

DAIRY PROCESSING WATER DEFINITIONS AND REUSE OPPORTUNITIES

Definitions - Water Reuse, Recycling and Reclamation

Based on definitions from several environmental NGOs and water stewardship organizations¹, water reuse, water recycling and water reclamation are generally defined as follows:

- **Recycled/reused water** - Generally refers to treated process wastewater that is used more than once before it passes back into the water cycle. “Reused” and “recycled” are often used interchangeably.
- **Reclaimed water** - Refers to treated process wastewater that is available for recycling or reuse. Reclaimed water is not reused or recycled until it is put to a purpose (e.g., irrigation).

The Food and Agriculture Organization (FAO), in collaboration with the World Health Organization (WHO), published Safety and Quality of Water Used in Food Production and Processing, which contains water use definitions in a food and beverage processing context²:

- **First-use water** - Potable water from an external source that can be used in any food processing operation.
- **Reuse water** - Water that has been recovered from a processing step within the food operation, including from the food components and/or water that, after reconditioning treatment(s) as necessary, is intended to be reused in the same, prior or subsequent food processing operation. The three types of reuse water are as follows:
 - **Reclaimed water** - Water that was originally a constituent of a food material, which has been removed from the food material by a process step and is intended to be subsequently reused in a food processing operation.
 - *Examples:* Water that was originally part of a raw material or food (e.g., milk, whey) and removed by a process step (e.g., condensate water from milk or whey evaporate; reverse osmosis permeate water from whey).
 - **Recycled water** - Water, other than first-use or reclaimed water, which has been obtained from a food processing operation, or water that is reused in the same operation after reconditioning.
 - *Examples:* Brine, scalding water and water for transporting or washing of raw materials, such as vegetables and fruits, in subsequent units, for which first-use water is used initially and then reused in previous units until it is used for cleaning of product coming from the field before being discarded and reconditioned.
 - **Recirculated water** - Water reused in a closed loop for the same processing operation without replenishment.
 - *Examples:* A cooling or heating system in which water circulates, such as a condenser or pasteurizer.
- **Process water** - Water recovered from processes such as evaporation or membrane processing and subsequently handled and treated in such a manner that it can be considered a safe water supply³.

¹Environmental NGOs and water stewardship organizations consulted include WaterReuse.org, the U.S. EPA, The Water Education Foundation and The National Academies of Sciences, Engineering and Medicine.

²FAO and WHO. 2019. Safety and Quality of Water Used in Food Production and Processing - Meeting report. Microbiological Risk Assessment Series no. 33. Rome.

³USDA Agricultural Marketing Service. 2013. DA Instruction 918-PS, instructions for Dairy Plant Surveys.

Opportunities and Applications for Water Reuse in Dairy Processing

Residual water

In a dairy processing context, residual water is generated from a variety of processes, depending on the type(s) of products manufactured. However, residual dairy processing water can generally be grouped into three categories⁴:

- **Reclaimed water from milk and milk products (COW water)** - Condensed water vapors formed during the process of evaporation of milk and milk products, or the permeate from reverse osmosis (RO) processing of milk and milk products.
- **Cleaning wastewater** - Derived from washing equipment in direct contact with milk or milk products, as well as product spillage, whey, pressing and brine, CIP (clean-in-place) effluents or equipment malfunction/operational error.
- **Sanitary wastewater** - Used in restrooms, showers, and other facilities not associated with product manufacturing. This wastewater is generally piped to sewage.

Cow water

Reclaimed water from milk and milk products lacks pollutants and can generally be reused after minimal pretreatment, depending on its application. Typical reuse applications for reclaimed water from milk and milk products include processes that do not come into direct contact with derived products, such as hot water and steam production, membrane cleaning, boiler feedwater, or cooling water makeup.

For reclaimed water from milk and milk products (COW water) specifically (in Grade “A” milk plants), the U.S. FDA Grade-A Pasteurized Milk Ordinance (PMO) defines standards dictating required water quality, treatment and monitoring for various uses⁵:

- **The Category 1 standard**, the most stringent of the three, applies to water to be used for potable treatment. This water can ultimately be used for final rinses in the CIP process.
- **The Category 2 standard** applies if COW water is reused as boiler feedwater where steam directly contacts milk or milk products, for CIP pre-rinsing and for cleaning solution water.
- **The Category 3 standard** allows COW water to be used as boiler feedwater where steam is not in direct contact with milk or milk products, or as cooling water where there is no direct contact, nor potential for contact with milk or milk products.

⁴Slavov A. K. (2017). General Characteristics and Treatment Possibilities of Dairy Wastewater - A Review. Food technology and biotechnology, 55(1), 14-28. <https://doi.org/10.17113/ftb.55.01.17.4520>
⁵Daniels T. (2020). Recycling COW Water in Boiler and Cooling Tower Systems”