# Disinfection By-Products Troubleshooting Guide

| Troubleshooting Guide #1 - DBP - Water Distribution System Contributors | | | |
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| **Observation** | **Probable Cause** | **Check** | **Remedy** |
| DBP Significant Excursion occurs in **Distribution System** at select points<br>▪ Free/Combined CL Residual | ▪ Water age is excessive allowing reaction between free chlorine & TOC. | ▪ Determine water age in water distribution system. | 1. Initiate corrective flushing program.<br>2. Install automatic flush valves |
| DBP Significant Excursion are occurring in Distribution System following long period of E**xtended Hot Weather**.<br>▪ Free/Combined CL Residual<br>▪ HPC | ▪ Biogrowth in distribution system is concentrating organic materials that are reacting with free chlorine. | ▪ Check for chorine residual.<br>▪ Determine Free Chlorine potion of total chlorine (> 80%)<br>▪ Perform HPC. | 1. Increase flushing frequencies.<br>2. Superchlorination may be needed followed by change to chloramines as disinfectant.. |
| DBP Significant Excursion occur in isolated areas of **Low Flow or in Areas with Dead End Pipelines.**<br>▪ Free/Combined CL Residual<br>▪ HPC<br>▪ System Pressure Analysis<br>▪ Water Age Calculations | ▪ Biogrowth in distribution system is concentrating organic materials that are reacting with free chlorine producing DBPs.<br>▪ Pipelines are experiencing tuberculation.<br>▪ System valves are closed increasing water age in some isolated pipelines. | ▪ Check for chorine residual.<br>▪ Determine Free Chlorine potion of total chlorine (> 80%)<br>▪ Perform HPC.<br>▪ Perform system pressure test | 1. Increase flushing frequencies.<br>2. Superchlorination may be needed followed by change to chloramines as disinfectant.<br>3. Ensure that all system valves are open.<br>4. May need to pig lines to restore hydraulic efficiency. |
| DBP Significant Excursion occur in isolated areas of **Near Water Storage Tanks.**<br>▪ Free/Combined CL Residual<br>▪ HPC<br>▪ Water Age Calculations<br>▪ Water Tank Temperatures.<br>▪ Water Tank Levels<br>▪ Tank Fill & Turnover Calcs | ▪ Sediment accumulations in water storage tank is concentrating organic material & reacting with free chlorine producing DBPs.<br>▪ Stratification & turnover of stagnant water in tank has occurred.<br>▪ Changes in tank levels have occurred because of hydraulic demands. | ▪ Check maintenance records for last sediment removal.<br>▪ Check tank temperatures for water stratification.<br>▪ Perform tank fill & turnover calculations. | 1. Ensure that tank is properly filling & emptying & that no stratification is occurring; tank levels should be changing daily with at least 2/3 of tank water changing over. |
| DBP Significant Excursion occurs after **Maintenance, Repair or Start Up of Distribution Pipelines**.<br>▪ Free/Combined CL Residual<br>▪ Flushing Frequency & Locations | ▪ Flow patterns have been disrupted &/or sediment transported.<br>▪ Excess chlorine has entered water system following repair or startup. | ▪ Check maintenance records for last water main repairs or new main startup.<br>▪ Check to ensure that system valves are in open position. | 1. Re-institute flushing in affected areas. |

# Disinfection By-Products Troubleshooting Guide

| Troubleshooting Guide #2 - DBP - Process Upsets in Water Treatment Plant | | | |
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| **Observation** | **Probable Cause** | **Check** | **Remedy** |
| DBP Significant Excursion is noticed following changes in **Chlorination Practices**.<br><br>▪ Total & Free Chlorine Residuals<br>▪ Temp, pH, Turbidity & TOC | ▪ Changes in dosing at a plant location is producing higher levels of DBPs.<br>▪ Chlorine dose is too high for conditions. | ▪ Check Bromide levels in Source Water.<br>▪ Perform water quality checks, i.e. temperature, pH, turbidity, reducing inorganic agents & for TOC increases. | 1. Plot chlorine demand curve & reset dosage to achieve desired residual.<br>2. Adjust chlorine dose based on pH. |
| **Prechlorination** has been initiated to control tastes or odors.<br><br>▪ Free Chlorine Dose/Residual | ▪ Prechlorination is causing premature DBP reactions prior to removal of TOC. | ▪ Determine DBP formation potential. | 1. Move point of chlorine application. |
| DBP Significant Excursion noticed with Changes in **Chlorine Residual** in plant processes with no chlorine dose increases<br><br>▪ Free Chlorine Residual<br>▪ Ph, TOC, Turbidity<br>▪ Flow Rate<br>▪ Detention Times in Basins | ▪ Source water quality has changed.<br>▪ Plant flow has significantly changed, decreasing detention<br>▪ detention times through plant facilities.<br>▪ pH has changed resulting in more reactive disinfectant | ▪ Determine source water quality.<br>▪ Check for equipment failures, chlorine feed calibration & for improper chlorine feed rates.<br>▪ Chlorine feed rates are not being flow paced. | 1. Decrease chlorine feed to establish necessary in-plant residuals<br>2. Repair &/or recalibrate equipment.<br>3. Calibrate chlorine monitoring equipment, including hand held test equipment. |
| DBP Significant Excursion noticed combined with upset in **Sedimentation Basin**<br><br>▪ Sludge Blanket Depth<br>▪ Clarifier Effluent Turbidity<br>▪ Flow Rate<br>▪ Weir Conditions for Short Circuiting<br>▪ Velocity Currents | ▪ Excess sludge build up in settling basin causing resolublization of organics.<br>▪ Carry over of organic solids has occurred & is combining with chlorine forming DBPs.<br>▪ Higher flow has decreased the amount of organics removed in the sedimentation tank, | ▪ Check current sludge blanket levels & previous records to determine if carryover has occurred.<br>▪ Check hydraulic loading rates to clarifier to determine if short circuiting has occurred<br>▪ Check weirs for solids carryover. | 1. Lower sludge blanket levels in the sedimentation tank.<br>2. Clean weirs as needed.<br>3. Ensure that baffles are in place & properly set. |

# Disinfection By-Products Troubleshooting Guide

| Troubleshooting Guide #2 - DBP - Process Upsets in Water Treatment Plant (continued) | | | |
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| **Observation** | **Probable Cause** | **Check** | **Remedy** |
| DBP Significant Excursion noticed with **Filter Performance** problem<br><br>▪ Filter Effluent Turbidity<br>▪ Chlorine Residual in Filters<br>▪ Filter Turbidity Spikes following backwash<br>▪ Filter Loading rates & duration<br>▪ Length of Filter Runs<br>▪ GAC EBCT & TOC removal efficiency | ▪ There has been a turbidity or colloidal breakthrough associated with longer filter run(s) or backwash return.<br>▪ High chlorine residual was retained in filters for an extended period.<br>▪ Filters were significantly overloaded by higher flow rates.<br>▪ GAC filter adsorptive capacity is exhausted. | ▪ Check length of filters runs, turbidity & head loss at backwash.<br>▪ Check Coagulation & Flocculation Process.<br>▪ Check Sedimentation operation.<br>▪ Check for hydraulic filter overloading<br>▪ A filter has been taken off-line causing others to run at too high a rate.<br>▪ Chlorine is being added ahead of GAC filter | 1. Verify proper backwash & headloss operation, adjust Backwash Cycle as needed.<br>2. Make prefilter process control adjustments as required. |
| DBP are higher coming out of **Clearwell**<br><br>▪ Flow Rate<br>▪ Detention Time in Clearwell<br>▪ Continuous Plant (not batch) operation.<br>▪ TOC or Turbidity increases out of clearwell | ▪ There are dead zones in the clearwell.<br>▪ There is excessive sediment in clearwell. | ▪ Check hydraulic detention time in clearwell.<br>▪ Check maintenance records for last sediment removal. | 1. Reduce storage volume<br>2. Clean sediment from clearwell |
| DBP are higher following **Maintenance** activities<br><br>• Residual Chlorine Levels at select points in distribution system | • Flow patterns or retention times have been disrupted<br>• Sediment has been re-transported into treatment processes. | • Check Maintenance Records | 1. Re-establish proper equipment operation. |

# Disinfection By-Products Troubleshooting Guide

| Troubleshooting Guide #3 - DBP - Source Water Changes | | | |
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| **Observation / Metric** | **Probable Cause** | **Check** | **Remedy** |
| DBP Significant Excursion & increase in TOC in Source Water following **Wet Weather**.<br><br>▪ TOC, SUVA<br>▪ PH, Alkalinity<br>▪ Flow Rate<br>▪ Temperature<br>▪ Turbidity | ▪ Heavy Rainfall, flooding, or algae bloom.<br>▪ Source Water turnover.<br>▪ Surface water is intruding into groundwater supply. | ▪ Rainfall, reservoir level or flow increases.<br>▪ Temperature changes that cause water stratification mixing,<br>▪ For high seasonal temperatures causing upwelling of organic materials<br>▪ Alkalinity & pH. | 1. Run jar test for coagulant changes or for enhanced coagulation to reduce incoming TOC.<br>2. Identify alkalinity & pH changes for possible adjustment.<br>3. Perform more frequent TOC monitoring & initiate removal actions. |
| DBP Significant Excursion & some increase in TOC in Source Water following **Dry Weather** event<br><br>▪ Bromide Concentration<br>▪ TOC<br>▪ PH, Alkalinity & TDS<br>▪ Temperature<br>▪ Flow Rate/Detention Times<br>▪ Turbidity | ▪ Brackish water Intrusion.<br>▪ Ground Water quality changes due to aquifer water level decline | ▪ Check Bromide levels in Source Water.<br>▪ 2. Perform water quality checks, i.e. temperature, pH, turbidity, reducing inorganic agents & for TOC increases. | 1. Run jar test for coagulant changes or for enhanced coagulation to reduce incoming TOC.<br>2. Identify alkalinity & pH changes for possible adjustment. |
| DBP Significant Excursion after **Source Water Supply Changes** incorporated.<br><br>▪ TOC, SUVA,<br>▪ pH & Temperature | ▪ Source water supplies have different levels of TOC. | ▪ Determine water quality from source water points. | 1. Adjust coagulant dosage based on jar test.<br>2. Move to other source water feed points |