Essentials of Surface Water Treatment (Part 2 of 2)

Oregon Health Authority
Drinking Water Services
www.healthoregon.org/dws

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Overview of Course:

Part 1:

- ✓ Background of Surface Water Treatment Rules
- ✓ Filtration
- ✓ Disinfection
- ✓ Operations

Part 2:

1. Review of Part 1
2. Reporting Requirements
3. Emerging Issues
4. Resources for Operators

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Part 1 – Review

Filtration Types:

- Conventional Filtration (CF) & Direct Filtration (DF) – a.k.a. “Rapid Rate”
  - Granular media filtration (Backwashed every 1-2 days)
- Slow sand
  - Sand filtration (scraping/harrowed every 1-6 months)
  - Ripening (24-hr filter-to-waste)
- Membrane
  - Pore size dictates removal (backwash every 30-90 minutes)
  - Chemical cleaning
- Cartridge/bag
  - Discard/replace clogged filters based on pressure differential
- Diatomaceous Earth (DE)
  - Diatoms (remove and replace cake layer)

Part 1 - Review

1989 SWTR

Surface Water Treatment Rule

- Required filtration for most SW and GWUDI (Groundwater Under Direct Influence).
  - States were required to identify GWUDI sources.
- Required pathogen removal/inactivation:

  3-log *Giardia* (99.9%) & 4-log virus (99.99%)
- Limited turbidity in filtered water (combined filter effluent):
  - Slow sand/DE/membrane/cartridge/bag:

    95% of turbidity readings ≤ 1 NTU; all < 5 NTU
  - CF/DF:

    95% of turbidity readings ≤ 0.5 NTU; all < 5 NTU (replaced under LT1)
- Required detectable disinfectant residual.
- Did not address *Cryptosporidium*.

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Part 1 – Review

1998 IESWTR

Interim Enhanced Surface Water Treatment Rule

- Addressed concerns about *Cryptosporidium*

  required 2-log Crypto (99%) removal)

- Lowered turbidity standard for CF/DF systems:

  95% of readings ≤ 0.3 NTU, all readings <1 NTU for systems with population ≥10,000 (later extended to all CF/DF systems under LT1)

- Required Individual Filter Effluent (IFE) turbidimeters

Background (continued)

2002 LT1

Long-Term 1 Enhanced SW Treatment Rule

- Extended 0.3 NTU requirement to CF/DF systems with <10,000 population.

2006 LT2

Long-Term 2 Enhanced SW Treatment Rule

- Requires additional Crypto treatment for systems with ≥ 0.075 oocysts/L in their source water.
- Very few systems are required to install additional treatment in Oregon.

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Part 1 – Review
Disinfection Requirements for Surface Water

- Surface Water Treatment Rule (SWTR) requires 3-log reduction of *Giardia* using a combination of **disinfection** and **filtration**
- 2.0 to 2.5-log removal is achieved through **filtration**
- 0.5 to 1.0-log inactivation is achieved through **disinfection**
- Determines which column of EPA tables used to calculate CTs (0.5 or 1.0-log)

Part 1 – Review

What are CT's?

- It's a way to determine if disinfection is adequate

CT = Chlorine **C**oncentration x Contact **T**ime

- Do not confuse "CT" and "Contact Time"

Part 1 – Review

How do we calculate CT's?

- We use the EPA tables to determine the CTs needed to inactivate *Giardia* ($CT_{required}$)
  - We need to know pH, temperature, and free chlorine residual at the first user in order to use the EPA tables.
- Then we compare that with the CTs achieved in our water system (CT_{actual})
- CT_{actual} must be equal to or greater than $CT_{required}$

Part 1 – Review
Tracer Studies and Contact Time:

- Used to determine contact time (T) which is used in calculating CT's

- Determines the time that chlorine is in contact with the water from the point of injection to the point where it is measured (sometimes referred to as the "CT segment")
    - May be at or before the 1st user
    - May be more than one CT segment

- Estimates of contact time are not allowed for calculating CT's for surface water!
  - ***The degree of short-circuiting is only <u>approximately</u> known until a tracer study is conducted.***

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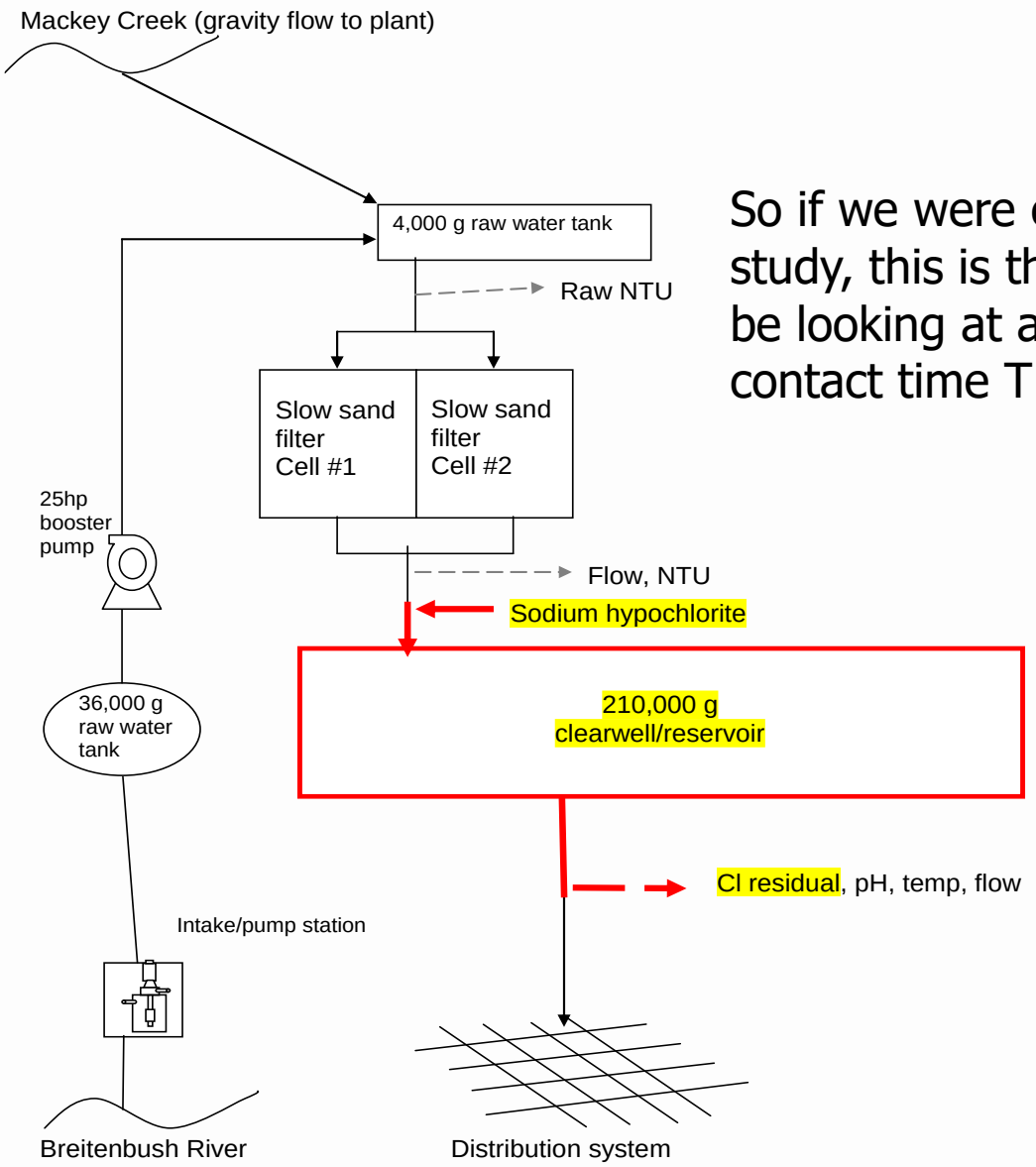
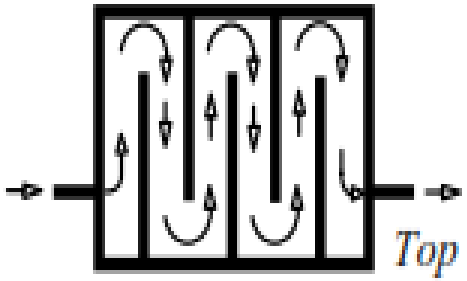


So if we were conducting a tracer study, this is the segment we would be looking at and determining the contact time T for.

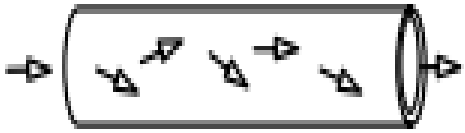
The shorter the path, the shorter the contact time (T)



Top View

Superior Circulation

Baffling Efficiency = 70%



Perfect Circulation

Baffling Efficiency = 100%

Plug flow through a length of pipe

Part 1 – Review

Tracer studies (continued):

- Must redo if peak hour demand flow increases more than 10% of the maximum flow used during the tracer study
- Community water systems with populations <10,000 and non-profit non-community systems can use the circuit rider to perform a tracer study
- Must submit a proposal to DWS for approval prior to conducting the tracer study (even if using the circuit rider).

Part 1 – Review

Operations & Maintenance Manual

Keep written procedures on:

- Instrument calibration methods and frequency
- Data handling/reporting
- Chemical dosage determinations
- Filter operation and cleaning
- CT determinations
- Responding to abnormal conditions (emergency response plan)

REPORTING REQUIREMENTS

(Part 2)

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Overview

- How to fill out the monthly SWTR operating reports
  - How often to record turbidities
  - Highest turbidity of the day
  - Peak hourly demand flow
  - CT calculations
- Common mistakes
- What to do when things go wrong

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How to fill out the monthly SWTR reports

- There are 4 forms:
  - Conventional/Direct
  - Slow Sand / Membrane / DE / Unfiltered
  - Cartridge
  - UV (if used for *Giardia* credit)
- Must use correct form because each has questions that must be answered that are specific to the filtration type

How to fill out the monthly SWTR reports

Forms have places to report:

- Turbidity
- Peak Hourly Flow
- CT calculations
- Log inactivation requirement (0.5 or 1.0-log, CF/DF only)

Turbidity

- Record how often?
  - Conventional and direct: every 4 hours
  - SSF, DE & Alternative: daily
- Report CFE turbidities
- Answer questions about IFEs
- Highest turbidity of the day (can be between the 4 hour readings)

OHA - Drinking Water Program – Turbidity Monitoring Report Form County:
Conventional or Direct Filtration

System Name: **ID #:** **WTP-:** **Month/Year:**

DAY	12 AM [NTU]	4 AM [NTU]	8 AM [NTU]	NOON [NTU]	4 PM [NTU]	8 PM [NTU]	Highest Reading of the Day[1] [NTU]
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							

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5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							

Conventional or Direct Filtration	Monthly Summary (Answer Yes or No)	
95% of the 4-hour turbidity readings ≤ 0.3 NTU? **Yes / No** All the 4-hour turbidity readings ≤ 1 NTU? **Yes / No** All turbidity readings < IFE[2] triggers? **Yes / No** [2]	CT's met everyday? (see back) **Yes / No**	All Cl_2 residuals at entry point ≥ 0.2 mg/l? **Yes / No**
Notes:	**PRINTED NAME:**	
	SIGNATURE:	**DATE:**
	PHONE #: ( )	**CERT #:**

[1] Including continuous turbidity data, if applicable, for optimization recording purposes. Compliance values in columns "12 AM" through "8 PM" may not correspond to continuous readings' maximum.

[2] IFE = Individ. Filter Effl. (OAR 333-061-0040(1)(e)(B&C))

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Peak hourly flow

- Report the Peak Hourly Flow
  - greatest volume of water passing through the system during any one hour in a consecutive 24 hr period
- Not the same as Peak Instantaneous Flow
- Report demand flow: flow leaving the clearwell, not plant flow (in most cases)

Method for determining peak hourly demand flow

- On a daily basis, use the best available operational data to identify the hour within the 24 hr period that had the highest demand flow

- For the hour of highest demand flow:
  - Calculate the average flow rate within the one hour period (i.e., add the flow rates and divide by the number of data points).
  - Use as many data points as possible, preferably no less than four data points taken at 15 minute intervals

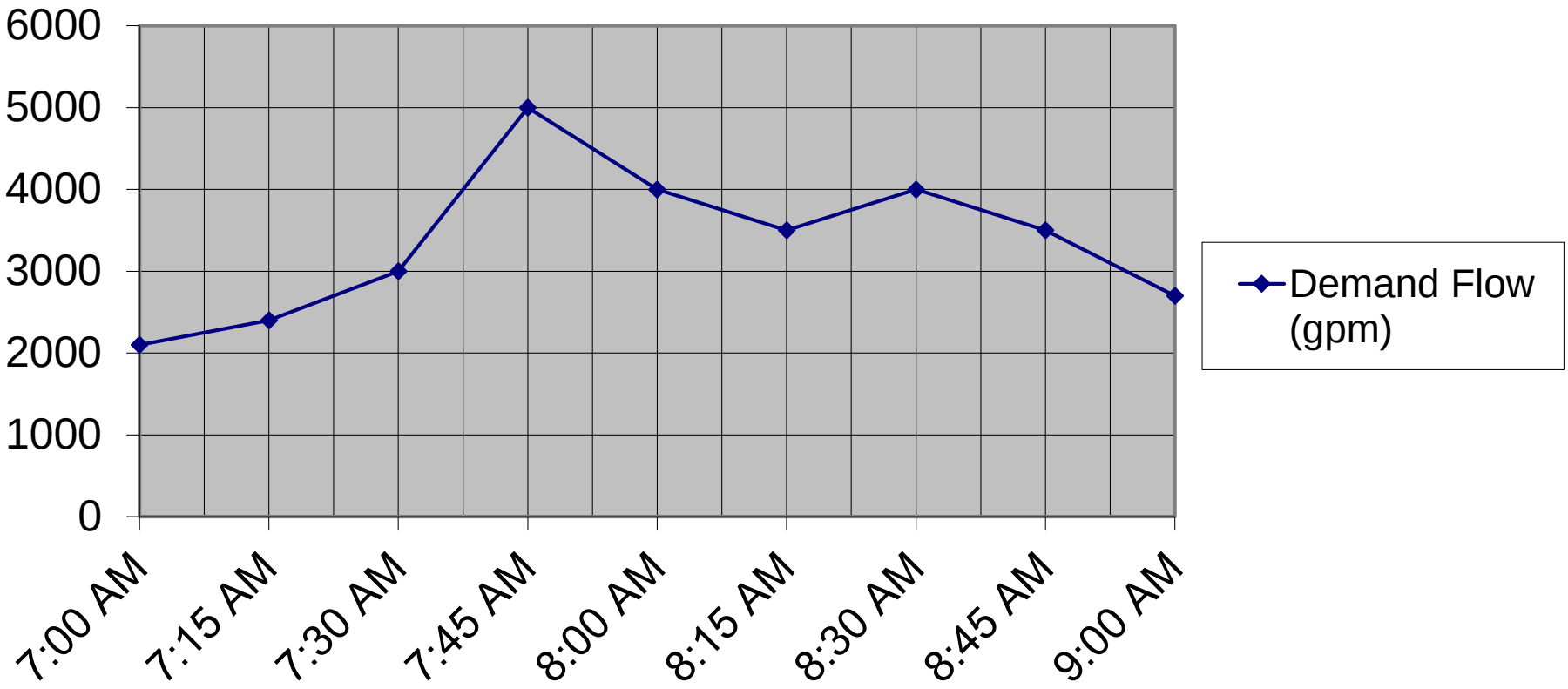
Method for determining peak hourly demand flow (continued)

- For systems that only have a flow totalizer, spot check throughout the day to determine the time of peak demand
- Once that time has been identified (e.g., 8am or 9pm for residential; mid-day for industrial), then record how much water is used during that hour each day and divide by 60 minutes to get a peak hour demand

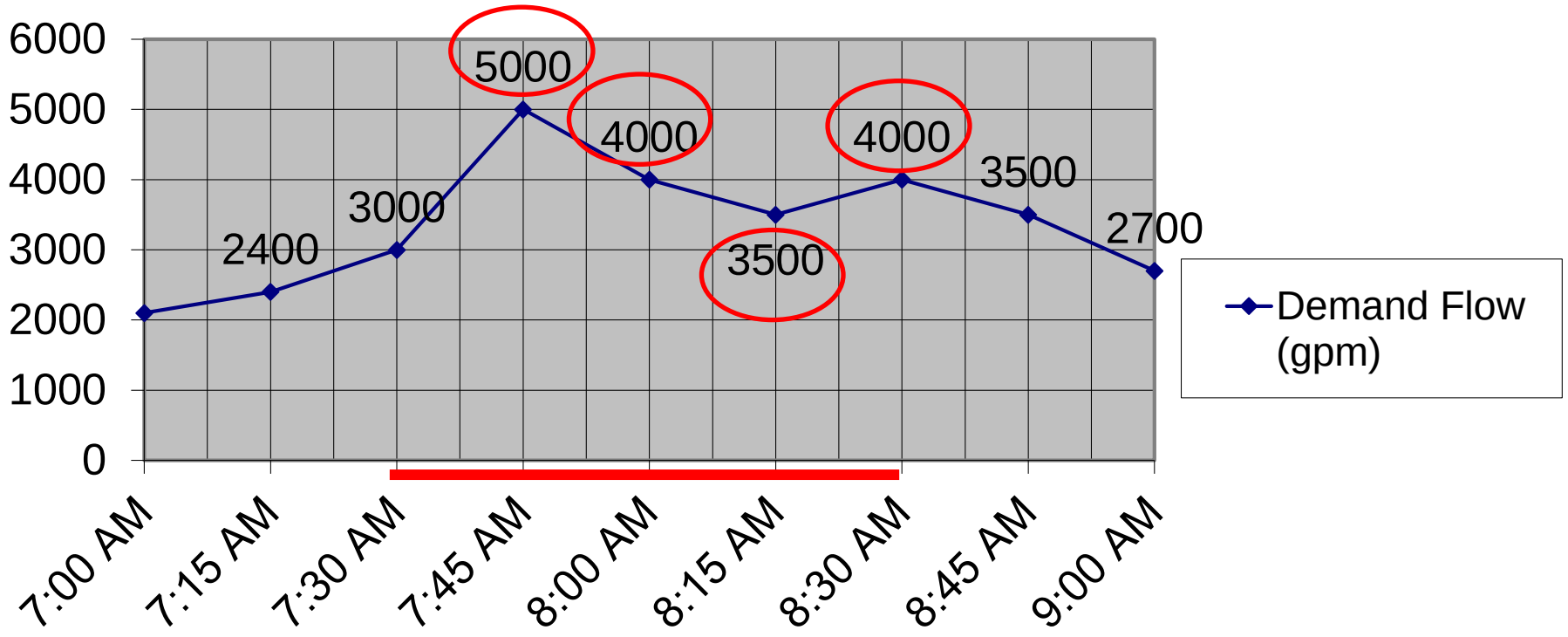
OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /								
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								



Here's an example chart, meant to represent continuous readings that shows demand flow through a reservoir used for contact time. The time period shown is from 7am to 9am. What would you say the peak hourly demand flow is?



Again, the peak hourly demand flow is the hour within the 24-hr period of the highest demand flow. The red line represents the span of 1 hour: **7:30 am to 8:30 am – the peak hour.** The avg. of the 4 data points equals **4125 gpm - the peak hourly demand flow.**

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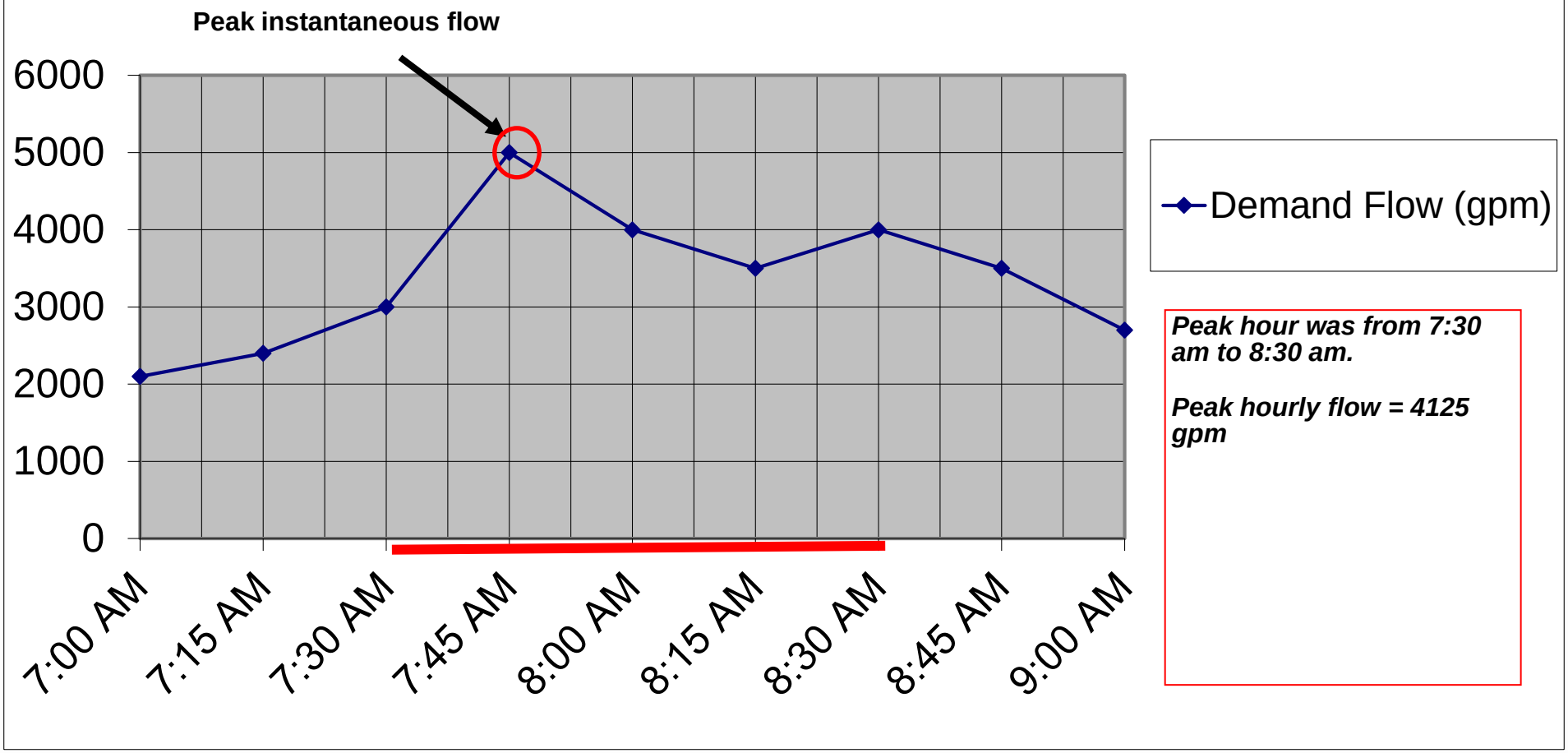

The highest flow point, **5000 gpm, is the peak instantaneous flow**, not the peak hourly demand flow.

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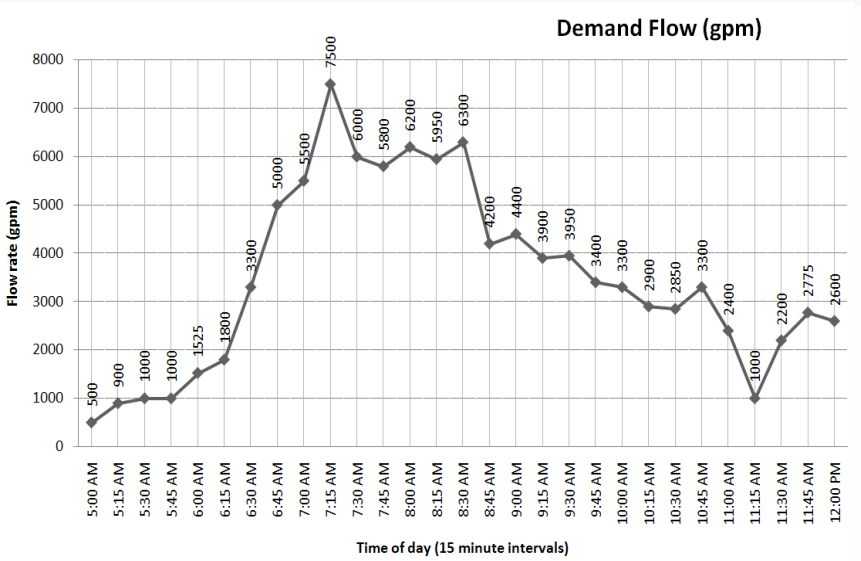
Exercise #4

- Calculate peak hourly demand flow based on continuous flow rate data



Questions:

- At what 1-hour interval did PHD occur?
- What is the peak hourly demand flow (gpm)?
- What was the peak instantaneous demand flow (gpm)?

Bonus questions:

- Is it ok to use the peak instantaneous flow instead for calculating time T?
- If so, what are the advantages/disadvantages?
- Is it ok to use the average daily flow instead for calculating time T?
  Why or why not?

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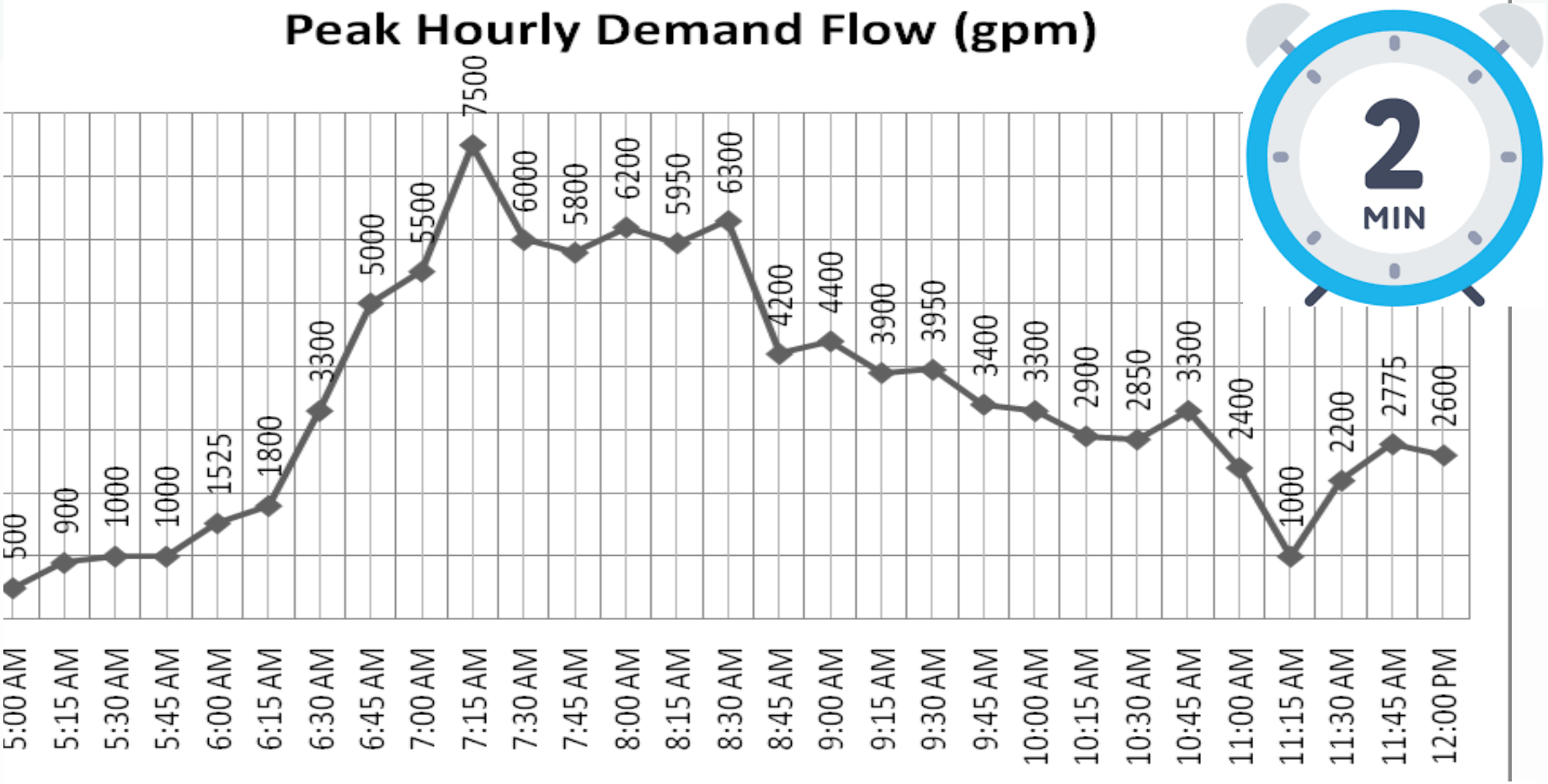

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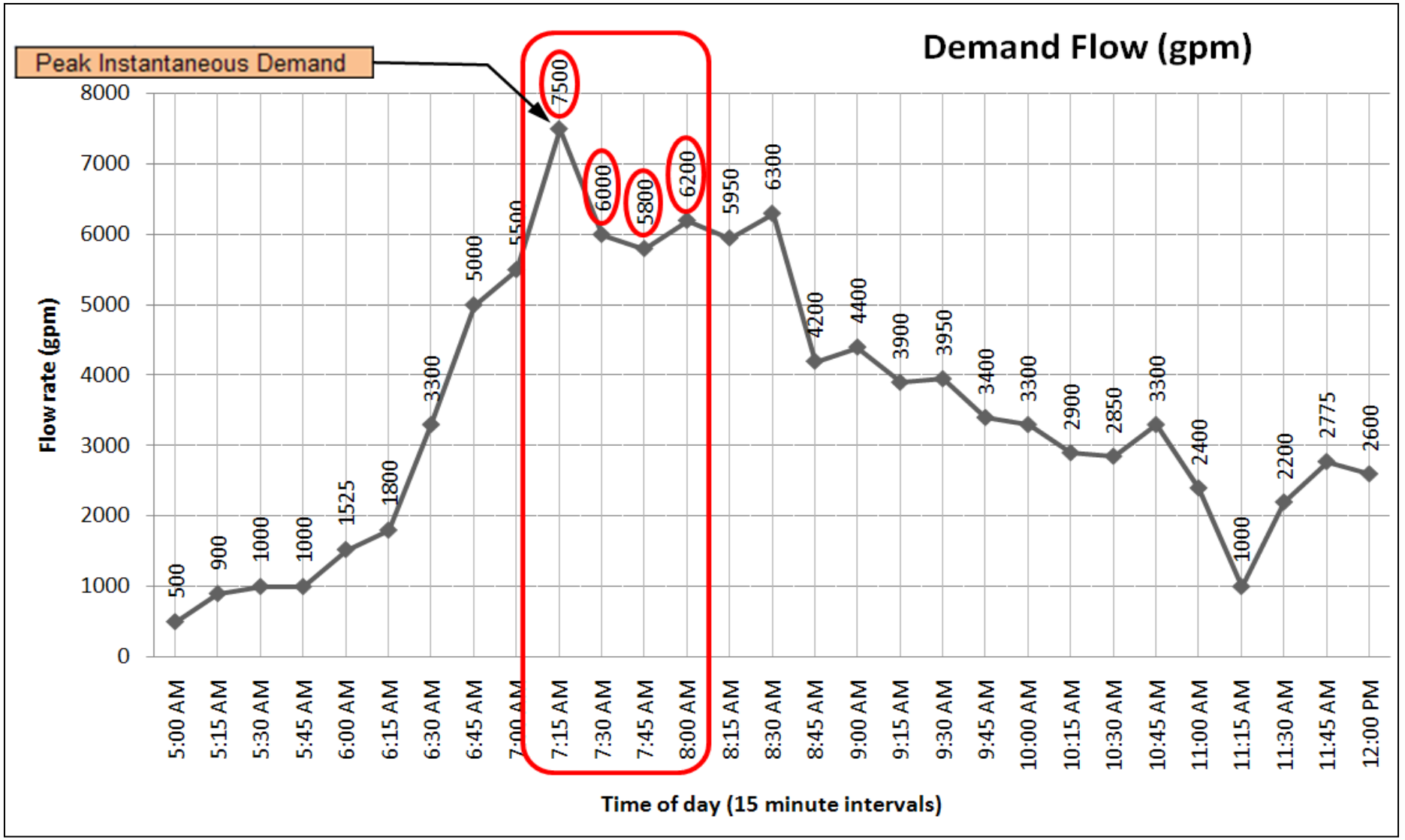

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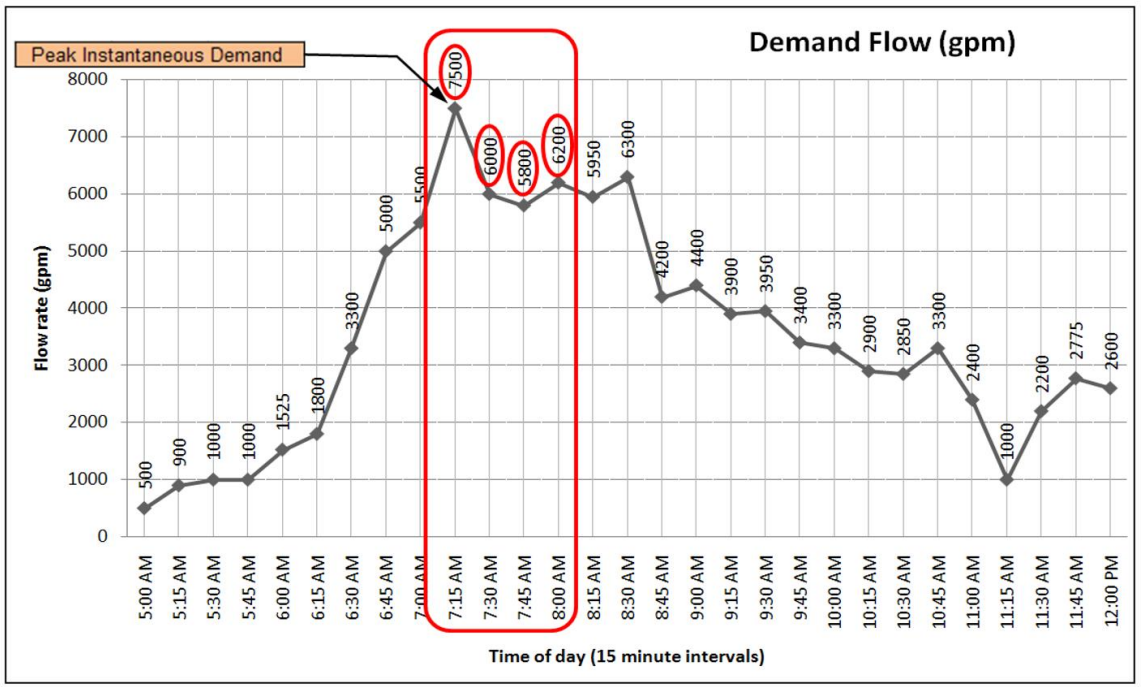
Questions:

At what 1-hour interval did PHD occur? **7:00 am to 8:00 am**

What is the peak hourly demand flow (gpm)? **6375 gpm (sum 4 data pts & divide by 4)**

What was the peak instantaneous demand flow (gpm)? **7500 gpm**



- Example of calculate a running hourly average by averaging the previous 4 data points every 15 minutes.

Time (min)	Demand Flow (gpm)	Running Hourly Average Flow (gpm)
5:00 AM	500	
5:15 AM	900	
5:30 AM	1000	
5:45 AM	1000	850.0
6:00 AM	1525	1,106.3
6:15 AM	1800	1,331.3
6:30 AM	3300	1,906.3
6:45 AM	5000	2,906.3
7:00 AM	5500	3,900.0
7:15 AM	7500	5,325.0
7:30 AM	6000	6,000.0
7:45 AM	5800	6,200.0
8:00 AM	6200	6,375.0 <= Peak Hour Demand

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Bonus questions:

Is it ok to use the peak instantaneous flow instead for calculating time T?

Yes - it's more conservative

If so, what are the advantages/disadvantages?

Advantage - easy to determine.

Disadvantage - may exceed tracer study flow by more than 10%

Is it ok to use the average daily flow instead for calculating time T?

No

Why or why not?

Averaging the whole day would not be conservative enough (it would not account for sustained period of high flow which is when it is important for CTs to be met)

How to use the EPA CT tables to figure out $CT_{required}$

- There are six EPA CT tables based on temp
- Find the correct table based on your water temperature in degrees Celsius.
    - °C = 5/9 x (°F – 32)
- If water temp is between values, then round down
    - Example: for water temp of 12°C, use the 10°C table
    - *Even if the water temp is 14.9°C, round down to 10°C*
- *Water gets more viscous the colder it gets and chemical reactions take longer, so rounding temp down is more conservative.*

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CT Values for Inactivation of Giardia Cysts by Free Chlorine at 10° C

10°C – 14.9°C

Chlorine Concentration	PH < 6						6.1 – 6.5 PH = 6.5						6.6 – 7.0 PH = 7.0					
mg/L <=	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	12	24	37	49	61	73	15	29	44	59	73	88	17	35	52	69	87	104
0.6	13	25	38	50	63	75	15	30	45	60	75	90	18	36	54	71	89	107
0.8	13	26	39	52	65	78	15	31	46	61	77	92	18	37	55	73	92	110
1	13	26	40	53	66	79	16	31	47	63	78	94	19	37	56	75	93	112
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114
1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
2.8	16	31	47	62	78	93	19	37	56	74	93	111	22	45	67	89	112	134
3	16	32	48	63	79	95	19	38	57	75	94	113	23	46	69	91	114	137

Chlorine Concentration	7.1 – 7.5 PH < 7.5						PH = 8.0						PH = 8.5					
mg/L <=	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	21	42	63	83	104	125	25	50	75	99	124	149	30	59	89	118	148	177
0.6	21	43	64	85	107	128	26	51	M	102	128	153	31	61	92	122	153	183

How to use the EPA CT tables (cont.)

- There are 7 sections for pH on each table
- Find the section that corresponds to your water's pH level
- If your pH is between the choices, then round up to the higher pH
    - Example: if pH of water is 6.8, use the pH 7.0 section

CT Values for Inactivation of Giardia Cysts by Free Chlorine at 10° C

10°C – 14.9°C

Chlorine Concentration	PH < 6						6.1 – 6.5 PH = 6.5						6.6 – 7.0 PH = 7.0					
mg/L <=	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	12	24	37	49	61	73	15	29	44	59	73	88	17	35	52	69	87	104
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1	13	26	40	53	66	79	16	31	47	63	78	94	19	37	56	75	93	112
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114
1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
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0.6	21	43	64	85	107	128	26	51	M	102	128	153	31	61	92	122	153	183

How to use the EPA CT tables (cont.)

- Use the 0.5 log inactivation column if your plant is rated at 2.5 log removal for *Giardia*
- All others use the 1.0 log inactivation column
- Note: unfiltered surface water must achieve the 3-log inactivation through disinfection

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10°C – 14.9°C

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1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
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0.4	21	42	63	83	104	125	25	50	75	99	124	149	30	59	89	118	148	177
0.6	21	43	64	85	107	128	26	51	M	102	128	153	31	61	92	122	153	183

How to use the EPA CT tables (cont.)

- Match your free chlorine residual on the far left column

- If in between, then round up
  - Rounding chlorine residual up is more conservative because as chlorine residual increases at a given pH, more CT is required

- The point where it intersects with the log inactivation column is the $CT_{required}$
    - Example: free chlorine residual is 0.6 ppm

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CT Values for Inactivation of Giardia Cysts by Free Chlorine at 10° C

10°C – 14.9°C

Chlorine Concentration	PH < 6						6.1 – 6.5 PH = 6.5						6.6 – 7.0 PH = 7.0					
mg/L <=	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	12	24	37	49	61	73	15	29	44	59	73	88	17	35	52	69	87	104
0.6	13	25	38	50	63	75	15	30	45	60	75	90	18	36	54	71	89	107
0.8	13	26	39	52	65	78	15	31	46	61	77	92	18	37	55	73	92	110
1	13	26	40	53	66	79	16	31	47	63	78	94	19	37	56	75	93	112
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114
1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
2.8	16	31	47	62	78	93	19	37	56	74	93	111	22	45	67	89	112	134
3	16	32	48	63	79	95	19	38	57	75	94	113	23	46	69	91	114	137

Chlorine Concentration	7.1 – 7.5 PH < 7.5						PH = 8.0						PH = 8.5					
mg/L <=	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	21	42	63	83	104	125	25	50	75	99	124	149	30	59	89	118	148	177
0.6	21	43	64	85	107	128	26	51	M	102	128	153	31	61	92	122	153	183

In review:

- temp of 12°C,
- pH of 6.8,
- free chlorine residual of 0.6
  - $CT_{required}$ = **36**

- Remember…
  - $CT_{achieved}$ must be > $CT_{required}$

(CT achieved = chlorine concentration x contact time)

15 Minute Break

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15 Minute Break

- 10 minutes left

15 Minute Break

- 5 minutes left

Exercise #5

- Using EPA CT tables to calculate CTs required

Exercise #5

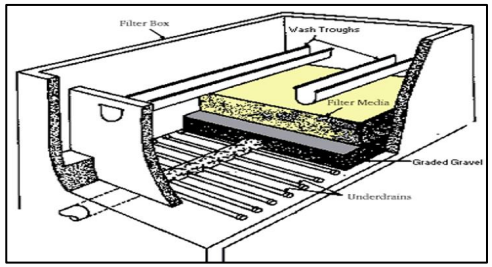
- There are six EPA CT tables based on temp

APPENDIX TABLE 4-1.
CT VALUES FOR INACTIVATION OF GIARDIA CYSTS BY FREE CHLORINE AT 0.5° C

Chlorine Concentration	PH < 6						PH = 6.5						PH = 7.0					
mg/L < =	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	23	46	69	91	114	137	27	54	82	109	136	163	33	65	98	130	163	195
0.6	24	47	71	94	118	141	28	56	84	112	140	168	33	67	100	133	167	200
0.8	24	48	73	97	121	145	29	57	86	115	143	172	34	68	103	137	171	205
1	25	49	74	99	123	148	29	59	88	117	147	176	35	70	I05	140	175	210
1.2	25	51	76	101	127	152	30	60	90	120	I50	180	36	72	108	143	179	215
1.4	26	52	78	103	129	155	31	61	92	123	153	184	37	74	111	147	184	221
1.6	26	52	79	105	131	157	32	63	95	126	158	189	38	75	113	ISI	188	226
1.8	27	54	81	108	135	162	32	64	97	129	161	193	39	77	116	154	193	231
2	28	55	83	110	138	165	33	66	99	131	164	197	39	79	118	157	197	236
2.2	28	56	85	113	141	169	34	67	101	134	168	201	40	81	121	161	202	242
2.4	29	57	86	115	143	172	34	68	103	137	171	205	41	82	124	165	206	247
2.6	29	58	88	117	146	175	35	70	I05	139	174	209	42	84	126	168	210	252
2.8	30	59	89	119	148	178	36	71	107	142	178	213	43	86	129	171	214	257
3	30	60	91	121	151	181	36	82	109	145	181	217	44	87	131	174	218	261

Exercise #5: Using EPA CT tables to calculate CTs required

Example #1: Conventional filter plant (2.5-log)



Example #2: Slow sand filter plant (2-log)

Example #3: Membrane filter plant (2.5-log)

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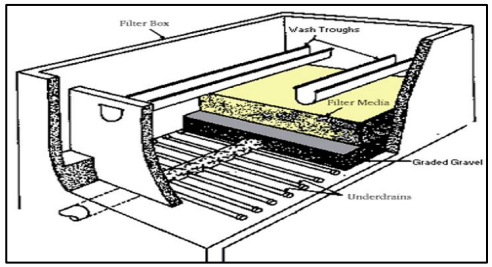
CT parameters measured at the first user are provided below

Example #1: Conventional filter plant (2.5-log)

- Temperature: 10° C
- pH: 7.0
- Free chlorine residual: 0.8 ppm
- Contact time T: 100 minutes



Example #2: Slow sand filter plant (2-log)

- Temperature: 16° C
- pH: 6.6
- Free chlorine residual: 0.5 ppm
- Contact time T: 46 minutes

Example #3: Membrane filter plant (2.5-log)

- Temperature: 8° C
- pH: 7.3
- Free chlorine residual: 1.3 ppm
- Contact time T: 100 minutes

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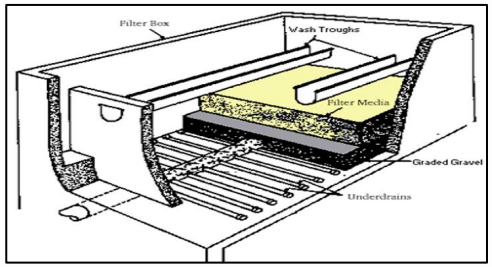
Directions: Use the data provided in the examples to determine the CTs required for giardia inactivation at the treatment plant for that day



Example #1: Conventional filter plant (2.5-log)

- Temperature: 10° C
- pH: 7.0
- Free chlorine residual: 0.8 ppm
- Contact time T: 100 minutes

Example #2: Slow sand filter plant (2-log)

- Temperature: 16° C
- pH: 6.6
- Free chlorine residual: 0.5 ppm
- Contact time T: 46 minutes

Example #3: Membrane filter plant (2.5-log)

- Temperature: 8° C
- pH: 7.3
- Free chlorine residual: 1.3 ppm
- Contact time T: 100 minutes

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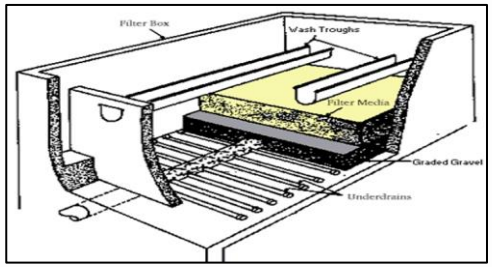
Answer 3 questions for each example…

1. What are the CTs required for that day?
2. What was the CT achieved?
3. Were CTs met?



Example #1: Conventional filter plant (2.5-log)

Example #2: Slow sand filter plant (2-log)

Example #3: Membrane filter plant (2.5-log)

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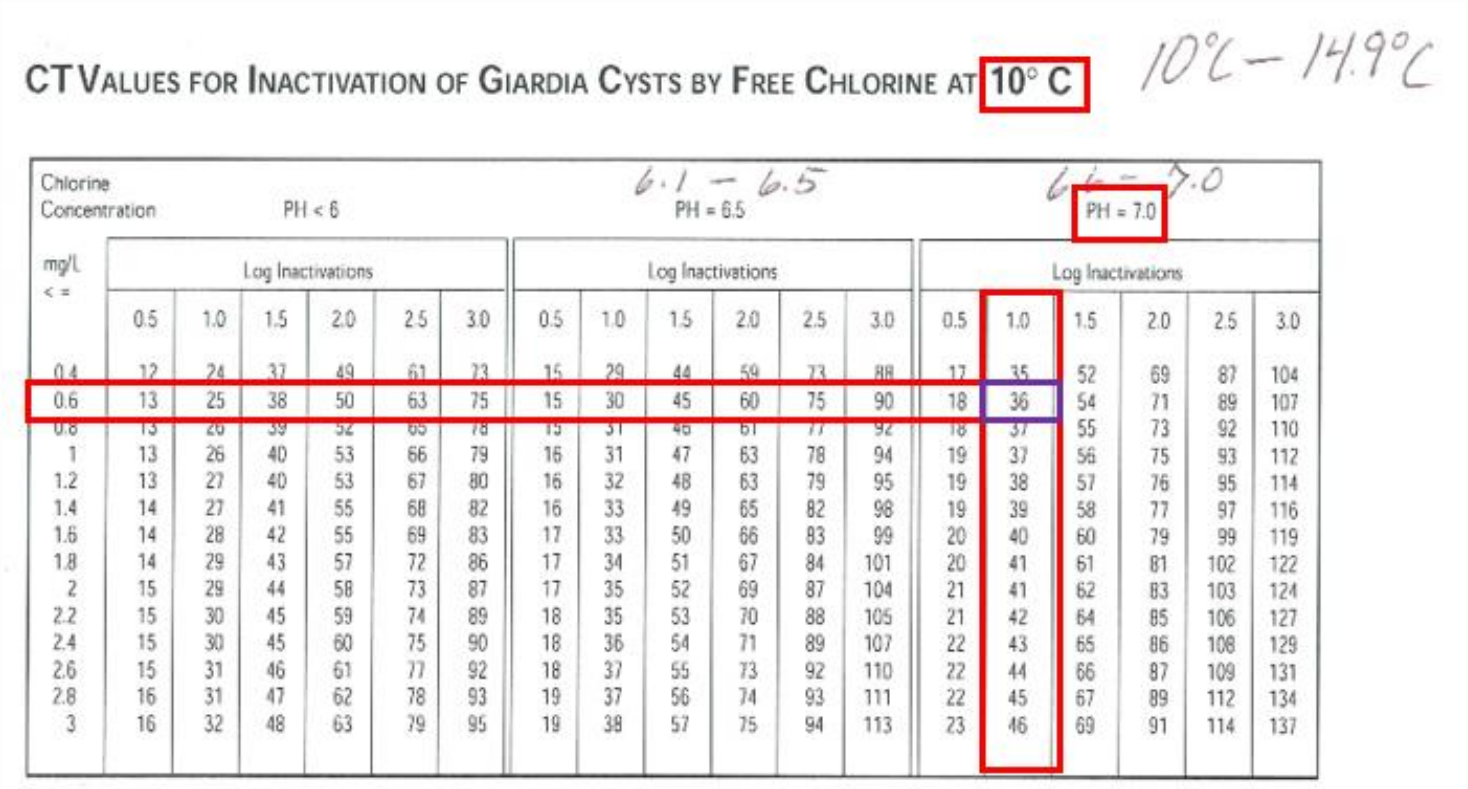
Exercise #5

- Remember to set the bar high for $CT_{required}$



CT VALUES FOR INACTIVATION OF GIARDIA CYSTS BY FREE CHLORINE AT 10° C

10°C – 14.9°C

Chlorine Concentration mg/L <=	PH < 6						6.1 – 6.5 PH = 6.5						6.6 – 7.0 PH = 7.0					
	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	12	24	37	49	61	73	15	29	44	59	73	88	17	35	52	69	87	104
0.6	13	25	38	50	63	75	15	30	45	60	75	90	18	36	54	71	89	107
0.8	13	26	39	52	65	78	15	31	46	61	77	92	18	37	55	73	92	110
1	13	26	40	53	66	79	16	31	47	63	78	94	19	37	56	75	93	112
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114
1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
2.8	16	31	47	62	78	93	19	37	56	74	93	111	22	45	67	89	112	134
3	16	32	48	63	79	95	19	38	57	75	94	113	23	46	69	91	114	137

Exercise #5

Avoid common mistakes for $CT_{required}$…

– Must round down for temperature

– Must round up for pH

– Must round up for free chlorine residual

Exercise #5: Use EPA CT tables to calculate CTs required

Example #1: Conventional filter plant (2.5-log)
- Temperature: 10° C
- pH: 7.0
- Free chlorine residual: 0.8 ppm
- Contact time T: 100 minutes

Example #2: Slow sand filter plant (2-log)
- Temperature: 16° C
- pH: 6.6
- Free chlorine residual: 0.5 ppm
- Contact time T: 46 minutes

Example #3: Membrane filter plant (2.5-log)
- Temperature: 8° C
- pH: 7.3
- Free chlorine residual: 1.3 ppm
- Contact time T: 100 minutes

For each example:

1. What are the CTs required for that day?
2. What was the CT achieved?
3. Were CTs met?

Exercise #5: Use EPA CT tables to calculate CTs required

Example #1: Conventional filter plant (2.5-log)

- Temperature: 10° C
- pH: 7.0
- Free chlorine residual: 0.8 ppm
- Contact time T: 100 minutes

Example #2: Slow sand filter plant (2-log)

- Temperature: 16° C
- pH: 6.6
- Free chlorine residual: 0.5 ppm
- Contact time T: 46 minutes

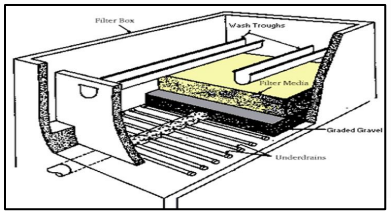
Example #3: Membrane filter plant (2.5-log)

- Temperature: 8° C
- pH: 7.3
- Free chlorine residual: 1.3 ppm
- Contact time T: 100 minutes

For each example:

1. What are the CTs required for that day?
2. What was the CT achieved?
3. Were CTs met?

Example #1: Conventional Filter Plant (2.5-log)



CT Required = 18

Temp = 10° C

pH = 7.0

Residual = 0.8 ppm

Appendix Table 4-3.

CT Values for Inactivation of Giardia Cysts by Free Chlorine at 10° C

Chlorine Concentration	PH < 6						PH = 6.5						PH = 7.0					
mg/L < =	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	12	24	37	49	61	73	15	29	44	59	73	88	17	35	52	69	87	104
0.6	13	25	38	50	63	75	15	30	45	60	75	90	18	36	54	71	89	107
0.8	13	26	39	52	65	78	15	31	46	61	77	92	18	37	55	73	92	110
1	13	26	40	53	66	79	16	31	47	63	78	94	19	37	56	75	93	112
1.2	13	27	40	53	67	80	16	32	48	63	79	95	19	38	57	76	95	114
1.4	14	27	41	55	68	82	16	33	49	65	82	98	19	39	58	77	97	116
1.6	14	28	42	55	69	83	17	33	50	66	83	99	20	40	60	79	99	119
1.8	14	29	43	57	72	86	17	34	51	67	84	101	20	41	61	81	102	122
2	15	29	44	58	73	87	17	35	52	69	87	104	21	41	62	83	103	124
2.2	15	30	45	59	74	89	18	35	53	70	88	105	21	42	64	85	106	127
2.4	15	30	45	60	75	90	18	36	54	71	89	107	22	43	65	86	108	129
2.6	15	31	46	61	77	92	18	37	55	73	92	110	22	44	66	87	109	131
2.8	16	31	47	62	78	93	19	37	56	74	93	111	22	45	67	89	112	134
3	16	32	48	63	79	95	19	38	57	75	94	113	23	46	69	91	114	137

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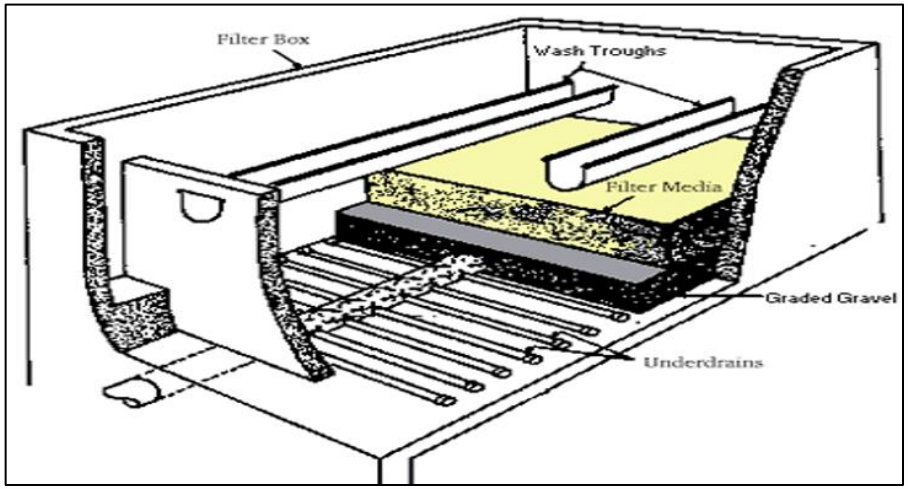
Example #1: Conventional Filter Plant (2.5-log)

Temp = 10° C

pH = 7.0

Residual = 0.8 ppm

Contact Time = 100 min



1. What are the CTs required for that day? **18 (EPA Table)**

2. What was the CT achieved? **80 (0.8 ppm x 100 min)**

3. Were CTs met? **Yes (CT achieved > CT required)**

Example #2: Slow Sand Filter Plant (2.0-log)

CT Required = 24

Temp = 16° C

pH = 6.6

Residual = 0.5 ppm

APPENDIX TABLE 4-4.

CT VALUES FOR INACTIVATION OF GIARDIA CYSTS BY FREE CHLORINE AT 15° C

Chlorine Concentration	PH < 6						PH = 6.5						PH = 7.0					
mg/L < =	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	8	16	25	33	41	49	10	20	30	39	49	59	12	23	35	47	58	70
0.6	8	17	25	33	42	50	10	20	30	40	50	60	12	24	36	48	60	72
0.8	9	17	26	35	43	52	10	20	31	41	51	61	12	24	37	49	61	73
1	9	18	27	35	44	53	11	21	32	42	53	63	13	25	38	50	63	75
1.2	9	18	27	36	45	54	11	21	32	43	53	64	13	25	38	51	63	76
1.4	9	18	28	37	46	55	11	22	33	43	54	65	13	26	39	52	65	78
1.6	9	19	28	37	47	56	11	22	33	44	55	66	13	26	40	53	66	79
1.8	10	19	29	38	48	57	11	23	34	45	57	68	14	27	41	54	68	81
2	10	19	29	39	49	58	12	23	35	46	58	69	14	28	42	55	69	83
2.2	10	20	30	39	50	59	12	23	35	47	58	70	14	28	43	57	71	85
2.4	10	20	30	40	51	60	12	24	36	48	60	72	14	29	43	57	72	86
2.6	10	20	31	41	51	61	12	24	37	49	61	73	15	29	44	59	73	88
2.8	10	21	31	41	52	62	12	25	37	49	62	74	15	30	45	59	74	89
3	11	21	32	42	53	63	13	25	38	51	63	76	15	30	46	61	76	91

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Example #2: Slow Sand Filter Plant (2.0-log)

Temp = 16° C

pH = 6.6

Residual = 0.5 ppm

Contact Time = 46 min

1. What are the CTs required for that day? **24 (EPA Table)**

2. What was the CT achieved? **23 (0.5 ppm x 46 min)**

3. Were CTs met? **No (CT achieved < CT required)**

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Example #3: Membrane Filter Plant (2.5-log)

CT Required = 31

Temp = 8° C

pH = 7.3

Residual = 1.3 ppm

APPENDIX TABLE 4-2.
CT VALUES FOR INACTIVATION OF GIARDIA CYSTS BY FREE CHLORINE AT 5.0° C

Chlorine Concentration	PH < 7.5						PH = 8.0						PH = 8.5					
mg/L < =	Log Inactivations						Log Inactivations						Log Inactivations					
	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0	0.5	1.0	1.5	2.0	2.5	3.0
0.4	28	55	83	111	138	166	33	66	99	132	165	198	39	79	118	157	197	236
0.6	29	57	86	114	143	171	34	68	102	136	170	204	41	81	122	163	203	244
0.8	29	58	88	117	146	175	35	70	105	140	175	210	42	84	126	168	210	252
1	30	60	90	119	149	179	36	72	108	144	180	216	43	87	130	173	217	260
1.2	31	61	92	122	153	183	37	74	111	147	184	221	45	89	134	178	223	267
1.4	31	62	94	125	156	187	38	76	114	151	189	227	46	91	137	183	228	274
1.6	32	64	96	128	160	192	39	77	116	155	193	232	47	94	141	187	234	281
1.8	33	65	98	131	163	196	40	79	119	159	198	238	48	96	144	191	239	287
2	33	67	100	133	167	200	41	81	122	162	203	243	49	98	147	196	245	294
2.2	34	68	102	136	170	204	41	83	124	165	207	248	50	100	150	200	250	300
2.4	35	70	105	139	174	209	42	84	127	169	211	253	51	102	153	204	255	306
2.6	36	71	107	142	178	213	43	86	129	172	215	258	52	104	156	208	260	312
2.8	36	72	109	145	181	217	44	88	132	175	219	263	53	106	159	212	265	318
3	37	74	111	147	184	221	45	89	134	179	223	268	54	108	162	216	270	324

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Example #3: Membrane Filter Plant (2.5-log)

Temp = 8° C

pH = 7.3

Residual = 1.3 ppm

Contact Time = 100 min

1. What are the CTs required for that day? **31 (EPA Table)**

2. What was the CT achieved? **130 (1.3 ppm x 100 min)**

3. Were CTs met? **Yes (CT achieved > CT required)**

Exercise #5: Using EPA CT tables to calculate CTs required

Directions: Use the data provided in the examples below to determine the CTs required for giardia inactivation at the treatment plant for that day

Example #1: Conventional filter plant (2.5-log)

CT parameters measured at the 1st user as follows:
- Temperature: 10° C
- pH: 7.0
- Free chlorine residual: 0.8 ppm
- Contact time T: 100 minutes

What are the CTs required for that day? **18**

What was the CT achieved? **80**

Were CTs met? **Yes**

Example #2: Slow sand filter plant (2-log)

CT parameters measured at the 1st user as follows:
- Temperature: 16° C
- pH: 6.6
- Free chlorine residual: 0.5 ppm
- Contact time T: 46 minutes

What are the CTs required for that day? **24**

What was the CT achieved? **23**

Were CTs met? **No**

Example #3: Membrane filter plant (2.5-log)

CT parameters measured at the 1st user as follows:
- Temperature: 8° C
- pH: 7.3
- Free chlorine residual: 1.3 ppm
- Contact time T: 100 minutes

What are the CTs required for that day? **31**

What was the CT achieved? **130**

Were CTs met? **Yes**

Bonus: Use the data provided below to determine the CTs required for virus inactivation at the treatment plant for that day

CT parameters measured at the 1st user as follows:

- Temperature: 10° C
- pH: 7.0

Table A-7. CT Values for Inactivation of Viruses by Free Chlorine[1]

		Log Inactivation				
		2.0-log		3.0-log		4.0-log
Temperature (C)	pH=> 6-9	10	6-9	10	6-9	10
0.5	6	45	9	66	12	90
5	4	30	6	44	8	60
10	3	22	4	33	6	45
15	2	15	3	22	4	30
20	1	11	2	16	3	22
25	1	7	1	11	2	15

1. What log inactivation is required for viruses in surface water?
2. What are the CTs required for viruses that day?
3. Assuming a contact time T of 30 minutes, what free chlorine concentration is needed to meet the CT required above?
4. What does this tell you about meeting the CT requirements for viruses compared to meeting the CT requirements for giardia?

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Bonus: Use the data provided in the examples below to determine the CTs required for virus inactivation at the treatment plant for that day

CT parameters measured at the 1st user as follows:
- Temperature: 10° C
- pH: 7.0

Table A-7. CT Values for Inactivation of Viruses by Free Chlorine[1]

		Log Inactivation				
		2.0-log		3.0-log		4.0-log
Temperature (C)	pH=> 6-9	10	6-9	10	6-9	10
0.5	6	45	9	66	12	90
5	4	30	6	44	8	60
10	3	22	4	33	6	45
15	2	15	3	22	4	30
20	1	11	2	16	3	22
25	1	7	1	11	2	15

1. What log inactivation is required for viruses in surface water? **4.0-log**
2. What are the CTs required for viruses that day? **6**
3. Assuming a contact time T of 30 minutes, what free chlorine concentration is needed to meet the CT required above? **0.2 ppm**
4. What does this tell you about meeting the CT requirements for viruses compared to meeting the CT requirements for giardia? **If you meet CT requirements for giardia, then you automatically meet them for viruses (i.e. it takes more CTs to inactivate Giardia than it does for viruses)**

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Filling out the monthly surface water quality report form

OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name:	ID #:	WTP-:	Month/Year:	Log Requirement (Circle One): 0.5 / 1.0

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /								
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

So here's our reporting form (available for download on our website…)
Every day you must calculate the CTs required using the tables and record it on this form.
So let's enter our data from the example into the form starting w/ temp…

Filling out the monthly surface water quality report form

Picking up where we left off when determining required CT, these same parameters will be used to fill out the monthly surface water quality form.

- temp of 12°C,
- pH of 6.8,
- free chlorine residual of 0.6
- $CT_{required}$ = 36

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Filling out the monthly surface water quality report form

Picking up where we left off when determining required CT, these same parameters will be used to fill out the monthly surface water quality form.

- temp of 12°C,
- pH of 6.8,
- free chlorine residual of 0.6
- $CT_{required}$ = 36

Yet to be determined is...

- CT_{actual} = contact time x chlorine residual
- Contact time
- Peak hour demand flow
- Turbidity data

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /				12				
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

Here's where we enter temp

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /				12	6.8			
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

Here's where we enter pH

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6			12	6.8			
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

Here's where we enter free chlorine residual

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6			12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

And here's where we enter CT required 36, which we found from the EPA tables

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6			12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

OK. We now we need to calculate the actual CTs achieved and compare it to the CTs required of 36 to determine if CTs were met for the day.

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Filling out the monthly surface water quality report (cont.)

- Remember:
  - CT achieved = Chlorine **C**oncentration x Contact **T**ime

- We know the free chlorine residual at the first user is 0.6 ppm

- Contact Time (T) obtained from a disinfection *tracer study*
  - Example: tracer study shows our contact time to be 110 minutes

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6	110		12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

Here's where we enter contact time T from our tracer study

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6	110		12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

So free chlorine residual C of 0.6 ppm times 110 minutes of contact time = ?

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6	110	66	12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

CT achieved by the plant is 66. So now we compare this to CT required.

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6	110	66	12	6.8	36		
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

In order for CTs to be met, CTactual must be greater than CTrequired, which it is.

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OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:** **WTP-:** **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	0.6	110	66	12	6.8	36	Yes	
2 /								
3 /								
4 /								
5 /								
6 /								
7 /								
8 /								
9 /								
10 /								
11 /								
12 /								
13 /								
14 /								
15 /								
16 /								
17 /								
18 /								
19 /								

So in the CT MET column we write YES.
CTs were met for this day.

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Common mistakes:

- Rounding errors:
  - Must round down for temperature
  - Must round up for pH
  - Must round up for free chlorine residual

- Bad formulas in excel spreadsheets:
  - Make sure you understand your formula
  - Wilkes Equation not allowed, must use Regression Equation

Common mistakes (continued):

- Not calculating CT's daily
  - Don't wait until the end of the month to do the calculations because if you discover you didn't meet CT's, it's too late!
- If adjusting contact time according to flow rate, use the demand flow, not the plant flow.
- Failure to answer questions at bottom of form correctly (or at all)
- Always answering "Yes" to the questions at the bottom of the form without actually looking at the numbers

Conventional or Direct: Answer all the yes/no questions

Conventional or Direct Filtration		Monthly Summary (Answer Yes or No)	
95% of the 4-hour turbidity readings ≤ 0.3 NTU?	**Yes / No**	CT's met everyday? (see back) **Yes / No**	All Cl_2 residuals at entry point ≥ 0.2 mg/l? **Yes / No**
All the 4-hour turbidity readings ≤ 1 NTU?	**Yes / No**		
All turbidity readings < IFE[2] triggers?	**Yes / No** [2]		
Notes:		**PRINTED NAME:**	
		SIGNATURE:	**DATE:**
		PHONE #: ( )	**CERT #:**

[1] Including continuous turbidity data, if applicable, for optimization recording purposes. Compliance values in columns "12 AM" through "8 PM" may not correspond to continuous readings' maximum.

[2] IFE = Individ. Filter Effl. (OAR 333-061-0040(1)(e)(B&C))

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Slow Sand/Membrane/DE/Unfiltered

Answer all the yes/no questions

Slow Sand/Membrane/DE Filtration/Unfiltered	Monthly Summary (Answer Yes or No)	
95% of daily turbidity readings ≤ 1 NTU? [2] **Yes / No** All daily turbidity readings ≤ 5 NTU? **Yes / No**	CT's met everyday? (see back) **Yes / No**	All Cl_2 residual at entry point ≥ 0.2 mg/l? **Yes / No**
Notes:	**PRINTED NAME:**	
	SIGNATURE:	**DATE:**
	PHONE #: ( )	**CERT #:**

[1] Including continuous turbidity data, if applicable, for optimization recording purposes. Compliance values in columns "12 AM" through "8 PM" may not correspond to continuous readings' maximum. [2] Filtered systems only.

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Cartridge/Bag

Answer all the yes/no questions

Cartridge Filtration	Monthly Summary (Answer Yes or No)	
95% of daily turbidity readings ≤ 1 NTU? **Yes / No** All daily turbidity readings ≤ 5 NTU? **Yes / No**	CT's met everyday? (see back) **Yes / No**	All Cl_2 residual at entry point ≥ 0.2 mg/l? **Yes / No**
Notes: PSI = pounds per square inch **PSID = pounds per square inch difference (before filter – after filter)** **PSID When to Change Filter = Manufacturer's recommendation; may need to look in manual for manufacturer's specifications when to change the filter, at what PSID.**	**PRINTED NAME:**	
	SIGNATURE:	**DATE:**
	PHONE #: ( )	**CERT #:**

[1] Including continuous turbidity data, if applicable, for optimization recording purposes. Compliance values in "Daily Turbidity Reading" Column may not correspond to continuous readings' maximum.

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Everyone needs to fill out the CT section!

Cartridge Filtration	Monthly Summary (Answer Yes or No)	
95% of daily turbidity readings ≤ 1 NTU? **Yes / No** All daily turbidity readings ≤ 5 NTU? **Yes / No**	CT's met everyday? (see back) **Yes / No**	All Cl_2 residual at entry point ≥ 0.2 mg/l? **Yes / No**
Notes: PSI = pounds per square inch **PSID = pounds per square inch difference (before filter – after filter)** **PSID When to Change Filter = Manufacturer's recommendation; may need to look in manual for manufacturer's specifications when to change the filter, at what PSID.**	**PRINTED NAME:**	
	SIGNATURE:	**DATE:**
	PHONE #: ( )	**CERT #:**

[1] Including continuous turbidity data, if applicable, for optimization recording purposes. Compliance values in "Daily Turbidity Reading" Column may not correspond to continuous readings' maximum.

PAGE 1 of 2

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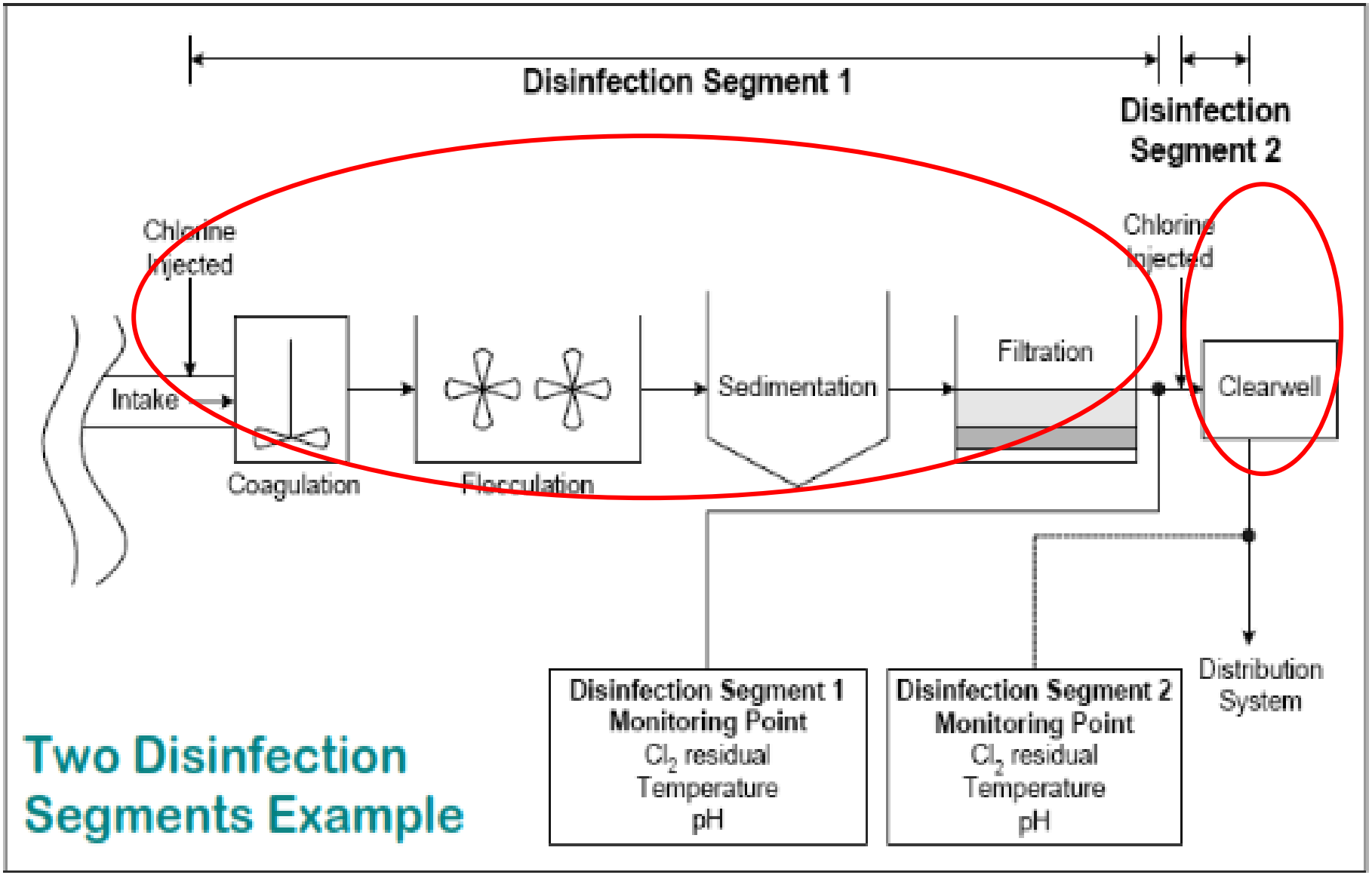
Multiple CT segments

- A “CT segment” is the point between which chlorine is injected and free chlorine residual is measured

- Treatment plants can have multiple CT segments (i.e. multiple chlorine injection points)



Two Disinfection Segments Example

Total inactivation = ∑ log inactivation from each disinfection segment

Multiple CT segments

- Multiple CT segments can be added together in order to meet CTs

- Do not add contact times “T” together!
  - Why? Chlorine, temp, pH may change throughout the process

Multiple CT segments (cont.)

- Must calculate log inactivation ratios for each segment and add ratios together
  - Inactivation ratio = $\frac{C1T1_{actual}}{CT1_{reqd}} + \frac{C2T2_{actual}}{CT2_{reqd}}$
- Modify reporting form: add column for log inactivation ratios (sum must be >1)
  - Not to be confused with 1-log inactivation
- Contact your regulator for further assistance

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What to do when things go wrong:

Such as:

- Treatment interruptions
- CTs not met
- Turbidity exceeds regulatory limits

What to do:

- Call your regulatory contact at the drinking water program

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In Summary:

- In order to verify adequate disinfection is taking place, we need to calculate CT achieved (CT_{actual})
- EPA reviewed many disinfection studies in order to create CT Tables that specify minimum CT requirements needed to achieve specific log reduction levels for *Giardia* ($CT_{required}$)
- CT_{actual} must be equal to or greater than $CT_{required}$

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Things you should do:

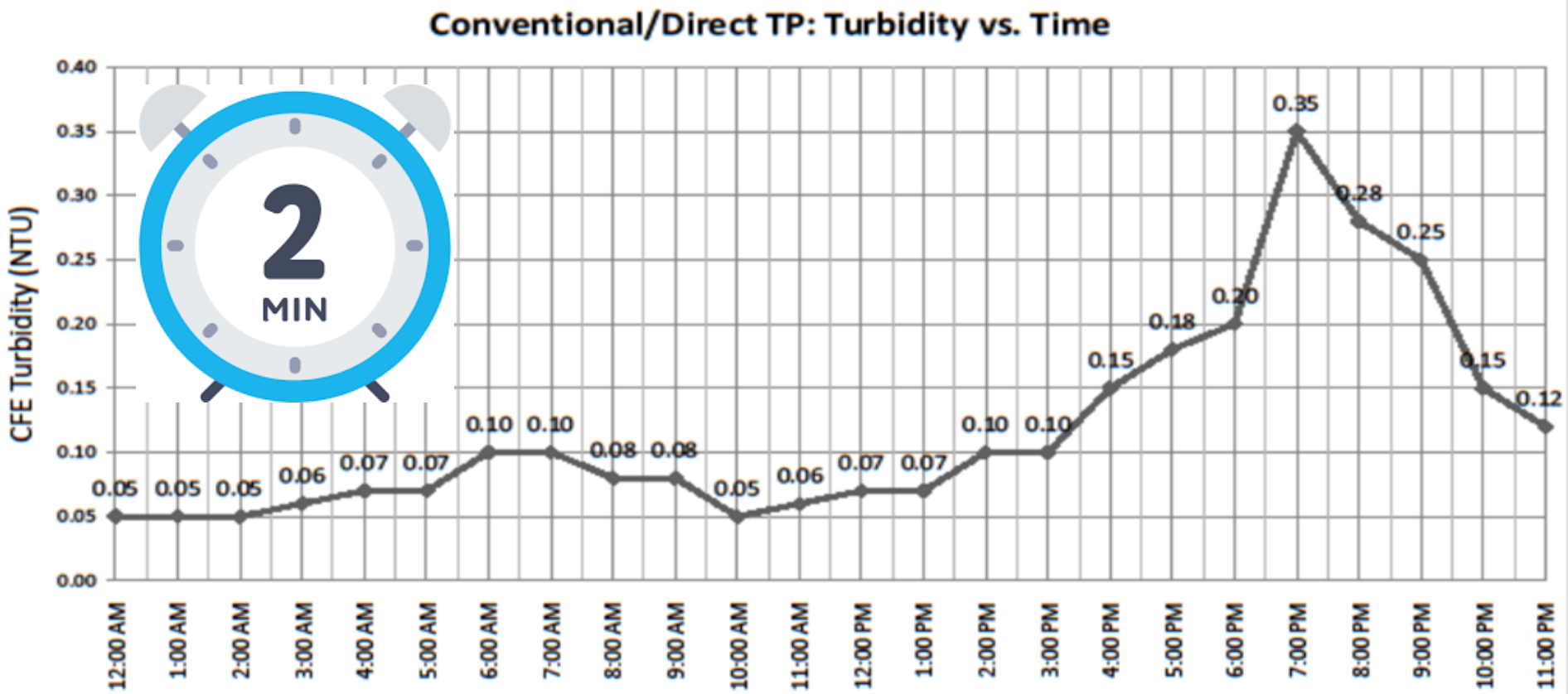
- Check how T is calculated at your plant
- Do all treatment plant operators understand it?
- Review spreadsheet equation for CTs (if applicable)
- Write an SOP for CT determination
- Arrange for a tracer study if necessary

Exercise #6 – Example 1

- Filling out the monthly surface water quality operating report for a 2.5-log conventional filtration plant

Example #1: Conventional or direct filter plant - Turbidity

- Use the data in the graph to record the 4-hour daily turbidities on the first day of the month of the Conventional/Direct Filtration monthly reporting form.
- What number should be entered in the “Highest Reading of the Day (NTU)” column?_____



Example #1: Conventional or direct filter plant - Turbidity

- Use the data in the graph to record the 4-hour daily turbidities on the first day of the month of the Conventional/Direct Filtration monthly reporting form.
- What number should be entered in the “Highest Reading of the Day (NTU)” column? **0.35 NTU**

OHA - Drinking Water Program – Turbidity Monitoring Report Form County:
Conventional or Direct Filtration

System Name: **ID #:**

WTP-: **Month/Year:**

DAY	12 AM [NTU]	4 AM [NTU]	8 AM [NTU]	NOON [NTU]	4 PM [NTU]	8 PM [NTU]	Highest Reading of the Day[1] [NTU]
1	**0.05**	**0.07**	**0.08**	**0.07**	**0.15**	**0.28**	**0.35**
2							
3							
4							
5							

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Example #1: Conventional or direct filter plant - Turbidity

- Let's say your plant runs 24 hours a day and you have turbidity readings filled in for every 4-hour interval for all 31 days of the month. How many readings could you have that were > 0.3 NTU? (Hint: 95% of readings should be ≤ 0.3 NTU)_____

- What should you do if you answer "no" to the turbidity question "All readings ≤ 1 NTU?" on the bottom of the form? _____
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

- What should you do if you answer "no" to the turbidity question "All readings < IFE triggers?" on the bottom of the form?_____
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #1: Conventional or direct filter plant - Turbidity

- Let's say your plant runs 24 hours a day and you have turbidity readings filled in for every 4-hour interval for all 31 days of the month. How many readings could you have that were > 0.3 NTU? (Hint: 95% of readings should be ≤ 0.3 NTU) **9**
  (6 readings/day x 31 days = 186 readings total. 5% x 186 = 9.3)

- What should you do if you answer "no" to the turbidity question "All readings ≤ 1 NTU?" on the bottom of the form? **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

- What should you do if you answer "no" to the turbidity question "All readings < IFE triggers?" on the bottom of the form? **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #1: Conventional or direct filter plant - Disinfection

- Use the following parameters to calculate the CTs achieved at a 2.5-log conventional plant and fill it in on the form on first day of the month:
  - Free chlorine residual: 0.6 ppm
  - Contact time: 100 minutes
  - Peak hourly demand: 2000 gpm

- Use the following parameters to calculate the CTs required using the EPA tables from Exercise 5 and fill it in on the form:
  - Temp: 12°C
  - pH: 7.2

Example #1: Conventional or direct filter plant – Disinfection

- Use the following parameters to calculate the CTs achieved at a 2.5-log conventional plant and fill it in on the form on first day of the month:
  - Free chlorine residual: 0.6 ppm
  - Contact time: 100 minutes
  - Peak hourly demand: 2000 gpm
- Use the following parameters to calculate the CTs required using the EPA tables from Exercise 5 and fill it in on the form:
  - Temp: 12°C
  - pH: 7.2

OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:**

WTP-: **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

t

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	**0.6**	**100**	**60**	**12**	**7.2**	**21**	**Yes**	**2000**
2 /								
3 /								
4 /								
5 /								

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Example #1: Conventional or direct filter plant - Disinfection

- Let's say the Peak Hourly Demand Flow for the day was 2000 gpm. If the Peak Hourly Demand Flow during the tracer study was 1750 gpm, is this a problem? Why or why not?

- What should you do if you answer "no" to either of the CT questions on the turbidity side of form?

- "CTs met at all times?"
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

- "Residual at EP ≥ 0.2 ppm at all times?"
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #1: Conventional or direct filter plant - Disinfection

- Let's say the Peak Hourly Demand Flow for the day was 2000 gpm. If the Peak Hourly Demand Flow during the tracer study was 1750 gpm, is this a problem? Why or why not? **Yes this is a problem – flow cannot exceed 10% of tracer study flow. 10% x 1750 gpm = 175 gpm. 1750 + 175 = 1925 gpm. Therefore flow cannot be >1925 gpm or else a new tracer study is needed.**

- What should you do if you answer "no" to either of the CT questions on the turbidity side of form?

- "CTs met at all times?" **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

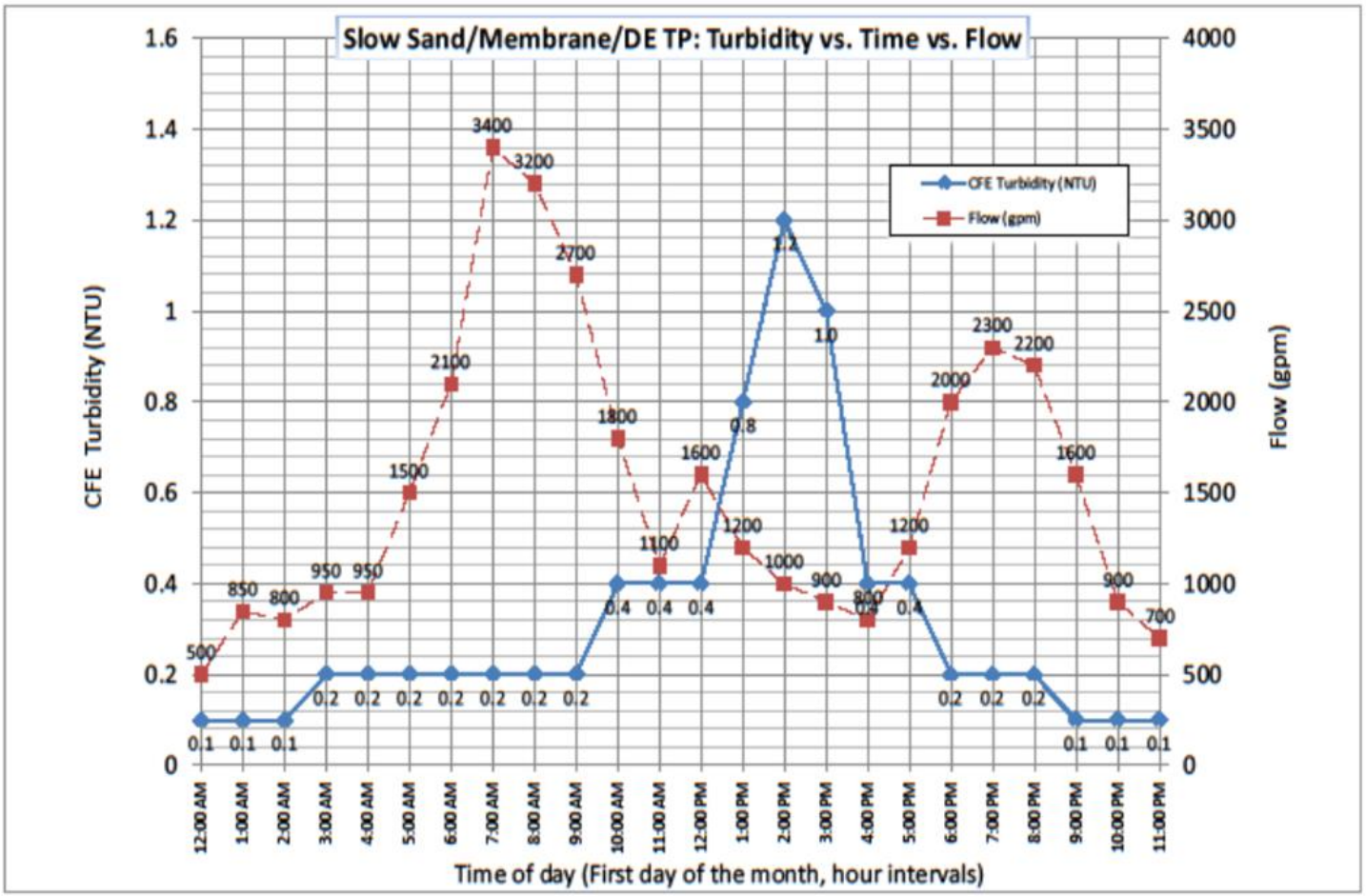
- "Residual at EP ≥ 0.2 ppm at all times?" **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Exercise #6 – Example 2

- Filling out the monthly surface water quality operating report for a 2.0-log slow sand plant

Example #2: Slow sand filter plant - Turbidity

- Use the data in the graph to record the daily combined filter effluent turbidity on the first day of the month of the slow sand monthly reporting form. Which column should it be reported in and why?
- What number should be entered in the “Highest Reading of the Day (NTU)” column?



Example #2: Slow sand filter plant - Turbidity

- Use the data in the graph to record the daily combined filter effluent turbidity on the first day of the month of the slow sand monthly reporting form. Which column should it be reported in and why? **Any of the columns is fine to use. Most people use the column that is closest to the time they observed the turbidity**

- What number should be entered in the "Highest Reading of the Day (NTU)" column? **1.2 NTU**

OHA - Drinking Water Program – Turbidity Monitoring Report Form County:
Slow Sand, Membrane, Diatomaceous Earth Filtration, or Unfiltered Systems

System Name: **ID #:**

WTP-: **Month/Year:**

DAY	12 AM [NTU]	4 AM [NTU]	8 AM [NTU]	NOON [NTU]	4 PM [NTU]	8 PM [NTU]	Highest Reading of the Day [1] [NTU]
1			0.2				1.2
2							
3							
4							
5							

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Example #2: Slow sand filter plant - Turbidity

- Let's say your plant runs everyday and you have turbidity readings filled in once a day for all 31 days of the month. How many readings could you have that were > 1 NTU and still meet the requirement of 95% of readings being ≤ 1 NTU?
- What should you do if you answer "no" to the turbidity question "All readings ≤ 5 NTU?" on the bottom of the form?
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #2: Slow sand filter plant - Turbidity

- Let's say your plant runs everyday and you have turbidity readings filled in once a day for all 31 days of the month. How many readings could you have that were > 1 NTU and still meet the requirement of 95% of readings being ≤ 1 NTU? **1 out of the 31 readings total. 5% x 31 = 1.6**
- What should you do if you answer "no" to the turbidity question "All readings ≤ 5 NTU?" on the bottom of the form? **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #2: Slow sand filter plant - Disinfection

- Use the following parameters to calculate the CTs achieved at a 2.0-log slow sand plant and fill it in on the form on first day of the month:
  - Free chlorine residual: 0.3 ppm
  - Contact time: 60 minutes
- Use the chart to calculate peak hour demand.
- Use the following parameters to calculate the CTs required using the EPA tables from Exercise 5 and fill it in on the form:
  - Temp: 9°C
  - pH: 7.8
- Are CTs met for this day?

Example #2: Slow sand filter plant - Disinfection

- Use the following parameters to calculate the CTs achieved at a 2.0-log slow sand plant and fill it in on the form on first day of the month:
  - Free chlorine residual: 0.3 ppm
  - Contact time: 60 minutes
  - **Peak hourly demand: 3300 gpm**
- Use the following parameters to calculate the CTs required using the EPA tables from Exercise 5 and fill it in on the form:
  - Temp: 9°C
  - pH: 7.8
- Are CTs met for this day - **No - CT achieved (18) is < CT required (66)**

OHA - Drinking Water Program – Surface Water Quality Data Form - *Giardia* Inactivation

System Name: **ID #:**

WTP-: **Month/Year:** **Log Requirement (Circle One): 0.5 / 1.0**

t

Date / Time	Minimum Cl_2 Residual at 1st User (**C**) [3]	Contact Time (**T**)	Actual CT	Temp	pH	Required CT	CT Met? [3]	Peak Hourly Demand Flow
	[ppm or mg/L]	[minutes]	**C X T**	[° C]		Use tables	Yes / No	[GPM]
1 /	**0.3**	**60**	**18**	**9**	**7.8**	**66**	**No**	**3300**
2 /								
3 /								
4 /								
5 /								

Oregon Health Authority

Example #2: Slow sand filter plant - Disinfection

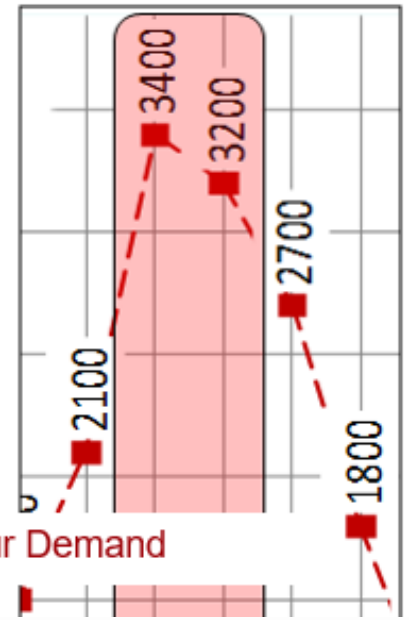
- How was peak hour demand calculated using only flow readings taken every hour?
- Tabulate the chart data and calculate a running hourly average using 2 consecutive flow readings for every hour.

What number should be entered in the "Peak Hourly Demand Flow" column? **3300 gpm.**

Average of flows between 7 am and 8 am.

Exercise #6, Example #2 Slow Sand - Peak Hour Demand Determination

Time	Flow Reading (gpm)	Running hourly average of demand flow readings (gpm)
12:00 AM	500	
1:00 AM	850	675
2:00 AM	800	825
3:00 AM	950	875
4:00 AM	950	950
5:00 AM	1500	1225
6:00 AM	2100	1800
7:00 AM	3400	2750
8:00 AM	3200	3300 <= Peak Hour Demand
9:00 AM	2700	2950



Example #2: Slow sand filter plant - Disinfection

- What should you do if you answer “no” to either of the CT questions on the turbidity side of form?

- “CTs met at all times?”
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

- “Residual at EP ≥ 0.2 ppm at all times?”
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Example #2: Slow sand filter plant - Disinfection

- "CTs met at all times?" **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

- "Residual at EP ≥ 0.2 ppm at all times?" **a**
  a) Call the state
  b) Issue a boil water notice
  c) Issue a public notice within 30 days
  d) Both a & c

Emerging Issues

Emerging Issues

- Climate change and water supply
- Cyanobacteria (Harmful Algal Blooms)
- www.healthoregon.org/dws

News & “Hot Topics”

Oregon Health Authority

Climate Change and Water Supply

- Earlier and heavier snowpack runoff
- Increasing variability of storm frequency and intensity
- Weather extremes already evident
- Increased variability in water quality; can affect both surface and groundwater systems.
- Changes in rainfall patterns affect all systems
- Rising sea levels could lead to salt water intrusion or flooding

Cyanobacteria

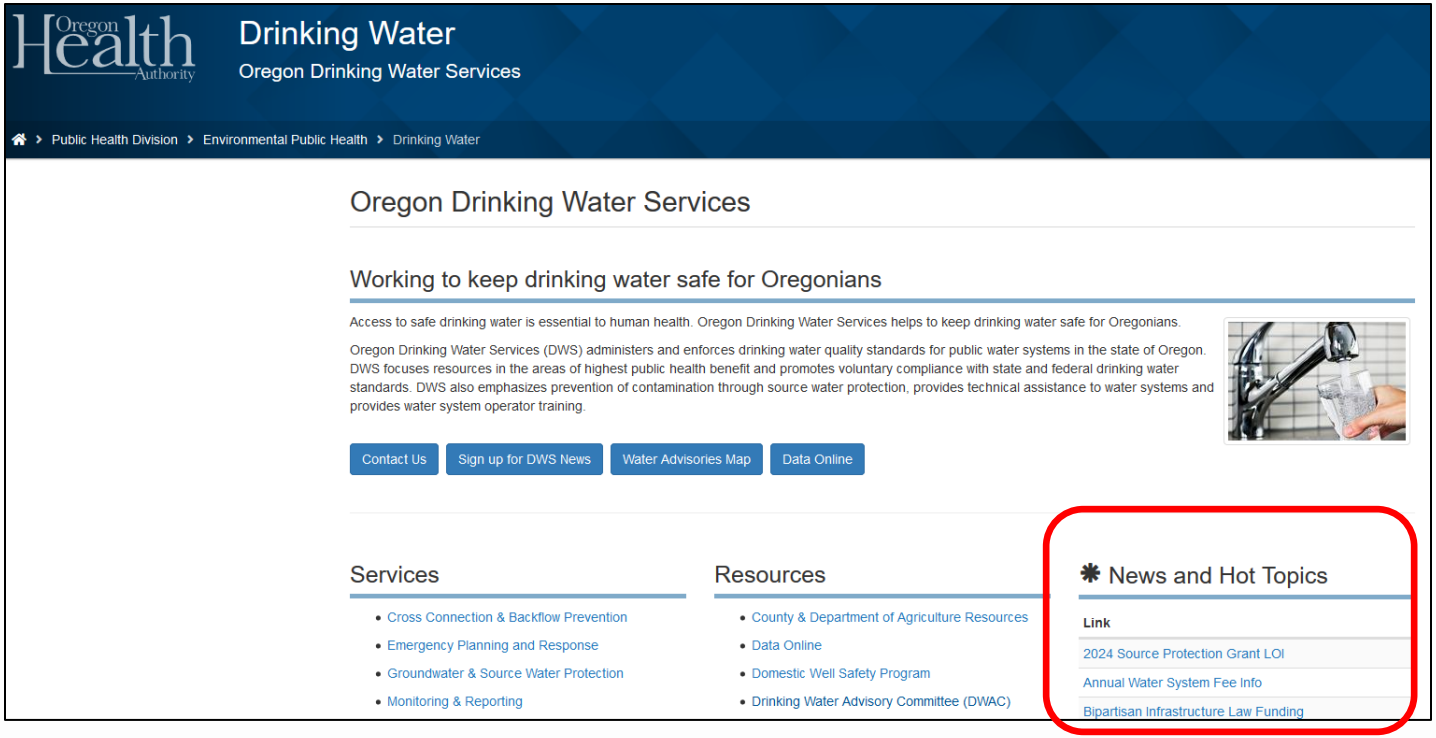
- Produce toxins that can be harmful
- Occur in warm, slow moving water
- Increasing in frequency and duration
  - happening more or better reporting?
  - more people, more nutrients, warmer water
- Resources for operators on-line at:

www.healthoregon.org/dwcyanotoxins

Oregon Health Authority

www.healthoregon.org/dws

- News
- Hot Topics

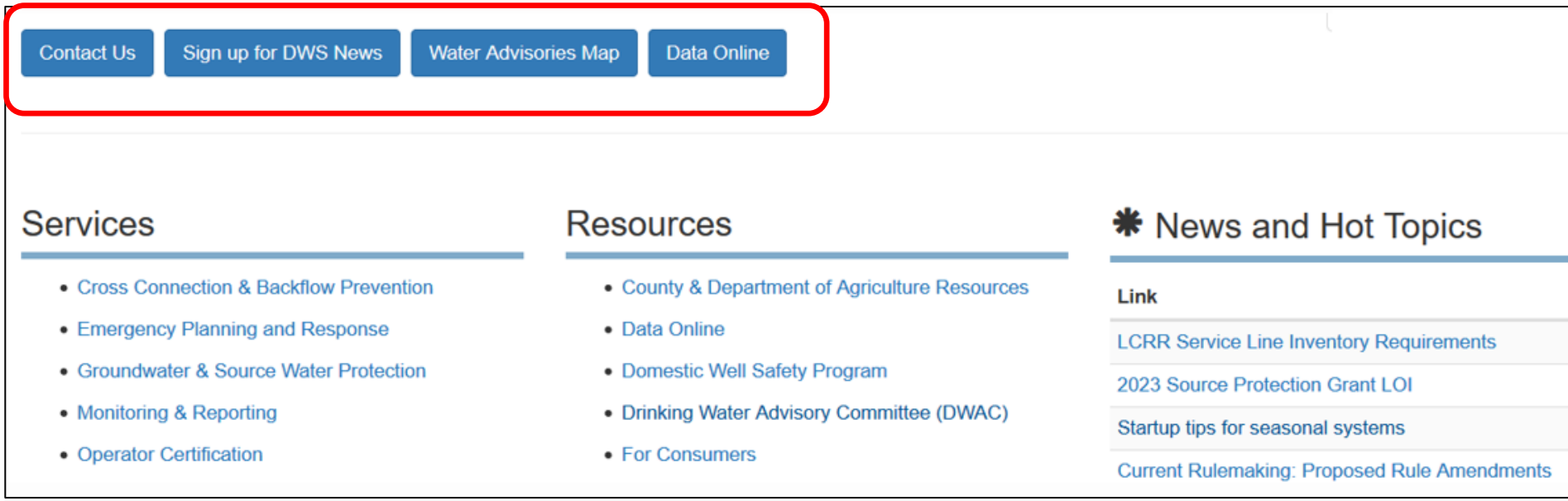


RESOURCES FOR OPERATORS

Oregon Health Authority

www.healthoregon.org/dws

- Sign up for DWS Alerts
- Contact Us
- Data Online



Tools & Resources

- For surface water systems:
  www.healthoregon.org/dws

Click on “Water System Operations” on left-side menu list, then “Surface Water Treatment”

  - Monthly Surface Water Quality Report form template
  - Tracer Study form

- Surface Water Treatment Rule guidance manual, Appendix C: Determination of Disinfectant Contact Time

Tools & Resources (continued)

- US Environmental Protection Agency (USEPA) Rules
  http://water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm
- AWWA http://www.pnws-awwa.org/
  (American Water Works Association)
- OAWU http://www.oawu.net/
  (Oregon Association of Water Utilities)
- Oregon Drinking Water Services Circuit Rider Program
  http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Pages/circuitrider.aspx
- ORWARN http://www.orwarn.org/
  (Oregon Water/Wastewater Agency Response Network)

Oregon Health Authority

Information Available Online

www.healthoregon.org/dws

Oregon Drinking Water Services

Working to keep drinking water safe for Oregonians

Access to safe drinking water is essential to human health. Oregon Drinking Water Services helps to keep drinking water safe for Oregonians.

Oregon Drinking Water Services (DWS) administers and enforces drinking water quality standards for public water systems in the state of Oregon. DWS focuses resources in the areas of highest public health benefit and promotes voluntary compliance with state and federal drinking water standards. DWS also emphasizes prevention of contamination through source water protection, provides technical assistance to water systems and provides water system operator training.

Contact Us | Sign up for DWS News | Water Advisories Map | Data Online

Services

- Cross Connection & Backflow Prevention
- Emergency Planning and Response
- Groundwater & Source Water Protection
- Monitoring & Reporting
- Operator Certification
- Plan Review
- Drinking Water Funding
- Water System Operations
- Capacity Development

Resources

- County & Department of Agriculture Resources
- Data Online
- Domestic Well Safety Program
- Drinking Water Advisory Committee (DWAC)
- For Consumers
- Online Maps
- Rules & Implementation Guidance
- Training Opportunities
- Site Map
- Contact Us

News and Hot Topics

Link
LCRR Service Line Inventory Requirements
2023 Source Protection Grant LOI
Startup tips for seasonal systems
Current Rulemaking: Proposed Rule Amendments
Bipartisan Infrastructure Law Funding
Compliance Monitoring Data Portal
Per- and Polyfluoroalkyl Substances (PFAS)
Cyanotoxin Resources for Water Systems
Wildfire Information for Water Systems
Annual Water System Fee Info
DWS Annual Compliance Report

View archived hot topics and news items

Information By Subject

"Data Online"

(data specific to each water system)

Contact Us

News and Hot Topics

Oregon Health Authority

Information By Subject

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Water System Operations

- Surface Water Treatment
- Capacity Development
- Public Notice Resources…..

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Water System Operations

Resources for Oregon Water System Operators

- Drinking Water Services
- Water System Operations
- Surface Water Treatment
- Capacity Development
- Public Notice Templates and Resources
- Fact Sheets & Best Management Practices
- Water System Surveys & Outstanding Performance
- Circuit Rider Program
- ePipeline Newsletter
- Emerging Contaminants in Drinking Water
- Per - and Polyfluoroalkyl Substances (PFAS)
- Contact Us

Surface Water Treatment

Water systems that treat surface water sources have to deal with complex regulatory requirements, constantly changing raw water quality, and costly management of various assets. The Surface Water Treatment site provides information and tools needed to optimize water treatment processes and maximize public health protection without costly capital improvements.

Capacity Development

Water system capacity is the technical, managerial and financial capability of a water system to achieve and maintain compliance with drinking water standards and consistently provide safe drinking water. The Capacity Development site provides information and resources for drinking water systems to help build their capacity.

Public Notice Resources & Templates

Water systems are required to issue public notices to alert consumers under specific circumstances (for example, when exceeding a Maximum Contaminant Level, failing to complete required tests, failing to report the results, or failing to meet treatment technique requirements). This page includes information on public notification requirements and templates for issuing public notices, as well as translations and FAQs for effective communication with partners and the public.

Fact Sheets & Best Management Practices

Information, techniques, and best management practices for water system management, including coliform sampling plans, start-up and shut-down tips for seasonal systems, shock chlorination instructions, preparing for water system surveys.

Water System Surveys & Outstanding Performance

Information for water system operators on how to prepare for water system surveys and treatment plant inspections, as well as information on the outstanding performance designation for community water systems.

Circuit Rider Program

Circuit Riders provide free on-site technical services for short-term operational problems for community water systems serving populations under 10,000, as well as not-for-profit transient and non-transient non-community water systems.

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/Pages/index.aspx

Water System Operations

- Surface Water Treatment
- Capacity Development
- Public Notice Resources
- Fact Sheets & Best Practices
- Surveys & Outstanding Performance
- Circuit Rider Program
- Emerging Contaminants
- Pipeline Newsletter

Emerging Contaminants in Drinking Water

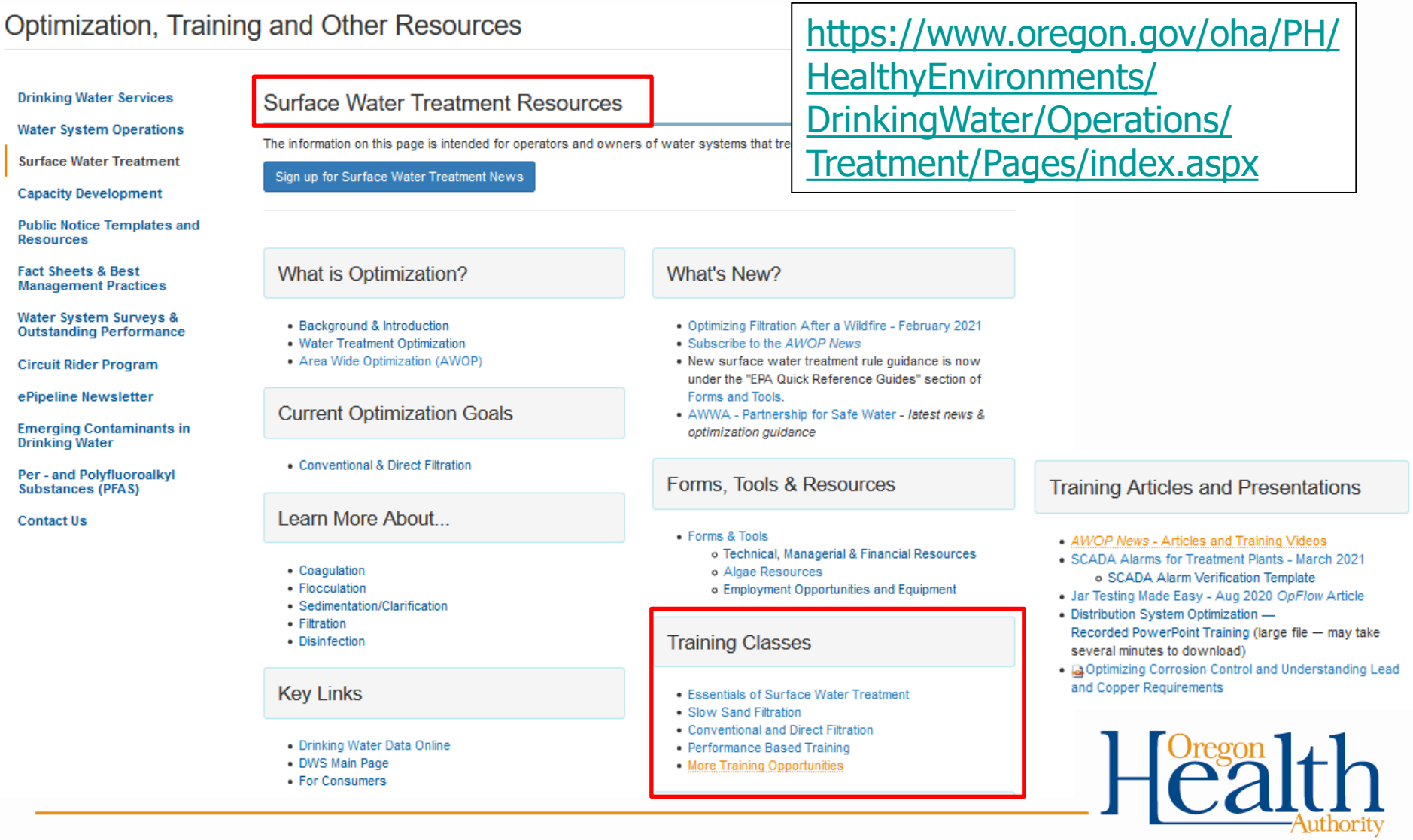
Emerging contaminants are naturally occurring or manmade chemicals present in drinking water that are known or suspected to pose risks to human health and are not yet subject to federal regulatory oversight. Some emerging contaminants of concern in Oregon include toxins produced by cyanobacteria (cyanotoxins), Per- and Polyfluoroalkyl Substances (PFAS), and Manganese.

Pipeline Newsletter

Published quarterly by Oregon Drinking Water Services, the Pipeline newsletter provides information on technology, training, and regulatory and policy issues for public water systems in order to improve the quality of drinking water in Oregon.

Oregon Health Authority

Surface Water Treatment



Oregon Health Authority

“Data Online”

www.healthoregon.org/dws

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Contact Us | Sign up for DWS News | Water Advisories Map | **Data Online**

Services

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✱ News and Hot Topics

Link
LCRR Service Line Inventory Requirements
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DWS Annual Compliance Report

View archived hot topics and news items

Information By Subject

“Data Online”

(data specific to each water system)

Contact Us

News and Hot Topics

Oregon Health Authority

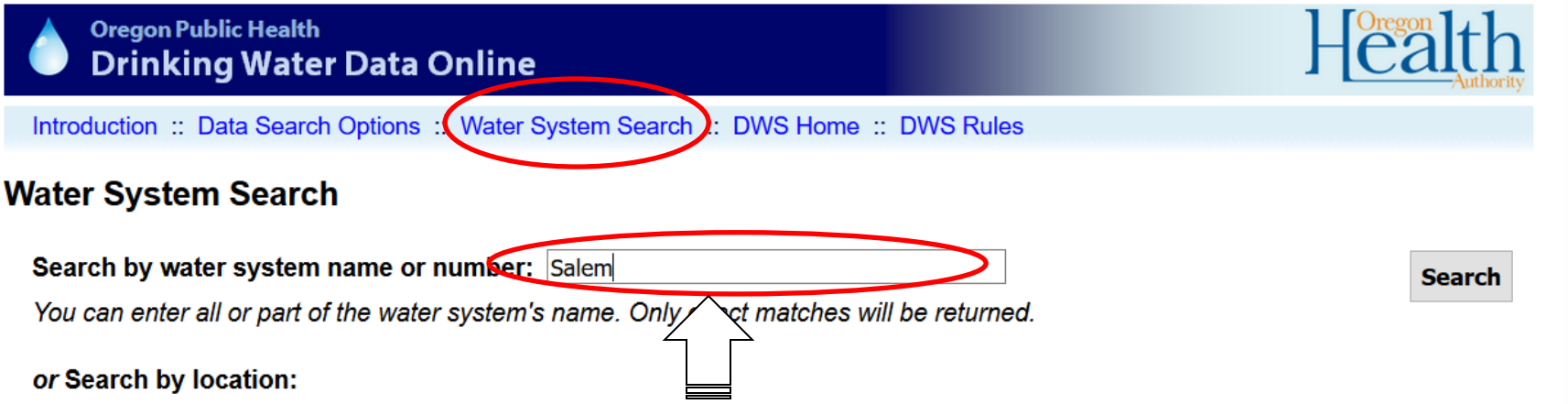
Drinking Water Data Online

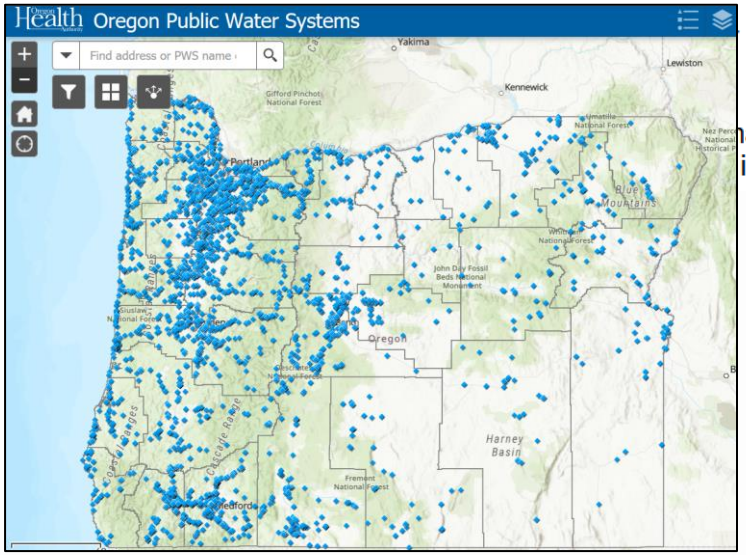
https://yourwater.oregon.gov/

Many data search options are available

Find Your Water System

WS Name Look Up





1. Select Water System Search
2. Enter water system name (e.g., "Salem")
3. Click Search

Note: You also could have used WS ID Look Up and entered the ID# for Salem (00731) or you could have used the map

Oregon Health Authority

Select Your Water System

Select the Water System by
Clicking on the PWS ID#

Search results: 5 systems found.*Select a water system by clicking on its row (opens in a new tab).*

PWS ID	Water System Name	Regulating Agency	County Served	System Type	Activity Status
05564	BPA-SALEM SUBSTATION	POLK COUNTY	Polk	OVS	Inactive
95003	FORUM SALEM CAMPUS	DEPT OF AGRICULTURE	Marion	NTNC	Active
00779	SALEM MOBILE ESTATES/SHADY ACRES	MARION COUNTY	Marion	C	Active
00731	SALEM PUBLIC WORKS	REGION 1	Marion	C	Active
00768	SUBURBAN EAST SALEM WD	REGION 1	Marion	C	Active

https://yourwater.oregon.gov/inventory.php?pwsno=00731

Oregon Health Authority

Oregon Public Health
Drinking Water Data Online

Oregon Health Authority

Introduction :: Data Search Options :: Water System Search :: DWS Home :: DWS Rules :: Quick Data Links

OR41 00731 **SALEM PUBLIC WORKS** **Classification**: COMMUNITY

Contact: DWAYNE BARNES
PO BOX 14300
SALEM, OR 97309
Population: 199,820
Operating Period: January 1 to December 31
Certified Operator(s)
Required: Y
Distribution class: 4
Treatment class: 3
Filtration Endorsement Required: No

Phone: 503-588-6483 View on Map
County: MARION
Activity Status: ACTIVE -- History
Number of Connections: 55,970
Regulating Agency: REGION 1
Owner Type: LOCAL GOVERNMENT
Licensed By: N/A
Approved Drinking Water Protection Plan: No
Source Water Assessment: Yes
Last Survey Date: Jul 25, 2023 - Outstanding Performer!

General Information

Sources

Facility ID	Facility Name - Well Logs	Activity Status	Availability	Source Type
EP-A	**EP FOR GEREN ISLAND (ALDERSGATE)**	**A**		**SW**
SRC-AA	NORTH SANTIAM RIVER	A	Permanent	SW
SRC-AB	GEREN ISLAND EAST WELL - L75842	A	Permanent	GU
SRC-AC	GEREN ISLAND WEST WELL - L75839	A	Permanent	GU
SRC-AD	I.G. / ROUGHING FILTER #1	A	Seasonal	GU
EP-B	**EP FOR ASR WELLS**	**A**		**GW**
SRC-BA	ASR WELL #1 - L82685	A	Seasonal	GW
SRC-BB	ASR WELL #2 - L82688	A	Seasonal	GW
SRC-BC	ASR WELL #4 - L10522	A	Seasonal	GW
SRC-BD	ASR WELL #5 - L16342	A	Seasonal	GW
EP-C	**EP FOR HEMLOCK WELL**	**I**		**GW**
SRC-CA	HEMLOCK WELL - L62600	I	Emergency	GW

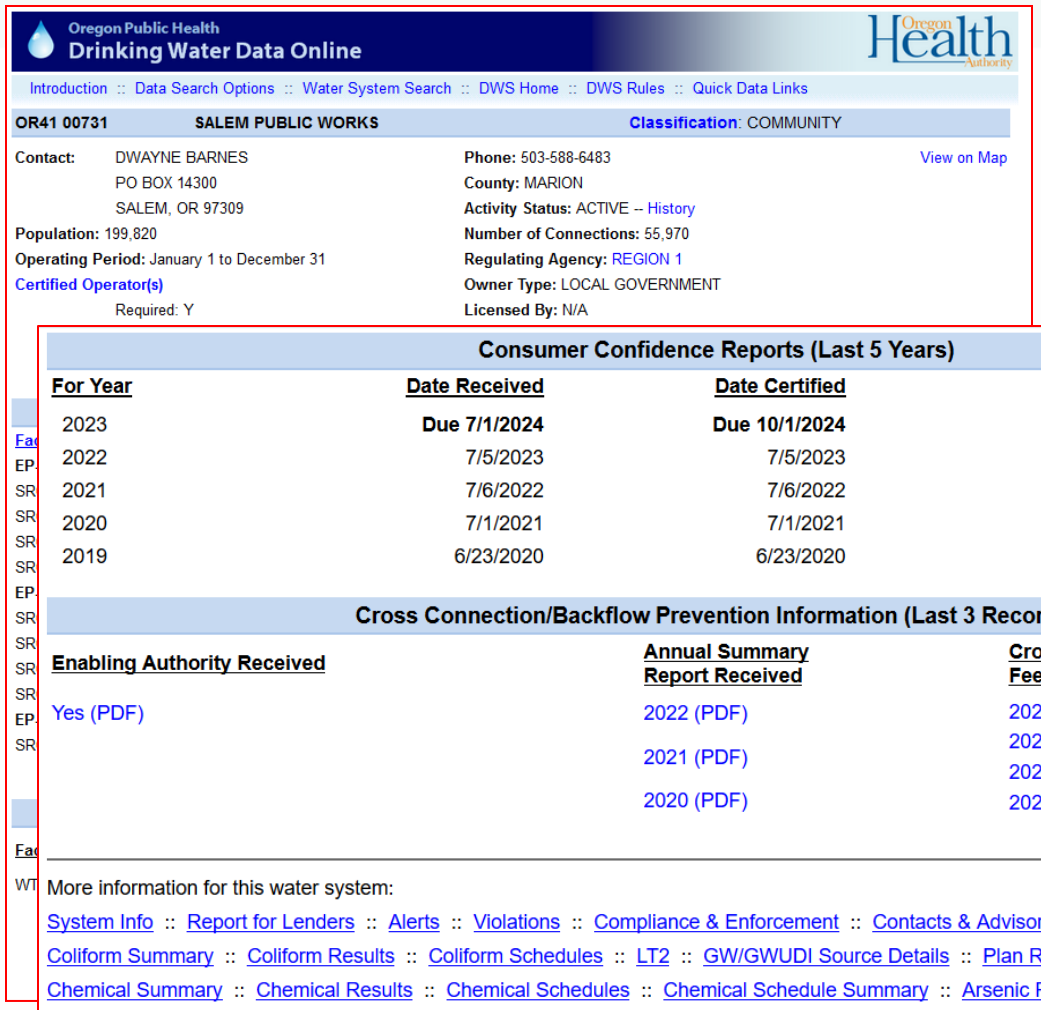
Find Purchasers/Sellers

Sources

Treatment

Facility ID	Facility Name	Filter Type	Giardia Removal Credit	Treatment Process	Treatment Objective
WTP-A	TP FOR GEREN ISLAND	SLOW SAND	2.0-log	FILTRATION, SLOW SAND	PARTICULATE REMOVAL
				HYPOCHLORINATION, POST	DISINFECTION
				PH/ALKA ADJ-SODA ASH	CORROSION CONTROL
				OZONATION, PRE	DISINFECTION
				ACT. CARBON, PWD - CYANOTOXINS	OTHER

Treatment



Oregon Public Health
Drinking Water Data Online

Oregon Health Authority

Introduction :: Data Search Options :: Water System Search :: DWS Home :: DWS Rules :: Quick Data Links

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Owner Type: LOCAL GOVERNMENT
Licensed By: N/A

View on Map

Population: 199,820
Operating Period: January 1 to December 31
Certified Operator(s)
Required: Y

Consumer Confidence Reports (Last 5 Years)

For Year	Date Received	Date Certified
2023	**Due 7/1/2024**	**Due 10/1/2024**
2022	7/5/2023	7/5/2023
2021	7/6/2022	7/6/2022
2020	7/1/2021	7/1/2021
2019	6/23/2020	6/23/2020

Cross Connection/Backflow Prevention Information (Last 3 Records)

Enabling Authority Received	Annual Summary Report Received	Cross Connection Fee Status
Yes (PDF)	2022 (PDF)	2024 - Paid
	2021 (PDF)	2023 - Paid
		2022 - Paid
	2020 (PDF)	2021 - Paid

More information for this water system:

SDWIS ID 3906

System Info :: Report for Lenders :: Alerts :: Violations :: Compliance & Enforcement :: Contacts & Advisories :: Site Visits :: Public Notice
Coliform Summary :: Coliform Results :: Coliform Schedules :: LT2 :: GW/GWUDI Source Details :: Plan Review :: Annual Fee
Chemical Summary :: Chemical Results :: Chemical Schedules :: Chemical Schedule Summary :: Arsenic RAA :: Cyanotoxins :: PFAS
Lead & Copper :: Corrosion Control (LCR) :: DBP Sample Sites :: FANLs :: MRDL :: GWR 4-Log :: Turbidity :: SWTR :: LRAA

Information for all water systems:

Water System Inventory :: Water System Surveys :: Outstanding Performers :: Treatment Plant Inspections :: Treatment :: Plan Reviews
Alerts :: Violations :: Compliance & Enforcement :: Deficiencies :: System Scores :: Exceedances :: Public Notices
Water Advisories :: Contact Reports :: Cyanotoxins :: PFAS :: Post-wildfire VOCs :: Fluoride

Introduction :: Data Search Options :: Water System Search :: DWS Home :: DWS Rules

Need help? Email Drinking Water Services for assistance.

Staff/Partner Login

Consumer Confidence Report (CCR)

Cross Connection Program Info

<= Many Other Options

Oregon Health Authority

General Information

System Classification

OR41 00731 **SALEM PUBLIC WORKS** **Classification**: COMMUNITY

Contact: DWAYNE BARNES
PO BOX 14300
SALEM, OR 97309

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Filtration Endorsement Required: No

Phone: 503-588-6483 View on Map

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Activity Status: ACTIVE -- History

Number of Connections: 55,970

Regulating Agency: REGION 1

Owner Type: LOCAL GOVERNMENT

Licensed By: N/A

Approved Drinking Water Protection Plan: No

Source Water Assessment: Yes

Last Survey Date: Jul 25, 2023 - Outstanding Performer!

All written correspondence goes to this person (e.g., violation notices, general mailings, etc.)

View a list of Certified Operators

Oregon Health Authority

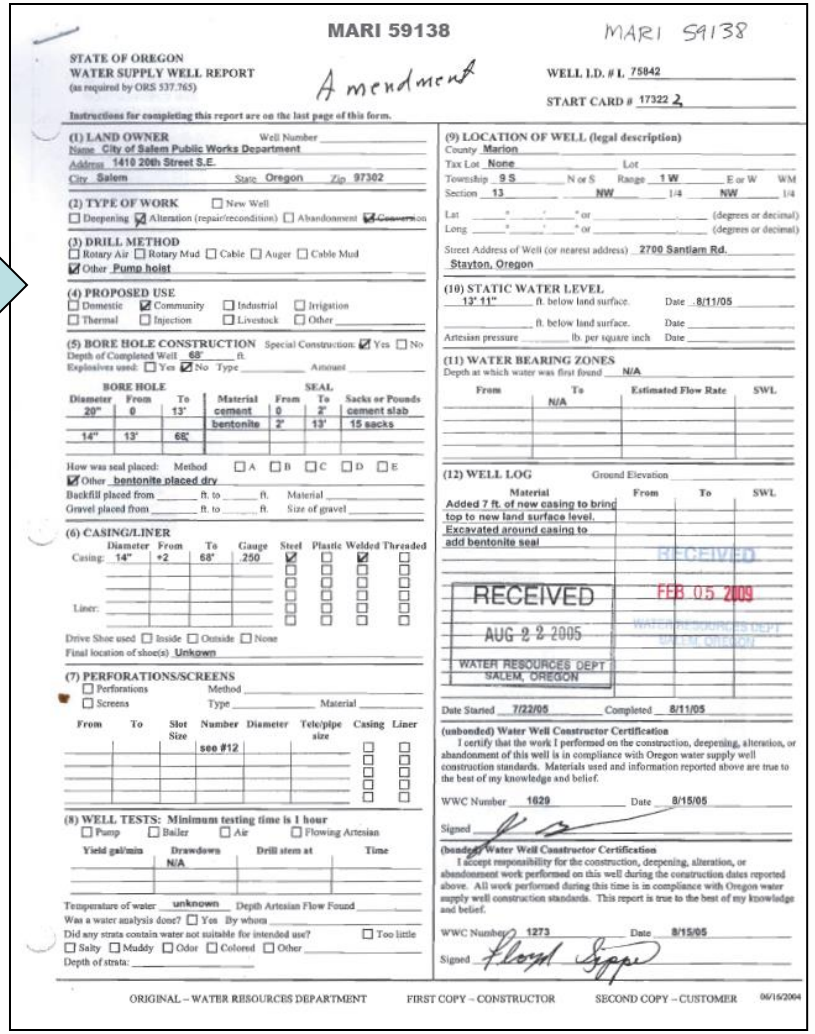
Sources

Well Log Query Results

Well Tag Nbr: 75842

Well Log	T-R-S/ QQ-Q	Taxlot	Street o
MARI 59138			

Facility ID	Facility Name - Well Logs
EP-A	EP FOR GEREN ISLAND WTP
SRC-AA	NORTH SANTIAM RIVER
SRC-AB	GEREN ISLAND EAST WELL - L75842
SRC-AC	GEREN ISLAND WEST WELL - L75839
SRC-AD	INFILTRATION GALLERY



MARI 59138

MARI 59138

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Amendment

WELL I.D. # L 75842
START CARD # 17322 2

Instructions for completing this report are on the last page of this form.

(1) LAND OWNER
Name City of Salem Public Works Department
Address 1410 20th Street S.E.
City Salem State Oregon Zip 97302

(2) TYPE OF WORK
☐ New Well ☐ Deepening ☑ Alteration (repair/recondition) ☐ Abandonment ☑ Conversion

(3) DRILL METHOD
☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud
☑ Other Pump hoist

(4) PROPOSED USE
☐ Domestic ☑ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION
Special Construction: ☑ Yes ☐ No
Depth of Completed Well 68' ft.
Explosives used: ☐ Yes ☑ No Type Amount

BORE HOLE Diameter	From	To	SEAL Material	From	To	Sacks or Pounds
20"	0	13'	cement	0	2'	cement slab
			bentonite	2'	13'	15 sacks
14"	13'	68'				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☑ Other bentonite placed dry
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	14"	+2	68'	.250	☑	☐	☑	☐
Liner:					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s) Unkown

(7) PERFORATIONS/SCREENS
☐ Perforations Method
☐ Screens Type Material

From	To	Slot Size	Number	Diameter	Tele/pipe size	Casing	Liner
			see #12			☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
	N/A		

Temperature of water unknown Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL (legal description)
County Marion
Tax Lot None Lot
Township 9 S N or S Range 1 W E or W WM
Section 13 NW 1/4 NW 1/4
Lat ° ' " or (degrees or decimal)
Long ° ' " or (degrees or decimal)
Street Address of Well (or nearest address) 2700 Santiam Rd.
Stayton, Oregon

(10) STATIC WATER LEVEL
13' 11" ft. below land surface. Date 8/11/05
ft. below land surface. Date
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES
Depth at which water was first found N/A

From	To	Estimated Flow Rate	SWL
	N/A		

(12) WELL LOG Ground Elevation

Material	From	To	SWL
Added 7 ft. of new casing to bring top to new land surface level. Excavated around casing to add bentonite seal			

RECEIVED
AUG 22 2005
WATER RESOURCES DEPT
SALEM, OREGON

RECEIVED
FEB 05 2009

Date Started 7/22/05 Completed 8/11/05

(unbonded) Water Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1629 Date 8/15/05
Signed

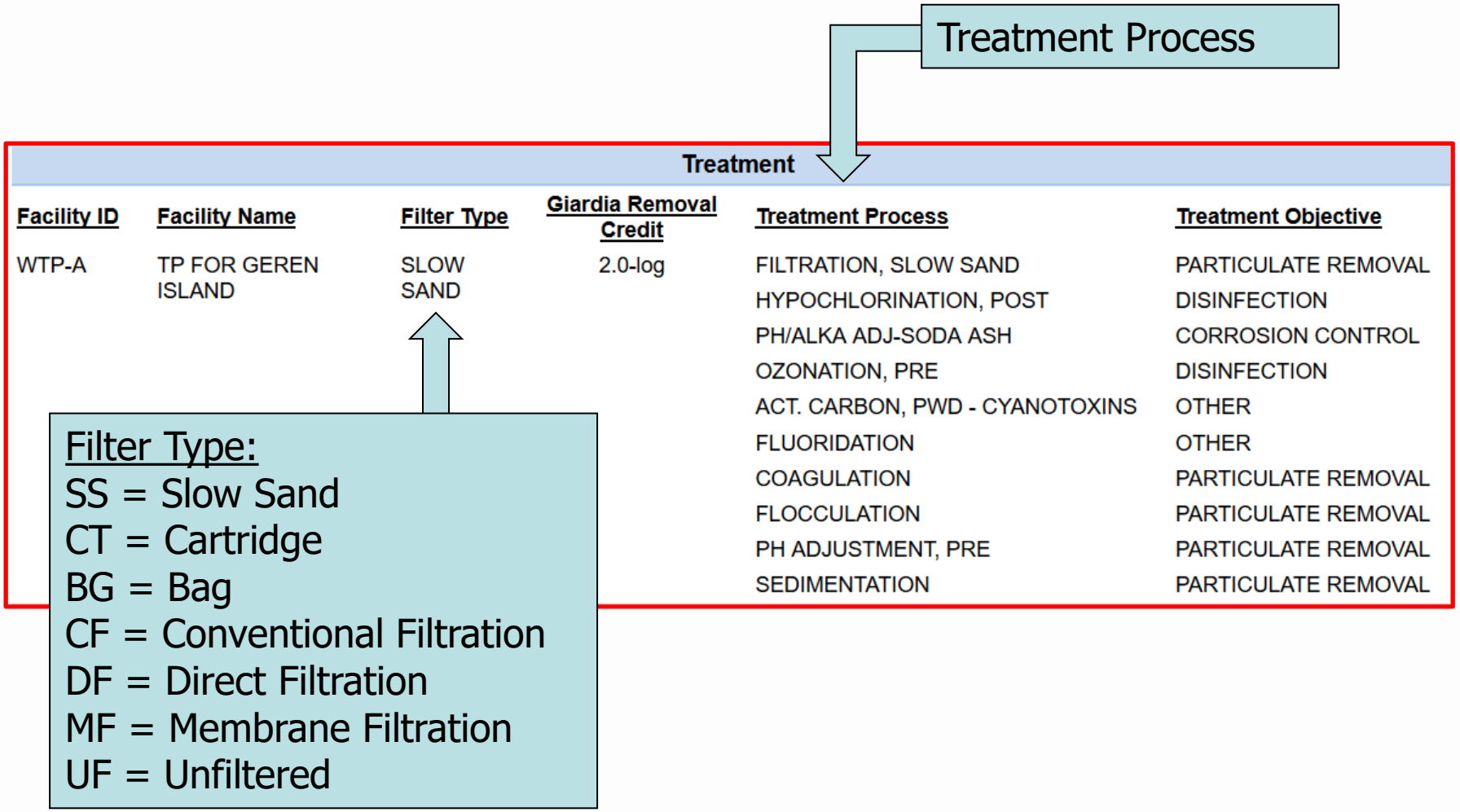
(bonded) Water Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1273 Date 8/15/05
Signed

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER 06/15/2004

Clicking on a Well ID allows you to view well logs and data from the Oregon Water Resources Department

Oregon Health Authority

Treatment



Oregon Health Authority

Sampling Schedules

More information for this water system:

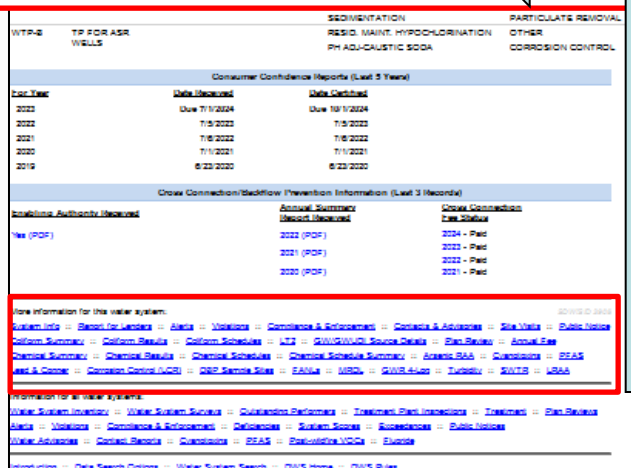
SDWIS ID 3906

System Info :: Report for Lenders :: Alerts :: Violations :: Compliance & Enforcement :: Contacts & Advisories :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Coliform Schedules :: LT2 :: GW/GWUDI Source Details :: Plan Review :: Annual Fee

Chemical Summary :: Chemical Results :: Chemical Schedules :: Chemical Schedule Summary :: Arsenic RAA :: Cyanotoxins :: PFAS

Lead & Copper :: Corrosion Control (LCR) :: DBP Sample Sites :: FANLs :: MRDL :: GWR 4-Log :: Turbidity :: SWTR :: LRAA



Sampling Schedules:

1. Sampling Schedule for Coliform
   - Includes repeat schedules
2. Chemical Schedule Summary
   - Required chemical sampling
3. Chemical Schedules - progress report on chemical sampling

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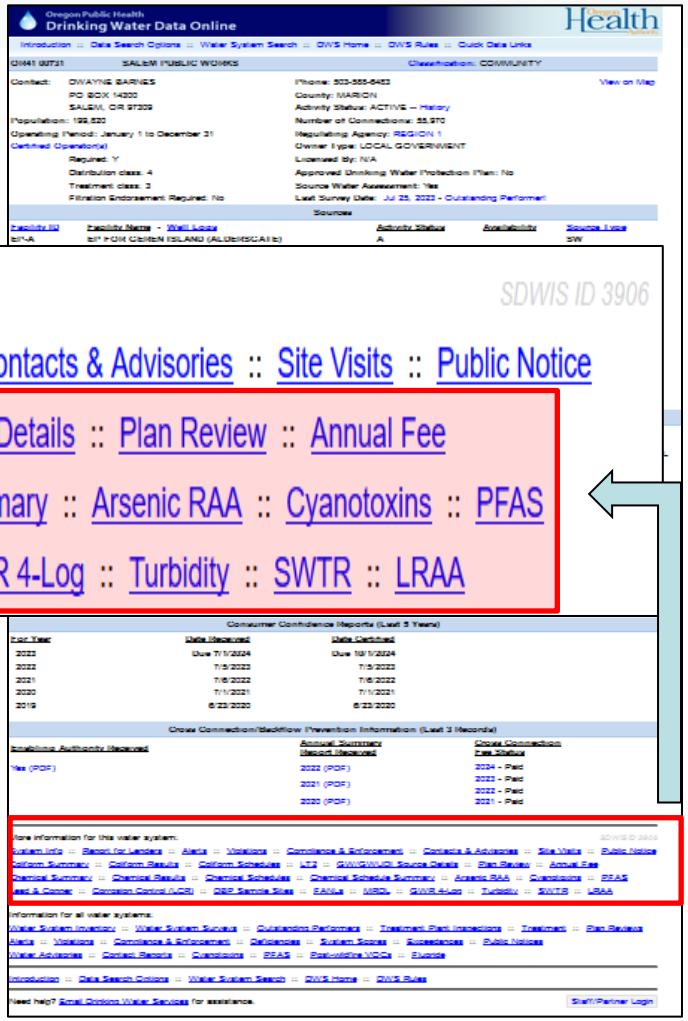
Sampling Data



1. Coliform Summary (by month)
2. Coliform Results (by sample, results before 2002)
3. Chemical Summary (VOC, SOC)
4. Chemical Results (individual contaminants)
5. Lead & Copper & Corrosion Control (L&C, pH, etc.)
6. Arsenic Running Annual Average (RAA) & PFAS
7. Turbidity (maximum daily turbidity), LT2 (source crypto/coliform), Cyanotoxins
8. SWTR (results from the bottom of the monthly SW report)
9. LRAA (DBP running annual average results)

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Alerts, Contacts, Advisories & Site Visits

1. Alerts - Sample results that require State/County/Dept of Ag staff to respond
2. Contacts – Document alert follow-ups and other significant correspondence
3. Advisories – boil water notice advisories, etc.
4. Site Visits – Document surveys and treatment plant inspections

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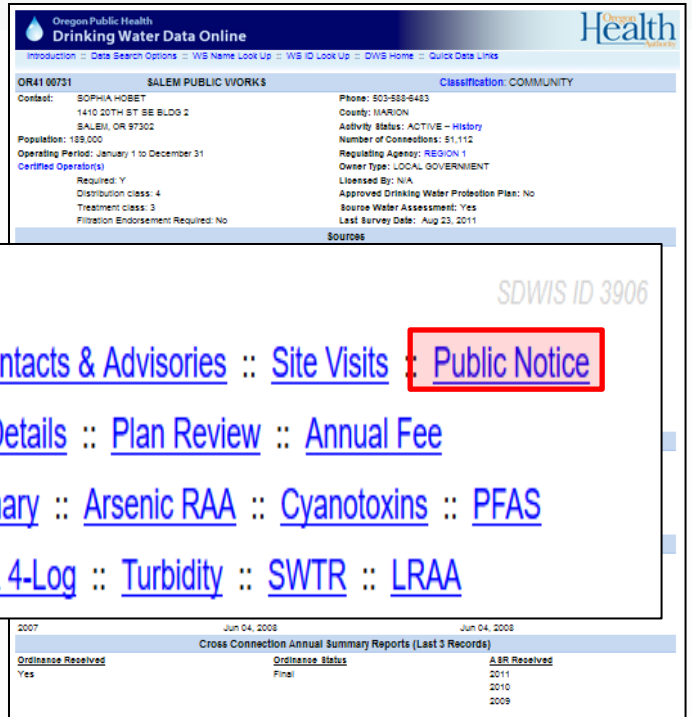
Violations, Enforcements & Public Notices



1. Violations
   - Also shows related enforcement actions
   - Systems should strive to see "Returned to Compliance" or "RTC"
   - System score should be less than 11 and as close to 0 as possible
2. Enforcements
   View pdf copies of original Administrative Orders and Bilateral Compliance Agreements as well as their status
3. Public Notice
   - Notices required
   - Notices delivered

Violations, Enforcements & Public Notices

PWS ID: 00731 ---- SALEM PUBLIC WORKS OR41

Violation History

Violations are displayed for the last 5 years only.

Group Abbreviations: CCR = Consumer Confidence Report

Gray shading indicates return to compliance.

Hide Auto-RTC | Show Determination Dates Go to public notices

Violation Number	Auto-RTC?	Monitoring Period Begin	End	Facility ID	Analyte Group	Violation Type - Analyte Count *Show analytes for all violations*	Enforcement Action - Date *Show history*	Points
902792450	Y	Jul 01, 2023	Jul 05, 2023		CCR	CCR Late/Nonreporting - 1	Returned To Compliance - Jul 05, 2023	1

SYSTEM SCORE SUMMARY

Learn about system scores

Unaddressed Points:	0
Number of years the oldest violation has been unaddressed (*n*):	0
System Score:	**0**
Points under formal enforcement:	0
Points RTC'd:	1

1. Violations
   - Systems should strive to see "Returned to Compliance" or "RTC"
   - System score should be less than 11 and as close to 0 as possible

Oregon Health Authority

Plan Review Information

For further information on this public water system, click on the area of interest below:

System Info :: Report for Lenders :: Alerts :: Violations :: Compliance & Enforcement :: Contacts & Advisories :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Sampling Schedule for Coliform :: Groundwater/GWUDI Source Details :: Plan Review :: Annual Fee

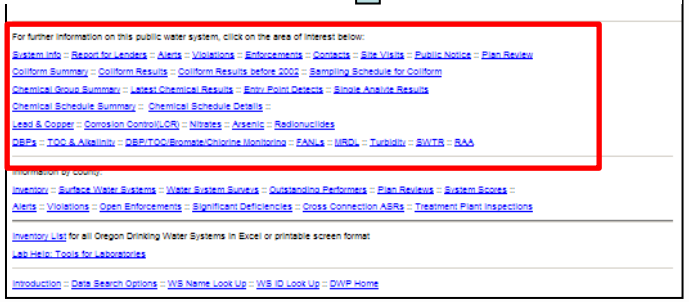
Chemical Group Summary :: Latest Chemical Results :: Entry Point Detects :: Single Analyte Results

Chemical Schedule Summary :: Chemical Schedule Details

Lead & Copper :: Corrosion Control (LCR) :: Nitrate :: Arsenic :: Radionuclides :: GWR 4-Log :: LT2 :: Cyanotoxins :: PFAS

DBPs :: TOC & Alkalinity :: DBP Sample Sites :: FANLs :: MRDL :: Turbidity :: SWTR :: RAA :: LRAA

For SDWIS: 3906



1. Project ID and Name
2. Date Plans Received
3. Date Preliminary Approval was Granted
   (no conditions)
4. Date Conditional Approval was Granted
   (required items not shown on submitted plans)
5. Date Abandoned (project was not completed)
6. Final Approval Date (approval for use)
7. Reviewer (initials of State staff engineer reviewing the plans)

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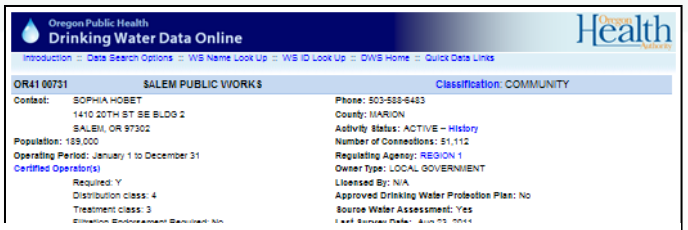
Annual Fee



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For SDWIS: 3906

1. Based on system type
2. Based on # of connections for most systems
3. Based on population served for wholesale only systems (no direct retail services)
4. Fee ranges from $75 for Oregon Very Small (OVS) systems to $65,000 for large community systems serving more than 100,000 people
5. “Pay Now” option to pay online

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System Info & Report For Lenders

For further information on this public water system, click on the area of interest below:

System Info :: Report for Lenders : Alerts :: Violations :: Compliance & Enforcement :: Contacts & Advisories :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Sampling Schedule for Coliform :: Groundwater/GWUDI Source Details :: Plan Review :: Annual Fee

Chemical Group Summary :: Latest Chemical Results :: Entry Point Detects :: Single Analyte Results

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For SDWIS: 3906

1. System Info
   - Main water system information page (already covered)

2. Report for Lenders
   - Provides proof that the water supply is under regulatory oversight
   - Satisfies lending institutions

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Information Available Online

www.healthoregon.org/dws/

Oregon Drinking Water Services

Working to keep drinking water safe for Oregonians

Access to safe drinking water is essential to human health. Oregon Drinking Water Services helps to keep drinking water safe for Oregonians.

Oregon Drinking Water Services (DWS) administers and enforces drinking water quality standards for public water systems in the state of Oregon. DWS focuses resources in the areas of highest public health benefit and promotes voluntary compliance with state and federal drinking water standards. DWS also emphasizes prevention of contamination through source water protection, provides technical assistance to water systems and provides water system operator training.

Contact Us | Sign up for DWS News | Water Advisories Map | Data Online

Services

- Cross Connection & Backflow Prevention
- Emergency Planning and Response
- Groundwater & Source Water Protection
- Monitoring & Reporting
- Operator Certification
- Plan Review
- Drinking Water Funding
- Water System Operations
- Capacity Development

Resources

- County & Department of Agriculture Resources
- Data Online
- Domestic Well Safety Program
- Drinking Water Advisory Committee (DWAC)
- For Consumers
- Online Maps
- Rules & Implementation Guidance
- Training Opportunities
- Site Map
- Contact Us

✱ News and Hot Topics

Link
LCRR Service Line Inventory Requirements
2023 Source Protection Grant LOI
Startup tips for seasonal systems
Current Rulemaking: Proposed Rule Amendments
Bipartisan Infrastructure Law Funding
Compliance Monitoring Data Portal
Per- and Polyfluoroalkyl Substances (PFAS)
Cyanotoxin Resources for Water Systems
Wildfire Information for Water Systems
Annual Water System Fee Info
DWS Annual Compliance Report

View archived hot topics and news items

Oregon Health Authority

End of Part 2

- Complete the application for all 6 contact hours online at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/TREATMENT/Pages/sw-essentials.aspx
- The link to attend more trainings is online under “Free Training Resources” at www.healthoregon.org/swt
- E-mail questions to: DWS.SurfaceWater@odhsoha.oregon.gov

Oregon Health Authority

QUESTIONS?

- E-mail questions to: DWS.SurfaceWater@odhsoha.oregon.gov
- Call your technical services contact at the State.
- State Drinking Water Services
  - General Info: (971) 673-0405

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Thank you!

- Please provide any feedback you have in the chat for this training.

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