



## WP4 Tailored Standard Operating Procedures

### Deliverable 4.1 Standard Operating Procedures

*Report on internal validated sensor based SOPs*

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## 1. Introduction

The main objective of this 4D4F workpackage is to develop/(test/implement) a series of Standard Operating Procedures (SOPs) which can be tailored to the specific needs of individual farms when adopting sensor and data analysis technology in dairy farming.

Standard Operating Procedures (SOPs) will set out protocols for how farmers perform specific tasks in such a way that other people can do the same task according to the protocol. In the 4D4F environment we see that tasks and processes more and more are supported and driven by data, the sensors that are used for monitoring, advice systems and machines to perform actions. So also for these situations SOPs are needed. In this report we describe the results of the SOP development process in the context of the 4D4F project. The SOPs will be designed so that they can be tailored to individual farmer needs. In the workpackage the following five tasks are foreseen. In this report we describe the results of the first task.

- Task 4.a Develop draft Standard Operating Procedures (SOPs):

This task will identify a set of topics (at least 10 e.g. the use of sensors to monitor mastitis, humidity in dairy housing) in which SOPs are needed and work with partners to establish a special interest group for each topic. A special interest group will typically contain 2 or more farmers, a technology company, an advisor/vet and a researcher/facilitator who will work together to develop a SOP for their topic area.

- Task 4.b Test the Standard Operating Procedures

This will be led by VHL with support from other partners to ensure the SOPs are tested in a variety of farm situations from across Europe. It will also learn from emerging systems which integrate sensor data into decision making such as Herd Navigator from DeLaval.

- Task 4.c Integrate SOPs into a management decision tool:

It will test how to integrate the SOPs into a strategic dairy decision support tool (OptiCow) which has already been developed by ZLTO in consultation with dairy farmers. This will be done by working with 30 farmers to gather relevant information (from sensors and other sources), define the objectives of the farm, describe the expected effects, check if these effects are realized and if necessary revise the tool to address farmer feedback (the plan – do – check – act cycle). This will enable the 4D4F network to evaluate how to implement the SOPs seamlessly with existing dairy decision support tools.

- Task 4.d Publish Standard Operational Procedures (SOPs) which are capable of being tailored to specific farm situations:

This task will create easily accessible materials for each SOP developed and tested in tasks 4a and 4b.

- Tasks 4.e Link to EIP Operational Groups:

This will be led by the network coordinator (Innovation for Agriculture) and will focus on ensuring that the SOP working groups created by the 4D4F project link to appropriate EIP Operational Groups and/or where groups focused on dairy sensor technology do not exist work with project partners to stimulate their creation.



## Literature review

The International Conference on Harmonization (ICH) defines standard operating procedures (SOPs) as 'detailed, written instructions to achieve uniformity of the performance of a specific function' (Nickols, 2000). The ICH GCP cites in section 2.13 that 'systems with procedures that assure the quality of every aspect of the trial should be implemented'. Companies that write or are going to write SOPs, need to take these two very precisely. It says that SOPs need to be detailed, and need to be set out by writing. Traditionally SOPs contained a large amount of paper, but most SOPs are becoming more digitally available (Nickols, 2000).

In short: every document giving written instructions on how to do a task, or describing a system is considered an SOP (Edy et al., 2007). Some procedures for different areas of an organization are given different names. What these different types of instruction documents are called is really a matter of convenience for the different organizations. SOPs inform people what to do, and how to do it. That means that there are many different types of SOPs, for many different tasks all over the world. All of these SOPs contain different content and are very specific to an organization (Edy et al, 2007).

## How to apply SOPs in Dairy Farming

But how can we make SOPs more useable in dairy farming? Today's farms are getting more and more in touch with automatic systems, such as for example milking robots, sensor technology and more real-time applications that make work on a dairy farm more easy. SOPs can help to make a decision on what to do when a certain alarm shows up when using sensors on cattle. But farms also get bigger and bigger in size and amount of cattle. This is also where SOPs can help managing a dairy farm.

But what is the difference between the organization of an average farm and a big farm? The biggest difference can be found in the perspective of the manager and his tasks on his farm. On an average farm the manager is mostly doing all of the tasks. On the bigger farm the manager is the person who controls the activities on the farm, done by co-workers, contractors or freelancers. The manager controls the overall farm, and the co-workers or contractors are just responsible for a part of the fulfilment. The combination of the manager and all the persons working on the farm is determinative for the success of the dairy farm (Zijlstra e.a., 2008). Other differences between an average farm and a bigger farm are the speed of growing, and the relevance for the farmer.

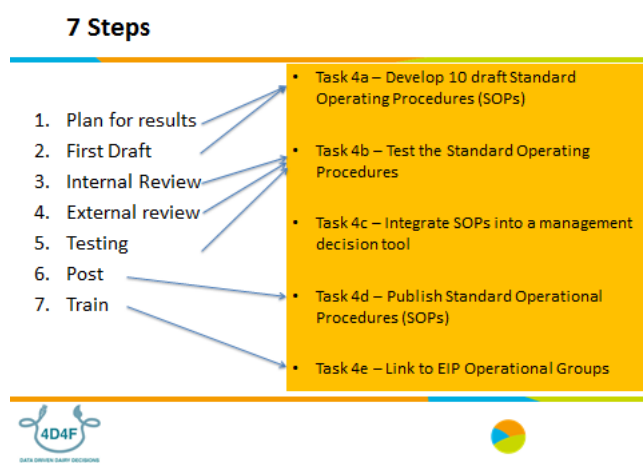
Jelle Zijlstra (2013) describes how labor on a farm should be organized after a so called 'growing phase'. The next challenge for the farmer after getting a certain size or amount of cattle, is to organize and manage the big farm. Important is to look at communication between co-workers on the farm, which is the key for a healthy working farm.



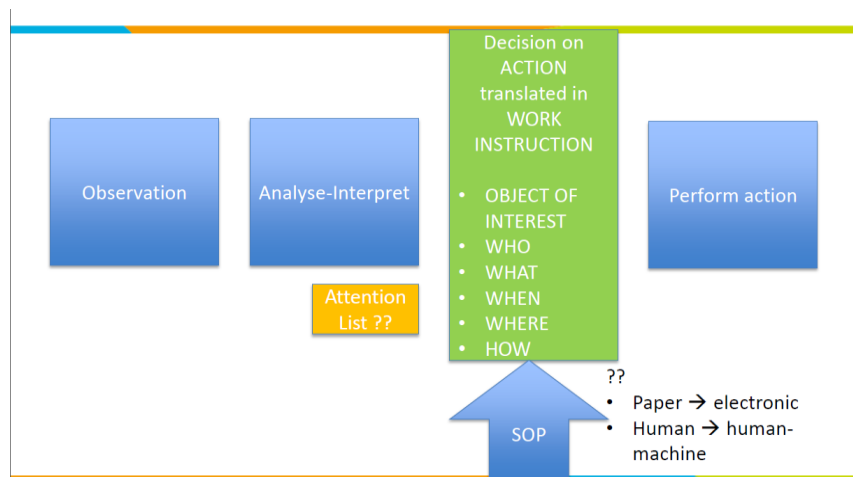
## 2. Methods and materials

The adopted method for this work package is developed by PennState Extension and called 'Standard Operating Procedures: A Writing Guide'. This Writing Guide contains 7 steps of developing and implementing SOPs. And also knowhow about how define systems, procedures and steps and formats for Standard Operating Procedures. This Writing Guide is also the basis behind DeLaval's SOPs. Source: <http://extension.psu.edu/animals/dairy/hr/personnel/ud011>

In the following figure the relation between the 7 steps and the work package tasks is described.



In addition, the figure below has been used for subscribing the actions.



*Scheme for developing SOPs (Source: Kees Lokhorst)*

### How to read the results?

In chapter 3 you'll find several different Standard Operating Procedures (SOP). These SOPs are composed with a starting point of European farmer who want to start with working with SOPs and with sensors. Irrelevant in this report is the size of the farm. So this means the SOPs are not only developed for large farms with staff but also for family farms.

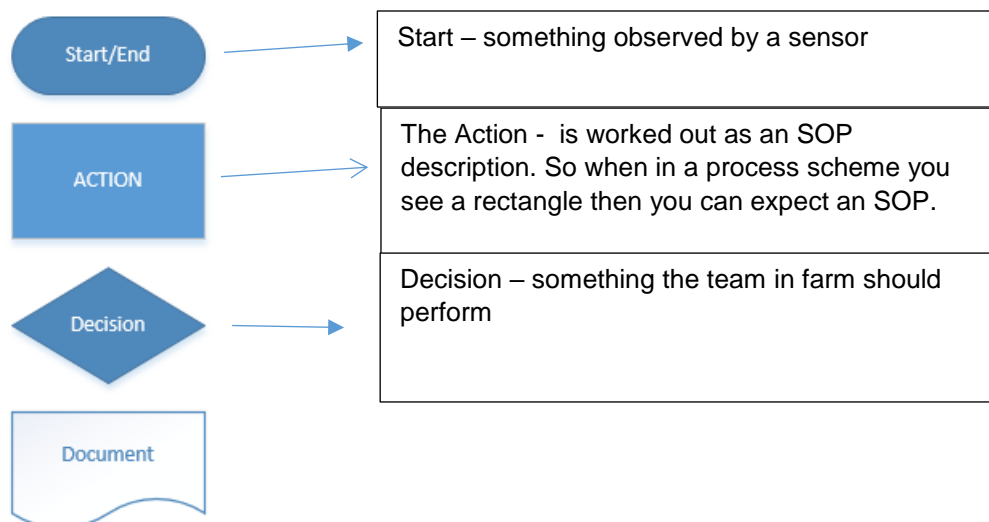
Every SOP on every farm is different. It depends on the aims of the farmers and the type of sensors they want to use. So in this report we present some examples of SOPs. When you want to adopt



them into your farm, we will advise you to ask your (technical) advisor to support you with adopting SOPs.

In the beginning of each SIG you'll find an overview belonging to the subject of the SIG. In this overview there are empty spaces. These empty spaces mean that there are a lot more possibilities to develop SOPs and to input sensors. Every process will be changing by adding sensors. Every sensor will have a different operating procedure.

For making flowcharts of a PROCESS the next symbols are adopted;



For the classification of the SOP's we use the SIG classification of the 4D4F project. In the next chapters per SIG the same structure will be used.

Level 1: 4D4F SIG number and process

Level 2: SENSOR

Level 3: DATA

Level 4: SOP

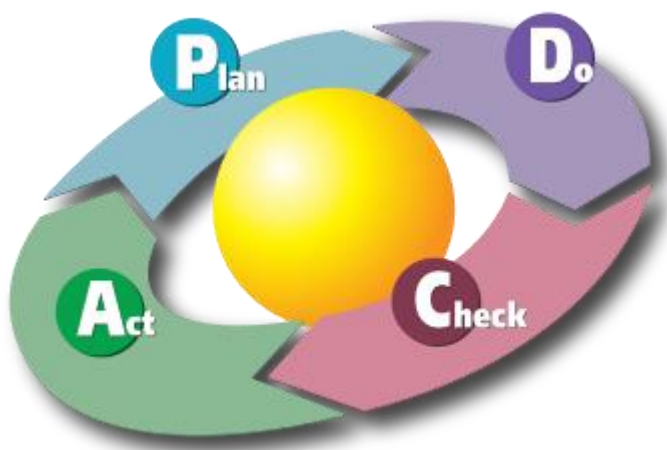
In the SIG/process level it is identified on which topic we work and described what the context is. You should imagine that the process is triggered by output (data) from a sensor. The sensor level we brought in to be able to show the difference when the same process is supported with different sensors and different data. The work instructions that should be described as a SOP in such a way that for the object of interest it is clear who does what, when, where and how.

#### 4D4F SIG overview

1. Udder Health
2. Lameness
3. Nutrition
4. Reproduction
5. Data management
6. Milking data
7. Activity and behaviour
8. Metabolic diseases
9. Calves and young stock
10. Goats
11. Grassland management
12. Housing

#### General assumptions

You should consider these SOPs as an example of useful SOPs in practice. But when you will implement these SOPs in your own management you need to adjust them to your own management. Before you can adjust and adopt the SOPs on your own farm you need to use the **PDCA-cycle**.



First you need to make a **plan**. This plan has to contain the next two questions; What business goals will be achieved through better management with this SOPs? And how will those goals be measured? Then you need to adjust the SOP into your own (business)plan. Afterwards you have to implement the plan (just **do** it). When you have implemented the plan, the SOP, on your farm you have to collect data. **Check** the actual results by studying the data. Compare these to your plan. After checking the actual results you need to act on these. Are the results you suspected? You should **act** going forward with this SOP otherwise you need to probably change your plan or your SOP to fit better into your management.

The major aim of this report is to provide insight in the possibilities to develop SOPs.



### 3. Internal validated sensor based SOPs

#### 3.1 Udder Health

Mastitis, an inflammation of the udder tissue, is one of the most common and most costly diseases in dairy cattle. The majority of mastitis cases are caused by bacteria that enter through the teat canal. The most important bacteria include *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp.*, *Streptococcus uberis*, *Streptococcus dysgalactiae*, and *Streptococcus agalactiae*.

The economic repercussions of mastitis are considerable. Possible financial losses include a decreased milk production, discarded milk, treatment costs, additional labor, veterinary services and a higher culling rate. The average cost of one case of mastitis is estimated at +/- €300, with large differences depending on the severity, withdrawal times and veterinary legislation differing between countries. Mastitis therapy and dry-cow treatment are also the primary indication of antibiotic use in dairy cattle.

The symptoms of clinical mastitis include a drop in the milk yield, flakes or clots in the milk, watery milk, swelling of the mammary quarter, redness of the udder skin, fever and general illness. Detection with sensors can e.g. be made through conductivity, temperature, colour and LDH.

Maintaining a good udder health on AMS farms has proven to be even more challenging. The somatic cell count and the total bacterial count of milk is often higher in AMS farms compared to conventional dairy farms, whereas treatment cases are reported to be lower. Special attention should be paid to the hygiene management of the milk robot, the cubicles and the floors in the dairy barn.<sup>1</sup>

The plan for results of this SIG will be described like:

#### **What business goals will be achieved through better management with this SOPs?**

By using these SOPs the udder health will improve. Like the somatic cell count (SCC) will decrease, the cows will both be healthier and increase in milk yield. It will also result in decrease the veterinarian costs and the use of antibiotics as well as waste of milk.

#### **How will those goals be measured?**

The udder health can be evaluated by monitoring:

- Individual somatic cell counts (at cow and quarter level)
- Bulk milk somatic cell counts
- Bacterial culturing
- Electrical conductivity (and other sensor-related data)
- Antibiotic use
- Clinical mastitis records

For detail description; see Best Practice Guides on the 4D4F website.

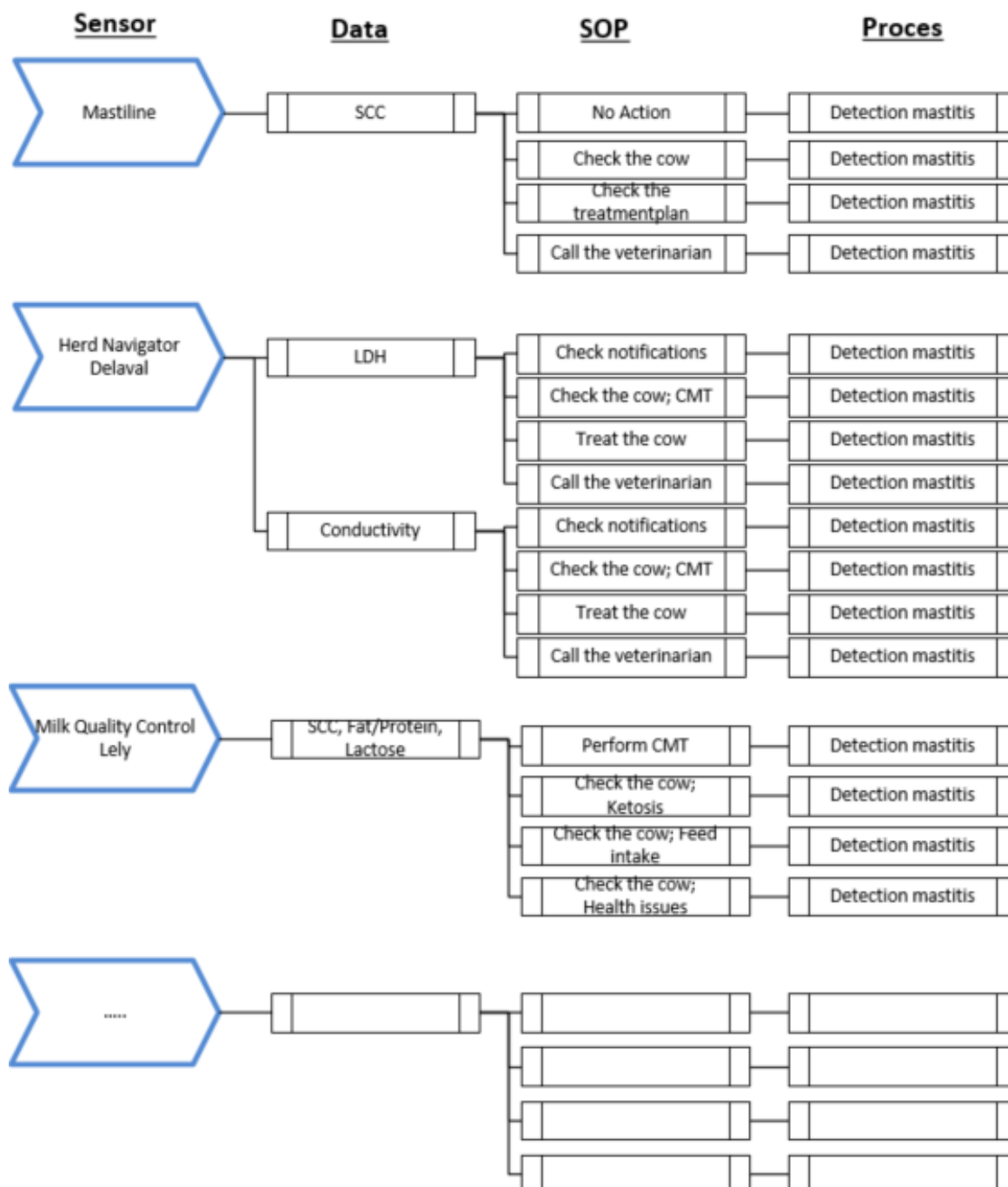
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<sup>1</sup> Source: BPG Udder Health



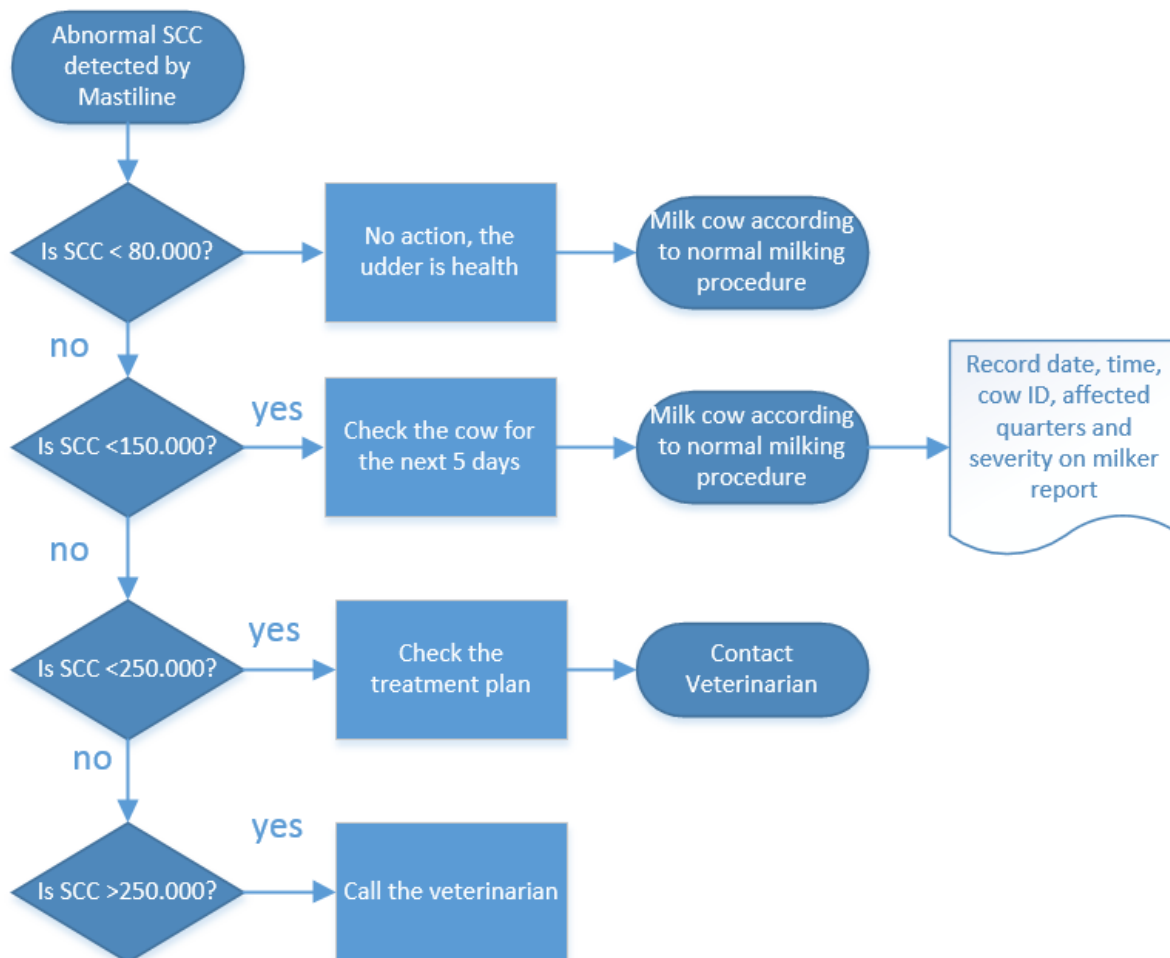


## SIG 1 – Udder Health





Mastiline – SCC - process detection mastitis



**Note: the SCC numbers are an example. It depends to every different farm and management system/goals of the farmer.**



*SOP – No action*

**Object of interest:** The udder  
**Who:** The person who is responsible for the mastitis  
**What:** No action  
**When:** By SCC between < 80.000  
**Where:** No specific area  
**How:** Milking the cow just like all the other cows.

No action, the  
udder is health

*SOP – Check the cow*

**Object of interest:** The udder of the cow  
**Who:** The person who is responsible for mastitis  
**What:** Check the cow for the next 5 days  
**When:** When the SCC is higher than 150.000  
**Where:** In the milking parlour  
**How:** see how to pre milk the cow

Check the cow for  
the next 5 days

---

*HOW TO PRE MILK THE COW*

---

1. Clean all four teats
2. Make sure the floor under the udder is clean
3. Milk the cow by hand until you have 4 milk rays
4. Do you see deviations? Like flakes or is the milk washy?
5. Write down the deviations
6. Clean your hands
7. Clean the floor



*SOP – Check the treatment plan*

**Object of interest:** Treatment plan  
**Who:** The person who is responsible for the mastitis  
**What:** Check the treatment plan  
**When:** By SCC between 150.000-250.000  
**Where:** In the office  
**How:** On the computer

Check the  
treatment plan

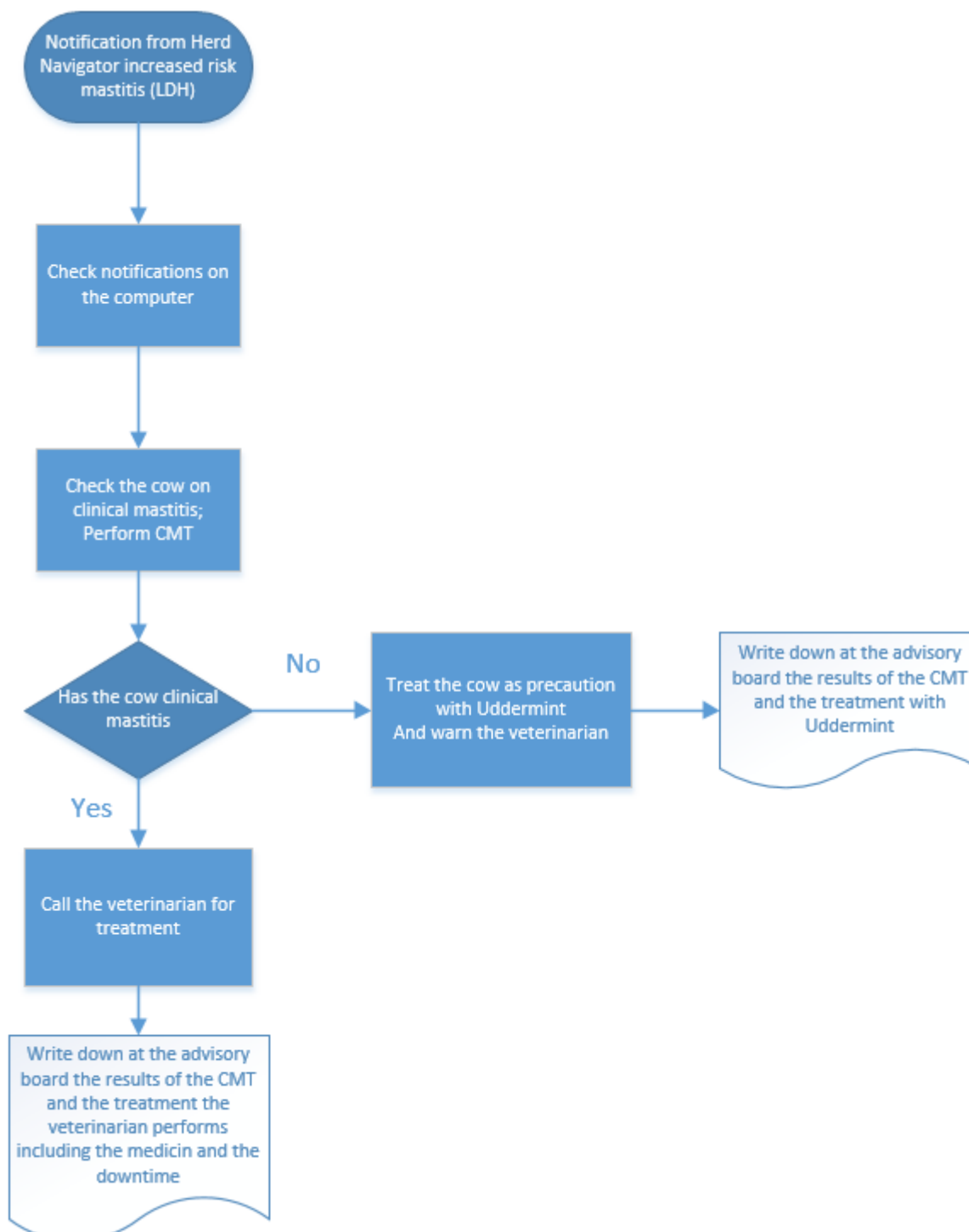
*SOP – Call the veterinarian*

**Object of interest:** Veterinarian  
**Who:** The person who is responsible for mastitis  
**What:** Call the veterinarian  
**When:** When the SCC is higher than 250.000  
**Where:** Wherever you are  
**How:** Call number.....

Call the veterinarian



Delaval Herd Navigator - LDH – process detection mastitis





*SOP – Check the notifications on the computer*

Check which cows are on the attention list.

**Object of interest:** Mastitis attention list

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk for mastitis

**Where:** Office, phone (f.e.)

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT.

Check the cow on  
clinical mastitis;  
Perform CMT

## HOW TO PERFORM THE CMT

1. Clean the four-well plastic paddle exhaustively
2. Pre-milk every quarter
3. Put the four-well plastic paddle straight underneath the udder, keep around 5 cm space between the udder and the four-well plastic paddle. Milk every quarter twice in a separate cup of the four-well plastic paddle
4. Remove the four-well plastic paddle from the udder. Keep the four-well plastic paddle slantwise until the milk hits the marking lines.
5. Add CMT liquid to the milk. The amount of liquid has to be the same as the amount of milk.
6. Swerve the four-well plastic paddle for 10 seconds slowly until the milk and the CMT-liquid is mixed.



UGA is de uiergezondheidsaanpak van de GD



*SOP – Treat the cow as precaution*

If a cow has subclinical mastitis, it must be treated with care. This prevents clinical mastitis.

**Object of interest:** Cow with subclinical mastitis

**Who:** The person who is responsible for udder health

**What:** Treat cows with subclinical mastitis

**Where:** Milking parlour or separation box when there is an AMS

**When:** After milking the cow

**How:** Massage the udder after milking and salve the udder with udder mint

*(Before treatment check the package for instructions, follow these instructions)*

Treat the cow as precaution  
with Uddermint  
And warn the veterinarian

*SOP – Call the veterinarian*

**Object of interest:** Veterinarian

**Who:** The person who is responsible for udder health

**What:** Call the veterinarian

**When:** When you suspect the cow has clinical mastitis

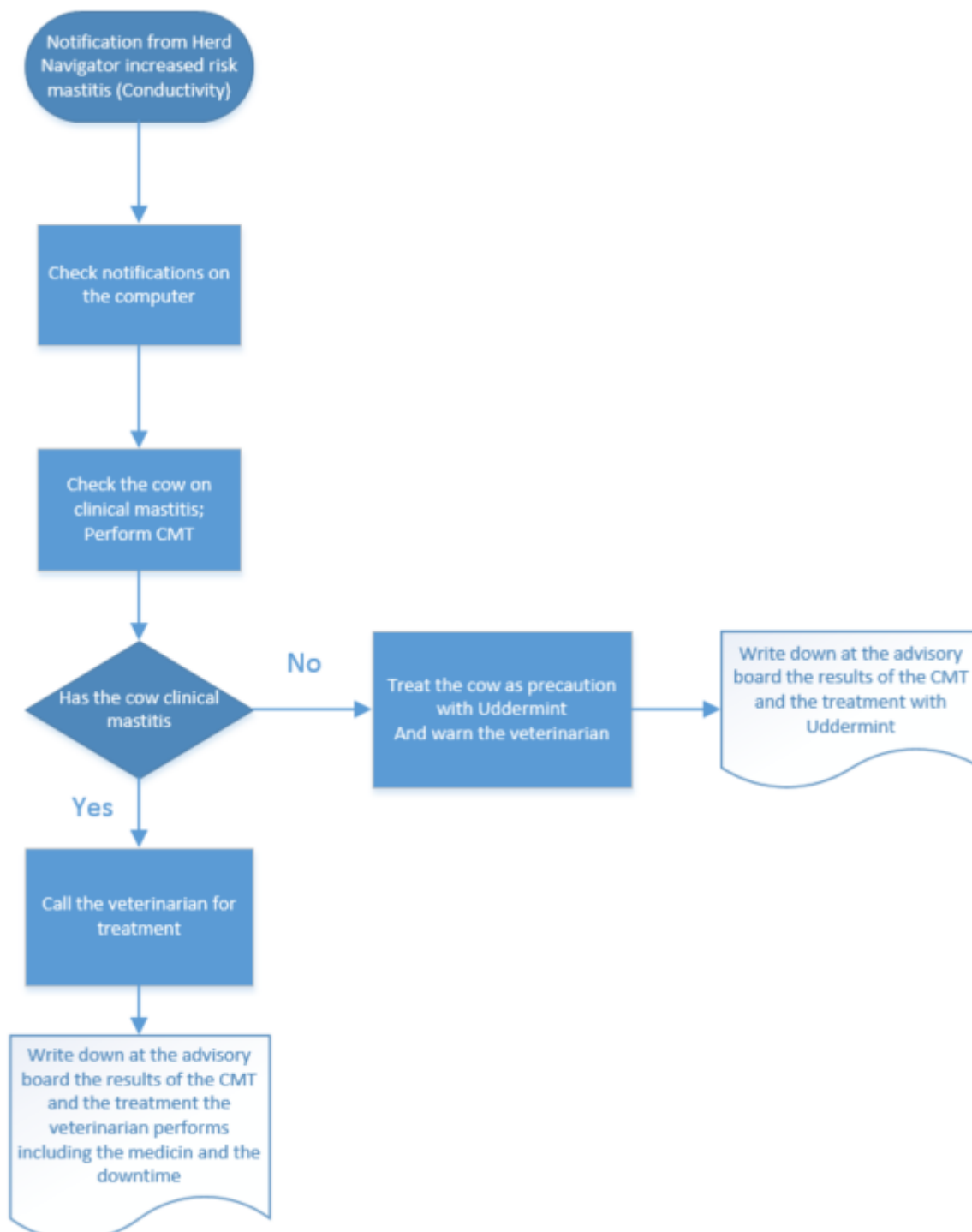
**Where:** Wherever you are

**How:** Call number.....

Call the veterinarian



Delaval Herd Navigator – Conductivity – process detection mastitis





*SOP – Check the notifications on the computer*

Check which cows are on the attention list.

**Object of interest:** Mastitis attention list

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk of Mastitis

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT.

Check the cow on  
clinical mastitis;  
Perform CMT

## HOW TO PERFORM THE CMT

1. Clean the four-well plastic paddle exhaustively
2. Pre-milk every quarter
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4. Remove the four-well plastic paddle from the udder. Keep the four-well plastic paddle slantwise until the milk hits the marking lines.
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**Object of interest:** Cow with subclinical mastitis

**Who:** The person who is responsible for udder health

**What:** Treat cows with subclinical mastitis

**Where:** F.e. Milking parlour or separation box when there is an AMS

**When:** After milking the cow

**How:** Massage the udder after milking and salve the udder with udder mint

*(Before treatment check the package for instructions, follow these instructions)*

Treat the cow as precaution  
with Uddermint  
And warn the veterinarian

*SOP – Call the veterinarian*

**Object of interest:** Veterinarian

**Who:** The person who is responsible for udder health

**What:** Call the veterinarian

**When:** When you suspect the cow has clinical mastitis

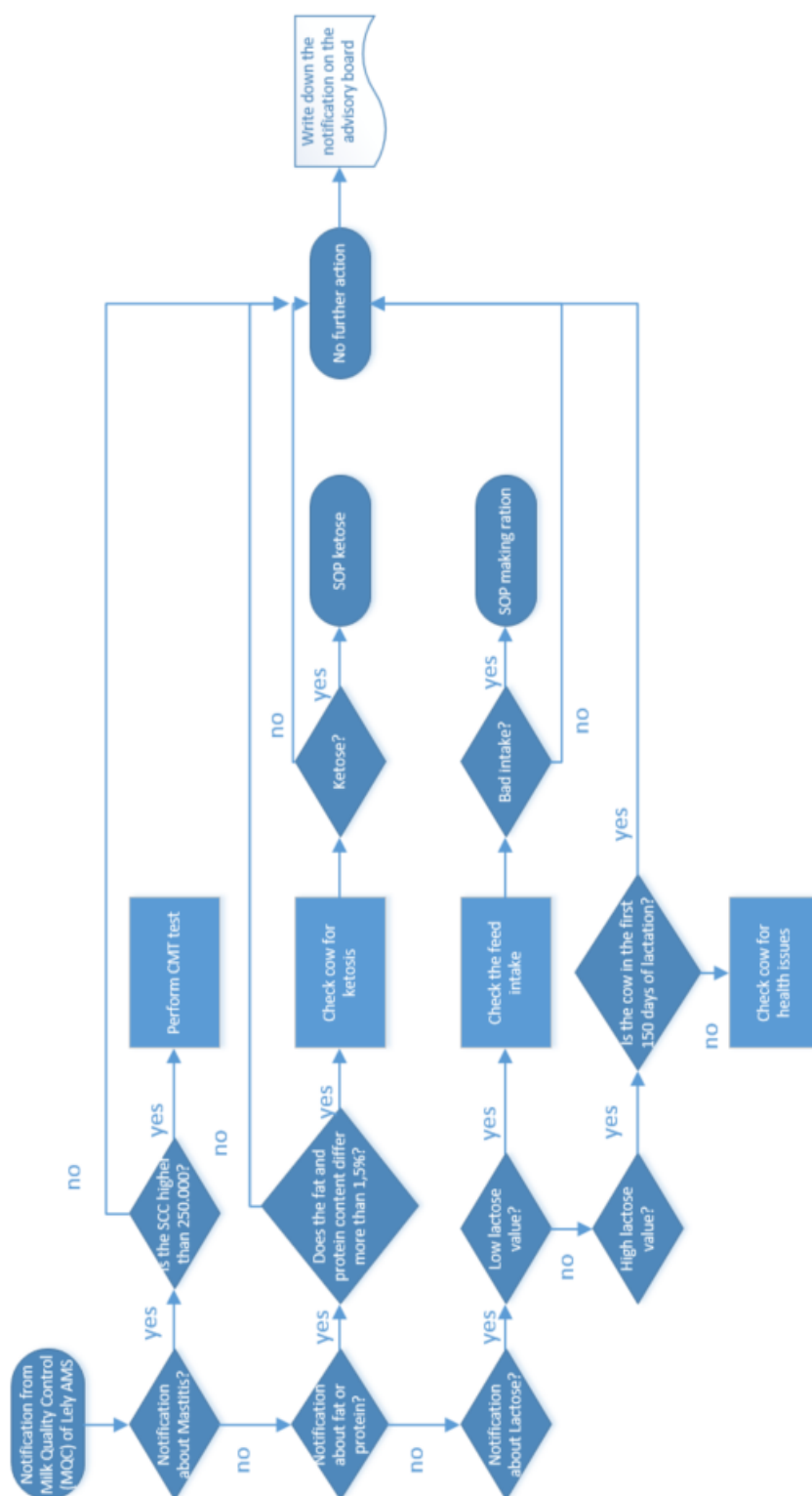
**Where:** Wherever you are

**How:** Call number.....

Call the veterinarian



Lely Milk Quality Control - SCC - process detection mastitis





*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT.

Perform CMT test

HOW TO PERFORM THE CMT

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3. Put the four-well plastic paddle straight underneath the udder, keep around 5 cm space between the udder and the four-well plastic paddle. Milk every quarter twice in a separate cup of the four-well plastic paddle
4. Remove the four-well plastic paddle from the udder. Keep the four-well plastic paddle slantwise until the milk hits the marking lines.
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6. Swerve the four-well plastic paddle for 10 seconds slowly until the milk and the CMT-liquid is mixed.



UGA is de uiergezondheidsaanpak van de GD

*SOP – Check the cow on Ketosis*

**Object of interest:** The cow

**Who:** The person who is responsible for health

**What:** Check the cow on ketosis

**When:** When you have a notification of the MQC on fat or protein

**Where:** In the barn

**How:** to check if the cow has disease phenomena of ketosis

Check cow for  
ketosis

*SOP – Check the feed intake*

**Object of interest:** The cow

**Who:** The person who is responsible for the feeding

**What:** Check the feed intake

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

**How:** to check if the cow has eaten enough during the last 5 days

Check the feed  
intake



*SOP – Check the cow for health issues*

**Object of interest:** The cow

**Who:** The person who is responsible for the health

**What:** Check the cow for health issues

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

**How:** to check if the cow has disease phenomena

Check cow for  
health issues



### 3.2. Reproduction

Reproduction is on the most farms a very important topic. With a good breeding system you have the opportunity to breed cows of good quality. You can aim on the goals you have in breeding. Nowadays there is a lot of information about the characteristics of the bulls and a lot of bulls to choose to use for breeding. Important KPIs on reproduction are; Submission Rate (SR) and Conception Rate (CR). The product of SR and CR is the Pregnancy Rate (PR).

In this chapter we are talking about the reproduction by cows as well as heifers.

The plan for results of this SIG will be described like:

**What business goals will be achieved through better management with this SOPs?**

By using these SOPs the KPI's on reproduction will improve. Like the amount of inseminations per cow per lactation and calving interval.

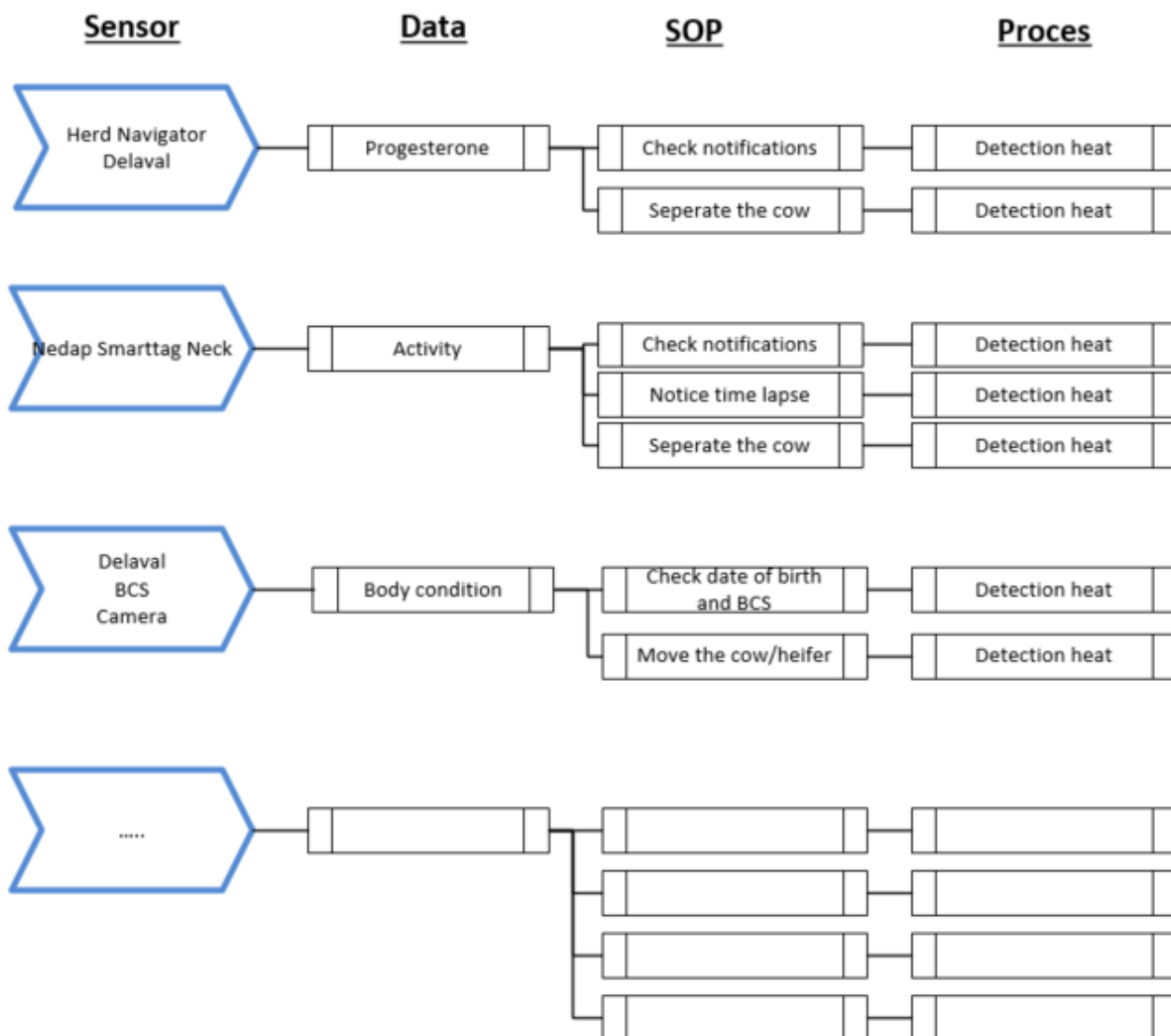
**How will those goals be measured?**

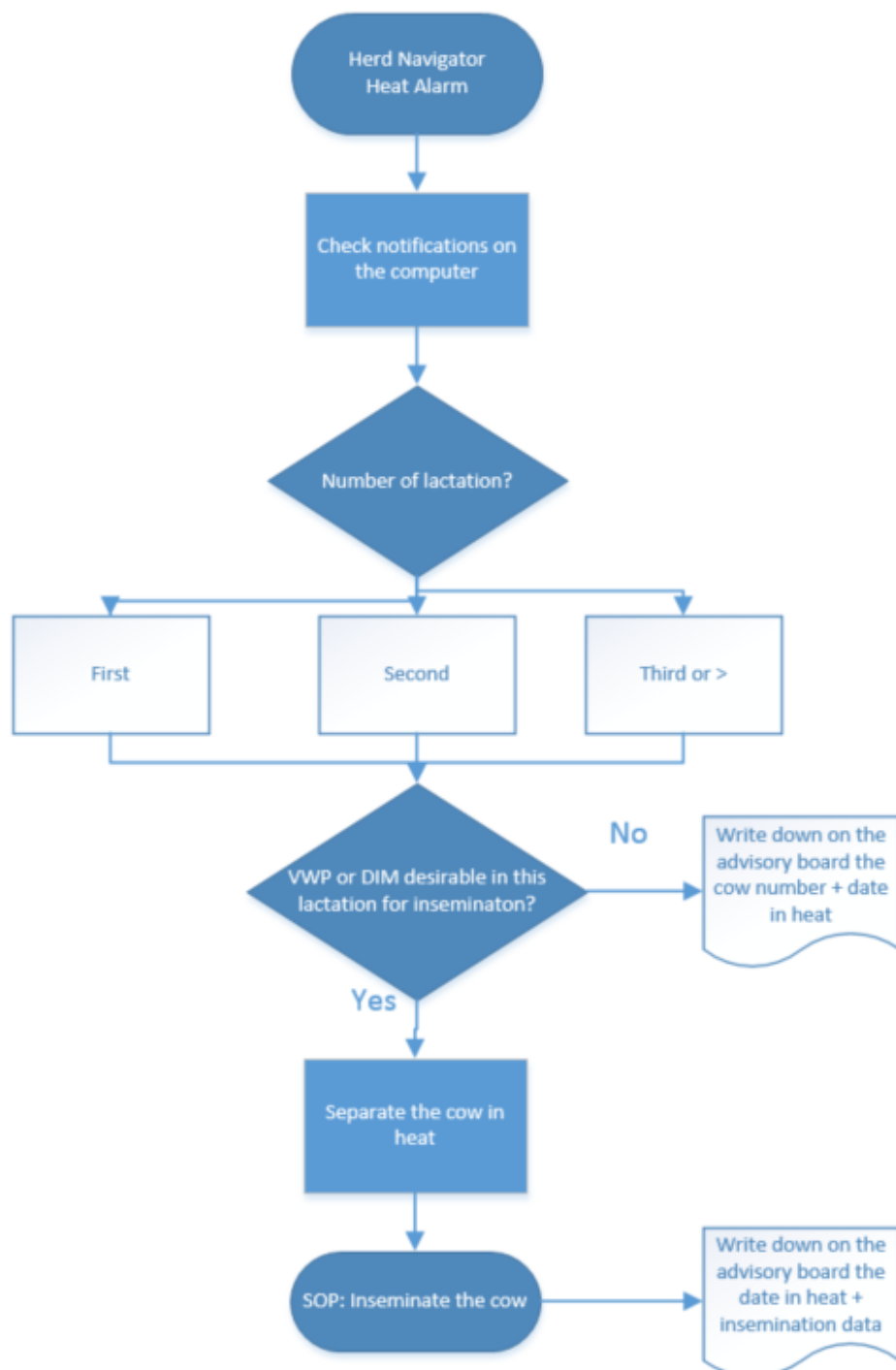
After the lactation you can see how much inseminations you needed to get the cow pregnant and how many days the calving interval was.

For detail description; see Best Practice Guides on the 4D4F website.



## SIG 4 – Reproduction







*SOP – Check the notifications on the computer*

**Object of interest:** Attention list in heat

**Who:** The person who is responsible for reproduction

**What:** Check which cows (numbers) have an Herd Navigator Heat Alarm

**Where:** PC/ Office

**When:** twice a day, in the morning and in the evening

**How:** Click on the list of attentions

Check notifications on  
the computer

*SOP – Separate the cow*

**Object of interest:** Cow in heat

**Who:** Farmer

**What:** Separate the cow in heat

**Where:** Separation room

**When:** If the Herd Navigator indicates it

**How:** By separating the cow from the herd, most of the time installing action on the Herd Navigator

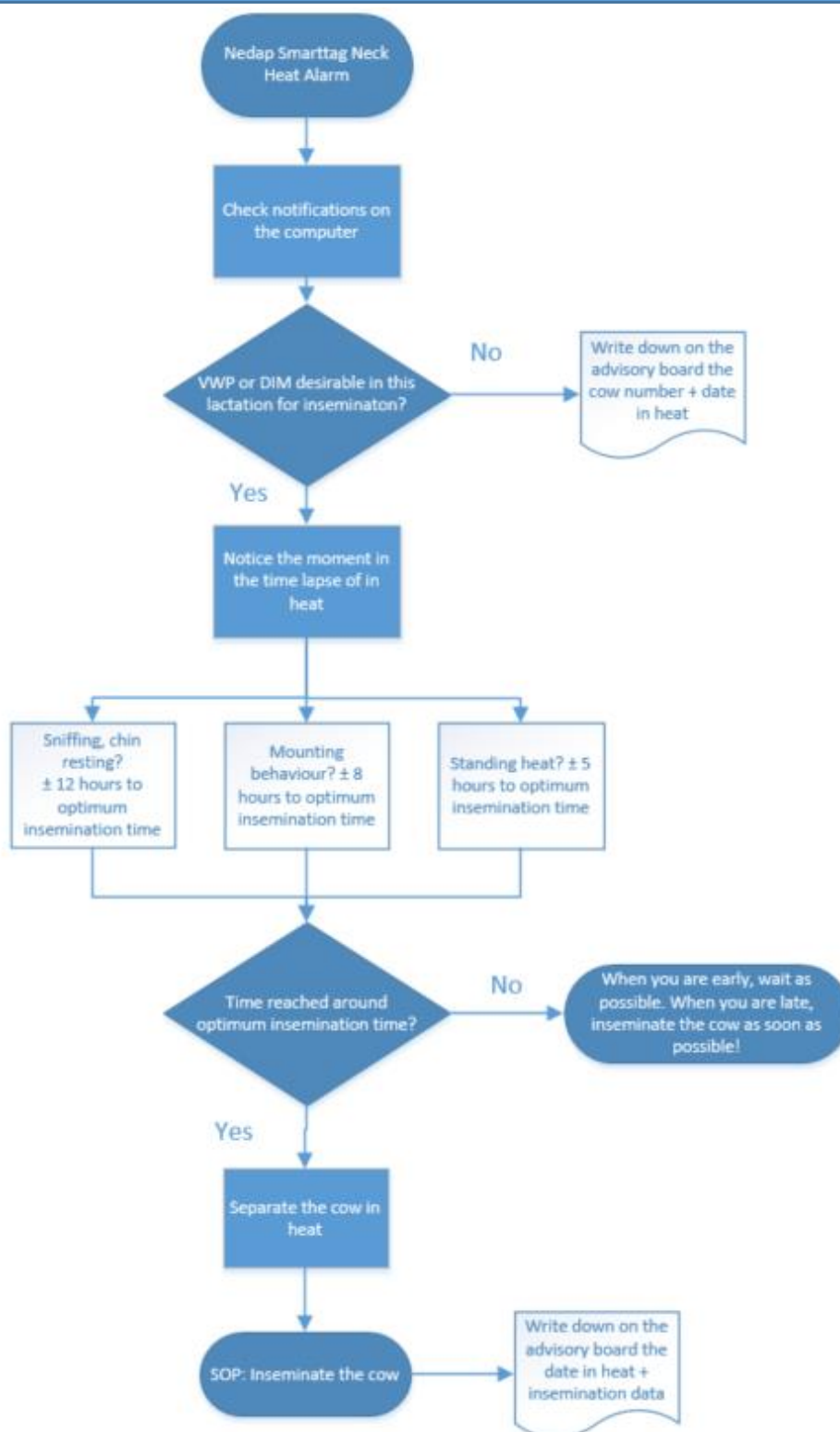
Separate the cow in  
heat

*Note: The Herd Navigator indicates the correct moment of insemination. Separate the cow according to the Herd Navigator SOP. Inseminate the cow as soon as the Herd Navigator indicates that the moment of inseminating has reached the right time.*





Nedap Smarttag Neck – Activity – Process detection heat





*SOP – Check the notifications on the computer*

**Object of interest:** Attention list in heat

**Who:** The person who is responsible for reproduction

**What:** Check which cows (numbers) have an Nedap Smarttag Neck Heat Alarm

**Where:** PC/ Office

**When:** twice a day, in the morning and in the evening

**How:** Click on the list of attentions

Check notifications on  
the computer

*SOP – Notice the time lapse of in heat*

**Object of interest:** the time lapse of the cow in heat

**Who:** Farmer

**What:** Notice the time laps of in heat

**Where:** Devise with the Nedap system installed

**When:** When there is a notification of the Nedap Smarttag

**How:** Checking the optimum insemination time on the notification

Notice the moment in  
the time lapse of in  
heat

*SOP – Separate the cow*

**Object of interest:** Cow in heat

**Who:** Farmer

**What:** Separate the cow in heat

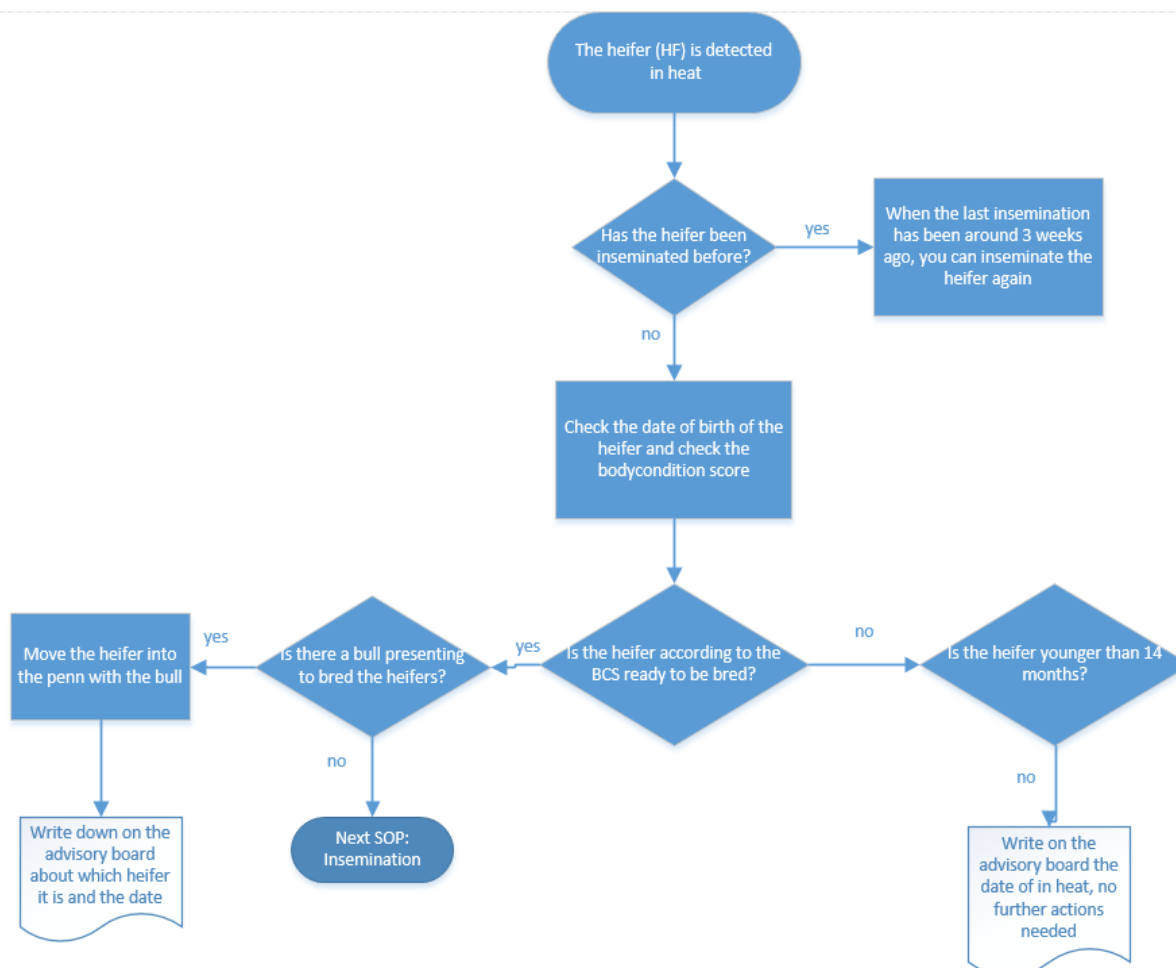
**Where:** Separation room

**When:** If the Herd Navigator indicates it

**How:** By separating the cow from the herd.

Separate the cow in  
heat

*Note: The Nedap Smarttag Neck gives an indication of the optimum moment to inseminate the cow.*





*SOP – Check Body Condition Score with Camera*

**Object of interest:** Body condition score

**Who:** The person who is responsible for the youngstock

**What:** Check the body condition score

**When:** When the heifer is detected in heat

**Where:** Under the BSC camera

**How:** see how to check the body condition score with BCS-camera

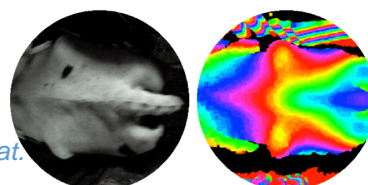
Check the date of birth of the  
heifer and check the  
bodycondition score

---

*HOW TO CHECK THE BODY CONDITION SCORE WITH BCS-CAMERA*

---

- 1 Open Delaval Delpro Farm Manager
- 2 Check notifications at the system
- 3 Select the individual graph of the heifer in heat
- 4 Does the heifer fall into a certain score of 3,0?
- 5 Check the body score measurements of the last days
- 6 Insert a notification in to the management system of in heat.



*SOP description – Move the cow/heifer*

**Object of interest:** The heifer

**Who:** The person who is responsible for the young stock

**What:** move the heifer into the penn with the bull

**When:** When the heifer is detected in heat

**Where:** in the barn

**How:** see how to move cows/heifers

Move the heifer  
into the penn with  
the bull

---

*HOW TO MOVE COWS/HEIFERS*

---

1. Put a halter round the cows head (optional)
  2. Make sure you have made an cloister of gates to the next penn
  3. Direct the cow to the right penn (optional guiding with a rope and the halter)
  4. Close all the gates again.
  5. Write down the date of moving on the advisory board
-



### 3.3 Milking Data

Milk in itself is a great tool for managing your herd's health, production and fertility. National dairy herd improvement associations and animal health organizations therefore offer many different milk analyses on bulk milk or individual milk samples, such as:

- **Disease testing:** measuring the level of antibodies against Johne's disease, Leptospirosis, Salmonella, BVD, IBR, Q-fever, Neospora, liver fluke, ...
- **Pregnancy checks:** by measuring the amount of progesterone or pregnancy associated proteins in milk (PAG)
- **Microbiology:** diagnosis of mastitis, evaluation of selective dry cow treatment
- **Milk quality testing:** measuring the somatic cell count, total bacterial count, coli count freezing point, fat and protein content, ...
- **Evaluating the ration:** based on milk urea, fat-protein ratio, ketone bodies, ...
- **Genetic evaluation:** based on milking speed, teat morphology..

Recording the daily milk yield is a basic prerequisite for fine-tuning herd management decisions. There are many good reasons for milk recording, such as deciding which cows to breed from, or which ones to cull, calculating the herd's feed rations and identifying health issues.<sup>2</sup>

The plan for results of this SIG will be described like:

#### **What business goals will be achieved through better management with this SOPs?**

By using these SOPs the understanding and the using of the milking data can be increased. By knowing how to interpret the data, working with milking data will become more easier.

#### **How will those goals be measured?**

After all when the milking data has been understand well, the early warnings of diseases and other health issues can be interpret better. On long term it will mean lower advise and veterinarian costa.

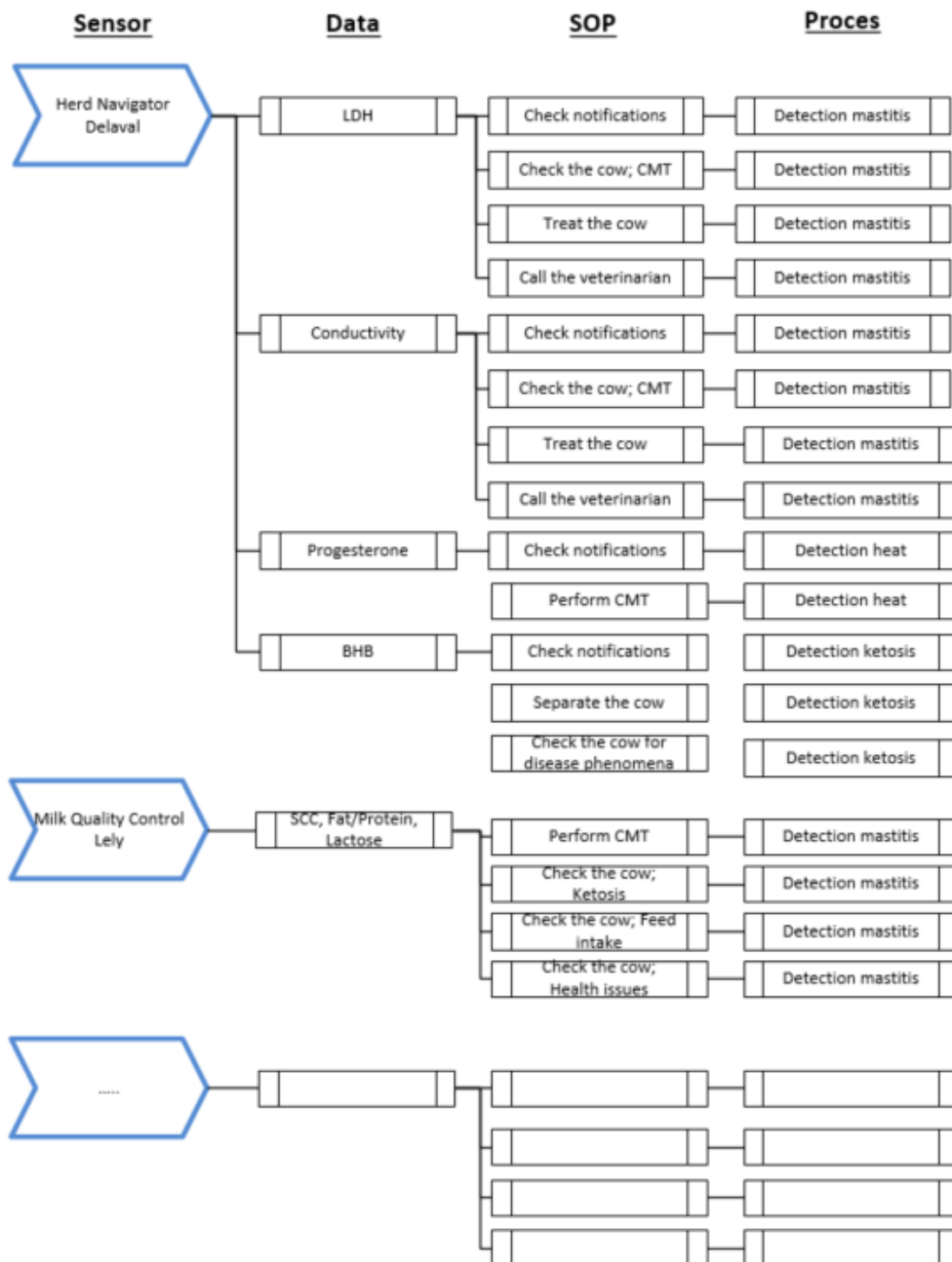
For detail description; see Best Practice Guides on the 4D4F website.

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<sup>2</sup> Source: BPG Milking Data

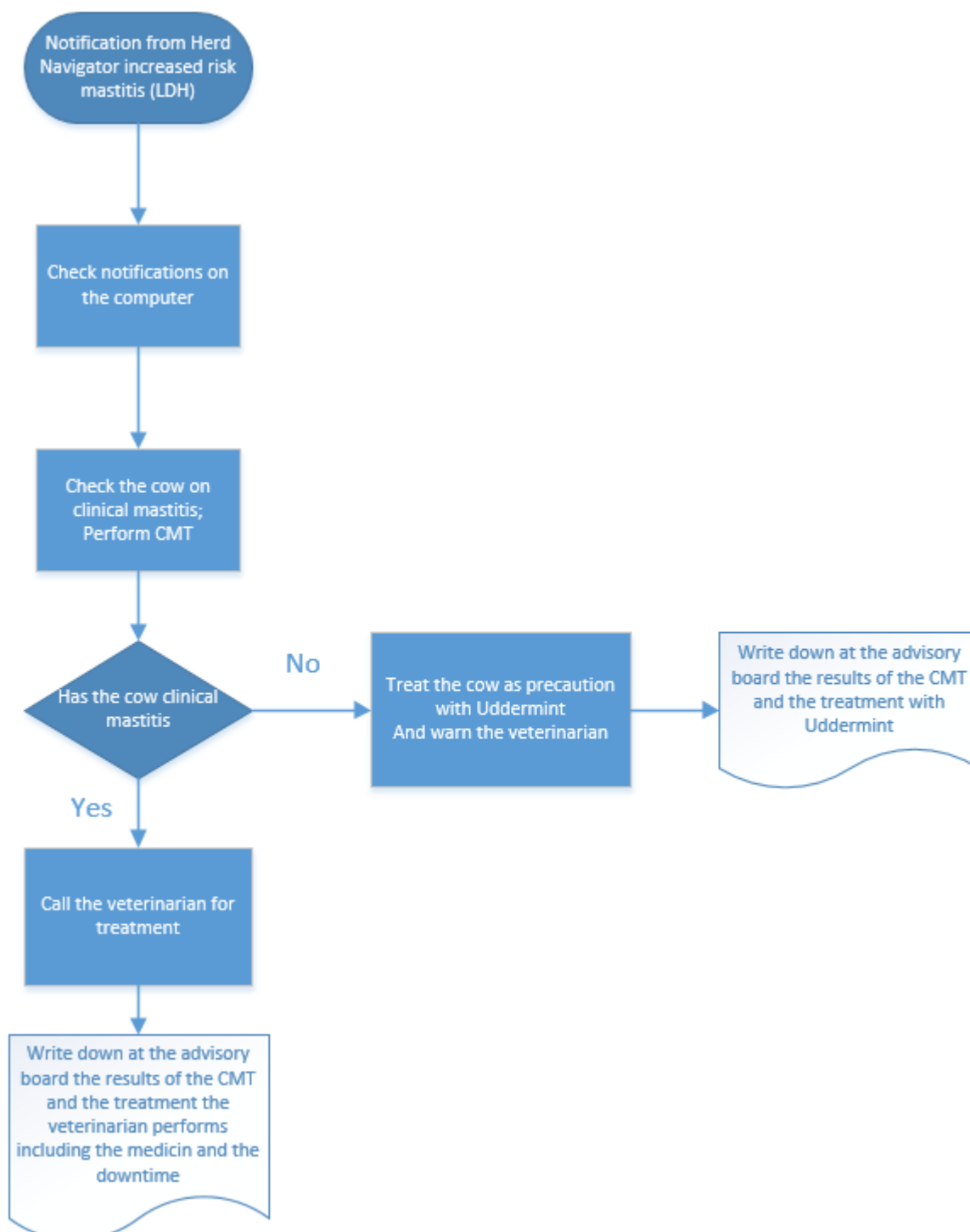


## SIG 6 – Milking data





Delaval Herd Navigator - LDH – Process detection mastitis





*SOP – Check the notifications on the computer*

Check which cows are on the attention list.

**Object of interest:** Mastitis attention list

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk for mastitis

**Where:** Office, phone (e.g.)

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT

Check the cow on  
clinical mastitis;  
Perform CMT

## HOW TO PERFORM THE CMT

1. Clean the four-well plastic paddle exhaustively
2. Pre-milk every quarter
3. Put the four-well plastic paddle straight underneath the udder, keep around 5 cm space between the udder and the four-well plastic paddle. Milk every quarter twice in an separate cup of the four-well plastic paddle
4. Remove the four-well plastic paddle from the udder. Keep the four-well plastic paddle slantwise until the milk hits the marking lines.
5. Add CMT liquid to the milk. The amount of liquid has to be the same as the amount of milk.
6. Swerve the four-well plastic paddle for 10 seconds slowly until the milk and the CMT-liquid is mixed.



UGA is de uiergezondheidsaanpak van de GD





*SOP – Treat the cow as precaution*

If a cow has subclinical mastitis, it must be treated with care. This prevents clinical mastitis.

**Object of interest:** Cow with subclinical mastitis

**Who:** The person who is responsible for udder health

**What:** Treat cows with subclinical mastitis

**Where:** F.e. Milking parlour or separation box when there is an AMS

**When:** After milking the cow

**How:** Massage the udder after milking and salve the udder with udder mint

*(Before treatment check the package for instructions, follow these instructions)*

Treat the cow as precaution  
with Uddermint  
And warn the veterinarian

*SOP – Call the veterinarian*

**Object of interest:** Veterinarian

**Who:** The person who is responsible for udder health

**What:** Call the veterinarian

**When:** When you suspect the cow has clinical mastitis

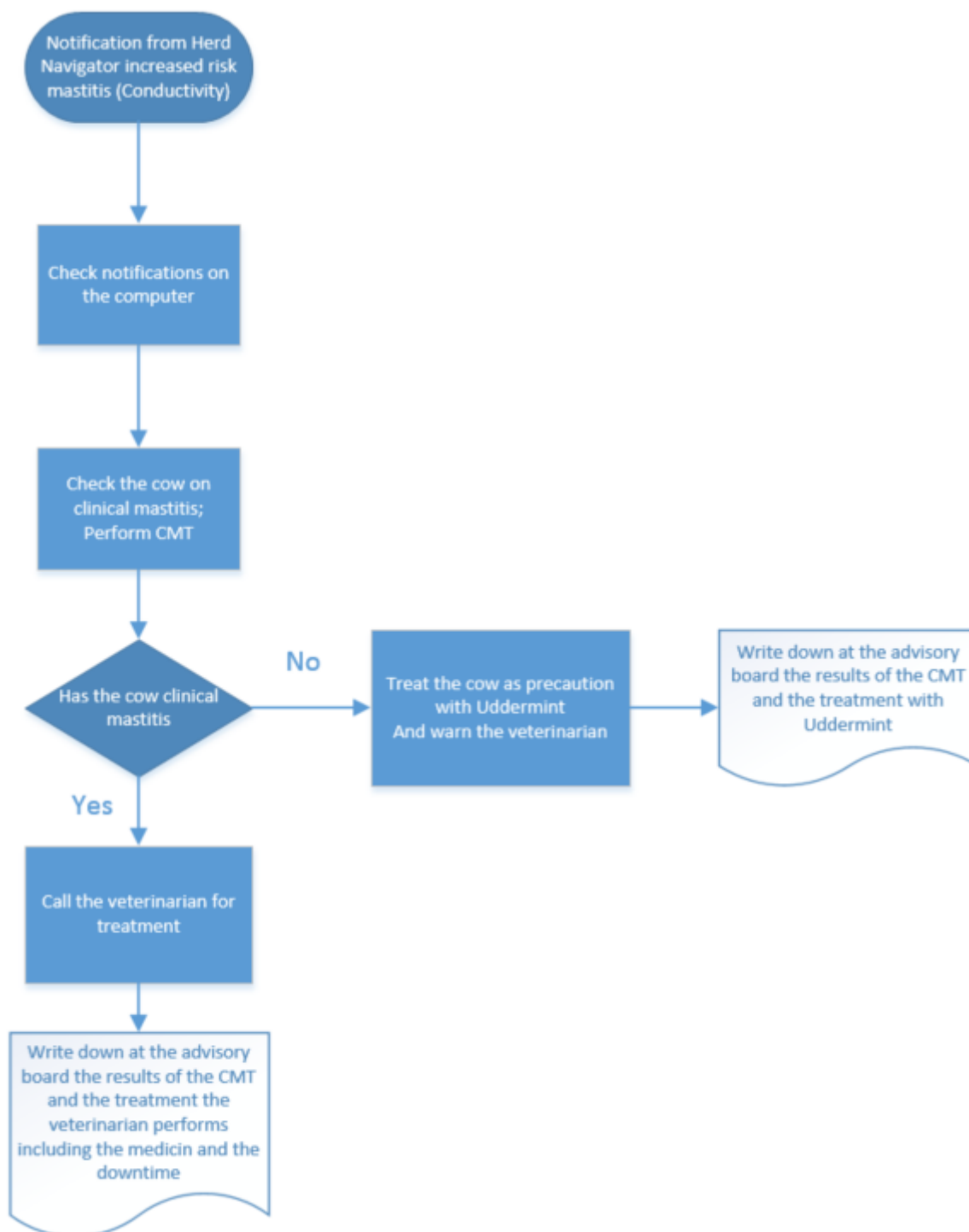
**Where:** Wherever you are

**How:** Call number.....

Call the veterinarian



Delaval Herd Navigator - Conductivity – Process detection mastitis





*SOP – Check the notifications on the computer*

Check which cows are on the attention list.

**Object of interest:** Mastitis attention list

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk of Mastitis

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT

Check the cow on  
clinical mastitis;  
Perform CMT

## HOW TO PERFORM THE CMT

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5. Add CMT liquid to the milk. The amount of liquid has to be the same as the amount of milk.
6. Swerve the four-well plastic paddle for 10 seconds slowly until the milk and the CMT-liquid is mixed.



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**Who:** The person who is responsible for udder health

**What:** Treat cows with subclinical mastitis

**Where:** F.e. Milking parlour or separation box when there is an AMS

**When:** After milking the cow

**How:** Massage the udder after milking and salve the udder with udder mint

*(Before treatment check the package for instructions, follow these instructions)*

Treat the cow as precaution  
with Uddermint  
And warn the veterinarian

*SOP – Call the veterinarian*

**Object of interest:** Veterinarian

**Who:** The person who is responsible for udder health

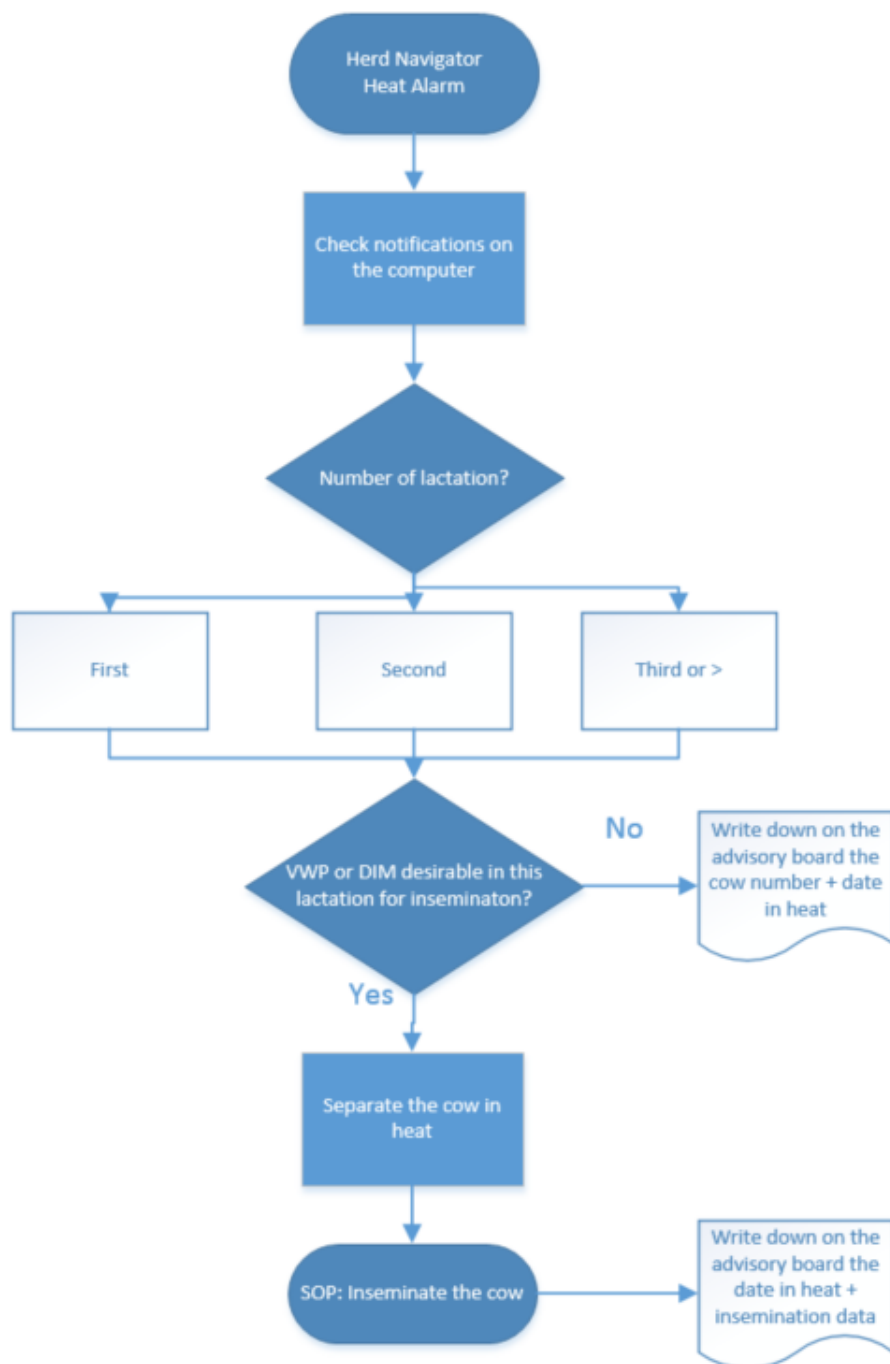
**What:** Call the veterinarian

**When:** When you suspect the cow has clinical mastitis

**Where:** Wherever you are

**How:** Call number.....

Call the veterinarian





*SOP – Check the notifications on the computer*

**Object of interest:** Attention list in heat

**Who:** The person who is responsible for reproduction

**What:** Check which cows (numbers) have an Herd Navigator Heat Alarm

**Where:** PC/ Office

**When:** twice a day, in the morning and in the evening

**How:** Click on the list of attentions

Check notifications on  
the computer

*SOP – Separate the cow*

**Object of interest:** Cow in heat

**Who:** Farmer

**What:** Separate the cow in heat

**Where:** Separation room

**When:** If the Herd Navigator indicates it

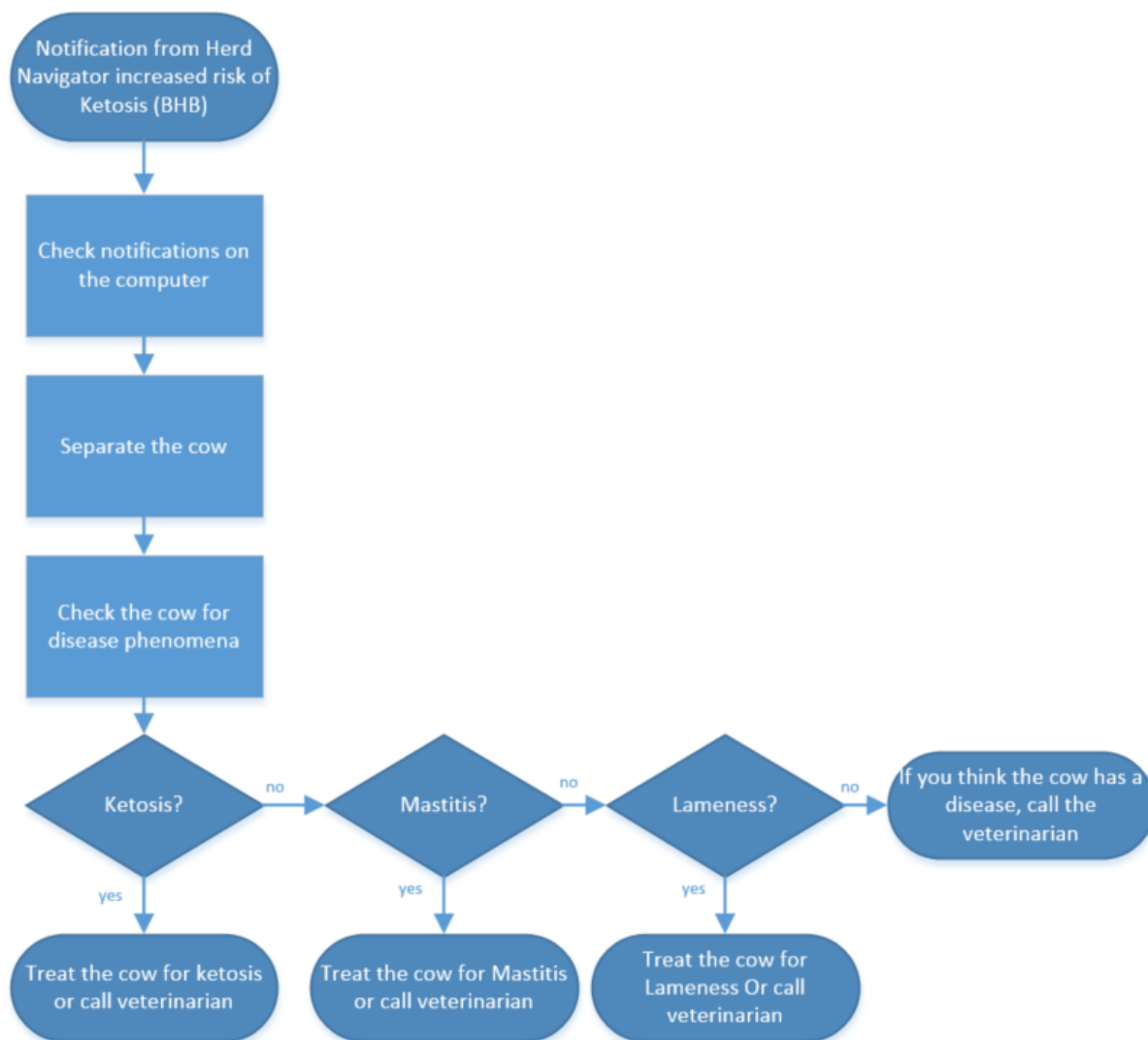
**How:** By separating the cow from the herd, most of the time installing action on the Herd Navigator

Separate the cow in  
heat

*Note: The Herd Navigator indicates the correct moment of insemination. Separate the cow according to the Herd Navigator SOP. Inseminate the cow as soon as the Herd Navigator indicates that the moment of inseminating has reached the right time.*



Delaval Herd Navigator - BHB – Process detection ketosis





*SOP – Check notifications on the computer*

**Object of interest:** Attention list increased risk of ketosis

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk of ketosis

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Separate the cow*

**Object of interest:** cow with ketosis

**Who:** Farmer

**What:** Separate cow with ketose

**Where:** PC space

**When:** After viewing the Attention List

**How:** Separate SOP

Separate the cow

*SOP – Check the cow for health issues*

**Object of interest:** The cow

**Who:** The person who is responsible for the health

**What:** Check the cow for health issues

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

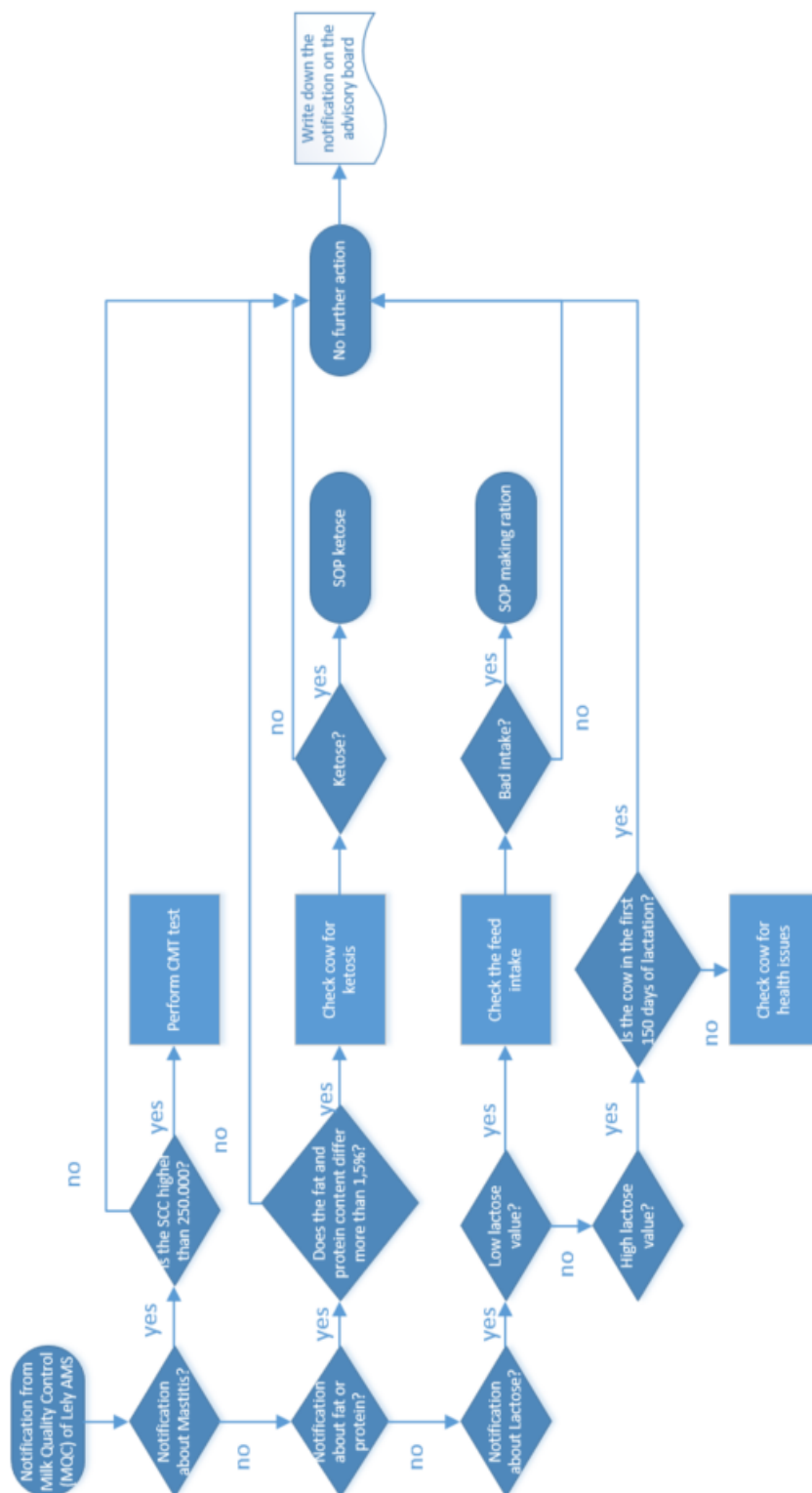
**How:** to check if the cow has disease phenomena

Check cow for  
health issues





Lely Milk Quality Control - SCC - process detection mastitis





*SOP – Perform the CMT*

**Object of interest:** The CMT test

**Who:** The person who is responsible for the mastitis

**What:** Perform the CMT test on all four quarters

**When:** When you suspect mastitis

**Where:** In the milking parlour

**How:** see how to perform the CMT.

Perform CMT test

HOW TO PERFORM THE CMT

1. Clean the four-well plastic paddle exhaustively
2. Pre-milk every quarter
3. Put the four-well plastic paddle straight underneath the udder, keep around 5 cm space between the udder and the four-well plastic paddle. Milk every quarter twice in an separate cup of the four-well plastic paddle
4. Remove the four-well plastic paddle from the udder. Keep the four-well plastic paddle slantwise until the milk hits the marking lines.
5. Add CMT liquid to the milk. The amount of liquid has to be the same as the amount of milk.
6. Swerve the four-well plastic paddle for 10 seconds slowly until the milk and the CMT-liquid is mixed.



UGA is de uiergezondheidsaanpak van de GD

*SOP – Check the cow on Ketosis*

**Object of interest:** The cow

**Who:** The person who is responsible for health

**What:** Check the cow on ketosis

**When:** When you have a notification of the MQC on fat or protein

**Where:** In the barn

**How:** to check if the cow has disease phenomena of ketosis

Check cow for  
ketosis

*SOP – Check the feed intake*

**Object of interest:** The cow

**Who:** The person who is responsible for the feeding

**What:** Check the feed intake

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

**How:** to check if the cow has eaten enough during the last 5 days

Check the feed  
intake



*SOP – Check the cow for health issues*

**Object of interest:** The cow

**Who:** The person who is responsible for the health

**What:** Check the cow for health issues

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

**How:** to check if the cow has disease phenomena

Check cow for  
health issues



### 3.4 Metabolic Diseases

Metabolic disorders of cattle are a group of diseases that affect dairy cows immediately after calving. A number of disorders linked to incorrect diet or feeding can have adverse effects on dairy cow health and welfare, as well as productivity. Health disorders are associated with significant economic losses for dairy farms due to reductions in milk production, increased risk of culling and death, increased treatment cost and reduced reproductive performance. There are several metabolic disorders identified in dairy cows. In this guide we focus on three type of metabolic diseases include: ketosis, acidosis, and fatty liver. They all relate to the transition period, but then into the first week of lactation.

The reason that these diseases are called metabolic disorders is related to the fact that they are associated with the disturbance of one or more blood metabolites in sick cows. For example, ketosis is associated with enhanced ketone bodies in the blood.

Metabolic diseases have a great economic impact. The losses are as a result of decreased milk production, decreased efficiency of milk production, premature culling, veterinarian costs, reduced fertility and death in serious cases.<sup>3</sup>

#### **What business goals will be achieved through better management with this SOPs?**

By using these SOPs the health of the cattle will improve. Afterwards it will increase the milk yield and also decrease the veterinarian costs and the use of antibiotics.

#### **How will those goals be measured?**

The health of the cattle can be measured by the amount of cows with a disease per year.

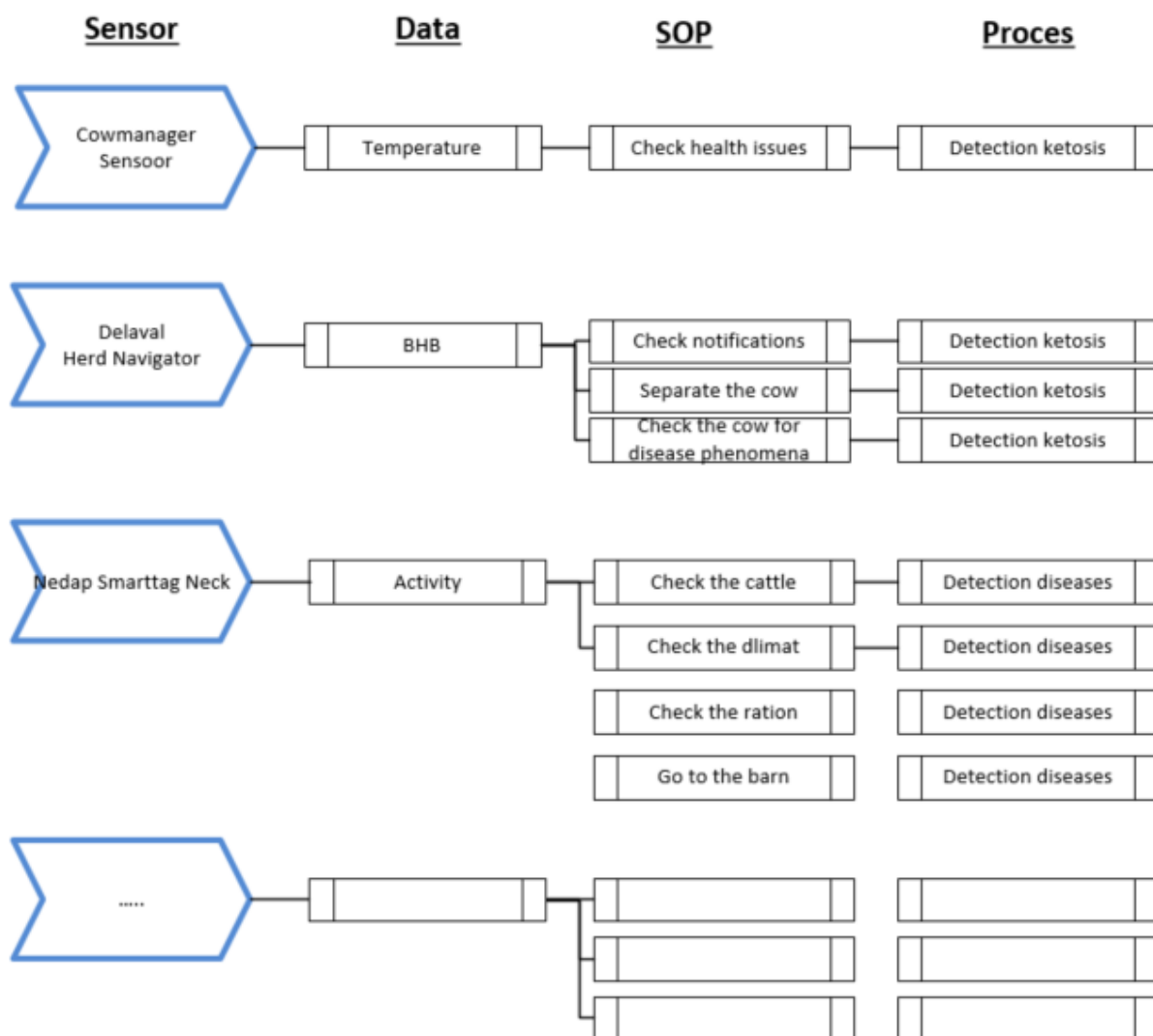
For detail description; see Best Practice Guides on the 4D4F website.

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<sup>3</sup> Source: BPG Metabolic diseases

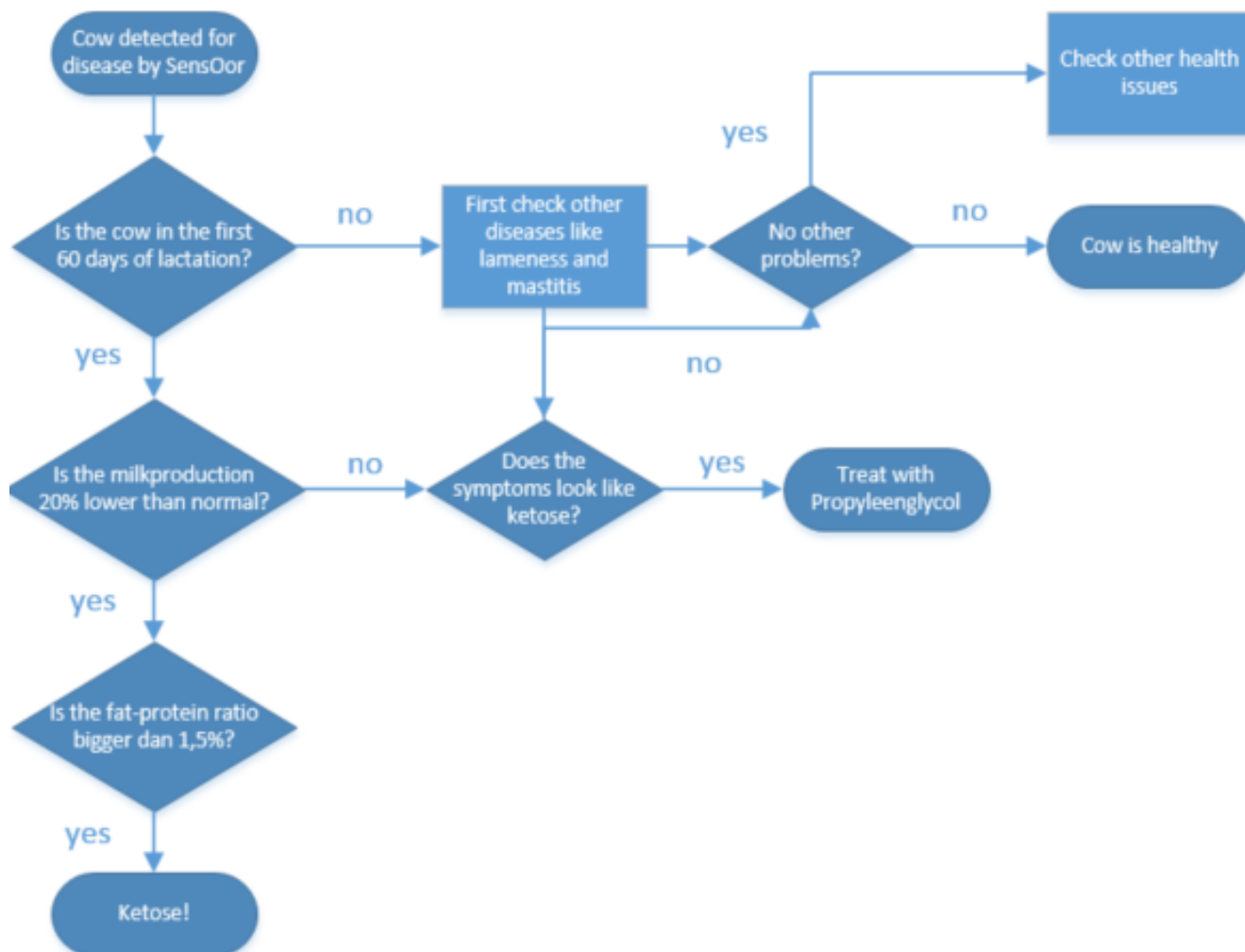


## SIG 8 – Metabolic disease





Cowmanager SensOor – Temperature - Process detection ketosis



*SOP – Check the cow for health issues*

**Object of interest:** The cow

**Who:** The person who is responsible for the health

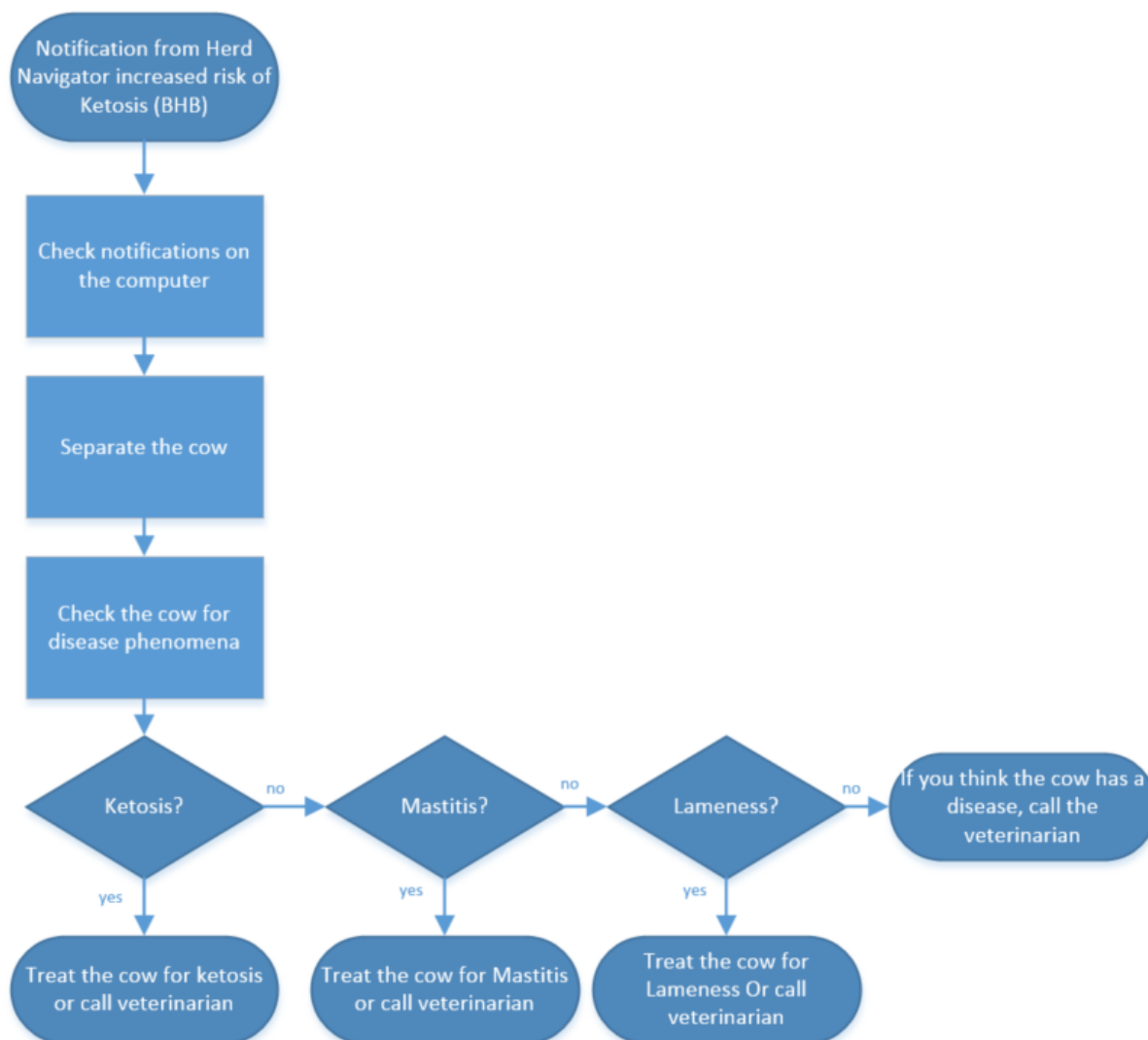
**What:** Check the cow for health issues

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

**How:** to check if the cow has disease phenomena

Check cow for health issues





*SOP – Check notifications on the computer*

**Object of interest:** Attention list increased risk of ketosis

**Who:** Farmer

**What:** Check which cows (numbers) have an increased risk of ketosis

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Click list of attentions

Check notifications on  
the computer

*SOP – Separate the cow*

**Object of interest:** cow with ketosis

**Who:** Farmer

**What:** Separate cow with ketose

**Where:** PC space

**When:** After viewing the Attention List

**How:** By separating the cow from the herd

Separate the cow

*SOP – Check the cow for health issues*

**Object of interest:** The cow

**Who:** The person who is responsible for the health

**What:** Check the cow for health issues

**When:** When you have a notification of the MQC on lactose

**Where:** In the barn

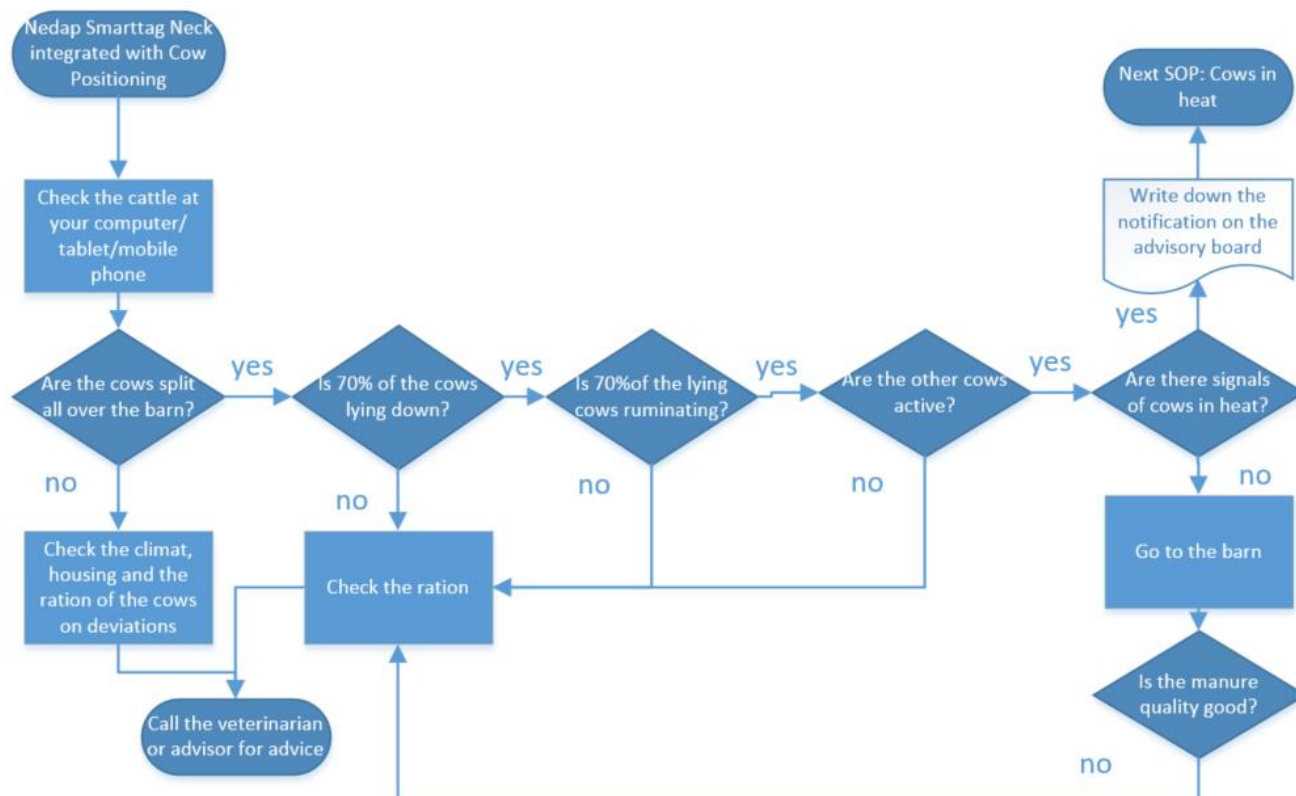
**How:** to check if the cow has disease phenomena

Check cow for  
health issues





Nedap Smarttag Neck with Cow Positioning – Activity – Process detection diseases



*SOP – Check the cattle on the computer*

**Object of interest:** The cattle

**Who:** Farmer

**What:** Check the cattle on the computer

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Checking all the attention lists on the computer

Check the cattle at  
your computer/  
tablet/mobile  
phone

*SOP – Check the climat*

**Object of interest:** The climat in the barn

**Who:** Farmer

**What:** Checking the climat in the barn

**Where:** In the barn

**When:** twice a day, in the morning and in the evening

**How:** Checking the lights, water facilities, gates and if there is enough fresh air

Check the climat,  
housing and the  
ration of the cows  
on deviations



*SOP – Check the ration*

**Object of interest:** The ration

**Who:** Farmer

**What:** Checking the ration

**Where:** In the barn or the fields

**When:** three times a day, in the morning, afternoon and in the evening

**How:** Checking the feeding facilities, the stock and quality of the ration

Check the ration

*SOP – Go to the barn*

**Object of interest:** The barn

**Who:** Farmer

**What:** Go to the farm

**Where:** From location to the barn

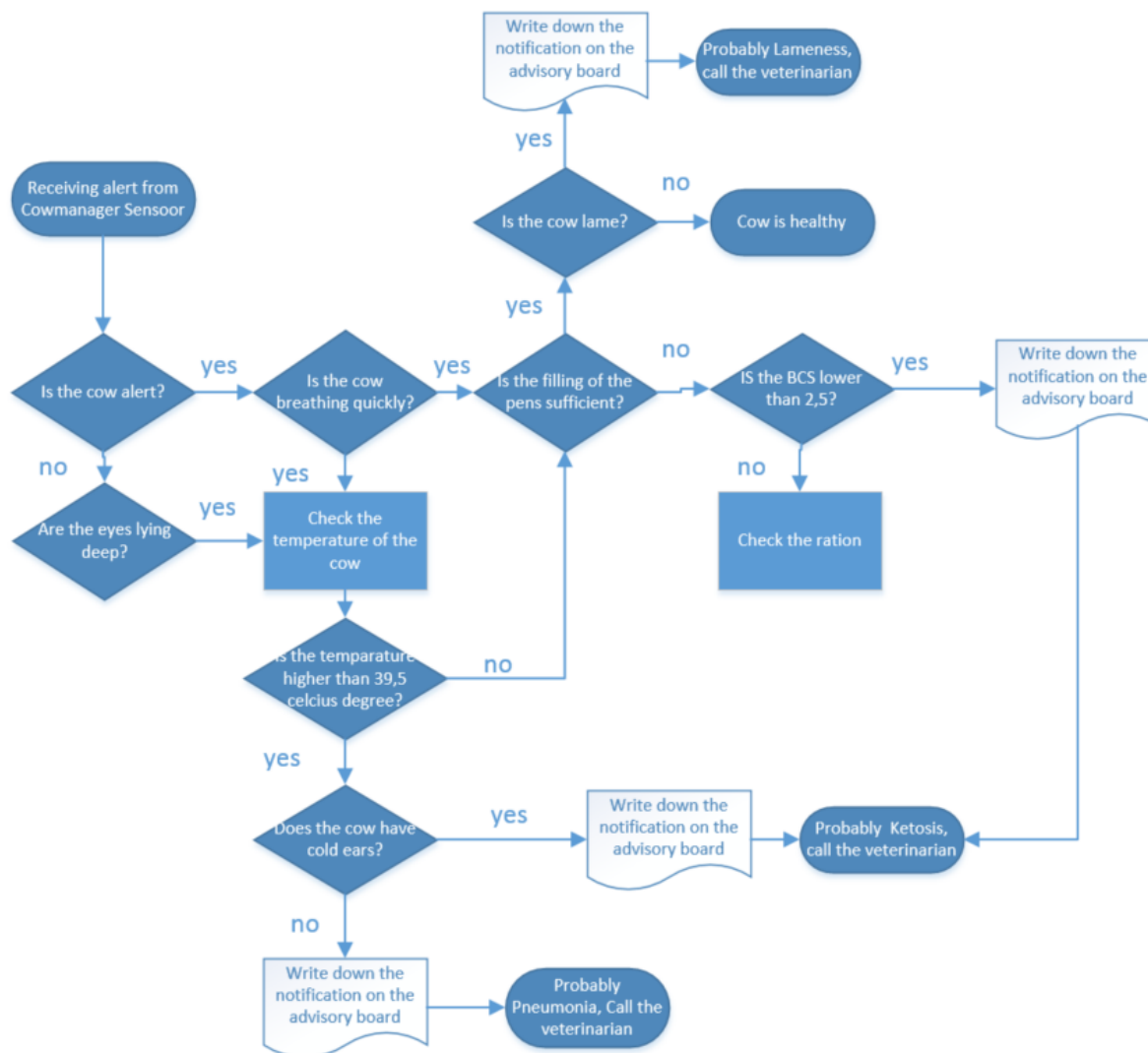
**When:** Several times a day.

**How:** Walking

Go to the barn



Cowmanager Sensor – Temperature – Process detection diseases



*SOP – Check the temperature of the cow*

**Object of interest:** The cow

**Who:** Farmer

**What:** Checking the temperature of the cow

**Where:** In the barn

**When:** When you received a notification from Sensor

**How:** measuring with a thermometer in the rectum of the cow

Check the  
temperature of the  
cow

*SOP – Check the ration*



Horizon 2020  
European Union Funding  
for Research & Innovation



**Object of interest:** The ration

**Who:** Farmer

**What:** Checking the ration

**Where:** In the barn or the fields

**When:** three times a day, in the morning, afternoon and in the evening

**How:** Checking the feeding facilities, the stock and quality of the ration

Check the ration



### 3.5 Calves and Youngstock

Calves and youngstock are very valueable for farmers. They are the future of their farms. In about two years a new born calf will having their first calf, so in two years of good care the young stock will be cows, money makers of the farm.

#### What business goals will be achieved through better management with this SOPs?

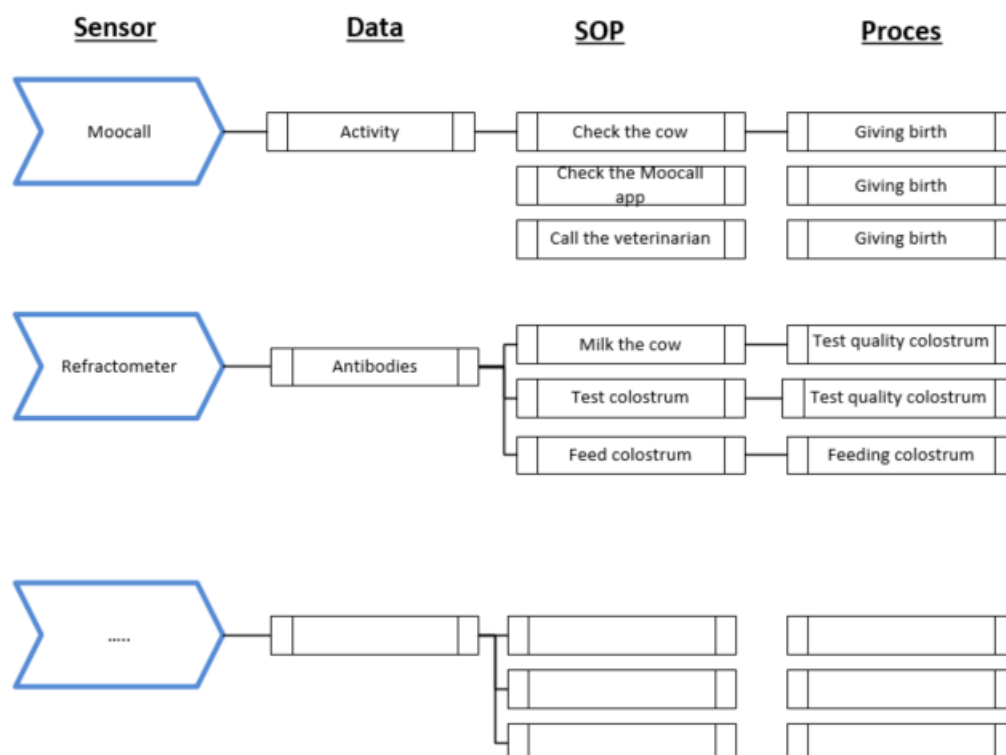
By using these SOPs the health of calves and youngstock will improve. When the calves are treated well they have more opportunities to be a healthy cow. When heifers are healthy they are probably easier to breed with. Afterwards it will also decrease the veterinarian costs and the use of antibiotics.

#### How will those goals be measured?

The health of calves and youngstock can be measured by the numbers of dead animals and the veterinarian costs.

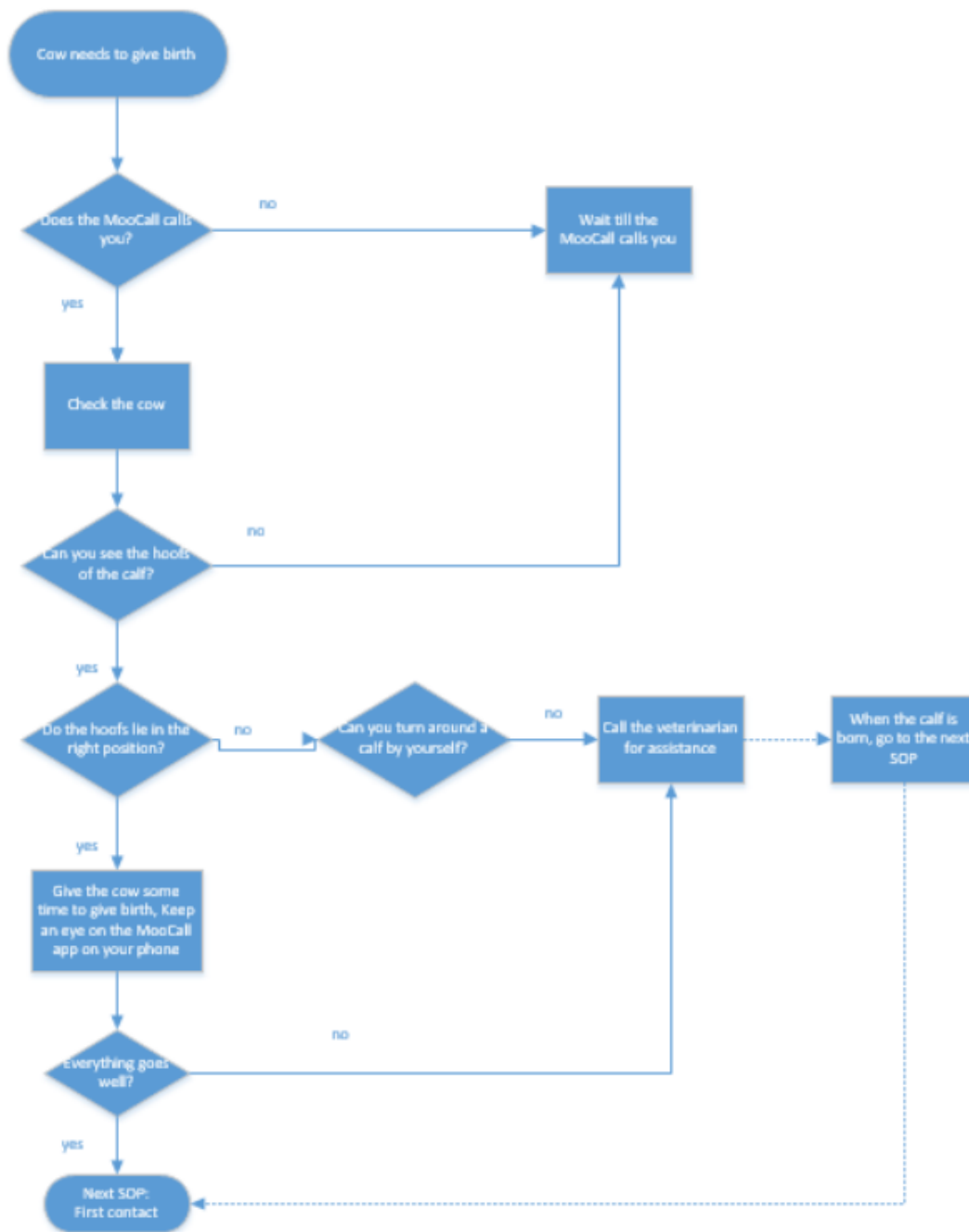
For detail description; see Best Practice Guides on the 4D4F website.

## SIG 9 – Calves and Youngstock





Moocall – Activity – Process detection giving birth





*SOP – Check the cow in labour*

**Object of interest:** The cow

**Who:** The person who is responsible for the cows in labour

**What:** Move the cow in the straw penn

**When:** When the cow is ready to give birth

**Where:** In the barn

**How:** See how to check the cow during labour

Move the cow in  
the straw penn

---

*HOW TO CHECK THE COW DURING LABOUR*

---

1. *Check the time when you start watching the cow*
2. *Notice the status of the cow in labour*
3. *Check the cows several times at your own discretion*
4. *Keep tracking your time when you've seen changes during labour*

**Attentions to check by cows in labour**

1. *Is there enough clean straw?*
2. *Is the cow leaking milk?*
3. *Are the bands of the cow descent?*
4. *Can you see the fleeces?*
5. *Can you see the hooves of the calf?*

*SOP – Keep an eye on the Moocall app*

**Object of interest:** The Moocall app

**Who:** The person who is responsible for the cows in labour

**What:** Keep an eye on the Moocall app

**When:** When the cow is in labour

**Where:** On the phone

**How:** See how to check the Moocall app

Wait till the  
MooCall calls you

Give the cow some  
time to give birth, Keep  
an eye on the MooCall  
app on your phone

---

*HOW TO CHECK THE MOOCALL APP*

---

1. *Receive the first text message*
  2. *About an hour after the first text message the cow will start calving.*
  3. *The second text message will follow in an hour when tail activity continues*
  4. *Easy calving may results in shorter notice periods*
  5. *After the second text message you need to check on the cow by yourself*
-



*SOP – Call the veterinarian*

**Object of interest:** Veterinarian

**Who:** The person who is responsible for the cows in labour

**What:** Call the veterinarian

**When:** When the cow can't give birth by herself

**Where:** Wherever you are

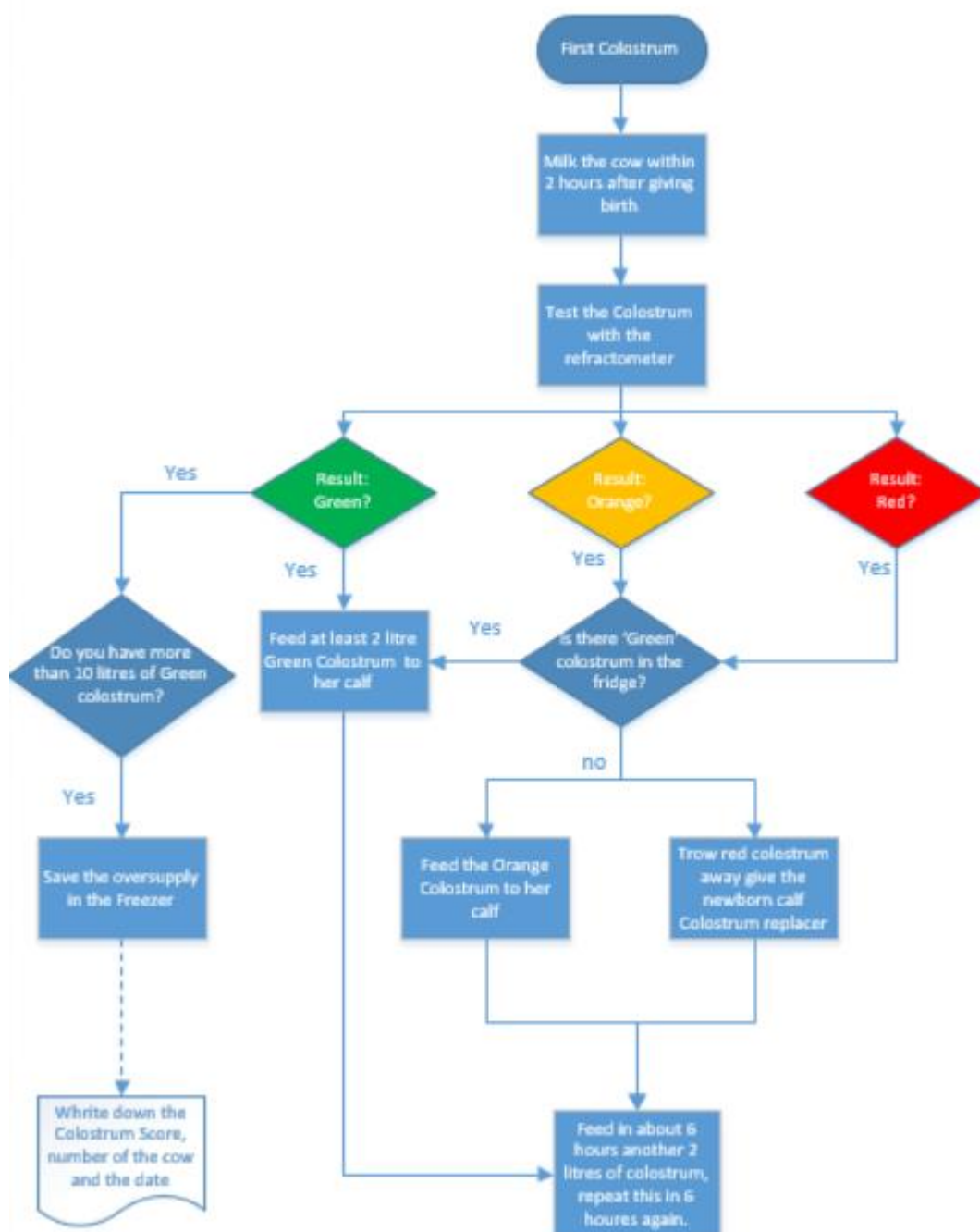
**How:** By calling.....

Call the veterinarian





Refractometer – Antibodies – process detection quality of colostrum





*SOP – Milking the cow after giving birth with trolley milker*

**Object of interest:** The milk

**Who:** The person who is responsible for milking cows

**What:** Milk the cow

**When:** After giving birth

**Where:** In the milking parlour

**How:** see how to milk with a trolley milker

Milk the cow within  
2 hours after giving  
birth

#### HOW TO MILK WITH A TROLLEY MILKER

1. *Feed the cow concentrate*
2. *Clean the udder*
3. *Massage the udder*
4. *Connecting liners*
5. *Take off all four liners gently*
6. *Post dip the cow*

*SOP – testing the colostrum with the refractometer*

**Object of interest:** The colostrum

**Who:** The person who is responsible for testing colostrum

**What:** Test the colostrum

**When:** After milking

**Where:** In the milking parlour

**How:** see how to test colostrum with refractometer

Test the Colostrum  
with the  
refractometer

#### HOW TO TEST COLOSTRUM WITH REFRACTOMETER

1. *Harvest the colostrum (see SOP milking with trolley milker)*
2. *Take the refractometer*
3. *Put some colostrum on the scale*
4. *Measure the quality of the colostrum*
5. *Administrate the outcome*



*SOP – feeding colostrum*

**Object of interest:** The colostrum

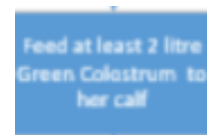
**Who:** The person who is responsible for feeding calves

**What:** 2 litres of colostrum

**When:** immediately after cow is milked

**Where:** in the barn

**How:** see how to feed colostrum



---

*HOW TO FEED COLOSTRUM*

---

1. *Put 2 litres of colostrum in a bottle*
  2. *Heat it up until 40-45 degrees Celsius*
  3. *Go to the calf*
  4. *Let the calf drink all the colostrum*
-



### 3.6 Grassland Management

Grass is the cheapest forage available, and optimizing the growth stage at which grass is harvested/grazed will lead to more milk produced from forage, and more profit. But grazing management is rather complex. Dairy farmers that apply grazing on their farm have to cope with a daily variation in grass offer, grass quality and the grass intake of their cows. Also changing weather conditions and soil conditions have to be taken into account. Working with different parcels at the same time it is important to support dairy farmers in making more data driven decisions on when to mow the grassland or to start grazing on that specific parcel.

Within Europe there are a lot of different grazing systems that can be practiced on dairy farms. In all of these grazing systems there is a need for objective measurement and prediction of grass growth. In this best practice guide we focus on tools and systems to measure and predict grass growth.

#### **What business goals will be achieved through better management with this SOPs?**

By using these SOPs the management of grassland will improve. The stock of grasses will be better managed, the cattle will have available more and better quality of grasses. The moment of choice by making decisions like can I start harvesting or can the cattle graze in this pasture will be better supported by using tools in combination with the SOP.

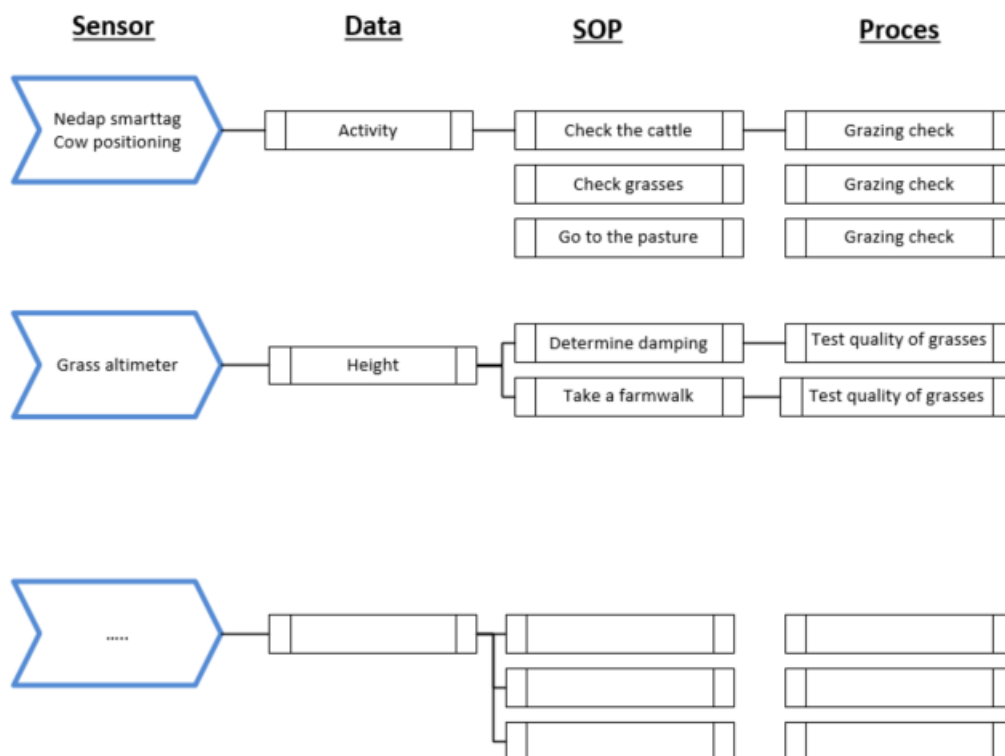
#### **How will those goals be measured?**

The quality of the harvested grasses can be measured in the grass-resources. The quality of grazing grasses can be measured in the quality of the milk.

For detail description; see Best Practice Guides on the 4D4F website.

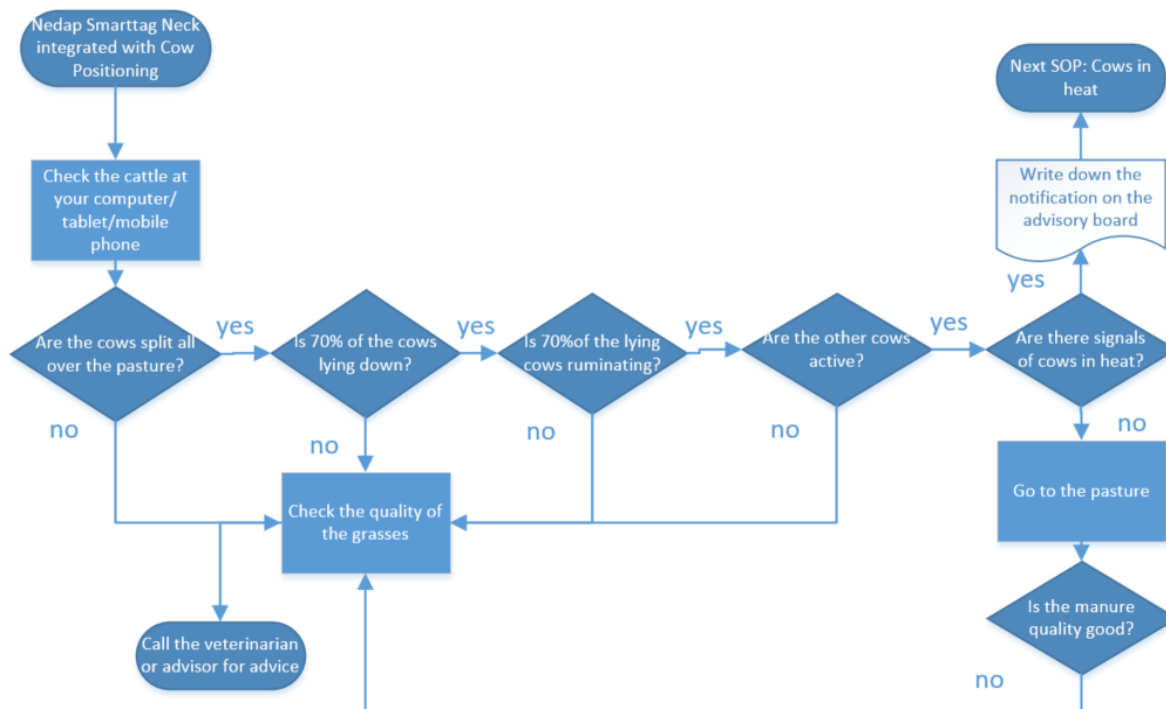


## SIG 11 – Grassland management





Nedap Smarttag Neck with cow positioning – activity – Process detection the pasture



*SOP – Check the cattle on the computer*

**Object of interest:** The cattle

**Who:** Farmer

**What:** Check the cattle on the computer

**Where:** PC space

**When:** twice a day, in the morning and in the evening

**How:** Checking all the attention lists on the computer

Check the cattle at  
your computer/  
tablet/mobile  
phone



*SOP – Check the quality of the grasses*

**Object of interest:** The grasses

**Who:** The person who is responsible for measuring grassland

**What:** Determine the stock in the other available pastures

**When:** When not 70% of the cows is 70% lying down

**Where:** In the pasture

**How:** see how to check grasses

Check the quality of  
the grasses

---

*HOW TO CHECK THE GRASSES IN THE PASTURE*

---

1. *Go to the pasture*
  2. *Walk through the pasture and measure by using an linear for example the height of the grasses*
  3. *Reduce this with the cutting height.*
  4. *Calculate the average height.*
  5. *Convert this into KG/DM per HA*
- 

*SOP – Go to the pasture*

**Object of interest:** The pasture

**Who:** Farmer

**What:** Go to the pasture

**Where:** From location to the pasture

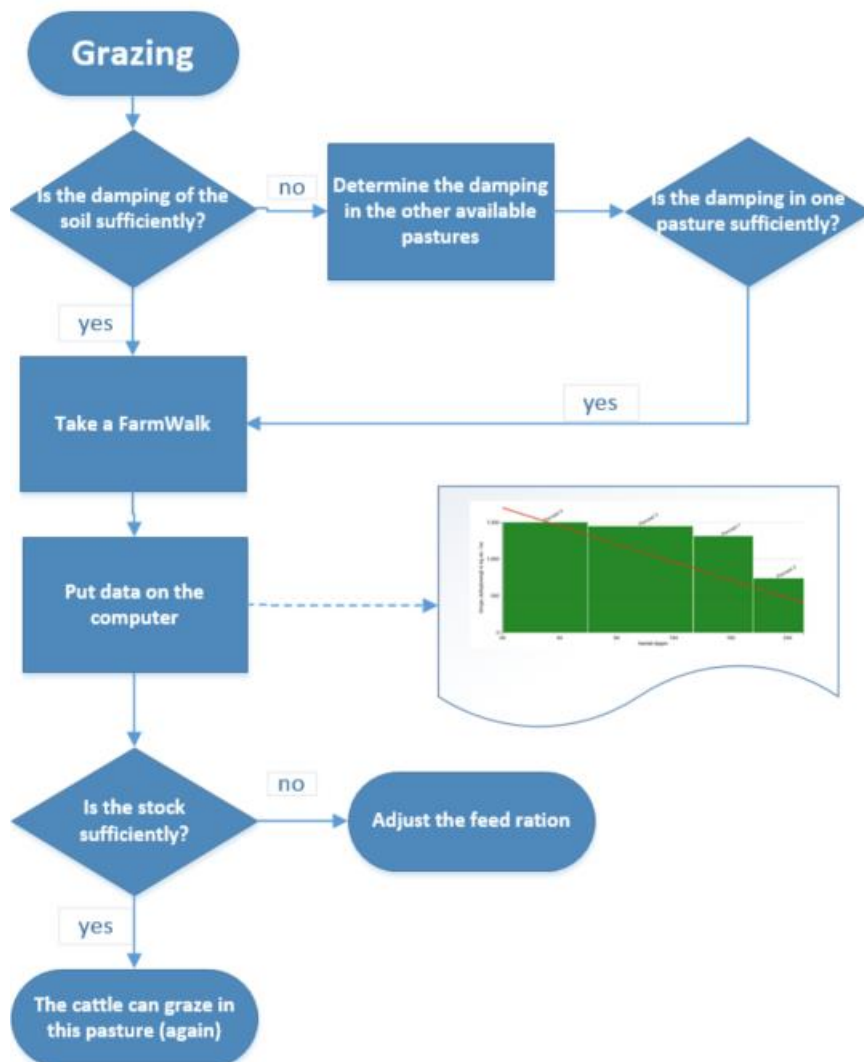
**When:** Several times a day.

**How:** Walking

Go to the pasture



Grass altimeter – height – process detection grass growth







*SOP – Determine the damping in the pasture*

**Object of interest:** The damping

**Who:** The person who is responsible for measuring grassland

**What:** Determine the damping in the other available pastures

**When:** When you'll start grazing

**Where:** In the pasture

**How:** see how to determine the damping in the pasture

Determine the damping  
in the other available  
pastures

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#### *HOW TO DETERMINE THE DAMPING IN THE PASTURE*

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1. *Go to the pasture*
  2. *Walk through the pasture and measure by walking the damping of the pasture*
  3. *Multiple your footprint with 7,5, this will be the footprint the cow will make*
- 

*SOP – Take a Farmwalk*

**Object of interest:** The Farmwalk

**Who:** The person who is responsible for measuring grassland

**What:** Take a Farmwalk

**When:** When you'll start grazing

**Where:** In the pasture

**How:** see how to do a farmwalk

Take a FarmWalk

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#### *HOW TO DO A FARMWALK*

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1. *Go to the pasture*
  2. *Walk through the pasture and measure by using a grass altimeter the height of the grasses*
  3. *Walk in a V or W shape*
  4. *Measure at 30 points in the walked shape.*
  5. *Reduce this with the cutting height.*
  6. *Calculate the average height.*
  7. *Convert this into KG/DM per HA*
-



## Discussion

There are a legion of possibilities to make SOPs. Every SOP will be different when we add a specific sensor or when we change something in the farm management. So be aware, like us, that not every SOP will fit immediately in the desirable situation. Every SOP needs to adjust to the specific situation. This report can be expanded unlimited.

During the process of developing SOPs, our students have been making up some innovative ideas about new sensors to use; temperature sensor, moving sensor and belly button control-app.

### **Temperature sensor at the top of the calf room**

*To monitor the temperature of cow and calf just after calving.*

Description:

By hanging a temperature sensor / temperature camera above the calf space, the temperature of the calf and cow can be checked easy after calving. For example, if the cow stays lying down and becomes cold, it may mean that the cow develops milk disease. The temperature sensor / camera can handle the first signs and save the costs of the veterinarian. The calf can also be monitored. If the calf gets too cold, help can be on time.

The specifications:

- The temperature camera can be combined with an ordinary camera. With 1 press the button can be switched. For example, calves can be monitored remotely. This can be done on the computer from the office / home or on the phone with an app.
- The temperature camera must have a variable sensitivity. And to set the difference between the ear and nose temperature clearly.

### **Motion sensor at the top of calf space**

*To see if calf breathes by measuring chest motion.*

Description:

A motion sensor above the calf space, can measure at different moments during the calving process. First, the unrest of the cow when he seeks a place to calf down, then the calm behavior of the cow as it stops to ruminate and is busy giving birth. After calving, the sensor can be used for checking that the calf normally breathes. This is done by looking at the chest's movement.

The specifications:

- Must be able to detect and process chest movement.
- Can see a difference between cow and calf.
- Forward to computer or phone app.
- Report as motion differs from normal pattern.

### **App to check belly button**

*With a network of pictures and veterinary practices.*

Description:

An app on your phone to check if a calf's belly button looks healthy or that there are still further treatments to be done next to the iodine. For example, you see images of healthy belly buttons but also images with belly buttons that are not healthy; Like too thick belly button, bleeding belly button, open belly button. It is then clear what action should be taken such as treating or consulting a vet.

The specifications:

- Convenient overview of healthy and wrong nails.



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- Good manual for any further treatments.
- Ability to get in touch with different veterinary practices through the app.

So do you have good ideas about (new) SOPs, don't hesitate and let us know!

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