Public Health Division

Center for Health Protection, Drinking Water Services

Tina Kotek, Governor

February 5, 2026

Troy Trute
CHR District Improvement Co
3370 Ridge Rd
Otis, OR 97368

Re: Membrane Module Replacement (PR#178-2021)
CHR District Improvement Co (PWS ID#00600)
Conditional Approval

Dear Troy Trute:

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 CHR District Improvement Co. On November 9, 2021, our office received a filtration system upgrade plan and a plan review fee of $248.

The project includes replacing the existing two Polymem UF120 ultrafiltration modules with three DuPont Inge dizzer XL 0.9 MB 60W modules. The existing WesTech Altapac II skid and water treatment plant programming will be modified to accommodate the three new modules.

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. A DIT sensitivity reflective of particle and pathogen removal in the 3 micron or less size range. **DIT test pressure (P_{test})** must remain above a minimum of 17.8 psi at all times to demonstrate the required test sensitivity.
    b. A **maximum pressure decay rate (PDR_{max})**, which is set no higher than 0.14 $^{psi}/_{min}$ that indicates a failure of the DIT and prompts an automatic shut-down of the filtration skid.

2. Indirect Integrity Testing is performed by continuously monitoring individual filter effluent (IFE) turbidity on each membrane unit. If IFE turbidity readings are above 0.15 NTU for a period of greater than 15 minutes, the associated membrane unit must immediately be taken off-line and a DIT performed.
3. An operations and maintenance manual is developed that includes a diagnosis and repair plan such that the ability to remove pathogens is not compromised.

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 dizzer XL 0.9 MB 60W 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.**

The design and implementation of this membrane filtration system upgrade pre-dates DWS adoption of an ongoing log removal value ($LRV_{ambient}$) as the primary membrane performance metric. Future membrane filtration expansion or module replacement, or SCADA and PLC upgrades will require a new plan review process, and $LRV_{ambient}$ must be included to remain in compliance with current requirements.

Until we receive verification that the conditions have been met and final approval has been issued, the dizzer XL 0.9 MB 60W 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 #178-2021 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
Nicole Alfafara, 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
DIT frequency	Conduct at least 1 DIT on each unit for each day of operation
DIT starting test pressure[1]	**TBD**
Minimum allowed DIT pressure	17.8 psi throughout the DIT duration
PDR_{max}	0.14 $^{psi}/_{min}$
Minimum DIT pressure transducer accuracy for the established PDR_{max}[2]	≤ 0.014 $^{psi}/_{min}$
LRV_{max}	**TBD**. LRV_{max} is the maximum LRV that can be reliably demonstrated by the DIT
Maximum TMP	14.5 psi at 20°C
Maximum allowed filtrate flux	105 $^{gal/SqFt}/_{day}$ @ 20°C

[1] DIT starting pressure will be specified in the membrane supplier's test protocol and calculations.

[2] **Pressure transducer accuracy** is typically based on the manufacturer's stated accuracy (best-fit straight line), expressed as % of span. A pressure transducer accuracy of +/- 10% of the DIT pressure span is recommended. The accuracy calculated in terms of [$^{psi}/_{min}$] must be less than or equal to the PDR_{max}.

Accuracy in terms of [$^{psi}/_{min}$] is calculated as follows:

Accuracy in $^{psi}/_{min}$ = $^{(\%\ Accuracy\ x\ Max\ of\ span\ in\ psi)}$ / $_{DIT\ duration\ in\ minutes}$

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.
  Variables used to calculate $LRV_{ambient}$ are included in Table A. 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. IFE > 0.15 NTU for > 15 min.
     The IFE turbidity exceeds 0.15 NTU for more than 15 minutes.

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