#### Texas Commission on Environmental Quality

#### Low Pressure Membrane Treatment Plant Checklist

References in () are to sections in the TCEQ document, “Common Issues with Low Pressure Membrane Treatment Plants.” Refer to that document for discussion and clarification of each checklist item.

**Unchecked boxes may indicate an issue that needs to be resolved. Please ask the TCEQ for assistance if you are unsure what the issue is or how to address it. TCEQ contacts are provided at the end of the checklist.**

|  |  |
| --- | --- |
|  | Collect the following data from TCEQ approval letters: <PWS Name>, PWS ID <nnnnnnn>, Treatment Plant ID TP<nnnnnn> |
|  | Membrane Approval Letter(s)  | (Enter data below) |
| 🞏 | Date(s) of TCEQ letter(s) |  |
| 🞏 | Approved Membrane Filter Module (brand, model, surface area per module)Example: Pall UNA-620A HF MF, 538 square feet (sq ft) |  |
| 🞏 | Assumed duration of a membrane filtration cycle, in other words, length of time a membrane unit filters water before a backwash or other cleaning process. Example: 14.9 minutes or 2,000 gallons |  |
| 🞏 | Assumed duration of air scrub, backwash and forward flush cycles before returning to filtration. Example: 1 minute simultaneous air scrub and backflush followed by 20 seconds of feed flush  |  |
| 🞏 | Assumed frequency and duration of maintenance cleans (not a full chemical clean in place). Example: maintenance clean with sodium hypochlorite once every 24 hours for 30 minutes followed by a backflush for 1 minute and feed flush for 20 seconds |  |
| 🞏 | Maximum approved instantaneous filtrate flux rate in gallons per square foot per day (gfd) temperature corrected to 20 °C. Example: 50.3 gfd |  |
| 🞏 | Net filtrate capacity per module in gallons per day (gpd) at 20 °C. Example: 24,012 gpd per module  |  |
| 🞏 | Number of modules per membrane unit (tank, train, skid, rack, etc.) Example: 42 modules per unit |  |
| 🞏 | Approved mode of operation: Deposition (Dead-end) or Crossflow (Suspension). |  |
|  | Direct Integrity Test (DIT) Values Letter |
| 🞏 | Date of TCEQ letter |  |
| 🞏 | Ptest, minimum test pressure to detect 3.0 micron defect (psi) |  |
| 🞏Or🞏 | Upper Control Limit (UCL)Pressure-Based DIT in psi per minute (psi/min)OrAir Flow-Based DIT in liters per minute (L/min) |  |
| 🞏 | Log Removal Credit (LRC) (log) Example: 3.0 |  |
|  | LT2 Bin Classification Letter |
| 🞏 | Date of most recent TCEQ Bin Classification letter |  |
| 🞏 | Treatment plant’s Bin ClassificationExample: Bin 1 |  |
|  | Concentration-Time (CT) Study Letter |
| 🞏 | Date of TCEQ letter |  |
| 🞏 | Required Log Inactivations – GiardiaExample: 0.5 |  |
| 🞏 | Required Log Inactivations – VirusExample: 4.0 |  |
| 🞏 | Assumed treatment processes in CT Study letter.Example: Pall ultrafiltration membrane with pretreatment of coagulation, flocculation, and clarification. |  |
| If you have issues locating the data above for your membrane plant, please contact Regina Frisancho at regina.frisancho@tceq.texas.gov for assistance. |
|  | **Treatment** (A.1., A.2.) |
| 🞏 | Only the approved membrane filter module is installed in the membrane units (trains, racks, skids, etc.). The TCEQ has been notified each time the modules have been replaced in a membrane unit. (B.1.a.) |
| 🞏🞏Or🞏 | Membrane filter units (trains, racks, skids, etc.) pass DITs on a regular schedule (see below) using approved parameters. DITs are never run on membrane units that have less than the approved number of membrane modules in operation. (B.1.b.)Bin 1 Membrane Plant – DIT conducted at least once every seven days on each unitOrBin 2, 3, or 4 Membrane Plant – DIT conducted daily on each unit |
| 🞏 | Manually trigger a DIT on each membrane unit (train, rack skid, etc.), manually record the DIT Start Pressure, Stop Pressure, and Test Duration directly from the membrane control system, and manually calculate the other data fields below. Note: If your membrane plant does not use a pressure-based DIT (for example, uses an air flow rate based DIT), please contact the TCEQ’s Technical Review and Oversight Team at 512-239-4691 and request an alternate DIT table for this checklist. (Make additional copies of this page if you have more than 7 membrane units.) |
|  | Membrane Unit | Start Pressure (psi) | Minimum Pressure (psi) | Pressure Drop (psi) | Test Duration (sec) | Test Duration (min) | Pressure Decay Rate (psi per min) |
|  | 1 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  | Where:Pressure Drop = Start Pressure – Minimum Pressure. Example: DIT Start Pressure = 15.3 psi, DIT Min. Pressure = 14.9 psi, Pressure Drop = 15.3 – 14.9 = 0.4 psiThe Test Duration must be in units of minutes. If the test duration is measured in seconds, divide by 60 to convert the duration to minutes. Example: Test Duration = 343 seconds. 343 sec divided by 60 = 5.72 minutes.Pressure Decay Rate = Pressure Drop (psi) / Test Duration (min). Example: Pressure Drop = 0.4 psi, Test Duration = 5.72 min, Pressure Decay Rate = 0.4 psi divided by 5.72 min = 0.070 psi per min. Note: Do not calculate the Pressure Decay Rate in psi per second. |
| 🞏 | Is the approved number of membrane modules in service in each membrane unit? (B.1.b.) |
| 🞏 | The membrane mode of operation (deposition or crossflow) matches the TCEQ’s membrane approval letters. (B.1.b.)  |
| 🞏 | Are all of the Stop Pressures greater than or equal to Ptest, the minimum test pressure to detect a 3.0 micron defect from the TCEQ’s DIT Values Letter? (B.1.b.) |
| 🞏 | Are all of the manually calculated Pressure Decay Rates in psi/min less than or equal to the Upper Control Limit (UCL) in psi/min from the TCEQ’s DIT Values Letter? (B.1.b.) |
| 🞏N/A | In the plant’s SWMOR-Alt form, at the top of pages 4 and 5 (in the Excel spreadsheet, go to the tab labeled “P. 4&5-Disinfection Data”), if the value listed under Virus in the block titled Performance Standards, Log Inactivations is less than 4.0, is a coagulant injected ahead of the membrane units at all times? (If this value is 4.0, circle N/A and move to the next checklist item.) If the value is 2.0, the plant must have coagulation, flocculation, and clarification basins before the membrane filters. (B.1.c.)  |
| 🞏 | Do the actual durations and frequencies of membrane filtration cycles, backwashes, chemical maintenance cleans, etc. match the assumed values in the TCEQ’s membrane approval letters? (B.1.d.)Any additional downtime between filtration cycles, for example, time spent resetting valves or refilling the membranes, must be included with your backwash times, maintenance clean times, etc. You must define the entire time when the filters are not in a filtration cycle. |
| 🞏 | Feed water, filtrate, backwash supply, and backwash drain lines are protected from chemical cleaning piping with double block and bleed valve arrangements or other approved cross-connection controls. See Appendix A in the companion document, Common Issues in Low-pressure Membrane Treatment Plants, for schematics of typical cross-connection controls around low-pressure membrane units. (B.1.e.) |
| 🞏 | After a Clean-in-Place (CIP) procedure, the membrane unit passes a DIT before returning to production. Operators understand how to distinguish CIPs from other maintenance cleans. (B.1.f.) |
| 🞏 | There are no recurring, uncontrolled turbidity spikes during membrane filtration cycles. These spikes commonly occur when the membrane unit first starts a filtration cycle after a DIT, maintenance clean, or CIP. (B.1.g.) |
| 🞏 | The plant has been evaluated for all potential cross-connections between filtered/finished water and unfiltered water, including chlorine injection systems. (B.2.a.) |
| 🞏 | Chemical disinfectant injection points match the plant’s approved CT Study. (B.2.b.) |
| 🞏 | Water flows into and through the plant exactly as laid out in the CT Study. All sources of water in the plant are accurately described in the CT Study. (B.2.c.) |
| 🞏 | Chemical doses are regularly calculated for all chemicals. (B.2.d.) |

|  |  |
| --- | --- |
|  | **Monitoring** (A.3.) |
|  | See the discussion under Section C.1. in the companion document, Common Issues with Low-pressure Membrane Plants. It includes a link to a template that takes raw 5-minute data from a membrane unit and calculates the values that should be reported in the SWMOR-Alt that day. It can be used to check that the plant’s control systems are generating the correct data in daily membrane reports. |
| 🞏 | Compare the Pressure Decay Rates that were manually calculated during the DITs earlier in the checklist to the values that were recorded in the membrane control system or SCADA system. Do the manually calculated values match the recorded values for each membrane unit? (C.1.a.) |
|  | Find a recorded value of Normalized Filter Flux in the membrane control system or SCADA system for one of the membrane units, note the time that the calculation occurred, and collect the following monitored data from the same time:* Water temperature in °C
	+ If water temperatures are recorded in °F, here is the formula to convert the temperature to °C:

$$T\_{C}= \frac{5}{9} x (T\_{F}-32)$$Where:TC = temperature in °CTF = temperature in °F* Instantaneous flow rate through the membrane unit in gallons per day (gpd)
	+ If the instantaneous flow rates are recorded in gallons per minute (gpm), here is the formula to convert the flow rate to gpd:

$$Q\_{gpd}= 1440 x Q\_{gpm}$$Where:Qgpd = flow rate in gpdQgpm = flow rate in gpmYou will also need the surface area of each individual membrane module (Amod) in the membrane unit in square feet (sq ft) and the number of modules in each membrane unit (Nmod) from the list of data collected at the beginning of the checklist.With this data you will manually calculate the Normalized Filter Flux for that instant in time:$$J\_{20}=\frac{Q\_{gpd} x TCF}{A\_{mod} x N\_{mod}}$$Where:J20 = Normalized Filter Flux in gallons per square foot per day (gfd)TCF = temperature correction factor$$TCF= 1.784-\left(0.0575 x T\_{C}\right)+\left(0.0011 x T\_{C}^{2}\right)-(10^{-5} x T\_{C}^{3})$$ |
| 🞏 | Does your manually calculated Normalized Filter Flux, J20, equal the recorded value? (C.1.b.) |
|  | Manually calculate a transmembrane pressure (TMP) value using the procedure outlined in Section C.1.c. in the companion document. |
| 🞏 | The manually calculated TMP value is effectively the same as the TMP value recorded in the control system at the same instant. (C.1.c.) |
| 🞏 | Continuous, online turbidimeters are installed on the effluent of each individual membrane unit (train, rack, skid, etc.) that is used for pathogen removal credit. (C.2.) |
| 🞏 | Individual filter effluent turbidity measurements are recorded at least once every 5 minutes by the membrane control system or the plant SCADA system for each membrane unit. (C.2.) |
| 🞏 | The online turbidimeters installed to sample each membrane unit’s individual filter effluent are one of these TCEQ-approved models (C.2.):* Hach Filter Trak (FT) 660
* Lovibond PTV 2000
* Lovibond PTV 6000
* Hach TU5400sc
 |
| 🞏 | The combined filter effluent turbidity is monitored at least once a day for systems that serve a population of less than 500, or once each standard 4-hour period during the day that the plant is in operation for systems that serve a population of 500 or more. (C.3.) |
| 🞏 | The combined filter effluent turbidity sample point for the low-pressure membrane filters is located where only low-pressure membrane filtrate is sampled. No other types of filtered water have been mixed with the sample and no other removal processes (like reverse osmosis) have impacted the sample. (C.3.) |
| 🞏 | Disinfectant residual sample sites match the plant’s approved CT Study. (C.4.) |
| 🞏 | Volumetric meters are installed on both the raw water entering the plant and water pumped to distribution. Instantaneous flow rates are measured within each disinfection zone described in the CT Study. (C.5.) |
| 🞏 | Metering devices are installed that allow measurement or calculation of instantaneous flow rates and total daily volumes of water filtered through each membrane unit. (C.5.) |
| 🞏N/A | Assumptions of equal flow splits to parallel treatment units can be demonstrated as valid. (If there are no assumed equal flow splits between parallel units, in other words, all flow splits are equipped with individual flaw rate measuring devices, circle N/A and move to the next checklist item.) (C.6.) |
| 🞏 | All monitoring and testing equipment is calibrated and verified by approved methods and on the schedule required by the TCEQ. (C.7.) |
| 🞏🞏 | Disinfectant residuals entering distribution system (C.8.)Sample site located after the end of the last disinfection zone.Number and schedule of daily samples appropriate for population served. (Online disinfectant residual analyzer and recorder installed if population > 3,300.) |
| 🞏 | The raw water sample location is before any treatment, including chemical treatment, and represents a blend of all water sources. (C.9.) |
| 🞏 | Disinfection performance data (disinfectant residual, flow rate, temperature, and pH) at the end of each disinfection zone are collected when the plant is operating at its peak flow rate each day. (C.10.) |
|  | You will now check that the online turbidimeters, the membrane control system, and the plant’s SCADA system are spanned to read and record all applicable trigger and compliance turbidity levels accurately. (C.11., C.12.)In order to verify this, you must look at both the online turbidimeters and the control systems where turbidity measurements are recorded. There are often two control systems in a membrane plant: the membrane manufacturer’s control system that controls the operation of the membrane filters and a separate plant SCADA system that controls operations for the remainder of the plant and records and reports data for the whole plant.* IFE and CFE turbidimeters

Each online turbidimeter is typically set up to send an analog 4 – 20 mA signal to the control systems which corresponds to the span of turbidities that the turbidimeter is programmed to transmit. (This is different from the range of turbidities that the turbidimeter can measure. For example, the turbidimeter may be capable of measuring turbidity from 0 – 100 NTU but the turbidimeter is programmed onsite to only transmit turbidity readings in a span between 0.000 – 1.000 NTU.) Occasionally, online turbidimeters are set up with digital signal outputs. In either case, check the turbidimeter controller and make note of the lowest and highest turbidity values that the turbidimeter can transmit. For example, a particular turbidimeter may be programmed so that 4 mA signal corresponds to 0 mNTU (0.000 NTU) and a 20 mA signal corresponds to 1,000 mNTU (1.000 NTU). Note that each online turbidimeter can be set up differently, so verify each one. You may need the user’s manual for the online turbidimeters to figure out how to check these settings.* Membrane control system and plant’s separate SCADA system

After you have verified the spans in each online turbidimeter, you need to check the plant control systems/data loggers to make sure that they have the same span. The easiest way to check the spans that have been programmed into the membrane control system and the plant’s SCADA system is to send test signals from the online turbidimeters to the control systems. You may need the user’s manual for the online turbidimeters to figure out how to send test signals. Send test signals from every online turbidimeter because the membrane control system and plant SCADA system could be programmed to interpret signals differently for each turbidimeter. Make notes in the plant’s daily log of the times you send test signals from each turbidimeter because the test signal values should not be recorded in the plant’s SWMOR. **Caution:** You may trigger alarms and shutdowns of membrane units during these tests. Only send a test signal from one online turbidimeter at a time to avoid shutting down the entire plant. 1. Send a test signal from the online turbidimeter corresponding to the lowest value in the programmed span. [This should be 0 mNTU (0.000 NTU), but sometimes SCADA contractors program in a signal offset to compensate for signal losses.] If the turbidimeter controller is transmitting 4 – 20 mA signals, send a 4 mA test signal. Note the values that are recorded in both the membrane control system and plant SCADA system. Do the low values in the online turbidimeter controller’s span match what is being recorded in the control systems?
2. Send a test signal from the online turbidimeter corresponding to highest value in the programmed span. If the turbidimeter controller is transmitting 4 – 20 mA signals, send a 20 mA test signal. Note the values that are recorded in both the membrane control system and plant SCADA system. Does the high value in the online turbidimeter controller’s span match what is being recorded in the control systems?
3. If the programmed span in the online turbidimeter does not match the recorded readings in the membrane control system or the plant SCADA system, check to see if this is simply a signal scaling issue or if other control system problems could be affecting the results.
	1. Reduce the test signal from the online turbidimeter to the mid-range of the span. For 4 – 20 mA signals, send a 12 mA test signal from the online turbidimeter. Make a note of the turbidity value to which this test signal should correspond. For example, if the online turbidimeter is spanned to transmit turbidities from 0 mNTU (0.000 NTU) to 1,000 mNTU (1.000 NTU), the middle of this span is 500 mNTU (0.500 NTU).
	2. Did the recorded turbidity in the membrane control system or the plant SCADA system drop by 50% compared to the value recorded when the test signal was at the top of the online turbidimeter’s span?
		1. If yes, then this is only a signal scaling issue. The membrane control system or the plant SCADA system was not programmed to interpret and scale the signals from the online turbidimeter correctly and this signal scaling issue must be corrected. In many cases these are not settings that an operator can change.
		2. If no, in addition to signal scaling issues, there may be some issues like signal loss between the transmitter and receiver or inappropriate signal processing within the control system. More thorough diagnostics may be necessary to troubleshoot and correct these issues.
 |
| 🞏 | All of the online turbidimeters are spanned to measure and transmit turbidities from 0 mNTU (0.000 NTU) to above the applicable trigger and compliance turbidity levels. (C.11.)For membrane filters:* IFE turbidimeters must be spanned to measure and transmit turbidities from 0 mNTU (0.000 NTU) to at least 165 mNTU (0.165 NTU). Membrane filter shutdowns are triggered when there are confirmed IFE turbidities above 154 mNTU.
* CFE turbidimeters must be spanned to measure and transmit turbidities from 0.00 NTU to 1.10 NTU (0 - 1,100 mNTU). The maximum allowable CFE turbidity is 1.04 NTU (1,040 mNTU).

**WARNING:** If the spans of any online turbidimeters must be corrected, the programmed spans and signal scaling factors in the membrane control system and the plant SCADA system must also be adjusted. Do not proceed with any additional Monitoring checklist items until those corrections have been made and you have verified that the spans of the online turbidimeters match the membrane control system and the plant SCADA system. |
| 🞏 | There are no signal scaling issues between any online turbidimeter, the membrane control system, and the plant SCADA system. (C.12.)**WARNING:** If there are signal scaling issues, you must correct them before you proceed with any additional Monitoring checklist items. |
| 🞏 | The instantaneous readings on the displays of other online instruments besides turbidimeters - disinfectant residual analyzers, pressure transducers, flow meters, temperature probes, etc. - match the values that are being recorded in the membrane control system and/or plant SCADA system. If the online instrument does not have a display, a manual measurement of the parameter matches what is being recorded in the control system. (C.13.) |
|  | Automatic alarms and shutdowns for low pressure membrane plants (C.14.)DIT control settingsFind a nut, plug, pressure relief valve, or some similar location on the pressure side of a membrane unit where air pressure can be released during a DIT so that a DIT can be caused to purposely fail. Do not use a motor-operated vent valve on the membrane unit because the membrane control system may recognize that as an aborted DIT. Manually trigger a DIT on the membrane unit, wait until the membrane unit enters the pressure decay or air flow rate portion of the test (in other words, after pressurization and stabilization have finished), then manually release the pressure. Observe how the control systems respond to an apparent failed DIT. (Make a note in the plant’s daily log that this DIT was a test because the results of the DIT should not be reported in the SWMOR.) |
| 🞏 | Does the membrane control system register that this is a failed DIT and disable the membrane unit so it cannot produce more water? |
| 🞏 | Does the membrane control system trigger the shutdown based on the pressure decay rate or airflow rate exceeding the TCEQ-approved UCL? |
| 🞏 | Does the membrane control system trigger the shutdown based on the TCEQ-approved Ptest, the minimum DIT test pressure to detect a 3 micron defect? |
| 🞏 | Does the membrane control system trigger an alarm for the failed DIT? |
|  | IFE turbidity control settingsWhile a membrane unit is filtration mode, send a test signal from its online IFE turbidimeter to the control systems that appears to be above 154 mNTU. For example, assuming your IFE turbidimeters are spanned correctly (which you checked earlier and fixed, if necessary), sending a 20 mA test signal from the turbidimeter controller to the membrane control system will appear to be an IFE turbidity above 154 mNTU. Observe how the control systems respond to the apparent high turbidity event. Measure how long it takes the control systems to respond to the apparent high IFE turbidity event. (Make a note in the plant’s daily log of the start and end time of this test because the recorded turbidities during the test should not be reported on the SWMOR.) We recommend that you repeat this procedure on each membrane unit to verify that they are all programmed the same. |
| 🞏 | Does the membrane control system automatically shut the membrane unit down based on two consecutive IFE turbidity readings above 154 mNTU in the plant’s 5-minute turbidity record? |
| N/A | (Circle N/A if the following checklist item does not apply.) If a turbidity shutdown occurred but it was not based on two consecutive IFE turbidity readings in the plant’s 5-minute turbidity record, verify the following item: |
|  | 🞏 | Is the turbidity shutdown based on an instantaneous IFE turbidity reading above 154 mNTU? If there is any time delay between the first instantaneous reading above 154 mNTU and the shutdown, there is an issue that needs to be resolved. |
| 🞏 | Does the membrane control system immediately trigger a DIT on the membrane unit? If the membrane control system does not automatically trigger a DIT after the turbidity shutdown, does it disable the membrane unit until an operator manually triggers a DIT and the membrane unit passes the DIT? |
| 🞏 | Does the membrane control system trigger an alarm for the high IFE turbidity event? |
|  | CFE turbidity control settingsIf your plant has an online CFE turbidimeter, while at least one membrane unit is producing filtered water, send a test signal from the online CFE turbidimeter to the control systems that appears to be between 0.9 NTU and 1.0 NTU. For example, if your CFE turbidimeter is programmed to transmit a 4 – 20 mA signal corresponding to a span of 0.0 – 1.1 NTU, sending a 17.8 mA test signal from the turbidimeter controller to the membrane control system will appear to be a CFE turbidity of about 0.95 NTU. Observe how the control systems respond to the apparent high CFE turbidity event. Measure how long it takes the control systems to respond to the apparent high turbidity event. (Make a note in the plant’s daily log of the start and end time of this test because the recorded turbidities during the test should not be reported on the SWMOR.) |
| 🞏 | Does the membrane control system automatically shut the membrane filters down at a CFE turbidity level below 1.0 NTU? Keep in mind that a single reading above 1.0 NTU is a treatment technique violation. Setting a CFE turbidity shutdown at 1.0 NTU would be counter-productive. |
| 🞏 | Does the membrane control system trigger an alarm for the high CFE turbidity event? |
| 🞏 | An operator is onsite at the plant whenever it is treating water or the plant is equipped with an online CFE turbidimeter, online disinfectant residual analyzer, and automatic alarms and shutdowns that will prevent the plant from producing inadequately treated water when the operator is not onsite. (C.15., C.16.) |
| 🞏 | Free chlorine residuals are not measured with DPD reagent in the presence of other potential disinfectants, oxidants, and metals, particularly when reporting free chlorine residuals for pathogen disinfection/inactivation credit. (C.17.) |

|  |  |
| --- | --- |
|  | **Reporting (SWMOR-Alt)** (A.4.) |
| 🞏 | The membrane plant is using the latest version of SWMOR-Alt, Form TCEQ-00102D to report plant data. (D.1.) |
| 🞏 | The plant has written approval to use all of the treatment technologies being claimed on the SWMOR-Alt Form. (D.2.) |
| 🞏 | Daily raw water pumpage and treated water pumpage are collected from different meters in the plant. (C.5., D.3.) |
| 🞏 | The flow rates reported in the disinfection process data on pages 4 and 5 of the SWMOR-Alt are not the same numerical values reported in either the raw water pumpage or treated water pumpage columns on page 2 of the SWMOR-Alt. (C.5., D.4.) |
| 🞏 | Membrane filters – all individual rack/skid effluent turbidity readings are reported in units of mNTUs. (D.5.) |
| 🞏 | The LT2 Summary worksheet is completed and included with the SWMOR-Alt submittal to the TCEQ. (D.6.) |
| 🞏 | Measurements from different sets of disinfection process data are not mixed, and the set of data that generates the lowest inactivation ratio is reported daily. (D.7.) |
| 🞏 | Individual membrane unit turbidity readings above a trigger or compliance level are only reported if they are confirmed. (D.8.) |
| 🞏 | Maximum daily individual filter turbidities reported on the membrane page of the SWMOR-Alt are determined from a 5-minute record of each membrane unit’s data. (D.8.) |
| 🞏 | No turbidity spikes are excluded from the reported data. This includes recurring, uncontrolled turbidity spikes that occur when a membrane filtration cycle starts and that operators attribute to air bubbles. (D.8.) |
| 🞏 | Combined filter effluent turbidity readings collected when no filters were in operation are not reported in the SWMOR. (D.9) |
| 🞏 | CIPs are reported correctly on the SWMOR. (D.10.)  |
| 🞏 | The average of all daily normalized filter flux values is reported in the SWMOR. (D.11.) |
| 🞏 | The average of all daily transmembrane pressure values is reported in the SWMOR. (D.12.) |
| 🞏 | If multiple DITs are conducted on a single membrane unit during a day, the lowest test pressure and the highest pressure decay rate from any test are reported. These data can come from different DITs. (D.13.) |
| 🞏 | The plant’s SWMOR form is customized with the correct parameters from the TCEQ-approved, site-specific DIT, CT Study, and LT2 Bin Classification letters. (D.14.) |
|  | **Record Keeping** (A.5.) |
| 🞏 | Records are kept of all instrument calibrations, checks, and verifications. (E.1.) |
| 🞏 | Hand-written and electronic records are kept for the required number of years. (E.2.) |
| 🞏 | A record is kept of all plant on and off cycles, as well as individual treatment unit down time for maintenance. (E.3.) |
| 🞏 | A record of all DITs is kept, including DITs that were attempted but did not complete. (E.4.) |
|  | **Auto Cycling Plants That Run without an Operator Present** |
| 🞏 | An online turbidimeter is installed to monitor combined filter effluent. (C.3.) |
| 🞏 | Disinfectant residual, flow rate, temperature, and pH are monitored online at the end of each disinfection zone. (C.10.) |
| 🞏 | Alarms and automatic plant shut downs are installed and set to prevent the plant from producing noncompliant water. (C.15, C.16.) |
| 🞏 | An online CFE turbidimeter and disinfectant residual analyzer are installed and used to report levels when the plant is unmanned and to trigger alarms and shut downs. (C.16.) |

If you have any questions about this checklist or need additional assistance after completing the checklist, please contact one of the following people on the TCEQ’s Technical Review and Oversight Team by email:

David Williams, P.E. at david.a.williams@tceq.texas.gov

Marlo Berg, P.E. at marlo.berg@tceq.texas.gov

Sylvana (Sam) Turner at sylvana.turner@tceq.texas.gov

* Please include the name of the public water system and public water system ID (7-digit code) in your email so that these team members can retrieve and review your membrane approval letters before responding to you.