

5. Additional Guidance for Plants with Alternative Treatment Technologies

This chapter describes how to enter and report compliance data using this workbook when customized for alternative treatment technologies, and how to complete the required worksheets for the following technologies:

- Pre-sedimentation with coagulation
- Two-stage lime softening
- Bank filtration
- Enhanced filter performance
- Bag or cartridge filtration
- Membrane filtration
- Second stage filtration
- Inactivation (using chlorine dioxide or ozone, or UV light)

Alternative Technology Worksheets

Your workbook will automatically determine which alternative technology worksheets you are required to submit each month, based on how you customize it. The required worksheets are indicated by visible tabs at the bottom of the workbook screen. The individual worksheets are explained in this chapter beginning with Section 5.4.

Note: We have not developed worksheets for alternative technologies such as watershed control programs and site-specific demonstration of performance. If you have approved credit for one of these programs, you should have an exception approval letter from us explaining what data to report with your MOR. If you need a copy of an approval letter, contact a SWTR Coordinator.

5.1 Customizing Your Workbook

To begin customizing your SWMOR workbook, refer to Chapter 1 for instructions on accessing and opening a blank copy of an MOR workbook. Save a blank copy of the workbook on your desktop. After you open the workbook, select [Enable Content], if applicable and follow the guidance in this section. After customizing the workbook once, and saving the customized workbook as a master file, you will not need to customize it again unless there are changes to your plant.

Note: Do not use the workbook while a macro is running. Be patient because macros take time to run.

System Information Dialog Box

Refer to Chapter 2.2.

Plant Parameters Dialog Box

Refer to Chapter 2.3.

Disinfection Process Parameters Dialog Box

Refer to Chapter 2.4.

Alternative Technologies and LT2 ESWTR Dialog Box

The **Alternative Technologies and LT2 ESWTR** dialog box apply to plants that use alternative treatment technologies. Most of the alternative treatment technology information you need to enter in this dialog box can be found in your approval letter(s). If you cannot locate your approval letter(s), contact a SWTR Coordinator.

The **Alternative Technologies and LT2 ESWTR** dialog box, as shown in Figure 5.1 consists of a **Non-conventional treatments/programs** section and a **LT2 Compliance** section.

Alternative Technologies and LT2 ESWTR

Non-conventional treatments/programs?

YES, I have non-conventional treatment technologies and/or programs, such as membranes, prefiltration, bag/cartridge filters, UV inactivation, Watershed Control Program, or Demonstration of Performance.

LT2 Compliance

Specify the bin class of the plant

BIN 1 or N/A BIN 2 BIN 3 BIN 4

Specify the starting date for LT2 compliance

Choose system size range

at least 100,000 50,000 - 99,999

10,000 - 49,999 less than 10,000

Enter LT2 Effective Date as MM/DD/YYYY

OK Cancel

Figure 5.1. Alternative Technologies and LT2 ESWTR Dialog Box

Non-conventional Treatments or Programs?

Select [YES] if you have received TCEQ approval for at least one of the following treatment systems or programs:

- Source water protection
- Presedimentation with coagulation
- Two-stage lime softening
- Bank filtration
- Enhanced filter performance
- Demonstration of performance
- Bag or cartridge filtration
- Membrane filtration
- Second stage filtration
- Inactivation using chlorine dioxide or ozone, or UV light

LT2 Compliance

Select the [bin class] of your plant. Refer to the Bin Classification letter from TCEQ to determine which bin classification your source was assigned. If you select Bin 2, Bin 3, or Bin 4, you must also select the [system size range], which includes both residential and wholesale connections, and enter the {LT2 effective date}. If you select Bin 1 or N/A, the size range and LT2 effective date portion of the dialog box will be greyed out because it does not apply to your system.

Treatment Technologies Dialog Box

Based on your responses in the **Alternative Technologies and LT2 ESWTR** dialog box, the workbook determines whether you need to complete the **Treatment Technologies** dialog box. As shown in Figure 5.2, the **Treatment Technologies** dialog box includes categories specific to the types of alternative treatment used at your facility. The additional information will allow the workbook to calculate the treatment credits achieved by your plant for *Cryptosporidium* removal or inactivation.

Note: You must have TCEQ approval before you can claim *Cryptosporidium* removal or inactivation credit for any of the technologies listed in the **Treatment Technologies** dialog box.

Figure 5.2. Treatment Technologies Dialog Box

Source Protection and Management

Select [Watershed Control Program] if TCEQ has approved a watershed control program for your treatment plant that includes removal or inactivation credit.

Pre-Filtration

Presedimentation Basin with Coagulation

Select [Presedimentation Basin with Coagulation] if all the following apply:

- You have a TCEQ approval letter stating that your plant may receive presedimentation Cryptosporidium treatment credit.
- You have a presedimentation basin located upstream of your primary rapid mix and sedimentation basins or clarifiers.
- All the water that you treat normally passes through the presedimentation basin before primary treatment begins.
- You normally apply a coagulant continuously to the water as it enters the presedimentation basin.

Two-stage Lime Softening

Select [Two-stage Lime Softening] only if you have approval to claim addition removal credit for two-stage lime softening.

Bank Filtration

Select [Bank Filtration] if you have approval for riverbank filtration. In the **Well** box, enter the {number} of bank filters (or wells) that supply your plant. The SWMOR workbook can accommodate as many as 20 bank filters so you may only enter values from 1 to 20. If you have more than 20 wells, you will need to contact us for another version of a workbook.

Treatment Performance

You can receive additional pathogen removal credit by ensuring that your plant operates efficiently by producing water with extremely low turbidity from each individual filter; or by demonstrating excellent plant performance overall. You must have documented test results that demonstrate these requirements.

Enhanced Filter (IFE) Performance

Select [Enhanced Filter (IFE) Performance] if you receive pathogen removal credit for IFE performance data; that is, producing filtered water with 95% of IFE turbidity levels below 0.15 NTU, and never exceeding 0.3 NTU.

This additional credit is only available if you use conventional, granular media filters. To receive any credit for granular filters, you must continuously monitor turbidity from each filter.

Demonstration of Performance

Demonstration of performance applies to any innovative or nonstandard treatment that is not described by the specific processes described in this guidance. Select [Demonstration of Performance] and enter the {approved credit} given to you by TCEQ in the **Log Credit** box.

Additional Filtration

Bag or Cartridge Filters

Select [Bag or Cartridge Filters], if applicable, and enter the {number of assemblies} and the {maximum approved credit} you received. There is a maximum of 15 assemblies allowed.

Select either [primary] or [secondary] treatment. Primary applies if the bag or cartridge is your only filtration technology. Secondary may apply if you are also claiming pathogen removal credit using conventional filters or membranes.

If we have approved an alternative method for continuously monitoring the performance of the individual cartridge assemblies other than turbidity, select [Alternative Monitoring Approved].

Note: If you have granular filters with continuous IFE monitoring, and you are claiming log removal for granular filtration, you can add bag and cartridge filters downstream as secondary treatment. To receive credit for bag and cartridge filters as secondary treatment, you must monitor turbidity at least once per day.

Membrane Filtration

Click [Membrane Filtration], if applicable. If you select this option, you must select which DIT method indicated below is used to verify the ongoing performance of the membrane units:

- [PBT] if you use a pressure based DIT method, meaning you measure the rate that the pressure drops in the membrane unit during a DIT.
- [QBT] if you use a volumetric, or airflow, based DIT method, meaning you measure the volume of air added to the membrane unit during a DIT.
- [MBT] if you use a marker based DIT method, meaning you feed a known amount of a pathogen sized marker (or particles) during the DIT and then measure the amount of marker removed by the membrane unit.

If you specify that you use a specific DIT method, you must also indicate how many membrane units use that method. The workbook can accommodate as many as 20 units for each type, so you may only enter values between 1 and 20.

You must also indicate what kind of IIT method you use to continuously monitor membrane performance. Select [Turbidity] if you use a laser turbidimeter (or one of the other approved turbidimeters) to continuously monitor the performance of each unit. Select [Others] if you use a particle counter, particle monitor, or some other parameter to monitor performance.

If you select Membrane Filtration, you must specify the DIT parameters for each membrane unit. Depending on your selection, additional dialog boxes will appear so you can enter the approved DIT parameter for each membrane unit. They will open after you complete this dialog box and select [OK]. These additional dialog boxes are explained later in this chapter.

Second Stage Filtration

Select [Second Stage Filtration] if you have approval to claim additional credit for second stage filtration and meet all the following criteria:

- Your plant has two or more conventional granular media filters that operate in a series.
- Coagulant is applied upstream of the first stage filters.
- IFE turbidity levels are continuously monitored upstream of the second stage filters.

Inactivation

Select [chlorine dioxide or ozone] or [UV] if your plant has approval to claim *Cryptosporidium* inactivation credit for chlorine dioxide or ozone; or ultraviolet inactivation processes. If you select chlorine dioxide or ozone, enter the {amount of credit} we approved in the **Log Credit** box.

If you select UV, additional dialog boxes will appear for you to record information about your UV facilities and the inactivation credit they receive. These additional dialog boxes are explained later in this chapter. They will open after you complete this dialog box and select [OK].

Note: Do not select chlorine dioxide or ozone unless you are using them as disinfectants for *Cryptosporidium* inactivation and have a letter from us stating this. The SWMOR workbook will automatically give you disinfection credit for *Giardia* and viruses, so additional reporting is not required.

DIT Parameters Dialog Boxes

If you selected Membrane Filtration in the **Treatment Technologies** dialog box, you must enter the DIT parameters specified in your DIT approval letter for each type of membrane unit. One of three dialog boxes will appear corresponding to which DIT treatment technology you selected. For example, if you selected PBT, the **PBT DIT Parameters** dialog box shown in Figure 5.3 will appear. If you selected QBT or MBT, those corresponding dialog boxes will appear.

	Pmin (psi)	LRC	UCL (psi/min)
Unit 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 3	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 18	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 19	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 20	<input type="text"/>	<input type="text"/>	<input type="text"/>

OK Cancel

Figure 5.3. PBT DIT Parameters Dialog Box

PBT DIT Parameters

Pmin (psi)

Enter the {minimum test pressure in pounds per square inch (psi)} for each membrane unit given to you by TCEQ. To pass a DIT, the air pressure you apply at the beginning of the test must be higher than the P_{min} shown in your approval letter. *Note:* P_{min} is

referred to as P_{rest} in *EPA Membrane Filtration Guidance Manual* (EPA 815-R-06-009, November 2005).

LRC

Enter the {log removal credit} for each membrane unit. The approved log removal credit is the maximum log removal credit you can claim based on your approved DIT test conditions. *Note:* The log removal credit is referred to as LRV_{DIT} (the log removal value for a DIT) in *EPA Membrane Filtration Guidance Manual*.

UCL (PSI/min)

Enter the {UCL (in psi/min)} for each membrane unit. To pass a DIT, the pressure decay rate measured during the DIT test cannot exceed the approved UCL shown in your approval letter.

The UCL is the maximum pressure decay rate that guarantees the integrity of a membrane system during a DIT. That is, if the pressure decay rate obtained during a DIT is greater than the UCL, the membrane system has at least one breach greater than $3\ \mu\text{m}$ and fails the DIT.

QBT DIT Parameters

The **QBT DIT Parameters** dialog box is shown in Figure 5.4.

	Pmin (psi)	LRC	UCL (L/min)
Unit 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 3	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 18	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 19	<input type="text"/>	<input type="text"/>	<input type="text"/>
Unit 20	<input type="text"/>	<input type="text"/>	<input type="text"/>

OK Cancel

Figure 5.4. QBT DIT Parameters Dialog Box

P_{min} (psi)

Enter the {minimum test pressure (in psi)} for each membrane unit. To pass a DIT, the air pressure you apply at the beginning of the test must be higher than the P_{min} shown in your approval letter. *Note:* P_{min} is referred to as P_{test} in *EPA Membrane Filtration Guidance Manual*.

LRC

Enter the {log removal credit} for each membrane unit. The approved log removal credit is the maximum log removal credit you can claim based on your approved DIT test conditions. *Note:* The log removal credit is referred to as LRV_{DIT} (the log removal value for a DIT) in *EPA Membrane Filtration Guidance Manual*.

UCL (L/min)

Enter the {UCL (in L/min)} for each membrane unit. To pass a DIT, the pressure decay rate measured during the DIT test cannot exceed the approved UCL shown in your approval letter.

The UCL is the maximum pressure decay rate that guarantees the integrity of a membrane system during a DIT. That is, if the pressure decay rate obtained during a DIT is greater than the UCL, the membrane system has at least one breach greater than 3 μm .

MBT DIT Parameters

The **MBT DIT Parameters** dialog box is shown in Figure 5.5.

	Cfeed,max concentration	LRC
Unit 1	<input type="text"/>	<input type="text"/>
Unit 2	<input type="text"/>	<input type="text"/>
Unit 3	<input type="text"/>	<input type="text"/>
Unit 18	<input type="text"/>	<input type="text"/>
Unit 19	<input type="text"/>	<input type="text"/>
Unit 20	<input type="text"/>	<input type="text"/>

OK Cancel

Figure 5.5. MBT DIT Parameters Dialog Box

Cfeed, Max Concentration

Enter the {Cfeed, max concentration (in mg/L)} for each unit. The maximum marker concentration in the feed water that you apply during the test must be lower than the $C_{\text{feed, max}}$ shown in your approval letter. *Note:* $C_{\text{feed, max}}$ is referred to as $C_{\text{test, max}}$ in *EPAs Membrane Filtration Guidance Manual*.

LRC

Enter the {log removal credit} for each membrane unit. The approved log removal credit is the maximum log removal credit you can claim based on your approved DIT

test conditions. *Note:* The log removal credit is referred to as LRV_{DIT} (the log removal value for a DIT) in *EPAs Membrane Filtration Guidance Manual*.

UV Validation Method Dialog Box

If you clicked UV in the **Treatment Technologies** dialog box, you must complete the **UV Validation Method** dialog box shown in Figure 5.6. The dialog box consists of a **Location of UV Reactors** section and a **UV Reactor Validation Method** section.

Figure 5.6. UV Validation Method Dialog Box

Location of UV Reactors

Select [Upstream of the clearwell] or [Downstream of the clearwell] depending on where the UV reactors are located.

UV Reactor Validation Method

To receive treatment credit, UV reactors must undergo validation testing. Validation testing can involve either an ISA or a CDA.

Enter the approved {Minimum Required Crypto Log Inactivation} for your plant and then select the type and number of reactors as follows:

- [UV intensity Setpoint Approach] and enter the {number of ISA reactors}, if your plant uses any reactors that were validated using the ISA.
- [UV Calculated Dose Approach] and enter the {number of CDA reactors} and the {Number of UVT analyzers} if your plant uses any reactors that were validated using the CDA.

If your plant uses both types of reactors, enter the required information for each type.

UV Intensity Setpoint Approach Dialog Box

The ISA reactor relies on one or more UV intensity setpoints established during validation testing to ensure the reactor provides the required level of inactivation. The UV intensity, as measured by the UV sensors during operation, must meet or exceed the approved setpoint(s). This criterion ensures delivery of the required dose. Additionally, the reactors must operate within validated operational conditions for flow rates and lamp status. In this approach, UVT does not need to be monitored separately because the sensors account for this parameter.

As shown in Figure 5.7, the **UV Intensity Setpoint Approach** dialog box is used to enter information about validation parameters specific to your plant. The number of spaces depends on the number of reactors you specified in the **UV Validation Method** dialog box. Select the units for Maximum Validated Flow Rate at the bottom of the dialog box, then enter the {Maximum Validated Flow Rate}; the {Intensity Setpoint}; and the {Number of Duty Sensors} for each reactor. *Note:* Duty sensors are online UV sensors that continuously monitor UV intensity during operation.

UV Reactor Validation Method - Intensity Setpoint Approach						
Reactor 1	Maximum Validated Flow Rate (MGD)	5	Intensity Setpoint	5	Number of Duty Sensors	10
Reactor 2	Maximum Validated Flow Rate (MGD)	5	Intensity Setpoint	5	Number of Duty Sensors	10
Reactor 3	Maximum Validated Flow Rate (MGD)	5	Intensity Setpoint	5	Number of Duty Sensors	10
Reactor 4	Maximum Validated Flow Rate (MGD)	5	Intensity Setpoint	5	Number of Duty Sensors	10

Figure 5.7. UV Intensity Setpoint Approach Dialog Box

UV Calculated Dose Approach Dialog Box

The CDA uses a dose monitoring equation to calculate an estimated UV dose. The applied UV dose is based on operating conditions such as UV intensity, flow rate, and UVT. The UV unit is calibrated during validation testing to determine the required dose for the target pathogen and log inactivation level.

The number of spaces in the **UV Calculated Dose Approach** dialog box shown in Figure 5.8 depends on the number of reactors you specified in the **UV Validation Method** dialog box. Select the units for the Maximum Validated Flow Rate at the bottom of the dialog box, then enter the {Maximum Validated Flow Rate}; the {Minimum Validated UVT (in percent)}; and the {Number of Duty Sensors} for each reactor. *Note:* Duty sensors are online UV sensors that continuously monitor UV intensity during operation.

UV Reactor Validation Method - Calculated Dose Approach						
Reactor 1	Maximum Validated Flow Rate (MGD)	1	Minimum Validated UVT (%)	5	Number of Duty Sensors	10
Reactor 2	Maximum Validated Flow Rate (MGD)	2	Minimum Validated UVT (%)	5	Number of Duty Sensors	10
Reactor 3	Maximum Validated Flow Rate (MGD)	3	Minimum Validated UVT (%)	5	Number of Duty Sensors	10

Figure 5.8. UV Calculated Dose Approach Dialog Box

LT2 Summary Worksheet

Figure 5.19 shows the tab for the **LT2 Summary** worksheet. If this tab is not visible, close the file and recustomize your workbook.

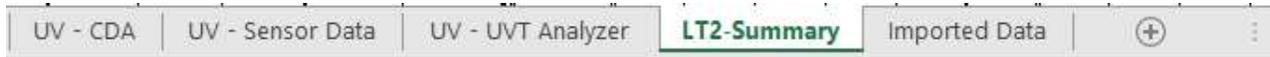


Figure 5.9. LT2 Summary Worksheet Tab

At the top of this worksheet, there is a block of information describing your system, plant, and reporting period. Leave this information blank during this step. It will be copied here from the information you enter when you complete the **P.2 Turbidity Data** worksheet as explained in the next section (see Section 5.2). The plant information cannot be reentered or edited here.

Treatment Technologies Table

The **LT2-Summary** worksheet contains two tables, the **Treatment Technologies** table and the **Giardia and Cryptosporidium Treatment Credits** table. Figure 5.10 shows the upper section of the **Treatment Technologies** table.

Indicate the treatment processes in each train. (see comment)	PRETREATMENT CREDITS				FILTRATION TECHNOLOGY CREDITS						ENHANCED PERFORMANCE CREDITS		DISINFECTION TECHNOLOGY CREDITS			OTHER TREATMENT CREDITS	
	Riverbank Filtration	Presed. with Coagul.	Two-stage Lime Softening	Conventional Sedimentation or Clarification	Conventional Granular Media Filters	Bag or Cartridge Filtration	Two-Stage Filtration	Membrane Filtration (PBT)	Membrane Filtration (QBT)	Membrane Filtration (MBT)	Enhanced CFE Perform	Optimized IFE Perform	Crypto Chemical Disinfect.	UV Disinfect. (ISA)	UV Disinfect. (CDA)	Waterhed Protection	Perform. Demon.
Overall	FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE
Train 1																	
Train 2																	
Train 3																	
Train 4																	
Train 5																	

Figure 5.10. Upper Section of the Treatment Technologies Table

The **Treatment Technologies** table lists all 17 potential treatment credits, identifies all your treatment technologies, and provides five rows to describe up to five different trains (see description below). Below the heading, there are 31 rows for the daily or monthly log removal credits the plant receives for using specific technologies or processes; and a row for the minimum credit received for each specific technology.

Overall CALC

The **Treatment Technologies** table uses the information you entered when customizing it to report all your treatment technologies and processes in the **Overall** row. If you indicated that your plant includes a specific process or technology, the worksheet will automatically report TRUE in the cell immediately below the corresponding heading. If not, the worksheet will report FALSE.

If the information shown on the **Overall** row is incorrect, close the file and recustomize your workbook.

Trains 1 – 5

The term “train” is used to describe a unique combination of parallel treatment technologies or processes, like conventional filters and membrane filters, rather than a series of disinfection zones. All water treatment plants have at least one unique combination of treatment processes or technologies. This section is used to specify your treatment trains and describe up to five unique treatment trains.

Using the drop-down list, select [TRUE] if a specific train contains a certain treatment process technology. If the train does not contain that specific process, leave the cell blank or use the drop-down list and select [FALSE]. You must enter data in the **Train 1** row. Only enter data in the **Train 2** through the **Train 5** rows if you have more than one unique combination of treatment processes. Similar units operating in parallel should not be shown as separate trains.

Note: Examples of different treatment trains are described later in this chapter. (See Figures 5.13, 5.14, and 5.15.)

Daily Data and Monthly Minimum CALC

The **LT2 Summary** worksheet uses the data you entered on other worksheets to automatically determine how much *Cryptosporidium* removal or inactivation credit each technology or process provides on a daily or monthly basis. It then uses the daily data to determine the minimum daily credit received by each technology or process your plant uses.

Perform. Demon.

If your plant has received our written approval to use some other technology or process to remove or inactivate *Cryptosporidium*, then summarize the daily removal credit that the plant receives in the **Perform. Demon.** column. Attach any required supporting documentation when you submit your MOR.

Giardia and Cryptosporidium Treatment Credits Table CALC

Figure 5.11 shows the heading for the **Giardia and Cryptosporidium Treatment Credits** table. After you enter treatment technologies data and daily performance data, the worksheet automatically completes this table and transfers the applicable information to the **P.1 Summary** worksheet. You cannot enter data in this table.

GIARDIA AND CRYPTOSPORIDIUM TREATMENT CREDITS											
Total Daily Credit By Train						Total Daily Bin 3 & 4 Credit by Train					
FALSE					Minimum	FALSE				Minimum	
	FALSE						FALSE				
		FALSE						FALSE			
			FALSE						FALSE		
				FALSE							FALSE

Figure 5.11. *Cryptosporidium* Treatment Credits Table

Total Daily Credit by Train CALC

After entering treatment technologies data and daily performance data, the worksheet automatically reports the total *Cryptosporidium* removal and the inactivation credit achieved in each of treatment trains each day. The worksheet also determines the lowest total credit for any of your trains and automatically reports it in the **Minimum** column. The results shown in the **Total Daily Credit by Train** section include cumulative, or total, log removal and inactivation credit achieved in each train.

Total Daily Bin 3 and 4 Credit by Train CALC

If we assigned your treatment plant to Bin 3 or Bin 4, you must achieve at least a 1.0 log removal or inactivation of *Cryptosporidium* with membrane filters, bag filters, cartridge filters, chlorine dioxide, ozone, or UV light. Therefore, the worksheet also calculates the total daily treatment credit your plant receives for using one or more of these specific Bin 3 and Bin 4 technologies. From this, it determines the minimum daily credit achieved by any train and reports the result in the **Minimum** column.

Treatment Trains Examples

Figures 5.12, 5.13, and 5.14 show three example approaches for defining treatment trains at plants utilizing a combination of cartridge, conventional, and membrane filters. Advantages and disadvantages are discussed after each example.

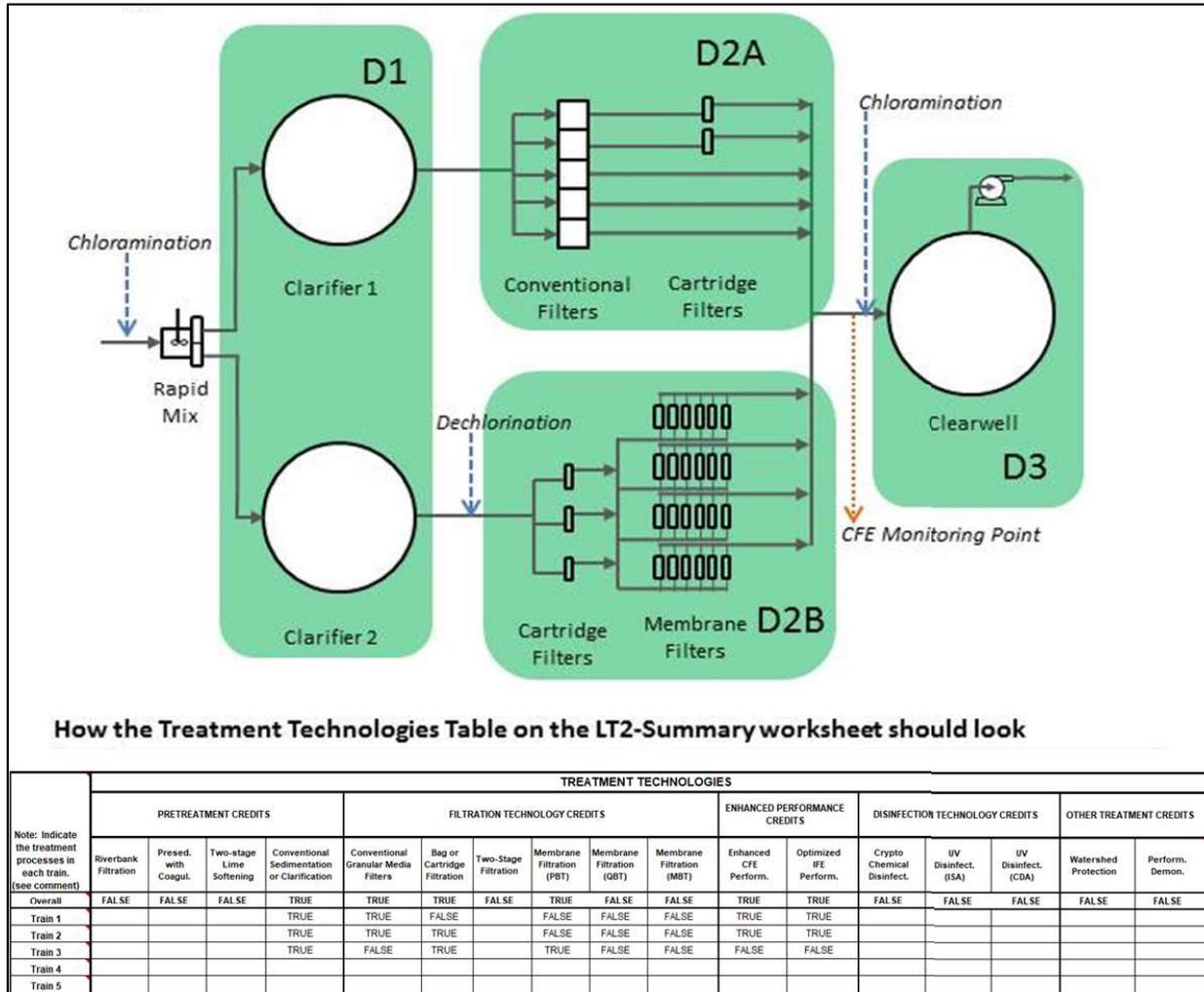


Figure 5.12. Treatment Train Approach 1 (Complex)

Advantages of Approach 1 (Complex):

- One SWMOR workbook.
- One CFE monitoring point.
- SWTP can claim disinfection credit for Zone D2A when the membrane train is not used.

Disadvantages of Approach 1 (Complex):

- Disinfection practices must achieve a 0.5 log *Giardia* inactivation because of the conventional filters without secondary cartridge filtration in Train 2.

- Operators must monitor the chlorine residual at the end of both Zones D2A and D2B.
- If Train 3 (the membrane train) is in operation, the SWTP will not receive disinfection credit for Zone D2. Regardless of the credit achieved in Zone D2A, the credit in Zone D2B will be 0.0 log because there will be no residual.
- If Train 3 is online, the plant must achieve all the required 0.5 log *Giardia* inactivation in the clarifiers and clearwell. There will be no credit for zone D2 when any of the water is passing through the membrane train.
- CFE turbidity levels above 1.0 NTU will trigger a BWN because the CFE monitoring point includes membrane filtration.

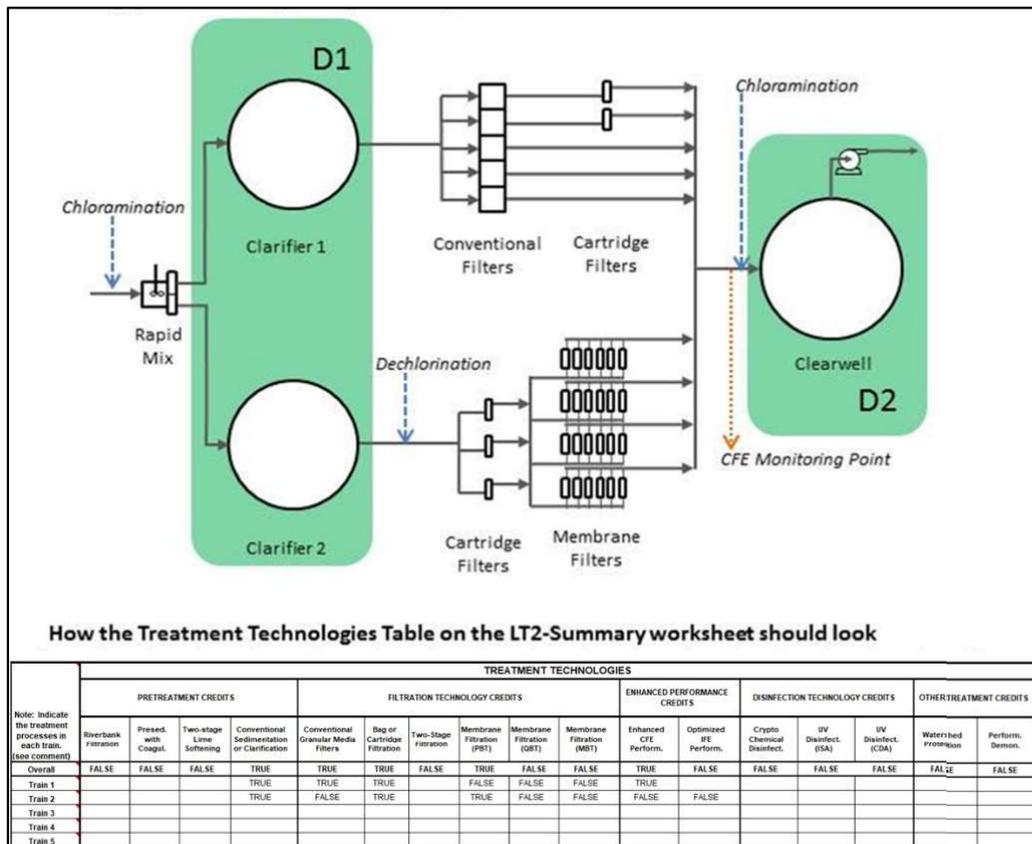


Figure 5.13. Treatment Train Approach 1 (Simplified)

Advantages of Approach 1 (Simplified):

- One SWMOR workbook.
- One CFE monitoring point.
- Eliminating the disinfection credit for the filters means no CT disinfectant monitoring will be required downstream of the filters; in contrast to the Complex Approach 1.

Disadvantages of Approach 1 (Simplified):

- Disinfection practices must achieve a 0.5 log *Giardia* inactivation because of the conventional filters without secondary cartridge filtration in Train 2.
- Because Zones D2A and D2B are eliminated, the plant must achieve all the required 0.5 log *Giardia* inactivation in the clarifiers and clearwell, even when Train 3 is not in service.
- CFE turbidity levels above 1.0 NTU will trigger a BWN because the CFE monitoring point includes membrane filtration.

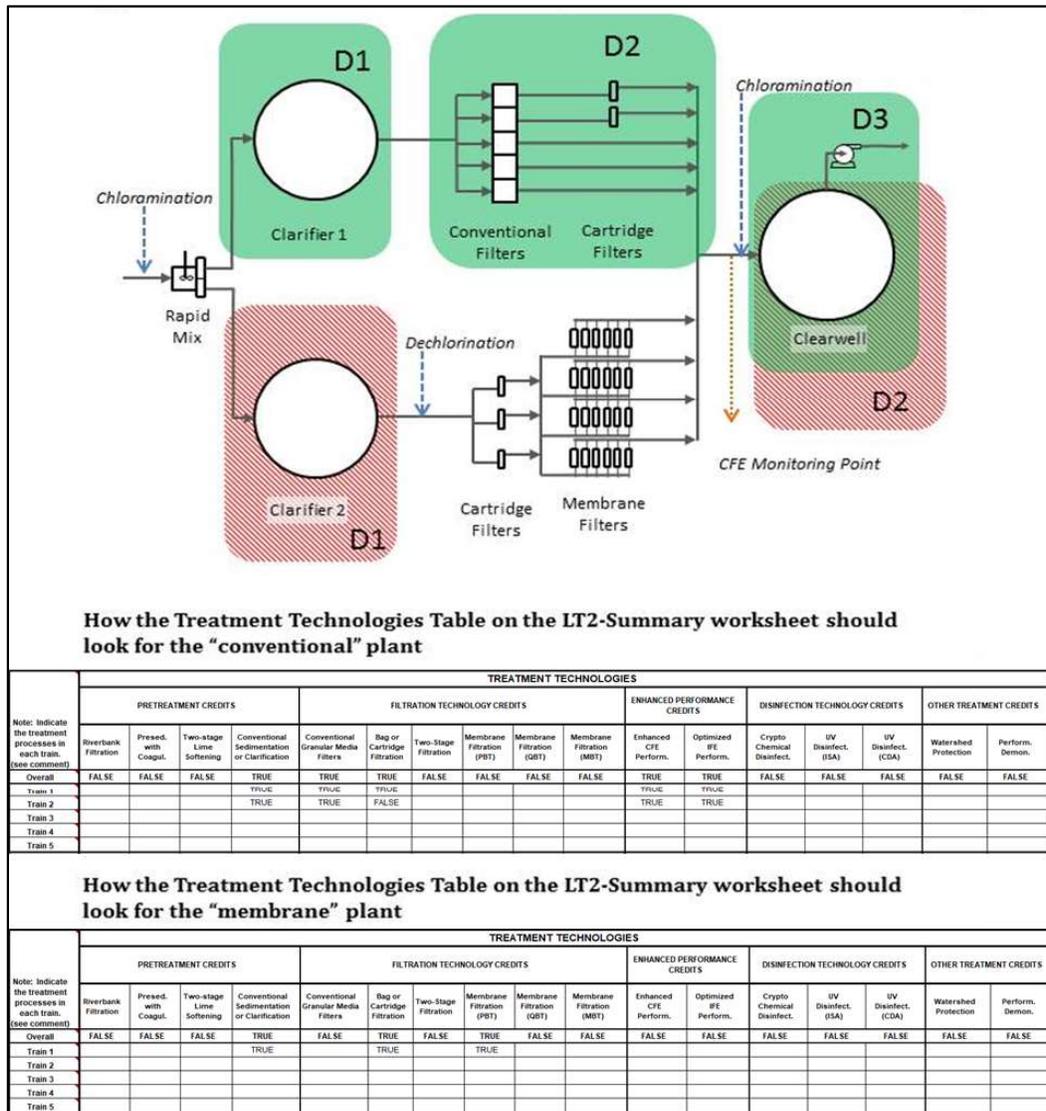


Figure 5.14. Treatment Train Approach 2 (Two SWMOR Workbooks)

Advantages of the Two SWMOR Workbook Approach:

- The SWTP can optimize the disinfection process for each plant independently.
- Turbidity levels above 1.0 NTU at the CFE monitoring point for the membrane plant automatically triggers a BWN; however, an automatic BWN at the

conventional plant is not triggered until the CFE turbidity levels at that monitoring site rise above 5.0 NTU.

Disadvantages of the Two SWMOR Approach:

- The SWTP submits one SWMOR workbook for the membrane plant and a separate SWMOR workbook for the conventional plant. *Note:* Operators could also use the regular SWMOR workbook since some of the water produced by conventional filters does not pass through secondary cartridge filtration. Doing so, however, would prevent the plant from claiming additional removal credit when the two filters with cartridges are the only ones in operation for the entire day.
- The CFE turbidity levels at each SWTP must be monitored before the water is blended.

Entering Your Plant Information (P.2)

Refer to Chapter 2.6.

Saving Your Customized SWMOR Workbook

Refer to Chapter 2.7.

5.2 Entering Data in Customized SWMOR for Plants with Alternative Treatment

To begin entering data at the beginning of each month, open your customized master workbook. The **Customize MOR** dialog box will prompt you to determine whether the SWMOR workbook needs an update to reflect plant changes. If no changes have occurred, select [Yes] for the first question and [No] for the second question, and then [OK]. You can now begin entering data and information for the reporting month. *Note:* The **Customize Dialog** box will appear each time you open a saved workbook during the reporting month. Repeat the sequence described above and continue entering data.

To avoid overwriting data, always start each monthly report using your customized master workbook. Do not use the previous month's workbook as a starting point.
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Creating a Monthly Workbook File

Refer to Chapter 3.1.

Data Entry

Every day your plant treats water, or sends water to the distribution system, you must monitor and enter data in the applicable MOR workbook pages. The instructions for entering performance and operation data for plants with alternative treatment are identical to those for conventional plants.

Refer to the following Chapters:

- 3.2 Entering Performance Data (P.2)
- 3.3 Entering IFE Turbidity Data (P.3)
- 3.4 Entering Disinfection Process Performance Data (P.4 & 5)
- 3.5 Entering TOC Data (P.6, 7, 8 and SUVA)

5.3 Compiling Summary Data

Refer to Chapter 4.

5.4 Membrane Worksheets (PBT, QBT, and MBT)

The three worksheets described in this section are used to record daily performance data for DIT membrane units. The **Membrane PBT** worksheet is for pressure based DIT units; the **Membrane QBT** worksheet is for flow based DIT units; and the **Membrane MBT** worksheet is for marker based DIT units. If you indicated that your plant has one of these types of membrane systems when you customized the SWMOR workbook, that worksheet will be visible. Select the applicable tab at the bottom of your workbook to begin entering data.

DIT Conditions and Additional Data

Just below the block of plant information at the top of each worksheet, there is the **DIT Conditions and Additional Data** table. This table contains the DIT parameters for each membrane unit; its DIT results from the previous month; and cells where you enter other general information about the membrane unit.

Figures 5.15, 5.16, and 5.17 show the sections of the **DIT Conditions and Additional Data** table for Unit 1 for each type of system. The worksheet automatically reports the information in the **DIT Cond'ns** row based on information you entered during customization. You cannot edit this information here. Because the **DIT Cond'ns** section of **DIT Conditions and Additional Data** table varies slightly depending on the type of membrane system, this table section is explained separately for each type. The other two sections (**Prev. Month Data and Optional Data**) in this table are identical for each membrane type, and therefore are not explained separately.

Note: The majority of SWTPs with membrane filters utilize PBTs. The QBT and MBT types are in limited use.

DIT Cond'ns – PBT **CALC**

DIT CONDITIONS & ADDITIONAL DATA	Unit No. 1									
	DIT Cond'ns	P_{test} psi	LRC -	UCL psi/min		Prev. Month Data	DIT _{last} date	Pass? Yes/No	C/A success?	95th % count
Optional Data	Filt.Flux gfd	TMP psi								

Figure 5.15. DIT Conditions and Additional Data Table for PBT Membranes

P_{test} psi **CALC**

This cell contains the minimum test pressure (in psi) at which you must begin each DIT for the membrane unit to receive treatment credit.

LRC **CALC**

This cell contains the log removal credit that the membrane unit receives when it passes its DIT.

UCL psi/min **CALC**

This cell contains the UCL (in psi/min), which is the maximum allowable rate that the pressure can drop during the DIT.

DIT Conditions – QBT **CALC**

DIT CONDITIONS & ADDITIONAL DATA	Unit No. 1									
	DIT Cond'ns	P_{test} psi	LRC -	UCL L/min		Prev. Month Data	DIT _{last} date	Pass? Yes/No	C/A success?	95th % count
Optional Data	Filt.Flux gfd	TMP psi								

Figure 5.16. DIT Conditions and Additional Data Table for QBT Membranes

P_{min} psi **CALC**

This cell contains the minimum test pressure (in psi) at which you must begin each DIT for the membrane unit to receive treatment credit.

LRC CALC

This cell contains the log removal credit that the membrane unit receives when it passes its DIT.

UCL L/min CALC

This cell contains the UCL (in L/min), which is the maximum allowable air flow rate during the DIT.

DIT Conditions – MBT CALC

DIT CONDITIONS & ADDITIONAL DATA	Unit No. 1								
	DIT Cond'ns	$C_{feed,max}$ Conc.	LRC -		Prev. Month Data	DIT _{last} date	Pass? Yes/No	C/A success?	95th % count
	Optional Data	Filt.Flux gfd	TMP psi						

Figure 5.17. DIT Conditions and Additional Data Table for MBT Membranes

$C_{feed, max}$ Conc. CALC

This cell contains the maximum marker concentration (in particles/mL or mg/L) in the DIT feed stream for the membrane unit to receive treatment credit.

LRC CALC

This cell contains the log removal credit that the membrane unit receives when it passes its DIT.

Prev. Month Data

The **Prev. Month Data** section of the **DIT Conditions and Additional Data** table is for data you entered the previous month. To complete, this section, review your operational records from the previous month and enter the required information for the current month. Do not leave the cells in this section blank because the worksheet uses this information to determine when the first DITs are needed during the current month.

DIT_{last} Date

Enter the {date} the last DIT was conducted on the membrane unit during the previous month. If you do not know the date of the last DIT, enter {ND}.

Pass? (Yes or No)

This cell specifies whether the membrane unit passed the last DIT conducted in the previous month. Enter {YES} if the unit passed. Enter {NO} if the unit failed. Enter {ND} if you did not record or have the results of the last DIT.

CA Success?

The **CA success?** cell specifies the status of CA based on the last DIT of the previous month.

CA is required if a unit failed the last DIT of the previous month, or you did not enter the data from the unit's last DIT. To successfully complete CA when required, you must run, pass, and document the results of a subsequent DIT. If you cannot verify that the barrier is intact, stop producing water from the membrane unit, or you will receive a treatment technique violation.

Enter one of the following:

- Leave the cell blank if no DIT was performed the previous month, and therefore no CA was taken.
- {NA} if the unit passed the last DIT of the previous month.
- {YES} if you investigated why the unit failed the DIT and demonstrated the membrane unit is intact by passing a subsequent DIT. Enter {YES} even if the only CA you took was to successfully repeat the DIT before you placed the unit into service for the first time this month.
- {NO} if you investigated why the unit failed the DIT, but the unit is still unable to pass a subsequent DIT. Enter {NO} even if the only CA you took was to repeat the DIT without success.
- {ND} if one of following applies:
 - You have not yet investigated why the unit failed the DIT.
 - You investigated the problem but have not yet conducted a subsequent DIT.
 - You investigated the problem and conducted a subsequent DIT but failed to collect the data needed to determine if the unit passed the DIT.

95th % Count

You may only enter data in the **95th % count** cell if you use particle counters or particle monitors to continuously monitor the performance of your membrane units. If you use laser turbidimeters for continuous monitoring, the header will be hidden, and the data entry cell will be locked. If you continuously monitor the performance of the membrane unit with a particle counter or particle monitor, you must determine and enter the {95th percentile reading (in number of particles per mL)} from the previous month. The 95th percentile value for the membrane unit must be calculated from all the data recorded by its SCADA system during the previous month.

Optional Data

The **Optional Data** section of the **DIT Conditions and Additional Data** table contains cells to enter other design or operational data used to assess the ongoing performance of the membrane unit. Since the data in this part of the table is not used for daily compliance calculations, you may leave the cells in this portion of the report blank.

Filt. Flux gfd

Enter the {maximum temperature adjusted normalized filter flux in gallons per square foot per day (gfd)} that we approved. You may leave this cell blank; however, this data can help determine if the membrane unit is operating at an approved flux. It can also help if you need to request permission to operate at higher flux rates.

TMP psi

Enter the {maximum TMP (in psi)} approved for the membrane unit. You may also leave this cell blank; however, this data can help you determine if the membrane unit is operating at an approved TMP. It could also help if you need to request permission to operate the unit at higher pressures.

The cells to the right of the **TMP psi** cell are unprotected and can be used to record a variety of data that might be helpful. For example, some plants use one of the columns to keep track of the normalized temperature adjusted specific flux of a clean membrane unit. This helps determine if it is time to chemically clean the unit; calculate the level of irreversible fouling that remains after a CIP is completed, or both.

Performance Data

The **Performance Data** table is for reporting daily data about membrane operating conditions and results of DITs and IITs for each membrane unit. This table contains an **Operational Data** section, a **DIT Data** section, and a **Summary** section. Only the **DIT Data** section is different for each membrane type and is presented separately for each membrane type.

Operational Data

Figure 5.18 shows the **Operational Data** section headings of the **Performance Data** table. This section contains six columns. The first five columns are for reporting data that summarizes the daily performance of the membrane unit. The last column is used to report any date you conducted a full chemical cleaning of a membrane unit. Only leave cells in the **CIP done?** column blank if no cleaning was performed.

Operational Data					
Daily	Norm.	TMP	Norm.	Daily	CIP
Pump.	Filt.Flux		Spc.Flux	Max.	done?
MG	gfd	psi	gfd/psi	mNTU	-

Figure 5.18. Operational Data Table for All Membrane Types

Daily Pump. MG

Each day, you must measure the total volume of filtered water produced by the membrane unit each day. Enter one of the following:

- {Total volume (in MG)} of filtered water.
- {ND} if you know that the membrane unit sent filtered water to the clearwell, but you have no production data.
- {0.0} if the unit was offline for the entire day and sent no water to the clearwell.

The worksheet uses the data recorded in this cell to determine which days the membrane unit sent filtered water to the clearwell. If your plant's control system only tracks the volume of feed water sent to the membrane, you must enter the volume of feed water treated each day (rather than the volume of filtrate produced) and assume that all the feed water was filtered and sent to the clearwell.

Norm.filt. flux gfd

At least once per day, you must measure the normalized (i.e., temperature adjusted to 20°C) filter flux of the membrane. Enter one of the following:

- {Normalized filter flux (in gfd)}. Enter the average of all readings from the day if you measure this more than once each day, or your membrane control system continuously monitors the flux rate of your membrane unit.
- {X} if the unit was offline for the entire day.
- {ND} if the membrane unit sent any water to the clearwell, but you did not record any temperature adjusted normalized filter flux data.

TMP psi

At least once per day, you must measure the TMP applied to the membrane unit. Enter one of the following:

{TMP (in psi)}. Enter the average of all readings from the day, if you measure this more than once each day, or your membrane control system continuously monitors the TMP of your membrane unit.

{X} if the unit was offline for the entire day.

{ND} if the membrane unit sent any water to the clearwell, but you did not record any TMP data.

Norm. Spc. Flux gfd/psi CALC

Do not enter anything in this cell. The normalized specific flux is automatically reported from the values entered for normalized filter flux and TMP.

Daily max. mNTU

The **Daily Max. mNTU** cell is used to report the highest level of turbidity or particles measured from each unit each day. These tests are referred to as IITs because they only provide a qualitative indication that the membrane unit is structurally intact. You

must conduct these IITs at least once every five minutes whenever the membrane unit is sending filtered water to the clearwell, unless you have a letter from us that allows you to monitor less frequently.

The column heading will automatically specify either mNTU or P. Count based on how you customized your SWMOR workbook. If you reported that your plant uses laser turbidimeters, the column heading will specify mNTU. If you reported that your plant uses particle counters or particle monitors, the column heading will specify P. count.

Enter one of the following:

- Highest {Turbidity (in mNTU or P. count)} of the filtered water produced by the membrane unit. Only enter a reading above 154 mNTU if it was confirmed by two consecutive 5-minute readings (or particle count higher than last month's 95th percentile).
- {X} if the unit was offline for the entire day and sent no filtrate to the clearwell.
- {ND} if the unit sent filtrate to the CW, but you did not record any of the required filtrate turbidity data.
- {MD} if the unit sent filtrate to the CW and you recorded some, but not all, of the required filtrate turbidity data and all the readings you did record were 154 mNTU or less (or less than last month's 95th percentile reading if you are using particle counters or monitors). Otherwise, enter the highest confirmed turbidity above 154 mNTU (or particle count higher than last month's 95th percentile).

If CIP was Conducted

Enter {YES} if you conducted a full chemical CIP on the membrane unit during the day. Leave the cell blank if you conducted a mini CIP or partial CIP, or you did not conduct a CIP at all.

DIT Data

The number of DITs you must run each month depends on the following conditions at your plant independent of membrane type:

- At least once per day when the membrane unit sends water to the clearwell, if your plant has been assigned to Bins 2, 3, or 4, and the LT2 requirements are in effect at your plant.
- At least once every 7 days if your plant:
 - is assigned to Bin 1; or,
 - has been assigned to Bins 2, 3, or 4, but the LT2 requirements are not yet in effect;
- On any day you have a confirmed turbidity reading above 154 mNTU (or above last month's 95th percentile reading if you are using particle counters or monitors).
- Immediately after you conduct a full CIP procedure, but not after a mini CIP or partial CIP.

The following sections describe the different reporting requirements for the three membrane types.

PBT

Figure 5.19 shows the **DIT Data** section of the **Performance Data** table for PBT membranes.

DIT Data			
P_{min}	$\Delta P/\Delta t$	DIT	C/A
psi	psi/min	pass?	success?
-	-	-	-

Figure 5.19. DIT Data Table for PBT Membranes

 P_{min} psi

The table in Figure 5.20 was revised to reflect the reporting of P_{min} rather than $P_{initial}$. This change is effective as of April 1, 2021. Prior to April 1, 2021 you may report either P_{min} or $P_{initial}$. If you use $P_{initial}$, you must use the SWMOR-Alt workbook with a revision date of 2019. See Appendix H for instructions on reporting $P_{initial}$ DIT pressure data. After you receive revised DIT parameters from TCEQ, you can begin reporting P_{min} but you must use the SWMOR-Alt workbook with a revision date of 2020 or later. Beginning April 1, 2021, all plants that use low-pressure membrane units for pathogen removal must report P_{min} on the SWMOR-Alt workbook revised in 2020 or later. If you are unsure about what to report or which form to use contact a SWTR coordinator.

Enter one of the following:

- {Minimum pressure (in psi)} recorded at any point during the DIT. Enter the lowest of all minimum pressure values, if more than one DIT was performed during the day.
- {X} if the unit was offline for the entire day.
- {ND} if:
 - you did not conduct a DIT when one was required
 - you conducted one or more DITs on the unit but failed to record the minimum pressure measured
 - you attempted one or more DITs and the membrane control system interrupted the test(s) before entering the pressure decay portion (often the result of a membrane unit failing to pressurize or to maintain a stable starting pressure).

Leave the cell blank if a DIT was not performed on the unit because it was not required.

 $\Delta P/\Delta t$ psi/min

Enter one of the following in this cell:

- {Pressure decay rate (in psi/min)} that occurred during the DIT. Enter the highest pressure decay rate if more than one DIT was performed.
- {X} if the unit was offline for the entire day.

- {ND} if:
 - you did not perform a DIT when one was required
 - you conducted one or more DITs on the unit but failed to record the minimum pressure measured
 - you attempted one or more DITs and the membrane control system interrupted the test(s) before entering the pressure decay portion (often the result of a membrane unit failing to pressurize or to maintain a stable starting pressure).

Leave the cell blank if a DIT was not run on the unit because it was not required.

If DIT Passed CALC

The worksheet automatically reports whether or not (Y or N) the unit passed the DIT by comparing the DIT data entered with the DIT criteria for the unit. If you did not record the data from the DIT, the worksheet reports ND in this cell.

If CA was Successful

The **CA success?** cell is used to specify whether CA was required following the DIT and; and, if so, document whether the CA was successfully completed.

CA is required if a unit failed the DIT, or you did not enter the DIT data. To successfully complete CA when required, you must run, pass, and document the results of a subsequent DIT. If you cannot demonstrate that the barrier is intact, stop producing water from the membrane unit, or you will incur a treatment technique violation.

Enter one of the following:

- {NA} if the unit passed the DIT.
- {YES} if you investigated why the unit failed the DIT and demonstrating an intact barrier by passing the subsequent DIT. Enter YES even if the only CA you took was to successfully repeat the DIT.
- {NO} if you investigated why the unit failed the DIT, but the unit is still unable to pass a subsequent DIT. Enter NO even if the only CA you took was to repeat the DIT without success.
- {ND} if one of the following applies:
 - You have not yet investigated why the unit failed the DIT.
 - You investigated the problem but have not yet conducted a subsequent DIT.
 - You investigated the problem and conducted a subsequent DIT but failed to collect the data needed to determine if the unit passed the DIT.

Leave the cell blank if no DIT was performed, and no CA was therefore required or taken.

QBT

Figure 5.20 shows the **DIT Data** section of the **Performance Data** table for QBT membranes.

DIT Data			
P_{min}	Q_{air}	DIT	C/A
psi	L/min	pass?	success?
		-	-

Figure 5.20. DIT Data Table for QBT Membranes

 P_{min} psi

The table in Figure 5.21 has been revised in this version of RG-211 to reflect the reporting of P_{min} rather than $P_{initial}$. This change is effective as of April 1, 2021. Prior to April 1, 2021 you may report either P_{min} or $P_{initial}$. If you use $P_{initial}$, you must use the SWMOR-Alt workbook with a revision date of 2019. See Appendix H for instructions on reporting $P_{initial}$ DIT pressure data. After you receive revised DIT parameters from TCEQ, you can begin reporting P_{min} but you must use the SWMOR-Alt workbook with a revision date of 2020 or later. Beginning April 1, 2021, all plants that use low-pressure membrane units for pathogen removal must report P_{min} on the SWMOR-Alt workbook revised in 2020 or later. If you are unsure about what to report or which form to use contact a SWTR coordinator.

Enter one of the following:

- {Minimum pressure (in psi)} recorded at any point during the DIT. Enter the lowest of all the minimum pressure values if more than one DIT was performed during the day.
- {X} if the unit was offline for the entire day.
- {ND} if:
 - you did not conduct a DIT when one was required
 - you conducted one or more DITs on the unit, but failed to record the minimum pressure measured
 - you attempted one or more DITs and the membrane control system interrupted the test(s) before the portion that measures air flow rate (often the result of a membrane unit failing to pressurize or to maintain a stable starting pressure).

Leave the cell blank if a DIT was not run on the unit because it was not required.

 Q_{air} L/min

Enter one of following:

- {Air flow rate (in L/min)} that occurred during the DIT. Enter the highest of all average air flow rate, if more than one DIT was performed during the day.
- {X} if the unit was offline for the entire day.
- {ND} if:

- you did not conduct a DIT when one was required
- you conducted one or more DITs on the unit, but failed to record the minimum pressure measured
- you attempted one or more DITs and the membrane control system interrupted the test(s) before the portion that measures air flow rate (often the result of a membrane unit failing to pressurize or to maintain a stable starting pressure).

Leave the cell blank if a DIT was not run on the unit because it was not required.

If DIT Passed **CALC**

The worksheet automatically reports whether or not (Y or N) the unit passed the DIT by comparing the DIT data entered with the DIT criteria for the unit. If you did not record the data from the DIT, the worksheet automatically reports ND in this cell. You may not enter any results in this cell.

If CA was Successful

The **CA success?** cell is used to specify whether CA was required following the DIT and, if so, document whether the CA was successfully completed.

CA is required if a unit failed the DIT, or you did not enter DIT data. To successfully complete CA when required, you must run, pass, and document the results of a subsequent DIT. If you cannot demonstrate that the barrier is intact, stop producing water from the membrane unit, or you will incur a treatment technique violation.

Enter one of the following:

- {NA} if the unit passed the DIT.
- {YES} if you investigated why the unit failed the DIT and demonstrating an intact barrier by passing the subsequent DIT. Enter YES even if the only CA you took was to successfully repeat the DIT.
- {NO} if you investigated why the unit failed the DIT, but the unit is still unable to pass a subsequent DIT. Enter NO even if the only CA you took was to repeat the DIT without success.
- {ND} if one of the following applies:
 - You have not yet investigated why the unit failed the DIT.
 - You investigated the problem but have not yet conducted a subsequent DIT.
- You investigated the problem and conducted a subsequent DIT but failed to collect the data needed to determine if the unit passed the DIT.

Leave the cell blank if no DIT was performed, and no CA was therefore required or taken.

MBT

Figure 5.21 shows the **DIT Data** section of the **Performance Data** table. As the figure shows, this section contains four columns.

DIT Data			
C_{feed}	C_{product}	DIT	C/A
Conc.	Conc.	pass?	success?
-	-	-	-

Figure 5.21. DIT Data Table for MBT Membranes

 C_{feed} Conc.

Enter one of the following:

- {Marker concentration (in particles/mL or mg/L)} in the DIT feed stream. If more than one DIT was performed during the day, enter the lowest of all the feed stream marker concentrations.
- {X} if the unit was offline for the entire day.
- {ND} if you did not conduct a DIT when one was required; or if you conducted one or more DITs on the unit but failed to record any feed stream marker concentration data.

Leave the cell blank if a DIT was not run on the unit because it was not required.

 C_{product} Conc.

Enter one of the following:

- {Marker concentration (in particles/mL or mg/L)} in the DIT permeate or filtrate stream. If more than one DIT was performed during the day, enter the highest of all the product stream marker concentrations.
- {X} if the unit was offline for the entire day.
- {ND} if you did not conduct a DIT when one was required; or you conducted one or more DITs on the unit but failed to record any product stream marker concentration data.
- {MDL} of the analytical instrument used to test the sample if no marker was detected in the product stream.

Leave the cell blank if a DIT was not run on the unit because it was not required.

If DIT Passed CALC

The worksheet automatically reports whether or not (Y or N) the unit passed the DIT by comparing the DIT data entered with the DIT criteria for the unit. If you did not record the data from the DIT, the worksheet automatically reports ND in this cell. You may not enter any results in this cell.

If CA was Successful

The **CA success?** cell is used to specify whether CA was required following the DIT and; and, if so, document whether the CA was successfully completed.

CA is required if a unit failed the DIT, or you did not enter the DIT data. To successfully complete CA when required, you must run, pass, and document the results of a subsequent DIT. If you cannot demonstrate that the barrier is intact, stop producing water from the membrane unit, or you will incur a treatment technique violation.

Enter one of the following:

- {NA} if the unit passed the DIT.
- {YES} if you investigated why the unit failed the DIT and demonstrating an intact barrier by passing the subsequent DIT. Enter YES even if the only CA you took was to successfully repeat the DIT.
- {NO} if you investigated why the unit failed the DIT, but the unit is still unable to pass a subsequent DIT. Enter NO even if the only CA you took was to repeat the DIT without success.
- {ND} if one of the following applies:
 - You have not yet investigated why the unit failed the DIT.
 - You investigated the problem but have not yet conducted a subsequent DIT.
 - You investigated the problem and conducted a subsequent DIT but failed to collect the data needed to determine if the unit passed the DIT.

Leave the cell blank if no DIT was performed, and no CA was therefore required or taken.

Summary

At the end of each reporting month, you must complete the worksheet’s **Summary** section in Figure 5.22.

SUMMARY			Unit No. 1
	IIT	Number of days with DIT triggered by high turbidity or particle count	
		Number of days with a monitoring violation	
	DIT	Number of days with failure to pass a DIT	
		Number of days with a treatment technique violation	
	Comments	General Remarks	Additional Comments

Figure 5.22. Summary Table for All Membrane Types

The worksheet automatically reports all of the following IIT and DIT data:

- Number of days in which your plant needed to conduct a DIT due to high turbidity (or particle count).
- Number of days in which the membrane unit had one or more monitoring violations.
- Number of days in which the membrane unit failed to pass a DIT.
- Number of days in which the membrane unit had a treatment technique violation.

You will incur a monitoring violation for each day you fail to collect the required turbidity (or particle count data) in a day that the membrane unit sends filtrate to the clearwell (i.e., you entered MD or ND in the Daily Max cell). You will also incur a monitoring violation if you do not pass a DIT or complete successful CA on a day one is required.

You will incur a treatment technique violation each day you produce water after failing a DIT and not successfully completing CA. The worksheet “assumes” that you took the membrane unit offline as soon as it failed a DIT. Consequently, you will not be cited for a treatment technique violation on the day that the unit failed its DIT. The worksheet does not “assume” that CA was completed before you produced water on any subsequent day. Therefore, you must report successful CA at least one day before you report that the unit sent water to the clearwell. This means that if you fail a DIT on one day, and fix the unit the following day before restarting, you need to show the CA was completed on the first day. This way, the worksheet will “know” that CA was completed before the unit was restarted.

Comments

The worksheet provides a row for you to enter comments about the membrane treatment process, as well as comments about the performance of individual membrane units. Cells are available for both general and unit specific comments.

State and federal rules require that you describe the CAs you took for certain membrane failing a DIT. This information is required for Bin 2, 3, and 4 systems. Other comments are optional. Some examples of optional comments include dates you conducted mini CIPs or partial CIPs, or pinned fibers; and how many fibers had to be pinned in each module. If you do not have enough room, enter {See attached page} and attach a separate page to the MOR.

5.5 Crypto CT Worksheet

The **Crypto CT** worksheet is used to calculate and report monthly log inactivation credit for *Cryptosporidium* based on chemical disinfection. According to the LT2, SWTPs in Bins 2, 3, and 4 must achieve additional log removal or inactivation credit for *Cryptosporidium*. One acceptable method is inactivation by ozone or chlorine dioxide. If your plant has been approved for this type of credit, this worksheet is a part of your MOR. Select the **Crypto CT** tab to begin entering data.

Performance Data

The **Crypto CT** worksheet consists of the **Performance Data** table only, as shown in Figure 5.23.

PERFORMANCE DATA								
CRYPTOSPORIDIUM INACTIVATION CREDIT (LOG INACTIVATION)								
Date	Disinfectant and Zone		Crypto Credit	Disinfectant and Zone		Crypto Credit	Total Credit	Time ^a (hrs)
1								

Figure 5.23. Crypto-CT Worksheet Performance Data Table

Disinfectant and Zone CALC

The worksheet automatically reports the data in the **Disinfectant and Zone** from the information you reported on the **P.4&5 Disinfection Data** worksheet. The data cannot be reentered or edited here. You must complete the **P.4&5** worksheet before you complete this page or the corresponding cells on this **Crypto CT** worksheet will be blank. The maximum number of disinfectants and zones for each day is 10.

Crypto Credit CALC

The worksheet also automatically reports the log credit for *Cryptosporidium* inactivation. There is one cell for each disinfection zone. This data also cannot be reentered or edited on the **Crypto CT** worksheet.

If the disinfectant is either chlorine dioxide or ozone, the log credit for *Cryptosporidium* inactivation is calculated as follows:

- **Chlorine Dioxide:** $0.001506 \times (1.09116^{\text{Temperature}}) \times \text{Chlorine Dioxide Concentration} \times T_{10}$
- **Ozone:** $0.0397 \times (1.09757^{\text{Temperature}}) \times \text{Ozone Concentration} \times T_{10}$

If the Inactivation Ratio for a specific disinfection zone in the **P.4&5 Disinfection Data** worksheet is empty, the cell will be blank.

Cryptosporidium inactivation is not credited for any other disinfectant besides chlorine dioxide or ozone. In all other circumstances, the worksheet automatically reports 0 in this cell.

Total Credit CALC

For each day, the worksheet automatically reports the total log inactivation credit for *Cryptosporidium* by summing all data from the **Crypto Credit** column. This data cannot be reentered or edited.

If all **Crypto Credit** cells are empty for a given day, the worksheet leaves this cell blank.

Time (hrs)

For each day, enter the {total time (in hours)} the plant operated below the performance goal for total *Cryptosporidium* inactivation. Enter a value for the cumulative duration of time (in ¼-hr increments). If there were two or more periods in the day when the inactivation was less than the goal, enter the sum of the duration times for each excursion. Leave the cell blank if either of the following apply:

- The total inactivation credit achieved at the plant never fell below the inactivation performance goal at any time during the day.
- You did not use either chlorine dioxide or ozone in at least one of the disinfection zones.

5.6 UV Sensor Data Worksheet

The **UV Sensor Data** worksheet is one of four UV worksheets and is used to report UV Sensor calibration results. Using the calibration information, the worksheet automatically reports the sensor CFs. The CFs are then used by the **UV ISA** and **UV CDA** worksheets (see Sections 5.7 and 5.8). Select the UV Sensor Data tab shown in Figure 5.24 to begin entering data.



Figure 5.24. UV Sensor Data Tab

The **UV Sensor Data** worksheet contains two sections; one corresponding to the ISA and one corresponding to the CDA. If your plant only uses one of these approaches, only the applicable section will be visible. If two sections are visible, the upper section contains the calibration data for the sensors in your ISA reactors. The lower section contains the calibration data for the sensors in your CDA reactors. Figure 5.25 shows the headings for both sections.

UV MONTHLY OPERATING REPORT
FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
UV Sensor Calibration for Calculated Dose Reactors

PUBLIC WATER SYSTEM NAME: _____ PLANT NAME OR NUMBER: _____
PWS ID No.: _____ Plant ID No.: _____ Month: _____ Year: _____

CALIBRATION DATA		CALIBRATION DATA	
CDA	UV Sensor Calibration Report for Calculated Dose Reactors	CDA	UV Sensor Calibration Report for Calculated Dose Reactors

UV MONTHLY OPERATING REPORT
FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES
OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)
UV Sensor Calibration for Calculated Dose Reactors

PUBLIC WATER SYSTEM NAME: _____ PLANT NAME OR NUMBER: _____
PWS ID No.: _____ Plant ID No.: _____ Month: _____ Year: _____

CALIBRATION DATA		CALIBRATION DATA	
CDA	UV Sensor Calibration Report for Calculated Dose Reactors	CDA	UV Sensor Calibration Report for Calculated Dose Reactors

Figure 5.25. UV Sensor Calibration Section Headings (Top for ISA Reactors and Bottom for CDA Reactors)

UV Sensor Calibration Data Tables

A duty sensor is an online UV sensor installed in the UV reactor to monitor UV intensity during normal operation. You must use a reference sensor to calibrate each duty sensor in each of your UV reactors at least once each month and enter the calibration results in the appropriate **Calibration Data** table for that reactor. Figure 5.26 shows the cells where you enter calibration data for the first ISA reactor. The corresponding table for CDA reactors (not shown) is identical, except for the units for the sensor readings.

CALIBRATION DATA									
CDA Reactor Number	UV Sensor Calibration Report for Calculated Dose Reactors								
	Calibration Date and Data	Duty Sensor	Duty Sensor Serial #	Ref Sensor Serial #	Duty Sensor Reading (mJ/cm ²)	Ref Sensor Reading (mJ/cm ²)	Cal Ratio	Duty Sensor Replaced?	Calculated Sensor CF
UVCD No. 1	Previous Month's Sensor CF	1							
		2							
		3							
		4							
	Calibration Date	5							
		6							
		7							
	New Sensor CF	8							
		9							
		10							

Figure 5.26. UV Sensor Calibration Data Table

The worksheet uses the information you entered when you customized the SWMOR workbook and automatically configures the calibration data tables. Entry cells for reactors or sensors that do not exist are shaded and locked. The worksheet allows for up to 20 reactors of each type (ISA and CDA) and up to ten duty sensors per reactor.

If you are not allowed to enter calibration results for one of your sensors or reactors because that area is shaded, close the file and recustomize your workbook.

Calibration Date and Data

Previous Month's Sensor CF

At the beginning of each month, enter the {sensor CF} of each reactor from the previous month. This value is used in the calculations in the other UV worksheets for all days up to the date of recalibration for this month. The value you enter in this cell must match the value you reported in the **New Sensor CF** cell in the previous month's worksheet. Do not leave this cell blank.

Calibration Date

You must calibrate all the sensors in a given reactor on the same day. Enter the {date} in the current month that verified the performance of all the duty sensors in the UV reactor. If you tested the sensors in a given reactor more than once during the current month, enter the test date that produced the highest calibration ratio. Do not leave this cell blank.

New Sensor CF **CALC**

The worksheet uses the calibration data you enter for the duty and reference sensors (see below) to calculate a new CF for each UV reactor. The new sensor CF is based on the highest CF for any sensor in the reactor. This CF is used to evaluate the reactor's performance starting on the date the sensors are calibrated. Therefore, it is important, as previously stated, that you calibrate all the sensors in a given reactor on the same date. Prior to this date, the previous month's sensor CF is used.

UV Sensor Calibration Report

Duty and Reference Sensor Serial Numbers

Enter the {serial number} of each duty and reference sensor in the applicable cells. You do not have to enter the entire serial numbers. Include just enough information to identify the specific sensors used. Do not leave these cells blank.

Duty and Reference Sensor Readings

Measure and enter the {UV intensity} of both the duty and reference sensors. For ISA reactors, enter these values in milliwatts per square centimeter (mW/cm²). For CDA reactors, the calculated dose approach should result in a calculated value of millijoules/cm² (mJ/cm²) on your instrument's output. Do not leave either of these cells blank.

The duty and reference sensor readings must be reported in the same units. If your instrument shows the values in units other than those indicated here, contact us for guidance. Other units of measurement are likely acceptable as long as they are the same for both the duty and reference sensors.

Calibration Ratio **CALC**

The worksheet automatically reports the new calibration ratio for each sensor in the appropriate **Cal Ratio** column by dividing the applicable Duty Sensor Reading by the corresponding Reference Sensor Reading.

If Duty UV Sensor was Replaced

The selections available in the drop-down list for this column depend on the duty sensor's calculated calibration ratio in the adjacent **Cal Ratio** cell. Select one of the following responses:

- [NA] if the sensor's calibration ratio was 1.2 or lower, and you did not replace the sensor.
- [Yes] if one of the following applies:
 - The sensor's calibration ratio was greater than 1.20 and you replaced it with a new sensor having a calibration ratio of 1.20 or lower.
 - The sensor's calibration ratio was 1.2 or lower, and you replaced it anyway.
- [No] if the sensor's calibration ratio was greater than 1.20, and you did not replace it.

Note: Your duty sensor's calibration ratio must be 1.20 or less. You may not replace the duty sensor unless the replacement sensor has a calibration ratio that is 1.20 or lower.

Calculated Sensor CF **CALC**

The worksheet automatically reports the sensor CF for each sensor based on the data contained in the corresponding **Cal Ratio** and **Duty UV Sensor Replaced?** cells.

If the sensor's calibration ratio was 1.20 or lower, the worksheet reports a calibration ratio of 1.0 because the sensor meets minimum performance requirements for a properly calibrated sensor.

If the sensor's calibration ratio was greater than 1.20 and you replaced the inaccurate sensor with a properly calibrated one, the worksheet automatically reports the word Replaced in the **Calculated Sensor CF** cell and will exclude the sensor when calculating the New Sensor CF for the reactor.

If the old sensor's calibration ratio was greater than 1.20 and you did not replace it with a properly calibrated one, the worksheet automatically subtracts 0.2 from the value shown in the corresponding **Cal Ratio** cell and reports the result.

5.7 UV ISA Worksheet

This **UV-ISA** worksheet is used to summarize the performance of the UV reactors with an intensity setpoint dose monitoring strategy. If applicable, select the **UV ISA** worksheet tab to begin entering data.

This worksheet is used to enter daily performance data for up to 20 ISA reactors. The **Performance Data** area groups every five UV reactors into a data entry sub-area for the entire month. The number of sub areas depends on the total number of UV reactors you entered when you customized your workbook. The data entry cells for reactors that do not exist are locked. If you are not allowed to enter daily data for one of your ISA reactors because it is locked, close the file and recustomize your workbook.

At the end of the month, the UV ISA worksheet automatically generates a performance summary for your ISA reactors. It is important that you enter all of the required performance data for each reactor. If not, you might not receive the correct treatment credit for the month and incur a violation.

Validated Operational Conditions for UV-ISA CALC

Figure 5.27 shows the portion of the **UV ISA** worksheet where validated operational conditions are shown for the first five UV ISA reactors. If your plant has more than five UV ISA reactors, similar cells are located lower in the worksheet. The right-hand portion of the figure shows a blank cell (just below the Crypto Log Inactivation title) for the required *Cryptosporidium* log inactivation to be achieved.

The information in this section of the **UV ISA** worksheet is automatically reported based on the information you entered when you customized the SWMOR workbook. It is not possible to edit this data on this worksheet.

VALIDATED OPERATIONAL CONDITIONS						
VALIDATED PARAMETERS						PERFORMANCE REQUIREMENTS
Parameters	Reactor Number					Crypto Log Inactivation
	UVIS1	UVIS2	UVIS3	UVIS4	UVIS5	
Max. Validated Flow Rate (MGD)						
Intensity Setpoint (mW/cm ²)						

Figure 5.27. Validated Operational Conditions for ISA Reactors

Daily Performance Data for Individual UV Reactors

As shown in Figure 5.28, the **Operational Data** table of the **Performance Data** table is used to enter daily data for each UV reactor.

PERFORMANCE DATA								
OPERATIONAL DATA								
Date	Reactor	Total Product. (MG)	Max. Flow Rate (MGD)	Min. Intensity (mW/cm ²)	Sensor CF	Adjusted Min. Intensity (mW/cm ²)	Total Off-Spec Product. (MG)	Consec. Off-Spec Hours (hr)
1	1							
	2							
	3							
	4							
	5							
2	1							
	2							
	3							
	4							
	5							

Figure 5.28. Operational Data for UV Reactors No. 1-5 Using the ISA

Total Product. (MG)

For each date that the UV reactor is used for treatment, enter one of the following for each reactor:

- {Total amount of water (in MG)} treated by each UV reactor.
- {X} if a reactor was offline all day.
- {ND} if a reactor treated water on a specific day, but you failed to record how much.

Max. Flow Rate (MGD)

You are required to record the flow rate through each UV reactor at least once every 15 minutes whenever it is treating water. For each date, enter one of the following for each reactor:

- {Maximum flow rate (in MGD)} if you collected either of the following:
 - All the required data when the reactor was treating water.
 - Some of the required flow rate data, and it shows the reactor operated at a flow rate above the maximum validated flow rate.
- {X} if a reactor was offline all day.
- {ND} if a reactor treated water on a specific day but you failed to collect any flow rate data during the day.
- {MD} if a reactor treated water and you collected some, but not all, of the required flow rate data, and all of the data that you do have is less than the maximum validated flow rate. If you collected some, but not all of the required

flow-rate data, and one or more of the readings is greater than the maximum validated flow rate, enter that peak flow reading in the **Max Flow Rate** cell for that UV reactor.

The maximum flow rate cannot be less than the total production (in MG) and will generally be greater. The two values will only be the same if the reactor operated at a constant flow rate for the entire 24-hr period. For example, if you ran the plant for 12 hours at 1 MGD, and 12 hours at 2 MGD, your total production would be 1.5 MG which is less than 2 MG maximum flow rate that occurred during that day.

Min. Intensity (mW/cm²)

You must also record the UV intensity in each UV reactor at least once every 15 minutes whenever it is treating water. For each date, enter one of the following for each reactor:

- {Lowest UV intensity (in mW/cm²)} recorded during the day if you recorded either of the following:
 - All of the required intensity data while the reactor was treating water.
 - Some of required intensity data, and the data show there were sensor readings below the required intensity setpoint.
- {X} if a reactor was offline all day.
- {ND} if a reactor treated water on a specific day, but you failed to collect any UV intensity data during the day.
- {MD} if you collected some, but not all of the required UV intensity data.

If your UV control system shows the sensor readings in units other than those indicated here, contact us for guidance. Other units are probably okay as long as they are the same for both the duty and the reference sensors.

Sensor CF CALC

The **UV ISA** worksheet automatically reports the sensor CF based on the data entered on the **UV Sensor Data** worksheet. Prior to the calibration date, the value is calculated using the previous month's CF. On and after the calibration date, the value is calculated using the new CF.

If the cell for a particular reactor reads Sensor MD, it means some of the data needed to calculate the sensor CF is missing. If this happens, go to the **UV Sensor Data** worksheet and enter the missing data for that reactor's sensors.

Adjusted Min. Intensity (mW/cm²) CALC

The **UV ISA** worksheet automatically reports the adjusted minimum intensity based on the data contained in the corresponding **Min. Intensity** and **Sensor CF** cells.

The adjusted minimum intensity values are valid only when the reactor is operating within its validated operating conditions. If the reactor operates outside its validated conditions at any point during the day, its adjusted minimum intensity value recorded in the cell will be followed by an asterisk.

Total Off-spec Prod. (MG)

The amount of off-spec water produced by a reactor cannot exceed the total amount of water it produces during the day. A reactor is off-spec when one of the following conditions occur:

- The Max Flow Rate is higher than the Max Validated Flow Rate of the reactor.
- The Adjusted Minimum Intensity is lower than the required Intensity Setpoint.

You cannot enter a nonzero value in this cell if the reactor was operating within validated conditions at or above the Intensity Setpoint. For each date, enter one of the following responses:

- {Volume of water (in MG)} produced by each reactor during periods when the reactor was operating off-spec that day.
- {X} if the reactor was offline all day.
- {0} or leave the cell blank if the reactor was continuously operated within its validated range and the Adjusted Minimum Intensity was not less than the Required Intensity Setpoint.

Consec. Off-spec Hours (hr)

You must enter the duration of any event each day when one or more of the reactors was operating in an off-spec condition as described in the previous section. An off-spec event begins when the first reactor begins producing off-spec water and ends when all of the reactors are again simultaneously operating with validated conditions and meeting disinfection requirements. For each date, enter one of the following responses to describe the off-spec circumstances:

- {Time (in hours)} of consecutive off-spec production. If this occurs more than once during the day, enter the duration of the longest consecutive period when the reactor was operating off-spec.
- {X} if the reactor was offline all day.
- {0} or leave the cell blank, if the reactor was continuously operated within its validated range and the Adjusted Min Intensity was not less than the Intensity Setpoint.

You cannot enter a nonzero value in this cell if the reactor was operating within validated conditions at or above the required Intensity Setpoint.

Monthly Summary for All UV Reactors

At the end of the month, the **UV ISA** worksheet summarizes the production data for all UV reactors. The **Monthly Summary for All UV Reactors** table shown in Figure 5.29 is located to the lower right of the **Data Performance** table where you entered the daily data explained above. If you have both ISA and CDA reactors at your plant this table will summarize data for both. The values in this table are updated daily based on the daily data you enter; however, the values at the end of the month are most important because those values use the entire months data set.

MONTHLY SUMMARY FOR ALL ISA REACTORS	Total Production (MG)	Total Off-spec Production (MG)	Total % Off-spec
	Raw water pumpage and total production by all UV reactors differ in more than 15% on the following month and days:		

Figure 5.29. Monthly Summary for All UV Reactors

Total Production (MG) CALC

The **UV ISA** worksheet automatically reports this value by summing the daily total production data for all the individual reactors at the plant.

Total Off-Spec Production (MG) CALC

The **UV ISA** worksheet automatically reports the value by summing the daily total off-spec production data.

Total % Off-Spec CALC

The **UV ISA** worksheet automatically reports this value by dividing the total off-spec production data by the total production data.

Treated (or Raw) Water Pumpage and Total UV Production Differ by More than 15% on These Days CALC

The **UV ISA** worksheet automatically reports if there were days when there was more than a 15% difference between the amount of water produced by the plant and the total amount of water that passed through all the UV reactors.

If your reactor is located upstream of the clearwell, this calculation is based on the amount of raw water pumped during the day entered on the **P.2 Turbidity Data** worksheet. If your reactor is downstream from the clearwell, the calculation is based on the amount of treated water produced during the day.

If there were any days when there was more than a 15% difference in the two values, they are reported in this cell. If there were no days in which there was more than 15% difference in the two values, then the worksheet reports the word None.

5.8 UV CDA Worksheet

The **UV CDA** worksheet is used to summarize the performance of the UV reactors in plants that use a calculated dose monitoring strategy. If applicable, select the **UV CDA** worksheet tab to begin entering data.

The worksheet provides space to enter daily performance data for up to 20 CDA reactors. The **Performance Data** area is grouped into data entry sub-areas for the entire month. The number of subareas depends on the total number of UV reactors you entered when you customized your workbook. The data entry cells for reactors that do

not exist are locked. If you are not allowed to enter daily data for one your reactors because it is locked; close the file, and recustomize your workbook.

At the end of the month, the UV CDA worksheet automatically generates a performance summary for your CDA reactors. Therefore, it is important that you enter all of the required performance data for each reactor. If not, you may not receive the correct treatment credit for the month and incur a violation.

Validated Operational Conditions for UV CDA

Figure 5.30 shows the section of the worksheet where validated operational conditions required by the CDA are shown for the first five UV CDA reactors.

The validated parameters include the Max Validated Flow Rate (MGD) and the Min Validated UVT (%). A cell for these parameters for each reactor is generated automatically. If your plant has more than five UV CDA reactors, similar cells are located lower in the worksheet. The righthand portion of the figure shows a blank cell (just below the Crypto Log Inactivation title) for the required *Cryptosporidium* log inactivation to be achieved.

The information in this section of the **UV CDA** worksheet is automatically reported based on the information you entered when you customized the SWMOR workbook. It is not possible to edit this data on this worksheet.

VALIDATED OPERATIONAL CONDITIONS							
VALIDATED PARAMETERS					PERFORMANCE REQUIREMENTS		
Parameters	Reactor Number					Crypto Log Inactivation	Required UV Dose (mJ/cm ²)
	UVCD1	UVCD2	UVCD3	UVCD4	UVCD5		
Max Validated Flow Rate (MGD)							
Min Validated UVT (%)							

Figure 5.30. Validated Operational Conditions for CDA Reactors No. 1 to 5

Daily CDA Performance Data for Individual UV Reactors

As shown in Figure 5.31, the **Operational Data** table of the **Performance Data** table provides for daily information entry for each UV reactor.

PERFORMANCE DATA								
Date	OPERATIONAL DATA							
	Reactor	Total Product. (MG)	Max. Flow Rate (MGD)	Min. Intensity (mW/cm ²)	Sensor CF	Adjusted Min. Intensity (mW/cm ²)	Total Off-Spec Product. (MG)	Consec. Off-Spec Hours (hr)
1	1							
	2							
	3							
	4							
	5							

Figure 5.31. Operational Data for UV Reactors No. 1-5 Using the CDA

Total Product (MG)

For each date that the UV reactor is used for treatment, enter one of the following responses:

- {Total amount of water (in MG)} treated by each UV reactor.
- {X} if the reactor was offline all day.
- {ND} if a reactor treated water on a specific day but you failed to record how much.

Max Flow Rate (MGD)

You are required to record the flow rate through each UV reactor at least once every 15 minutes whenever it is treating water. For each date, enter one of the following for each reactor:

- {Maximum flow rate (in MGD)} if you collected either of the following:
 - All the required flow rate data while the reactor was treating water.
 - Some of the required flow rate data and the data show the reactor operated at a flow rate above the maximum validate flow rate.
- {X} if the reactor was offline all day.
- {ND} if a reactor treated water on a specific day but you failed to collect any flow rate data during the day.
- {MD} if a reactor treated water and you collected some, but not all, of the required flow rate data, and all of your data is less than the maximum validated flow rate. If you collected some, but not all, of the required flow rate data, and some of the data you have is greater than the maximum validated flow rate, enter that peak flow reading in the **Max Flow Rate** cell for that UV reactor.

The maximum flow rate cannot be less than the total production (in MG) and will generally be greater. The two values will only be the same if the reactor operated at a constant flow rate for the entire 24-hr period. For example, if you ran the plant for 12

hours at 1 MGD, and 12 hours at 2 MGD, your total production would be 1.5 MG which is less than 2 MG maximum flow rate that occurred during that day.

Min UV Transmittance (%)

Treatment plants that use CDA reactors must use online analyzers to monitor and record the UVT of the water being treated by CDA reactors at least every 15 minutes. In situations in which the online analyzer is not measuring accurately, operators can collect grab samples at least once every 4 hours and measure the UVT of the water with a benchtop UVT analyzer. For each date, enter one of the following for each reactor:

- {Minimum UVT (as %)} recorded during the day if you collected either of the following:
 - All the required UVT data while the reactors were treating water.
 - Some of the required UVT data, and the data show there were UVT readings below the reactor's minimum validated UVT.
- {X} if the reactor was offline all day.
- {ND} if a reactor treated water on a specific day, but you failed to collect any UVT data.
- {MD} if you collected some, but not all of the required UVT data and the data is greater than the minimum validated UVT.

If you use a single UVT monitoring location for all of the reactors, you must enter the same value for each reactor. If there is more than one monitoring location, you must enter the applicable value for each individual reactor in the appropriate cells.

Minimum Meas'd UV Dose (mJ/cm²)

You must also continuously (i.e., every 15 minutes) record the UV dose provided by each reactor whenever it is treating water. For each date, enter one of the following for each reactor:

- {Lowest UV dose (in mJ/cm²)} recorded during the day if you collected either of the following:
 - All the required UV dose data while the reactors were treating water.
 - Some of the required UV dose data, and the data show all the readings were below the reactor's minimum validated UV dose.
- {X} if the reactor was offline all day.
- {ND} if a reactor treated water on a specific day, but you failed to collect any UV intensity data.
- {MD} if you collected some, but not all of the required UV dose data; and all of the data is greater than or equal to the dose required to meet your inactivation requirement.

A UV CDA reactor will receive reduced inactivation credit during periods when the actual UV dose was below the required UV dose.

Sensor CF CALC

The **UV CDA** worksheet automatically reports the sensor CF based on the data from the **UV Sensor** worksheet. Prior to the calibration date, the value is calculated using the previous month's CF. On and after the calibration date, the value is calculated from the new CF.

If the cell for a particular reactor specifies Sensor MD it means some of the data needed to calculate the sensor CF is missing. If this happens, go to the **UV Sensor Data** worksheet and enter the missing data for that reactor's sensors.

Adjusted Minimum UV Dose (mJ/cm²) CALC

The **UV CDA** worksheet automatically reports the Adjusted Minimum UV Dose based on the data entered in the **Minimum Measured UV Dose** cell and the **Sensor CF** cell.

The Adjusted Minimum UV Dose values are valid only when the reactor is operating within its validated operating conditions. If the reactor operates outside its validated conditions at any point during the day, its Adjusted Minimum UV Dose value is followed by an asterisk (*).

Total Off-Spec Production (MG)

The amount of off-spec water produced by a reactor cannot exceed the total amount of water it produces during the day. A reactor is off-spec when the one of the following occurs:

- Max Flow Rate is higher than the Max Validated Flow Rate of the reactor.
- Min UVT of the water is lower than the Min Validated UVT of the reactor.
- Adjusted Minimum UV Dose is below the Required UV Dose.

You cannot enter a nonzero value in this cell if the reactor was operating within validated conditions and provided the minimum required dose. For each date, enter one of the following for each reactor:

- {Amount of water (in MG)} produced by each reactor during periods each day when the reactor was operating off-spec.
- {X} if the reactor was offline all day.
- {0} or leave the cell blank if the reactor was continuously operated within its validated range and the Adjusted Minimum UV Dose was not less than the Required UV Dose.

Consecutive Off-Spec Hours (hr)

You must record the duration of any event when one or more of the reactors was operating off-spec as described in the previous section. An off-spec event begins when the first reactor begins producing off-spec water and ends when all the reactors are again simultaneously operating within validated conditions and meeting disinfection requirements. Enter one of the following responses in this cell.

- {Time (in hours)} of consecutive off-spec production. If this occurs more than once during the day, enter the duration of the longest consecutive period when the reactor was operating off-spec.
- {X} if the reactor was offline all day.
- {0} or leave the cell blank, if the reactor was continuously operated within its validated range and the Adjusted Min Intensity was not less than the Required UV Dose. You cannot enter a nonzero value in this cell.

UV Treatment Credit and Performance Summary CALC

At the end of each month, the **UV CDA** worksheet automatically reports both the daily inactivation credits achieved by the UV reactors as well as UV treatment performance.

Daily Minimum Inactivation Credit

Figure 5.32 shows a partial view (i.e., first 16 days of the month) of the **Daily Minimum Inactivation** table for a plant with three CDA reactors. The **Summary Data** section of the table is for the entire set (or range) of UV CDA reactors at your plant. The worksheet automatically indicates the entire range of reactors.

DAILY MINIMUM INACTIVATION											
Reactor Range	SUMMARY DATA					Reactor Range	SUMMARY DATA				
	Date	Min Dose (mJ/cm ²)	Inactivation Credit Achieved				Date	Min Dose (mJ/cm ²)	Min Inactivation		
			Giardia Log	Virus Log	Crypto Log				Giardia Log	Virus Log	Crypto Log
1 to 3	1					1 to 3	9				
	2						10				
	3						11				
	4						12				
	5						13				
	6						14				
	7						15				
	8						16				

Figure 5.32. Daily Minimum Inactivation Summary for the UV CDA

Minimum Dose (mJ/cm²) CALC

For each day, the worksheet searches for the minimum adjusted UV dose applied in all UV reactors based on the daily information you entered in the **Performance Data** table. It then automatically reports this value in the **Min Dose** cell.

Inactivation Credit Achieved CALC

The worksheet uses a series of mathematical equations to determine the levels of *Giardia*, viral, and *Cryptosporidium* inactivation achieved in each of the UV reactors for

each day. The worksheet then searches for the minimum inactivation level among all the UV reactors and automatically reports the minimum value in the **Giardia Log**, **Virus Log**, and **Crypto Log** columns.

Monthly Summary for All UV Reactors **CALC**

The **UVA CDA** worksheet automatically reports if your UV treatment met the performance criteria for the Crypto inactivation credit. This summary information shown in Figure 5.33 is located below the **Summary Data** section of the **Daily Minimum Inactivation** table. If you have both ISA and CDA reactors at your plant, this table will summarize data for both. The values in this table are updated daily based on the data you enter daily; however, the values at the end of the month are most important because those values use the entire months data set.

Total volume of water treated by all CDA reactors:	_____ MG	Raw water pumpage and total production by all UV reactors differ by more than 15% on these days:	<input type="text"/>
Total volume of off-spec water produced by all CDA reactors:	_____ MG		
Percentage of off-spec water produced by all CDA reactors:	_____ %		

Figure 5.33. Monthly Summary for All UV Reactors in the UV CDA Worksheet

Total Volume of Water Treated by UV Reactors **CALC**

The **UV CDA** worksheet automatically reports this value by summing the total production data for all reactors at the plant.

Total Volume of Off-spec Water Produced **CALC**

The **UV CDA** worksheet automatically reports this value by summing the total off-spec production data for the individual reactors.

Percentage of Off-spec Water **CALC**

The **UVA CDA** worksheet automatically reports this value by dividing the total off-spec production. data by the total production data.

Treated (or Raw) Water Pumpage and Total UV Production Differ by More than 15% on these Days **CALC**

The **UV CDA** worksheet automatically reports if there were any days when there was more than a 15% difference between the amount of water produced by the plant and the total amount of water that passed through all the UV reactors.

If your reactor is located upstream of the clearwell, this calculation is based on the amount of raw water pumped during the day on the **P.2 Turbidity Data** worksheet.

If your reactor is downstream from the clearwell, the calculation is based on the amount of treated water produced during the day.

If there were any days there was more than a 15% difference in the two values, they will be listed in this cell. If there were no days in which there was more than a 15% difference in the two values, then the worksheet reports the word None.

5.9 UVT Analyzer Worksheet

The **UVT Analyzer** worksheet is used to report the weekly calibration results, required for online UVT analyzers used for UV CDA reactors. The worksheet has space to enter data for up to 20 online analyzers with cells for 5 (i.e. weekly) calibration events per analyzer. As an example, Figure 5.34 shows the area for UVT analyzer No.1.

CALIBRATION DATA								
UVT Analyzer Number	Benchtop UVT Analyzer Serial Number:							
	Week	Calibration Date	On-line UVT Analyzer Serial #	On-line Reading (% UVT)	Grab Sample Reading (% UVT)	Difference (% UVT)	Recalibration Performed? (if Diff > 2%)	Other Action Taken
UVT No. 1	1							
	2							
	3							
	4							
	5							

Figure 5.34. UVT Analyzer Calibration Data for UVT No. 1

Calibration Data

Benchtop UVT Analyzer Serial Number

The calibration requirement discussed above requires a benchtop UVT analyzer. Enter the {serial number} of your laboratory benchtop UV analyzer. You don't need to include the entire serial number, just enough to identify it. Unless you have a new instrument put in service within the last month, this number should be the same as the previous month.

Calibration Date

Enter the {date} you perform each calibration.

Online UVT Analyzer Serial

Enter the {UVT analyzer serial number}. Again, you do not have to include the entire serial number, just enough to identify it. Unless you have a new instrument that was put in service within the last month, this number should also be the same as entered the previous month.

Online Reading (% UVT)

Enter the {%UVT reading} from the online UVT analyzer in the appropriate cell.

Grab Sample Reading (% UVT)

You are required to collect the grab samples for comparison to the online measurements from a location close to the online UVT analyzer sampling point. Enter the {%UVT} of the grab sample in the appropriate cell. *Note:* For the analysis, set the wavelength of benchtop spectrophotometer to 254 nm and use 1 cm cell.

Difference (% UVT) CALC

The worksheet calculates the difference between the %UVT readings from the online analyzer and the spectrophotometer, and automatically reports this value as a positive number).

If Recalibration Performed (Diff > 2% UVT)

For each UVT analyzer, use the drop-down list and select one of the following:

- [NA] if the value contained in the corresponding **Difference** cell is less than or equal to 2.00%.
- [YES] if the value contained in the corresponding **Difference** cell is greater than 2.00% and the online UVT analyzer has been recalibrated.
- [NO] if the value contained in the corresponding **Difference** cell is greater than 2.00% but the online UVT analyzer has not been recalibrated. In this case, you must enter information in the **Other Action Taken** column.

Other Action Taken

Select [NA] from the drop-down menu if the corresponding **Recalibration Performed** cell is either NA or YES.

Select one of the following from the drop-down list if the corresponding **Recalibration Performed** cell is NO:

- [Manual Sample] when you take manual UVT measurements with a calibrated benchtop spectrophotometer every 4 hours and enter the UVT into the UV reactor's program logic controller.
- [Daily verification] when you enter the design UVT value into the program logic controller and verify daily that the design UVT does not exceed the actual UVT with a grab sample.
- [None] when neither of the above two options are taken. If you select this operation, it means your UV facility is off-spec until one of the first two options is followed, or until the UVT analyzer meets the calibration criterion.

5.10 Prefilters Worksheet

The **Prefilters** worksheet is used to report the *Giardia* and *Cryptosporidium* log removal credit based on removal of turbidity or total hardness in prefiltration treatment systems. Prefiltration systems include presedimentation with coagulation; two-stage lime softening; and bank filtration. If your plant uses one of these approved systems for pathogen removal credit, the worksheet will be available. Select the tab to begin entering data.

The **Prefilters** worksheet has a **Performance Data** table and a **Summary** table for each prefiltration treatment method. It is unlikely that a PWS will have more than one method; but if so, tables will be visible for each type.

Presedimentation with Coagulation

We may approve up to 0.5 log *Cryptosporidium* removal credit for presedimentation if all of the following conditions apply:

- The basin treats 100% of the flow.
- Coagulant is added continuously during operation.
- There is a monthly mean turbidity reduction of 68% or greater.

Performance Data

Figure 5.35 shows the **Performance Data** section of the **Presedimentation with Coagulation** table.

<i>Presedimentation with Coagulation</i>				
PERFORMANCE DATA				
	100% of Plant Flow Treated?	Coagulant Added Prior to Basin	Presed Basin Influent Turbidity (NTU)	Presed Basin Effluent Turbidity (NTU)
Date	Yes/No	Yes/No	(NTU)	(NTU)
1				
2				

Figure 5.35. Presedimentation with Coagulation Performance Data Table

If 100% of Plant Flow Treated (Yes or No)

For each date, you must specify if 100% of the raw water was treated by the presedimentation basin.

Using the drop-down list, select [Yes] if 100% of the raw water passed through the basin; or [No] if, at any point in the day, some raw water bypassed the basin.

The worksheet automatically reports X if the plant did not treat any water on a given date.

If Coagulant Added Prior to Basin (Yes or No)

For each date, you must specify if coagulant was applied continuously upstream of the presedimentation basin.

Using the drop-down list, select [Yes] if coagulant was applied continuously to all raw water treated; or [No] if the coagulant was not added continuously.

The worksheet automatically reports X, if the plant did not treat any water on a given date.

Presed Basin Influent Turbidity (NTU)

If the presedimentation basin treated all of the raw water and operated under continuous coagulant addition for a given date, enter one of the following:

- {Raw water turbidity (in NTUs)}. If the raw water turbidity was tested multiple times, enter the average turbidity of all the readings.
- {ND} if the raw water turbidity was not tested at least once during the day.

Leave the cell blank, if 100% of the raw water was not treated or if coagulant addition was not continuous.

The worksheet automatically reports X, if the plant did not treat any water on a given day.

Presed Basin Effluent Turbidity (NTU)

If the presedimentation basin treated all of the raw water and was operated under continuous coagulant addition for a given date, enter one of the following responses:

- {Turbidity (in NTUs)} of the water leaving the presedimentation basin. If the effluent turbidity was tested multiple times, enter the average turbidity of all the readings.
- {ND} if the effluent turbidity was not tested at least once during the day.

Leave the cell blank, if 100% of the raw water was not treated or if coagulant addition was not continuous.

The worksheet automatically reports X if the plant did not treat any water on a given date.

Presedimentation Basin Summary and Credit Data

Figure 5.36 shows the **Presedimentation Basin Summary and Credit** table of the **Prefilters** worksheet.

PRESEDIMENTATION BASIN SUMMARY & CREDIT	Monthly Mean	
	Treatment Criteria & Credit	
	Did 100% of the water being treated pass through the presed basin?	
	Was coagulant continuously added upstream of the presed basin each day?	
	Did the plant achieve at least a 0.5-log of turbidity removal?	
<i>Giardia</i> and <i>Cryptosporidium</i> Log Removal Credit Allowed For Presedimentation		

Figure 5.36. Presedimentation Basin Summary and Credit Table

Monthly Mean **CALC**

The **Prefilters** worksheet automatically reports the monthly mean of the presedimentation basin influent and effluent turbidity data. This information is updated daily as each day's data is entered; however, the value at the end of the month is most important.

If 100% of the Water Being Treated Passed Through the Presed Basin
CALC

The worksheet automatically reports one of the following:

- YES if you specified in the **Performance Data** table on a given date that 100% of the raw water passed through the basin.
- NO if you reported some raw water bypassed the basin.
- X if the plant did not treat any water on a given date.

If Coagulant was Continuously Added to the Presedimentation Basin Each Day **CALC**

The worksheet automatically reports one of the following:

YES if you specified in the **Performance Data** table on a given date, that coagulant was continuously added upstream of the presedimentation basin during operation.

NO if you specified on any given date, that coagulant was not added continuously upstream of the presedimentation basin.

If the Plant Achieved at Least a 0.5-log of Turbidity Removal **CALC**

The worksheet calculates the log turbidity reduction between the monthly mean influent and effluent turbidity values; and automatically reports one of the following responses in this cell:

- YES if the calculated log reduction is greater than 0.5 (greater than 68% removal).
- NO if the calculated log reduction is less than 0.5
- NA, if the answer to either of the previous two questions is NO.
- Unknown, if either the monthly mean influent or the effluent turbidity values are missing.

If the worksheet reports either YES or NO, the calculated log removal value achieved will be reported in the bottom half of the cell.

Giardia and Cryptosporidium Log Removal Credit Allowed for Presedimentation **CALC**

To receive credit for pathogen removal using presedimentation basins, a plant must:

- treat 100% of the raw water with continuous coagulant addition; and,
- achieve a 0.5 log reduction of the monthly mean influent turbidity level.

The worksheet calculates the *Giardia* and *Cryptosporidium* log removal credit allowed for the month and automatically reports one of the following:

- 0.5, if all of the three previous cells are YES and the calculated value for the log removal is greater than or equal to 0.5.
- 0.5 Assumed, if the first two of those cells are YES and the third is Unknown. In other words, all the water passed through the presedimentation basin and was continuously dosed with coagulant, but the influent or effluent monthly average turbidity data is missing.
- Leaves blank if either of the cells for the first two questions (100% of the flow and coagulant addition) is blank. If this is the case, review the data to find the day where you forgot to enter the coagulant data.
- 0, in all other cases.

Two-stage Lime Softening

We may grant up to a 0.5 log *Cryptosporidium* removal credit for two-stage lime softening if chemical addition and hardness precipitation occur in both stages. To receive the LRC, 100% of plant flow must pass through the two-stage lime softening system.

Performance Data

Figure 5.37 shows the **Performance Data** section of the **Two-Stage Lime Softening** table.

<i>Two-Stage Lime Softening</i>					
PERFORMANCE DATA					
Date	100% of Plant Flow Treated? Yes/No	Chemical Added Each Stage? Yes/No	Total Hardness		
			Raw Water (mg/L)	Stage 1 Effluent (mg/L)	Stage 2 Effluent (mg/L)
1					
2					

Figure 5.37. Performance Data Table for Two-Stage Lime Softening

100% of Plant Flow Treated? (Yes or No)

For each date of the month, you must specify if 100% of the raw water was treated through the two-stage lime softening system.

Using the drop-down list, select [Yes] if 100% of the raw water passed through both stages. Select [No] if, at any point in the day, some raw water bypassed either stage or both stages.

The worksheet automatically reports X, if the plant did not treat any water on a given date.

Chemical Added to Each Stage? (Yes or No)

For each date of the month, you must also specify if the chemical(s), such as lime or soda ash, was applied to each stage.

Using the drop-down list, select [YES] if chemical was applied separately to both stages. Select [NO] if chemical was added to only one (or neither) stage.

The worksheet automatically reports X if the plant did not treat any water on a given date.

Total Hardness

If the two-stage softening system treated all of the raw water and both stages received chemical addition for a given date, enter one of the following in the applicable **Raw Water**, **Stage 1 Effluent**, and **Stage 2 Effluent** cells:

- {Total hardness as calcium carbonate (in mg/L)}. Enter the average hardness if total hardness was tested multiple times for any water during the day.
- {ND} if the total hardness was not tested at least once during the day for any water.

Leave the cell blank if any bypass occurred, or chemical addition did not occur in both stages (i.e., if the entry for either of the two cells to the left is NO).

The worksheet automatically reports X, if the plant did not treat any water on a given date.

Two-Stage Lime Softening Summary and Credit

Figure 5.38 shows the **Summary and Credit** section of the **Two-Stage Lime Softening** table.

TWO-STAGE LIME SOFTENING SUMMARY & CREDIT	Treatment Criteria & Credit	
	Did 100% of the water being treated pass through two softening stages?	
	Was lime or soda ash added at each stage each day?	
	Did Hardness removal occur in both stages of treatment each day?	
<i>Giardia</i> and <i>Cryptosporidium</i> Log Removal Credit Allowed For 2-Stage Softening		

Figure 5.38. Two-Stage Lime Softening Summary Table

If 100% of the Water Being Treated Passed Through Two Softening Stages **CALC**

The worksheet automatically reports one of the following:

- YES if you entered in the **Performance Data** table, that for each day of treatment, 100% of the raw water passed through the two-stage softening system.
- NO if you entered that some raw water bypassed all or part of the two-stage system.

If Lime or Soda Ash was Added at Each Stage Each Day **CALC**

The worksheet automatically reports one of the following:

- YES if you entered in the **Performance Data** table, that for each day of treatment, chemical was applied to both stages.
- NO if you entered that the chemical was only added to one (or neither) of the stages, the worksheet reports NO.

If Hardness Removal Occurred in Both Stages of Treatment Each Day **CALC**

The **PreFilters** worksheet automatically checks to ensure hardness reduction after each stage and automatically reports one of the following:

- YES if hardness removal occurred in both stages every day.

- NO if hardness removal did not occur in both stages every day.
- NA if the answer to either of the previous two questions is NO.
- Unknown if there is any missing data.

Giardia and Cryptosporidium Log Removal Credit Allowed for Two-Stage Softening **CALC**

To receive additional log removal credit using two-stage lime softening, a SWTP must pass 100% of the raw water through both stages; add chemical to each stage; and remove hardness in each stage.

The worksheet calculates the monthly *Giardia* and *Cryptosporidium* log removal credit and automatically reports one of the following:

- 0.5 if responses in all three previous cells are YES.
- 0.5 Assumed if the first two previous cells are YES and the third is Unknown. In other words, if all the water treated at the plant passed through the two-stage softening process and was continuously dosed with chemicals for softening; but some hardness data is missing.
- Left blank if any of the three previous cells is blank. If this is the case, review the data to find the day where you forgot to enter one or more data points.
- 0 in all other cases.

Bank Filtration

Bank filtration involves wells located near a surface water source, like a river, so that when water is pumped, it is filtered through the riverbank. To achieve *Cryptosporidium* log removal credit for this type of filtration, the wells that induce surface water infiltration through the bank must be monitored. To be eligible for log removal credit, the aquifer must be unconsolidated and contain 10% fines. In addition, the average turbidity from each pumping well must be less than 1.5 NTU. We may grant up to 0.5 log *Cryptosporidium* log removal credit if the wells are located at least 25 ft from the surface water source. We may grant up to 1.0 log *Cryptosporidium* log removal credit if the wells are located at least 50 ft from the surface water source.

Performance Data

Figure 5.39 shows the **Performance Data** section of the **Bank Filtration** table.

Bank Filtration				
PERFORMANCE DATA				
Date	100% of Plant Flow Treated? Yes/No	Bank Filter/Well No.		
		1	2	3
		Daily Max Turbidity (NTU)	Daily Max Turbidity (NTU)	Daily Max Turbidity (NTU)
1				
2				
3				
29				
30				
31				
Monthly Avg.				
Distance (ft)				
Credit				

Figure 5.39. Upper and Lower Portions of Performance Data Table for Blank Filtration

If 100% of Plant Flow was Treated (Yes or No)

For every date, you must specify if 100% of the raw water was treated through the bank filtration system. This question refers to the whole system, not to individual filters.

Using the drop-down list, select [YES] if 100% of the raw water passed through the bank filtration system. Select [NO] if, at any point in the day, some raw water bypassed the system. NO means some water was taken directly from the surface water source to the plant influent without passing through a bank filter wells

The worksheet automatically reports X if the plant did not treat any water on a given date

Daily Maximum Turbidity (NTU)

You must also collect and enter turbidity data for each bank filter well on any day that 100% of the water reaching the plant passed through one or more of the wells. The **Prefilter** worksheet allows you to enter turbidity data for up to 20 bank filters. The turbidity level of the water produced by each bank filter should be recorded at least ever four hours when the filter is in service.

If 100% of the water reaching the plant passed through bank filters, enter one of the following:

- {Maximum turbidity (in NTU)} for the day if either of the following applies:
 - Turbidity level of the water produced by the bank filter was measured at least once every four hours that the well was in service.

- Raw water turbidity was measured less than once every four hours but the highest NTU reading was 1.5 or higher.
- {MD} if you collected some but not all, of the required turbidity data for a given bank filter but all the readings were below 1.5 NTU.
- {ND} if you did not record the turbidity of the water produced by the bank filter at any time during the day.
- {X} if the bank filter was offline for the enter day.

Leave blank, if 100% of the water did not pass through the bank filters. The worksheet prevents you from entering any turbidity data for any of your wells if the bank filtration system is ineligible of removal credit that day.

The worksheet automatically reports an X for each of your bank filters if the plant did not treat any water on a given day.

Monthly Avg.

The **PreFilters** worksheet calculates the monthly average of the maximum daily NTU readings for each bank filter; and reports one of the following:

- X if every value in the **Daily Max Turbidity** cell for the month is X, meaning the plant treated no water that month.
- ND if there are no turbidity values reported for a given well.

Distance

Enter the {distance (in ft.)} of each well from the source surface water. For vertical wells, the distance to the surface water is measured from the 100-year flood elevation to the well head. For horizontal wells, the distance to the surface water is measured from the normal flow stream bed to the well head. Your approval letter documents this distance.

Credit

The **PreFilters** worksheet calculates the *Cryptosporidium* log removal credit the plant can claim for a bank filter or well, based on the maximum daily turbidity reading and the well distance from the source water. It automatically reports one of the following:

- 0 if for any day of the month, a well's turbidity reading exceeds 1.5 NTU.
- 0.5 if a well is between 25 and 50 ft from the source water, all required turbidity measurements were obtained, and all were below 1.5 NTU.
- 0.5A (for assumed) if some readings were not obtained, but all existing readings were below 1.5 NTU.
- if the well is greater than 50 ft from the source water, all required turbidity measurements were obtained, and all were below 1.5 NTU.
- 1.0A (for assumed) if some readings were not obtained, but all existing readings were below 1.5 NTU.

Bank Filtration Summary and Credit

Figure 5.40 shows the **Bank Filtration Summary and Credit** section of the **Bank Filtration** table.

BANK FILTRATION SUMMARY & CREDIT	Treatment Criteria & Credit	
	Did 100% of the water treated being treated pass through a bank filter?	
	Was the Monthly Average of max daily NTU readings for each filter below 1.5 NTU?	
	<i>Giardia</i> and <i>Cryptosporidium</i> Log Removal Credit Allowed For Bank Filtration	

Figure 5.40. Bank Filtration Summary and Credit Table

Did 100% of the Water Treated Pass through a Bank Filter? **CALC**

The worksheet automatically reports one of the following:

- YES if you entered in the **Performance Data** table that, for each day of treatment, 100% of the raw water passed through the bank filter system.
- NO if you entered on any day of the month, that some raw water bypassed the bank filter system.

If the Monthly Average of the Max Daily Turbidity Readings for Each Filter was Below 1.5 NTU **CALC**

The worksheet automatically checks the monthly average turbidity measurements of each well and reports one of the following:

- YES if the monthly average of all wells was under 1.5 NTU.
- NO if the monthly average turbidity reading for any well exceeded 1.5 NTU.
- Unknown if there is any missing data.

Giardia and Cryptosporidium Log Removal Credit Allowed for Bank Filtration **CALC**

To receive log removal credit for bank filtration, a SWTP must pass 100% of the raw water through the system; and the maximum monthly average turbidity for each pumping well must be below 1.5 NTU.

The worksheet calculates the monthly *Giardia* and *Cryptosporidium* log removal credit based on bank filtration performance; and automatically reports one of the following:

- The minimum log credit, if the previous two cells for the above questions are YES, and the entire plant receives the minimum log credit achieved by any of the wells. For example, if the **Performance Data** table shows that one well received 0.5 credit and other wells received 1.0 credit, the plant will receive an overall 0.5 log removal credit for bank filtration.
- 0 if either of the previous two cells for the above questions are NO.
- Leaves blank if the cells for either of the answers to the above two questions are blank.

5.11 Bag, Cartridge Worksheet

The **Bag, Cartridge** worksheet is used to enter performance data for bag or cartridge filter assemblies, or units, that are used to meet minimum treatment requirements. If your plant uses these types of filters for pathogen removal credit, this worksheet will be available. Select the worksheet tab to begin entering data.

Bag or Cartridge Filtration Performance Data

The **Performance Data** table contains three sections. The top section, shown in Figure 5.41, contains the following design information about the bag or cartridge filters:

- Whether the bags or cartridges are a primary treatment technology or a secondary treatment technology.
- How much LRC you can claim.
- What alternative monitoring requirements, if any, apply to each bag or cartridge assembly you use.

Bag/Cartridge Filtration															
PERFORMANCE DATA															
Primary/Secondary Treatment:		Primary				Approved Removal Credit for Bag/Cartridge Filters:				2.0					
Date	100% of Plant Flow Treated? (Yes/No)	Bag or Cartridge Number													
		1		2		3		4		5		6		7	
		Turbidity (NTU)	Other	Turbidity (NTU)	Other	Turbidity (NTU)	Other	Turbidity (NTU)	Other	Turbidity (NTU)	Other	Turbidity (NTU)	Other	Turbidity (NTU)	Other

Figure 5.41. Bag/Cartridge Filtration Performance Table

Before you enter any daily performance results for your bag or cartridge filters, verify the information in the next two sections is correct. If the information shown in the **Primary/Secondary Treatment** cell and the **Approved Removal Credit** cell does not match the information contained in your exception approval letter, close the workbook and recustomize it.

If your approval letter requires you to continuously monitor a parameter other than turbidity, enter the {performance limit} we set for each unit in the **Other** cell. If your approval letter requires you to continuously monitor turbidity, the worksheet will lock these cells.

Primary or Secondary Treatment CALC

The worksheet uses the information you provided when you customized your workbook to automatically report one of the following:

- Primary if all the water that passes through the bag and cartridge units does not also pass through another type of filter.
- Secondary if all the water that passes through the bag and cartridge units also passes through another type of filter.

Note: A cartridge filter provides secondary treatment if all of the water it filters has been coagulated and already passed through a granular media gravity or pressure filter. However, cartridge filters are also considered to be a secondary filtration technology if all the water that passes through the units is subsequently sent to a membrane filter for primary filtration.

Approved Removal Credit for Bag and Cartridge Filters CALC

The worksheet automatically reports the approved log removal credit based on information you entered when you customized your workbook.

Daily Data for Bag and Cartridge Filters

The middle section of the **Performance Data** table contains daily data for each bag or cartridge assembly. Figure 5.42 shows the data entry area for the first few days of the month for filter assemblies 1 and 2.

Date	100% of Plant Flow Treated? (Yes/No)	1		2	
		Turbidity (NTU)	Other	Turbidity (NTU)	Other
		1			
2					
3					
4					

Figure 5.42. Middle Section of Performance Data Table

If 100% of Plant Flow was Treated (Yes or No)

If you treated any water during the day, you must indicate whether all of the water was treated by bag or cartridge filters.

Using the drop-down list, select [YES] if all of the water that was treated during the day was filtered through a bag or cartridge filter. Select [NO] if any of the water you treated was not filtered through the approved bag or cartridge filtration processes.

The worksheet automatically reports X if the plant was offline for the entire day and you did not treat any water at all. You must enter data each day. Do not leave any of these cells blank.

Turbidity (NTU)

Most plants that use bag or cartridge filters as a primary filtration process must measure and record the turbidity of the water produced by each membrane unit at least once every 15 minutes whenever it is sending data to the clearwell.

Even if you use bag and cartridge filters as a secondary treatment process or have been allowed to continuously monitor another performance parameter, you must still measure the turbidity of the water produced by each bag or cartridge filter at least once each day.

Enter one of the following:

- {Daily maximum turbidity (in NTUs)} if either of the following applies:
 - There were any confirmed readings above 1.0 NTU during the day.
 - You recorded all required readings, and none was above 1.0 NTU.
- {X} if the unit was offline for the entire day and no water was sent to the clearwell.
- {ND} if the unit was used during the day, but you did not record any of the required turbidity data.
- {MD} if both of the following apply:
 - The unit was used during the day.
 - You recorded some, but not all, of the required turbidity readings; and all of the readings were 1.0 NTU or less.

Do not leave any of these cells blank.

Turbidity levels above 1.0 and 2.0 NTU in the water produced by an individual bag or cartridge filter are not treatment violations. However, they can trigger mandatory special studies if they are confirmed by consecutive readings. Consequently, these turbidity levels are known as trigger levels and the consecutive readings are referred to as confirmed readings. You should never report turbidity levels on your MOR above the trigger levels unless they are confirmed, or you fail to collect a confirmation reading. If you fail to collect a confirmation reading, you must assume the worst and report the unconfirmed turbidity readings.

Other

Most plants using bag or cartridge filters must continuously monitor the turbidity level of water produced by each filter unit or assembly. However, we do sometimes allow plants to continuously monitor an operational parameter other than turbidity. For example, we may allow you to monitor the pressure of the water at the inlet of each filter or the pressure drop that occurs when water passes through the filter.

If your approval letter allows you to continuously monitor an alternative parameter, enter the {approved alternative performance standard} for each assembly in the appropriate cell at the top of each **Other** column. You must also measure the approved parameter at least once every 15 minutes that the filter assembly is sending water to the clearwell and enter the {highest reading} of the day.

If your approval letter requires you to continuously monitor turbidity, you cannot monitor an alternative parameter and the **Bag and Cartridge** worksheet does not allow

Total Number of Days with Elevated Readings in last Three Months

For each bag/cartridge filter unit at the plant, the worksheet automatically reports the total number of days that you entered a turbidity reading above 1.0 NTU in the last three months.

Number of Days with Event(s) Above 2.0 NTU this Month

The worksheet automatically reports the number of days in the current month that you entered a turbidity reading above 2.0 NTU for any bag or cartridge filter.

Number of Days with Events Above 2.0 NTU last Month

Enter the {total number of days} in the past month that you reported a turbidity reading above 2.0 NTU. Do not leave this cell blank.

If the Filter or Plant has an Approved Corrective Action Plan

This cell is used to indicate whether the plant is in the process of implementing a TCEQ approved CAP. Do not these cells blank.

Using the drop-down list, select [Yes] for a specific filter if you are currently implementing either an individual filter or plant wide CAP which has TCEQ approval Select [No] if are not current implementing either type of CAP.

Note: An individual filter CAP is not TCEQ approved until the SWTP has completed a filter assessment; submits an FAR and schedule to us; and receives our approval in writing. A plant wide CAP is not TCEQ approved until the plant has participated in a CPE and we have finalized the CAP.

If the Plant is Required to Submit a Filter Profile Report

For each bag and cartridge filter at the plant, the **Bag and Cartridge** worksheet automatically reports YES or NO, indicating whether the plant is required to produce a filter profile on the filter and submit an FPR with its MOR.

Note: Unless a unit has an approved CA schedule that waives the additional monitoring requirements, you must either identify the cause of the exceedance or produce a filter profile each time the filter exceeds 1.0 NTU in two consecutive 15-min. readings at any time during the filter run.

If the Plant is Required to Submit a Filter Assessment Report

For each bag and cartridge filter at the plant, the worksheet reports YES or NO, indicating whether the plant is required to conduct a filter assessment on the unit and submit an FAR with its MOR.

Note: Unless the filter unit has an approved CA schedule that waives the additional monitoring requirements, you must conduct a filter assessment if you reported that a specific filter produced water with a turbidity level above 1.0 NTU on three or more separate occasions during the last three months.

If the Plant is Required to Submit a Request for Compliance CPE **CALC**

The worksheet automatically reports YES or NO, indicating whether the plant is required to participate in a third-party CPE and submit a Request for Compliance CPE with its MOR.

Note: Unless the plant has an approved CA schedule that waives the CPE requirement, the plant must participate in a third-party CPE each time a bag/cartridge unit or any combination of filter units exceeds 2.0 NTU in two consecutive 15-min. readings during the previous two months.

If 100% of the Daily Plant Flow was Treated Each Day **CALC**

The worksheet reviews the data in the **100% of Plant Flow Treated (Y/N)?** column to determine if the all the water treated during the month passed through the bag and cartridge filters. In this cell, the worksheet automatically reports one of the following:

- YES if all the cells in the **100% of Plant Flow Treated (Y/N)?** column have a YES response (i.e., all water produced each day passed through a bag or cartridge filter).
- NO if any of the cells in the **100% of Plant Flow Treated (Y/N)?** column has a NO response.

If the Max IFE Turbidity Reading was 1.0 NTU or lower each day **CALC**

The worksheet reviews the all the maximum daily turbidity entries to determine if any of the bag or cartridge filters produced water with a turbidity level greater than 1.0 NTU on any day. If all of the turbidity readings on the **Bag/Cartridge** worksheet are 1.0 NTU or lower, the worksheet automatically reports YES. If you reported any readings above 1.0 NTU, the worksheet reports NO.

Crypto Removal Credit Allowed this Month for Bag or Cartridge Filters **CALC**

The worksheet automatically reports data in this cell based on the answers to the previous two questions and information you entered during customization. If the answers to the previous two questions are both YES, the worksheet will give the plant log removal credit shown in the **Approved Removal Credit for Bag/Cartridge Filters** cell at the top of the **Performance Data** table.

5.12 Enhanced IFE Worksheet

The **Enhanced IFE** worksheet is used to report the *Giardia* and *Cryptosporidium* LRC based on the enhanced removal of turbidity in granular media filters. You will receive additional removal credit for operating with enhanced IFE performance if there are no readings over 0.3 NTU in any two consecutive measurements, and 95% of the IFE turbidity readings are less than 0.15 NTU.

If you selected enhanced filtration as a treatment technology when you customized your SWMOR workbook, this worksheet will be available. Select the worksheet tab to begin entering data.

Note: You can only claim credit for enhanced IFE performance if each granular media filter is equipped with an IFE turbidimeter, and turbidity data is recorded at least once every 15 minutes when the filter is sending water to the clearwell. Systems equipped with membrane filters are not able to receive this treatment credit.

Performance Data Table

Figure 5.44 shows a section of the **Performance Table** of the **Enhanced IFE** worksheet. There is one line for each filter and four parameters for each.

Optimized Individual Filter Effluent (IFE) Performance									
PERFORMANCE DATA									
Filter No.	Total No. of Readings	No. of Readings > or = 0.15 NTU	Percent of Readings > or = 0.15 NTU	No. of Confirmed Readings > 0.3 NTU	Filter No.	Total No. of Readings	No. of Readings > or = 0.15 NTU	Percent of Readings > or = 0.15 NTU	No. of Confirmed Readings > 0.3 NTU
1					26				
2					27				
3					28				
4					29				

Figure 5.44. Performance Data Table for Enhanced IFE Worksheet

Total Number of Readings

For each filter, enter the one of the following:

- {total number of 15-min. IFE turbidity readings} recorded for the month when the filter was sending water to the clearwell. If there were days when some, but not all the IFE data was recorded, enter the number of 15-min. IFE turbidity readings that were recorded.
- {X} If the filter was offline the whole month, and no readings were recorded.
- {ND} if the filter was used, but no IFE turbidimeter was installed; or you did not record the IFE data.

Number of Readings > or = to 0.15 NTU

For each filter, enter the one of the following:

- {Number of IFE turbidity readings equal to 0.15 NTU or higher}. (See note below.)

- {X} if the filter was offline the whole month.
- {ND} if the filter was used, but no IFE turbidimeter was installed; or you did not record the IFE data.

Note: The number you enter in this cell must be less than or equal to the total number of IFE turbidity readings you entered for that filter. Also, this number cannot be greater than zero unless the **P.3 Filter Data** worksheet has at least one day when the filter had a maximum daily reading of 0.15 NTU or higher; or, there was a day with missing data.

Percent of Readings > or = to 0.15 NTU CALC

The worksheet automatically reports the percentage of readings equal to, or greater than 0.15 NTU for each filter based on the values in the **Total No. of Readings** cell and the **No. of Readings > or = 0.15 NTU** cell.

If you entered X in the previous cells to indicate that the filter was offline, the worksheet automatically reports X in this cell. If either of the two previous cells has ND in it, the worksheet reports ND, because there is no data.

Number of Confirmed Readings Over 0.3 NTU

For each filter, enter one of the following:

- {Number of IFE turbidity readings} equal to 0.35 NTU or higher. (See note below.)
- {X} if the filter was offline the whole month{X}.
- {ND} if the filter was used, but no IFE turbidimeter was installed on it.

Note: The number you enter in this cell cannot be higher than the number of IFE turbidity readings greater than or equal to 0.15 NTU. Also, the value cannot be greater than zero, unless the **P.3 Filter Data** worksheet has at least one day with a maximum reading of 0.35 NTU or higher; or, has a day with missing data.

Summary Table

Figure 5.45 shows the **Summary** section of the **Enhanced IFE** worksheet.

Summary	Were more than 5% of the IFE readings from any of the filters above the 0.15 NTU performance criteria?		<i>Giardia and Cryptosporidium Log Removal Credit Allowed this Month For Enhanced IFE Performance</i>
	Did any of the filters have confirmed IFE readings above 0.3 NTU?		

Figure 5.45. Summary Table of the Enhanced IFE Worksheet

If More than 5% of the IFE Readings from any Filters above the 0.15 NTU Performance Criteria CALC

To receive log removal credit, no more that 5% of the IFE turbidity readings from each individual filter can be greater than or equal to 0.15 NTU. The worksheet automatically

calculates the percent of readings that meets this performance criteria and reports one of the following:

- NO if none of the filters had more than 5% above 0.15 NTU; or, all the filters produced water with at least 5% of the readings less than 0.15 NTU.
- YES if any filter had 5% or more readings over 0.15.
- Unknown, if data was missing, so that you entered ND in any of the cells above.

If the cell is blank, check to see if you made an error completing the **P.3 Filter Data** worksheet

If Any of the Filters have Confirmed IFE Readings Above 0.3 NTU

In order to receive log removal credit, a plant also cannot have any confirmed IFE turbidity readings greater than 0.3 NTU. This means that two consecutive 15-min. readings cannot exceed 0.3 NTU. The worksheet automatically determines and reports one of the following:

- YES if you reported that any of the filters had confirmed readings over 0.3 NTU.
- Unknown if there is any missing data.
- NO if your filters never exceeded 0.3 NTU in two consecutive readings during the month.

If the cell is blank, check to see if you made an error completing the **P.3 Filter Data** worksheet.

Giardia and *Cryptosporidium* Log Removal Credit Allowed this Month for Enhanced IFE Performance

The worksheet automatically reports the log removal credit allowed monthly for *Giardia* and *Cryptosporidium* based on enhanced IFE performance. As stated previously, to receive this credit, a plant cannot have any confirmed readings over 0.3 NTU; and, at least 95% of the readings must be less than 0.15 NTU.

If both answers to the previous two questions are NO, the worksheet automatically reports 1.0. Otherwise, it reports 0. If the cells for either of the answers to the two questions above are empty, the worksheet leaves this cell empty.

5.13 2nd Stage Filters Worksheet

This **2nd Stage Filters** worksheet is used for entering performance data for a second stage filter process used to meet minimum treatment requirements for pathogen removal credit. To qualify for this credit, the first stage filter must be preceded by a coagulation step and meet all of the requirements for IFE monitoring. If a plant has an approved second stage granular media filtration process in place, this worksheet will be available. Select the tab to begin entering data.

Performance Data Table

This worksheet contains only the **Performance Data** table shown in Figure 5.46.

Second Stage Filtration			
Performance Data			
Date	100% of Plant Flow Treated by 2nd Stage? (Yes/No)	Stage 1 Filter Performance Criteria Met? (Yes/No)	Giardia and Crypto Removal Credit Allowed
1			
2			
3			
4			
5			

Figure 5.46. Performance Data for the 2nd Stage Filter Worksheet

100% of Plant Flow Treated by 2nd Stage? (Yes or No)

Using the drop-down list, select [Yes] if all the flow treated by the plant on a specific day passed through the second stage filtration process. Select [NO] if some or all the flow treated by the plant on that day did not pass through the second stage filtration process.

Stage 1 Filter Performance Criteria Met? (Yes or No) CALC

This column automatically reports whether the flow entering the second stage filters meets the filtration criteria for the stage one filtration process. The worksheet reports this information based on the stage one filter performance data you entered on the **P.3 Filter Data** worksheet.

The worksheet automatically reports one of the following for each date in this column:

- X if the raw water pumpage for a day was zero.
- NO IFE>1.0 if the IFE turbidity for any of the stage 1 filters was greater than 1.0 NTU.
- MD if the Maximum IFE turbidity reading for any of the stage 1 filters was missing or not specified (i.e., MD or ND).
- YES if none of the above situations occurred.

Giardia and Crypto Removal Credit Allowed CALC

This column reports the *Giardia* and *Cryptosporidium* log removal credit allowed by using second stage filtration. The worksheet automatically calculates this information based on the values in the preceding two columns and automatically enters the following information for each date in this column:

- X if the plant did not treat any water at all.

- 0.5 if all water treated by your plant passed through second stage filtration and all the performance criteria attached with stage one filtration were met. This means your plant gets a log removal credit of 0.5 towards *Giardia* and *Cryptosporidium* removal due to your use of second stage filtration that day.
- 0.5 (Assumed) if all water treated by your plant passed through second stage filtration and it cannot be determined whether all the performance criteria attached with stage one filtration were met. This result means that, after review by TCEQ, your plant is likely to get a credit of 0.5 towards *Giardia* and *Cryptosporidium* removal due to your use of second stage filtration that day.
- 0 if one of the following applies:
 - All water treated by your plant passed through the second stage filtration process, but the performance criteria for stage one filtration were not met.
 - Some or all of the water treated by your plant did not pass through the second stage filtration process. This result means that your plant will not get any credit towards *Giardia* and *Cryptosporidium* removal for second stage filtration that day.