Manitoba

Sustainable Development

Revised: March 27, 2018

Office of Drinking Water
Checklist Assessments: Appendix
Calculations for Hydraulic Retention Time and Effective Contact Time

Conversions:		
1 litre = 0.22 imperial gallons	1 litre = 0.264 US gallons	1 litre = 0.001 m^3
1 imperial gallon = 4.546 litres	1 US gallon = 3.785 litres	1 cubic metre (m^3) = 1,000 litres

Peak hourly flow should be based on meter data. If there is no meter data:
peak day / 24 hours = average hour on peak day
Peak Hour Factor (PHF) = 4.0
average hour on peak day x Peak Hour Factor (PHF) = peak hourly flow

hydraulic retention time = storage tank volume / (peak hourly flow)

Part 1: Calculations for Hydraulic Retention Time – Atmospheric Tanks

Example 1 (metric with low float level at 50%):

- peak hourly flow = 45 L/min
- 1,000 US gallons tank
- 1,000 US gallons x 3.785 L/US gallon = 3,785 litres
- 3,785 L x 0.50 = 1,892.5 L
- 1,832.5 L divided 45 L/min = 42 minutes

Example 2 (metric with low float level at 70%):

- Same process as above but x 0.70

Example 3 (US gallons with low float level at 50%):

- peak hourly flow = 15 USGPM
- 1,000 US gallons tank
- 1,000 US gallons x 0.50 = 500 US gallons
- 500 US gallons divided 15 USGM = 33 minutes

Note: hydraulic retention time is not the same as effective contact time. To determine effective contact time, short-circuiting in the tank(s) must be considered using a baffle factor (BF).

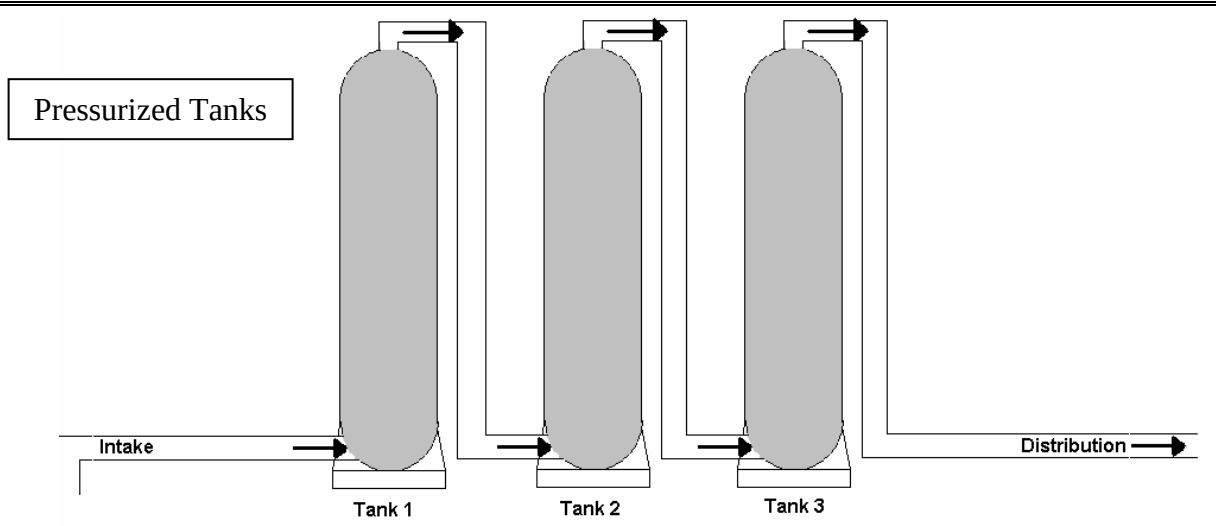
Part 2: Calculations for Hydraulic Retention Time – Pressurized Tanks

Pressurized (pressure) tanks would follow the same process except the operating tank volume is NOT reduced by a percentage (%) full because the pressure keeps it full all the time during operation.

Part 3: Calculations for Effective Contact Time, with Baffle Factor
Pressurized Tanks, Atmospheric Tanks, and Multiple Tanks in Series

Baffle factors can be found from the Office of Drinking Water (ODW) document titled:
"Filtration and Disinfection Log Reduction Credits" – Table 1: Baffling Factors for Water Storage Systems

A single tank is only eligible for a baffle factor (BF) of 0.1. Two tanks in series has a BF = 0.2, and three tanks in series has a BF = 0.3, etc. The maximum for un-baffled tanks in series is BF = 0.5



 # minutes of effective contact time = (total storage x baffle factor (BF)) / peak hourly flow
OR
total storage required = peak hourly flow x 20 minutes / baffle factor (BF)

TO FIND EFFECTIVE CONTACT TIME:

Example 4 (3 pressurized tanks in series with baffle factor (BF) = 0.3):

- peak hourly flow = 45 L/min
- 360 US gallons tanks (total)
- 360 US gallons x 3.785 L/US gallon = 1,362.6 L
- 1,362.6 L x BF = 408.8 L total effective volume
- 408.8 L divided 45 L/min = 9 minutes effective contact time

TO FIND VOLUME OF STORAGE REQUIRED
TO MEET 20 MINUTES EFFECTIVE CONTACT TIME:

Example 5:

- peak hourly flow = 45 L/min
- 20 minutes effective contact time
- (45 L/min x 20 minutes effective contact time) / baffle factor (BF) =
- assuming BF = 0.3
- 3,000 L volume of storage required
- Therefore, 3 tanks each 1,000 L would be required.

 # minutes of effective contact time = (total storage x <u>% full</u> x baffle factor (BF)) / peak hourly flow
OR
total storage required = peak hourly flow x 20 minutes / baffle factor (BF)

Atmospheric tanks in series would use the same method as above except the percentage (%) full of each storage tank would have to be applied.