TCEQ Groundwater Operational Evaluation Report

PWS ID	PWS Name	Quarter	Year
TX		JANUARY-MARCH (Q1)	

Operational Evaluation Requirements

An Operational Evaluation assesses source water, treatment, and distribution system processes, and helps identify actions to decrease any high DBP levels and avoid a Maximum Contaminant Level (MCL) violation.

All community and non-transient, non-community public water systems (systems) on quarterly disinfectant biproducts (DBP) monitoring must calculate their Operational Evaluation Level (OEL) for both total trihalomethane (TTHM) and five regulated haloacetic acids (HAA5) at all DBP monitoring locations.

OEL

An OEL Exceedance occurs, if the calculated OEL for either TTHM or HAA5 at any sample site is over the MCL for that analyte. An OEL Exceedance prompts the system to complete an Operational Evaluation to prevent future DBP formation.

DBP MCLs and MCL Compliance

The MCLs for TTHM and HAA5 are 80 micrograms per liter (µg/L) and 60 µg/L, respectively. MCL compliance, determined by the Locational Running Annual Average (LRAA), uses four running quarters (Q) of results averaged for both TTHM and HAA5 at each monitoring location. If the LRAA is over the MCL, a system will receive an MCL violation for the analyte and will be required to post public notice.

OEL Calculation

Although both the OEL and the LRAA are both compared against the MCL, these two values are calculated differently. OEL is a projected average using TTHM and HAA5 results at each monitoring location. Results for the two previous quarters (PQ1 and PQ2) plus twice the current quarter (CQ) result divided by 4. The figure below uses TTHM results from one monitoring location to illustrate the difference between the LRAA and OEL calculations. In the example below, the calculated TTHM OEL of 86.5 µg/L (greater than 80 µg/L) would be an OEL exceedance.

Difference in DBP Formulas

3Q2021 LRAA

Q1: 4Q2020	56 µg/L	
Q2: 1Q2021	73 µg/L	
Q3: 2Q2021	67 µg/L	
Q4: 3Q2021	+103 µg/L	
	299/4	
LRAA:	74.75 µg/L	

3Q2021 OEL

PQ1: 1Q2021	73 µg/L	
PQ2: 2Q2021	67 µg/L	
CQ: **3Q2021**	**103** µg/L	
CQ: **3Q2021**	+**103** µg/L	
	346/4	
OEL:	**86.5** µg/L	

Operational Evaluation Report

A system triggering an Operational Evaluation must document the evaluation using the Operational Evaluation Report. The system must submit the report to TCEQ within **90 days** after the exceedance has been identified by either the system receiving DBP results from the lab or notification from TCEQ of the OEL exceedance, whichever comes first.

The OEL Exceedance is not a violation and does not require public notice. However, if the Operational Evaluation Report is not submitted within 90 days, the system is at risk of receiving Monitoring and Reporting (M/R) violations which do require public notice. If a M/R violation is issued, TCEQ mails a letter notifying your system of the violation. The letter includes an explanation of the violation, sample site where the violation occurred, public notice template, certificate of delivery, and TCEQ contact information.

General Instructions

The primary purpose of TCEQ Operational Evaluation Report forms is to walk systems through an Operational Evaluation for the different source types across Texas.

Please choose the report form that matches the system's **State Primary Source Water Type**. The Operational Evaluation Requirements[1] webpage has the reports available for download.

- TCEQ Surface Water (SW) and Groundwater Under the Influence of Surface Water (GUI) Operational Evaluation Report (TCEQ-20797a)
- TCEQ Groundwater (GW) Operational Evaluation Report (TCEQ-20797b)
- TCEQ Surface Water Purchase (SWP) and Groundwater Purchase (GWP) Operational Evaluation Report (TCEQ-20797c)

The Operational Evaluation Report documents an evaluation of treatment and distribution at the time of the OEL exceedance. The questions in the report capture information for the time of the OEL exceedance only. The Operational Evaluation Report does not list or evaluate all causes for DBP formation, so space is provided in each section for additional information.

- **Section I:** Monitoring Results Summary
- **Section II:** Source Water Evaluation
- **Section III:** Disinfectant and Treatment Process Evaluation
- **Section IV:** Distribution System
- **Section V:** Actions to Prevent Future Exceedances
- **Section VI:** Signature
- **Appendix A:** Potential Actions for DBP Mitigation

Submitting an Operational Evaluation Report

Use any of the following methods to submit an Operational Evaluation Report to TCEQ.

Mail	Email	Fax
TCEQ Drinking Water Standards Section MC-155 Attn: DBP PO Box 13087 Austin TX 78711-3087	DBP@tceq.texas.gov	512-239-6050

Additional Guidance

TCEQ's Operational Evaluation Report is adapted from EPA's OEL checklist. TCEQ strongly recommends reading the *EPA Stage 2 Disinfectants and Disinfection Byproducts Rule Operational Evaluation Guidance Manual*[2] before gathering information and evaluating your system. This manual includes technical information about completing the evaluation, and factors or actions that affect DBP formation. If you need assistance completing the evaluation or this form, contact the TCEQ DBP compliance coordinator at 512-239-4691 or DBP@tceq.texas.gov.

[1] www.tceq.texas.gov/drinkingwater/chemicals/dbp/DBP2_training.html
[2] nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1002YDW.txt

I. Monitoring Results Summary

Instructions: *The monitoring results summary section provides a table for systems to enter monitoring results to calculate the OEL for each sample location. The data to complete the summary are found in the lab results or [Texas Drinking Water Watch][3].*

- *In the **first column** enter the Sample Site ID for each location where an OEL exceedance occurred, for example DBP2-01. If an exceedance for both TTHM and HAA5 at the same location the site ID occurred, then the sample site should be listed twice, once for each analyte.*
- *In the **second column** enter the sample site address. Location must match what is listed in DWW.*
- *In the **third column** select the analyte abbreviation TTHM or HAA5 from the dropdown menu.*
- *In the **fourth, fifth, and sixth columns** enter the results for the samples collected in the two prior quarters and the sample result for the current quarter multiplied by two. TTHM/HAA5 in micrograms per liter (µg/L). When using the electronic version of this form, the OEL is automatically calculated when results are entered.*

Subsection A: What are the monitoring results?

Sample Site ID	Sample Site Address/Location	Analyte (TTHM or HAA5)	Previous Quarter 2 (µg/L)	Previous Quarter 1 (µg/L)	Current Quarter (µg/L)	Current Quarter (µg/L)	OEL (µg/L)
		TTHM				0	0
		TTHM				0	0
		TTHM				0	0
		TTHM				0	0
		HAA5				0	0
		HAA5				0	0
		HAA5				0	0
		HAA5				0	0

Subsection B: Past OEL Exceedances

In response to all the questions. Check either Yes or No and if question does is not apply to the system, click N/A. Some questions apply to all systems so N/A is unavailable.

1. Has an OEL exceedance occurred at any of the above locations previously?

   Yes ☐ No ☐

2. Was the cause of the previous OEL exceedance identified? *If yes, please explain in the space at the bottom of the page.*

   Yes ☐ No ☐ N/A ☐

3. Are any previous OEL reports applicable to the current OEL exceedance? *If yes, attach applicable OEL report(s).*

   Yes ☐ No ☐ N/A ☐

Use the space below to give details to any question in this section.

[3] dww2.tceq.texas.gov/DWW/

II. Source Water Evaluation

***Instructions**: In response to each question check the appropriate box or boxes and, if needed, provide any additional information in the text box at the end of the section. Please attach any supporting documentation.*

Subsection A: Sources of Water

1. What Source Water types does the water system use?

   Click the blank to enter the percent of water produced and/or purchased by each Source Water Type.

Source Water Type	**Percent Produced**	**Percent Purchased**
Groundwater (GW)	%	%
Surface Water (SW)	%	%
Groundwater Under the Influence of Surface Water (GUI)	%	%

2. Did the source change or was a new source brought online? Yes ☐ No ☐

   Note: Different water sources may have different Total Organic Carbon (TOC) levels depending on climate and watershed characteristics. Seasonal use of sources may impact TOC levels and DBP formation; adjustments may need to be made to the treatment process as a result. Adjusting to an intake located closer to the bottom of the body of water could introduce additional precursors that are not normally present nor accounted for in treatment.

Subsection B: Raw Water Monitoring Data

1. Which of the following monitoring data are available for the raw source water? *Check all that apply:*

   Temperature ☐ TOC ☐ Turbidity ☐ pH ☐
   Alkalinity ☐ Bromide ☐ Ammonia as Nitrogen ☐ No Data ☐

   Note: Collecting and evaluating raw water quality data and comparing to historical and finished (treated) data may help identify causes of DBP formation and actions that may be taken to minimize exceedances. Systems that do not currently monitor raw water quality may wish to incorporate the listed parameters into regular monitoring.

2. Was the raw water temperature higher than normal? Yes ☐ No ☐ N/A ☐

   Note: Water temperature may affect DBP formation. Low flow in rivers or lakes, extended raw water storage time, and/or decreased water usage can increase water temperature.

3. Were there any changes in the raw water pH? Yes ☐ No ☐ N/A ☐

   Note: Coagulation salts, which help remove DBP-forming TOC, and chlorine are sensitive to changes in pH. Additionally, at a higher pH, the system may need to use more chlorine to make up for the decrease in the disinfection power of chlorine at higher pH. However, increasing chlorine levels could increase DBP formation.

4. Was bromide present in the raw water? Yes ☐ No ☐ N/A ☐

   Note: Bromide is an inorganic DBP precursor that reacts with free chlorine and organic DBP precursors to form TTHM and HAA5. Bromine has also been shown to accelerate chloramine decay, causing disinfectant residual loss.

5. Were there any changes in the watershed? Yes ☐ No ☐

   Note: Watershed events such as heavy rain, drought, logging, fires, industrial spills, and lake/reservoir turnover can alter organic and inorganic matter levels in water sources impacting DBP formation.

Use the space below to give details to any question in this section.

III. Disinfection and Treatment Process Evaluation

Instructions: *In response to each question check the appropriate box and, if needed, provide any additional information in the text box at the end of the section. Please attach any supporting documentation.*

Subsection A: Analysis

1. Which of the following monitoring data are available for the finished (treated) water? *Check all that apply:*

   Temperature ☐ pH ☐ Alkalinity ☐ Bromide ☐ No Data ☐

   Note: Collecting and evaluating finished (treated) water quality data and comparing to historical and raw data may help identify causes of DBP formation and actions that may be taken to minimize exceedances. Systems that do not currently monitor water quality may wish to incorporate the listed parameters into regular monitoring.

2. Were any of the analysis results higher or lower than normal? Yes ☐ No ☐ N/A ☐

   Note: Systems may need to adjust treatment processes in response to water quality changes to avoid formation of DBPs.

3. After Reviewing VOC data, are there TTHMs present at the entry point? If yes, what is the concentration?

   Select Yes or No, if yes enter the concentration in the field provided: Yes ☐ No ☐ Conc. ☐

   Note: Volatile Organic Chemicals (VOCs) are monitored annually at the entry point for systems producing/treating surface water and contain the four analytes, bromoform, chloroform, dibromochloromethane, and bromodichloromethane. When added together, the analytes will give the TTHM level. This information can tell a system if the DBP formation is happening due to treatment (before the water enters the distribution) or in the distribution.

Subsection B: Disinfectant

1. What disinfectant was used during treatment at the time of the OEL exceedance?

   Check all that apply: Free Chlorine ☐ Chloramine ☐ Chlorine Dioxide ☐ Ozone ☐

2. If on chloramines what was the chlorine to ammonia ratio at the time of the OEL exceedance?

   Click the blank to enter the Chlorine to Ammonia ratio into the field provided, if using Free Chlorine select N/A. Ratio- ☐ : ☐ N/A ☐

   Note: Sustaining the proper chlorine to ammonia ratio to maintain monochloramine will help prevent producing di- or tri-chloramines which are more likely to produce DBPs. Maintaining monochloramines will also prevent Nitrification. The proper ratio depends on the system, but typically ranges from 4:1 to 5:1 chlorine to ammonia (as nitrogen). If the source water has ammonia present, it should be included in calculating the chlorine to ammonia (as nitrogen) ratio.

3. Were there any changes to the type of disinfectant used? Yes ☐ No ☐
4. Were there any changes to disinfection processes or failures? Yes ☐ No ☐
5. If using chloramine disinfection, does the system maintain a NAP? Yes ☐ No ☐ N/A ☐

   Note: Any system distributing chloraminated water must create a Nitrification Action Plan (NAP). Using the monitoring data collected for the NAP can indicate that monochloramines are being produced rather than dichloramines or trichloramines.

Subsection C: Treatment

1. Were there any other treatment process changes or failures? Yes ☐ No ☐

   Note: Certain treatment adjustments could affect DBP formation, like pH adjustments. If the system utilizes reverse osmosis, a failure of the equipment could lead to an increase of bromides which in turn will lead to an increase in brominated DBPs.

2. Is an aeration system installed in the treatment plant? Yes ☐ No ☐

   Note: Aeration has been found to reduce chloroform but is not as effective for removing the brominated TTHMs. Aeration does not remove any of the HAA5s, as they are acids and are not volatile.

3. Are there any malfunctions in the aeration equipment? Yes ☐ No ☐ N/A ☐

Use the space below to give details to any question in this section.

IV. Distribution System

Instructions: *In response to each question, check either Yes or No. If the question does not apply to the system, click N/A. Some questions apply to all systems so N/A is unavailable.*

Subsection A: Distribution Disinfection

1. What disinfectant was used in the distribution system during the time of OEL Exceedance?
   Check all that apply: Free Chlorine ☐ Chloramine ☐
2. Are different disinfectants blending in the distribution? Yes ☐ No ☐
   Note: Different types of disinfectants interacting in the distribution lines could create dichloramine and trichloramine which are typically accompanied with DBP formation.
3. Is the disinfectant being boosted in the distribution? Yes ☐ No ☐
   Note: Booster disinfection is any addition of a disinfectant to previously treated water to maintain an adequate disinfectant residual throughout the distribution system. This includes disinfectant added to treated purchased water. If the system is boosting their chloramines, adding chlorine upstream of ammonia can inadvertently lower total chlorine residuals and produce di and trichloramines in the process, which can result in DBP production. The order of chemical injection when booster disinfecting chloraminated water should be ammonia upstream of chlorine.
4. Are there monitoring locations before and after booster disinfection? Yes ☐ No ☐ N/A ☐
   Note: To effectively booster disinfectant, free chlorine and/or total chlorine must be measured to add the correct amount of chemical. Adding too much chlorine can increase DBP, dichloramine, or trichloramine formation. Adding too much ammonia can increase chances of nitrification. Disinfectant levels should be monitored before and after booster disinfection to ensure residuals are as expected and within range of TCEQ requirements.

Subsection B: Storage Tanks

1. Are there storage tanks located upstream of the OEL exceedance? Yes ☐ No ☐
   Note: Tank circulation, turnover, maintenance records, and drawdown level should be evaluated. Storage tanks may contain stagnant zones which may be high in DBPs.
2. Is the freshest water the first to be drained from the storage tank? Yes ☐ No ☐ N/A ☐
   Some storage tanks use the same line for filling and draining. This can result in short-circuiting as fresh water enters the tank and quickly exits leaving older water behind. Additionally, some tanks are poorly designed with fill and suction lines in close proximity allowing fresh water to enter and exit quickly. Baffling walls/curtains, mixers and fill and suction line alterations are the most common remedies for poor design.
3. Was there any sediment in the storage tanks? Yes ☐ No ☐ N/A ☐
   Note: Sediment at the bottom of the tank can harbor pathogens and may be high in DBP precursors.
4. Are any of the storage tanks oversized? Yes ☐ No ☐ N/A ☐

Note: Storage of significantly more water than normal water use may lead to high water age due to low water turnover. Aged water in the tank may cause increased DBP levels.

5. Does adequate mixing occur in the storage tanks? Yes ☐ No ☐ N/A ☐

Oversized inlet piping can lead to low flow rates, resulting in improper mixing. In-tank mixing may reduce DBP formation.

6. Is an aeration system installed in the distribution storage tanks? Yes ☐ No ☐ N/A ☐

Aeration has been found to reduce chloroform but is not as effective for removing the brominated TTHMs. Aeration does not remove any of the HAA5s, as they are acids and are not volatile.

7. Are there any malfunctions in the distribution aeration equipment? Yes ☐ No ☐ N/A ☐
8. Has any recent maintenance occurred on the storage tanks? Yes ☐ No ☐ N/A ☐

Subsection C: Water Use

1. Was the overall water use in the system lower than normal? Yes ☐ No ☐
   Note: Low water demand may increase water age in the distribution system.
2. Are there any dead-end mains near the OEL exceedance(s)? Yes ☐ No ☐
   Note: Dead-end piping leads to increased water age and sediment accumulation which may result in increased DBP formation.

Subsection D: Temperature, Disinfectant Residual Levels, and pH

Note: Temperature, disinfectant residual and pH are taken by the TCEQ samplers during sample collection and is available to view on DWW under the link "Other Chemical Results".

1. Was the water temperature higher than normal? Yes ☐ No ☐

   Note: The rate of reaction between disinfectants and DBP precursors increases as water temperature increases. As a result, TTHM and HAA5 concentrations may increase with increasing temperature.

2. Was the disinfectant residual higher or lower than normal? Yes ☐ No ☐

   Note: High chlorine residuals may indicate an increase in chlorine feed rates, which could increase DBP formation. Low residuals may indicate higher chlorine demand due to increased levels of DBP precursors or higher water age.

3. Was the pH higher or lower than normal? Yes ☐ No ☐

   Note: HAA5 formation increases at lower pH while TTHM formation increases at higher pH. Also, at higher pH, the disinfecting power of free chlorine decreases. If using chloramines, experiencing lower pH than normal in the distribution system can indicate nitrification is occurring because of nitrifying bacteria naturally suppress pH.

Subsection E: Flushing

1. Does the system maintain a routine monthly flushing program? Yes ☐ No ☐

   Note: Public water systems are required to flush dead end mains at least monthly. Flushing reduces water age and helps maintain disinfectant residual levels.

2. Was it more than 10 days since the last flush when the OEL was recorded? Yes ☐ No ☐

Subsection F: Repairs and Maintenance

1. Were there any line breaks near the OEL exceedance(s)? Yes ☐ No ☐

   Note: When line breaks occur, older water in the distribution system or organic sediments can be drawn into high use areas because of flow pattern changes. Aged water may have higher DBP levels, while organic sediment contain DBP precursors which when disinfected using high chlorine levels may result in elevated DBPs.

2. Does the system perform routine free chlorine conversions? Yes ☐ No ☐ N/A ☐

   Note: Systems using chloramines must create and follow a NAP, to prevent the degradation of drinking water quality in the distribution system. The NAP helps water systems identify the early warning signs of nitrification.

3. Was a free chlorine conversion performed within 15 days of the OEL exceedance? Yes ☐ No ☐ N/A ☐

   Note: High chlorine levels present during a chlorine conversion may increase DBP formation. Systems should notify TCEQ before conducting a chlorine conversion to delay DBP sampling by emailing DBP@tceq.texas.gov.

Subsection G: Customer Complaints

1. Did the system receive any customer complaints during the quarter the OEL exceedance was recorded? Yes ☐ No ☐

   Note: Customer complaints of low pressure may indicate that water age is increasing or if there is a line break allowing sediments to enter the distribution system. Customer complaints of color and/or odor may indicate pipe scaling or sediment, which may contain DBP precursors. In a chloraminated system, odor could indicate the formation of dichloramine or trichloramine which are typically accompanied by DBP formation.

Use the space below to give details to any question in this section.

V. Actions to Prevent Future Exceedances

Background: Based on information gathered and evaluated in previous sections, identify actions the system has implemented or will implement to reduce DBP formation. If needed, **a list of potential actions a system** can take are in Appendix A. Additional information on these actions can be found in the *EPA Stage 2 Disinfectants and Disinfection Byproducts Rule Operational Evaluation Guidance Manual*. Systems that purchase water may choose to work with their provider to identify a strategy for minimizing DBP formation.

Instructions: *Click the blank boxes to enter actions the system may complete or has completed to reduce future exceedances, in one or more of the sections. If no action is planned for a section, please mark N/A.* ***There must be at least one action listed on this page for the report to be considered complete.***

Subsection A. Source Water Management

Please enter the action the system has taken or plans to take for pre-treatment.

Water System Actions	N/A
	☐

Subsection B. Treatment Operations

Please enter the action the system has taken or plans to take for treatment operations.

Water System Actions	N/A
	☐

Subsection C. Distribution System Operations

Please enter the action the system has taken or plans to take for distribution system operations.

Water System Actions	N/A
	☐

Subsection D: TCEQ Assistance

Would the system benefit from Financial, Managerial or Technical assistance for assistance with DBP mitigation, disinfection, or other support? Yes ☐ No ☐

Note: TCEQ assistance is free and available to all public water systems.

Use the space below to give details to any action mentioned in this section.

VI. Signature Page

Once all pages have been completed and reviewed, please attach any supporting documentation. Use the space below to provide additional information. Please fill in the requested information and provide a signature at the bottom of the page.

Use the space below to provide any additional information not covered in the above sections/pages.

I,___________________________, prepared and reviewed this Operational Evaluation Report and the provided information is true and correct to the best of my knowledge.

Signature:

Date:

Title:

Phone:

Email:

Appendix A. Potential Actions for DBP Mitigation

Subsection A. Source Water Management

1. Blending multiple sources water can lower DBP precursors. To determine blending ratio, review the water quality characteristics such as organic content, temperature, pH, corrosion potential, etc...
2. Monitoring source water quality can identify changes in water quality conditions that may impact DBP levels and organic content removal. Helpful parameters to monitor include TOC, SUVA, temperature, bromide, alkalinity, pH and turbidity. Treatment processes may need to be adjusted based on changes in the source water.
3. Changing water sources seasonally can help avoid issues such as temperature changes, algal blooms, and turnover that could significantly increase DBP formation.
4. Reduce DBP precursor levels through watershed management. This can help reduce organic content in the source water. Sources of organic matter will need to be identified and cooperation from local officials will be needed. Groups that could assist include soil and water conservation districts, conservation groups, farming organizations, fish and game commissions, and officials from local municipalities.

Subsection B. Treatment Operations

1. Optimize treatment process by enhanced coagulation, enhanced softening, settling, filtration, and/or pH adjustment. Optimizing treatment processes can increase removal of DBP precursors and decrease levels of chlorine.
2. Install sample taps on the influent and effluent of each treatment unit and/or storage tank to enable profile sampling in each stage of treatment. Profile sampling can help identify where DBPS are forming.
3. Use alternative pre-oxidants as switching oxidants may increase or decrease DBP levels. Potassium permanganate does not form DBPs, free chlorine may increase DBPs, and chlorine dioxide may decrease DBPs.
4. Adjust treatment seasonally based on temperature and precursor levels. Temperature and chlorine dosage increasing and changes in NOM characteristics could all affect DBP formation.
5. Adjusting disinfectant dosage or moving the point of injection can decrease the amount of DBPs that form in distribution. Additionally, adjusting plant flow to track system demand to reduce free chlorine contact time.
6. Using aeration to strip finished water of chloroform as it is the most volatile of the TTHM constituents. HAA5s are acids and are not efficiently removed by aeration. Aeration also mixes the water in storage tanks to reduce stratifications.
7. Switch to chloramines for secondary disinfection. When used appropriately, chloramines form significantly less regulated DBPs than free chlorine, especially if bromide is present in the source water.

Subsection C. Distribution System Operations

1. Actions to improve water quality in storage tanks include increasing the amount of water flowing into and out of a tank, optimizing inlet pipe location and orientation, decreasing residence time, improving maintenance, removing sediment, and/or identifying the excess capacity.
2. Physical improvements to the distribution such as looping dead ends, installing blow-offs at dead ends or stagnant zones, and replacing oversize mains. Water distribution models can be an effective tool to determine water residence time in distribution system pipes. Creating a comprehensive valve inventory includes locating and verifying valve position can also prevent any issues that could lead to increased DBP formation.
3. Reduce disinfectant demand by replacing, cleaning, or lining pipes as well as periodic free chlorine conversions. The use of booster disinfection may allow the system to use a lower chlorine dosage at the treatment plant. Aging pipes can exert high disinfection demand due to the presence of corrosion byproducts, biofilms, and sediment deposits.
4. Optimizing the monthly flushing program as flushing can help control DBP levels by purging stagnant water to reduce water age and clean pipes that exert chlorine demand. Conventional flushing removes water by opening hydrants in the affected area. Unidirectional flushing involves closing valves and opening hydrants in a specific sequence to increase water velocity which will scour the pipe and remove biofilm and any debris attached to the pipe.