8 GLASSES CLEAN WATER PROGRAM - REVERSE OSMOSIS SYSTEM

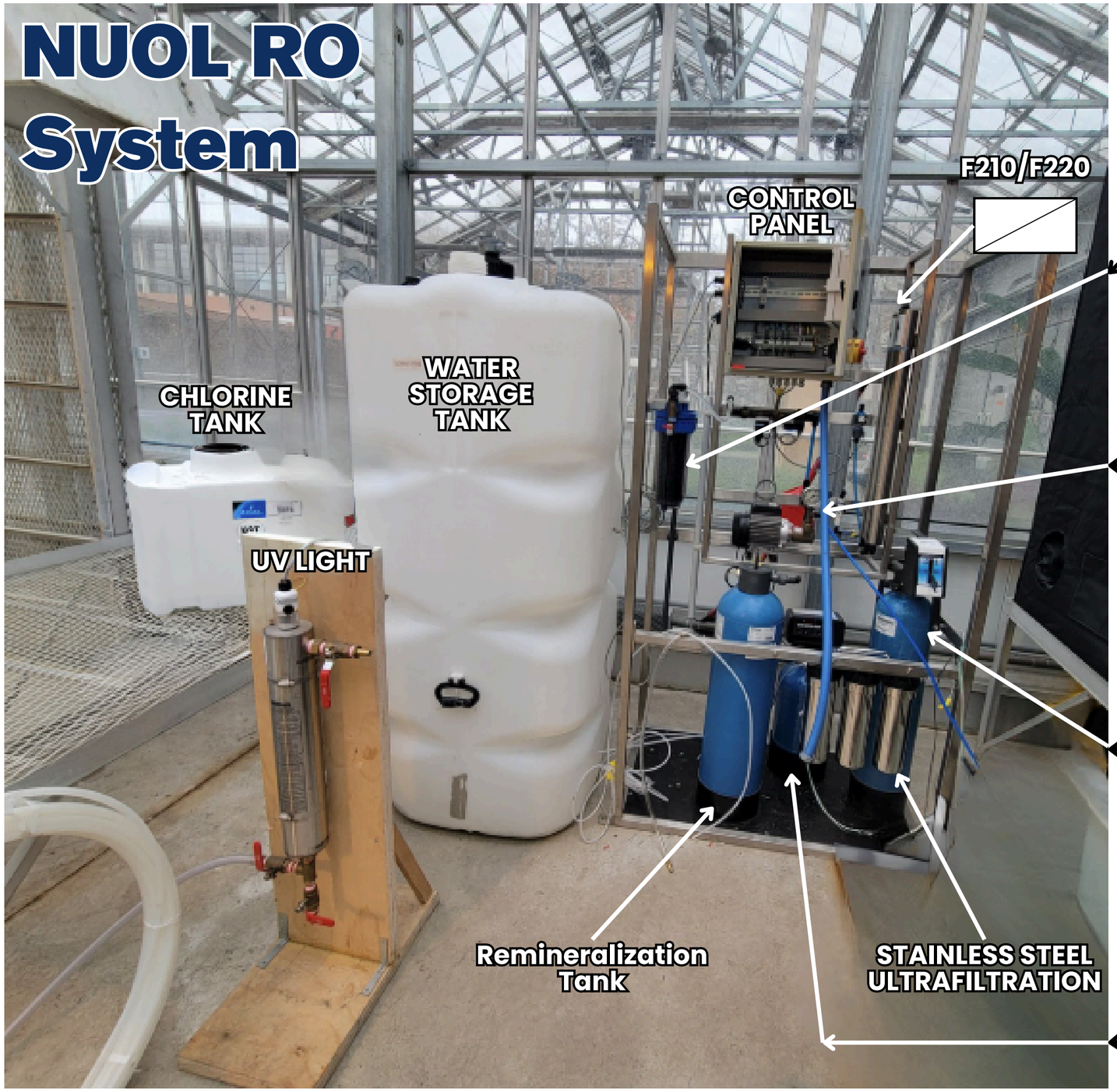
National University of Laos

Week 2: Components of the NUOL Pilot RO System and How It Works

The objectives for your second week include:

- Identifying each major component of the pilot RO system and understanding its function.
- Learning the water’s path through the system from start (raw water) to finish (clean water).
- Learning key operating parameters including flow rate and pressure.
- Recap of the RO membrane.

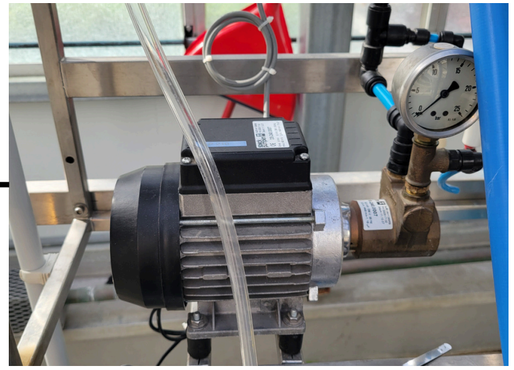
NUOL RO System



POLYPROPYLENE FILTER F130

Activated Carbon Filter F130

HIGH PRESSURE PUMP P210



MULTIMEDIA FILTER F110

SOFTENER F120

Raw Water Source

A pump pumps water from a borehole well into a chlorine dosing tank.

Types of water soures

including surface water (e.g. rivers, lakes, and reservoirs), groundwater (e.g. wells and natural springs) , and seawater.

Pumps

Pumps are used to create a pressure difference and overcome gravity and friction. The most common types include centrifugal and in-line pumps.

Chlorine Dosing Tank

Chlorine is added at the start of the system to remove bacteria. Reverse osmosis membranes are expensive and prone to biofouling (bacterial buildup). This is a preventative measure to ensure a longer shelf life of the RO membranes.

Pre-treatment

The water first passes through pre-filters .These filters remove big particles and some chemicals. For example, a sand filter catches dirt and a carbon filter removes chlorine or bad smells. This protects the RO membrane from clogging or damage.

Activated Carbon (GAC) Filter

This filter removes chlorine from the water. Chlorine can cause bad tastes/odours and can damage the RO membrane. A pressure gauge before the filters allows us confirm that the pressure if high enough to push the water through the two RO membranes.

Polypropylene Filter Cartidge

Metals were not tested in preliminary assessment. metals are commonly found in groundwater, and this filter is good at reducing rust, particles, and sediment.

Multimedia Gravel Filter

This tank is layered with coarse sand, fine sand, and granular activated carbon to remove any remaining large particles.

Water Softener

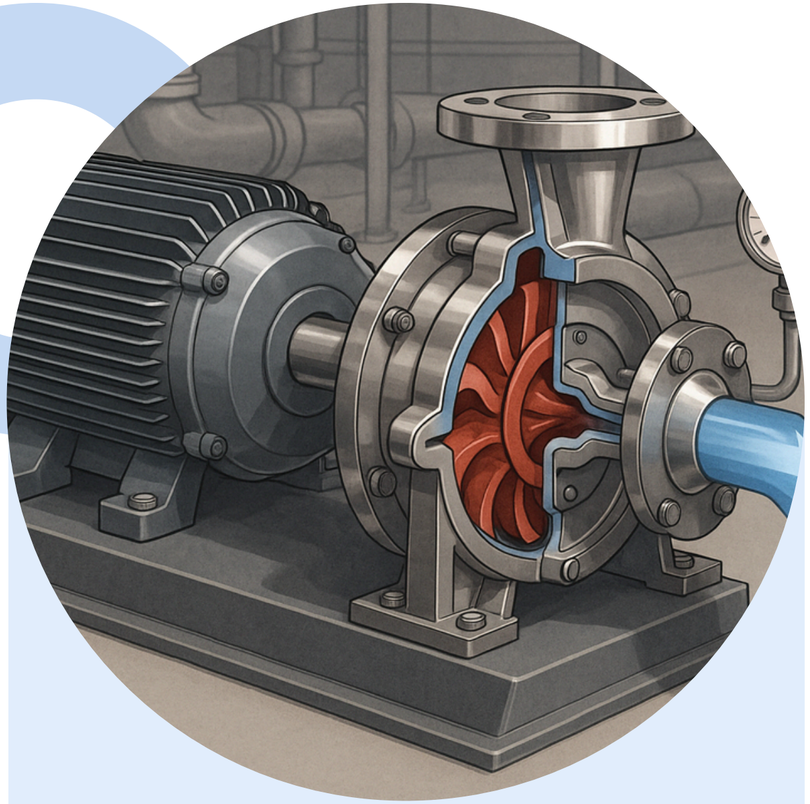
The softener removes hard metals such as calcium. This will aid in the prevention of inorganic scaling on the RO membrane.

Ultrafiltration (UF) Unit

This unit will remove any remaining fine particles in the water.

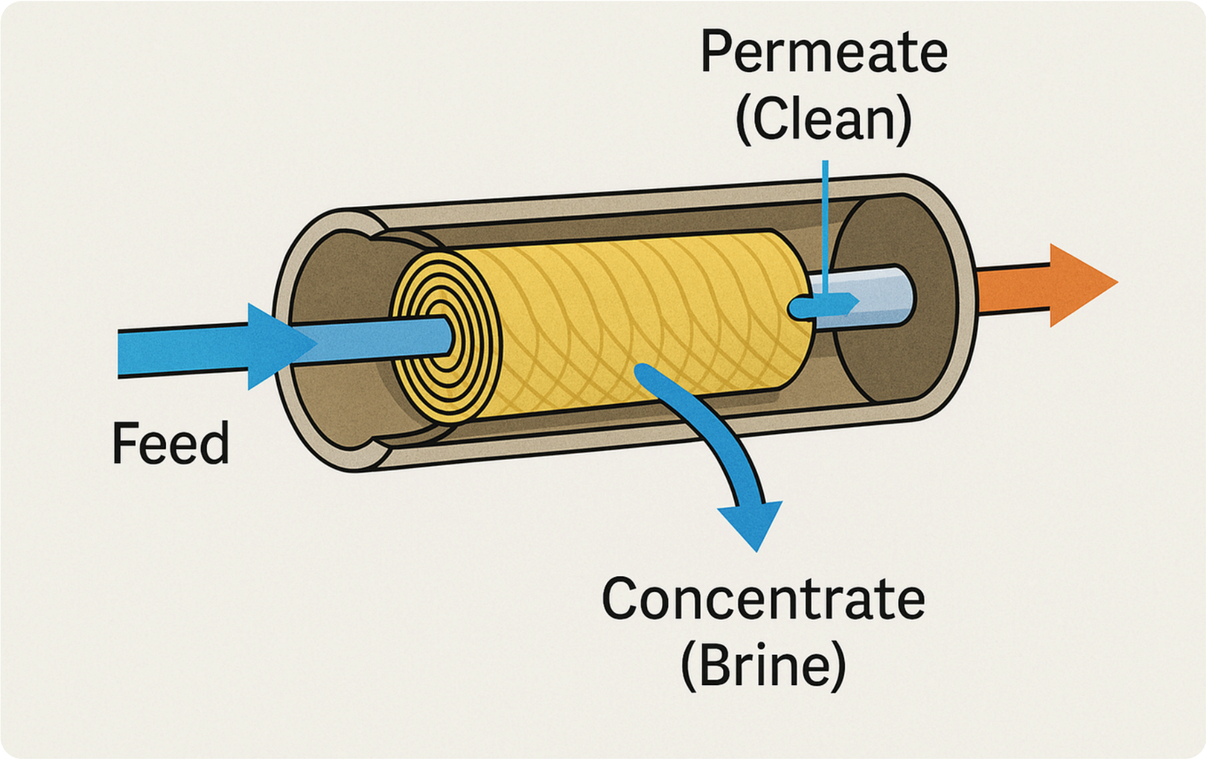
High-Pressure Pump

Now the water is clear of large particles, it goes to a pump. The pump raises the pressure of water very high because for reverse osmosis, we need to push water through the membrane against the natural direction. Recall in Week 1: We have to ‘push’ water molecules through the tiny membrane holes.



RO Membrane Module

Inside the tubes in this system, is a special thin film (the membrane) with microscopic pores. Under pressure, fresh water goes through the membrane, leaving impurities behind. On one side we get fresh water (permeate) and the leftover concentrated water (brine or concentrate) is separated. Two output streams exist: one we want, one we discard or recycle.



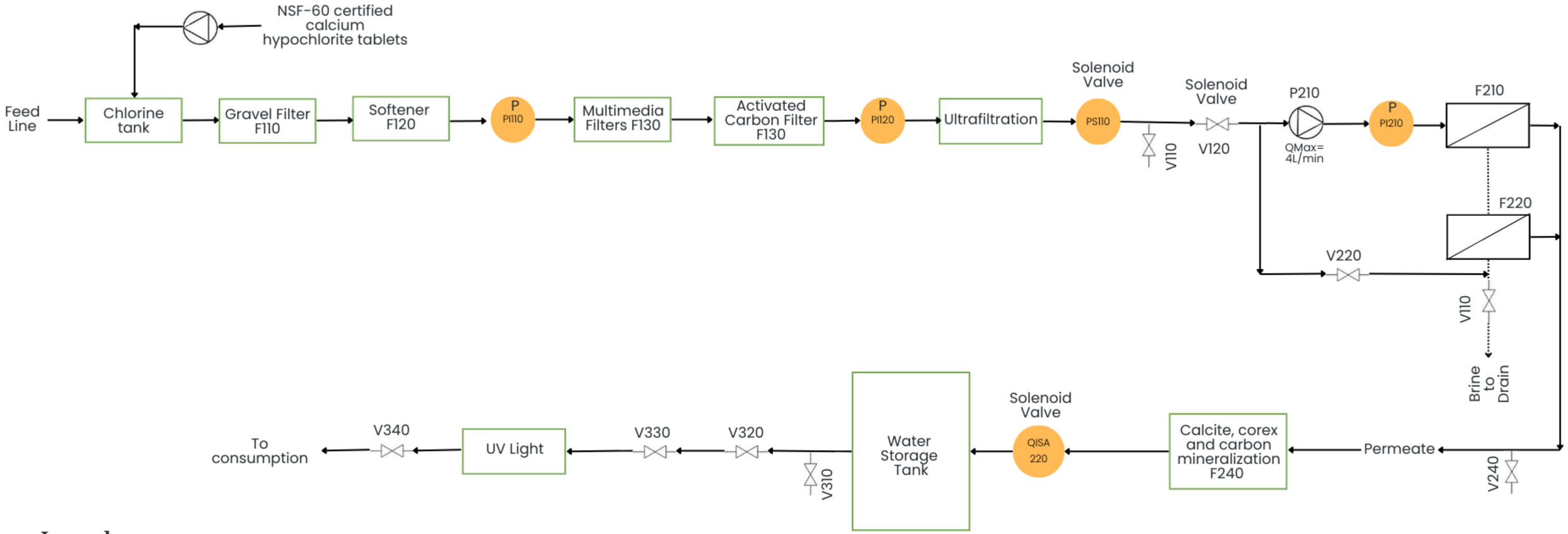
Post-Treatment & Storage

The clean water (permeate) often goes through a couple more steps before use. In our pilot, that’s UV disinfection and a remineralization.Now that we have filtered water, the water flows through a mineral bed (like a box of rocks) to add some minerals back for taste and to neutralize pH. The water then collects in a storage tank ready for drinking. Before collecting water to drink, we shine UV light on it to kill any remaining germs.

UV light

Never look directly at a glowing UV lamp—even brief exposure can cause “welder’s flash” (painful eye burn).

NUOL RO System Design



Legend

AF	Analog Flow Meter
pH	pH Meter
T	Thermistor
FS	Float Switch
EC	Electric Conductivity Sensor
PT	Pressure Transducer
DF	Digital Flow Meter
P	Pressure Gauge
	RO Membrane

QUIZ 2

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