for the DVC® System) cage is located, it is possible to click on a specific button called "Cage Realignment":



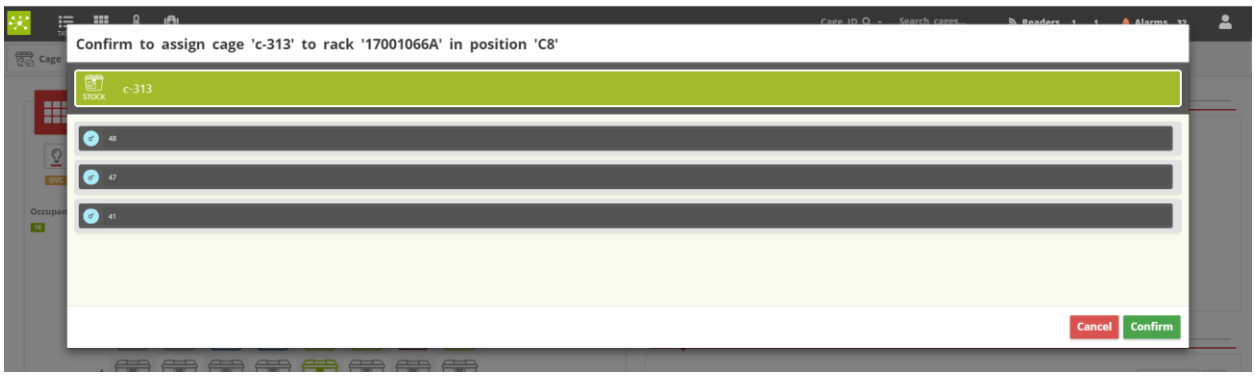
The DVC® Operator interface changes to a dedicated page where the user is requested to click on the empty cage to be updated.
By doing so, the corresponding cage is highlighted in the DVC® Rack view, and two different search areas appear.



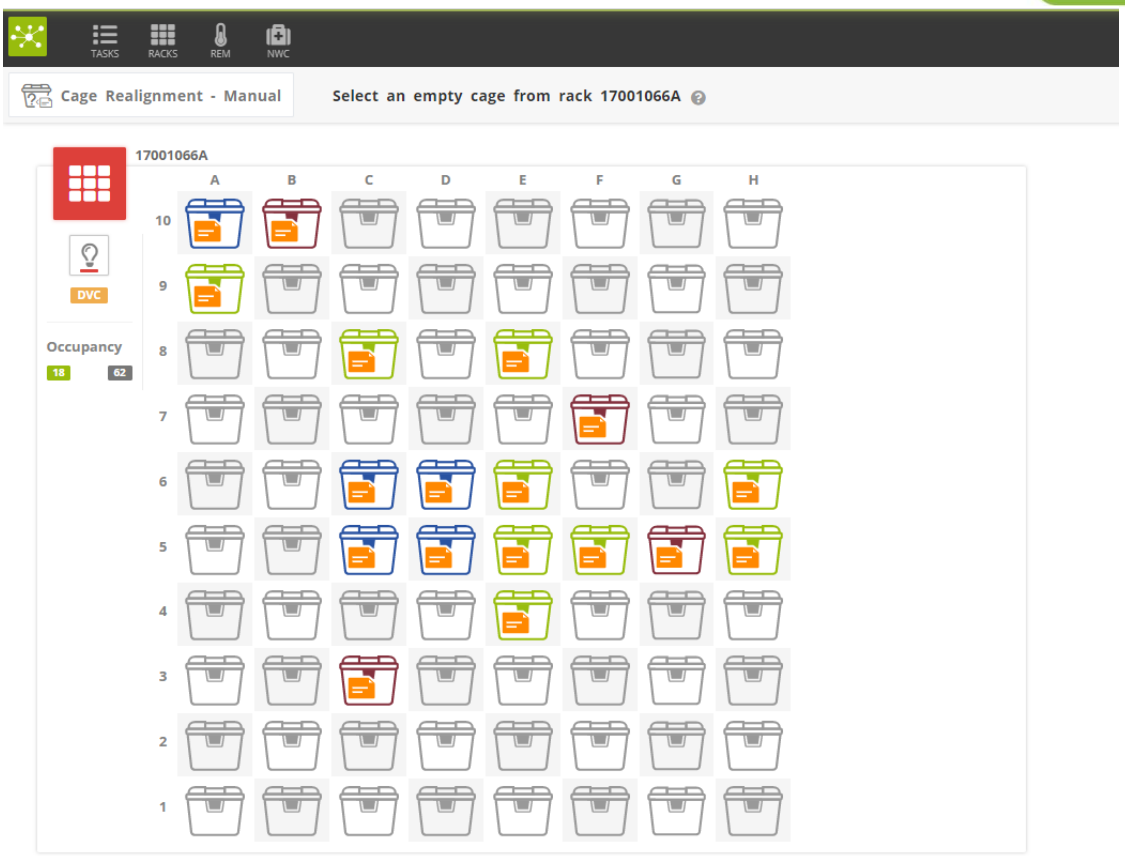
The user can update cage content by either searching the original cage between the currently "Missing Cages" (if any – empty in the above figure) and searching the original cage between the currently registered cages.
In this latter case, the user can type the Cage ID in the "Search cages" box and then click enter.
The registered cage appears in the below box and can be forced to be realigned by clicking the "Assign" button:



The DVC® System requires further confirmation before proceeding. It also shows more in detail the corresponding cage content to provide more confidence about this task.



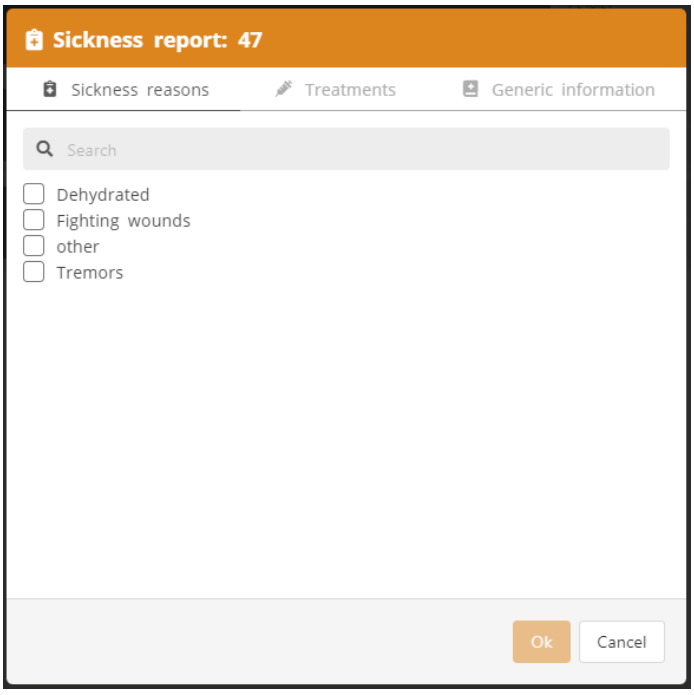
By clicking the “Confirm” button, the cage ID and its content are moved back to the selected empty cage to realign reality with the DVC® status.



3.9 Manual Task 7: How to track animal information

The DVC® System supports the possibility to track animals information by tagging them with a specific sickness reason, treatment, generic information or culling reasons.
Any sickness reason, treatment and culling reason have to be preventively created in the DVC® Workplace interface. The user can create as many as needed.
Once created, the suggested DVC® workflow to follow is described below as an example:
During a visual check (or thanks to the NWC task), the user finds an animal in trouble, and he/she wants to alert the owner of the cage and other people about this issue.
The first step is to open the corresponding cage (using the RFID Reader or by the DVC® Rack view) where the animal was already registered:

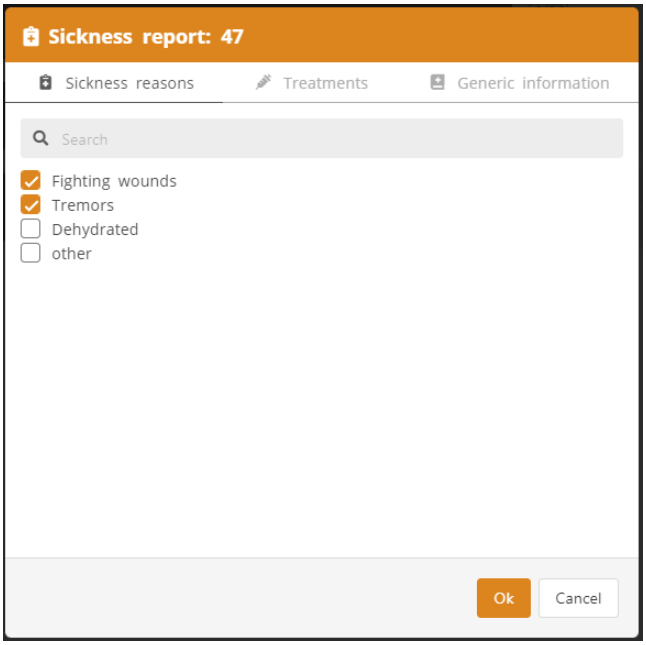
Then, click on the little icon  to open a dedicated pop-up:



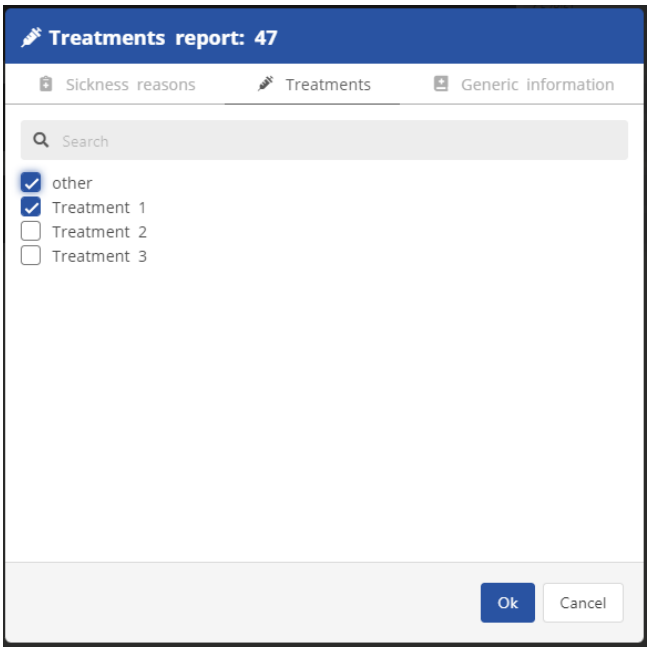
Three different sections can be filled with information:

- **Sickness reasons**: list preventively created in the DVC® Workplace
- **Treatments**: list preventively created in the DVC® Workplace
- **Generic information**: a free field where the user can write any information

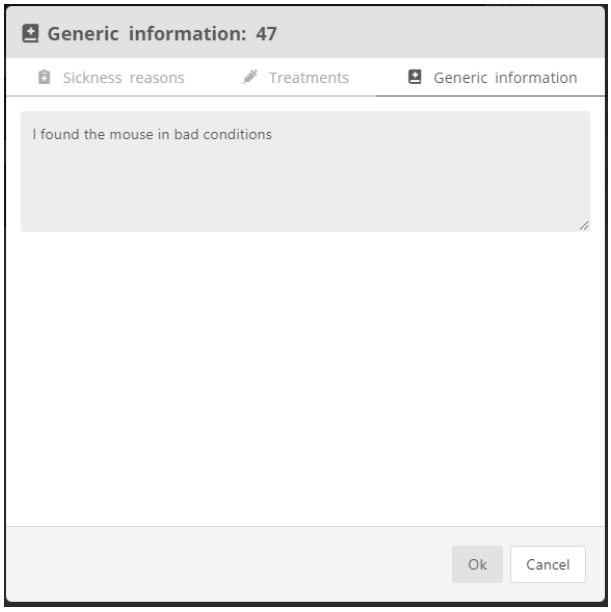
By selecting one or multiple sickness reasons, the corresponding OK button icon appears to confirm such status.



The same selection can be made by picking the proper treatments (if provided).



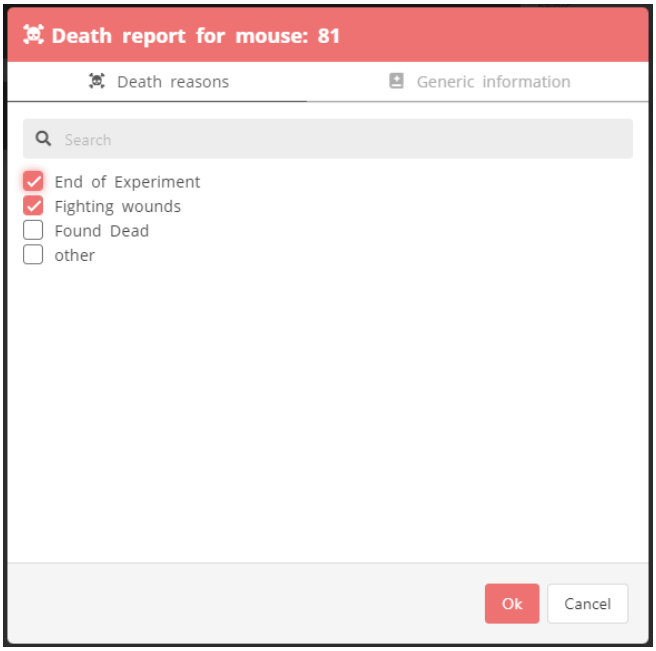
Finally, also the Generic Information field can be filled if needed to explicit any specific information:



By clicking OK, the animal is tagged with the selected sickness, treatments and generic information. Then, by closing the cage (or saving through the DVC® Operator interface), the corresponding alarm, called "Animal in Trouble" is created and sent by email to the Owner of the Cage and all the Users registered to receive notification about this type of alarm.

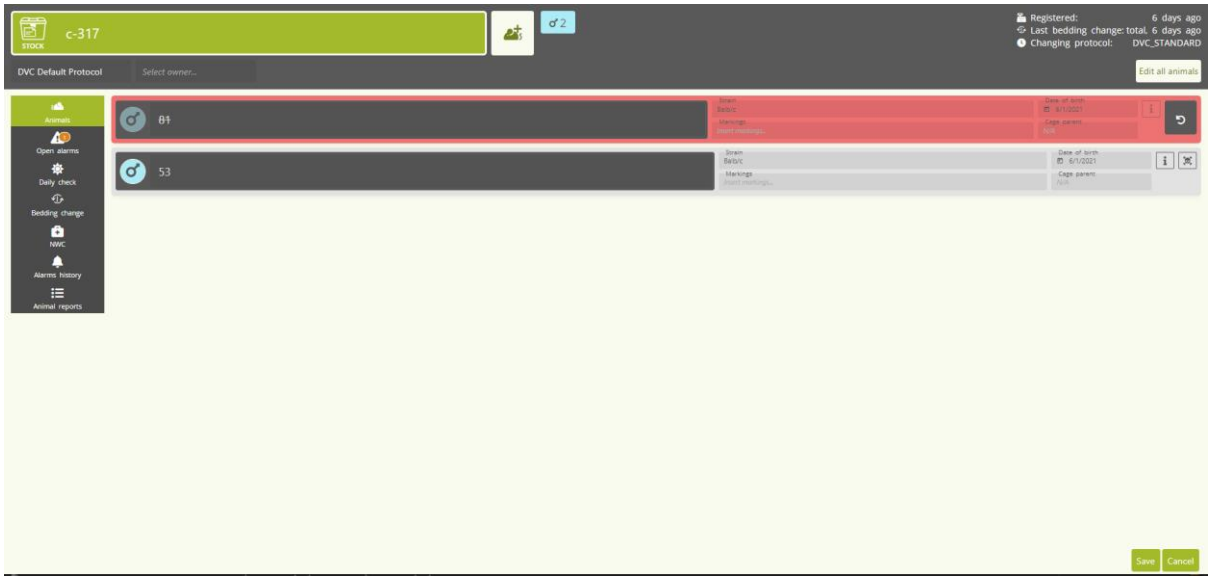
Please note that the user can also only assign a treatment (or multiple), or even more, just generic information to a selected animal. In this case, the alarm is not generated, but the animal is still tagged with a different icon  and the information is tracked in the Animal reports section.

Lastly, the same workflow can be applied to the event that an animal has to be culled (for whatever reason).
By opening the corresponding Cage through RFID Readers or from the DVC® Rack view, the user can click on the little icon  and choose from the pop-up page as many culling reasons as needed to justify the removal of the animal.



By clicking “OK”, the animal is highlighted as removed from the list.

This action can be reverted by clicking the icon 



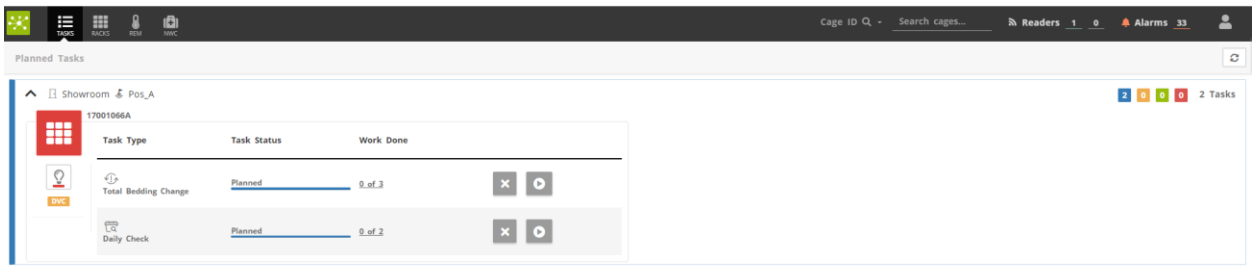
When the cage is closed (or saved), the animal is completely eliminated from the cage itself. The corresponding “Animal Report” (see below) is updated with this information:

3.10 Planned Tasks

Unlike manual tasks selected by the Operator, planned tasks have been defined by the DVC® System considering different parameters such as the status of the cages, the availability of Operators, and related skills. For details on the DVC® Planner settings, please refer to the DVC® Administrator Software Manual.
The current version of the DVC® System features three planned tasks:

- **Bedding Change Task**
- **Daily Check Task**
- **Anomalous Animal Activity Task (also called Night Welfare Check - NWC)**

Planned tasks are scheduled daily. As soon as the user gains access to the DVC® System and logs in, the home page immediately shows the several tasks which have been assigned to him/her:



Planned tasks are grouped by location (Showroom -> Pos_A) and by DVC® Rack side.
Multiple lines might appear if planned tasks are assigned to multiple locations, while multiple DVC® Racks (up to 4) might appear in the same line if located at the same place.
The little balloons 2 0 0 0 on the right-side display the **TASK STATUS**:

2 : **PLANNED TASKS** (2): tasks planned by the DVC® planner

0 : **SUSPENDED TASKS** (0): the task has been started but left running (the user has logged out and will log in back later)

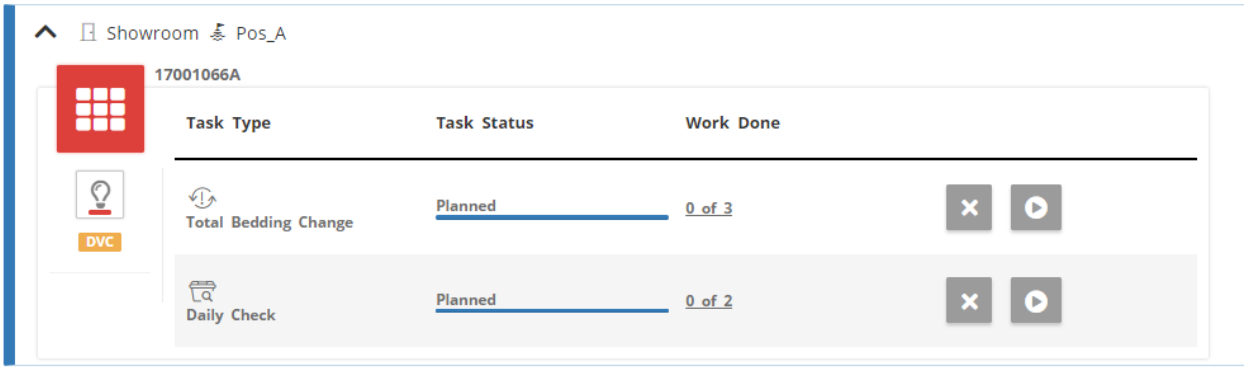
0 : **COMPLETED TASKS** (0): the task has been entirely performed

0 : **PARTIALLY COMPLETED/CANNOT BE DONE/CANCELLED TASK**: the task has not been completed (the user has communicated why the task has not been completed).

3.10.1 Task performing

1. Click on the icon to display all the tasks assigned to the location.

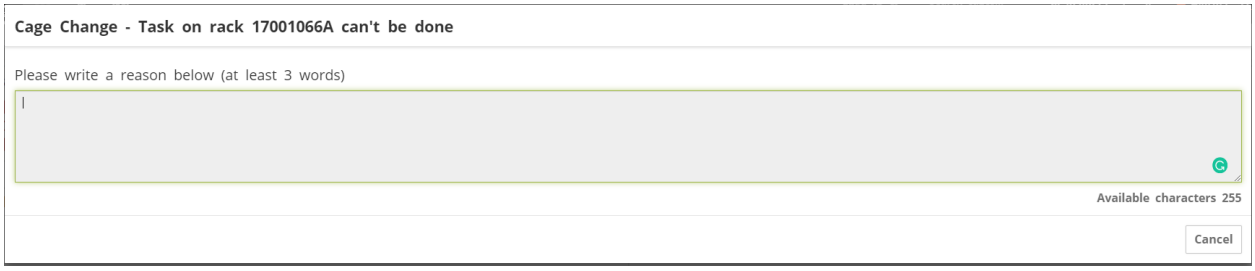
In the example shown below, there are two different tasks (Total Bedding Change and Daily Check) which are both still planned.



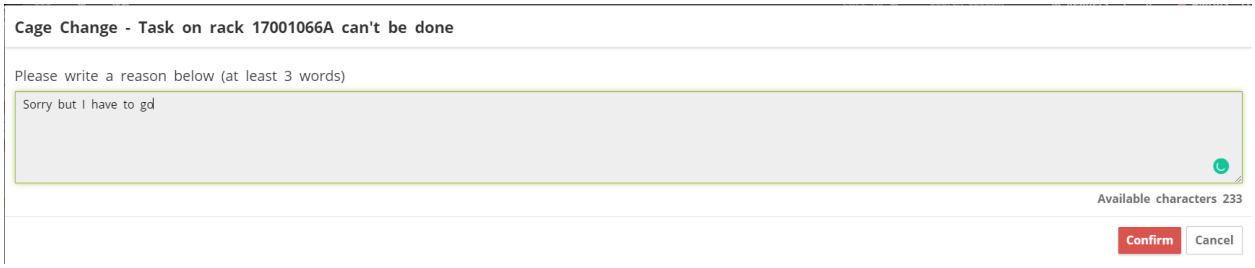
2. Click on the led icon to clearly identify the DVC® Rack where these tasks will be performed. The two top rows of the corresponding DVC® Rack will light up the same colour displayed in the interface (RED in this case). This feature is useful when multiple DVC® Racks (up to 4) are attached to the same BUOY (DVC® Master).
3. Carry out the selected task (see following paragraphs, according to the task type).

3.10.2 Tasks rejecting

To **reject the task**, click on the corresponding icon and remove this task. The System requires to write a reason of at least three words:



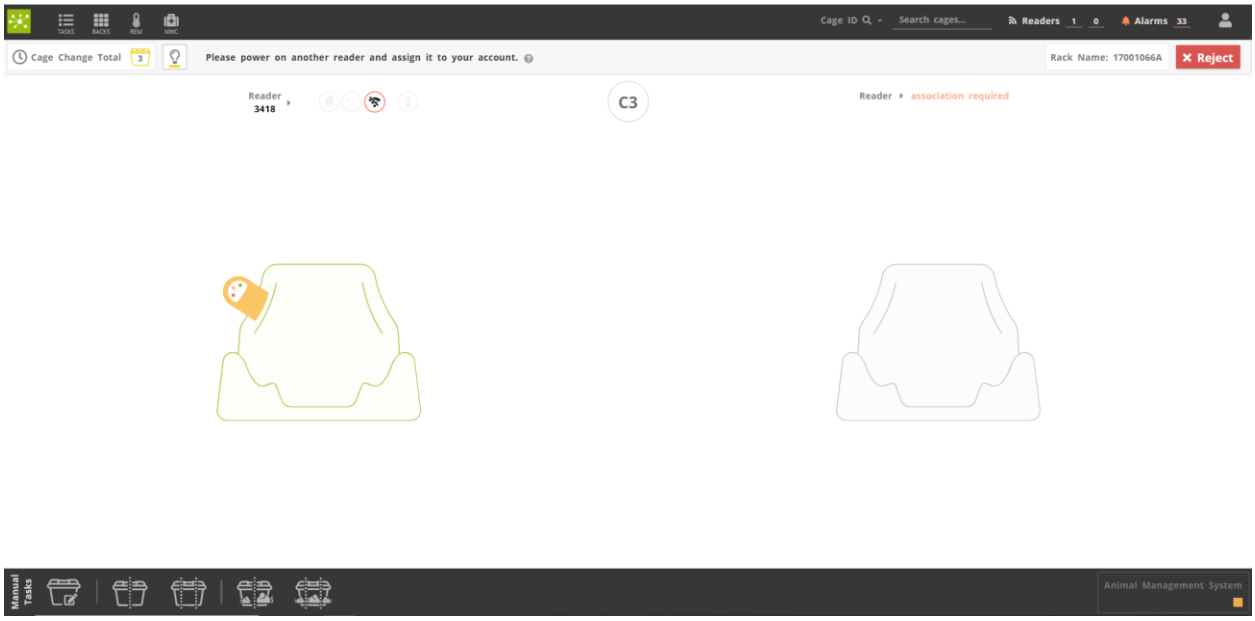
Click on CONFIRM and close the box



The task will be tracked as "Can't be done" with the corresponding reason attached to all the cages/animals involved in the task.

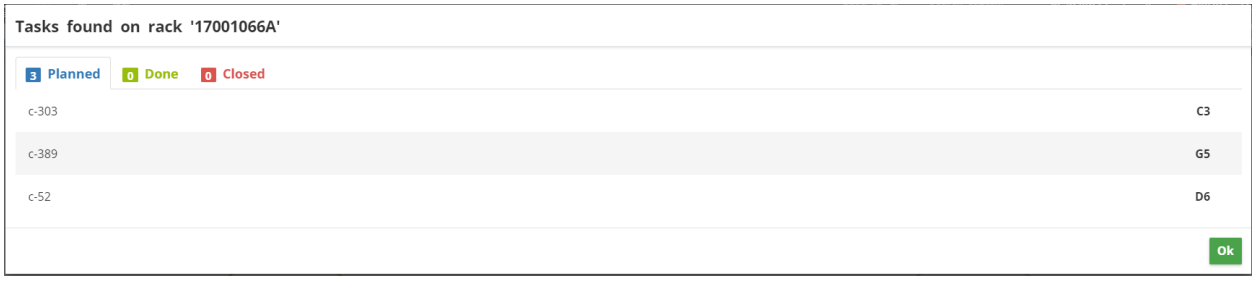
3.10.3 Bedding Change Task

This task is generated by the DVC® Planner when there are dirty cages in the Facility that need to be changed accordingly to the customer's LEARNING Phase (refer to the DVC® Administrator Software Manual for details).
Click on the corresponding icon and proceed as described in the previous paragraph related to the Total Bedding Change to perform the task.



To show information related to the cages to be changed, the user can:

- Click on the cage icon on the upper bar  to display the Cage ID, the coordinates to find the cage in the DVC® Rack and the status of the current task (Planned/Done/Closed)



Moreover, the DVC® System supports an important feature related to the possibility to highlight (in Yellow by clicking the corresponding icon ) all the dirty cages grouped in the DVC® Rack. This is a revolutionary feature enabling direct interaction between the user and the DVC® System.

If a specific cage cannot be changed, click on the icon and write the reason why the change could not be performed. In this case, the cage is marked as **CAN'T BE DONE.**
Usually, a common reason for rejecting the task is that the cage is still "too clean" and can be left longer in the DVC® Rack.
Please pay attention that this cage will be analyzed again the day after, and it could be included again in the list of planned tasks.

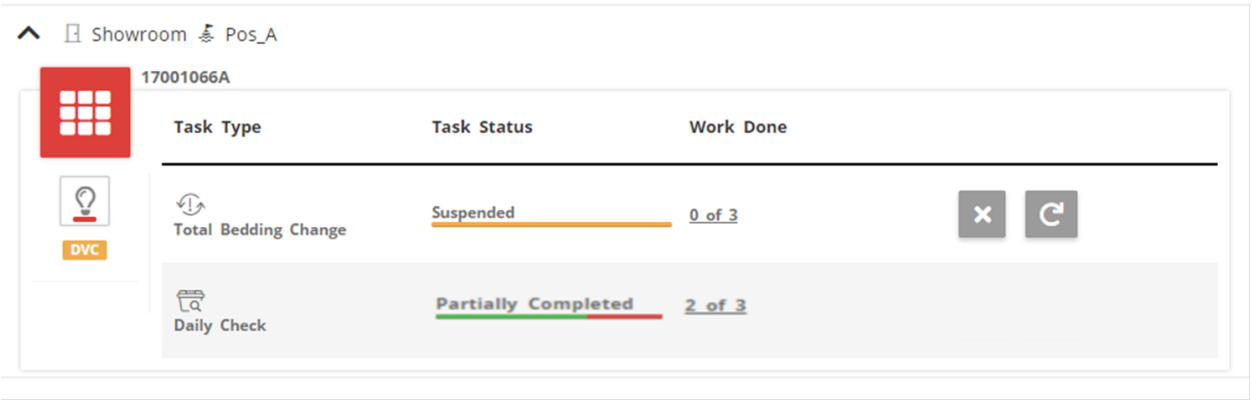
While performing the cage change, the Operator can leave important feedback for the DVC® System thanks to a specific icon shown on the interface, related to the **status of dirtiness** of the cage he/she just changed:

- **Too clean**: the suggested cage has been changed, but it was too clean
- **OK**: the suggested cage was "properly" dirty
- **Too dirty**: the suggested cage was too dirty

This feedback will be tracked into the DVC® System and shown in the history of the current cage.

Once a specific planned cage change task is performed, the corresponding cage slot position at DVC® Rack level, switch off the Yellow LED to confirm that the task has been correctly completed.

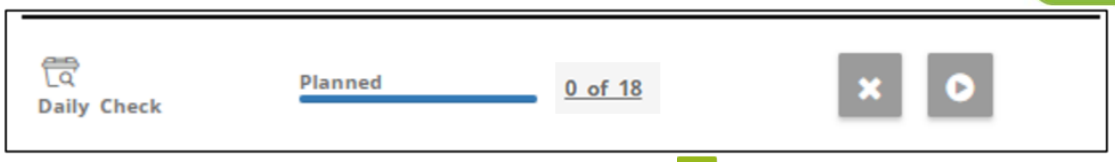
Finally all the planned cage changes have been performed, the task is registered as completed. The home page will display the report of the planned tasks (2 cages have been changed and 1 has been rejected in the example shown below)



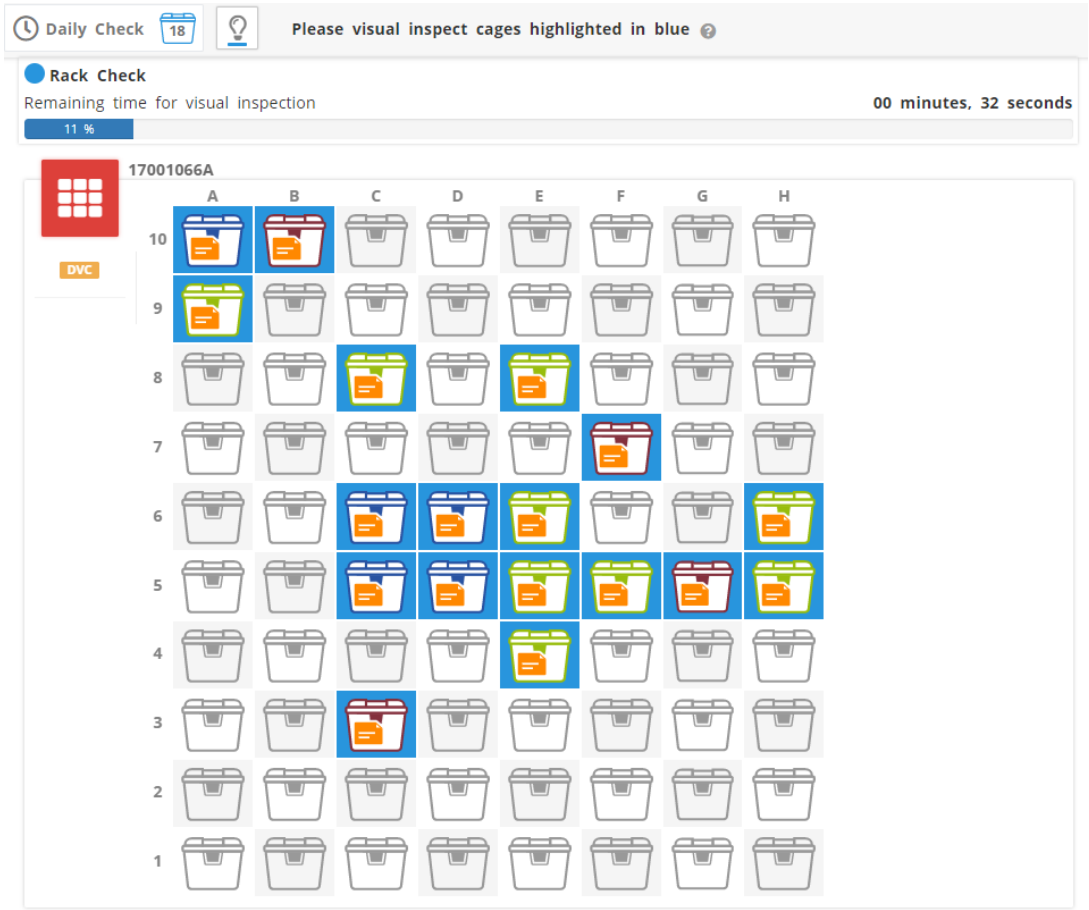
3.10.4 Daily Check Task

This task is generated by the DVC® Planner when the user wants to track that each cage has been individually (at least visually) checked during the day.

In the example shown below, 18 registered cages on this DVC® Rack need to be checked.

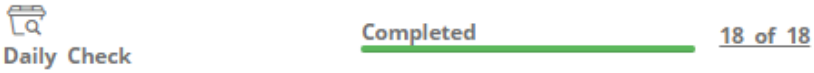


To perform the task, click on the corresponding icon and proceed to check the cages visually.
While the task is running, a **time progress bar** is displayed on the page top, showing the current task's remaining time



Eventually, LED can illuminate the cages to be checked (in BLUE), by clicking on the corresponding icon .
Moreover, all the cages to be checked have a coloured (BLUE) background as shown.
If a cage is extracted from the Rack during the task because something strange has been noticed, the time bar stops and restarts only when the cage is inserted back into position.

Once all the planned cages have been checked, the task is registered as completed. The home page will display the task as completed.



3.10.5 Anomalous Animal Activity Check Task (Night Welfare Check)

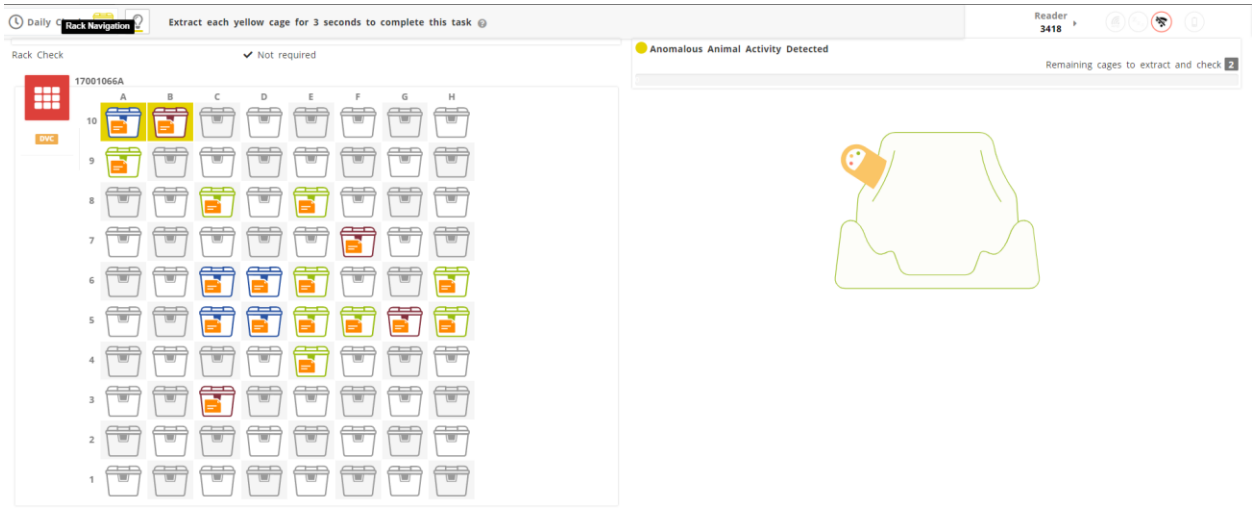
The DVC® System generates this task. It includes all the registered cages that showed, during the night period, an anomalous global animal activity (compared to the previous nights that are considered as baseline).

When the task is created, it is shown on the home page as any other planned task:

More specifically, it is included in the "Daily Check" task (they can run together or only the NWC task as in this example).

This NWC task requires a physical extraction of each individually tagged cage for a specific time.
In the DVC® Workplace interface (and please refer to it), it is possible to set the time required to keep the cage extracted before insertion to confirm the task has been performed.

Running the task by clicking the corresponding icon .
The DVC® Operator interface changes to a dedicated one where it is possible to discover which cages are to be physically extracted.

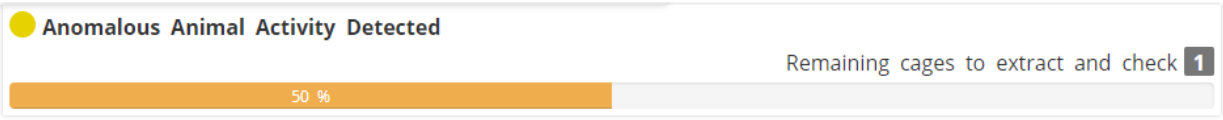


These cages are the ones with the yellow background (A10 and B10 coordinates).
The user can either illuminate these cages at DVC® Rack level by clicking the corresponding icon .
Once the first cage is extracted, the DVC® System also provides a graphical explanation (by Line chart and heatmaps) of why this task was requested.

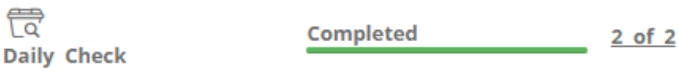
More specifically, the DVC® System creates three different NWC task types:

- **Hypoactivity detected**
- **Hyperactivity detected**
- **No activity detected**

These tasks are the outcomes of specific DVC® algorithms running during the night and analyzing DVC® data from all the registered cages.
Now, it is up to the user if going under the changing station and open this cage for deeper analysis or directly inserting it back in the DVC® Rack (no matter which position)
Once the cage has been inspected and inserted back into the DVC® Rack, the progress bar will show the task progress and the corresponding yellow LED switched off.



Once all requested cages have been inspected, the corresponding task is completed.



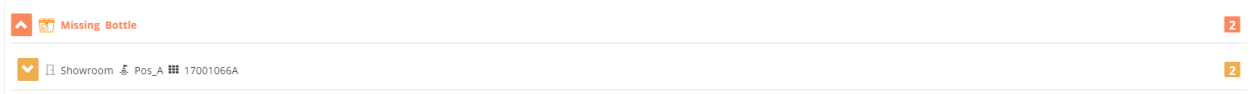
4. *Alarms*

Alarms are grouped by type.

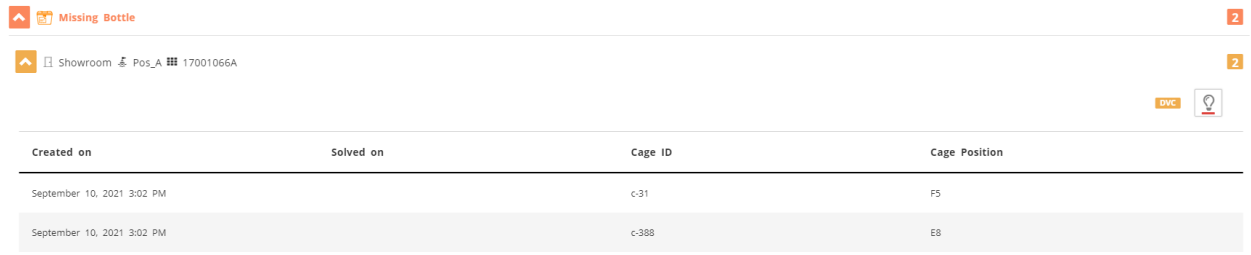
By clicking the Alarms icon 

, a dedicated section appears listing all the alarms.

Click on the expanding icon to group them by BUOY (location).



And click again to the icon to list the cages involved in such alarm



Lighting up all the cages with a specific alarm clicking on the switch on the right icon is possible.
When solved, alarms are shown in green colour with “Solved on” date information

Created on	Solved on	Cage ID	Cage Position
September 17, 2021 11:32 AM		c-313	F7
September 17, 2021 11:32 AM		c-310	C8
September 10, 2021 3:02 PM		c-389	G5
September 10, 2021 3:02 PM	September 17, 2021 11:35 AM	c-100	C5
September 10, 2021 3:02 PM		c-327	E6
September 10, 2021 3:02 PM		c-48	C6

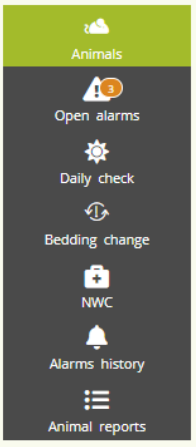
Finally, to clear the alarm status from all the already cleared alarms, it is possible to click on the little bin icon and only all the currently active alarms are finally displayed.

5. DVC® system extra features

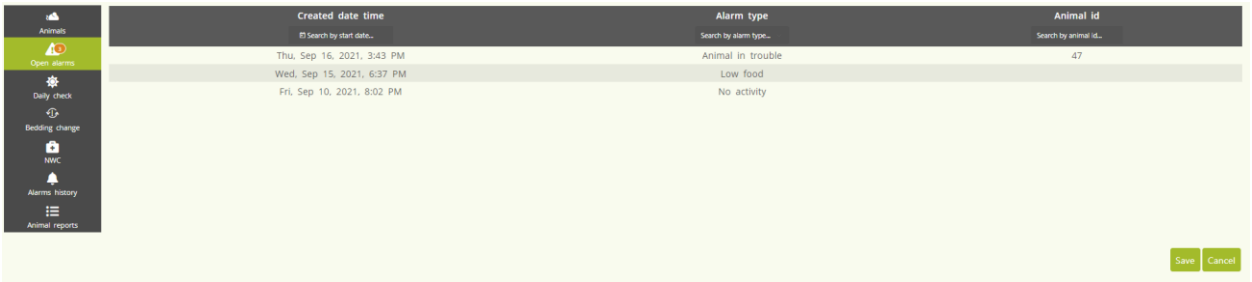
The electronic card label has been improved to manage specific information not present in the previous releases and new functionalities.
Also, a new specific dedicated table has been included to provide a better understanding of the NWC outcomes.
Lastly, a new device called REM is now managed by the DVC® Operator interface.

5.1 Cage Logbook

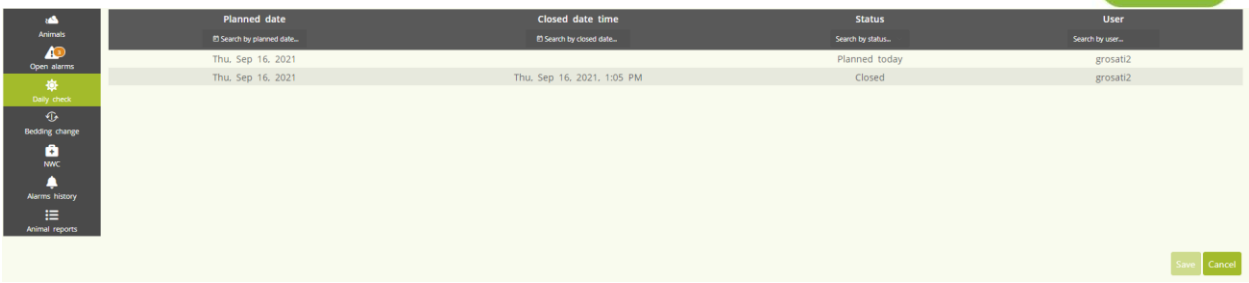
Independently from the type of Cage (Stock, Experiment or Breeding), the lateral section is dedicated to some important actual and historical information related to the cage and animals.



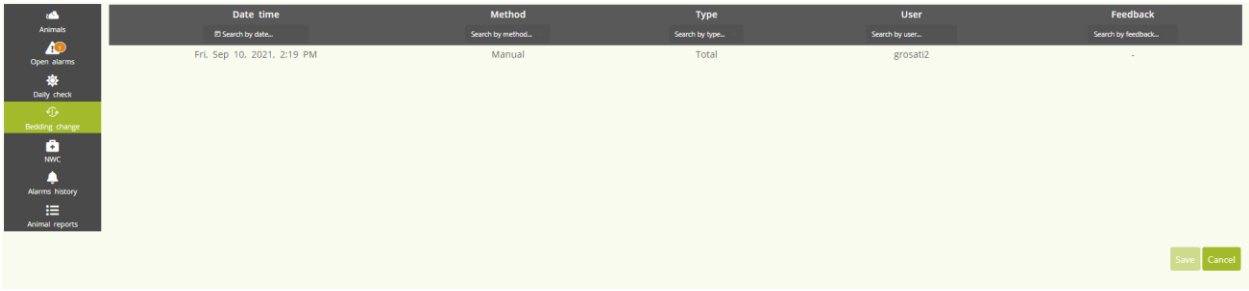
- "**Animals**" is the default view, and it refers to the mice registered in the cage
- "**Open alarms**" refers to the current alarms active in the cage with its creation date & time, the type of the alarm and Animal ID if present



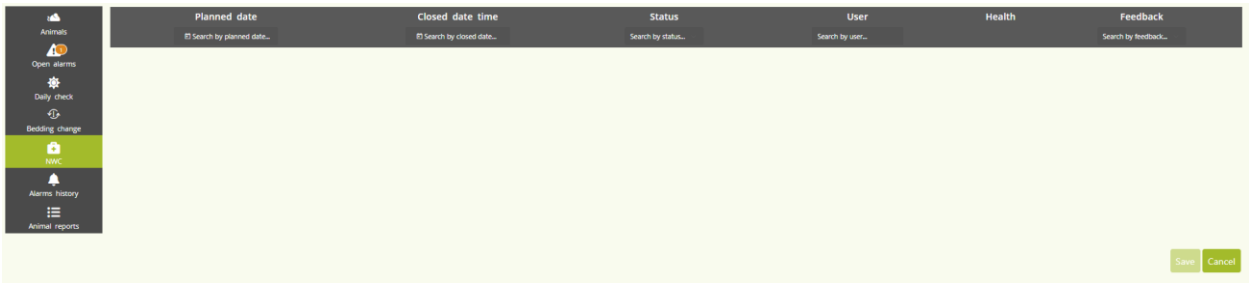
- "**Daily Check**" refers to planned daily checks planned and performed on this specific cage.



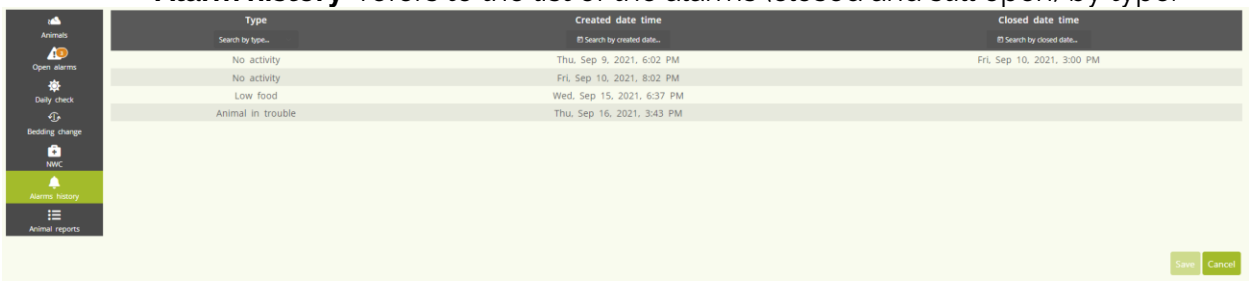
- "**Bedding Change**" tracks how many tasks of bedding change have been performed on such a cage. They can be filtered by date, method (manual or planned), type (total or partial), performed by who and feedback (if any)



- "**NWC**" shows how many planned tasks have been assigned to this cage, when, if and performed by who and if feedback has been left.



- "**Alarm history**" refers to the list of the alarms (closed and still open) by type.

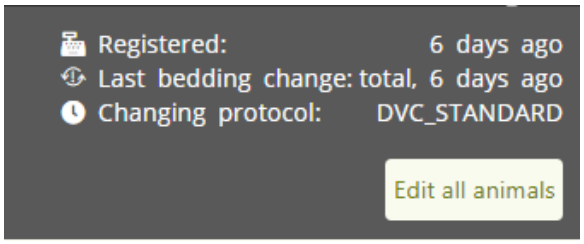


- Lastly, the "Animal report" tracks all the manual events triggered by the user, animal by animal of that cage.

5.2 Extra Cage information

On the right-top side of the electronic label, new information is added to provide a clear situation of the cage status.
More in detail, from this release, some cage information such as:

- **Registered**: When the Cage has been registered initially
- **Last bedding change**: When the last cage change has been performed and what was the type (total or partial)
- **Changing Protocol**: which is the assigned bedding changing protocol (please refer to the DVC® Workplace manual)

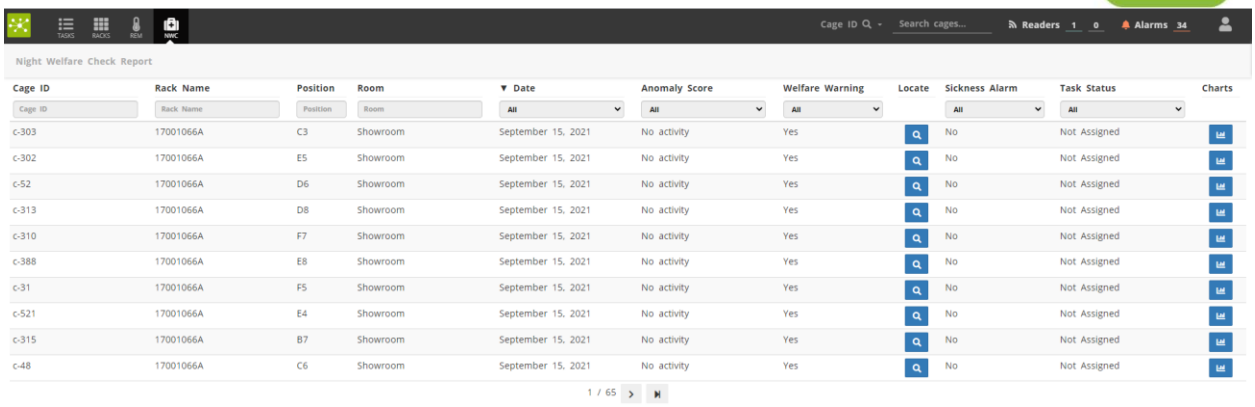


5.3 Same animal ID but in different Cage IDs

It is now possible to create multiple animals with the same animal ID but registered in different cages.
This functionality is off by default, but it can be enabled on request.

5.4 NWC table

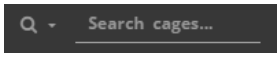
As previously described, the DVC® System daily analyze all the registered cages data during the dark period to generate an NWC outcome.
Only the NWC outcomes generated as anomalous hyperactivity, anomalous hypoactivity and no activity are translated into DVC® planned tasks (welfare warnings). All the others remain as NWC evaluations of the animal activity.
The NWC Table recap the latest 30-days evaluations for all the registered cages of any facility:



Moreover, it also represents the historical report about planned tasks, when generated, if performed and by who, and if a Sickness Alarm (i.e., "Animal in trouble" alarm) has been triggered for that cage.
Furthermore, the corresponding Chart is available on request for any generated NWC task (welfare warning) by clicking the corresponding icon  .

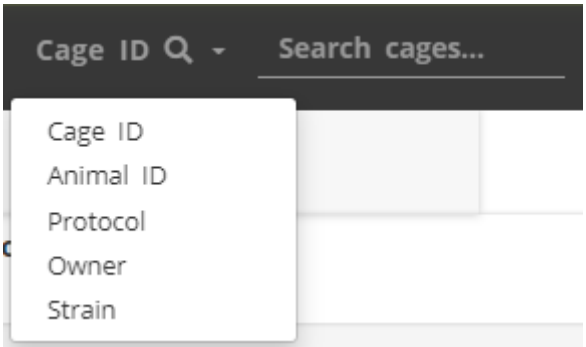
5.5 Search Function

The search function allows finding a specific cage or a group belonging to a specific query request.

The search field is located on the top right-hand side of the Main page 

and is valid for several groups.
The user can search by:

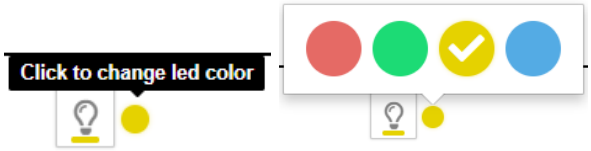
- **Cage Name**: enter the Cage ID
- **Animal Name**: enter the Animal ID
- **Protocol**: enter the research Protocol
- **Owner**: enter the researcher or group of research
- **Strain**: enter the animal strain



The result of the specific search is firstly grouped by location (by BUOY):

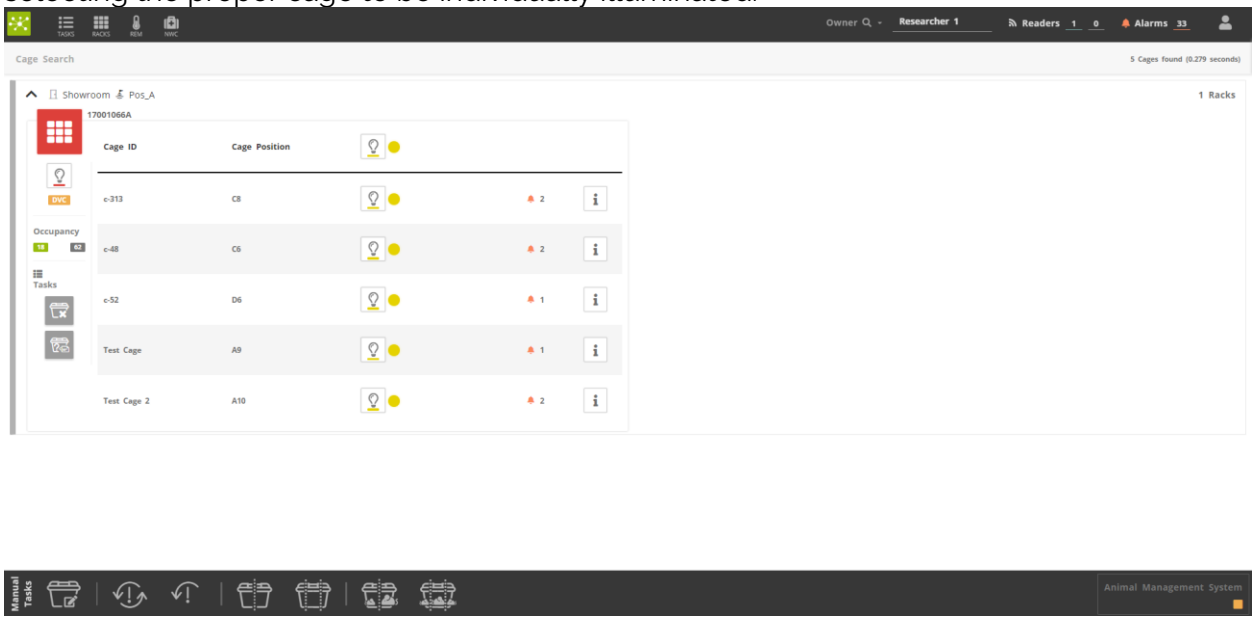
Then, clicking on the icon ⌄ , the precise location of the searched cage is displayed.

The corresponding cage can be easily illuminated just by clicking on the LED icon , and eventually, choose a different colour of the LED by clicking on this icon



Moreover, if the user wants to display the cage information, it is possible by clicking on the corresponding icon , and the cage content appears:

Suppose the user searches for multiple elements (such as cages belonging to a protocol or an Owner). In that case, the result can be a list of cages, always grouped at DVC® Rack level that can be illuminated altogether by clicking on the upper icon  or also one by one selecting the proper cage to be individually illuminated:



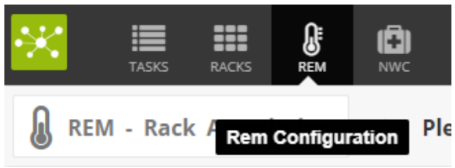
Last but not least, if the cage is in alarm, it can be seen directly at this level because a dedicated icon appears 

To discover the alarm, click on the icon and select the appropriate tab of the cage label.

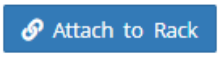
5.6 REM device management

It is possible to manage the REM device directly from the DVC® Operator interface.

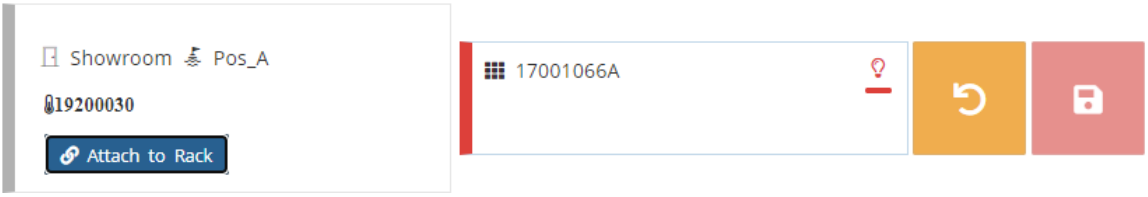
The first step is to attach the REM to the DVC®Master following the procedure described in the REM manual.
The attached REM appears in the Operator interface with a dedicated icon:



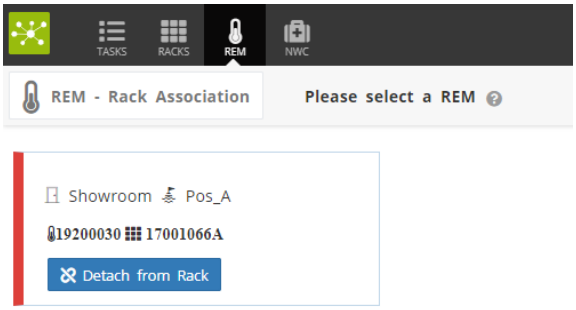
It automatically recognizes the DVC® Master attached to.

To Configure it, click on the corresponding icon and then click the button 

All the DVC® Racks (up to 4) attached to the same DVC® Master are displayed.



Select the DVC® Rack and then click the corresponding icon  to confirm.



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