NEWTRIENT SNAPSHOT

Aqua Innovations Plus, LLC

Ultrafiltration Membrane-Based Nutrient Partitioning Technology

BUSINESS OVERVIEW

Aqua Innovations Plus, LLC is a technology and consulting company dedicated to addressing the unique nutrient management needs of the dairy industry. With a deep understanding of the industry's complexities, Aqua Innovations Plus, LLC offers comprehensive technology solutions to enhance nutrient management efficiencies while creating revenue streams for dairy farmers and developers, and ensuring compliance with environmental regulations.

PROJECT

TECHNOLOGY OVERVIEW

The ultrafiltration (UF) membrane-based nutrient partitioning technology concentrates both suspended and dissolved solids in wastewater, including separated liquid manure effluent, through UF and reverse osmosis (RO). UF membranes use high-pressure to filter large solids containing most of the phosphorus, organic nitrogen, and pathogens from the liquid waste stream while allowing nutrients like ammonia and salts, along with water, to pass through the membrane. In the same way, RO membranes partition the remaining nitrogen, potassium, and salts, ensuring the resulting water is suitable for reuse or discharge. Depending on the final products desired, the UF component can be operated independent of the RO system.

PROJECT SIZE

Customizable to many dairy operations, the UF membrane-based nutrient partitioning technology is flow rate controlled. Each UF and RO unit is designed to operate at a flow rate of 50 gallons per minute. Typically operating with two units and an assumed 80% runtime, this equals a combined maximum capacity of 115,000 gallons per day and 42 million gallons annually[1].

REQUIREMENTS

Effective pre-treatment of the waste stream including sand removal and separation of coarse solids is essential to system reliability. Feedstock introduced into the membrane should be a low-solids slurry or liquid. Membrane-based nutrient partitioning technologies must be protected from freezing temperatures and adverse weather conditions. Proper storage of treated slurries and liquids ensures sustainable management, enabling efficient handling and application. Ongoing monitoring, routine maintenance, record keeping, operational oversight, and adequate training optimizes performance.

KEY CALL-OUTS

Clean Water Recycling: Recovery of clean water compliant for discharge, reuse, and recycling.

Nutrient Concentration: Phosphorus and nitrogen concentrates tailored for crop and soil requirements.

Pathogen Reduction: Ultrafiltration membranes prevent pathogens from passing through into the clean water stream and are retained in the nutrient-rich liquid fertilizer solution.

Cost Savings and Return on Investment: Lowers manure hauling costs, reduces the need to purchase commercial fertilizers, and generates valuable, marketable products.

Findings are based on an evaluation conducted under a Conservation Innovation Grant awarded to Newtrient. To view a more detailed description of these results, visit the Aqua Innovations Plus, LLC Ultrafiltration Membrane-Based Nutrient Partitioning Technology Evaluation Summary on the Newtrient website.

FINANCIAL OVERVIEW

CAPITAL INVESTMENT & OPERATIONAL COSTS

As of 2025, the estimated initial capital investment cost of an Aqua Innovations UF unit ranges from $750,000 (3,000 cows and one unit) to $1.6 million (5,000 cows and two units). Adding an RO with UF for 5,000 cows is an estimated $2.5 million. Average operations cost is $0.006 per gallon of power over three months. Costs may vary by project specifics, flow rates, infrastructure, market conditions, and additional features.

DOWNSTREAM BENEFITS

The process yields a phosphorus-rich solution from UF, a nitrogen and potassium-rich solution from RO, and clean discharge water. These concentrated liquid fertilizers reduce the reliance for commercial fertilizers and could be sold to create an additional revenue stream. Concentrating nutrients reduces hauling volume and transportation costs. On-farm water reuse decreases freshwater needs.

ENVIRONMENTAL IMPACT

WATER QUALITY AND SAVINGS

Clean water recovered from manure using the UF membrane-based nutrient partitioning technology is suitable for discharge and can be repurposed for various on-farm uses such as irrigation, sprinkler cooling systems, flush water, and cleaning. By increasing the amount of water that can be recycled and reused on the farm, dairy operations can reduce their dependence on external water sources, conserving freshwater sources and supporting improved water management.

ENHANCED SOIL AND CROP HEALTH

The nutrient-rich UF and RO solutions produced by the UF membrane-based nutrient partitioning technology enable targeted nutrient application tailored to specific soil and crop needs. This precision approach reduces dependence on commercial fertilizers and minimizes the number of field passes needed, decreasing soil compaction and improving field conditions.

Key ultrafiltration membrane-based nutrient partitioning technology products – manure (far left), phosphorus-rich solution (second from left), nitrogen-rich solution with potassium (second from right), and clean water (far right).

REFERENCES: [1]Liskow, T., and R. A. Larson. *Aqua Innovations Nutrient Concentration System Performance Evaluation*. Nelson Institute for Environmental Studies, University of Wisconsin–Madison. Final report prepared for Newtrient, updated February 2025. Included as Appendix to *NRCS Practice Standard 632: For Acceptance of Ultrafiltration Nutrient Partitioning Technology*, https://www.newtrient.com/about/our-work/grant-funded-projects/2020-nrcs-conservation-innovation-grant/.

NEWTRIENT'S 9-POINT TECHNOLOGY SCORING

For Aqua Innovations Ultrafiltration Membrane-Based Nutrient Partitioning Technology

Visit the Aqua Innovations Ultrafiltration Membrane-Based Nutrient Partitioning Technology page in Newtrient's Solutions Catalog

Each solution can earn up to nine points, one for each criterion. Colored numbers indicate fulfilled criteria.

1 | Operational History
2 | Operational Reliability
3 | Market Penetration
4 | Capital Cost
5 | Operations & Maintenance Cost
6 | Value Proposition
7 | Vendor Information Sharing
8 | Case Study
9 | Funding Availability

Discover Newtrient's technology evaluation process: Learn more about Newtrient's 9-Point Technology Scoring System.

Newtrient's mission is to reduce the environmental footprint of dairy while making it economically viable to do so.

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