CASE STUDY

HOW TO SET UP A PROCESS WATER RECOVERY AND REUSE SYSTEM in a potato processing plant

The state of Arizona in the USA is a dry region, where water is scarce. This is where a 150,000 square foot potato processing plant was built in 1984. Thanks to 36 acres of solar cells, and boilers that burn biomass waste, the plant was practically self-sustaining in electricity and steam before the project started.

Discover how this plant decided to **set up a reuse water system, to target self-sustainability in water too**.

1 | GOAL

RECOVER AND REUSE PROCESS WATER ON A MASSIVE SCALE

The plant aimed at recovering **and reusing 75% of its process water**, used to wash cookable products and equipment. As a prerequisite, the plant had to manage sanitary and other types of water in another way. They were collected separately and discharged to the municipal wastewater treatment plant.

Being a Food & Beverage plant, it also needed to **meet the EPA Primary and Secondary Drinking Water Standards**. To obtain permits, it also had to respect many chemical restrictions (including those relating to metals in the recycled water, such as selenium and copper).

The original baseline flow of the plant was 490 000 GPD (1 855 m3/d). But the project had to take into account future expansion of the plant, so its design flow was 645 000 GPD (2441 m3/d).

Challenges appeared during the pilot study phase

Membrane organic and inorganic fouling appeared in the water recovery and reuse system

Scaling was caused by the high pH of the water in one of the steps

To prevent these issues from occurring, the project had to implement additional water treatment technologies.

TECHNOLOGIES FOR A 14-STEP PROCESS WATER RECOVERY SYSTEM

To meet the plant's goals, **an effective 14-step process water recovery system was designed**.

- First, the water goes through **pretreatment systems**, to capture the starch and remove the oil from the process water, before going to a process sump. The next step consists of **primary screens**, which separate the big chunks of potato from the water itself. This organic residue goes to a blended tank, and then a centrifuge, to make a cake which is used as animal feed. As no chemicals are used in the process, the cake is safe for livestock.

- Next, the process water goes to an **equalization tank** (to minimize fluctuation), a **pH control system** (using CO_2 - a safe, food-grade method), and primary clarifiers (where the solids settle down). The plant decided to install two small clarifiers instead of one big one, to help minimize maintenance time when only one of them is needed.

- Afterwards, the water is sent to the **Membrane BioReactor (MBR)**.This phase is the heart of the system aiming at reducing the Chemical Oxygen Demand (COD) and nutrient load, it is constituted of a first phase of anoxic biology for de-nitrification, followed by a second aerobic biology phase. Then water then goes to the Membrane filtration system where solids are removed creating a high quality permeate.

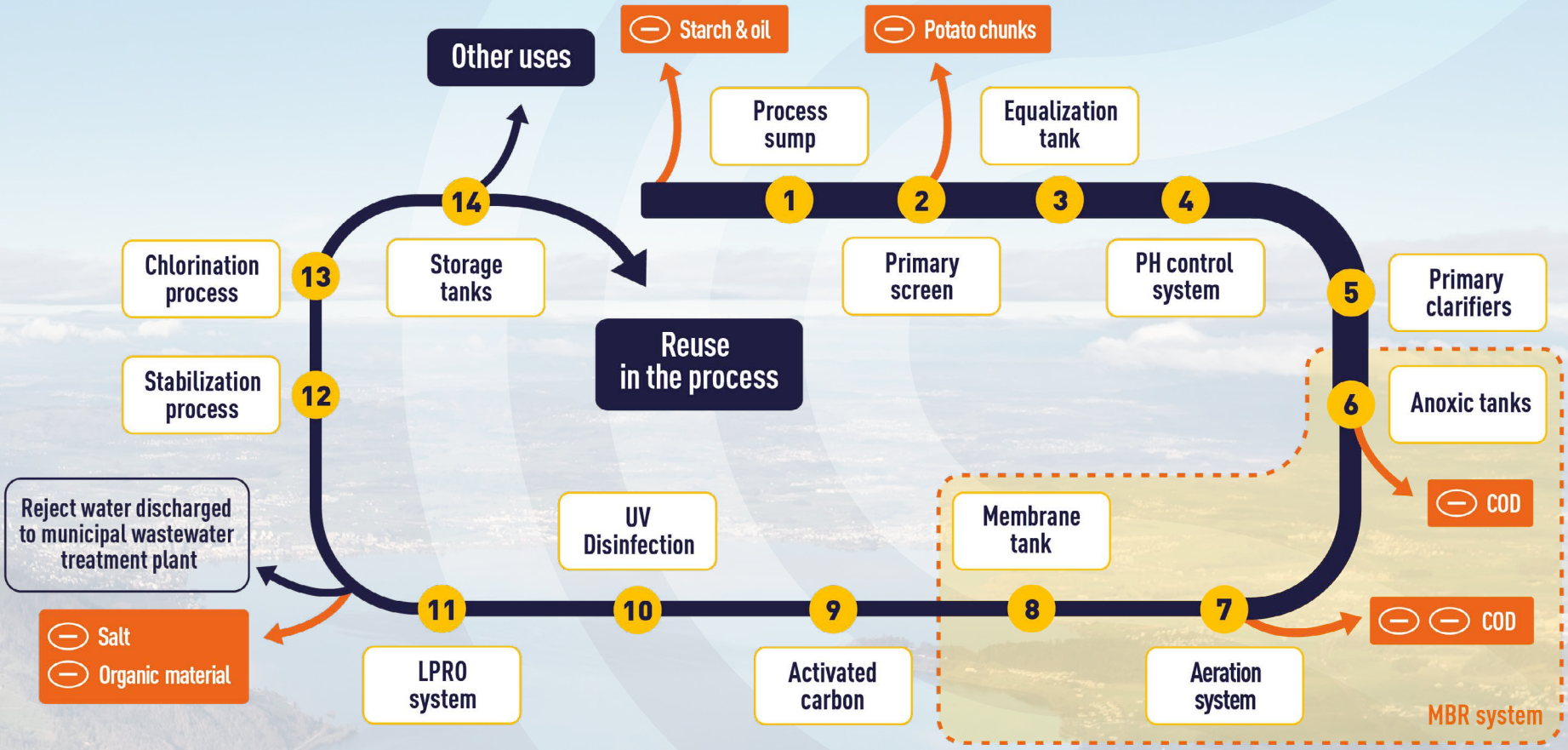
- To remove the fouling material, the water has to go through an **activated carbon** phase that uses no chemicals, to meet food safety standards. Then it moves to **Ultraviolet (UV) light disinfection** (making sure there are no microbiological organisms in the water to prevent organic fouling in the downstream RO), and a **Low Pressure Reverse Osmosis (LPRO)** two-stage system. In each of the eight pressurized tubes in the system, seven membrane elements help remove salts and organic materials from the water.

- At this stage, the water that comes out of the **LPRO** system is already suitable to be reused within the factory. The reject water, on the other side, is discharged to the municipal wastewater treatment plant.

- To finalize the recovery system, a **water stabilization process** (based on food-grade sodium hydroxide) was installed, to make sure the water is stable and avoid corrosion in the water distribution network. Finally, a **chlorination process** ensures the water microbiological quality is not modified when passing through the water distribution network.

- Ultimately, a large proportion of the recycled water is sent to a **water storage tank** that is directly linked to the plant, for final reuse in the process.

14-STEPS RECOVERY SYSTEM



WATER SUITABLE TO BE REUSED IN THE PROCESS THAT EXCEEDS THE QUALITY STANDARDS OF THE LOCAL MUNICIPAL WATER

Ultimately, **70 to 75% of the recovered water is reused in the plant's process**.

The recovered water quality was striking :

98% of the time, the Biological Oxygen Demand (BOD) is non-detectable in the water that comes out of the MBR system.

COD was detected at less than 5 ppm in the water that comes out of the MBR system.

Total Dissolved Solids (TDS) are reduced from 97% to 98.5% after the water comes through the MBR and LPRO system.

Ultimately, **the recycled water is suitable to be reused in the process, and exceeds the quality standards of the local municipal water**.

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