

Essentials of Surface Water Treatment (Part 2)

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



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Background (continued)

- 1998 Interim Enhanced Surface Water Treatment Rule (IESWTR)
- Addressed concerns about *Crypto* (required 2-log removal)
- CF/DF: Lowered turbidity standard to 95% of readings ≤ 0.3 NTU, all readings < 1 NTU for systems with population $\geq 10,000$.
- Required Individual Filter Effluent (IFE) turbidimeters



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Overview of 2-Part Course:

Part 1:

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

Part 2:

1. Review of Part 1
2. Reporting Requirements w/Exercises #4 - #6
3. Emerging Issues
4. Resources for Operators



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Background (continued)

- 2002 Long-Term 1 Enhanced Surface Water Treatment Rule (LT1)

-Extended 0.3 NTU requirement to systems with $< 10,000$ population.

- 2006: LT2 requires additional *Crypto* treatment for systems with ≥ 0.075 oocysts/L in their source water.
 - So far only one water system is required to install additional treatment in Oregon.



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Background of Surface Water Treatment Rules

- 1989: SWTR required most SW and GWUDI (Groundwater Under Direct Influence) systems to filter.
- States required to identify GWUDI sources.
- Required 3-log (99.9%) *Giardia* and 4-log (99.99%) virus removal.
- CF/DF: 95% of turbidity readings ≤ 0.5 NTU; all < 5 NTU
- Slow sand/DE/alt: 95% of turbidity readings ≤ 1 NTU; all < 5 NTU
- Required detectable disinfectant residual.
- Did not address *Cryptosporidium*.



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Filtration Types:

- Conventional & Direct (Rapid Rate)
 - Backwashing
- Slow sand
 - Scraping/harrowing
 - Ripening (24-hr filter-to-waste)
- Membrane
 - Backwash
 - Chemical cleaning
- Cartridge/bag
 - Discard/replace used filters



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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)



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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 approximately known until a tracer study is conducted.*



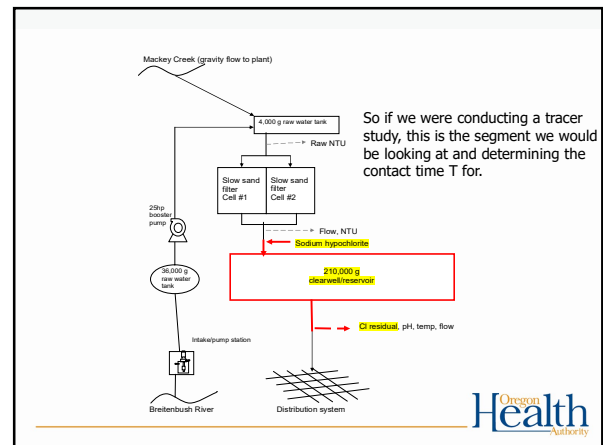
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What are CT's?

- 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"



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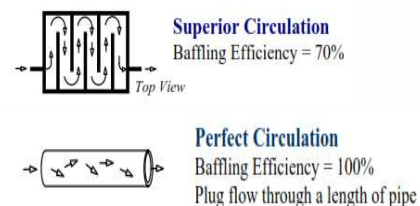
How do we calculate CT's?

- 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}



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



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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).



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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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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)



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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



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REPORTING REQUIREMENTS



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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)



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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)



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

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. IFE = Indivis. Filter Eff. (OAR 333-061-0040(1)(e)(B4C))

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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 [NTU] |
|-----|-------------|------------|------------|------------|------------|------------|----------------------------------|
| 1 | | | | | | | |
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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)



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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 [NTU] |
|-----|-------------|------------|------------|------------|------------|------------|----------------------------------|
| 1 | | | | | | | |
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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

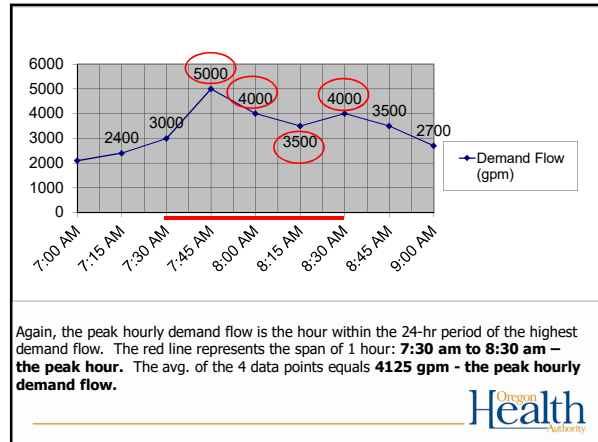


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Method for determining peak hourly demand flow (continued)

- 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

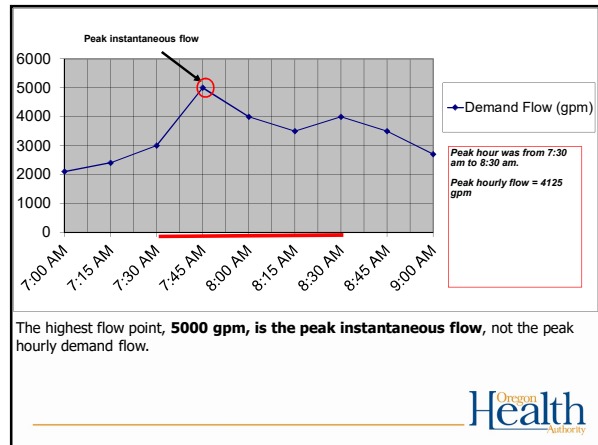
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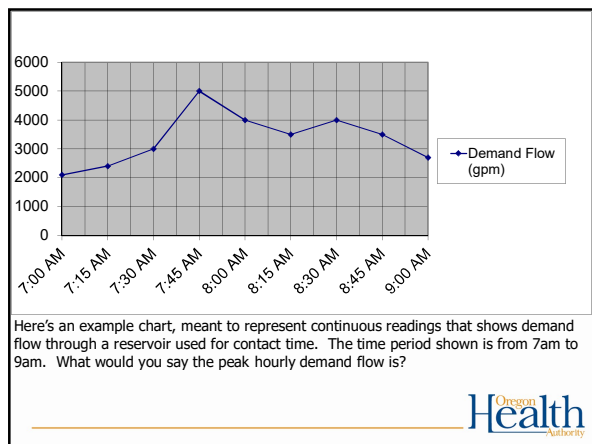
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| OHA - Drinking Water Program – Surface Water Quality Data Form - Giardia Inactivation | | | | | | | | |
|---|---|------------------|-----------|-------------|---------------------------------------|-------------|----------------------|-------------------------|
| System Name: | | ID #: | WTP-: | Month/Year: | Log Requirement (Circle One) 8.3/ 1.9 | | | |
| Date / Time | Minimum Cl ₂ Residual at 1 st User (C) ^a | Contact Time (T) | Actual CT | Temp | pH | Required CT | CT Met? ^b | Peak Hourly Demand Flow |
| | [ppm or mg/L] | [minutes] | C X T | [°C] | | Use tables | Yes / No | [GPM] |
| 1 / | | | | | | | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
| 4 / | | | | | | | | |
| 5 / | | | | | | | | |
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| 11 / | | | | | | | | |
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| 14 / | | | | | | | | |
| 15 / | | | | | | | | |

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Exercise #4

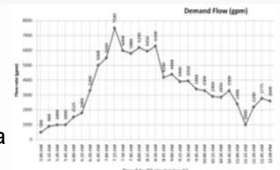
- Calculate peak hourly demand flow based on continuous flow rate data

Questions:

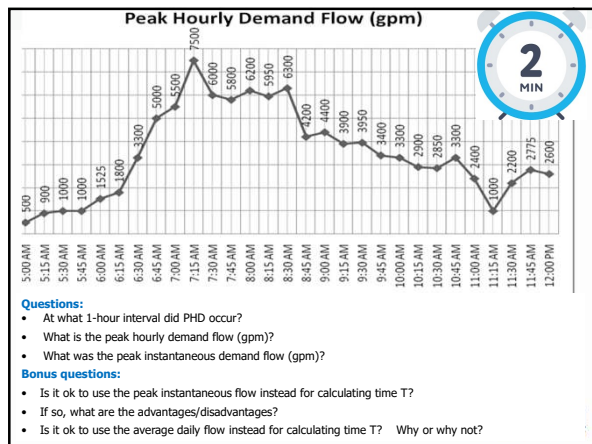
- At what 1-hour interval did PHD occur?
- What is the peak hourly demand flow (gpm)?
- What was the peak instantaneous demand flow (gpm)?

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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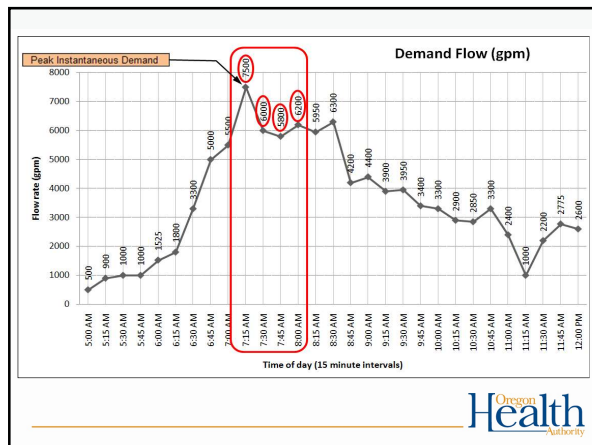


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• Example of calculate a running hourly average by averaging the previous 4 data points every 15 minutes.

| 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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Exercise #4: Calculating Peak Hourly Demand Flow

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%

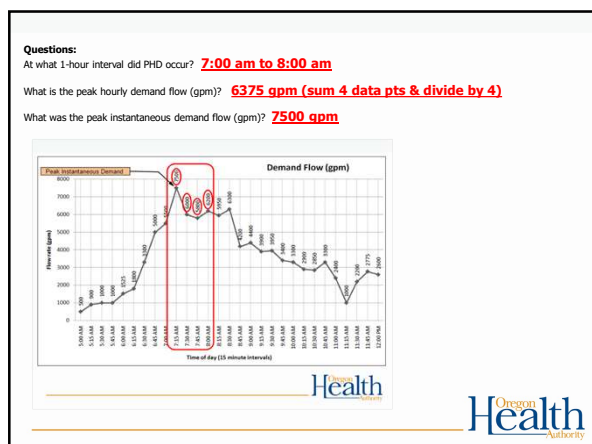
Is it ok to use the average daily flow instead for calculating time T?

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)

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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.
 - $^{\circ}\text{C} = 5/9 \times (^{\circ}\text{F} - 32)$
- 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 mg/L <= | pH < 6 | | | | | pH = 6.5 | | | | | pH = 7.0 | | | | | |
|-----------------------------------|--------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | |
| 0.4 | 12 | 24 | 37 | 49 | 61 | 73 | 15 | 29 | 44 | 58 | 73 | 88 | 17 | 35 | 52 | 69 |
| 0.6 | 13 | 25 | 38 | 50 | 63 | 75 | 15 | 30 | 45 | 60 | 75 | 90 | 18 | 36 | 54 | 71 |
| 0.8 | 13 | 26 | 39 | 52 | 66 | 78 | 15 | 31 | 46 | 61 | 77 | 92 | 18 | 37 | 55 | 73 |
| 1 | 13 | 26 | 40 | 53 | 66 | 79 | 16 | 31 | 47 | 63 | 78 | 94 | 19 | 37 | 56 | 75 |
| 1.2 | 13 | 27 | 40 | 53 | 67 | 80 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 57 | 76 |
| 1.4 | 14 | 27 | 41 | 55 | 68 | 82 | 16 | 33 | 49 | 65 | 82 | 98 | 19 | 39 | 58 | 77 |
| 1.6 | 14 | 28 | 42 | 56 | 69 | 83 | 17 | 33 | 50 | 66 | 83 | 99 | 20 | 40 | 60 | 79 |
| 1.8 | 14 | 29 | 43 | 57 | 72 | 86 | 17 | 34 | 51 | 67 | 84 | 101 | 20 | 41 | 61 | 81 |
| 2 | 15 | 29 | 44 | 58 | 73 | 87 | 17 | 35 | 52 | 69 | 87 | 104 | 21 | 41 | 62 | 83 |
| 2.2 | 15 | 30 | 45 | 59 | 74 | 89 | 18 | 35 | 53 | 70 | 88 | 105 | 21 | 42 | 64 | 85 |
| 2.4 | 15 | 30 | 45 | 60 | 75 | 90 | 18 | 36 | 54 | 71 | 89 | 107 | 22 | 43 | 65 | 86 |
| 2.6 | 15 | 31 | 46 | 61 | 77 | 92 | 18 | 37 | 55 | 73 | 92 | 110 | 22 | 44 | 66 | 87 |
| 2.8 | 16 | 31 | 47 | 62 | 78 | 93 | 19 | 37 | 56 | 74 | 93 | 111 | 22 | 45 | 67 | 89 |
| 3 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 57 | 75 | 94 | 113 | 23 | 46 | 69 | 91 |

| Chlorine Concentration mg/L <= | pH < 7.5 | | | | | pH = 8.0 | | | | | pH = 8.5 | | | | |
|-----------------------------------|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 |
| 0.4 | 21 | 42 | 63 | 83 | 104 | 125 | 25 | 50 | 75 | 99 | 124 | 148 | 149 | 177 | 183 |
| 0.6 | 21 | 43 | 64 | 85 | 107 | 128 | 26 | 51 | M | 102 | 128 | 153 | 31 | 61 | 92 |

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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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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



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

10°C - 14.9°C

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

| Chlorine Concentration mg/L <= | pH < 7.5 | | | | | pH = 8.0 | | | | | pH = 8.5 | | | | |
|-----------------------------------|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 |
| 0.4 | 21 | 42 | 63 | 83 | 104 | 125 | 25 | 50 | 75 | 99 | 124 | 148 | 30 | 59 | 89 |
| 0.6 | 21 | 43 | 64 | 85 | 107 | 128 | 26 | 51 | M | 102 | 128 | 153 | 31 | 61 | 92 |

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

10°C - 14.9°C


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

| Chlorine Concentration mg/L <= | pH < 7.5 | | | | | pH = 8.0 | | | | | pH = 8.5 | | | | | |
|-----------------------------------|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|-----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | |
| 0.4 | 21 | 42 | 63 | 83 | 104 | 125 | 25 | 50 | 75 | 99 | 124 | 148 | 30 | 59 | 89 | 118 |
| 0.6 | 21 | 43 | 64 | 85 | 107 | 128 | 26 | 51 | M | 102 | 128 | 153 | 31 | 61 | 92 | 122 |

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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 mg/L <= | pH < 6 | | | | | pH = 6.5 | | | | | pH = 7.0 | | | | |
|--------------------------------------|--------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 |
| 0.4 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 0.6 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 0.8 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 1.0 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 1.2 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 1.4 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 1.6 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 1.8 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 2.0 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 2.2 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 2.4 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 2.6 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 2.8 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |
| 3.0 | 12 | 25 | 38 | 50 | 63 | 15 | 30 | 45 | 60 | 75 | 18 | 36 | 54 | 72 | 90 |

| Chlorine Concentration mg/L <= | pH < 7.5 | | | | | pH = 8.0 | | | | | pH = 8.5 | | | | |
|--------------------------------------|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|
| | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 |
| 0.4 | 21 | 42 | 63 | 84 | 105 | 25 | 50 | 75 | 100 | 125 | 30 | 60 | 90 | 120 | 150 |
| 0.6 | 21 | 42 | 63 | 84 | 105 | 25 | 50 | 75 | 100 | 125 | 30 | 60 | 90 | 120 | 150 |

43

15 Minute Break

- 10 minutes left



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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)

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15 Minute Break


- 5 minutes left



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15 Minute Break



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Exercise #5

- Using EPA CT tables to calculate CTs required

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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 mg/L C = | PH = 6 | | | | | | PH = 6.5 | | | | | | 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 | 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 | 102 | 137 | 171 | 205 |
| 1 | 25 | 49 | 74 | 99 | 123 | 148 | 29 | 59 | 88 | 117 | 147 | 176 | 35 | 70 | 105 | 140 | 175 | 210 |
| 1.2 | 25 | 51 | 76 | 101 | 127 | 152 | 30 | 60 | 90 | 120 | 150 | 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 | 156 | 188 | 38 | 75 | 113 | 149 | 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 | 105 | 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 | 72 | 109 | 145 | 181 | 217 | 44 | 87 | 131 | 174 | 218 | 261 |

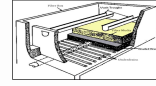
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Directions: Use the data provided in the examples to determine the CTs required for giardia inactivation at the treatment plant for that day

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

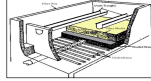


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Exercise #5: Using EPA CT tables to calculate CTs required

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



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



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

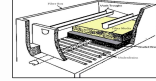


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Answer 3 questions for each example...

- What are the CTs required for that day?
- What was the CT achieved?
- 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)



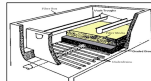
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CT parameters measured at the first user are provided below

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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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 | | PH = 6 | | | | | PH = 6.5 | | | | | PH = 7.0 | | | | | | |
|------------------------|-----|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|-----|-------------------|-----|-----|-----|-----|-----|-----|
| mg/L | C = | Log Inactivations | | | | | Log Inactivations | | | | | Log Inactivations | | | | | | |
| | | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | | |
| 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 | 102 | 137 | 171 | 205 |
| 1 | 25 | 49 | 74 | 99 | 123 | 148 | 29 | 59 | 88 | 117 | 147 | 176 | 35 | 70 | 105 | 140 | 175 | 210 |
| 1.2 | 25 | 51 | 76 | 101 | 127 | 152 | 30 | 60 | 90 | 120 | 150 | 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 | 156 | 188 | 38 | 75 | 113 | 149 | 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 | 105 | 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 | 72 | 109 | 145 | 181 | 217 | 44 | 87 | 131 | 174 | 218 | 261 |

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Exercise #5

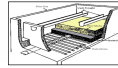
Avoid common mistakes for CT_{required}...

- Must round down for temperature
- Must round up for pH
- Must round up for free chlorine residual



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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 mg/L <= | PH < 6 | | | | | | PH = 6.5 | | | | | | 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 | 10 | 20 | 30 | 40 | 50 | 60 | 13 | 25 | 38 | 51 | 64 | 77 | 15 | 30 | 45 | 60 | 75 | 90 |
| 0.8 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 44 | 55 | 66 | 13 | 26 | 39 | 52 | 65 | 78 |
| 1.0 | 8 | 16 | 24 | 32 | 40 | 48 | 10 | 20 | 30 | 40 | 50 | 60 | 12 | 24 | 36 | 48 | 60 | 72 |
| 1.2 | 7 | 14 | 21 | 28 | 35 | 42 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 44 | 55 | 66 |
| 1.4 | 6 | 12 | 18 | 24 | 30 | 36 | 8 | 16 | 24 | 32 | 40 | 48 | 10 | 20 | 30 | 40 | 50 | 60 |
| 1.6 | 5 | 10 | 15 | 20 | 25 | 30 | 7 | 14 | 21 | 28 | 35 | 42 | 9 | 18 | 27 | 36 | 45 | 54 |
| 1.8 | 4 | 8 | 12 | 16 | 20 | 24 | 6 | 12 | 18 | 24 | 30 | 36 | 8 | 16 | 24 | 32 | 40 | 48 |
| 2.0 | 3 | 6 | 9 | 12 | 15 | 18 | 5 | 10 | 15 | 20 | 25 | 30 | 7 | 14 | 21 | 28 | 35 | 42 |
| 2.2 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 | 6 | 12 | 18 | 24 | 30 | 36 |
| 2.4 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 | 5 | 10 | 15 | 20 | 25 | 30 |
| 2.6 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 |
| 2.8 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 |
| 3.0 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 |



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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

For each example:

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

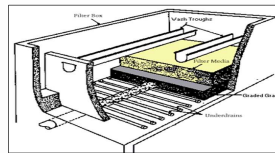
Example #3: Membrane filter plant (2.5-log)

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



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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)**



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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

For each example:

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

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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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 mg/L <= | PH < 6 | | | | | | PH = 6.5 | | | | | | 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 | 10 | 20 | 30 | 40 | 50 | 60 | 13 | 25 | 38 | 51 | 64 | 77 | 15 | 30 | 45 | 60 | 75 | 90 |
| 0.8 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 44 | 55 | 66 | 13 | 26 | 39 | 52 | 65 | 78 |
| 1.0 | 8 | 16 | 24 | 32 | 40 | 48 | 10 | 20 | 30 | 40 | 50 | 60 | 12 | 24 | 36 | 48 | 60 | 72 |
| 1.2 | 7 | 14 | 21 | 28 | 35 | 42 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 44 | 55 | 66 |
| 1.4 | 6 | 12 | 18 | 24 | 30 | 36 | 8 | 16 | 24 | 32 | 40 | 48 | 10 | 20 | 30 | 40 | 50 | 60 |
| 1.6 | 5 | 10 | 15 | 20 | 25 | 30 | 7 | 14 | 21 | 28 | 35 | 42 | 9 | 18 | 27 | 36 | 45 | 54 |
| 1.8 | 4 | 8 | 12 | 16 | 20 | 24 | 6 | 12 | 18 | 24 | 30 | 36 | 8 | 16 | 24 | 32 | 40 | 48 |
| 2.0 | 3 | 6 | 9 | 12 | 15 | 18 | 5 | 10 | 15 | 20 | 25 | 30 | 7 | 14 | 21 | 28 | 35 | 42 |
| 2.2 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 | 6 | 12 | 18 | 24 | 30 | 36 |
| 2.4 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 | 5 | 10 | 15 | 20 | 25 | 30 |
| 2.6 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 4 | 8 | 12 | 16 | 20 | 24 |
| 2.8 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 |
| 3.0 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 | 3 | 6 | 9 | 12 | 15 | 18 |



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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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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 #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**

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**

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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 mg/L <= | PH = 7.5 | | | | | | | | | | PH = 8.0 | | | | | | | | | | PH = 8.5 | | | | | | | | | |
|--------------------------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 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 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| 0.4 | 29 | 55 | 82 | 111 | 138 | 166 | 23 | 46 | 69 | 92 | 115 | 138 | 29 | 55 | 82 | 111 | 138 | 166 | 23 | 46 | 69 | 92 | 115 | 138 | 29 | 55 | 82 | 111 | 138 | 166 |
| 0.6 | 29 | 57 | 86 | 114 | 143 | 171 | 34 | 68 | 102 | 136 | 170 | 204 | 41 | 81 | 122 | 163 | 203 | 244 | 41 | 81 | 122 | 163 | 203 | 244 | 41 | 81 | 122 | 163 | 203 | 244 |
| 1 | 30 | 60 | 90 | 119 | 149 | 179 | 36 | 72 | 108 | 144 | 180 | 216 | 43 | 87 | 130 | 173 | 217 | 260 | 43 | 87 | 130 | 173 | 217 | 260 | 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 | 45 | 89 | 134 | 178 | 223 | 267 | 45 | 89 | 134 | 178 | 223 | 267 |
| 1.4 | 32 | 62 | 94 | 125 | 156 | 187 | 38 | 76 | 114 | 151 | 189 | 227 | 46 | 91 | 137 | 183 | 228 | 274 | 46 | 91 | 137 | 183 | 228 | 274 | 46 | 91 | 137 | 183 | 228 | 274 |
| 1.6 | 33 | 64 | 96 | 128 | 160 | 192 | 39 | 77 | 116 | 155 | 193 | 232 | 47 | 94 | 141 | 187 | 234 | 281 | 47 | 94 | 141 | 187 | 234 | 281 | 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 | 48 | 96 | 144 | 191 | 239 | 287 | 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 | 49 | 98 | 147 | 196 | 245 | 294 | 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 | 50 | 100 | 150 | 200 | 250 | 300 | 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 | 51 | 102 | 153 | 204 | 255 | 306 | 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 | 52 | 104 | 156 | 208 | 260 | 312 | 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 | 53 | 106 | 159 | 212 | 265 | 318 | 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 | 54 | 108 | 162 | 216 | 270 | 324 | 54 | 108 | 162 | 216 | 270 | 324 |

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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 | | | | | | | | | | | | |
|--|----------|----|-----|----|----------|----|-----|-----|----------|-----|-----|-----|
| Temperature (°C) | 2.0-log | | | | 3.0-log | | | | 4.0-log | | | |
| | pH > 6.9 | 10 | 6-9 | 10 | pH > 6.9 | 10 | 6-9 | 10 | pH > 6.9 | 10 | 6-9 | 10 |
| 0.5 | 5 | 45 | 9 | 66 | 12 | 90 | 18 | 135 | 24 | 180 | 36 | 270 |
| 5 | 4 | 30 | 6 | 44 | 8 | 60 | 12 | 88 | 16 | 112 | 24 | 176 |
| 10 | 3 | 22 | 4 | 33 | 6 | 45 | 10 | 66 | 12 | 90 | 18 | 135 |
| 15 | 2 | 15 | 3 | 22 | 4 | 30 | 8 | 60 | 12 | 90 | 18 | 135 |
| 20 | 1 | 11 | 2 | 16 | 3 | 22 | 6 | 45 | 10 | 66 | 12 | 90 |
| 25 | 1 | 7 | 1 | 11 | 2 | 15 | 4 | 33 | 6 | 45 | 10 | 66 |

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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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)**

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

Table A-7. CT Values for Inactivation of Viruses by Free Chlorine¹

| Temperature (°C) | 2.0-log | | | | 3.0-log | | | | 4.0-log | | | |
|------------------|----------|----|-----|----|----------|----|-----|-----|----------|-----|-----|-----|
| | pH > 6.9 | 10 | 6-9 | 10 | pH > 6.9 | 10 | 6-9 | 10 | pH > 6.9 | 10 | 6-9 | 10 |
| 0.5 | 5 | 45 | 9 | 66 | 12 | 90 | 18 | 135 | 24 | 180 | 36 | 270 |
| 5 | 4 | 30 | 6 | 44 | 8 | 60 | 12 | 88 | 16 | 112 | 24 | 176 |
| 10 | 3 | 22 | 4 | 33 | 6 | 45 | 10 | 66 | 12 | 90 | 18 | 135 |
| 15 | 2 | 15 | 3 | 22 | 4 | 30 | 8 | 60 | 12 | 90 | 18 | 135 |
| 20 | 1 | 11 | 2 | 16 | 3 | 22 | 6 | 45 | 10 | 66 | 12 | 90 |
| 25 | 1 | 7 | 1 | 11 | 2 | 15 | 4 | 33 | 6 | 45 | 10 | 66 |

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 1 st User (C) ¹ [ppm or mg/L] | Contact Time (T) [minutes] | Actual CT C X T | Temp [° C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | | | | | | | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
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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...

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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 1 st User (C) ¹ [ppm or mg/L] | Contact Time (T) [minutes] | Actual CT C X T | Temp [° C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | | | | 12 | | | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
| 4 / | | | | | | | | |
| 5 / | | | | | | | | |
| 6 / | | | | | | | | |
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Here's where we enter temp

70

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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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 1 st User (C) ¹ [ppm or mg/L] | Contact Time (T) [minutes] | Actual CT C X T | Temp [° C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | | | | 12 | 6.8 | | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
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| 19 / | | | | | | | | |

Here's where we enter pH

71

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 1 st User (C) ¹ [ppm or mg/L] | Contact Time (T) [minutes] | Actual CT C X T | Temp [° C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | | | 12 | 6.8 | | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
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| 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 1 st User (C) ¹ | Contact Time (T) [minutes] | Actual CT | Temp [°C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | | | 12 | 6.8 | 36 | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
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| 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 1 st User (C) ¹ | Contact Time (T) [minutes] | Actual CT | Temp [°C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | 110 | | 12 | 6.8 | 36 | | |
| 2 / | | | | | | | | |
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| 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 1 st User (C) ¹ | Contact Time (T) [minutes] | Actual CT | Temp [°C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | | | 12 | 6.8 | 36 | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
| 4 / | | | | | | | | |
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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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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 1 st User (C) ¹ | Contact Time (T) [minutes] | Actual CT | Temp [°C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | 110 | | 12 | 6.8 | 36 | | |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
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So free chlorine residual C of 0.6 ppm times 110 minutes of contact time = ?

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

- Remember:
 - CT achieved = Chlorine Concentration x Contact Time
- 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 1 st User (C) ¹ | Contact Time (T) [minutes] | Actual CT | Temp [°C] | pH | Required CT Use tables | CT Met? ² Yes / No | Peak Hourly Demand Flow [GPM] |
| 1 / | 0.6 | 110 | 66 | 12 | 6.8 | 36 | | |
| 2 / | | | | | | | | |
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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 1" User (C) ¹ | Contact Time (T) | Actual CT | Temp | pH | Required CT | CT Met? ² | 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 / | | | | | | | | |
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In order for CTs to be met, CT_{actual} must be greater than CT_{required}, which it is.

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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

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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 1" User (C) ¹ | Contact Time (T) | Actual CT | Temp | pH | Required CT | CT Met? ² | 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 / | | | | | | | | |
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| 19 / | | | | | | | | |

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

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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? ² | Yes / No | CT's met everyday? (see back) |
| All the 4-hour turbidity readings ≤ 1 NTU? | Yes / No | All Cl ₂ residuals at entry point ≥ 0.2 mg/l? |
| All turbidity readings < IFE ² triggers? | Yes / No ² | 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 = Indiv. Filter Eff. (OAR 333-061-0040(1)(b)(BAC))

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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

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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 | CT's met everyday? (see back) |
| All daily turbidity readings ≤ 5 NTU? | Yes / No | All Cl ₂ residual at entry point ≥ 0.2 mg/l? |
| 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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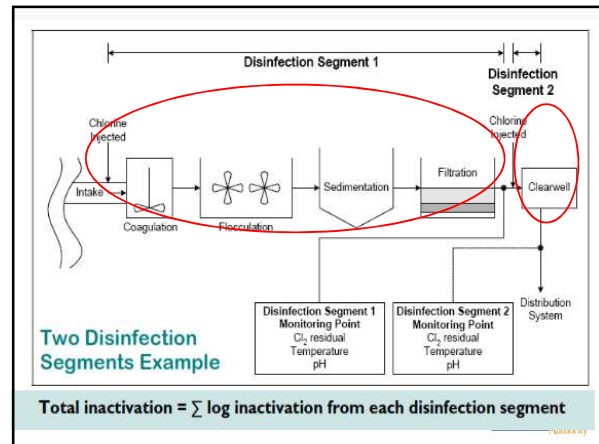
Cartridge/Bag Answer all the yes/no questions

| | | |
|--|---|--|
| Cartridge Filtration 95% of daily turbidity readings ≤ 1 NTU? Yes / No All daily turbidity readings ≤ 5 NTU? Yes / No | Monthly Summary (Answer Yes or 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 #: _____ | |

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 95% of daily turbidity readings ≤ 1 NTU? Yes / No All daily turbidity readings ≤ 5 NTU? Yes / No | Monthly Summary (Answer Yes or 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 #: _____ | |

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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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

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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)

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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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Exercise #6 – Example 1

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



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In Summary:

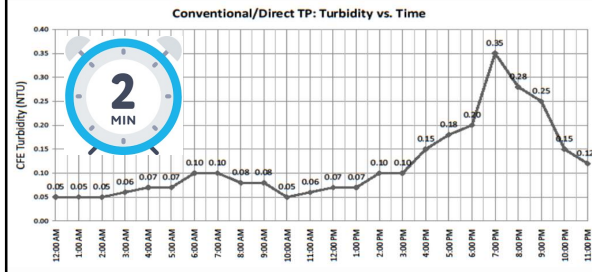
- In order to verify adequate disinfection is taking place, we need to calculate CT achieved (CT_{actual})
- EPA reviewed many disinfection studies in order to create CT Tables that specify minimum CT requirements needed to achieve specific log reduction levels for *Giardia* ($CT_{required}$)
- CT_{actual}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



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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? _____



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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



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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: | | WTP:- | | Month/Year: | | | ID #: |
| 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 < 1 FE 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



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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: _____ WTP: _____ Month/Year: _____ Log Requirement (Cyclic Disinfection): _____ ID #: _____

| Date / Time | Minimum CL Residual at Filter (C) | Contact Time (T) | Actual CT | Temp | pH | Required CT | CT Met? | Peak Hourly Demand Flow |
|-------------|-----------------------------------|------------------|-----------|------------------------|-----|-------------|----------|-------------------------|
| | (ppm or mg/L) | (minutes) | C x T | ($^{\circ}\text{C}$) | | | 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 - 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
 $(6 \text{ readings/day} \times 31 \text{ days} = 186 \text{ readings total. } 5\% \times 186 = 9.3)$
- 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 < 1 FE 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

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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



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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



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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? **Yes this is a problem - flow cannot exceed 10% of tracer study flow. $10\% \times 1750 \text{ gpm} = 175 \text{ gpm}$. $1750 + 175 = 1925 \text{ gpm}$. Therefore flow cannot be $> 1925 \text{ gpm}$ 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

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Exercise #6 – Example 2

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



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Example #2: Slow sand filter plant - Turbidity

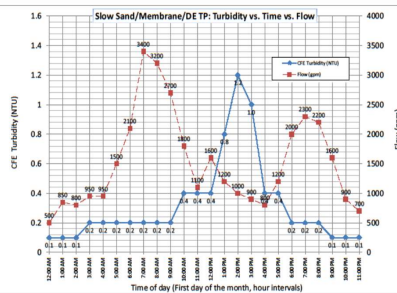
- Let's say your plant runs everyday and you have turbidity readings filled in once a day for all 31 days of the month. How many readings could you have that were > 1 NTU and still meet the requirement of 95% of readings being ≤ 1 NTU?
- What should you do if you answer "no" to the turbidity question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



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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?



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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? **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?
 - Call the state
 - Issue a boil water notice
 - Issue a public notice within 30 days
 - Both a & c



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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 ID #: _____

| DAY | 12 AM (NTU) | 4 AM (NTU) | 8 AM (NTU) | NOON (NTU) | 4 PM (NTU) | 8 PM (NTU) | Highest Reading of the Day (NTU) |
|-----|-------------|------------|------------|------------|------------|------------|----------------------------------|
| 1 | | | 0.2 | | | | 1.2 |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |



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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?



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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: _____ WTP: _____ Month/Year: _____ Log Requirement (Depth/Dose): 5.1/1.8 ID #: _____

| Date / Time | Minimum Cl ₂ Residual at End User (C) | Contact Time (T) | Actual CT | Temp (°C) | pH | Required CT | CT Met? + | Peak Hourly Demand Flow (GPM) |
|-------------|--|------------------|-----------|-----------|-----|-------------|-----------|-------------------------------|
| 1 / | 0.3 | 60 | 18 | 9 | 7.8 | 66 | No | 3300 |
| 2 / | | | | | | | | |
| 3 / | | | | | | | | |
| 4 / | | | | | | | | |
| 5 / | | | | | | | | |



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Example #2: Slow sand filter plant - Disinfection

- "CTs met at all times?" **a**
 - Call the state
 - Issue a boil water notice
 - Issue a public notice within 30 days
 - Both a & c
- "Residual at EP \geq 0.2 ppm at all times?" **a**
 - Call the state
 - Issue a boil water notice
 - Issue a public notice within 30 days
 - Both a & c



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Example #2: Slow sand filter plant - Disinfection

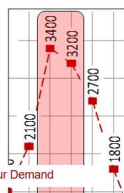
- How was peak hour demand calculated using only flow readings taken every hour?
- Tabulate the chart data and calculate a running hourly average using 2 consecutive flow readings for every hour.

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 |
| 9:00 AM | 2700 | 2950 |



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Emerging Issues



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

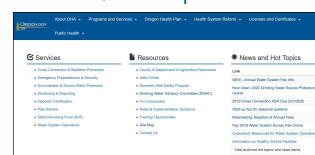


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Emerging Issues

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

News & "Hot Topics"



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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



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RESOURCES FOR OPERATORS



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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



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Tools & Resources

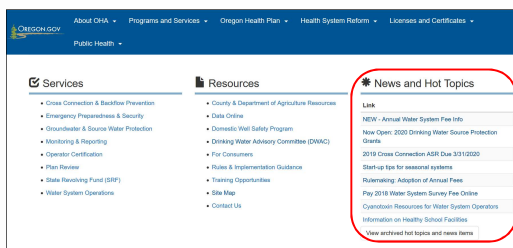
- For surface water systems:
www.healthoregon.org/dws
Click on “Water System Operations” on left-side menu list, then “Surface Water Treatment”
 - Monthly Surface Water Quality Report form template
 - Tracer Study form
- Surface Water Treatment Rule guidance manual, Appendix C: Determination of Disinfectant Contact Time



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www.healthoregon.org/dws

- News
- Hot Topics



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Tools & Resources (continued)

- EPA Rules
<http://water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm>
- AWWA <http://www.pnws-awwa.org/>
- OAWU <http://www.oawu.net/>
- Circuit Rider
<http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Operations/Pages/circuitrider.aspx>
- ORWARN <http://www.orwarn.org/>



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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. Each person on Earth requires at least 20 to 30 liters of clean, safe water a day for drinking, cooking and simply keeping themselves clean. Oregon Drinking Water Services works to help keep drinking water safe for Oregonians. Oregon Drinking Water Services (DWS) understands and promotes 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 encourages provision of information through source water protection, provides technical assistance to water systems and provides water system operator training.

[Introduction](#) [Data Search Options](#) [WS Name Look Up](#) [WS ID Look Up](#) [DWS Home](#)

Public Water Systems and Novel Coronavirus 2019 (COVID-19) Frequently Asked Questions - Updated March 22, 2020

Services

- Cross Connection & Backflow Prevention
- Emergency Preparedness & Security
- Groundwater & Source Water Protection
- Monitoring & Reporting
- Operator Certification
- Plan Review
- State Revolving Fund (SRF)
- Water System Operations

Resources

- County & Department of Agriculture Resources
- Data Online
- Domestic Well Safety Program
- Drinking Water Advisory Committee (DWAC)
- Public Notice Resources
- Training Opportunities
- Site Maps
- Contacts

News and Hot Topics

- NRJ - Annual Water System Fee Info
- New Open 2020 Drinking Water Source Protection Grants
- 2019 Cross Connection Audit Due 10/1/2020
- Don't forget to renew your system
- Reimbursement of Annual Fees
- Pay 2018 Water System Survey Fee Online
- Construction Resources for Water System Operators
- Information on Healthy School Facilities
- View archived hot topics and news items

Information By Subject

"Data Online" (data specific to each water system)

Contact Us

News and Hot Topics

Health Authority

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Find Your Water System

WS Name Look Up

Oregon Public Health
Drinking Water Data Online

Introduction :: Data Search Options :: **WS Name Look Up** :: WS ID Look Up :: DWS Home

Welcome to SDWIS Data Online

Water System Name Search

Type in a part of the water system's name (like how to find the City of Bead or Broadhead Post Office, or how to find USFS Blackhorse Campground) below.

Notes:
Names or parts of names that include & or ' may not be easily found. So, in those cases, enter the whole name or a part of the name that doesn't include & or '
The word 'and' should be entered as 'and'.

- Select WS Name Look Up
- Enter water system name (e.g., "Salem")
- Click Submit Query

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

Health Authority

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Information By Subject

Services

- Cross Connection & Backflow Prevention
- Emergency Preparedness & Security
- Groundwater & Source Water Protection
- Monitoring & Reporting
- Operator Certification
- Plan Review
- State Revolving Fund (SRF)
- Water System Operations

Resources

- County & Department of Agriculture Resources
- Data Online
- Domestic Well Safety Program
- Drinking Water Advisory Committee (DWAC)
- Public Notice Resources
- Training Opportunities
- Site Maps
- Contacts

9. Water System Operations

- Surface Water Treatment**
- Public Notice Resources
- Fact Sheets & Best Practices
- Outstanding Performance
- Circuit Rider Program
- Pipeline Newsletter

Health Authority

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Select Your Water System

Select the Water System by Clicking on the PWS ID#

Oregon Public Health
Drinking Water Data Online

Introduction :: Data Search Options :: WS Name Look Up :: **WS ID Look Up** :: DWS Home

Click on the PWS ID number of your water system to begin the search for information

| PWS ID # 41.... | Water System |
|-----------------|----------------------------------|
| 05564 | BPA-SALEM SUBSTATION |
| 00779 | SALEM MOBILE ESTATES SHADY ACRES |
| 00731 | SALEM PUBLIC WORKS |
| 00768 | SUBURBAN EAST SALEM WD |

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

Health Authority

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Drinking Water Data Online

<https://yourwater.oregon.gov/>

Many Data search options are available

Oregon Public Health
Drinking Water Data Online

Introduction :: Data Search Options :: **WS Name Look Up** :: WS ID Look Up :: DWS Home

Welcome to Data Online. Oregon's Drinking Water Program data access site. See below for various data search options that are available to you.

[Inventory List](#) of all Oregon drinking water systems in Excel or printable screen format

Information by county

[Inventory](#) [Surface Water Systems](#) [Water System Services](#) [Outstanding Performance](#) [Plan Review](#) [System Surveys](#)

[Alerts](#) [Violations](#) [Open Enforcement](#) [Significant Deficiencies](#) [Cross-Connection Audit](#) [Treatment Plant Inspections](#)

Information by water system

[Drinking Water Data Access / FAQ / Glossary](#)

[Find a Water System ID number](#) when you know the system's name or part of the name.

[Basic system information](#) including population, contact person's name and phone number, county served, number of connections, sources of water used, and Consumer Confidence Reports.

[Detailed System Results](#) that include data sample was collected, sample type, results, and more. This is limited to samples collected after July 1, 1997.

[Summary of system sampling](#) since July 1995. This includes the period (month or quarter), number of routines reported, number of positive routines, number of repeats, number of positive repeats, and more.

[Chemical Test Summary](#) will show when each of the major groups of chemical testing was completed. It's arranged by group (OC, NO3, Rad, DOC, VOC) and then by date from most recent to oldest. Actual chemical results are not yet on line.

[Chemical Detection](#) will show you all the detections of chemical contaminants that is over the trigger level (1/2 the MCL for inorganic, any detected value for synthetic and volatile organic groups). The MCL is listed for that chemical for comparison. If there is no MCL listed, then no maximum

Info by County

Info by Water System

Health Authority

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Oregon Public Health
Drinking Water Data Online

Introduction :: Data Search Options :: WS Name Look Up :: WS ID Look Up :: DWS Home :: Quick Data Links

0061 00731 SALEM PUBLIC WORKS Classification: COMMUNITY

Contact: SOPHIA HOBET
1410 20TH ST SE BLDG 2
SALEM, OR 97302
Population: 109,000
Operating Period: January 1 to December 31
Certified Operator(s): Required: Y
Distribution class: 4
Treatment class: 3
Filtration/Encasement Required: No

Phone: 503-588-6483
County: MARION
Activity Status: ACTIVE - History
Number of Connections: 51,112
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: Aug 23, 2011

Sources

| Facility ID | Facility Name - Well Logs | Activity Status | Availability | Source Type |
|-------------|--------------------------------|-----------------|--------------|-------------|
| EP-A | EP FOR GEREN ISLAND WTP | A | Seasonal | SW |
| SRC-AA | NORTH SANTANA RIVER | A | Permanent | SW |
| SRC-AB | GEREN ISLAND EAST WELL - 17583 | A | Seasonal | GU |
| SRC-AC | GEREN ISLAND WEST WELL - 17583 | A | Seasonal | GU |
| SRC-AD | RIFLITATION GALLERY | A | Seasonal | GU |
| EP-B | EP FOR ASR WELLS | A | Seasonal | GW |
| SRC-BA | ASR WELL #1 - MAR19824 | A | Seasonal | GW |
| SRC-BB | ASR WELL #2 - MAR16075 | A | Seasonal | GW |
| SRC-BC | ASR WELL #4 - 110522 | A | Seasonal | GW |
| SRC-BD | ASR WELL #5 - 110542 | A | Seasonal | GW |
| EP-C | EP FOR HEMLOCK WELL | I | Emergency | GW |
| SRC-CA | HEMLOCK WELL - L26200 | I | Emergency | GW |

Treatment

| State ID | Facility Name | Treatment Process | Treatment Objective | Filter Type |
|----------|---------------------|------------------------|---------------------|-------------|
| WTP-A | TP FOR GEREN ISLAND | FILTRATION, R/O, BARD | PARTICULATE REMOVAL | SS |
| WTP-A | TP FOR GEREN ISLAND | FLUORIDATION | OTHER | SS |
| WTP-A | TP FOR GEREN ISLAND | PHALAX AD-8204 ADH | CORROSION CONTROL | SS |
| WTP-A | TP FOR GEREN ISLAND | HYPOCHLORINATION, POST | DISINFECTION | SS |

General Information

Sources

Treatment

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Drinking Water Data Online

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

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 : LTZ : Cyanotoxins

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

Consumer Confidence Report (CCR)

| Per Year | Date Received | Date Certified |
|----------|---------------|----------------|
| 2019 | Due 7/15/2020 | |
| 2018 | May 24, 2019 | May 24, 2019 |
| 2017 | Jun 28, 2018 | Jun 28, 2018 |
| 2016 | Jun 12, 2017 | Jun 12, 2017 |
| 2015 | Jun 21, 2016 | Jun 21, 2016 |

Cross Connection Prevention Information (Last 3 Records)

| Enabling Authority Received | Annual Summary Report Received | Fee Invoice Paid |
|-----------------------------|--------------------------------|------------------|
| Yes (PDF) | 2019 (PDF) | 2020 |
| | 2018 (PDF) | 2019 |
| | 2017 | 2018 |

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

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 : LTZ : Cyanotoxins

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

<= Many Other Options

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Treatment

Treatment Process

| State ID | Facility Name | Treatment Process | Treatment Objective | Filter Type |
|----------|---------------------|-----------------------|---------------------|-------------|
| WTP-A | TP FOR GEREN ISLAND | FILTRATION SLOW SAND | PARTICULATE REMOVAL | SS |
| WTP-A | TP FOR GEREN ISLAND | FLUORIDATION | OTHER | SS |
| WTP-A | TP FOR GEREN ISLAND | PHALKA ADJ-SODA ASH | CORROSION CONTROL | SS |
| WTP-A | TP FOR GEREN ISLAND | HYPOCHLORINATION POST | DISINFECTION | SS |

Filter Type:

- SS = Slow Sand
- CT = Cartridge
- BG = Bag
- CF = Conventional Filtration
- DF = Direct Filtration
- MF = Membrane Filtration
- UF = Unfiltered

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General Information

System Classification

OR41 00731 SALEM PUBLIC WORKS Classification: COMMUNITY

Contact: SOPHIA HOBET
1410 20TH ST SE BLDG 2
SALEM, OR 97302

Population: 189,000

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

County: MARION

Activity Status: ACTIVE - History

Number of Connections: 51,112

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: Aug 23, 2011

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

View a list of Certified Operators

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Sampling Schedules

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

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 : LTZ : Cyanotoxins

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

Sampling Schedules:

- Sampling Schedule for Coliform
 - Includes repeat schedules
- Chemical Schedule Summary
 - Required chemical sampling
- Chemical Schedule Details - progress report on chemical sampling

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Sources

Well Log Query Results

Well Tag Nbr: 75842

| Well Log | T-R-S/ Q-Q-Q | Street |
|------------|--------------|--------|
| MARI_58138 | | |

Facility ID Facility Name - Well Logs

| | |
|--------|---------------------------------|
| EPA | 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 |

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

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Sampling Data

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

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 : LTZ : Cyanotoxins

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

- Coliform Summary (by month)
- Coliform Results (by sample, results before 2002)
- Chemical Group Summary (VOC, SOC)
- Latest Chemical Results (individual contaminants)
- Latest Chemical Results (sorted by date)
- Entry Point Detects (detections only)
- Single Analyte Results (individual contaminants)
- Lead & Copper & Corrosion Control (L&C, pH, etc.)
- Nitrates, Arsenic, Radionuclides, DBPs, TOC & Alkalinity
- Turbidity (maximum daily turbidity)
- SWTR (results from the bottom of the monthly SW report)
- RAA & LRAA (DBP running annual average results)

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Alerts, Contacts, Advisories & Site Visits

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

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

Chemical Schedule Summary : Chemical Schedule Details

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

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

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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Plan Review Information

System Info : Report for Lenders : Alerts : Violations : Enforcements : Contacts : Site Visits : Public Notice : Plan Review

Coliform Summary : Coliform Results : Coliform Results before 2002 : Sampling Schedule for Coliform

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

Chemical Schedule Summary : Chemical Schedule Details

Lead & Copper : Corrosion Control (CCR) : Nitrate : Arsenic : Radionuclides

DBPs : TOC & Alkalinity : DBP/TOC/Bromate/Chlorine Monitoring : FANLs : MRDL : Turbidity : SWTR : RAA

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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Violations, Enforcements & Public Notices

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

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

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System Info & Report For Lenders

System Info : Report for Lenders : Alerts : Violations : Enforcements : Contacts : Site Visits : Public Notice : Plan Review

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Chemical Schedule Summary : Chemical Schedule Details

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DBPs : TOC & Alkalinity : DBP/TOC/Bromate/Chlorine Monitoring : FANLs : MRDL : Turbidity : SWTR : RAA

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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Violations, Enforcements & Public Notices

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

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

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

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Information Available Online

www.healthoregon.org/dws/
<https://yourwater.oregon.gov/>

System Info : Report for Lenders : Alerts : Violations : Enforcements : Contacts : Site Visits : Public Notice : Plan Review

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

Chemical Schedule Summary : Chemical Schedule Details

Lead & Copper : Corrosion Control (CCR) : Nitrate : Arsenic : Radionuclides

DBPs : TOC & Alkalinity : DBP/TOC/Bromate/Chlorine Monitoring : FANLs : MRDL : Turbidity : SWTR : RAA

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End of Part 2

- 0.3 CEU certificates for Part 2 will be e-mailed to you soon.
- If you missed Part 1, you can receive an additional 0.3 CEU certificate.
- Register for Part 1 under "Free Training Resources" at www.healthoregon.org/swt



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QUESTIONS?

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



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Thank you!

- Please remember to provide your feedback today.



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