

# WOODINVILLE WATER DISTRICT'S



# WATER QUALITY REGULATORY COMPLIANCE HANDBOOK

# WOODINVILLE WATER DISTRICT



## DISINFECTION/DISINFECTION BYPRODUCT RULE STAGE 1 MONITORING PLAN

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Part 4 - Water Quality

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# Section I

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## **OVERVIEW IF DISINFECTANTS AND DISINFECTION BYPRODUCT RULE (D/DBP)**

### **1.1 Background on the Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBP Rule)**

In the past 25 years, the Safe Drinking Water Act (SDWA) has effectively protected public health, and evolved to respond to new and emerging threats to safe drinking water. Disinfection of drinking water is one of the major public health advances in the 20th century. One hundred years ago, typhoid and cholera epidemics were common through American cities; disinfection was a major factor in reducing these epidemics. However, the disinfectants themselves can react with naturally occurring materials in the water to form unintended byproducts which may pose health risks. In addition, in the past ten years, we have learned that there are specific microbial pathogens, such as *Cryptosporidium*, which can cause illness and are resistant to traditional disinfection practices.

Amendments to the SDWA in 1996 require EPA to develop rules to balance the risks between microbial pathogens and disinfection byproducts (DBP's). It is important to strengthen protection against microbial contaminants, especially *Cryptosporidium*, and at the same time, reduce potential health risks of DBP's. The Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBP Rule) and Interim Enhanced Surface Water Treatment Rule (IESWTR), announced in December 1998, are the first of a set of rules under the 1996 SDWA Amendments. This fact sheet focuses on the Stage 1 D/DBP Rule (Disinfectants and Disinfection Byproducts Rule). A separate fact sheet focuses on the Interim Enhanced Surface Water Treatment Rule (EPA 815-F-98-009).

## **1.2 Public Health Concerns**

While disinfectants are effective in controlling many microorganisms, they react with natural organic and inorganic matter in source water and distribution systems to form DBP's. Results from toxicology studies have shown several DBP's (e.g., bromodichloromethane, bromoform, chloroform, dichloroacetic acid, and bromate) to be carcinogenic in laboratory animals. Other DBP's (e.g., chlorite, bromodichloromethane, and certain haloacetic acids) have also been shown to cause adverse reproductive or developmental effects in laboratory animals. Several epidemiology studies have suggested a weak association between certain cancers (e.g., bladder) or reproductive and developmental effects, and exposure to chlorinated surface water. More than 200 million people consume water that has been disinfected. Because of the large population exposed, health risks associated with DBP's, even if small, need to be taken seriously.

## **1.3 Who must comply with the Rule?**

The Stage 1 Disinfectants and Disinfection Byproducts Rule applies to all community and nontransient noncommunity water systems that treat their water with a chemical disinfectant for either primary or residual treatment.

## **1.4 What does the Rule require?**

### **1.5**

The Stage 1 Disinfectant and Disinfection Byproduct Rule updates and supersedes the 1979 regulations for total trihalomethanes. In addition, it will reduce exposure to three disinfectants and many disinfection byproducts. The rule establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three chemical disinfectants - chlorine, chloramine and chlorine dioxide (see Table 1). It also establishes maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for total trihalomethanes, haloacetic acids, chlorite and bromate (see Table 1).

**Table 1**  
**MRDLGs, MRDLs, MCLGs and MCLs for Stage 1 Disinfectants**  
**and Disinfection Byproducts Rule**

<b>DISINFECTANT RESIDUAL</b>	<b>MRDLG (mg/L)</b>	<b>MRDL (mg/L)</b>	<b>COMPLIANCE BASED ON</b>
Chlorine	4 (as Cl <sub>2</sub> )	4.0 (as Cl <sub>2</sub> )	Annual Average
Chloramine	4 (as Cl <sub>2</sub> )	4.0 (as Cl <sub>2</sub> )	Annual Average
Chlorine Dioxide	0.8 (as ClO <sub>2</sub> )	0.8 (as ClO <sub>2</sub> )	Daily Samples
<b>DISINFECTION BYPRODUCTS</b>	<b>MCLG (mg/L)</b>	<b>MCL (mg/L)</b>	<b>COMPLIANCE BASED ON</b>
Total trihalomethanes (TTHM) <sup>1</sup>	N/A		
- Chloroform	0	0.080	Annual Average
- Bromodichloromethane	0		
- Dibromochloromethane	0.06		
- Bromoform	0		
Haloacetic acids (five) (HAA5) <sup>2</sup>	N/A		
- Dichloroacetic acid	0	0.060	Annual Average
- Trichloroacetic acid	0.3		
Chlorite	0.8	1.0	Monthly Average
Bromate	0	0.010	Annual Average

**N/A - Not applicable because there are no individual MCLGs for TTHMs or HAAs**

1-Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

2-Haloacetic acids (five) is the sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids.

Water systems that use surface water or ground water under the direct influence of surface water and use conventional filtration treatment are required to remove specified percentages of organic materials, measured as total organic carbon (TOC), that may react with disinfectants to form DBPs (See Table 2). Removal will be achieved through a treatment technique (enhanced coagulation or enhanced softening) unless a system meets alternative criteria.

**Table 2**  
**Required Removal of Total Organic Carbon by Enhanced Coagulation and Enhanced Softening for**  
**Subpart H Systems Using Conventional Treatment<sup>1</sup>**

<b>Source Water TOC (mg/L)</b>	<b>Source Water Alkalinity (mg/L as CaCO<sub>3</sub>)</b>		
	<b>0-60</b>	<b>&gt;60-120</b>	<b>&gt;120<sub>2</sub></b>
>2.0-4.0	35.0%	25.0%	15.0%
>4.0-8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%

<sup>1</sup>Systems meeting at least one of the alternative compliance criteria in the rule are not required to meet the removals in this table.

<sup>2</sup>Systems practicing softening must meet the TOC removal requirements in the last column to the right.

### **1.5 What are the Compliance Deadlines?**

Large surface water systems are required to comply with the Stage 1 Disinfectants and Disinfection Byproducts Rule and Interim Enhanced Surface Water Treatment Rule by January 2002. Ground water systems and small surface water systems must comply with the Stage 1 Disinfectants and Disinfection Byproducts Rule by January 2004.

### **1.6 What are the costs and benefits of the rule?**

EPA estimates that implementation of the Stage 1 Disinfectants and Disinfection Byproducts Rule will result in:

- As many as 140 million people receiving increased protection from DBPs.
- 24 percent national average reduction in TTHM levels.
- Reduction in exposure to the major DBPs from use of ozone (bromate) and chlorine dioxide (chlorite).

The total annual cost of the rule is about \$700 million. EPA believes that the benefits exceed the costs of the Stage 1 Disinfectants and Disinfection Byproducts Rule. An estimated 116 million households are affected by the Stage 1 Disinfectants and Disinfection Byproducts Rule. EPA estimates that 95 percent of the households will incur additional costs of less than \$1 per month on their water bills. An additional four percent will pay between \$1 and \$10 per month more and one percent are expected to incur increased water bills of \$10 to \$33 per month, if they choose to install treatment. However, many of these systems may choose less costly non-treatment options, such as consolidation. The majority of households incurring the highest costs are small systems serving less than 10,000 people that have never been regulated for DBPs.



### **1.7 What technical information will be available on the Rule?**

A series of guidance manuals supports the Interim Enhanced Surface Water Treatment Rule and the Stage 1 Disinfectants/Disinfection Byproducts Rule. The manuals aid EPA, State agencies and affected public water systems in implementing the two interrelated rules, and will help to ensure that implementation among these groups is consistent.

These manuals are available on the Internet at

<http://www.epa.gov/safewater/mdbp/implement.html> and may be ordered from the Safe Drinking Water Hotline, 1 (800) 426-4791.

# Section II

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## **WOODINVILLE WATER DISTRICT'S WATER SYSTEM OVERVIEW**

### **2.1 General Information**

Woodinville Water District (District)(System I.D. #41600) buys its water from the City of Seattle (System I.D. #77050Y). Seattle Public Utilities provides drinking water to approximately 1.3 million people in the Puget Sound area on a wholesale and retail (direct service) basis.

The District's primary source is SPU's South Fork Tolt River Watershed, which is occasionally supplemented by the Cedar River Watershed. Current treatment for the Tolt and the Cedar supplies includes fluoridation, chlorination, and pH adjustment through the addition of soda ash and lime for corrosion control. The South Fork Tolt supply has filtration and ozonation operational since the spring of 2001. Ozonation is currently in the planning stages for the Cedar supply. The District currently has no form of gaseous or hypochlorination to boost disinfectant residuals in the system.

Nine (9) sample stands currently are used to obtain daily water quality samples. These stands are located to represent different population concentrations, sources of supply (inlets), pressure zones and storage facilities so that representative water samples can be collected.

The District's water service area covers approximately 29.2 square miles and includes a residential population of 43,800. The service area is located in King County. Surrounding purveyors include Northshore Utility District, Cities of Bothell and Kirkland to the west, The City of Redmond to the south and Cross Valley Water District to the north.

The District does not have any formal interties with surrounding jurisdictions. However, the District does have informal emergency interties with the Northshore Utility District and the City of Bothell. A future intertie will be constructed with the City of Redmond at Blakely Ridge. Another potential future intertie with the City of Redmond is along the southern boundary of the District. The District also has potential for both formal and informal interties with Cross Valley Water District.

The District's system includes 12,800 water service connections, 253 miles of transmission and distribution piping, eight storage facilities (total storage of 14.9 MG), five pump stations (three active, two standbys), and 45 pressure reducing stations. The District has nine active taps to the Tolt River supply: eight to the Tolt Pipeline and one tap to the Tolt Eastside Supply Line.

The District currently has nine sample stands that Seattle Public Utilities uses for routine coliform compliance monitoring. These nine sample stands locations represent the hydrologic and geographic layout of the District's water system.

## **2.2 General Requirements for a D/DBP Monitoring Plan**

The Woodinville Water District must maintain and make the plan available for Washington State Department of Health (DOH) inspection and the general public no later than 30 days following the compliance date of January 2002.

The plan must include the following elements:

- Locations for collecting the samples
- How Woodinville Water District calculate compliance with the Maximum Contaminant Levels (MCL's) for Disinfection Byproducts.
- The sampling locations must reflect the entire distribution system.

As noted previously, Woodinville Water District purchases its water from the City of Seattle (System I.D. #77050Y). SPU provides all of the filtration and treatment for the water the Woodinville Water District distributes. The Woodinville Water District does

not rechlorinate or provide any treatment in the distribution system. As a result of this, Seattle Public Utilities (SPU) is responsible for meeting the maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three chemical disinfectants - chlorine, chloramine and chlorine dioxide noted in Table 1. SPU is also responsible for monitoring and meeting the maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for chlorite and bromate (see Table 1).

Seattle Public Utilities is responsible for the treatment techniques required in the D/DBP Rule. As noted previously, water systems that use surface water or ground water under the direct influence of surface water and use conventional filtration treatment are required to remove specified percentages of organic materials, measured as total organic carbon (TOC), that may react with disinfectants to form DBPs (See Table 2). Removal will be achieved through a treatment technique (enhanced coagulation or enhanced softening) unless a system meets alternative criteria.

### **2.3 Implementing the Stage 1 DDBP Rule**

- Woodinville Water District purchases water from the Tolt Supply.
- The D/DBP Rule requires four distribution (4) compliance locations for each source of supply.
- At least 25% of the sample sites must be at locations representing maximum residence time.
- The remaining sample sites are locations representative of at least average residence time in the distribution system and representing the entire distribution system.
- Maximum Contaminant Level (MCL) for HAA5 is 60 parts per billion
- Maximum Contaminant Level for TTHM's is 80 parts per billion
- Monitoring is conducted quarterly with collection for both HAA5 and TTHM's simultaneously
- MCL compliance for DBP's is based on a running annual average of the samples collected in the previous four quarters
- Seattle Public Utilities is responsible for source water related DBP monitoring (treatment technique)

## 2.4 D/DBP Sample Locations for Woodinville Water District:

Sample stands for D/DBP compliance monitoring.

Sample Stand	Location	Residence Time
104-4	Mink Rd and NE 172 <sup>nd</sup> Pl.	Maximum
104-3	132 <sup>nd</sup> Ave NE and NE 132 <sup>nd</sup>	Average
104-5	228 <sup>th</sup> Ave. NE and NE 150 <sup>th</sup> St.	Average
104-9	NE 142 <sup>nd</sup> St. and 180 <sup>th</sup> Ave. NE	Average

Justification for maximum sample stand:

Test station 104-4 represents maximum retention time for sample stands within WWD boundaries. Weekly chlorine samples continuously show this station to have the lowest chlorine residuals. The water that serves this sample stand is either sent to Brookside Reservoir first or supplied through a large transmission main that has low flow. Brookside Reservoir holds 2.5 MG and overflow is at 18 feet. This reservoir has a low turnover rate at times. In addition the sample stand is located in the eastern portion of the district which is not as densely populated.

Other Woodinville Water District sample locations:

Sample Stand	Free Chlorine Residual Averages	Address	DBP Compliance Point
<b>Tolt Sites</b>			
104-1	0.68	136 NE & NE 190 PL	
104-2	0.83	NE 195 ST & 168 AVE NE	
<b>104-3</b>	<b>0.93</b>	<b>132 AVE NE &amp; NE 132</b>	<b>Average</b>
<b>104-4</b>	<b>0.52</b>	<b>Mink RD NE &amp; NE 172 PL</b>	<b>Maximum</b>
<b>104-5</b>	<b>0.95</b>	<b>228 AVE &amp; NE 150 ST</b>	<b>Average</b>
104-6	0.59	198 DR & NE 128	
104-7	0.80	NE 153 ST & 158 AVE NE	
104-8	0.80	19117 194 AVE NE	
<b>104-9</b>	<b>0.84</b>	<b>NE 142 ST &amp; 180 AVE NE</b>	<b>Average</b>
<b>Tolt Average Chlorine for all</b>	<b>0.77</b>		

# Section III

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## **SAMPLE COLLECTION, ANALYSIS AND REPORTING**

### **3.1 Sample Collection**

- Seattle Public Utilities (SPU) will be collecting the D/DBP sample for Woodinville Water District on a quarterly basis at the 4 sample locations
- As a goal, all samples will be collected within a 24 hour period
- TTHM and HAA5 samples are taken at same time and location

### **3.2 Sample Analysis**

- SPU will perform the D/DBP analysis for Woodinville Water District
- Routine chlorine monitoring requires the system to measure residual disinfectant levels at the same points in the distribution system and at the same time as total coliforms are sampled (analysis and reporting are part of Regional Coliform Monitoring Plan)
- SPU is responsible for source water quality monitoring and reporting for the D/DBP Rule referenced in Table 2.

### **3.3 Sample Reporting**

- SPU will be updating the quarterly running annual average for Woodinville Water District
- SPU will be reporting the results of the distribution system D/DBP analysis to the Washington State Department of Health and to Woodinville Water District within 10 days after the end of each quarter
- Reporting includes:
  - Number of samples taken during the last quarter
  - Location, date, and results of each sample taken in last quarter
  - Arithmetic average of all samples taken in last quarter
  - Annual arithmetic average of quarterly averages for last 4 quarters
  - Whether MCL was exceeded

### **3.5 Calculating Compliance**

MCL compliance is based on a running annual arithmetic average of all samples computed quarterly. Thus, each of the four sample collection sites has a four-quarter running annual average. If running average of the combined four 8 averages of any consecutive 4-quarter period exceeds the MCL for TTHM's or HAA5, the system is in violation and must notify public and report to the Washington State Department of Health.