General DBP Background

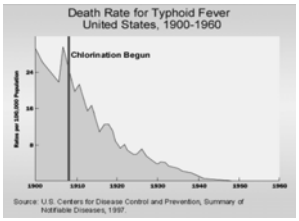
DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

1

Public Health & Disinfection

Disinfectants

- **Kill disease-causing microorganisms**
- **React with organic matter occurring naturally in water to form Disinfection Byproducts (DBPs)**



2

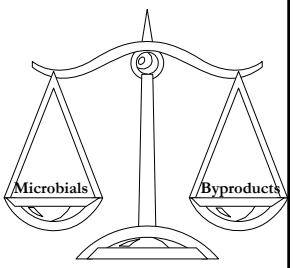
Health Effects of DBPs

- **Cancer**
- **Liver problems**
- **Kidney problems**
- **Central nervous system problems**
- **Anemia**
- **Reproductive problems**

3

A Delicate Balance

- ✓ **Risk: microbial contamination vs. DBP formation**
- ✓ **U.S. EPA's solution: control health risks from microbials, disinfectants, and DBPs**
- ✓ **Result: M-DBP suite of rules**



4

How Are DBPs Formed?

Precursor in Water		Added Disinfectant
Natural Organic Matter (NOM) Bromide	+	Chlorine Chloramines Ozone Chlorine Dioxide

= **DBP**

- TTHM
- HAA5
- Bromate
- Chlorite

5

DBP Precursors

NOM

- Decay of plant and animal materials
- Agricultural and urban runoff, WWTP discharges
- Higher in surface water than ground water

Bromide (Br^-)

- Salt water intrusion
- Industrial or agricultural chemicals
- Road salting

6

NOM Characterization

Total Organic Carbon (TOC)

- Total organic content in matter
- Measured in mg/L

Dissolved Organic Carbon (DOC)

- Soluble part of TOC that can pass through 0.45 micron filter
- Most organic matter in drinking water supplies is dissolved

7

NOM Characterization (cont.)

$$\text{Specific UV Absorbance (SUVA)} = \frac{UV_{254}\ (cm^{-1})}{DOC\ (mg/L)} \times 100$$

- Represents hydrophobic, less soluble fraction
- Higher SUVA has higher DBP formation potential, but is easier to remove during coagulation
- Good predictor of treatability, TTHM formation

8

Stage 1 DBPR TT Requirement for DBP Precursors

- For Subpart H systems that use conventional filtration or lime softening

- Required % TOC removal depends on monthly source water monitoring for
  - Alkalinity
  - TOC
- Alternative criteria if system can show that TOC, SUVA, or TTHM is low or can get State waiver
- All systems required to comply by Jan 1, 2004

9

Removal Percentages

Removal requirements depend on source water characteristics:

Treatment Technique Removal Percentages:

Source Water TOC (mg/L)	Source water alkalinity (mg/L as $CaCO_3$)		
	0-60	>60-120	>120
> 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%

Systems practicing softening must meet TOC removal requirements in this column

10

Factors Affecting DBP Formation

11

DBP Formation Depends On:

- Precursor concentration
- Disinfectant - type and dose
- Water chemistry
- Water temperature
- Residence time
- Biodegradation of HAAs

12

Precursor Concentration - NOM

- As NOM increases, DBPs increase
- DBP formation depends on properties of organics that make up NOM
  - Size, structure, and functionality
  - Hydrophobic, humic acids (SUVA) have a higher DBP formation potential
- For surface water systems, NOM can vary daily, seasona
- Some types are easier than others to remove
  - Fraction represented by SUVA

13

Precursor Concentration - Bromide

- In general, as bromide increases, DBPs increase
- Bromide shifts species of TTHM and HAA5 towards bromide-substituted compounds
  - Bromoform
  - DBCM
  - BDCM
  - MBAA
  - DBAA
- Bromide + Ozone = Bromate
  - Stage 2 MCL for Bromate = 10 µg/L, same as Stage 1

14

Disinfectant Type and Dose

Disinfectant	Reacts With	To Form*	Comments
Free Chlorine	**NOM and Bromide**	**TTHM and HAA5**	**Dose is more important at plant than in D.S.**
Chloramines	**NOM and Bromide**	**TTHM and HAA5**	**Much lower DBP formation than free chlorine**
Ozone	**Bromide**	**Bromate, some TTHM and HAA5**	**Bromate MCL = 0.010 mg/L, finished water**
Chlorine Dioxide	**NOM**	**Chlorite, some TTHM and HAA5 if bromide is present**	**Chlorite MCL = 1.0 mg/L, finished water and in D.S.**
UV Light	**Nothing**	**None**	

* Regulated DBPs only are shown

15

Effects of pH on DBP Formation

For Systems That Chlorinate

pH*	TTHM	HAA5
↑	↑	↓

* For pH range of 6 - 10

16

Effects of pH on DBP Formation (cont.)

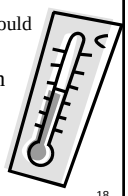
During **Ozonation**

pH < 7	Bromate
↓	↓

17

Temperature Effects on DBP Formation

- Rate of TTHM and HAA5 formation increases with increasing temperature
- However,
  - Water demands are higher in summer months, therefore shorter residence times
  - More bacteriological activity in the summer, could promote biodegradation of HAA5
- Result – TTHM and HAA5 levels are often highest during warmest month, but not always (site specific)
  - Spring and fall months are also common

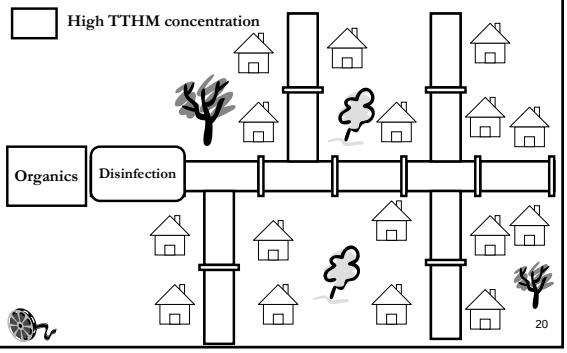


18

Water age and Biodegradation of HAA5

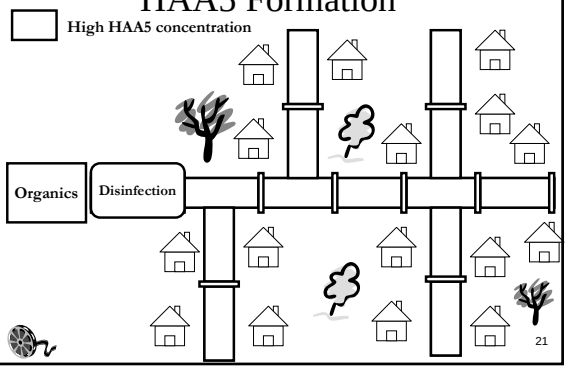
19

TTHM Formation



20

HAA5 Formation



21

Factors Affecting DBP Formation

For further reading:

- Appendix A of the Initial Distribution System Evaluation Guidance Manual (USEPA 2006), available on-line at http://www.epa.gov/safewater/disinfection/stage2/pdfs/guide_idse_app_a.pdf
- "Formation and Control of Disinfection By-Products in Drinking Water" (Singer, 1999), published by AWWA
- "Formation and Decay of Disinfection By-Products in the Distribution System" (Baribeau et al, 2007), published by AwwaRF

22

Questions?

23

Introduction to Compliance Strategies

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

1

Compliance Approaches

System, in consultation with the State, chooses the compliance approach

- Take into account magnitude/nature of the problem, existing treatment, source water characteristics, costs, technical capabilities, co-occurring contaminants
- This is a site-specific decision
- **THERE IS NO SILVER BULLET**

2

Compliance Approaches (cont.)

1) Optimize or modify current operations
2) Change primary or secondary disinfectant
3) Improve DBP precursor removal
4) Other
   - Change source water
   - Consolidate with another system

3

Optimize or Modify Current Operations

OPERATIONAL PRACTICES COVERED IN THE Simultaneous Compliance GM

- Source Management
- Distribution System Best Management Practices
- Moving Point of Chlorination
- Modifying pH During Chlorination
- Modifying Chlorine Dose Under Different Temperature Conditions
- Modifying Pre-sedimentation Basin Operations
- Enhanced Coagulation
- Enhanced Softening

4

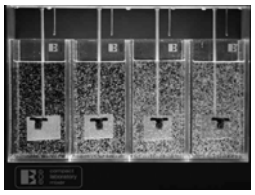
Distribution System BMPs

- Water Age Management Strategy
  - Improve mixing in tanks
  - Minimize residence time in tanks
  - Decommission excess storage
  - Minimize residence time in pipes
- Booster Disinfection
- Water Main Flushing Program
  - Conventional
  - Unidirectional

5

Enhanced Coagulation

- Increase coagulant dose
- Change coagulant
- Adjust pH (using acid to lower the pH as low as 5.5)
- Improve mixing or apply moderate dosage of an oxidant
- Add a polymer



6

Change Primary Disinfectant

- Ozone
- Chlorine Dioxide
- UV

7

Change Primary Disinfectant (cont.)

Required CT (mg-min/L)
for Chemical Disinfectants at ≤ 0.5ºC

Disinfectant	4-log Inactivation (99.99%) of Viruses	3-log Inactivation (99.9%) of *Giardia*	1-log Inactivation (99.9%) of *Cryptosporidium*
Ozone	1.8	2.9	24
Chlorine[1]	12	195	N/A
Chlorine Dioxide	50.1	63	637

Sources: SWTR guidance manual and the Final LT2ESWTR
N/A - these disinfectants are ineffective against *Cryptosporidium*
[1] at pH = 7.0 and chlorine residual = 0.4 mg/L

8

Change Primary Disinfectant (cont.)

UV Dose Requirements –
millijoules per centimeter squared (mJ/cm^2) [1]

Target Pathogens	Log Inactivation							
	0.5	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**
Cryptosporidium	1.6	2.5	3.9	5.8	8.5	12	15	22
Giardia	1.5	2.1	3.0	5.2	7.7	11	15	22
Virus	39	58	79	100	121	143	163	186

[1] Final LT2ESWTR

9

Change Secondary Disinfectant

Convert to chloramines for residual disinfection

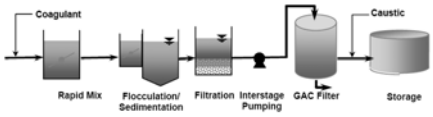
- Chloramines are generally too weak for primary disinfection but make a stable secondary disinfectant in the distribution system
- Reduce TTHM and HAA5 formation in the distribution system
  - 40 to 80 percent
- Can still get primary disinfection credit with chlorine by injecting ammonia downstream of chlorine injection point
- 3:1 to 5:1 chlorine-to-ammonia ratio for optimum performance

Chlorine (Cl_2)	+	Ammonia (NH_4)	=	Chloramines (NH_2Cl, $NHCl_2$, NCl_3)

10

Improve DBP Precursor Removal

- Granular Activated Carbon (GAC)
  - GAC_{20}, or GAC_{10} in combination with enhanced coagulation or enhanced softening are Best Available Technology (BAT) for Stage 2
  - Removes up to 90 percent of TOC



11

Improve DBP Precursor Removal (cont.)

Nanofiltration

- BAT for Stage 2 with MWCO ≤ 1000 daltons
- Small pore sizes
- Removes DOC
- Concentrated reject stream

12

Compliance Approaches for Consecutive Systems

- BATs:
  - Hydraulic flow and storage management (all systems)
  - Chloramines (systems serving at least 10,000 people)
- Other compliance approaches:
  - Improved water quality from the wholesale system
  - Alternative sources and blending strategies
- Essential to discuss issues and possible solutions with wholesale system
- For more information
  - The Stage 2 DBPR Consecutive Systems Guidance Manual (Draft)

13

Questions?

14

Disinfection Profiling and Benchmarking

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Disinfection Profiling and Benchmarking

- Required by IESWTR, LT1ESWTR, and LT2ESWTR
- Applies to PWSs using surface water or GWUDI.
- *Allows systems and States to assess whether a change in disinfection practices creates a microbial risk.*

2

Microbial Inactivation Requirements

SWTR requires:
- *99.9% (3-log) inactivation of Giardia lamblia*
- *99.99% (4-log) inactivation of viruses*

IESWTR and LT1ESWTR requires:
- *99% (2-log) removal of Cryptosporidium*

LT2ESWTR requires
- *Up to 3-log additional removal or inactivation of Cryptosporidium based on results of source water monitoring (bin classification)*

Disinfection must be sufficient to ensure that the total treatment process achieves these inactivation levels.

3

Disinfection Profiling and Benchmarking – The Issue

Many systems show compliance with SWTRs, but don't show their full level of inactivation.

The system records enough disinfection to comply, but may actually have much more than is needed.

Therefore, the exact level of disinfection is generally unknown.

4

Disinfection Profiling and Benchmarking – The Issue

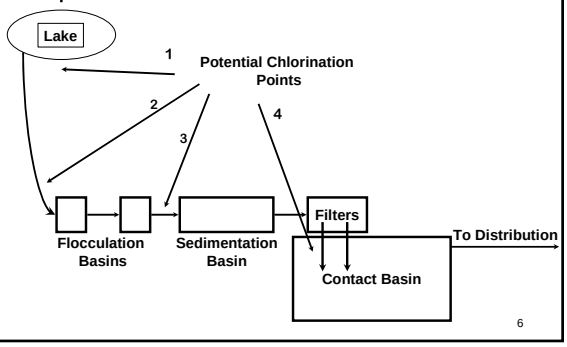
More stringent requirements of the Stage 2 DBPR may cause DBP compliance problems for some systems

To solve the problem, they may:

- Lower disinfectant levels
- Reduce contact time

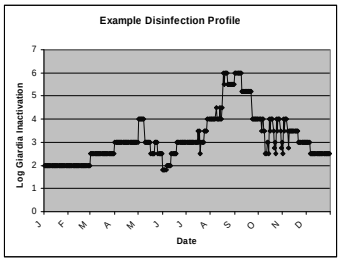
5

For Example:



6

Example disinfection profile



A **disinfection profile** is the graphical representation of a system's microbial inactivation over 12 consecutive months.

7

Disinfection Profiling

- Disinfection profiling was conducted:
  - 2000-2001 (Systems ≥10,000 people)
  - 2003-2004 (Systems 500-9,999)
  - 2004 (Systems <500)
- Requirements waived if one TTHM sample <0.064 mg/L and one HAA5 sample < 0.048 mg/L were collected during month of warmest water temperature and at the maximum residence time in the distribution system.

8

Developing a Disinfection Profile

- For systems serving ≥10,000 people, based on daily monitoring for 12 consecutive months
- For systems serving <10,000 people, based on weekly monitoring on same calendar day each week for 12 consecutive months

9

Developing a Disinfection Profile

Data needed to determine level of inactivation for each day or week:

- Peak hourly flow
- Water temperature
- pH (if the system uses chlorine)
- Residual disinfectant concentration (C)
- Contact time (T)

10

Developing a Disinfection Profile

Procedures for determining inactivation level using SWTR CT tables:

1. Determine CT_{actual}
2. Determine $CT_{required}$ for 3-log inactivation of *Giardia*
3. Determine actual inactivation level

   $3^* CT_{actual}/CT_{required}$

11

Disinfection Benchmarking

A **disinfection benchmark** is the lowest monthly average microbial inactivation value. It's used as a baseline of inactivation when considering changes in the disinfection process.

12

Disinfection Benchmarking

- Disinfection benchmark must be calculated if a system was required to develop a disinfection profile and is considering:
  - Changes to the point of disinfection
  - Changes to disinfectant
  - Changes to disinfection process
  - Other modifications identified by the State

13

Calculating a Disinfection Benchmark

- Before significant changes can be made to disinfection:
  - Calculate benchmark
  - Consult with State

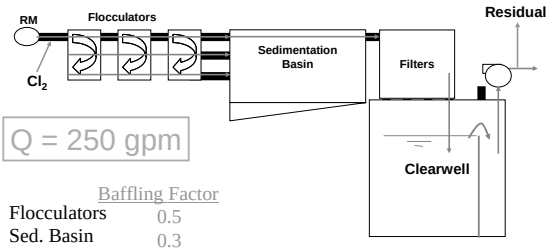
14

Calculating a Disinfection Benchmark

- Calculate each month's average inactivation level using daily or weekly data from disinfection profile.
- For systems with one year data, benchmark is lowest monthly average.
- For systems with 2 or more years data, benchmark is the average of each year's lowest monthly average.

15

Calculating a Disinfection Benchmark - Example



Q = 250 gpm

	Baffling Factor
Flocculators	0.5
Sed. Basin	0.3
Filters	0.7
Clearwell	0.1

16

Conditions at Peak Hourly Flow

- Constant Speed Raw Water Pumps (250 gpm)
- High Service Pumps (up to 250 gpm)
- 7,500 Gallons in Floc Basins
- 30,000 Gallons in Sed. Basin
- 1,750 Gallons Net Filter Volume
- 22,500 Gallons in Clearwell at 7' Weir
- pH of 7.5
- Temperature range:
  - 0.5° C min in January
  - 15° C max in August
- Chlorine Residual of 1.4 mg/L
- CT_{Actual} = 91 mg/L-min

17

Step 1: Determine Contact Time (T_{10})

Volume X baffling factor = effective volume
Effective Volume/Peak hourly flow = T_{10}

Effective volume = 16,225 gallons
Peak hourly flow = 250 gpm

T_{10} = 64.9 minutes

18

Step 2: Calculate CT_{Calc}

CT_{Calc} = Chlorine residual X T_{10}

CT_{Calc} = 1.4 mg/L X 64.9 minutes

CT_{Calc} = **91 mg/l-min**

19

Step 3: Look Up $CT_{1.0\text{-}log}$

Use CT tables in SWTR guidance manual:

$CT_{1.0\text{-}log}$ = 31 mg/L-min

20

Step 4: Check Compliance Ratio

CT_{Calc} = 91 mg/l-min

$CT_{1.0\text{-}log}$ 31 mg/l-min

CT_{Calc} / $CT_{1.0\text{-}log}$ = **2.9-log Inactivation**

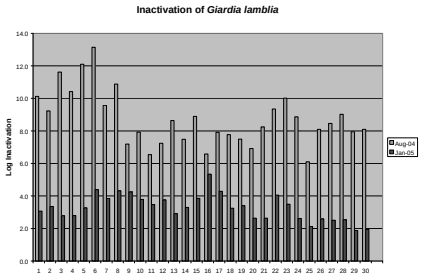
21

Use Disinfection Benchmark To Reduce DBPs

- Inactivation levels may change seasonally.
- Use CT tables to calculate inactivation level at warm and cold water condition
- Compare benchmark with inactivation level during times of high DBPs

22

Daily or Monthly Comparison



23

Take Home Message

Disinfection profiling and benchmarking can help you select appropriate actions to solve DBP compliance problems and reduce exposure to DBPs.

24

Additional Information

- Disinfection Profiling and Benchmarking Guidance Manual (EPA 1999)

  Available at:
  http://www.epa.gov/safewater/mdbp/

25

Questions?

Overview of Rule Requirements: IESWTR, LT1, LT2, and Stage 1 DBPR

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Interim Enhanced Surface Water Treatment Rule Overview

IESWTR

- Final rule published 1998
- Purpose:
  - To improve public health control of microbial contaminants, particularly *Cryptosporidium*.
  - To prevent significant increases in microbial risk due to implementing requirements of Stage 1 DBPR.

3

General Provisions of IESWTR

- ✓ Sanitary surveys required for all PWSs using surface water or GWUDI.
- ✓ Other requirements apply to subpart H systems serving 10,000 or more people
- ✓ Prohibition of uncovered finished water storage
- ✓ Disinfection profiling and benchmarking

4

Regulated Contaminants

- *Cryptosporidium*
  - MCLG of zero
  - 99 percent (2-log) removal for systems that filter
  - Include in watershed control program for systems that don't filter
- Turbidity performance standards
  - Conventional and direct filtration
    - <0.3 NTU in at least 95% of samples each month (combined filter effluent)
    - Maximum level of 1 NTU
  - Alternative filtration technologies
    - Bag or cartridge filtration, membranes
    - Demonstrate to the state that the alternative filtration technology, in combination with disinfection consistently meets:
      - 3-log *Giardia* and 4-log virus inactivation
      - 2-log *Cryptosporidium* removal

5

IESWTR Turbidity Monitoring Requirements

- Conventional and Direct Filtration Plants
  - Continuous monitoring of each individual filter
  - Combined filter effluent monitored every 4 hours
  - Calibrate Turbidimeters per Manufacturers' Recommendations
- Not a Treatment Technique
- Turbidity Excursions Trigger Evaluations, Not Violations
  - Failure to conduct an evaluation is a violation

6

Available Guidance Documents for IESWTR

Technical Guidance Manuals available at:
www.epa.gov/safewater/mdbp/implement.html

- Disinfection Profiling and Benchmarking
- Alternative Disinfectants and Oxidants
- Enhanced Coagulation and Precipitative Softening
- Turbidity
- M-DBP Simultaneous Compliance
- Sanitary Surveys
- Uncovered Finished Water Reservoirs

7

Questions?

Long Term 1 Enhanced Surface Water Treatment Rule Overview

LT1ESWTR

- Final rule published 2002
- Addresses subpart H systems that serve <10,000 people
- Purposes:
  - To improve public health protection through the control of microbial contaminants, particularly *Cryptosporidium*.
  - Extend IESWTR provisions to smaller systems

10

LT1 Requirements

- Covered finished water storage reservoirs
- Watershed control for unfiltered Systems
- Disinfection profiling and benchmarking
- Turbidity performance standards for combined filter effluent and individual filter effluent
- Reporting and recordkeeping

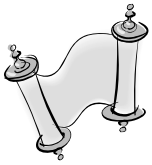
11

Questions?

Long Term 2 Enhanced Surface Water Treatment Rule Overview

Promulgation

- LT2 was published on January 5, 2006
  - Minor amendments were made on January 30 and February 6, 2006



14

Purpose of LT2ESWTR

- Improve Public Health Protection
  - Reduce illness caused by *Crypto.* and other microorganisms
    - Requires additional *Crypto*. treatment for higher risk systems
  - Reduce risk from uncovered finished water storage reservoirs
  - Balance microbial protection and disinfection byproduct formation

15

Applicability

- All surface water and GWUDI systems
  - CWSs, NTNCWSs, TNCWSs
  - Wholesale systems
  - Filtered and unfiltered systems

16

Key Provisions:

- Source Water Monitoring
- Treatment
- Profiling and Benchmarking
- Cover or treat uncovered finished water storage
- Sanitary Surveys

17

Key Provisions: Source Water Monitoring

- Filtered systems on Schedules 1, 2 or 3
  - *Cryptosporidium*
  - *E. coli* and turbidity - potential future indicators
- Filtered systems on Schedule 4
  - *E. coli* only unless *Cryptosporidium* monitoring is triggered
- Unfiltered systems
  - *Cryptosporidium* (in addition to sampling already taking place)

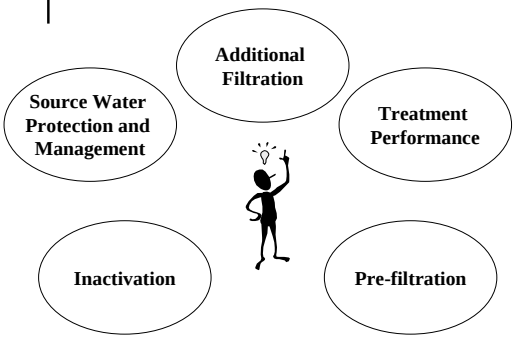
18

Key Provisions: Treatment

- Filtered Systems
  - Additional treatment for highest-risk systems
    - Bin classification based on source monitoring results
    - "Microbial toolbox" of options
- Unfiltered systems
  - Two or three log inactivation
    - Based on source monitoring results
  - Two disinfectants
    - Chlorine, Chloramines, Chlorine Dioxide, Ozone, UV
    - Each separately achieve total required inactivation for viruses, *Crypto*, or *Giardia*

19

Toolbox Options



20

Questions?

Stage 1 DBP Rule Overview

Stage 1 DBPR

- Final rule published 1998
- Purpose:

  To improve public health protection by reducing exposure to disinfection byproducts.

23

General Provisions of Stage 1 DBPR

- ✓ Applies to all sizes of CWS and NTNCWS that add a disinfectant to the drinking water during any part of the treatment process.
- ✓ Applies to TNCWS that use chlorine dioxide.
- ✓ Seven new standards.
- ✓ Treatment technique of enhanced coagulation or enhanced softening to further reduce DBP exposure for subpart H systems using conventional filtration or lime softening.

24

Regulated Contaminants

- Total Trihalomethanes (TTHMs)
  - MCL 0.080 mg/L (80 ug/L)
  - TTHM includes chloroform, bromodichloromethane, dibromochloromethane and bromoform
- Five Haloacetic Acids (HAA5)
  - MCL 0.060 mg/L (60 ug/L)
  - HAA5 includes monochloracetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid, and dibromoacetic acid

25

TTHM and HAA5 Monitoring Requirements

- Depends on system size, number of plants, and source.
- Reduced monitoring available except for subpart H systems serving <500.
- Compliance based on RAA of quarterly results or averages calculated quarterly.

26

Regulated Contaminants (cont.)

- Bromate
  - Plants that use ozone
  - MCL 0.010 mg/L (10 ug/L)
- Chlorite
  - Plants that use chlorine dioxide
  - MCL 1.0 mg/L

27

Regulated Disinfectants

- Chlorine
  - MRDL 4.0 mg/L as Cl_2
- Chloramines
  - MRDL 4.0 mg/L as Cl_2
- Chlorine Dioxide
  - MRDL 0.8 mg/L

MRDL = maximum residual disinfectant level

28

Treatment Technique Requirement

- Enhanced coagulation/softening to improve removal of DBP precursors for systems using conventional filtration treatment.

Source Water TOC (mg/L)	Source water alkalinity (mg/L as $CaCO_3$)		
	0-60	>60-120	>120
> 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%

- Routine monitoring requirements: 1 sample set per month including source water alkalinity and paired sample of source water TOC and treated water TOC.

29

Questions?

Stage 2 Disinfectants and Disinfection Byproducts Rule Overview

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Contents

- Stage 2 DBPR Background
- Key Changes from Stage 1 DBPR to Stage 2 DBPR
- Issues for Consecutive Systems
- Stage 2 DBPR Requirements
  - Schedule
  - Initial Distribution System Evaluation (IDSE)
  - Compliance Monitoring
- Stage 2 DBPR Implementation

2

Stage 2 DBPR Background

- EPA required by 1996 SDWA to develop Stage 2 DBPR
- Things learned through ICR data analysis, implementation, etc.
  - DBP formation in the distribution system more complex than previously thought
  - Consecutive systems not adequately protected
  - Treatment plant-based monitoring inadequate
- EPA chartered a federal advisory committee (FAC) to develop recommendations to regulate DBPs and pathogens as needed
  - Beyond Stage 1 DBPR and IESWTR/LT1ESWTR
  - Supported by a technical workgroup

3

Stage 2 DBPR Background (cont.)

- FAC signed Agreement in Principle in September 2000
  - Final rule published January 2006, consistent with FAC recommendations, public comments
  - Builds on existing rules in M-DBP Suite
- Provides greater public health protection and equity through risk targeting
  - Initial distribution system evaluations (IDSE) to identify compliance monitoring locations with high DBPs
  - Basing compliance on Locational Running Annual Averages (LRAAs) and population-based monitoring
  - Specifying requirements for consecutive systems

4

Key Changes from Stage 1 DBPR to Stage 2 DBPR

40 CFR 141.64

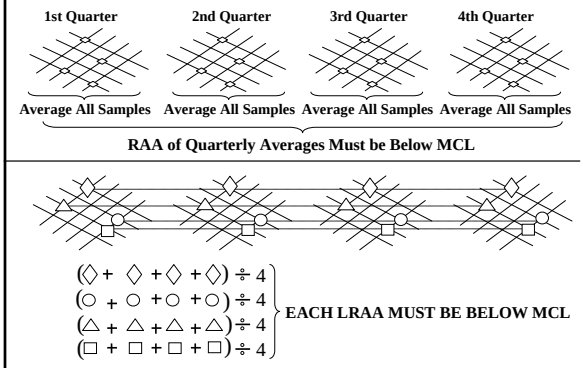
MCLs for DBPs

Disinfectant byproduct	MCL (mg/L)
TTHM	**0.080**
HAA5	**0.060**
Bromate	**0.010**
Chlorite	**1.0**

- TTHM and HAA5 MCLs remain the same
- Calculating compliance changes:
  - Stage 1 DBPR RAA vs. Stage 2 DBPR LRAA

6

RAA vs. LRAA



Stage 1 to Stage 2 DBPR – What has changed?

- Stage 2 DBPR is a population-based approach
- Stage 1 DBPR was a plant-based approach.

What does this mean to PWSs?

8

Stage 1 to Stage 2 DBPR – Plant-based vs. Population- based

- Stage 1 DBPR
  - **What you had to** do was based on
    - your source water type
    - your population served
    - your number of treatment plants/wells
  - **When you had to do it** was based on
    - your source water type
    - your population served
- Stage 2 DBPR
  - **What you have to do** is based on
    - your source water type
    - your population served
  - **When you have to do it** is based on
    - your source water type
    - **population of the largest system in combined distribution system (CDS)**

9

Combined Distribution Systems (CDSs)

- All systems in a CDS on the same schedule
  - Compliance schedule (1, 2, 3, or 4) is based on the population of the largest system in the CDS
  - Largest system is not necessarily the wholesaler
  - Discretion with emergency or seasonal connections

10

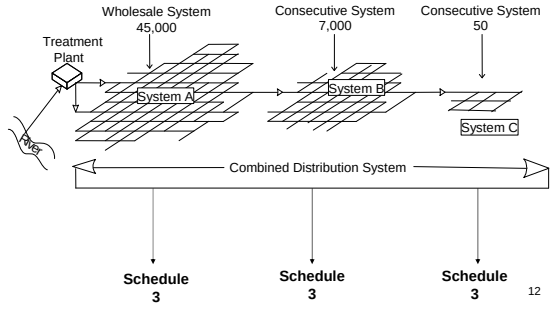
Schedules

System Category	*Schedule*
Population >= 100,000 OR part of a CDS with largest system* >= 100,000	**1**
Population 50,000 to 99,999 people OR part of a CDS with largest system* 50,000 to 99,999	**2**
Population 10,000 to 49,999 people OR part of a CDS with largest system* 10,000 to 49,999	**3**
Population < 10,000 OR part of a CDS with largest system* <10,000	**4**

* Population of largest system, not sum of all connected populations.

11

Combined Distribution Systems



12

Schedules for Alaska's Public Water Systems (PWSs)

System Category	*Schedule*
Population >= 100,000 OR part of a CDS with largest system* >= 100,000	**1 (3 PWSs)**
Population 50,000 to 99,999 people OR part of a CDS with largest system* 50,000 to 99,999	**2 (0 PWSs)**
Population 10,000 to 49,999 people OR part of a CDS with largest system* 10,000 to 49,999	**3 (6 PWSs)**
Population < 10,000 OR part of a CDS with largest system* <10,000	**4 (310 PWSs)**

* Population of largest system, not sum of all connected populations.

13

Stage 1 to Stage 2 DBPR – What has changed (cont.)?

- Stage 2 DBPR requires compliance for consecutive systems.
- Some systems must complete an IDSE to characterize DBP levels in their distribution system and to identify monitoring locations for Stage 2 DBPR.
- New operational evaluation requirements to identify and reduce peak TTHM and HAA5 levels
- Modifies compliance schedule for source water TOC monitoring
- New criteria for reduced monitoring for bromate

14

New Definitions

- Dual Sample Set
  - *a set of two samples collected at the same time and same location, with one sample analyzed for TTHM and the other sample analyzed for HAA5*
- Locational Running Annual Average (LRAA)
  - *the average of sample analytical results for samples taken at a particular monitoring location during the previous 4 calendar quarters.*

15

New Definitions (cont.)

- Combined Distribution System (CDS)
  - *the interconnected distribution system consisting of the distribution systems of wholesale systems and of the consecutive systems that receive finished water*
- Consecutive System
  - *a public water system that receives some or all of its finished water from one or more wholesale systems.*
- Wholesale System
  - *a public water system that treats source water to produce finished water and deliver some or all of that finished water to another public water system.*

16

New Acronyms

Acronym	Definition
40/30	IDSE - 40/30 Certification
CDS	Combined Distribution System
IDSE	Initial Distribution System Evaluation
LRAA	Locational Running Annual Average
SM	IDSE - Standard Monitoring
SSS	IDSE - System Specific Study
VSS	IDSE - Very Small System

17

Issues for Consecutive Systems

Consecutive Systems

- Stage 1 DBPR
  - Some states did not require systems to monitor
  - Consumers do not receive the same level of protection
    - Often oldest water in system
- Stage 2 DBPR
  - Extends protection to consecutive systems
    - IDSE requirements
    - TTHM and HAA5 monitoring
    - Chlorine and chloramine MRDLs of 4.0 mg/l
      - April 1, 2009

19

Challenges for Consecutive Systems

- No control of treatment process
- Most BATs focus on precursor removal
- BATs for consecutive systems
  - Switch to chloramination
    - ≥10,000 only
  - Manage residence time
- May not have data for VSS Waiver or 40/30 Certification

20

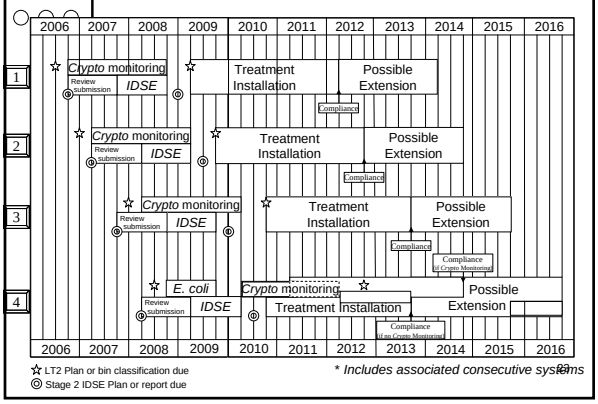
Consecutive Systems

- Resources
  - Stage 2 DBPR Consecutive Systems Guidance Manual (draft)
  - Appendix D of the IDSE Guidance Manual specifically addresses consecutive system and wholesale system issues
  - AwwaRF Project #3026 on Consecutive Systems

21

Stage 2 DBPR Schedule

Implementation Schedule



Initial Distribution System Evaluation (IDSE)

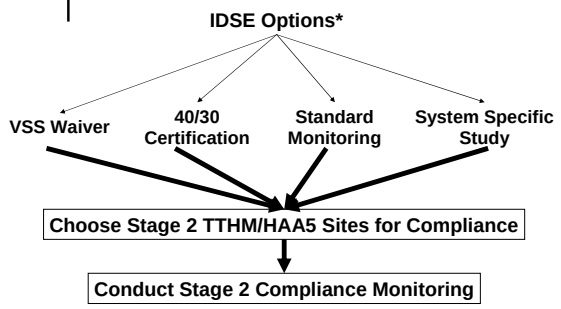
141.600

IDSE General Requirements

- Purpose:
  - Determine locations of high TTHM and HAA5 concentrations throughout distribution system
  - Results are used in conjunction with Stage 1 DBPR compliance monitoring to identify and select Stage 2 DBPR compliance monitoring locations
- Applicability
  - CWS (and NTNCWS serving 10,000+) that uses or delivers water that has been treated with a primary or residual disinfectant other than UV light

25

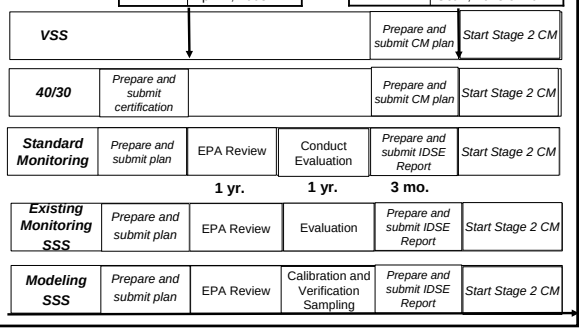
IDSE



*** IDSE required of all CWS and NTNCWS serving > 10,000 people**

Schedule	IDSE Initial Date
1	October 1, 2006
2	April 1, 2007
3	October 1, 2007
4	April 1, 2008

Schedule	Start CM Date
1	April 1, 2012
2	October 1, 2012
3	October 1, 2013
4	Oct 1, 2013 or 2014



Very Small System (VSS) Waivers

Eligibility Criteria

- Systems must
  - Serve fewer than 500 people
  - Have TTHM and HAA5 data
    - Reduced monitoring acceptable
    - Operational data acceptable
      - Let EPA/State know you have it

Note: Waiver may be denied, even if you meet eligibility criteria

29

VSS Waivers

- Waivers effective immediately
  - No application necessary
  - Unless you hear otherwise, assume you are OK
- Only a waiver from IDSE
  - Must conduct Stage 2 DBPR compliance monitoring
  - Continue compliance with Stage 1 DBPR until Stage 2 DBPR compliance begins

30

40/30 Certification

Eligibility Criteria

- 2-year eligibility period
  - (eight consecutive quarters)
- No individual sample can have exceeded:
  - 0.040 mg/L for TTHM
  - 0.030 mg/L for HAA5
- No TTHM or HAA5 monitoring violations (must have taken all required Stage 1 DBPR samples)

Note: Certification may be denied, even if system meets eligibility criteria

32

Eligibility Period and Deadline

Schedule	Eligibility Period Beginning No Earlier Than:	Submit 40/30 Certification By:
1	January 2004	October 1, 2006
2		April 1, 2007
3	January 2005	October 1, 2007
4		April 1, 2008

33

Additional Information May Be Required

- Distribution system schematic
  - Not CBI, subject to FOIA
- Sampling data used for certification
- Recommendations for Stage 2 DBPR compliance monitoring sites

34

40/30 Certification

- Only a waiver from IDSE
  - Continue compliance with Stage 1 DBPR until Stage 2 DBPR compliance begins
  - Must conduct compliance monitoring

35

Standard Monitoring

Standard Monitoring Steps

Schedule	Submit Plan	EPA Review	Complete Monitoring	Submit IDSE Report
1	10/1/2006	10/1/2007	9/30/2008	1/1/2009
2	4/1/2007	4/1/2008	3/31/2009	7/1/2009
3	10/1/2007	10/1/2008	9/30/2009	1/1/2010
4	4/1/2008	4/1/2009	3/31/2010	7/1/2010

37

Required Components of Standard Monitoring Plan

- Distribution system schematic
  - Entry points, sources, and storage facilities
  - Proposed Standard Monitoring sites
  - Stage 1 DBPR monitoring sites
- Source water type and population served
- Justification of site selection

38

Standard Monitoring Requirements

- Monitoring Locations
  - High TTHM
  - High HAA5
  - Avg. Residence Time
  - Near Entry Points
- Number of sites
  - Based on source water type and population served
- Sampling
  - Dual sample set
  - Both TTHM and HAA5 collected at all locations
- Monitoring Frequency
  - 1, 4, or 6 sampling events during 1 year period
- Peak historic month

39

Conduct Monitoring

If you do not hear from EPA within 12 months from the date when the plan was due, you can consider the plan approved.

- Monitor in accordance with approved plan
  - One year of monitoring
  - IDSE monitoring is not compliance monitoring
    - Cannot cause an MCL violation
- Continue with Stage 1 DBPR through standard monitoring period

40

IDSE Report

- Identify Stage 2 DBPR Compliance Monitoring Sites
- Deadline
  - 3 months from deadline for completing monitoring
- Rule sets protocol for choosing sites
  - Calculate average value for TTHM and HAA5 for each site (IDSE and Stage 1 DBPR)
  - Follow protocol to select Stage 2 DBPR compliance monitoring sites

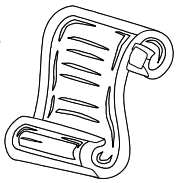
41

System Specific Study

- Existing Monitoring Results
  - Based on data already available to system
  - Similar to Standard Monitoring
  - Combination of Stage 1 DBPR and other operational data
    - Systems with many treatment plant and small population
- Modeling
  - Based on hydraulic model
- Steps Similar to Standard Monitoring
  - Submit study plan, conduct study, submit IDSE Report
  - Can do all together if you are ready

42

IDSE Recordkeeping



- VSS
  - No records to keep
- 40/30
  - Keep certification for 10 years from date of submittal
- Standard Monitoring and SSS
  - Keep plan for 10 years from date of submittal
  - Keep report for 10 years from date of submittal
  - CCR must include range of IDSE monitoring results from that calendar year
- Make all available for review by EPA, state or the public

43

Stage 2 DBPR Compliance Monitoring

Stage 2 DBPR Compliance Monitoring (CM)

- Start monitoring at Stage 2 DBPR sites
- Phase out Stage 1 DBPR (sites not selected)

Schedule	Conduct Stage 2 CM
1	April 1, 2012
2	October 1, 2012
3	October 1, 2013
4	October 1, 2013 If Crypto monitoring not required under LT2
4	October 1, 2014 If Crypto monitoring is required under LT2

45

Stage 2 DPBR Routine Compliance Monitoring
Frequency and Number of Sites

Source	Population	Frequency	Sites
Surface GWUDI Purchased Surface	<500	Annual	2
	500-3,300	Quarterly	2
	3,301-9,999		2 *
	10,000-49,999		4 *
	50,000-249,999		8 *
	250,000-999,999		12 *
	1,000,000-4,999,999		16 *
	≥ 5,000,000		20 *
Ground Purchased Ground	<500	Annual	2
	500-9,999		2
	10,000-99,999	Quarterly	4 *
	100,000-499,999		8 *
	≥ 5,000,000		20 *

*Dual Samples Taken at Each Site

Compliance Monitoring Plan

- VSS and 40/30 systems and NTNC <10,000
  - Did not conduct IDSE
    - No IDSE report
  - Must prepare a Stage 2 DBPR Monitoring plan
    - Before required to start monitoring
- Standard Monitoring or SSS systems
  - Not necessary **if** all the required elements of a compliance monitoring plan included in IDSE report
    - Compliance calculations procedures

47

Compliance Monitoring Plan

- VSS Systems
  - Only need two individual or one dual sample site
    - Choose a location for high TTHM
    - Choose a location for high HAA5
    - May be same location
- 40/30 and NTNC Systems
  - Select Stage 2 DBPR sites
    - Fewer Stage 2 DBPR sites than Stage 1 DBPR
      - Select from Stage 1 DBPR
    - More Stage 2 DBPR sites than Stage 1 DBPR
      - Use system information to find additional sites

48

Stage 2 DBPR Compliance Monitoring

- New Locations
  - Sampling based on source water type and population served (not number of plants)
  - From IDSE and Stage 1 DBPR
- Compliance Calculation
  - Locational Running Annual Average (LRAA)
- Operational Evaluations
  - $Q_1+Q_2+(2Q_3) > MCL$
  - Conduct Evaluation
    - Avoid Exceedance

49

Calculating LRAA

Example: SW system serving 100,000

Date	Site 1 TTHM	Site 2 TTHM	Site 1 HAA5	Site 2 HAA5
Q1: 2/08	0.040	0.040	0.040	0.040
Q2: 5/08	0.020	0.030	0.080	0.020
Q3: 8/08	0.010	0.020	0.100	0.010
Q4: 11/08	0.020	0.020	0.070	0.010
Q1: 2/09	0.030	0.020	0.040	0.010

50

Calculating LRAA (cont.)

Date	Site 1 TTHM	Site 2 TTHM	Site 1 HAA5	Site 2 HAA5
Q1: 1/07	0.040	0.040	0.040	0.040
Q2: 4/08	0.020	0.030	0.080	0.020
Q3: 7/08	0.010	0.020	0.100	0.010
Q4: 11/08	0.020	0.020	0.070	0.010
Q1: 1/08	0.030	0.020	0.040	0.010
Sum	**0.080**	**0.090**	**0.290**	**0.050**

51

Calculating LRAA (cont.)

Date	Site 1 TTHM	Site 2 TTHM	Site 1 HAA5	Site 2 HAA5
Sum	0.080/4	0.090/4	0.290/4	0.050/4
LRAA	0.020	0.023	0.073	0.013

52

Reduced Monitoring - Changes from Stage 1 DBPR

- TTHM and HAA5
  - Surface Water and GWUDI
  - Under Stage 1 DBPR
    - TTHM < 0.040 mg/L
    - HAA5 < 0.030 mg/L
    - TOC < 4.0 mg/L
  - Stage 2 DBPR adds:
    - Sample TOC every 30 days to qualify
    - Sample TOC every 90 days to remain
- Bromate
  - Systems that use ozone monitor for Bromate
  - Under Stage 1 DBPR
    - Reduced monitoring based on Bromide in source
  - Stage 2 DPBR adds:
    - New Bromate method
    - Bromate RAA ≤ 0.0025 mg/L
    - No longer have to monitor Bromide in source

53

Source Water TOC Reduced Monitoring

Stage 2 DBPR: **Monitor every 30 days**

July						
S	M	T	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
S	M	T	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September						
S	M	T	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

NOT: Monitor monthly

July						
S	M	T	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August						
S	M	T	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September						
S	M	T	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

54

Stage 2 DBPR Implementation

IPMC and DCTS

- Information Processing & Management Center (IPMC)
  - Centralized location to process hard copy Stage 2 DBPR submissions
  - Systems can submit 40/30 Certifications, Standard Monitoring Plans, System Specific Studies, and IDSE Reports
  - Conducts mail distribution and data entry into DCTS

Mailing Address:
Stage 2 DBPR & LT2ESWTR IPMC
P O Box 98
Dayton, OH 45401

Fax Number:
937-586-6557

Email Address:
stage2mdbp@epa.gov

56

IPMC and DCTS

- Data Collection & Tracking System (DCTS)
  - Database that tracks and stores Stage 2 DBPR early implementation submissions
  - Gives you access to the online IDSE tool
    - Develop and submit your 40/30 Certification or IDSE Plan or Report online

57

IDSE Tool

- 2 modules:
  - Wizard
    - Determines which IDSE option is best for the system
  - IDSE Plan/Report Entry
    - Creates custom forms for the selected IDSE option and helps the system complete electronic forms
- Can be accessed online, in CD version, and in hard copy template
- Both online and CD version have access to the Wizard and Plan/Report Entry feature

58

Additional Resources

- EPA's Web site: www.epa.gov/safewater/disinfection/stage2/
- Fact Sheets for the IDSE
- Quick Reference Guides for Schedule 1–4 systems
- IDSE Guidance Manual and Tool

Additional Resources

- Stage 2 Implementation Guidance Manual
- Simultaneous Compliance Guidance Manual for Stage 2 Rules
- Consecutive Systems Guidance Manual for the Stage 2 DBPR
- Small System Guidance Manual for the Stage 2 DBPR
- Operational Evaluation Guidance Manual

60

○ ○ ○

Questions?

Initial Distribution System Evaluations

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Presentation Outline

1. Very Small System (VSS) Waiver and 40/30 Certification
2. IDSE Standard Monitoring
   - How to select monitoring locations
3. Example Standard Monitoring Plan
4. IDSE System Specific Studies
5. IDSE Reports and Stage 2 DBPR Compliance Monitoring Plans

2

Very Small System (VSS) Waivers

Contents

- Eligibility Requirements
- Systems Not Granted a Waiver
- Recordkeeping

4

Eligibility Criteria

- Systems must
  - Serve fewer than 500 people
  - Have taken TTHM and HAA5 samples
    - Reduced monitoring acceptable
    - Operational data acceptable

Note: EPA or the state may require IDSE monitoring or study for any reason, even if system meets all VSS waiver eligibility criteria

5

VSS Waivers

- Waivers effective immediately
  - No application necessary
  - Systems must meet all criteria
- EPA or the state can require Standard Monitoring or System Specific Study
- VSS Waiver is only a waiver from additional IDSE activities
  - No Standard Monitoring or System Specific Study Plan
  - No IDSE Report
- Continue compliance with Stage 1 DBPR until Stage 2 DBPR compliance begins
  - Complete a monitoring plan for the Stage 2 DBPR

6

Reconsidering a Waiver

- EPA or the state may consider the following in deciding not to allow VSS Waiver:
  - Consecutive system not required to conduct Stage 1 DBPR monitoring
  - Difficulty maintaining disinfectant residual across entire system
  - Stage 1 DBPR sites are not representative of highest TTHM and HAA5 concentrations
  - Systems with branched or poorly looped distribution systems
  - System personnel are inexperienced or do not have adequate knowledge of the system
  - High DBP levels

7

Systems Not Receiving Waiver

- Systems must comply with IDSE through:
  - Standard Monitoring

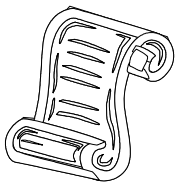
  OR

  - System Specific Study
- Work with EPA or the state to determine a timeline for compliance

8

System Recordkeeping

- No IDSE recordkeeping requirements
- Systems must prepare a Stage 2 compliance monitoring plan and keep it on file for EPA, state and public review



9

Implementation Issues

- EPA or the state must notify VSS if they must conduct Standard Monitoring or a System Specific Study
  - EPA or the state may disallow any or all VSS Waivers
- If system is denied waiver, completing Standard Monitoring or a System Specific Study on time could be challenging
  - EPA or the state may work with system to determine alternate timeline

10

Summary

- Eligibility Requirements
- Systems Not Granted a Waiver
- Recordkeeping

Questions?

11

40/30 Certification

Contents

- Eligibility Criteria
- Submittal Requirements
- 40/30 Timeline
- Primacy Agency Review Considerations
- System Recordkeeping
- Implementation Issues

13

Eligibility Criteria

- Systems must have taken all required Stage 1 DBPR TTHM and HAA5 compliance samples:
  - For eight consecutive calendar quarters
    - No individual sample can have exceeded:
      - 0.040 mg/L for TTHM
      - 0.030 mg/L for HAA5
    - No TTHM or HAA5 monitoring violations

Note: EPA or the state may deny the certification for any reason, even if system meets all eligibility criteria

14

Operational Data

- EPA or the state may allow systems not taking Stage 1 DBPR compliance samples to use operational data to qualify for certification
  - Should be equivalent to Stage 1 DBPR data
- Considerations
  - Samples taken and analyzed by approved methods at a certified lab
  - Adequate number of sample sites for system size
  - Samples taken at appropriate locations (average to maximum residence time)
  - Samples taken at appropriate frequency and during month of warmest water temperature

15

Eligibility Period and Deadline

Sch.	Population	Eligibility Period Beginning No Earlier Than*:	Submit 40/30 Certification By:
1	≥100,000	January 2004	Oct. 1, 2006
2	50,000-99,999		Apr. 1, 2007
3	10,000-49,999	January 2005	Oct. 1, 2007
4	<10,000		Apr. 1, 2008

*System is required to base the 40/30 Certification on 8 consecutive calendar quarters of Subpart L compliance monitoring results

16

Quiz#1: Reviewing 40/30 Data

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

- System is required to take 1 sample per plant per quarter
- System is on Schedule 4
- System must base review on 8 consecutive quarters beginning no earlier than January 2005
- System samples quarterly from October 2005 – September 2007 and uses these results as the 8 consecutive quarters of data

17

Quiz#1: Reviewing 40/30 Data

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

	TTHM	RAA	HAA5	RAA
10/9/2005	0.034	0.035	0.023	0.022
1/7/2006	0.039	0.037	0.020	0.022
4/7/2006	0.036	0.036	0.025	0.023
7/6/2006	0.034	0.036	0.022	0.023
10/4/2006	0.030	0.035	0.019	0.022
1/2/2007	0.027	0.032	0.024	0.023
4/2/2007	0.032	0.031	0.029	0.024
7/1/2007	0.030	0.030	0.026	0.025

18

Quiz#1: Reviewing 40/30 Data

System's data qualifies for 40/30 Certification

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

		RAA	HAA5	RAA
10/9/2005	0.034	0.035	0.023	0.022
1/7/2006	0.039	0.037	0.020	0.022
4/7/2006	0.036	0.036	0.025	0.023
7/6/2006	0.034	0.036	0.022	0.023
10/4/2006	0.030	0.035	0.019	0.022
1/2/2007	0.027	0.032	0.024	0.023
4/2/2007	0.032	0.031	0.029	0.024
7/1/2007	0.030	0.030	0.026	0.025

19

Quiz#2: Reviewing 40/30 Data

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

- System is required to take 1 sample per plant per quarter
- System is on Schedule 4
- System takes samples for 8 consecutive quarters beginning no earlier than January 2005
- System uses sample results from October 2005 – September 2007 as the 8 consecutive quarters of data

20

Quiz#2: Reviewing 40/30 Data

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

	TTHM	RAA	HAA5	RAA
10/9/2005	0.034	0.035	0.023	0.022
1/7/2006	0.039	0.037	0.020	0.022
4/7/2006	0.036	0.036	0.025	0.023
7/6/2006	0.034	0.036	0.022	0.023
10/4/2006	0.030	0.035	0.019	0.022
1/2/2007	0.027	0.032	0.024	0.023
4/2/2007	0.032	0.031	0.032	0.024
7/1/2007	0.030	0.030	0.029	0.026

21

Quiz#2: Reviewing 40/30 Data

System's data does not qualify for 40/30 Certification

Subpart H system serving 5,000 with 1 treatment plant on routine monitoring

		RAA	HAA5	RAA
10/9/2005	0.034	0.035	0.023	0.022
1/7/2006	0.039	0.037	0.020	0.022
4/7/2006	0.036	0.036	0.025	0.023
7/6/2006	0.034	0.036	0.022	0.023
10/4/2006	0.030	0.035	0.019	0.022
1/2/2007	0.027	0.032	0.024	0.023
4/2/2007	0.032	0.031	0.032	0.024
7/1/2007	0.030	0.030	0.029	0.026

Individual sample exceeded 0.030 mg/L for HAA5.

22

40/30 Certification Submittal

- Systems must submit a statement certifying that they meet the eligibility criteria
- Certification is only a waiver from additional IDSE activities
  - No IDSE Report
- Continue compliance with Stage 1 DBPR until Stage 2 DBPR compliance begins
  - Complete a monitoring plan for Stage 2 DBPR

23

Example 40/30 Certification Letter

System Information

PWS Name_____ PWS ID:_____

Street Address:_____ City, State, Zip:_____

Population Served:_____ Source Water Type: ☐ Ground ☐ Subpart H

System Type: ☐ CWS ☐ NTNCWS

Combined Distribution System: ☐ Wholesale ☐ Consecutive ☐ Neither

Contact Person

Name: _____Title: _____

Phone Number:_____Fax Number (if available):_____

Email Address (if available):_____

Certification

I hereby certify that each individual Stage 1 DBPR compliance sample collected from _____ to _____ was less than or equal to 0.040 mg/L for TTHM and 0.030 mg/L for HAA5. I understand that to be eligible, each individual sample must be equal to or below these values. I also certify that this PWS collected all required Stage 1 samples and did not have any monitoring violations during this time period.

Signature:_____ Date:_____

24

40/30 Certification Timeline

Schedule	Submit 40/30 Certification By:	Complete Standard Monitoring or SSS By:	Submit IDSE Report By:
1	Oct. 1, 2006	N/A	
2	Apr. 1, 2007		
3	Oct. 1, 2007		
4	Apr. 1, 2008		

25

Review Considerations

- Requirements
  - Certification based on appropriate dates
  - Certification received by deadline
  - Files verify that DBP levels below 40/30
- Additional elements maybe required
  - Schematic (not CBI, subject to FOIA)
  - Stage 1 DBPR results
  - Stage 2 DBPR site selection
- Other helpful information
  - System type
  - Population served
  - Part of combined distribution system?

26

Review Considerations (cont.)

- Issues EPA or the state may consider in requiring a system to conduct an IDSE
  - Stage 1 DBPR sites inadequate to select Stage 2 DBPR sites
    - Large population and few plants
    - Consecutive system with very little data
  - Other DBP data
    - Reviewer is aware of other data indicating higher levels of DBPs
  - Eligibility period not representative
    - Natural circumstances
    - Distribution system changes
    - Disinfection or other treatment changes
    - Source changes

27

System Not Receiving 40/30 Certification

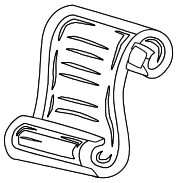
- Systems must comply with IDSE through:
  - Standard Monitoring

  OR
  - System Specific Study
- Work with EPA or the state to determine a timeline for compliance

28

System Recordkeeping

- Systems must keep a copy of their 40/30 Certification and supporting data for 10 years after date of submittal
- Make 40/30 Certification and any EPA or state correspondence available for review by EPA, the state or the public



29

Implementation Issues

- EPA or state may want to notify systems that may qualify for 40/30 Certification of:
  - Eligibility criteria and eligibility period
  - Appropriate schedule and submittal deadline
  - If additional information will be required, let systems know as soon as possible

30

Implementation Issues (cont.)

- For systems whose TTHM and HAA5 levels are close to the 40/30 Certification limits
  - EPA or the state may want to discuss the possibility of developing a Standard Monitoring Plan or System Specific Study Plan
- If EPA or the state intends to require Standard Monitoring or System Specific Study
  - Let systems know as soon as possible and work with the system to determine an alternate schedule

31

Summary

- Eligibility Criteria
- Submittal Requirements
- 40/30 Timeline
- Primacy Agency Review Considerations
- System Recordkeeping
- Implementation Issues

Questions?

32

IDSE Standard Monitoring

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Contents

- Purpose of Standard Monitoring
- Resources
- Standard Monitoring Steps
- Monitoring Requirements
- Selecting Standard Monitoring Sites
- Submitting Standard Monitoring Plan
- Next Steps and Reporting Requirements

2

What is Standard Monitoring?

- One of four options for compliance with IDSE requirements
- Most systems that need to complete an IDSE will use this option
- Process is set by EPA
  - Frequency, number, and location of samples
- Purpose:
  - Find representative sites for Stage 2 DBPR compliance monitoring to better protect public health

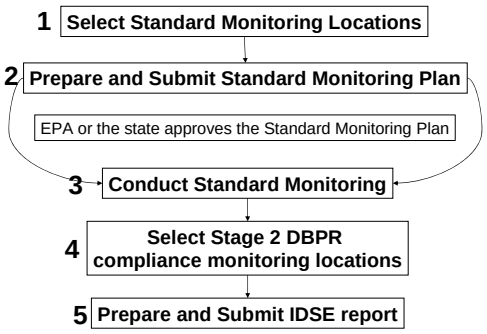
3

Resources

- IDSE Guidance Manual for the Final Stage 2 DBPR
  - Chapter 7 – Standard Monitoring
  - Blank forms for submittals
  - Example completed forms in appendices
- IDSE Guide for Systems Serving < 10,000 People
  - Chapter 5 - Standard Monitoring
  - Blank forms for submittals
  - Example completed forms in appendices
- IDSE Tool
  - Walks systems through entire IDSE process
- All materials available
  - on-line at (including link to the IDSE tool) http://www.epa.gov/safewater/disinfection/stage2/compliance_idse.html
  - by calling the Safe Drinking Water Hotline (800-426-4791)

4

Standard Monitoring IDSE Steps



5

Standard Monitoring Requirements

- What, where, and how often do I monitor?
  - Samples Collected
    - Dual sample set (both TTHM and HAA5) collected at all locations
  - Monitoring Locations
    - High TTHM levels
    - High HAA5 levels
    - Average Residence Time
    - Near Entry Points
  - Number of sites
    - Based on system's source water type and population served
  - Monitoring Frequency
    - 1, 4, or 6 monitoring periods during the year at each location
    - Number based on population served and source type

6

Requirements for Ground Water Systems

- **For groundwater systems or systems that purchase groundwater**

Population	Frequency (in year)	Total Sites	Near EP	ART	High TTHM	High HAA5
< 500 consecutive	1 (during peak historical month)(2)	2	1	-	1	-
< 500 non-consecutive		2	-	-	1	1
500-9,999	4 (every 90 days)	2	-	-	1	1
10,000 – 99,999		6	1	1	2	2
100,000-499,999		8	1	1	3	3
≥ 500,000		12	2	2	4	4

(1) A dual sample set (i.e., a TTHM and an HAA5 sample) must be taken at each monitoring location during each monitoring period.
(2) The peak historical month is the month with the highest TTHM or HAA5 levels or warmest water temperature.

7

Requirements for Subpart H Systems

- **For Subpart H systems and systems that purchase Subpart H water**

Population	Frequency	Total	Near EP	ART	High TTHM	High HAA5
<500 consecutive	1 (during peak historical month)(2)	2	1	-	1	-
<500 non-consecutive		2	-	-	1	1
500-3,300 consecutive	4 (every 90 days)	2	1	-	1	-
500-3,300 non-consecutive		2	-	-	1	1
3,301-9,999		4	-	1	2	1
10,000-49,999	6 (every 60 days)	8	1	2	3	2
50,000- 249,999		16	3	4	5	4
250,000-999,999		24	4	6	8	6
1,000,000-4,999,999		32	6	8	10	8
≥ 5,000,000		40	8	10	12	10

See previous slide for footnotes.

8

Standard Monitoring Requirements (cont.)

- When do I sample?
  - Sample months
    - Peak historical month
      - Peak TTHM levels

        OR
      - Peak HAA5 levels

        OR
      - Month of warmest water temperature
    - All systems sample during this month
    - Systems sampling more than once will set sample months every 60 days or every 90 days around peak historical month

9

Standard Monitoring Example

- Stage 2 DBPR: Monitor every 90 days

July

S	M	T	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

October

S	M	T	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

- NOT: Every quarter

July

S	M	T	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

December

S	M	T	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

10

IDSE Schedule for Standard Monitoring

Sch.	Systems Serving	Submit Plan	Complete Monitoring	Submit IDSE Report
1	≥ 100,000	10/1/2006	9/30/2008	1/1/2009
2	50,000 –99,999	4/1/2007	3/31/2009	7/1/2009
3	10,000 –49,999	10/1/2007	9/30/2009	1/1/2010
4	< 10,000	4/1/2008	3/31/2010	7/1/2010

Schedule for systems in a combined distribution system is based on that of largest system in the combined distribution system

11

Required Components of Standard Monitoring Plan

- Distribution system schematic
  - Entry points, sources, and storage facilities
  - Locations and dates of proposed Standard Monitoring sites
  - Locations and dates of Stage 1 DBPR monitoring sites
- Population served
- Source water type
- Justification of Standard Monitoring sites
  - Must include a summary of data used to justify selection of Standard Monitoring sites

12

Standard Monitoring
Submitting Schematics

- Distribution System Schematics are not CBI and therefore are subject to the Freedom of Information Act (FOIA)
- Distribution System Schematics submitted should be either:
  - A schematic of pipes with no landmarks that indicate entry points, tanks, and monitoring locations

  OR
  - A city road map without pipes that only indicate boundaries, entry points, tanks, and monitoring locations

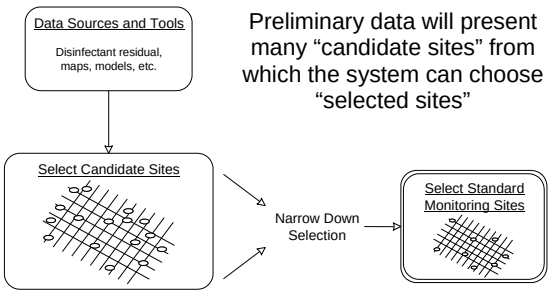
13

Standard Monitoring
Site Selection – Justification

- Plan must include a justification for the selection of sites to be sampled during Standard Monitoring
- Data sources and tools
  - Distribution system maps
  - Water quality data
  - Distribution system operating data

14

Standard Monitoring
Site Selection

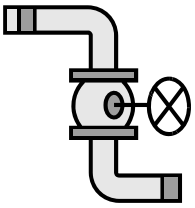


Preliminary data will present many “candidate sites” from which the system can choose “selected sites”

15

Data Sources and Tools for Site Selection

- Distribution system maps
  - Pipe
    - Dead ends
    - Length and diameter
    - Age and material
  - Water use
    - Highly and lightly developed areas
    - Major users
  - Entry points and sources
  - Key components
    - Tanks, pump stations, booster chlorination



16

Data Sources and Tools for Site Selection

- Water quality data
  - Source water quality
    - Multiple sources
  - DBP data
    - Should use Stage 1 DBPR data for information
    - Cannot use Stage 1 DBPR sites for Standard Monitoring sites
  - Disinfectant residual data
    - Can be indicative of residence time, but…
      - Other factors can deplete residual
      - Booster chlorination will increase residual
  - Heterotrophic Plate Count (HPC)
    - May indicate biodegradation of HAA5
    - Sites with high HPC counts may not be a good HAA5 sites

17

Data Sources and Tools for Site Selection

- Distribution system operating data
  - Understanding water flow
    - Pump run times
    - Metered flows between pressure zones
    - Billing records for major users
    - Advanced tools (hydraulic modeling or tracer studies)
  - Impact of tanks
    - Tank level records and tank configurations
  - Impact of booster chlorination
    - Typically located in areas of long residence time
    - Increasing disinfectant can increase DBP formation

18

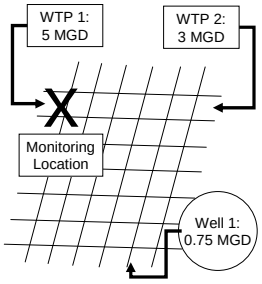
Selecting Near Entry Point Sites

- Tools
  - Distribution system map
- Location
  - After treatment
  - Before first customer (not required)
- If more entry points than needed
  - Use entry points with highest annual water flow
- If fewer entry points than needed
  - Replace with high TTHM and HAA5 sites
    - Alternate between high TTHM and high HAA5 sites, starting with TTHM

19

Selecting Near Entry Point Sites– Example

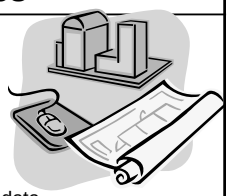
- System needs 1 location near entry point
- System has 2 surface water treatment plants and 1 well = 3 entry points
- System considers flows from each source
  - WTP 1 – 5 MGD
  - WTP 2 – 3 MGD
  - Well 1 – 0.75 MGD
- Locate site near entry point for WTP 1



20

Selecting Average Residence Time Sites

- Determination
  - Flow weighted analysis
  - Population weighted analysis
- Tools
  - Distribution system map
  - Distribution system operational data
    - Hydraulic modeling or tracer study
    - Pump run times, metered flow
  - Distribution system water quality data
    - Average Disinfectant Residual



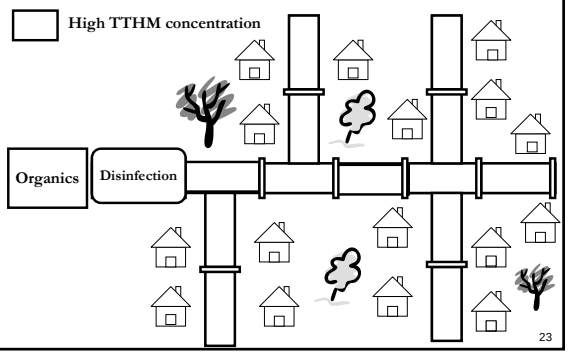
21

Selecting High TTHM Sites

- TTHM formation
  - **Residence time** is primary factor
- Avoid
  - Dead ends with no users
  - Sites upstream of booster chlorination
  - Sites after the last hydrant or blowoff
- Good TTHM sites
  - Downstream of tanks
  - Dead ends, but prior to last customer and prior to last hydrant or blowoff
  - Hydraulic dead ends and mixing zones
  - Downstream of booster chlorination
  - Sites with difficulty maintaining residual
  - Areas with low water use
  - Areas of high historic levels

22

TTHM Formation



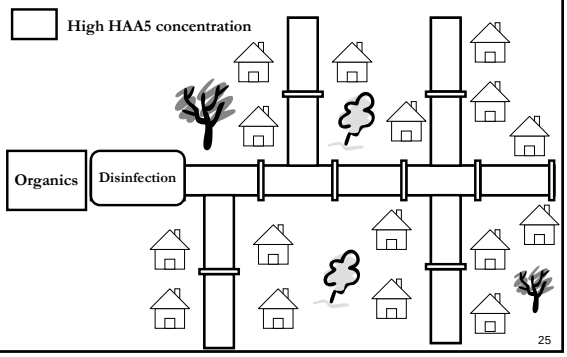
23

Selecting High HAA5 Sites

- HAA5 formation
  - Residence time, but also consider biodegradation
- Avoid
  - Areas with known biofilm growth
  - Areas with difficulty maintaining a residual
- Good HAA5 sites
  - Downstream of booster chlorination
  - Sites with low but detectable residual
  - Areas of high historic levels
  - Other
    - Tanks
    - Dead ends
    - Hydraulic dead ends and mixing zones
    - Areas with low water use

24

HAA5 Formation



25

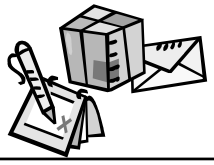
Final "Selected" Sites

- Some site selection will be obvious
  - Near entry point
- Others will require professional judgment
  - Consider geographic representation
  - Consider hydraulic representation
  - Consider areas fed by sources with higher DBP precursors
  - Use sites that "multi-task"
  - Consider accessibility

26

Submitting Standard Monitoring Plan

- Once the system has collected and analyzed its information, it must prepare the plan and submit it to EPA or the state
  - Electronically (through IDSE tool)
  - Hard-copy (mail to IPMC address)
- Must include required information



27

Standard Monitoring Plan Review Process

- EPA or the state will review the monitoring plan submitted by the system
  - Verify that it contains required elements
  - Review Standard Monitoring site selection and justification

If EPA or the state does not take action within 12 months from the date when the Standard Monitoring Plan was due, the system can consider the plan approved.

28

Standard Monitoring Plan Review Process, cont.

- If review cannot be completed within 12 months of submission deadline, EPA or state can notify system that review is not complete
  - System may not be able to meet compliance schedule
    - EPA or state will have to work with system to set new schedule for monitoring and submittal of IDSE report
    - Review should avoid sending approval too late to meet compliance monitoring deadlines
  - System may not be able to sample as proposed in plan
    - Sampling dates may have to be amended
    - System must still sample during peak historical month

29

Next Steps

- Conduct 1 year* of monitoring based on Standard Monitoring Plan
  - As approved or amended by EPA or the state
  - Begin monitoring as outlined in plan after plan has been approved or 12 months from submission deadline
  - Monitor HAA5 and TTHM dual sample set at every site

***1 year of monitoring = 1, 4, or 6 monitoring periods**

30

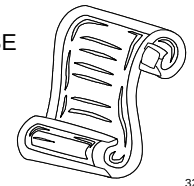
Next Steps (cont.)

- Prepare and submit IDSE report
  - Purpose of the report is to identify Stage 2 DBPR Compliance Monitoring Sites
  - Deadline – depends on schedule (3 months from deadline for conducting monitoring)
  - Submit compliance monitoring plan
    - Systems whose IDSE report includes all the required elements of a compliance monitoring plan will have satisfied this requirement
- Begin Stage 2 DBPR Compliance Monitoring

31

System Recordkeeping

- Must keep a copy of their Standard Monitoring plan as well as EPA or state modification or approval for 10 years after date of submittal
- Make all available for review by EPA, state or the public
- CCR for a given calendar year must include range of IDSE monitoring results from the same calendar year



32

Summary

- Purpose of Standard Monitoring
- Standard Monitoring Steps
- Monitoring Requirements
- Selecting Standard Monitoring Sites
- Submitting Standard Monitoring Plan
- Next Steps and Reporting Requirements

Questions?

33

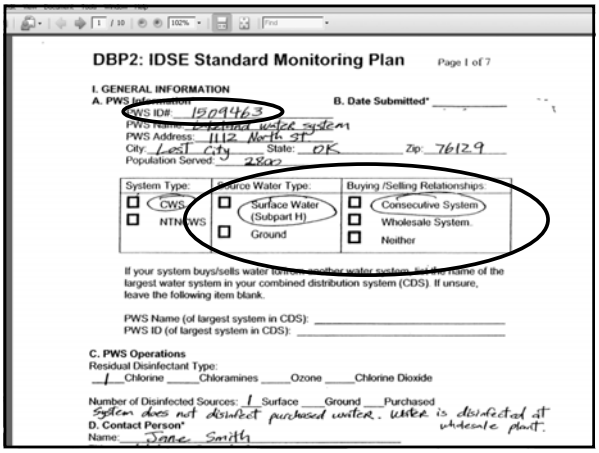
Standard Monitoring Plan Example – Avoiding Mistakes

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Avoiding Mistakes

- PWS ID# = Water System ID
  - Complete ID number includes the "OK" in front of the number
- Source Water Type
  - Ground water systems that purchase surface water are classified as Surface Water
- Buying/Selling Relationship
  - Consecutive = your system purchases water from another system
  - Wholesale = your system supplies water to another water system

2



DBP2: IDSE Standard Monitoring Plan Page 1 of 7

I. GENERAL INFORMATION
A. PWS Information B. Date Submitted* _____
PWS ID#: 1509463
PWS Name: Ground water system
PWS Address: 1112 North St
City: Lost City State: OK Zip: 76129
Population Served: 2800

System Type:	Source Water Type:	Buying /Selling Relationships:
☐ CWS	☐ Surface Water (Subpart H)	☐ Consecutive System
☐ NTNCWS	☐ Ground	☐ Wholesale System
		☐ Neither

If your system buys/sells water to another water system, list the name of the largest water system in your combined distribution system (CDS). If unsure, leave the following item blank.

PWS Name (of largest system in CDS): _____
PWS ID (of largest system in CDS): _____

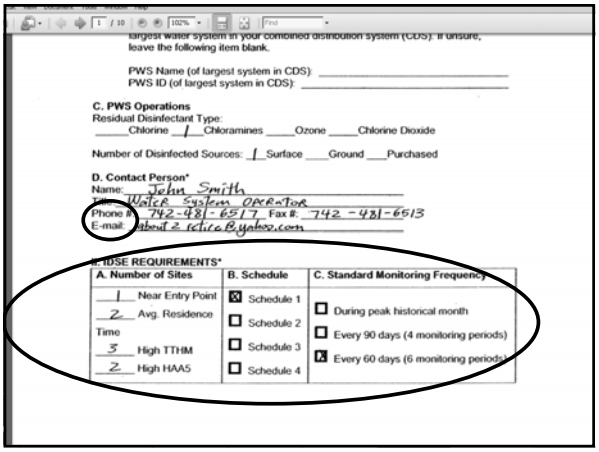
C. PWS Operations
Residual Disinfectant Type:
/ Chlorine ____ Chloramines ____ Ozone ____ Chlorine Dioxide

Number of Disinfected Sources: 1 Surface ____ Ground ____ Purchased
System does not disinfect purchased water. Water is disinfected at wholesale plant.
D. Contact Person*
Name: Jane Smith

Avoiding Mistakes (cont.)

- Contact Person
  - List a contact person who can answer questions about your Standard Monitoring Plan.
  - List complete phone number including area code.
- Schedule
  - List the Schedule for the largest system in your CDS. This is also your Schedule.
  - Call EPA and/or other systems in your CDS if you are unsure.
- Summary of Data
  - Write three to five sentences explaining what info you used to select your Standard Monitoring sites.

4


largest water system in your combined distribution system (CDS). If unsure, leave the following item blank.

PWS Name (of largest system in CDS): _____
PWS ID (of largest system in CDS): _____

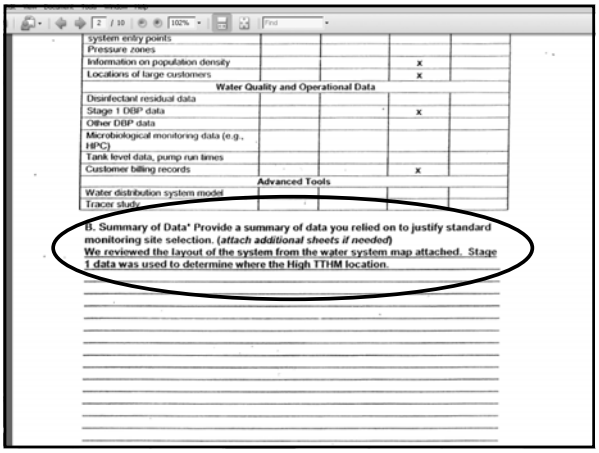
C. PWS Operations
Residual Disinfectant Type:
____Chlorine __/__Chloramines ____Ozone ____Chlorine Dioxide

Number of Disinfected Sources: _/_Surface ___Ground ___Purchased

D. Contact Person*
Name: John Smith
Title: Water System Operator
Phone #: 742-481-6517 Fax #: 742-481-6513
E-mail: about2relive@yahoo.com

E. IDSE REQUIREMENTS*

A. Number of Sites	B. Schedule	C. Standard Monitoring Frequency
__1__ Near Entry Point	☒ Schedule 1	☐ During peak historical month
__2__ Avg. Residence Time	☐ Schedule 2	☐ Every 90 days (4 monitoring periods)
__3__ High TTHM	☐ Schedule 3	☒ Every 60 days (6 monitoring periods)
__2__ High HAA5	☐ Schedule 4	



system entry points				
Pressure zones				
Information on population density			x	
Locations of large customers			x	
Water Quality and Operational Data				
Disinfectant residual data				
Stage 1 DBP data			x	
Other DBP data				
Microbiological monitoring data (e.g., HPC)				
Tank level data, pump run times				
Customer billing records			x	
Advanced Tools				
Water distribution system model				
Tracer study				

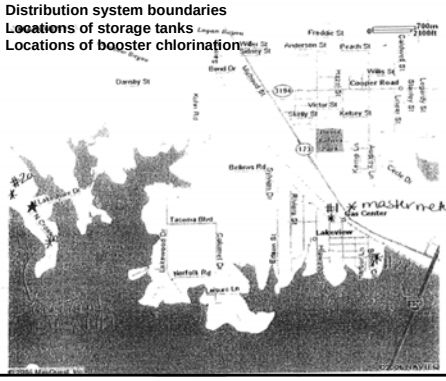
B. Summary of Data* Provide a summary of data you relied on to justify standard monitoring site selection. (*attach additional sheets if needed*)
We reviewed the layout of the system from the water system map attached. Stage 1 data was used to determine where the High TTHM location.

Avoiding Mistakes (cont.)

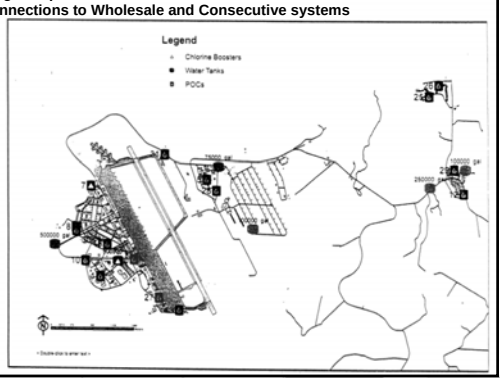
- Distribution System Schematic
  - Do NOT include security sensitive information.
  - Do NOT include street names if you show your system's pipe layout.
  - Identify boundaries of your distribution system.
  - Identify storage tanks and booster chlorine stations, (if there are none please say so on your map).
  - Put your PWS ID on your map especially if you submit your Standard Monitoring Plan by mail.

7

Missing Components:
1) Distribution system boundaries
2) Locations of storage tanks
3) Locations of booster chlorination



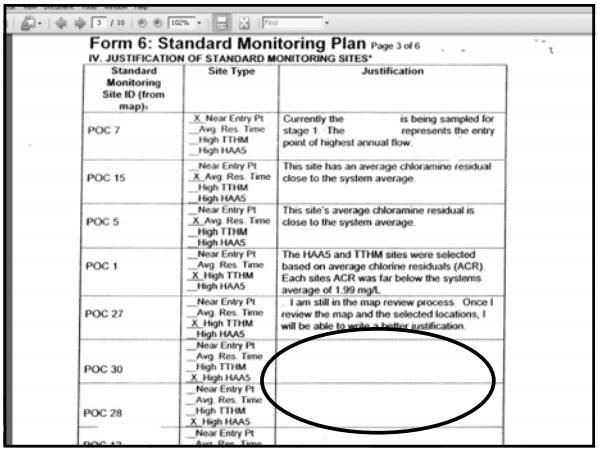
Missing Component:
1) Connections to Wholesale and Consecutive systems



Avoiding Mistakes (cont.)

- Justification
  - You must have justification for each sample site. No justification means EPA/State cannot adequately review your plan.
  - Make sure your Site ID matches what is on your distribution system schematic.
- Proposed Monitoring Schedule
  - Include the week, month, and year of the projected sampling date.
  - Must include the peak historical month in your proposed monitoring schedule!

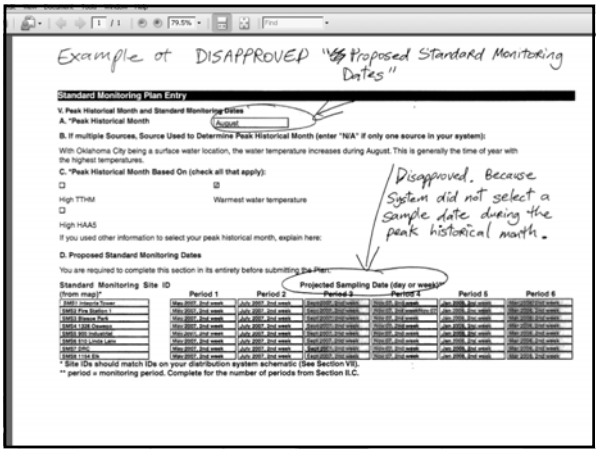
10



Form 6: Standard Monitoring Plan Page 3 of 6

IV. JUSTIFICATION OF STANDARD MONITORING SITES*

Standard Monitoring Site ID (from map):	Site Type	Justification
POC 7	_X_ Near Entry Pt __Avg. Res. Time __High TTHM __High HAA5	Currently the is being sampled for stage 1. The represents the entry point of highest annual flow.
POC 15	__Near Entry Pt _X_ Avg. Res. Time __High TTHM __High HAA5	This site has an average chloramine residual close to the system average.
POC 5	__Near Entry Pt _X_ Avg. Res. Time __High TTHM __High HAA5	This site's average chloramine residual is close to the system average.
POC 1	__Near Entry Pt __Avg. Res. Time _X_ High TTHM __High HAA5	The HAA5 and TTHM sites were selected based on average chlorine residuals (ACR). Each sites ACR was far below the systems average of 1.99 mg/L.
POC 27	__Near Entry Pt __Avg. Res. Time _X_ High TTHM __High HAA5	I am still in the map review process. Once I review the map and the selected locations, I will be able to write a better justification.
POC 30	__Near Entry Pt __Avg. Res. Time __High TTHM _X_ High HAA5	
POC 28	__Near Entry Pt __Avg. Res. Time __High TTHM _X_ High HAA5	
	__Near Entry Pt __Avg. Res. Time	



Example of DISAPPROVED "Proposed Standard Monitoring Dates"

Standard Monitoring Plan Entry

V. Peak Historical Month and Standard Monitoring Dates

A. *Peak Historical Month

August

B. If multiple Sources, Source Used to Determine Peak Historical Month (enter "N/A" if only one source in your system):

With Oklahoma City being a surface water location, the water temperature increases during August. This is generally the time of year with the highest temperatures.

C. *Peak Historical Month Based On (check all that apply):

☐ High TTHM

☑ Warmest water temperature

☐ High HAA5

If you used other information to select your peak historical month, explain here:

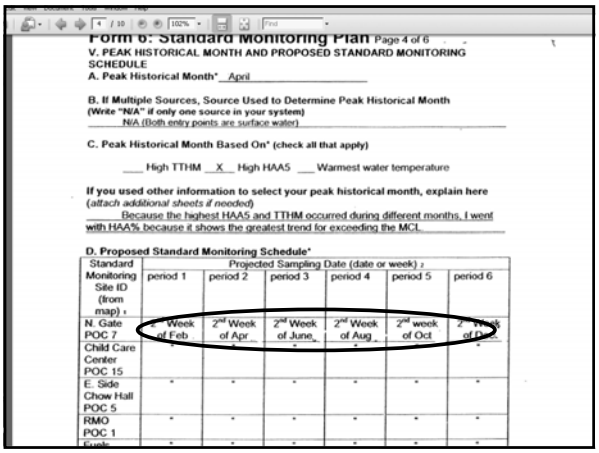
Disapproved. Because System did not select a sample date during the peak historical month.

D. Proposed Standard Monitoring Dates

You are required to complete this section in its entirety before submitting the Plan.

Standard Monitoring Site ID (from map)**	Projected Sampling Date (day or week)** Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
SM01 Intercity Tower	May 2007, 2nd week	July 2007, 2nd week	Sept2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar2008,2nd week
SM02 Fire Station 1	May 2007, 2nd week	July 2007, 2nd week	Sept2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM03 Simon Park	May 2007, 2nd week	July 2007, 2nd week	Sept2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM04 1308 Oswego	May 2007, 2nd week	July 2007, 2nd week	Sept2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM05 905 Industrial	May 2007, 2nd week	July 2007, 2nd week	Sept 2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM06 512 Linda Lane	May 2007, 2nd week	July 2007, 2nd week	Sept 2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM07 SWC	May 2007, 2nd week	July 2007, 2nd week	Sept 2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week
SM08 1104 Elk	May 2007, 2nd week	July 2007, 2nd week	Sept2007, 2nd week	Nov 07, 2nd week	Jan 2008, 2nd week	Mar 2008, 2nd week

* Site IDs should match IDs on your distribution system schematic (See Section VII).
** period = monitoring period. Complete for the number of periods from Section II.C.



Form 6: Standard Monitoring Plan Page 4 of 6

V. PEAK HISTORICAL MONTH AND PROPOSED STANDARD MONITORING SCHEDULE

A. Peak Historical Month* April

B. If Multiple Sources, Source Used to Determine Peak Historical Month (Write "N/A" if only one source in your system)

N/A (Both entry points are surface water)

C. Peak Historical Month Based On* (check all that apply)

___ High TTHM _X_ High HAA5 ___ Warmest water temperature

If you used other information to select your peak historical month, explain here (*attach additional sheets if needed*)

Because the highest HAA5 and TTHM occurred during different months, I went with HAA5 because it shows the greatest trend for exceeding the MCL

D. Proposed Standard Monitoring Schedule*

Standard Monitoring Site ID (from map) 1	Projected Sampling Date (date or week) 2					
	period 1	period 2	period 3	period 4	period 5	period 6
N. Gate POC 7	2nd Week of Feb	2nd Week of Apr	2nd Week of June	2nd Week of Aug	2nd week of Oct	2nd Week of Dec
Child Care Center POC 15	*	*	*	*	*	*
E. Side Chow Hall POC 5	*	*	*	*	*	*
RMO POC 1	*	*	*	*	*	*
Evans	*	*	*	*	*	*

Avoiding Mistakes (cont.)

- Mailing your Standard Monitoring Plan

The CORRECT ADDRESS is:
Stage 2 & LT2 IPMC
PO Box 98
Dayton, OH 45401

14

Question?

IDSE System Specific Studies

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Contents

- Overview
  - Resources
  - Schedule
- Existing Monitoring Results SSS
- Hydraulic Model SSS

2

What is a System Specific Study?

- One of four options to comply with IDSE
- Purpose is to Stage 2 DBPR monitoring sites
- SSS is appropriate for systems that:
  - Do not qualify for VSS waiver
  - Do not qualify for 40/30 certification
  - Have existing monitoring results or model that meets certain minimum requirements

3

Two Approaches for SSS

1) Existing Monitoring Results
   - Based on data already available to system
   - Similar to Standard Monitoring
2) Modeling
   - Based on hydraulic model

Steps are similar to Standard Monitoring
- Submit study plan, conduct study, submit IDSE Report
- Can do all together if you are ready
- Continue Stage 1 DBPR Monitoring until Stage 2 DBPR compliance date

4

Resources

- IDSE Guidance Manual for the Final Stage 2 DBPR
  - Chapter 5 – SSS Using Existing Monitoring Results
  - Chapter 6 – SSS Using Distribution System Hydraulic Model
  - Current version posted at:
    - http://www.epa.gov/safewater/disinfection/stage2/compliance_idse.html
- Stage 2 DBPR Implementation Guidance Document
  - Section 3 – State Implementation

5

Additional Resources

- IDSE Tool
- Forms in the IDSE Guidance Manual:
  - Form 2 – Existing Monitoring Results SSS Plan
  - Form 3 – IDSE Report for an Existing Monitoring Results SSS
  - Form 4 – Modeling Study Plan
  - Form 5 – IDSE Report for a Modeling SSS
- Resources found on-line:
  - http://www.epa.gov/safewater/disinfection/Stage2

6

SSS Schedule for Systems - Same as Standard Monitoring

Schedule Number	Submit SSS Plan	Complete SSS	Submit IDSE Report
1	October 1, 2006	September 30, 2008	January 1, 2009
2	April 1, 2007	March 31, 2009	July 1, 2009
3	October 1, 2007	September 30, 2009	January 1, 2010
4	April 1, 2008	March 31, 2010	July 1, 2010

7

SSS Schedule for States

Schedule Number	Complete Review of SSS Plan by	Complete Review of IDSE Report by
1	October 1, 2007	April 1, 2009
2	April 1, 2008	October 1, 2009
3	October 1, 2008	October 1, 2010
4	April 1, 2009	October 1, 2010

If the state does not approve, deny, or modify the SSS Plan or IDSE Report by these dates or notify the system that the plan/report is still being reviewed, the system may consider the plan/report approved

8

Existing Monitoring Results SSS

SSS - Existing Monitoring Results

- Minimum data requirements:
  - Collected no earlier than **5 years** prior to study plan submission date
  - Both regulatory compliance and operational data allowable
  - Samples analyzed using EPA approved methods by certified laboratory
  - Each location must be sampled once during month of highest TTHM/HAA5 or highest water temperature for each 12 months of data submitted

10

Number of Samples

- The minimum requirements for number of samples and locations must be met:
  - Most systems need 3 times as many sites as will be required under Stage 2 DBPR compliance monitoring
    - Except SW <3,301 and GW under 10,000
  - Locations must be representative of the entire distribution system
  - Additional monitoring beyond required Stage 1 DBPR monitoring may be necessary

11

Minimum Requirements for Number of Samples

Minimum number of samples and monitoring locations for ground water systems:

Source Water Type	Pop. Served	No. of Monitoring Locations	No. of TTHM and HAA5 Samples
Ground water	< 500	3	3
	500 – 9,999	3	9
	10,000 – 99,999	12	48
	100,000 – 499,999	18	72
	≥ 500,000	24	96

Requirements for both number of monitoring locations and number of TTHM/HAA5 samples must be met.

12

Number of Samples (cont.)

Minimum number of samples and monitoring locations for Subpart H systems:

Source Water Type	Pop. Served	No. of Monitoring Locations	No. of TTHM and HAA5 samples
Subpart H	< 500	3	3
	500 – 3,300	3	9
	3,301 – 9,999	6	36
	10,000 – 49,999	12	72
	50,000 – 249,999	24	144
	250,000 – 999,999	36	216
	1,000,000 – 4,999,999	48	288
	≥ 5,000,000	60	360

Requirements for both number of monitoring locations and number of TTHM/HAA5 samples must be met.

Types of Systems Likely to Use Existing Monitoring Approach

- Small and medium systems with many plants
  - Have more sites for Stage 1 DBPR monitoring than required by Stage 2
- Systems with operational monitoring data (TTHM and HAA5)

14

Overview of Compliance Steps for Existing Monitoring Approach

Similar to Standard Monitoring:

- Develop and submit SSS Plan
- Conduct monitoring (if any) based on SSS Plan
- Select Stage 2 DBPR compliance monitoring locations
- Prepare and submit IDSE Report
- Submit Stage 2 DBPR compliance monitoring plan (if Subpart H serving > 3,300 people)
- Begin Stage 2 DBPR compliance monitoring

15

Systems May Submit SSS Plan and IDSE Report Together

- Consider this option for systems if:
  - Enough existing data is available to meet or exceed minimum requirements, and
  - Existing data provides good coverage of system and adequately identifies location of high TTHM and HAA5.
- SSS Plan and IDSE Report should both be submitted by deadline for SSS Plan.
- *Review approach:*
  - *Review the SSS Plan and IDSE Report at the same time*

16

Minimum Elements of SSS Plan for Existing Monitoring Results

- ✓ Peak historical month
- ✓ Distribution system schematic
- ✓ Statement that system operation and configuration unchanged since monitoring data collected
- ✓ Monitoring data
- ✓ Number of samples
- ✓ Sampling locations

17

Peak Historical Month

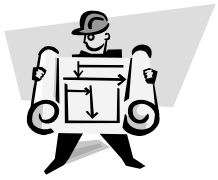
- Can be selected based on:
  - Monthly or quarterly TTHM and HAA5 data
  - Monthly water temperature data

System must document basis for selecting peak month in the SSS Plan.

18

Distribution System Schematic

- Required Elements:
  - ✓ All entry points and their sources
  - ✓ All monitoring sites
  - ✓ All storage facilities
- Optional Features:
  - ✓ Map scale
  - ✓ Pressure zone boundaries
  - ✓ Pump stations



19

System Changes

- Systems must certify that the following statement is true:

  "System operation and configuration has not changed significantly since samples were collected."

20

Allowable Changes in System Operation and Configuration

- Regular maintenance, rehabilitation, and upgrades to treatment processes.
- Short duration switches to free chlorine for secondary disinfection.
- Regular, repeating or seasonal changes in supply or treatment.
- Steady increases in water demand over time.
- Minor improvements to coagulation control that reduces DBP precursor levels in the distribution system.

21

Examples of Significant Changes that Would Not Be Allowable

- Major, permanent changes that affect DBP formation rates
- Changes to pumping operations that affect influence zones of treatment plants or mixing zones within the distribution system.
- Changes to water mains or storage tanks that affect water flow patterns
- Adding or removing a very high water use customer
- Adding a new water source
- Adding booster chlorination in the distribution system

22

Existing Monitoring Results - SSS Plan Approval

- If SSS Plan is rejected, system needs to conduct additional monitoring or conduct standard monitoring.
- If EPA or the state doesn't take action within 12 months of the plan deadline, the system may consider the plan approved.

23

Questions?

24

Hydraulic Modeling SSS

Types of Systems Likely to Use Modeling Approach

- Larger systems
- Systems with existing hydraulic models
- Systems with existing water quality models

26

Hydraulic Modeling Approach Overview of System Compliance Steps

1) Develop and submit SSS Plan
2) Conduct hydraulic modeling and monitoring (if any) based on SSS Plan
3) Select Stage 2 DBPR compliance monitoring locations
4) Prepare and submit IDSE Report
5) Submit compliance monitoring plan (Subpart H systems serving > 3,300)

Systems that have completed their modeling and monitoring may submit their SSS Plan and IDSE Report at same time. If both documents are submitted together, review at the same time.

27

Hydraulic Model Requirements

- Model must be an extended period simulation
- Model must represent current system facilities and operating conditions
- Model must be calibrated for operating conditions that represent the month when peak TTHM levels are observed
- Model output must show consistently repeating 24-hour pattern of water age

28

Example – Checking a System's Model Against IDSE Requirements

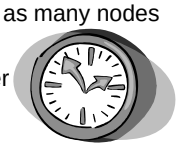
IDSE Requirement	Greater Cincinnati Water Works Model
Extended Period Simulation Capability	Yes
50% of pipe length	63%
75% of pipe volume	>90%
All 12 inch and larger pipes	Yes
Significant 6 inch and 8 inch pipes	Yes
Realistic controls (storage facilities, pump stations, control valves)	Yes
Intermediate calibration level	Yes
24-hour demand patterns	Yes
Demands assigned to >50% nodes	>90%
Demands assigned to all end nodes	Yes
Calibrated to highest DBP season	8 scenarios

Source: Swertfeger, J. 2005. IDSE Webcast. Denver, Colo.: AWWA.

29

Hydraulic Model Requirements Model Input for Water Demand

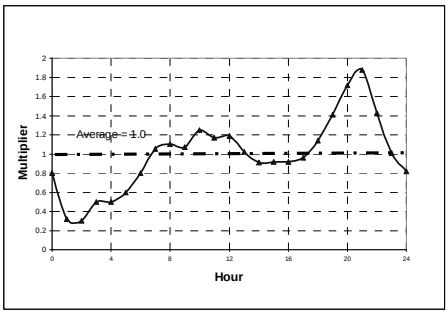
- Must represent total demand for peak month of TTHM formation
- Must reflect diurnal variations
- Should represent actual spatial distribution of demand throughout the system
- In general, should be assigned to as many nodes as possible
- Should include all significant water users



30

Hydraulic Model Requirements
Model Design

Example of Diurnal Demand Variation (midnight – midnight)



31

Calibration Requirements

- Need to verify simulated system performance with actual operating conditions
- Must use data for the peak month of TTHM formation and current system configuration
- Must be calibrated in sufficient simulation length to overcome initial conditions and produce a consistent, repeating pattern of 24-hour water age.
- Include all storage facilities
- Describe calibration activities in SSS Plan

32

What Does Calibration Entail?

- Typical calibration activities:
  - Collect Data
  - Test assumptions
  - Make sure model simulates what was intended
    - Demands
    - Supply inflow
    - Tank outflow over time to tank capacity
    - Velocities and pressures
  - Compare model predictions to field estimates
  - Track down discrepancies and adjust model parameters as necessary to match field data

Source: Cruikshank, J.R. 2006. Today's Models: Bigger Isn't Better Without Calibration. In Proc. Of the AWWA Annual Conference. Denver, Colo.: AWWA.

33

Reviewing SSS Plan for Model Development Information

- History of model development described including dates.
- Described historical uses for model
- Described types of decisions that have been based on model
- If using a water quality model, described modeling parameters and applications to date

- ***Review considerations:***
  - *Purpose is to show understanding of model*

Reviewer should ensure SSS Plan meets rule requirements and shows understanding of distribution system and model.

34

Review SSS Plan for Application of Demand Data to Model

- Described method used to assign demands throughout the system
- Look for the following:
  - Demand assigned to nodes in dead-end areas where they have large demand
  - Demands for large users assigned separately
  - System water losses included in demand
- Described method used to estimate diurnal demand
  - Look for: mass balance, series of multipliers, consideration of seasonality
- ***Review considerations:***
  - *Purpose is to show understanding of model*

35

Reviewing SSS Plan for Model Calibration Information

- Described history of model calibration activities including dates
- Described calibration data and field tests conducted to collect data
- Provided dates for field tests
- Used data for peak month of TTHM formation and typical operating controls
- Described how C-factors were determined

36

Review Considerations for Model Calibration Information

- *Review Considerations:*
  - *Calibration of extended period simulation (EPS) should start with steady-state calibration to address physical condition, customer demands, and hydraulic equipment representations*
    - *EPS calibration can then focus on system control and optional modifications*
  - *Important to develop accurate customer water usage profiles*
  - *Calibration is difficult during low head loss*
    - *In this case, need fire flow tests to show head loss.*
  - *Automated calibration:*
    - *Works well for estimating pipe roughness coefficients, demand, and location of closed valves*
    - *Needs a lot of field data to work well*

37

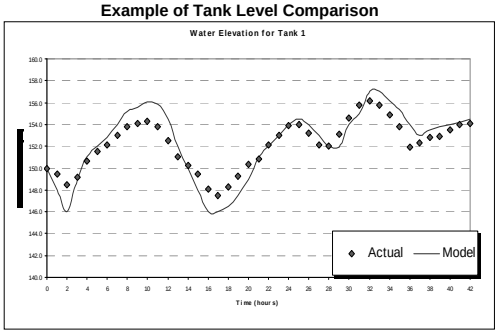
Model Calibration Output in SSS Plan

- Compared actual to predicted water levels for every storage tank using 1 hour time increments (or less) and at least a 24 hour period.
- Submitted graph of actual to predicted water levels for tank with highest water age in each pressure zone
- A time series graph of the residence time at the storage facility with the longest residence time in the distribution system. The graph must show the predictions for the entire simulation period (i.e., from time zero until the time it takes the model to reach a consistently repeating pattern of residence time).
- If calibration is complete, submitted final 24-hour average residence time predictions
- If calibration is not complete, the SSS Plan should explain how all required calibration steps will be completed within 12 months of Plan submission.

38

Hydraulic Model Output for SSS Plan

Example of Tank Level Comparison



39

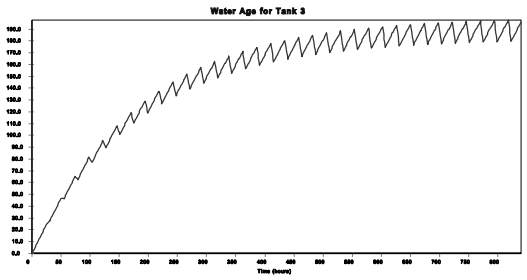
Review Considerations for Hydraulic Model Output

- If actual and modeled tank water levels follow same pattern within approximately 3 to 6 feet, hydraulic model can be considered accurate.
- If the difference between actual and modeled tank water levels is > 6 feet at any point, then concerns about hydraulic model may be warranted.

40

Hydraulic Model Output for SSS Plan

Example of Tank Residence Time Graph



41

Minimum Monitoring Requirements

- SSS Plan must include schedule for completing at least one round of TTHM and HAA5 monitoring
  - Number and type of monitoring locations based on type of system and population served
  - TTHM and HAA5 samples from each location
  - Monitoring to be conducted during historical month of high TTHM levels

42

Why is Monitoring Necessary with SSS?

- Behavior of HAA5 cannot be directly predicted based on residence time
- Generally, TTHM monitoring results should confirm model predictions and verify selection of preliminary sites
- Monitoring in controlling month (peak TTHM)

43

Example

- A Subpart H system serving 15,000 people must provide at least 8 monitoring locations:
  - 1 Near Entry Site
  - 2 Average Residence Time Sites
  - 3 High TTHM Sites
  - 2 High HAA5 Sites

44

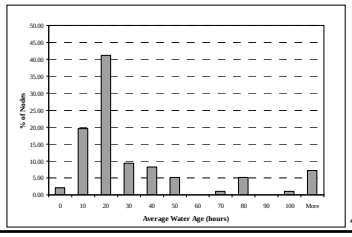
1. Near Entry Point Sites

- Located between entrance to DS and no later than first customer
- Compare # entry point sites required for SSS monitoring to # entry points in the system
  - If # required = # in system, select a sampling location near each entry point
  - If # required > # in system, replace the unassigned near entry point sites with high TTHM and HAA5 sites
  - If # required < # in the system, sample at entry points to the distribution system with highest annual water flows

45

2. Average Residence Time Sites

- Used model results for water age or DBP level
- Ranked results in order
- Plotted results on histogram (or used other method to determine average residence time)
- Selected number of average residence time sites in locations with determined average water age (e.g., 20 hours)



46

3. High TTHM Sites

- Ranked average water age results by concentration
- Selected sites with the highest water age or TTHM concentration
- Note that accuracy of water age estimates generally decreases as model moves from large to smaller diameter mains
- For skeletonized models, compared results for high water age/TTHM concentration areas to maps of the actual distribution system piping and customer locations

47

4. High HAA5 Sites

- Ranked water age results for nodes in model
- Selected sites with the highest water age or HAA5 concentration that were not selected as high TTHM sites
- Eliminated sites where HAA5 biodegradation is suspected based on analysis of disinfectant residual or HPC data
- For skeletonized models, compared results for high water age/HAA5 concentration areas to maps of the actual distribution system piping and customer locations

48

Acceptable Monitoring Sites

- Covered key areas of system (tanks, dead ends, booster chlorination)
- Geographically diverse
- Located in hydraulically different areas
- Have high water age
- Accessible
- Good sites for HAA5
- Did not include Stage 1 DBPR sites

49

Questions?

50

IDSE Report & Stage 2 DBPR Compliance Monitoring Plans

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

Contents

- **Schedule**
- **IDSE Reports**
- **Selecting Stage 2 Compliance Monitoring Sites**
- **Compliance Monitoring Plans**
- **Compliance Monitoring**

2

Schedule

Schedule Number	Systems Submit IDSE Report	State/EPA Complete Review of IDSE Report by	Systems Complete Stage 2 DBPR Compliance Monitoring Plan by
1	January 1, 2009	April 1, 2009	April 1, 2012
2	July 1, 2009	October 1, 2009	October 1, 2012
3	January 1, 2010	October 1, 2010	October 1, 2013
4	July 1, 2010	October 1, 2010	October 1, 2013 (if not monitoring for *Crypto*) October 1, 2014 (if monitoring for *Crypto*)

Notes: If the state does not approve, deny, or modify the IDSE Report by these dates or notify the system that the Report is still being reviewed, the system may consider the Report approved.

Systems serving more than 3,300 people must submit their Stage 2 Compliance Monitoring plan to the State

3

What is an IDSE Report?

- Recommends best representative Stage 2 DBPR compliance monitoring locations based on IDSE results
- IDSE Report must be completed by systems that:
  - Conduct standard monitoring
  - Conduct a system specific study (SSS)

4

IDSE Report - Minimum Elements

- IDSE Report must include:
  - Analytical results from Stage 1 DBPR compliance monitoring and SSS monitoring in a tabular or spreadsheet format
  - Selected Stage 2 DBPR compliance monitoring locations and timing, including justification for selection of those locations
  - An explanation of any deviations from the approved study plan
  - If changed from approved standard monitoring or SSS Plan, include:
    - An updated system schematic
    - Population served
    - System type (subpart H or ground water)
  - If conducted a SSS based on modeling, a 24-hour time series graph of residence time for each Stage 2 DBPR compliance monitoring location

5

Selecting Stage 2 DBPR Compliance Monitoring Sites

Overview

- For systems conducting standard monitoring or an SSS based on existing data, calculate LRAAs for all sites monitored since the IDSE plan submittal, including Stage 1 DBPR monitoring sites
- For systems conducting a modeling SSS, analyze modeling results for each SSS monitoring location, and compare modeling and sampling results
- Use the site selection protocol to select Stage 2 DBPR compliance monitoring locations
- Justify any alternate sites other than those identified using the protocol
- Recommend Stage 2 DBPR compliance monitoring locations in the IDSE Report

7

Number and Type of Site

- Based on Stage 2 DBPR Compliance Monitoring Requirements
- Three types of sites:
  - Highest TTHM Location
  - Highest HAA5 Location
  - Existing Stage 1 DBPR Monitoring Location

8

Number and Type of Sites (cont.)

Stage 2 Compliance Monitoring Requirements

Source Water Type	Population Size Category[1]	Monitoring Frequency[2]	Distribution System Monitoring Location			
			Total per monitoring period[3]	Highest TTHM Location	Highest HAA5 Location	Existing Stage 1 DBPR Compliance Location
Subpart H	<500	per year	2	1	1	.....
	500-3,300	per quarter	2	1	1	.....
	3,301-9,999	per quarter	2	1	1	.....
	10,000-49,999	per quarter	4	2	1	1
	50,000-249,999	per quarter	8	3	3	2
	250,000-999,999	per quarter	12	5	4	3
	1,000,000-4,999,999	per quarter	16	6	6	4
	≥5,000,000	per quarter	20	8	7	5
Ground Water	<500	per year	2	1	1	.....
	500-9,999	per year	2	1	1	.....
	10,000-99,999	per quarter	4	2	1	1
	100,000-499,999	per quarter	6	3	2	1
	≥500,000	per quarter	8	3	3	2

[1] Your monitoring requirements (locations and frequency) are based on the population served by your system.
[2] All systems must monitor during month of highest DBP concentrations.
[3] Systems on quarterly monitoring must take dual sample sets every 90 days at each monitoring location, except for subpart H systems serving 500-3,300. Systems on annual monitoring and subpart H systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location (and month, if monitored annually).

9

Stage 2 DBPR Compliance Monitoring Locations

	Steps of Site Selection Protocol [required by rule]	Stage 2 Compliance Monitoring Sites Selected
1	Select the location with the highest TTHM LRAA	1st highest TTHM site
2	Select the remaining location with the highest HAA5 LRAA	1st highest HAA5 site
3	For subpart H systems: Select the remaining existing Stage 1 DBPR average residence time compliance monitoring location with the highest HAA5 LRAA For ground water systems: Select the remaining existing Stage 1 DBPR maximum residence time compliance monitoring location with the highest HAA5 LRAA *Skip this step if you have no more Stage 1 DBPR sites*	1st Stage 1 DBPR site
4	Select the remaining location with the next highest TTHM LRAA	2nd highest TTHM site
5	Select the remaining location with the next highest TTHM LRAA	3rd highest TTHM site
6	Select the remaining location with the next highest HAA5 LRAA	2nd highest HAA5 site
7	For subpart H systems: Select the remaining existing Stage 1 DBPR average residence time compliance monitoring location with the highest TTHM LRAA For ground water systems: Select the remaining existing Stage 1 DBPR maximum residence time compliance monitoring location with the highest TTHM LRAA *Skip this step if you have no more Stage 1 DBPR*	2nd Stage 1 DBPR site
8	Select the remaining location with the next highest HAA5 LRAA	3rd highest HAA5 site

*If you need more Stage 2 DBPR compliance monitoring locations, Go back to **Step 1** of this protocol and repeat the steps until you have selected the required number of total sites.*

10

Site Selection Worksheet in IDSE Guidance Manual

Worksheet 7.2 Stage 2 DBPR Site Selection Worksheet for Standard Monitoring

Page 1 of 1

Instructions:

1) Enter the number of required Stage 2 DBPR compliance monitoring sites based on your ***Standard Monitoring Requirements - Attachment*** summary sheet from Chapter 2.

2) Enter the Site ID and LRAA for each IDSE standard monitoring and Stage 1 compliance monitoring location. You may want to sort your entries in order by TTHM LRAA or HAA5 LRAA values.

3) As you work through the site selection protocol in Exhibit 7.7, fill in the "Stage 2 Site Type" column each time you select a site to indicate whether the site is a high TTHM, high HAA5, Existing Stage 1 DBPR Compliance Monitoring Site, or selected using criteria other than the protocol.

No. of Stage 2 DBPR Compliance Monitoring Sites Required

_____Highest TTHM ____Highest HAA5 ____Existing Stage 1 _____TOTAL

Site ID	LRAA		Stage 2 DBPR Site Type*
	TTHM (mg/L)	HAA5 (mg/L)	
Example	*0.075*	*0.045*	*Highest TTHM*

11

Other Factors that Influence Site Selection

- Geographic coverage
- Opportunity to maintain a historical record
- Opportunity to collect other water quality or operational data
- Quarterly vs. annual monitoring during peak historical month

12

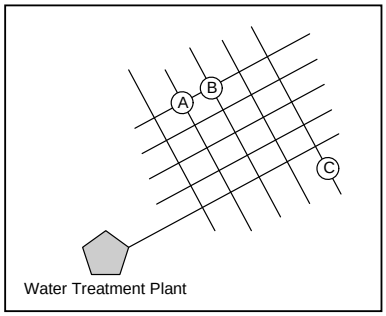
Example – Selecting Stage 2 DBPR Compliance Monitoring Sites

Site Number and Description	LRAA	
	TTHM (mg/L)	HAA5 (mg/L)
4 (operational site)	0.072	0.051
8 (operational site)	0.065	0.056
9 (Stage 1 DBPR max residence time site)	0.070	0.051

Although Site 4 has highest TTHM LRAA, Stage 1 DBPR site (Site 9) has only slightly lower TTHM LRAA. Site 9 can be chosen over Site 4 as the Stage 2 DBPR high TTHM site to maintain historical DBP record at that site.

13

Example – Selecting Stage 2 DBPR Compliance Monitoring Sites



14

Add Justification If Site Selection Doesn't Follow Protocol

- Example from IDSE Guide for Systems Serving < 10,000 People:

Among the three remaining high TTHM sites, standard monitoring site 1 has the highest TTHM LRAA. However, Stage 1 DBPR Site 2 has only a slightly lower TTHM LRAA than standard monitoring Site 1. Therefore, we chose Stage 1 DBPR Site 2 over Standard Monitoring Site 1 to maintain the historical DBP record.

15

Reviewing Recommended Monitoring Sites

- Protocol followed correctly
  - If not, did the system provide adequate justification for why alternative sites were chosen?
- All key sites covered?
  - Tanks
  - Booster chlorination
  - Isolated sections
  - Dead ends
- Adequate coverage of the system?
  - Geographic
  - Hydraulic

16

Stage 2 DBPR Compliance Monitoring Plan

What is a Stage 2 DBPR Compliance Monitoring Plan?

- Presents monitoring locations, monitoring schedule, and compliance calculation procedures for Stage 2 DBPR compliance monitoring
- Stage 2 DBPR Compliance Monitoring Plan must be completed <u>all systems subject to the Stage 2 DBPR</u>, including small NTNCWSs and systems receiving waivers

18

Compliance Monitoring Plan

- Stage 2 DBPR Compliance Monitoring Plan must include:
  - Monitoring locations
  - Monitoring dates
  - Compliance calculation procedures
  - If the state has reduced monitoring requirements, monitoring plans for other systems in the combined distribution system

19

Compliance Monitoring Plan vs. IDSE Report

- IDSE report requires:
  - Monitoring locations
  - Peak month (date)
- IDSE report contains elements of compliance monitoring plan EXCEPT Compliance calculation procedures
  - Systems have option of including compliance calculation procedures in IDSE Report to avoid creating a separate Stage 2 DBPR compliance monitoring plan
  - Applies to systems conducting standard monitoring or a SSS using existing or modeled data

If IDSE Report includes compliance calculation procedures, system does not need to prepare a Stage 2 DBPR Compliance Monitoring Plan

20

Stage 2 DBPR Compliance Monitoring

Stage 2 DBPR Compliance Monitoring

- Submit Compliance Monitoring Plan before date required to begin monitoring
  - If you are a subpart H system and you serve more than 3,300 people
- Begin Stage 2 DBPR Compliance Monitoring
  - Monitoring requirements vary by system type and size

22

Consecutive System Requirement

- Consecutive systems delivering water that has been treated with a disinfectant other than UV must comply with Stage 1 DBPR requirements for chlorine and chloramines
  - Requirement is effective beginning January 1, 2009
  - Associated analytical, monitoring, compliance, and reporting requirements under Stage 1 DBPR are applicable

23

Reduced Monitoring

- Systems qualify if LRAAs at all monitoring locations are:
  - $\leq$ 0.040 mg/L for TTHM, and
  - $\leq$ 0.030 mg/L for HAA5
- Subpart H systems must also have TOC levels $\leq$ 4.0 mg/L in source water at each treatment plant
  - Systems must sample for TOC every 30 days to qualify for reduced monitoring

24

Remaining on Reduced Monitoring

- Systems on quarterly reduced monitoring
  - Quarterly LRAAs for TTHMs and HAA5 must be ≤ 0.040 mg/L and 0.030 mg/L, respectively
- Systems on annual or less frequent monitoring
  - Quarterly LRAAs for TTHMs and HAA5 must be ≤ 0.060 mg/L and 0.045 mg/L, respectively
- Subpart H systems must monitor TOC levels every 90 days and maintain annual average levels of ≤ 4.0 mg/L in source water at each treatment plant

25

Remaining on Reduced Monitoring (cont.)

- If you are on reduced monitoring for Stage 1 and you receive a VSS waiver or 40/30 certification for the IDSE, you can remain on reduced monitoring as long as:
  - You did not change or add compliance monitoring locations from Stage 1 to Stage 2
  - If you are a subpart H system, the source water annual average TOC level is ≤ 4.0 mg/L for each treatment plant

26

Increased Monitoring

- Systems must increase monitoring frequency to dual sample sets once per quarter at all locations when TTHM sample > 0.080 mg/L or HAA5 sample > 0.060 mg/L at any location

- After completing at least four quarters of increased monitoring, systems can return to routine monitoring when TTHM LRAA ≤ 0.060 mg/L and HAA5 LRAA ≤ 0.045 mg/L at every monitoring location
- Systems on increased Stage 1 DBPR monitoring schedule must begin Stage 2 DBPR monitoring on increased schedule until meet requirements to return to routine schedule

27

Reduced Bromate Monitoring

- Systems using ozone must monitor for bromate as RAA at entrance to distribution system
- Bromate MCL remains at 0.010 mg/L
- New criteria to qualify for reduced bromate monitoring:
  - Bromate RAA must be ≤ 0.0025 mg/L using 1 year of monthly data
  - Bromate samples must be analyzed using Method 317.0 Revision 2.0, 326.0, or 321.8
  - New criteria are effective beginning April 1, 2009
- If RAA > 0.0025 mg/L, system must return to routine monitoring

28

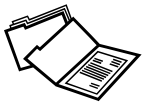
System Recordkeeping and Reporting

- System must retain IDSE Report for 10 years after date system submitted the Report
  - All primacy agency notifications of monitoring location modification or approval of alternative monitoring locations
- Systems must keep copy of Stage 2 DBPR Compliance Monitoring Plan for at least 5 years or 3 years after modification (whichever is longer)
- Records must be made available to the primacy agency or public
- CCR must include the range of sample results from the IDSE monitoring
  - In same calendar year as sampling occurred

29

Primacy Agency Recordkeeping

- Must retain a copy of IDSE report and any modifications until replaced or revised in its entirety
- Must maintain records of any decision made regarding IDSE and compliance monitoring



30

Questions?

DBP Treatment and Non-Treatment Options

DBP Microbial Rules Workshop
Anchorage, AK
November 13-15, 2007

1

Contents

- Non-treatment options
  - Benefits
  - Potential operational and simultaneous compliance issues
  - Possible solutions
- Treatment options
  - Benefits
  - Potential operational and simultaneous compliance issues
  - Possible solutions
- Issues to consider when making compliance decisions
- Technical resources

2

Compliance Approaches

System, in consultation with the State, chooses the compliance approach

- Take into account magnitude/nature of the problem, existing treatment, source water characteristics, costs, technical capabilities, co-occurring contaminants
- This is a site-specific decision
- **THERE IS NO SILVER BULLET**

3

Non-Treatment Options

4

Optimize or Modify Current Operations

OPERATIONAL PRACTICES COVERED IN THE Simultaneous Compliance GM

- Source Management
- Distribution System Best Management Practices
- Moving Point of Chlorination
- Modifying pH During Chlorination
- Modifying Chlorine Dose Under Different Temperature Conditions
- Modifying Pre-sedimentation Basin Operations
- Enhanced Coagulation
- Enhanced Softening

5

Source Management

- Examples of Source Management techniques
  - Selecting optimum depth from which to draw water
  - Blending
  - Alternating sources or intakes

6

Source Management (cont.)

- Benefits
  - Reduced DBP precursors, turbidity, pathogens
  - Reduce oxidant demand
  - Improve treatability
- Potential simultaneous compliance and operational issues
  - Changes in raw water quality may adversely impact treatment processes:
    - Temperature and pH impact CT
    - Coagulation and flocculation
  - Can impact corrosion control
  - Change aesthetic quality of water, more customer complaints
- Possible Solutions
  - Monitoring to characterize new raw water qualities
  - Jar testing to determine impact on coagulation, flocculation

7

Distribution System BMPs

- Water Age Management Strategy
  - Improve mixing in tanks
  - Minimize residence time in tanks
  - Decommission excess storage
  - Minimize residence time in pipes

- Booster Disinfection
- Water Main Flushing Program
  - Conventional
  - Unidirectional

8

Distribution System BMPs (cont.)

- Benefits
  - Targets specific area
  - Improve maintenance of disinfection residual and microbial control
  - Reduce corrosion
  - Reduce nitrification
- Potential simultaneous compliance and operational issues
  - Re-suspension of sediments
  - Issues with disposal of disinfected water
  - Lining materials leach into water
  - Less storage available for emergencies
  - Increased water loss
- **Possible Solutions**
  - Dechlorinate discharges
  - Use lining material that are NSF Standard 61 certified
  - Engineering analysis for pressure and fire flow needs

9

Moving Point of Chlorination

Exhibit 3.1 Typical Chlorine Points of Application and Uses

Point of Application	Typical Uses
Raw Water Intake	Zebra mussel and Asiatic clam control, control biological growth
Flash Mixer or Rapid Mix (prior to sedimentation)	Disinfection, iron and manganese oxidation, improved coagulation[1], taste and odor control, oxidation of hydrogen sulfide, algae control
Filter Influent	Disinfection, control biological growth in filter, iron and manganese oxidation, taste and odor control, color removal
Filter Clearwell	Disinfection, disinfectant residual
Distribution System	Maintain disinfectant residual

Source: *Alternative Disinfectants and Oxidants Guidance Manual*, USEPA 1999b.
[1]Not included as a typical use in the above reference, but documented by research

10

Moving Point of Chlorination (cont.)

Exhibit 3.2 Percent Reduction in DBP Formation by Moving Point of Chlorination

Chlorination Point	TTHM Baseline (%)	TTHM Enhanced (%)	HAA5 Baseline (%)	HAA5 Enhanced (%)
Pre rapid mix	Baseline	17	Baseline	5
Post rapid mix	2	21	5	21
Mid flocculation	9	36	14	36
Post sedimentation	21	48	35	61

Notes: Source: USEPA 1997 based on Summers et al. 1996
Baseline = Baseline coagulant (alum) dose for optimal turbidity removal (~30 mg/L)
Enhanced = Enhanced coagulant (alum) dose for optimal TOC removal (~ 52 mg/L)

11

Moving Point of Chlorination (cont.)

- Benefits
  - Reduces DBP formation within the treatment plant
  - Reduces amount of disinfectant used
- Potential simultaneous compliance and operational issues
  - Issues with meeting CT requirements
  - Filter fouling, asiatic clam or zebra mussel control
  - Could limit coagulation and filtration effectiveness, effectiveness of iron and manganese removal
  - Could change pH
- Possible Solutions
  - Use alternative oxidants
  - Adjust coagulant dose or add other chemical for pH control

12

Decreasing pH

- Chlorine is more effective at pH levels < 7.5
  - More HOCl compared to OCl^-
  - Can achieve same log inactivation with lower disinfectant dose or shorter contact time

Temperature	pH	CT Required for 0.5 log inactivation of *Giardia lamblia*	Contact time (minutes)	Free Chlorine Residual needed to meet CT Required
≤ 0.5 ºC	8.0	56	31	1.8 mg/L
≤ 0.5 ºC	7.0	36	31	1.2 mg/L

Source: Adapted from CT tables in 40 CFR 141.74 National Primary Drinking Water regulations.

13

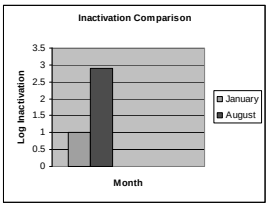
Decreasing pH (cont.)

- Benefits
  - Lower formation of DBPs within plant due to lower chlorine residual to achieve same CT
- Potential simultaneous compliance and operational issues
  - May increase HAA5 formation
  - Acidic conditions could impact treatment plant materials
  - Impacts on treatment chemistry, sludge dewatering, and inorganic solubility
  - Lower pH of finished water could impact LCR compliance
  - May need to increase chlorine in finished water to maintain residual in the distribution system
- Possible Solutions
  - Conduct SDS tests to evaluate impacts of pH adjustment of TTHM and HAA5 formation
  - Optimize pH, alkalinity, and DIC of finished water or add a corrosion control chemical
  - add chlorine to finished water or use booster disinfection

14

Reducing Chlorine Dose under Warm Water Conditions

- If disinfection profile shows much higher log inactivation in summer compared to winter months, consider reducing chlorine dose in summer.
- Systems should consult with state before making change in disinfection



15

Reducing Chlorine Dose under Warm Water Conditions (cont.)

- Benefits
  - Reduce DBP formation at the treatment plant
- Potential Simultaneous Compliance and Operational Issues
  - Pathogen concentrations in source water may be higher in summer months
  - Distribution system impacts if finished water chlorine is decreased
- Possible Solutions
  - Evaluate source water for seasonal trends in pathogen occurrence
  - Increase chlorine in finished water to maintain residual in the distribution system

16

Modifying Pre-Sedimentation Basin Operations

- Approaches:
  - Add a coagulant
  - Increase residence time in basin
- Benefits
  - Reduce DBP precursors
  - Possibly achieve 0.5 log Cryptosporidium removal credit under LT2 ESWTR
  - Reduce solids loading

17

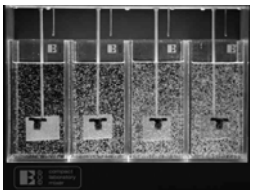
Modifying Pre-Sedimentation Basin Operations (cont.)

- Potential Simultaneous Compliance and Operational Issues
  - Algal grown in basins can increase DBP precursors
  - Challenges with removing settled solids
- Possible Solutions
  - Add potassium permanganate or cover basin to prevent algal growth
  - Modifying cleaning strategy

18

Enhanced Coagulation

- Increase coagulant dose
- Change coagulant
- Adjust pH (using acid to lower the pH as low as 5.5)
- Improve mixing or apply moderate dosage of an oxidant
- Add a polymer



19

Enhanced Coagulation (Cont.)

- Benefits
  - May improve disinfection effectiveness
  - Improve removal of DBP precursors
  - Can remove arsenic and radionuclides
- Potential Simultaneous Compliance and Operational Issues
  - Can adversely impact filtration process if less dense, more fragile floc is carried over from the clarifyer
  - Corrosion concerns
  - Increased concentrations of inorganics in finished water
  - Residual disposal issues
- Possible Solutions
  - Jar test / pilot test different coagulants to determine which forms most settleable floc
  - Adjust finished water pH
  - Systems with a high chloride to sulfate ratio should consider using a sulfate-based coagulant instead of a chloride-based coagulant

20

Enhanced Softening

Accomplished by increasing lime dose, thereby increasing the pH

- Benefits
  - Removes more TOC
  - Two stage plants may achieve additional Cryptosporidium removal
- Potential Simultaneous Compliance and Operational Issues
  - Effectiveness of chlorine reduced at higher pH levels
  - Higher formation of TTHMs
  - Can cause scaling
  - Increased residuals, change in residual characteristics
- Possible Solutions
  - Increase pH in finished water
  - Conduct SDS tests to evaluate impacts of pH adjustment of TTHM and HAA5 formation
  - Estimate impact on residuals production and characteristics

21

Treatment Options

22

Overview

- Change Primary disinfectant
  - Ozone
  - Chlorine Dioxide
  - UV
- Change Secondary Disinfectant
  - Chloramines
- Remove DBP Precursors
  - GAC
  - Nanofiltration

23

Ozone

- Generated on-site using air or liquid oxygen
- Very effective at inactivating *Giardia*, viruses, and *Cryptosporidium*
- Can oxidize iron and manganese

24

Ozone (cont.)

- Benefits
  - Does not form chlorinated DBPs (TTHM and HAA5)
  - Can oxidize taste and odor compounds
  - Can increase UV transmittance of water and improve UV effectiveness
  - Effectiveness is independent of pH
  - Can aid in coagulation

25

Ozone (cont.)

- Potential Simultaneous Compliance and Operational Issues
  - Can form Bromate
  - Forms smaller organic particles
  - May form taste and odor compounds
  - Ozone bubbles can hinder performance
- Possible Solutions
  - To control for bromate:
    - Optimize pH
    - Keep ratio of ozone to DOC low
    - Add ammonia
  - Use biological filtration
  - De-gas before filters

26

Chlorine Dioxide

- Benefits
  - Less TTHM and HAA5 formation than chlorine
  - Effective oxidant for control of iron, manganese, and hydrogen sulfide
  - Effective for inactivation of viruses and Giardia, some Cryptosporidium inactivation
  - Generally independent of pH

27

Chlorine Dioxide

- Potential Simultaneous Compliance and Operational Issues
  - Reduced effectiveness at low temperatures
  - Forms Chlorite
  - Can form brominated DBPs
  - Degrades when exposed to UV light
  - Residual dissipates quickly
- Possible Solutions
  - Minimize chlorite formation
    - Add chlorine dioxide after filters
    - Reduce pH
    - Use a reducing agent such as thiosulfate
    - Limit dose to ≤ 1.2
  - Use covered contact basin

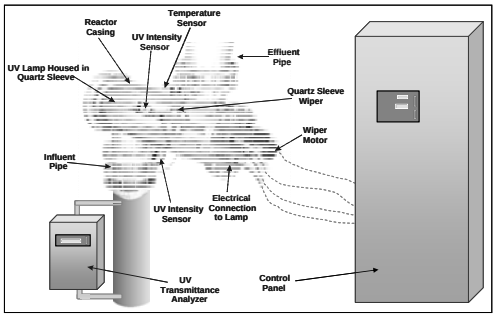
28

UV Disinfection

- Works by damaging the genetic material of microorganisms
  - UV light at wavelengths between 200 and 300 nm is most effective
- Depends on intensity of light and time of exposure
- Can be used instead of chlorine to inactivate *Giardia*, effective for inactivation of *Cryptosporidium*
- Toolbox option for LT2ESWTR
  - Reactor validation and monitoring requirements

29

Examples of UV Disinfection Equipment

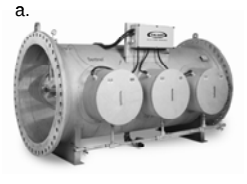


Source: Courtesy of and adapted from Severn Trent Services
Note: Not to scale

30

Examples of UV Disinfection Equipment (cont.)

a.



b.

Source: (a) Courtesy of Calgon Carbon Corporation and (b) Courtesy of WEDECO UV Systems

31

UV Disinfection – Validation Requirements

Requirement	Conditions	Citation
Validated operating conditions must include	Flow rate UV intensity as measured by a UV sensor UV lamp status	40 CFR 141.720 (d)(2)
Validation testing must include [1]	Full-scale testing of a reactor that conforms uniformly to the UV reactors used by the water system Inactivation of a test microorganism whose dose-response characteristics have been quantified with a low-pressure mercury vapor lamp	40 CFR 141.720 (d)(2)(ii)
Validation testing must account for	UV absorbance of the water Lamp fouling and aging Measurement uncertainty of on-line sensors UV dose distributions arising from the velocity profiles through the reactor Failure of UV lamps or other critical components Inlet and outlet piping or channel configurations of the UV reactor	40 CFR 141.720 (d)(2)(i)

[1] The state may approve an alternative approach to validation testing.

32

UV Disinfection

- Benefits
  - Does not produce DBPs
  - Not pH or temperature dependent
  - Can inactivate *Giardia* and *Cryptosporidium* at relatively low doses
- Potential Simultaneous Compliance and Operational Issues
  - Substances in water can interfere with UV disinfection
  - Hydraulic upsets can lower dose and possibly cause lamp breakage
  - Power quality problems can disrupt disinfection
  - Much higher doses needed for virus inactivation
- Possible Solutions
  - Modify treatment to improve UV transmittance
  - UV guidance manual provides design and operating recommendations to minimize lamp breakage
  - Use UV in series or in combination with other technology (chlorine) for virus inactivation
  - Perform a power quality assessment, determine if backup power or power conditioning equipment is needed

33

Change Secondary Disinfectant

Convert to chloramines for residual disinfection

- Chloramines are generally too weak for primary disinfection but make a stable secondary disinfectant in the distribution system
- Reduce TTHM and HAA5 formation in the distribution system
  - 40 to 80 percent
- Can still get primary disinfection credit with chlorine by injecting ammonia downstream of chlorine injection point
- 3:1 to 5:1 chlorine-to-ammonia ratio for optimum performance

Chlorine (Cl_2)	+	Ammonia (NH_4)	=	Chloramines (NH_2Cl, $NHCl_2$, NCl_3)

34

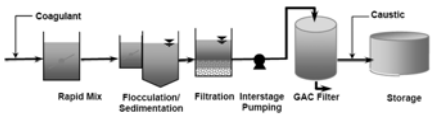
Chloramines for Secondary Disinfection

- Benefits
  - Lower DBP formation compared to chlorine
  - More persistent than free chlorine residual
  - Biofilm control in the distribution system
  - May reduce occurrence of *Legionella*
- Potential operational and simultaneous compliance issues
  - Nitrification
  - Increased corrosion and metals release
  - Task and odors
  - Blending issues – chlorinated and chloraminated waters
  - Issues for dialysis patients, fish owners, and industrial customers
- Possible solutions
  - To control nitrification
    - Distribution system flushing
    - Increase chloramine residual
    - Modify chlorine-to-ammonia nitrogen ratio
    - temporary conversion to free chlorine (“chlorine burn”)
  - Public education

35

Remove DBP Precursors – GAC

- Granular Activated Carbon (GAC)
  - GAC20, or GAC10 in combination with enhanced coagulation or enhanced softening are Best Available Technology (BAT) for Stage 2
  - Removes up to 90 percent of TOC



36

GAC (cont.)

- Benefits
  - Removes DBP precursors
  - Can remove task and odor compounds
  - Can be used as a biologically active filter to remove assimilable organic carbon
  - If used as a secondary filter, could get 0.5 log *Cryptosporidium* removal credit
- Potential Simultaneous Compliance and Operational Issues
  - Release of bacteria or previously adsorbed compounds (chromatographic peaking)
  - Carbon fines can foul downstream processes
  - Issues when used in conjunction with chlorine dioxide, after ammonia addition
- Possible Solutions
  - Adjust pH and add chlorine / chlorine dioxide / ammonia after filter
  - Proper backwashing and regeneration frequencies

37

Nanofiltration

- BAT for Stage 2 with MWCO ≤ 1000 daltons
- Small pore sizes
- Removes DOC
- Concentrated reject stream

38

Nanofiltration

- Benefits
  - Significant removal of bacteria, protozoa, and viruses
  - Can remove DBP precursors
  - Removes arsenic
- Potential Simultaneous Compliance and Operational Issues
  - Can be fouled by organics and precipitated material
  - Can increase corrosiveness of water
  - Issues with reject stream
    - 10 to 20 percent process water as waste stream
    - Brine waste
- Possible Solutions
  - Place membranes after conventional filters or install pretreatment
  - Adjust pH after membranes, optimize alkalinity
  - Evaluate options to withdrawl additional water
  - Dispose waste stream to the ocean or sanitary sewer

39

Making Compliance Decisions

40

Issues to Consider When Making Compliance Decisions

- Production capacity
  - Especially where water is scarce
  - Lost water can be an issue with membranes
- Compatibility with existing treatment
  - Modifications to chemical properties such a pH, alkalinity, and metals concentration can impact coagulation and sedimentation
- Production of residuals and disposal issues
  - Pretreatment requirements
  - Characterization of residuals
- Distribution systems issues
  - Changes in finished water quality, particularly pH, alkalinity, and redox potential, an impact compliance with LCR
  - Changes in characteristics of NOM could impact bacteriological growth and compliance with TCR

41

Issues to Consider When Making Compliance Decisions (cont.)

- Environmental issues
  - For example
    - Changes in secondary disinfectant could impact receiving streams
    - New chemicals could impact waste water treatment
    - Impacts of acquiring additional land for new treatment processes should be evaluated
- Consumer driven issues
  - Changes in taste and odor
  - Water rates
  - Public education can head off customer problems
- Preference of operations staff
  - Chemical treatment vs. UV

42

Issues to Consider When Making Compliance Decisions (cont.)

- Consecutive Systems
  - Need to carefully consider needs of consecutive systems, mixing with other water
- Site specific issues
  - Availability of resources, space requirements, hydraulic impacts, operations staff
- COSTS
  - Can be driving force behind selection of compliance strategy

43

Tools for Gathering More Information

- Water quality monitoring
- Hydraulic or water quality modeling
- Desktop evaluation
- Bench-scale testing
- Pilot testing
- Full-scale applications
- Cost estimation
- Community preferences

44

Resources

- Simultaneous Compliance Guidance Manual for the Stage 2 and LT2 Rules
  - Finalized in March 2007, available on-line at http://www.epa.gov/safewater/disinfection/stage2/pdfs/guide_st2_pws_simultaneous-compliance.pdf
  - Identifies potential issues, directs reader to other references for more in-depth information
  - Contains:
    - Summary tables for quick reference
    - 14 Case studies
    - Comprehensive discussion of decision making tools and associated references

45

Resources (cont.)

- Alternative Disinfectants and Oxidants Guidance Manual
  http://www.epa.gov/safewater/mdbp/alternative_disinfectants_guidance.pdf
- Enhanced Coagulation and Enhanced Precipitative Softening Guidance Manual
  http://www.epa.gov/safewater/mdbp/coaguide.pdf
- Membrane Filtration Guidance Manual
  http://www.epa.gov/safewater/disinfection/lt2/pdfs/guide_lt2_membranefiltration_final.pdf
- UV Disinfection Guidance Manual
  http://www.epa.gov/safewater/disinfection/lt2/pdfs/guide_lt2_uvguidance.pdf

46

Questions?

47

Stage 2 DBPR

Acronym Key

40/30	IDSE 40/30 Certification
ART	average residence time
BAT	best available technology
CCR	consumer confidence report
CDS	combined distribution system
CWS	community water system
DBPs	disinfection byproducts
DBP Precursors	disinfection byproduct precursors
EPDS	entry point to the distribution system
GWUDI	ground water under the direct influence of surface water
HAA5	the sum of the 5 haloacetic acids
IDSE	Initial Distribution System Evaluation
LRAA	Locational Running Annual Average
M-DBP Suite	Microbial-DBP suite of rules
MCL	maximum contaminant level
MRDL	maximum residual disinfection level
MRT	maximum residence time
NOM	natural organic material/ matter
NTNCWS	non-transient non-community water system
PN	public notification
PWS	public water system
RAA	running annual average
SDWA	Safe Drinking Water Act
SM	IDSE Standard Monitoring
SSS	IDSE System Specific Study
Subpart H Systems	surface water or GWUDI systems
TTHM	total trihalomethanes
TCR	Total Coliform Rule
TNCWS	transient non-community water system
TOC	total organic carbon
TT	treatment technique
VSS	Very Small System

Key Terms

Combined Distribution System - interconnected distribution system consisting of distribution systems of wholesale systems and of the consecutive systems that receive finished water.

Consecutive System - PWS that receives some or all of its finished water from one or more wholesale systems.

Dual Sample Set - set of two samples collected at the same time and location, with one sample analyzed for TTHM and the other sample analyzed for HAA5.

Finished Water - water introduced into the distribution system of a PWS that is intended for distribution and consumption without further treatment, except as necessary to maintain water quality in the distribution system.

GAC10 - granular activated carbon filter beds with an empty-bed contact time of 10-minutes based on average daily flow and a carbon reactivation frequency of every 180 days.

GAC20 - granular activated carbon filter beds with an empty-bed contact time of 20-minutes based on average daily flow and a carbon reactivation frequency of every 240 days.

HAA5 - the sum of the concentration of 5 haloacetic acids; monochloro-, dichloro-, and trichloro-acetic acid and monobromo- and dibromo-acetic acid.

Locational running annual average - the average of sample analytical results for samples taken at a particular monitoring location during the previous 4 calendar quarters

Monitoring Period – the number of times (NOT locations) you will collect appropriate Stage 2 DBPR samples in a year. Example: Monitoring every 60 days = 6 monitoring periods

TTHM - Total Trihalomethanes - which is the sum of the trihalomethane compounds chloroform, bromoform, and dibromochloro- and bromodichloro-methane.

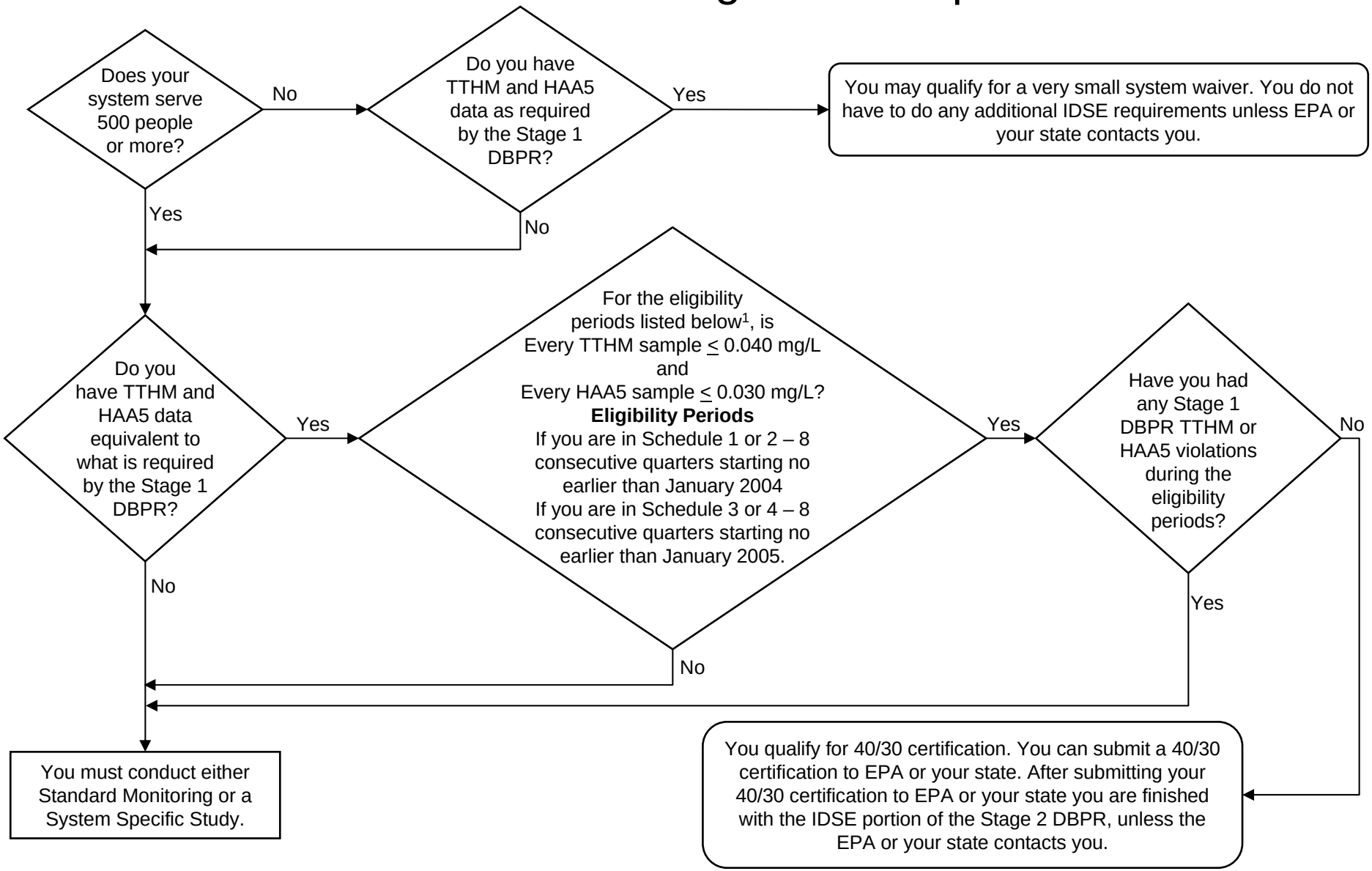
Tier 1 Violation - violation requiring notification to customers within 24 hours.

Tier 2 Violation - violation requiring notification to customers within 30 days.

Tier 3 Violation - violation requiring notification to customers within 12 months

Wholesale System - PWS that treats source water as necessary to produce finished water and then delivers some or all of that finished water to another PWS.

Flowchart for Determining IDSE Requirements



1 Unless you are on a reduced monitoring schedule for Stage 1 DBPR and were not required to monitor during the specified eligibility periods. If you did not monitoring during the specified eligibility period because you are on reduced Stage 1 DBPR TTHM/HAA5 monitoring, you must base your eligibility on compliance samples taken during the 12 months preceding the specified eligibility period.

STAGE 2 DBPR
US EPA-IPMC
P O Box 98
Dayton, OH 45401-0098

System Information

PWS Name:_____ PWS ID:_____
Street Address:_____ Population Served:_____
City:_____
State:_____
Zip:_____

Source Water Type: Ground Subpart H
System Type: CWS NTNCWS
Combined Distribution System: Wholesale Consecutive Neither

Contact Person

Name: _____ Title: _____
Phone Number:_____ Fax Number (if available):_____
Email Address (if available):_____

Certification

I hereby certify that each individual Stage 1 DBPR compliance sample collected from _____ to _____ was less than or equal to 0.040 mg/L for TTHM and 0.030 mg/L for HAA5. I understand that to be eligible, each individual sample must be equal to or below these values. I also certify that this PWS collected all required Stage 1 samples and did not have any Stage 1 monitoring violations during this time period.

Signature:_____ Date:_____

Standard Monitoring Plan Required Elements Checklist

Check if Provided ☑	Required Element	Section in Form 6
☐	Population served by the system	I.A
☐	Source water type (subpart H or ground)	I.A
☐	Peak historical month	V.A
☐	Proposed dates of standard monitoring	V.D
☐	Dates of planned Stage 1 DBPR compliance monitoring	VI
☐	Justification of standard monitoring site selection	IV
☐	Summary of data relied on to justify standard monitoring sites	III.B
A distribution system schematic with:		VII
☐	• All entry points	
☐	• All sources	
☐	• All storage facilities	
☐	• Locations of proposed standard monitoring sites	
☐	• Locations of Stage 1 DBPR compliance sampling	

Tip Sheet
Good TTHM Monitoring Locations

- Downstream of tanks
- Downstream of booster chlorination
- Dead ends, but prior t last customer and prior to last hydrant or blowoff
- Hydraulic dead ends and mixing zones
- Sites with difficulty maintaining residual
- Areas with low water use
- Areas of high historic levels

Tip Sheet
Poor TTHM Monitoring Locations

- Dead ends with no users
- Upstream of booster chlorination
- After the last hydrant or blowoff

Tip Sheet
Good HAA5 Monitoring Locations

- Downstream of booster chlorination
- Downstream of storage facilities
- Sites with low but detectable residual (>0.2 mg/L chlorine residual or >0.5 mg/l chloramine residual)
- Hydraulic dead-ends and mixing zones
- Areas of high historic levels
- Areas with low water use
- Older but not oldest water

Tip Sheet
Poor HAA5 Monitoring Locations

- Areas with known biofilm growth
- Areas with free chlorine residual less than 0.2 mg/L or with chloramine residuals less than 0.5 mg/L
- Dead ends
- Locations where Biodegradation of HAA5 are possible
  - Areas where the DIFFERENCE between free and total chlorine residual is 0.2 mg/L or greater
  - Areas where HPC counts are greater than 100 CFUs

- REMEMBER! HAA5 can biodegrade where biological activity is present and disinfectant residual levels are low or non-existent.

Form 6: Standard Monitoring Plan

I. GENERAL INFORMATION

A. PWS Information*

B. Date Submitted _____

PWSID: _____

PWS Name: _____

PWS Address: _____

City: _____ State: _____ Zip: _____

Population Served: _____

System Type:	Source Water Type:	Buying / Selling Relationships:
CWS	Subpart H	Consecutive System
NTNCWS	Ground	Wholesale System
		Neither

C. PWS Operations

Residual Disinfectant Type: Chlorine Chloramines Other:_____

Number of Disinfected Sources: ___Surface ___GWUDI ____ Ground ___ Purchased

D. Contact Person*

Name: _____

Title: _____

Phone #: _____ Fax #: _____

E-mail: _____

II. IDSE REQUIREMENTS*

A. Number of Sites:		B. Schedule	C. Standard Monitoring Frequency
Total:	____		
Near Entry Point:	____	Schedule 1	During peak historical month (1 monitoring period)
Avg Residence Time:	____	Schedule 2	
High TTHM:	____	Schedule 3	Every 90 days (4 monitoring periods)
High HAA5:	____	Schedule 4	Every 60 days (6 monitoring periods)

Form 6: Standard Monitoring Plan

III. SELECTING STANDARD MONITORING SITES

A. Data Evaluated. Put a " " in each box corresponding to the data that you used to select each type of standard monitoring site. Check all that apply.

Data Type	Type of Site			
	Near Entry Pt.	Avg. Residence Time	High TTHM	High HAA5
System Configuration				
Pipe layout, locations of storage facilities				
Locations of sources and consecutive system entry points				
Pressure zones				
Information on population density				
Locations of large customers				
Water Quality and Operational Data				
Disinfectant residual data				
Stage 1 DBP data				
Other DBP data				
Microbiological monitoring data (e.g., HPC)				
Tank level data, pump run times				
Customer billing records				
Advanced Tools				
Water distribution system model				
Tracer study				

B. Summary of Data.* Provide a summary of additional data you relied on to justify standard monitoring site selection. You are not required to submit original data. (*attach additional sheets if needed*)

_____

_____

_____

_____

_____

_____

Form 6. Standard Monitoring Plan

IV. JUSTIFICATION OF STANDARD MONITORING SITES*

Standard Monitoring Site ID (from map)[1]	Site Type	Justification
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	
	~ Near Entry Pt ~ Avg. Res. Time ~ High TTHM ~ High HAA5	

[1] *Site IDs should match IDs in Section IV and on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if you are required to select more than 8 standard monitoring locations or need more room.*

Form 6. Standard Monitoring Plan

V. PEAK HISTORICAL MONTH AND STANDARD MONITORING SCHEDULE

A. Peak Historical Month:* _____

B If Multiple Sources, Source Used to Determine Peak Historical Month
(write "N/A" if only one source in your system):

_____

C. Peak Historical Month Based On:* (check all that apply)

~ High TTHM

~ Warmest water temperature

~ High HAA5

If you used other information to select your peak historical month, explain here (*attach additional sheets if needed*):

_____

_____

_____

D. Proposed Standard Monitoring Schedule:*

Standard Monitoring Site ID (from map) [1]	Projected Sampling Date (date or week) [2]					
	period 1	period 2	period 3	period 4	period 5	period 6

[1] *Site IDs should match IDs in Section IV and on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if you are required to select more than 8 standard monitoring locations.*

[2] *period = monitoring period. Complete for the number of periods from Section II.C. Can list exact date or week (e.g., week of 7/9/07)*

Form 6. Standard Monitoring Plan

VI. PLANNED STAGE 1 DBPR COMPLIANCE MONITORING SCHEDULE*

Stage 1 DBPR Monitoring Site ID (from map) [1]	Projected Sampling Date (date or week) [2]			
	Period 1	Period 2	Period 3	Period 4

[1] Site IDs should match IDs on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if you are required to monitor at more than 8 Stage 1 DBPR sites.

[2] period = monitoring period. Complete for the number of periods in which you must conduct Stage 1 DBPR monitoring during IDSE monitoring. Can list exact date or week (e.g., week of 7/9/07)

VII. DISTRIBUTION SYSTEM SCHEMATIC*

ATTACH a schematic of your distribution system.

Distribution system schematics should not contain information that poses a ***security risk*** to your system. EPA recommends that you use one of two options:

Option 1: Distribution system schematic with no landmarks or addresses indicated. Show locations of sources, entry points, storage facilities, standard monitoring locations, and Stage 1 compliance monitoring locations (required). Also include pressure zone boundaries and locations of pump stations. Provide map scale.

Option 2: City map without locations of pipes indicated. Show locations of sources, entry points, storage facilities, standard monitoring locations, and Stage 1 compliance monitoring locations (required). Also include boundaries of the distribution system, pressure zone boundaries and locations of pump stations. Provide map scale.

Form 6. Standard Monitoring Plan

VIII. ATTACHMENTS

- ~ Distribution System Schematic (required)
- ~ Additional sheets for the summary of additional data you relied on to justify your standard monitoring site selection (Section III).
- ~ Additional copies of Page 3 for IDSE Standard Monitoring Sites (Section IV). **Required if** you are a subpart H system serving **more than 49,999 people** or a ground water system serving **more than 499,999 people**.
- ~ Additional sheets for explaining how you used data other than TTHM, HAA5, and temperature data to select your peak historical month (Section V).
- ~ Additional copies of Page 4 for proposed monitoring schedule (Section V). **Required if** you are a subpart H system serving **more than 49,999 people** or a ground water system serving **more than 499,999 people**.
- ~ Additional sheets for planned Stage 1 DBPR compliance monitoring dates (Section VI).

Total Number of Pages in Your Plan _____

Note: Fields with an asterisk (*) are required by the Stage 2 DBPR

PWS SUBMISSION GUIDELINES FOR SENDING DOCUMENTS TO IPMC

Submitting Materials to the IPMC

Mailing Address:
Stage 2 DBPR &
LT2ESWTR IPMC
P O Box 98
Dayton, OH 45401

Fax Number:
937-586-6557

Email Address:
stage2mdbp@epa.gov

With EVERY submission, send a cover letter including the following:
• PWS ID
• PWS NAME
• Compliance Schedule the PWS is on for sending in the submission
• Identify what submission type the document is (SMP, 40/30, SSS-M, etc.)

**You may choose to include this information on your fax cover page or in the body of your email submission vs. creating an additional cover letter to send with your submission.

Attachment Submissions:
When sending in an attachment by itself, include in the cover letter, fax cover page, or email the PWS # and what submission type the attachment belongs to. Also include the PWS # on the attachment itself.

Submitting attachments created in MS Excel—please convert the Excel document to PDF format prior to sending to IPMC. If you don't have the software to do this, then please include the name of the attachment and the PWS # in each worksheet within the Excel submission.

Data results
Do not submit without specifying in your cover letter, fax cover page, or email what the data is (i.e. grandfathered data, Stage 1 DBPR data, etc.). If you are an administrator over more than one PWS or facility and are sending in results for more than one PWS or facility at the same time, identify this fact in the cover letter, fax cover page, or email AND do not send all the results in as one package of data, i.e. separate the results by PWS or facility.

When submitting electronic copies of attachments either on CD or via email, please submit the attachments in PDF format. If you do not have the software to convert your document to PDF, please be sure to create your attachment in a format (such as MS Word or Excel) that IPMC can convert to PDF.

Revised Submissions

When sending in a revised copy of a previous submission, identify to IPMC in your cover letter, fax cover page, or email that it is a revised copy. If you have additional pages to add to a previous submission, send IPMC the additional pages only and identify in your cover letter, fax cover page or email the PWS # and what previous submission the additional pages go with—do not resend to IPMC the pages that were previously submitted.

Schematics

Convert large schematics to PDF file prior to sending to IPMC or use the CAD software which allows for conversion to PDF format. Put the electronic images of large schematics on CD or email them to us instead of sending printed oversized schematic—alleviates delay in getting schematic uploaded. Color schematics or schematics with any color-coding or highlighting on them—please submit on CD or via email in PDF format.

Do not submit pencil drawings of distribution system schematics—they do not scan well.

Duplicates

If you submit a document electronically and then choose to send IPMC a copy by fax, email or mail just to have for our records, include in your cover letter, fax cover page or email that the submission is a duplicate of what you have already submitted electronically into the DCTS so the IPMC team will know this is just a copy for our files and not a document we need to upload. Submit documents once only to IPMC either by fax, email or U.S. mail –do not send same document in multiple times by more than one method of sending in. Refrain from resending additional copies of a submission unless revisions have been made to the first submission.

IDSE Standard Monitoring Log

Use this log to describe when you could not monitor as described in you Standard Monitoring Plan. Suppose there is a water system scheduled to collect samples April 1, 2008, but could not collect the samples until April 3rd because of a line break. This would be an example of a deviation of the Standard Monitoring Schedule and should be logged. Later when completing the IDSE Report this information can easily be transferred right to the IDSE Report.

Date	Monitoring Location	Monitoring Event or Deviation

IDSE Standard Monitoring Requirements

Source Water Type	Population Size Category[1]	Monitoring Periods and Frequency of Sampling	Distribution System Monitoring Locations[2]				
			Total per monitoring period	Near Entry Points	Average Residence Time	High TTHM Locations	High HAA5 Locations
Subpart H	<500 consecutive systems	one (during peak historical month)[3]	2	1	.....	1	.....
	<500 non-consecutive systems		2	.....	.....	1	1
	500-3,300 consecutive systems	four (every 90 days)	2	1	.....	1	.....
	500-3,300 non-consecutive systems		2	.....	.....	1	1
	3,301-9,999		4	.....	1	2	1
	10,000-49,999	six (every 60 days)	8	1	2	3	2
	50,000-249,999		16	3	4	5	4
	250,000-999,999		24	4	6	8	6
	1,000,000-4,999,999		32	6	8	10	8
	$5,000,000		40	8	10	12	10
Ground Water	<500 consecutive systems	one (during peak historical month)[3]	2	1	.....	1	.....
	<500 non-consecutive systems		2	.....	.....	1	1
	500-9,999	four (every 90 days)	2	.....	.....	1	1
	10,000-99,999		6	1	1	2	2
	100,000-499,999		8	1	1	3	3
	$500,000		12	2	2	4	4

[1] Your monitoring requirements (locations and frequency) are based on the population served by your system.
[2] A dual sample set (i.e., a TTHM and an HAA5 sample) must be taken at each monitoring location during each monitoring period.
[3] The peak historical month is the month with the highest TTHM or HAA5 levels or the warmest water temperature.

Stage 2 Compliance Monitoring Requirements

Source Water Type	Population Size Category[1]	Monitoring Frequency[2]	Distribution System Monitoring Location			
			Total per monitoring period[3]	Highest TTHM Locations	Highest HAA5 Locations	Existing Stage 1 DBPR Compliance Locations
Subpart H	<500	per year	2	1	1	.....
	500-3,300	per quarter	2	1	1	.....
	3,301-9,999	per quarter	2	1	1	.....
	10,000-49,999	per quarter	4	2	1	1
	50,000-249,999	per quarter	8	3	3	2
	250,000-999,999	per quarter	12	5	4	3
	1,000,000-4,999,999	per quarter	16	6	6	4
	$5,000,000	per quarter	20	8	7	5
Ground Water	<500	per year	2	1	1	.....
	500-9,999	per year	2	1	1	.....
	10,000-99,999	per quarter	4	2	1	1
	100,000-499,999	per quarter	6	3	2	1
	$500,000	per quarter	8	3	3	2

[1] Your monitoring requirements (locations and frequency) are based on the population served by your system.
[2] All systems must monitor during month of highest DBP concentrations.
[3] Systems on quarterly monitoring must take dual sample sets every 90 days at each monitoring location, except for subpart H systems serving 500-3,300. Systems on annual monitoring and subpart H systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location (and month, if monitored annually).