



# Nutrient Recovery Systems

REASONS AND RESULTS

# Reasons NRS are needed

- ▶ Most waste by volume in any system is WATER!
- ▶ Nutrients and Organic Matter are very valuable.
  - ▶ Organic Matter is difficult to value, for those that have never utilized it long term.
  - ▶ Nutrients, proper soil nutrition, is becoming a key topic as growers and consumers alike become more aware of Sustainable Practices.
- ▶ Manure Nutrients are the **original fertilizer**, most compatible to soil health needs.

# Most Manure Waste in Dairy Systems is Water!

- ▶ Every Manure system is different. Each system creates different manure characteristics.
  - ▶ Manure Characteristics are firstly dictated by cultural processes in the barn.
    - ▶ Sand Bedded
    - ▶ Fiber Bedded
    - ▶ Water/Rubber beds with sawdust/fiber filler
    - ▶ Etc..(California)
  - ▶ Manure Characteristics and process pathways are considerations as to the last step of NR
- ▶ WHAT ARE YOU AS THE OPERATOR WANTING TO/ OR DESIRING TO ACHIEVE?

# What do you WANT/NEED? What are your Reasons?

- ▶ Regulatory?
- ▶ \$\$\$\$\$\$, ROI
- ▶ Do you have enough information: [www.Newtrient.com](http://www.Newtrient.com)
  
- ▶ [Americanbiogascouncil.org](http://Americanbiogascouncil.org)
- ▶ University Extension Specialists
  
- ▶ What current infrastructure do you have, or can you utilize?
  - ▶ Available Management, Labor, etc.
  - ▶ Lagoons, pits
  - ▶ Solids Separation Systems
  - ▶ Solids storage pads
  - ▶ Digester

# TO DIGEST, OR NOT TO DIGEST!

- ▶ Digested manure has had the Mucoïd structure broken down, making it easier for certain NRS to function.
  - ▶ Digesters and any ancillary systems can affect manure characteristics and flow.
- ▶ Digesters also serve as a large mixing tank, allowing for a homogenous feed into the NRS of your choosing.
  - ▶ After bedding the %solids in the lane manure can change rather drastically.
  - ▶ Do you flush more on certain days, or A change in % Solids over time?
  - ▶ Did you recently change the ratio of milk/dry cows? MCE?

# How does individual process ownership affect the operation as a whole?

- ▶ What is the ownership structure you have, or desire?
  - ▶ If you Digest, who controls the Inf/Eff rates?
  - ▶ If you digest, what Digester pressure controls are in place?(GUS)
  - ▶ If you do not Digest, do you have enough storage to serve as a buffer for feed into your NRS?
  - ▶ What agreements are possible, what is practical for the different NRS offtakes?

# NRS Available??

- ▶ Micro-Nano Filtration Technology
- ▶ Flocculation/Daf tech to MD presses or centrifuges
- ▶ Centrifuge w/o polymers or flocculants
- ▶ Centrifuges w/ polymers and flocculents
- ▶ Belt or plate/frame-- filter presses
- ▶ Staged Lagoon variations
- ▶ Ammonia harvest to Liquid AMS
- ▶ Varcor----
- ▶ Hybrid systems that use components together to make a tailored process
- ▶ Biochar Technologies

# Our Experience

- ▶ We set out trying to separate P back in '03 with flotation tanks.
- ▶ We added a centrifuge to dewater the daf sludge
  - ▶ Worse 18 months of our existence. Mainly due to feed issues.
  - ▶ In 2012 we tested several different Daf tanks, belt filter presses, plate and frame presses, screw presses and centrifuges.
  - ▶ 2014-2015 we added the Trident Processes system, Daf and MD press system.





**TRIDENT**  
separators

→ Recycle  
→ Restoration  
→ Reuse



# Trident Nutrient Recovery Systems

	TS	TKN	P	K
DIGESTER EFFLUENT AVERAGE	4.10%	0.24%	0.05%	0.14%
DAF INFLUENT AVERAGE	2.63%	0.20%	0.04%	0.13%
DAF EFFLUENT AVERAGE	1.09%	0.15%	0.01%	0.12%
DIGESTER SOLIDS AVERAGE	23.39%	0.87%	0.35%	0.17%
DAF TO DIGESTER EFFLUENT REDUCTION	73.30%	39.41%	81.00%	13.14%

# Digested<sup>®</sup> ORGANICS



*Nutrient Concentration  
and Water Reclamation Systems*

## ULTRAFILTRATION

Stainless steel tubular  
membranes remove  
suspended solids



Robust cross-flow filtration  
Porous stainless steel tubular membranes  
No internal moving parts  
10+ year membrane life



# SRDU™ Solids Removal and de-watering unit



Minimal chemical use  
Patented gas mixing technology  
No internal moving parts  
25% dry matter in solids

Parameter	UNITS	Pressate	SRS Clarified Effluent	Thick Slurry
Total solids	%	3.9	1.8	9.0
Total volatile solids	%	2.2	0.8	5.7
Total suspended solids	mg/L	23,500	3,597	71,751
Ammoniacal Nitrogen	mg/L	847	634	1,364
Organic nitrogen	mg/L	1,144	487	2,737
Total Kjeldahl nitrogen (TKN)	mg/L	1,989	1,124	4,087
Phosphorus	mg/L	400	103	1,120
Potassium	mg/L	2,600	2,310	3,303
Sulfur	mg/L	204	79	507
Calcium	mg/L	1,889	383	5,541
Magnesium	mg/L	643	368	1,310
Sodium	mg/L	1,957	1,822	2,285
Iron	mg/L	41	5.4	128
Manganese	mg/L	7.3	1.4	22
Zinc	mg/L	11.3	1.4	35
Copper	mg/L	19.3	2.4	60



# Digested<sup>®</sup> ORGANICS



*Nutrient Concentration  
and Water Reclamation Systems*

## **SUPERFILTRATION**

Spiral-wound membranes  
remove organic colloidal  
matter



Patented anti-fouling membranes  
Removes 99% of molecules > 1 kDa  
Easy to clean and bleach tolerant  
Membranes designed to last 2-3  
years





### SUB-INDUCTION TIME REVERSE OSMOSIS™

RO membranes remove water in a repeat batch process



Unique sequencing batch RO technology

High water recovery

Lower energy consumption

Membranes last 2-3 years



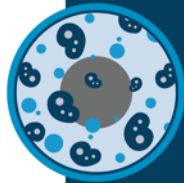
Parameter	Units	SIT-RO Feed	SIT-RO Permeate	SIT-RO Concentrate
Percent solids	%	0.67	0.02	4.12
Chemical oxygen demand (COD)	mg/L	1,685	16	12,540
<b>Ammoniacal Nitrogen</b>	<b>mg/L</b>	<b>1,350</b>	<b>383</b>	<b>6,170</b>
<b>Organic nitrogen</b>	<b>mg/L</b>	<b>20</b>	<b>20</b>	<b>920</b>
<b>Total Kjeldahl nitrogen (TKN)</b>	<b>mg/L</b>	<b>1,370</b>	<b>403</b>	<b>7,090</b>
<b>Phosphorus</b>	<b>mg/L</b>	<b>11.5</b>	<b>0.16</b>	<b>10.8</b>
<b>Potassium</b>	<b>mg/L</b>	<b>1,721</b>	<b>133</b>	<b>9,243</b>
Sulfur	mg/L	72.5	0.9	303
Calcium	mg/L	62.4	0.79	81
Magnesium	mg/L	262.3	2.9	1,400
Sodium	mg/L	856.7	48.4	4,872
Iron	mg/L	5.4	n.d.	17.5
Manganese	mg/L	1.6	0.01	n.d.
Zinc	mg/L	n.d.	n.d.	n.d.
Copper	mg/L	n.d.	n.d.	n.d.
Conductivity	mS/cm	15.9	2.62	64.7
pH		8.25	8.89	8



*Nutrient Concentration  
and Water Reclamation Systems*

## **BIOFILTRATION TOWERS**

Bacteria growing on plastic media  
remove trace amounts of organic  
matter and nitrogen prior to  
discharge

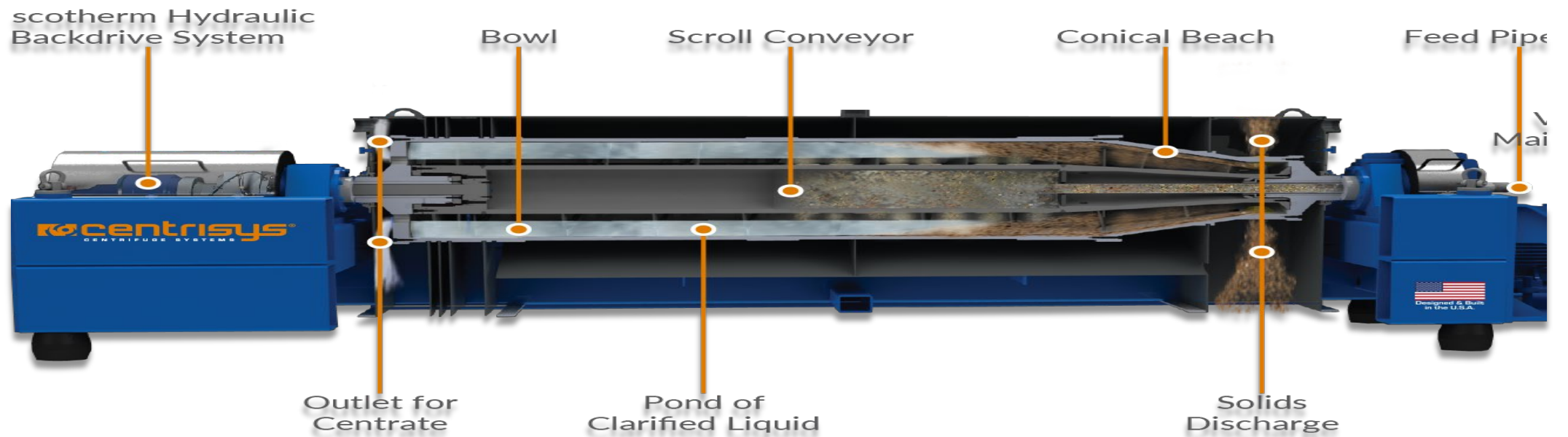


- Bacteria remove organics and ammonia
- Low energy consumption
- Aerates water prior to discharge
- Self cleaning design





# Centrifuges





# Operating Principle


- ▶ How it Works
- ▶ The separation of a solid and liquid(s) in a decanter centrifuge system work on the principle of gravitational forces. Whereas it takes considerable time for the gravitational separation of a muddy mixture (to fall to the bottom) and water (to rise to the top) in separation technologies based on 1xG separation such as, a static container, clarifier or lamal separator, the rapid rotation of a centrifuge greatly speeds up this gravitational principle.
- ▶ In fact, the G-force generated by a decanter centrifuge can be well in excess of three-thousand times greater than gravity reducing the separation process from hours to mere seconds. Today's centrifuges are a counter-current type technology. The separation process in a 2-phase decanter centrifuge results in the denser solid particles to be compacted and settled out in the inner drum and then transported and removed via solids discharge end of the decanter. The centrate is routed to the opposite end of the centrifuge and removed via the centrate outlet

# Separation Performance w/ Centrifuge

- ▶ P Removal will range from 40 to 60% in most cases w/o polymers and or Ferric
- ▶ Total N ranges vary based upon infeed % solids, as that is what will mostly be captured.
- ▶ Ammonia and K capture is generally less, because they are dissolved solids.

# Full Nutrient Separation???

- ▶ Value of Nutrients vs Water
  - ▶ In most scenarios “Concentrated Nutrients” are valued higher than water.
  - ▶ Arid climates might argue that Potable water, irrigatable water is also very valuable.
  - ▶ Either scenario creates value.
  
- ▶ Technology used creates different nutrient forms. Each grower must choose what fits his Management and Infrastructure base better.

A large, stylized background graphic in shades of orange and white. It features a gear on the left side and a tree-like structure on the right side, both rendered in a simplified, geometric style. The gear has a circular center and a serrated outer edge. The tree has a thick trunk and several branching limbs with small, leaf-like shapes at the ends.

# THE VARCOR™ SYSTEM

CONFIDENTIAL  
INFORMATION



**SEDRON**®  
TECHNOLOGIES

# VARCOR™ SYSTEM

A COMPLETE,  
HOLISTIC LIQUID  
WASTE  
HANDLING  
SYSTEM

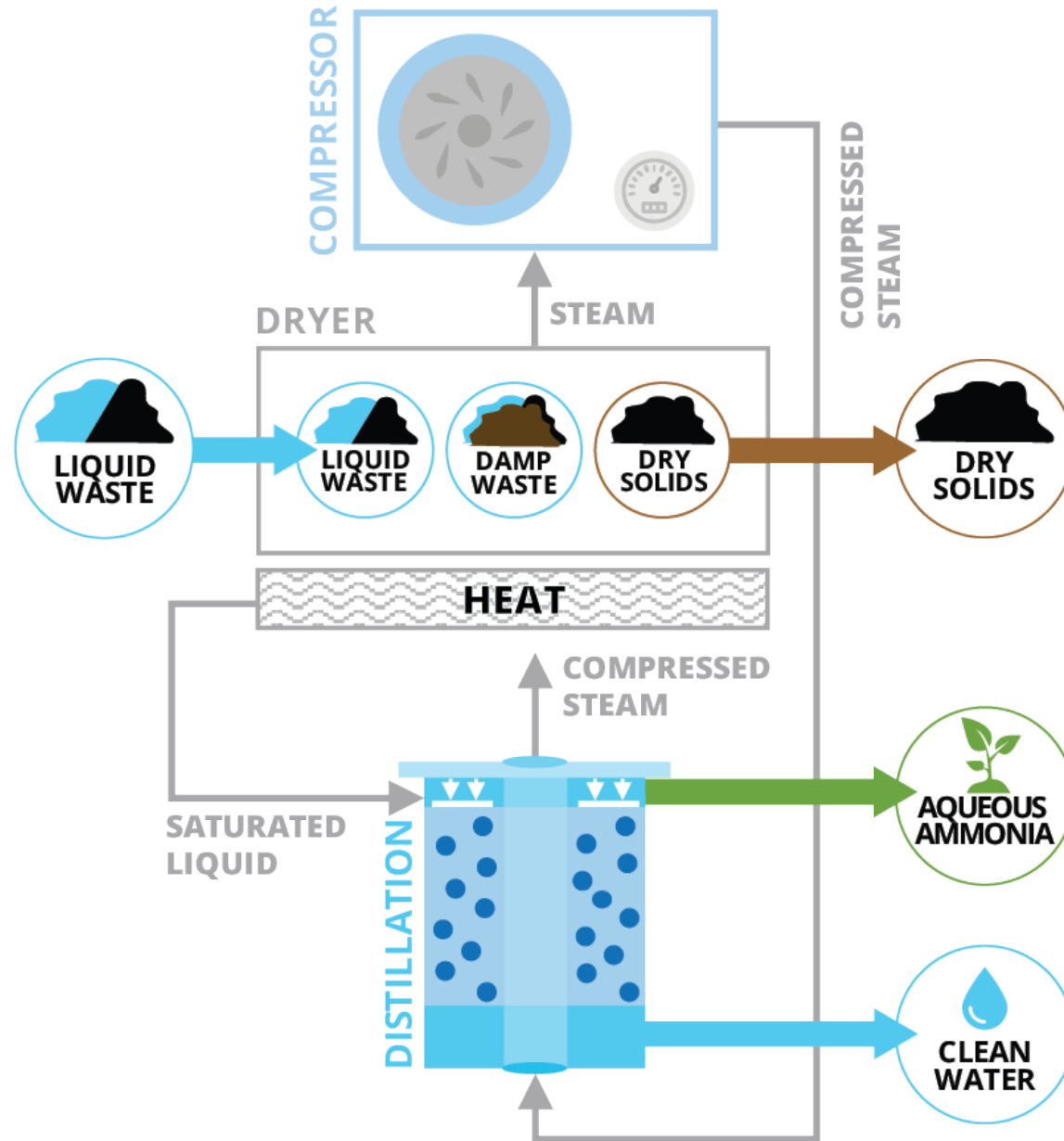
- ✓ Combined dewatering and drying
- ✓ Solids recovery for beneficial use
- ✓ Very clean steam stripped condensate



TM

VARCOR

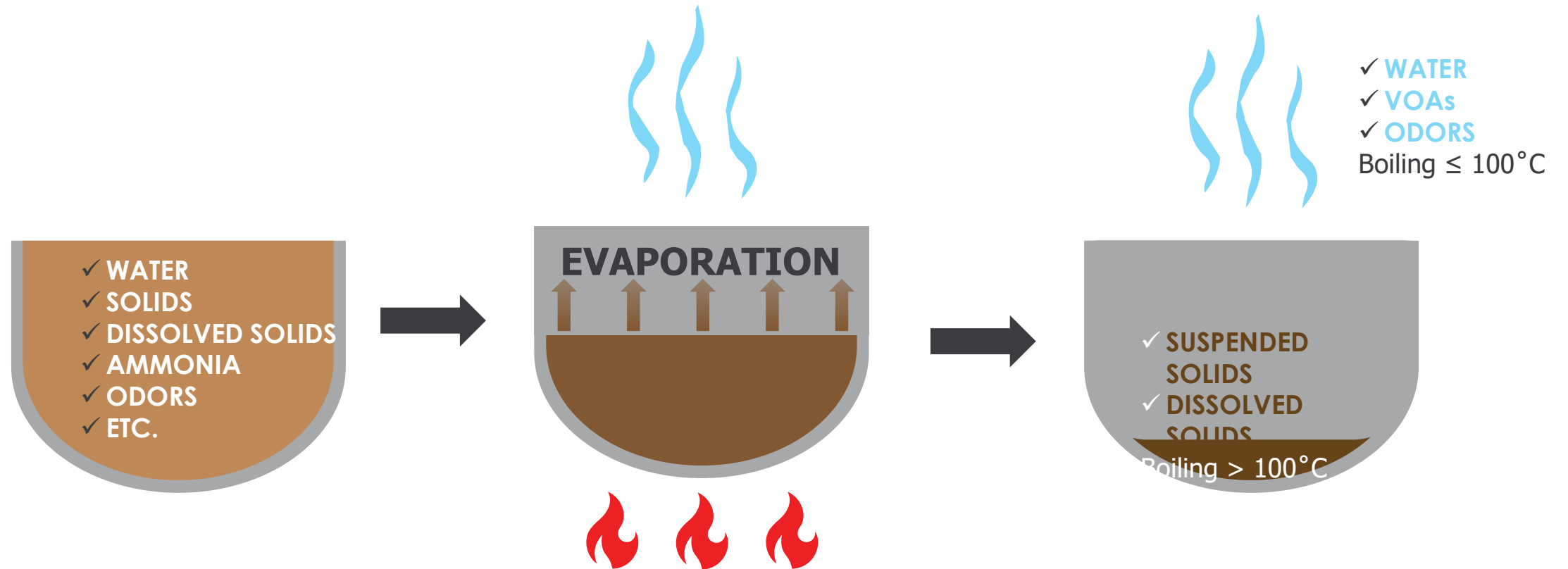
► What it Does





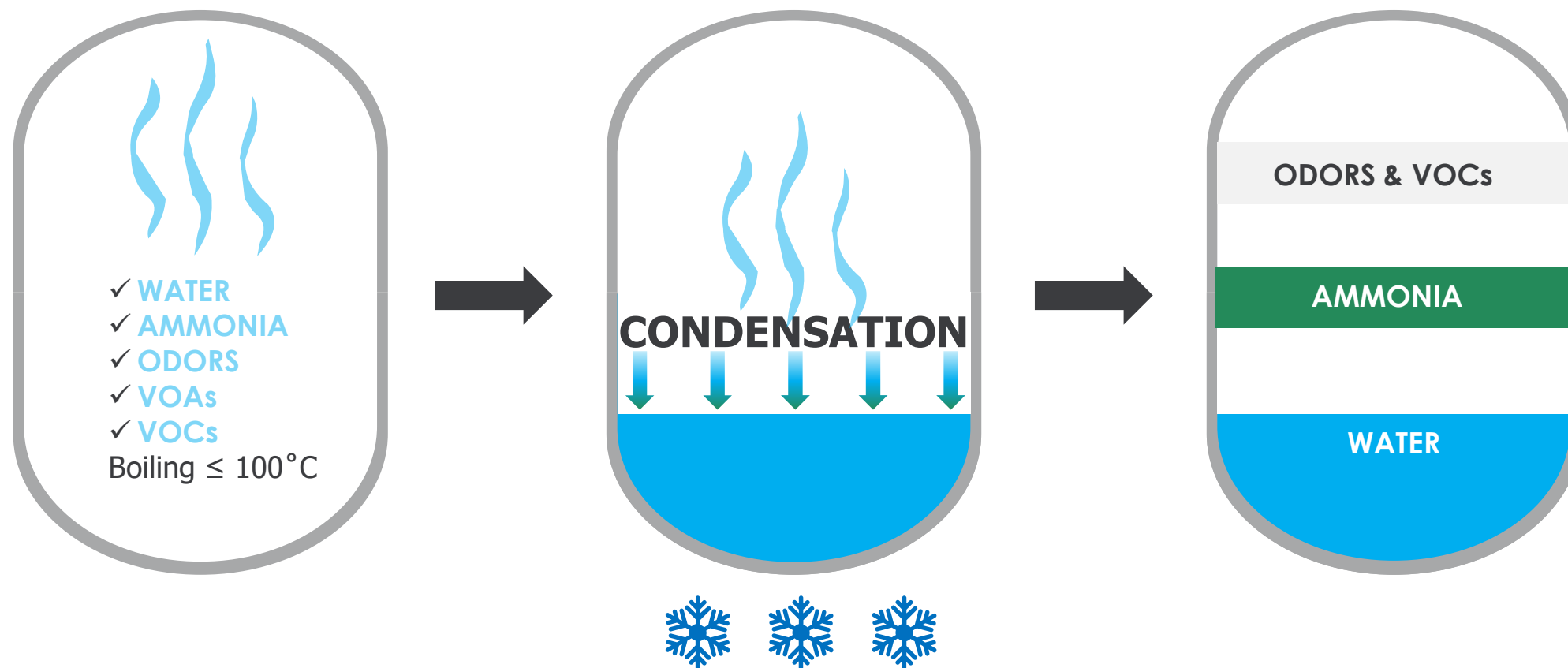
► Why is Varcor so effective?

**1.** When you apply heat, evaporation separates the solids from the other components.



► Why is Varcor so effective?

2. As the vapor cools & condenses, it releases each component at a different temperature through distillation.



# CLEAN WATER

WATER  
PRODUCT FOR  
RE-USE



**SEDRON**  
TECHNOLOGIES

# DRY SOLIDS

AG:

- ✓ OMRI Certified
- ✓ Dry
- ✓ Pathogen Free



# AQUEOUS AMMONIA

ORGANIC  
HIGH  
NITROGEN  
PRODUCT

OMRI  
CERTIFIED





# Nutrient Recovery Systems

## SUMMARY

MANURE MANAGED AS AN ASSET

ALL UPCYCLING PROCESSES NEED TO BE MANAGED AS A SYSTEM TO ACHIEVE EACH PARTIES DESIRED GOALS.

MANURE TECHNOLOGY CATALOG: [WWW.NEWTRIENT.COM](http://WWW.NEWTRIENT.COM)