Public Health Division

Center for Health Protection, Drinking Water Services

Tina Kotek, Governor

February 2, 2026

Scott LaRoque
City of Albany
310 Waverly Dr NE
Albany, OR 97321

Re: Membrane Module Replacement (PR# 127-2025)
City of Albany (PWS ID# 00012)
Conditional Approval

Dear Scott LaRoque:

Thank you for your submittal to the Oregon Health Authority's Drinking Water Services (DWS) of plan review information for the membrane module replacement for the City of Albany (the City). On October 2, 2025, our office received a proposal for the phased replacement of membrane modules and a plan review fee of $3,300.

The project includes purchasing a total of 20 Memcor S10N and 1920 Memcor S10N V2 membrane modules. These modules will replace existing modules at the Albany-Millersburg Water Treatment Plant (WTP-B). Membrane module replacement will take place over approximately three years following the schedule below:

Phase	Cell #	# Modules / Cell	Module Make
Spring 2026	1	552	Memcor S10N
	2	640	Memcor S10N
	3	552	Memcor S10N
	4	640	Memcor S10N V2
Winter 2026 - Spring 2027	1	552	Memcor S10N
	2	640	Memcor S10N
	3	640	Memcor S10N V2
	4	640	Memcor S10N V2
Winter 2027 - Spring 2028	1	640	Memcor S10N V2
	2	640	Memcor S10N
	3	640	Memcor S10N V2
	4	640	Memcor S10N V2

Additionally, the City has requested approval for temporary modification to the approved number of membrane modules in operation on an as-needed basis. This request is in response to, and anticipation of high turbidity events in the Santiam River (SCR-BA) associated with drawdown operations of the Green Peter Reservoir. Adjustments to the number of on-line membrane modules in each cell provide additional operational flexibility and allows for the most accurate reporting of operating conditions and membrane performance.

Oregon Health Authority DWS approves the membrane module adjustment request, provided that the City operates WTP-B in accordance with the conditions listed below and the operating parameters included in Appendix A. The City shall report membrane module adjustments to Oregon Health Authority DWS and must submit documentation of any associated PLC changes.

The plans are approved subject to the following conditions:

Membrane Filtration Process

1. Direct Integrity Testing (DIT) parameters will need to be verified and programmed into the PLC/SCADA system. These parameters include:
    a. An ongoing **log removal value ($LRV_{ambient}$)** reflective of particle and pathogen removal in the 3 micron or less size range that is calculated every 15 minutes based on current ambient operating conditions and the most recent DIT result. In summary, $LRV_{ambient}$ is the performance indicator used to demonstrate the minimum 4.0-log (99.99%) *Cryptosporidium* removal that the membrane filters have been credited with.
    b. A **maximum pressure decay rate (PDR_{max})**, which is set no higher than 0.61 $^{psi}/_{min}$ that indicates a failure of the DIT and prompts an automatic shut-down of the filtration skid.
2. An operations and maintenance (O&M) manual is developed that includes a diagnosis and repair plan such that the ability to remove pathogens is not compromised. The existing O&M manual shall be updated to include information on the new Memcor S10N V2 modules.
3. As-needed replacement of membrane modules shall be conducted in a “like for like” fashion (i.e. a cell containing Memcor S10N modules can only receive a Memcor S10N module).[1]

[1]The practice of “like for like” membrane module replacement will maintain the

homogenous cell compositions detailed in this conditional approval letter. Deviation from this approved replacement plan and cell organization will require PLC/SCADA programming updates and must go through additional plan review.

When final approval is granted, each membrane filter unit will be granted log removal credits (LRCs) for pathogen removal as shown in Table 1. The LRCs are based on a verification of the Challenge Study Report for the Memcor S10N and Memcor S10N V2 membrane modules.

Table 1 – Filter Log Removal Credit (LRC)

Pathogen	Removal Credit (log_{10})
Giardia lamblia	4.0
Cryptosporidium sp.	4.0
Viruses	0.0

The LRCs are only valid provided operations are within the limits shown in Appendix A – Explanation of Operating Limits and Terms. Ensure SCADA/PLC programming accounts for the operating limits in Appendix A (e.g. set system alarms to ensure operating limits are met). **Some of the limits in Appendix A are yet to be determined as indicated by "TBD" and will need to be established prior to Final Approval.**

To remain in compliance, $LRV_{ambient}$ must be equal to or greater than the LRC for *Cryptosporidium* shown in Table 1. $LRV_{ambient}$ values displayed in SCADA should be calculated using the formulae and variables shown in the membrane supplier's calculations.

Until we receive verification that the conditions have been met and final approval has been issued, the replacement membrane modules are not approved for use. Upon completion of the project, the engineer must verify in writing that construction was completed according to the submitted plans. If substantial changes are made, a set of as-built drawings must be submitted. Documentation demonstrating how the above conditions were met should reference Plan Review #127-2025 and can be emailed to me at baxter.call@oha.oregon.gov.

If you have any questions, please feel free to email me or call me at 541-393-4374.

Sincerely,

B Call

Baxter Call, PE
Regional Engineer
Drinking Water Services

CC: Julie Wray, OHA/DWS
Nicholas Alviani, REHS, OHA/DWS

Appendix A – Explanation of Operating Limits and Terms

Appendix A
Operating Limits and Definition of Terms

The operating limits are listed in Table A, followed by definitions of the terms in this Appendix. Table A should be confirmed once plan review has been finaled.

Table A – Operating Limits

Operating Parameter	Limit - Memcor S10N	Limit - Memcor S10N V2
DIT frequency	Conduct at least 1 DIT on each unit for each day of operation	
DIT starting pressure[1]	**TBD**	**TBD**
Minimum allowed DIT pressure	16.46 psi	
PDR_{max}[2]	0.61 psi/min	
Maximum TMP	11 psi	
Maximum allowed filtrate flux	80 gpd/ft^2	155 gpd/ft^2
V_{sys} adjustment[3]	2.3 gal/clover	2.8 gal/clover

[1]DIT starting pressure will need to be updated from the proposed and has not been specified as of writing this Conditional Approval letter.

[2]The varying number and make of membrane modules in each cell during the module replacement project yields a range of cell specific PDR_{max} setpoints. Oregon Health Authority DWS has selected the most conservative PDR_{max} setpoint calculated using EPA Membrane Filtration Guidance Manual (MFGM) Equation 4.17.

[3]The V_{sys} adjustment factors are provided by the membrane manufacturer (DuPont) and must be incorporated into PLC changes during the temporary cell modifications discussed in the conditional approval letter. A clover is sub-unit

consisting of 4 grouped membrane modules sharing the same valving.

The ability of membranes to filter out pathogens (referred to as **membrane integrity**) is to be tested in two ways:

Direct Integrity Testing

1) Once a day using a more direct pressure decay or "air hold" test, often called a **"Direct Integrity Test" (DIT)** because the air hold test is a direct test for leaks or broken membrane fibers.

Indirect Integrity Testing

2) Continuously using a turbidimeter that monitors the effluent turbidity from each membrane unit, often called **individual filter effluent (IFE)** turbidity monitoring.

Direct Integrity Testing (DIT):

Like checking for leaks in a car tire, the membranes are pressurized with air and held for a set amount of time. Air hold times are generally 2 – 10 minutes. A pressure sensor then detects a drop in the held pressure. This pressure drop is called a pressure decay, measured in psi [$^{lbs.}/_{sq.\ in.}$]. How fast the pressure drops (or decays) is called the **pressure decay rate (PDR)**, expressed in $^{psi}/_{minute}$. The PDR is the drop in pressure [psi] divided by the air hold time [minutes]. In some cases, the SCADA will display only the pressure decay in psi, and it is up to the operator to know the hold time and determine the decay rate in $^{psi}/_{minute}$.

Direct Integrity Testing using P_{Test}:

For a DIT to be able to demonstrate that the membranes are intact (do not have holes or broken fibers) –

1. the membrane first needs to be pressurized to a certain minimum pressure (the **minimum DIT pressure – sometimes called P_{Test}**) and
2. the PDR needs to be under a specified upper limit or **"maximum pressure decay rate" (PDR_{max})**.

Indirect Integrity Testing (DIT):
Turbidity monitoring is "indirect integrity testing."
Should IFE turbidity exceed 0.15 NTU for more than 15 consecutive minutes, the membrane unit needs to be taken out of service and undergo a DIT. Turbidity is an indirect indicator of membrane integrity, and a DIT is needed to explicitly determine membrane integrity.

$LRV_{ambient}$ – Demonstrating continuous pathogen removal:
The results of the daily DIT can be used to calculate a pathogen removal efficiency under ambient operating conditions achieved by the membranes. This log removal value is termed **"$LRV_{ambient}$"** and can be used to demonstrate compliance by directly comparing this performance metric to the log removal credit (**LRC**) *Cryptosporidium* awarded in Table 1 in the letter.

More detail on the terms introduced above and the operating limits (*e.g.*, PDR_{max}) in Table A are further described as follows:

Glossary

- DIT Turbidity Trigger (IFE > 0.15 NTU for > 15 min):
  A DIT must be performed on each filter unit if the IFE turbidity is greater than 0.15 NTU for more than 15 minutes. This must be programmed into the SCADA system. Should the IFE turbidity exceed 0.15 NTU for more than 15 minutes, the membrane unit must be taken out of service and undergo a DIT. The membrane unit must not be placed back into service unless it passes the DIT (see PDR_{max} below). Membrane fiber repair/pinning is often needed to remedy this situation.

- DIT Daily Trigger:
  A DIT is also required each day of operation. If the resulting PDR exceeds the PDR_{max}, then the DIT is considered to have failed and the unit must remain off-

line, repaired, and retested to show that it passes a DIT before being placed back into service.
(In other words, should the PDR of the daily pressure decay test (PDT or "air hold test") exceed the PDR_{max}, this should indicate a "failed" DIT and the membrane must be taken out of service and may not be placed into service until it passes a DIT.) **A new DIT may be immediately run after a DIT failure, or repairs may be needed first (*e.g.*, fibers pinned, leaks at pipe fittings repaired, etc.) followed by passing a new DIT.**

- DIT test pressure (P_{Test}):
  As mentioned above on Page 2, the minimum DIT pressure (*i.e.*, the test pressure at the end of the DIT) must not drop below the minimum DIT pressure stated in Table A. **Should the pressure during a DIT drop below the level in Table A, the DIT is considered invalid or "failed" and must be repeated.**

- PDR_{max}:
  Every membrane system has a maximum pressure decay rate (PDR_{max}) measured in $^{psi}/_{min}$. This is the highest PDR allowed during a DIT. Exceeding the PDR_{max} indicates DIT failure. The failing membrane unit shall not operate until it passes a DIT. Ensure that the SCADA/PLC system is programmed to account for this PDR_{max}.

- DIT Sensitivity (can be used to determine "LRV_{max}"):
  The results of a DIT and the design flow can be used to determine the DIT sensitivity, expressed as a log removal value of *Cryptosporidium* (LRV_{max}). This LRV_{max} must be equal to or greater than the log removal credit (LRC) shown in Table 1.

- Membrane Performance ($LRV_{ambient}$):
  The results of the DIT will be used to determine the log removal value of *Crypto.* that is based on ambient or current operating conditions ($LRV_{ambient}$). The main difference between LRV_{max} and $LRV_{ambient}$ is the use of the current operating flow when calculating $LRV_{ambient}$. Lower flowrates could yield a lower $LRV_{ambient}$ value. In summary, $LRV_{ambient}$ is the metric for demonstrating compliance. $LRV_{ambient}$ must be equal to or greater than the LRC for *Crypto.* shown in Table 1.

- Transmembrane Pressure (TMP):
  The TMP is the pressure drop across the membranes and must not exceed the maximum value indicated in Table A.

  Flux:
  The flux ($^{flow}/_{filter\ feed\ area}$) is the flow per square feet of membrane surface area on the feed or inlet side of the membranes per day [$^{gal/SqFt}/_{day}$]. The flux must not exceed that indicated in Table A.

- Automatic Shutdown Conditions:
  The filters must be taken off-line or otherwise shut down, repaired and/or re-tested if any of the following occurs:

  1. PDR > PDR_{max}.
     The DIT PDR exceeds the PDR_{max} in Table A.

  2. $LRV_{ambient}$ < LRC.
     The $LRV_{ambient}$ is less than the LRC in Table 1

  3. IFE > 0.15 NTU for > 15 min.
     The IFE turbidity exceeds 0.15 NTU for more than 15 minutes.

  4. Combined Filter Effluent (CFE) turbidity exceeds 5.49 NTU (your regulator should be contacted as a boil water notice may be required)