

July, 2023

Product: Activated Carbon

1. Empty Bed Contact Time (EBCT)

Activated Carbon will reduce or remove many contaminants. Successful removal depends on proper application and equipment sizing.

Empty Bed Contact Time is determined by the contaminant. Some contaminants require longer contact time with carbon to safely reduce or remove these contaminants.

- **To ensure a successful outcome calculate the correct EBCT prior to installation.**
- Some applications such as, PFC's, require multiple tank configurations, known as lead-lag, worker- polisher, or worker-guard.
- A sample point is placed between the tanks for periodic testing of contaminant breakthrough.
- A totalizing water meter is also recommended after critical application carbon tanks to monitor carbon life

Empty Bed Contact Time is equal to the volume of the empty bed divided by the flow rate. It is a measure of the time water is in contact with activated carbon, assuming all water passes through at the same velocity.

$$\text{Empty Bed Contact Time in Minutes} = \frac{\text{Bed Volume (ft}^3\text{)} \times 7.48 \text{ Gallons /ft}^3}{\text{Flow Rate (gpm)}}$$

$$\text{Bed Volume} = \text{Tank Area (sq.ft.)} \times \text{Depth (ft.)}$$

$$\text{Bed Volume} = \frac{\text{Contact Time} \times \text{Flow Rate (gpm)}}{7.48 \text{ gal/ft}^3}$$

Link to EBCT Calculator

Link to [EBCT - Fiberglass Tanks 2 Min](#)

Link to [EBCT - Fiberglass Tanks 4 Min](#)

Link to [EBCT - Fiberglass Tanks 7 Min](#)

Link to [EBCT - Fiberglass Tanks 10 Min](#)

Common Activated Carbon Applications and Their Empty Bed Contact Times

1. Chlorine Removal*

All carbon reduces chlorine. Chlorine is not adsorbed – it is a catalytic reduction reaction. The reaction is very fast. The best carbon for Dechlorination is dense (pounds per cubic foot). The most common size is 12x40 mesh.

<https://www.cdc.gov/healthywater/drinking/public/chlorine-disinfection.html>

Empty Bed Contact Time for Chlorine Removal = 2 Minutes

2. Chloramine Removal*

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Chloramine is chlorine mixed with ammonia and an alternate to disinfection with chlorine. Many municipalities have used chloramine for decades. It is becoming more prevalent however because there are fewer disinfection by products (DBP) associated with its use vs. chlorine. Chloramine can be removed by all types of activated carbon. The rate of the catalytic reduction reaction is much slower. When applying, it requires the use of more GAC and careful monitoring for breakthrough.

We recommend the use of catalytic carbons (Calgon Centaur, Haycarb WAC-1000, Jacobi CX-MCA) which decompose chloramines faster than standard carbon.

[WAC-1000 Spec Sheet](#)

[Centaur Spec Sheet](#)

<https://www.cdc.gov/healthywater/drinking/public/chloramine-disinfection.html>

Empty Bed Contact Time for Chloramine Removal Standard Carbon at least 10 minutes

Empty Bed Contact Time for Chloramine Removal Catalytic Carbon at least 4 minutes

***For Kidney Dialysis applications AAMI standards apply. Advise Urbans Aqua or your water professional when purchasing carbon for Kidney Dialysis.**

3. Disinfection by Products – Trihalomethane, Halogens

Both chlorine and chloramine react with naturally occurring organic matter. This reaction may cause the formation of Trihalomethane (THM). THM is a regulated contaminant. Coconut type carbons are commonly used to reduce trihalomethane.

Empty Bed Contact Time for Disinfection-by-Products Removal Standard Carbon at least 7 minutes

4. Organics **

Organic matter in water comes from decaying plant life and may be referred to as tannins or lignin's. The levels of organics may vary by season. Municipalities use several removal methods including flocculation and powdered activated carbon. For point of entry, households, or point of use, faucets, activated carbon filters can pick up residual municipal water type organics.

Well water which is influenced by surface water often has organics. While activated carbon is a possible solution, it is most often used as post treatment to other treatment methods i.e. hyper-chlorination, anion resin (Tanex), or Ecomix, a specialty media. These alternative treatments are noted elsewhere on this website.

5. PFC – Perfluorinated Compounds: PFOA & PFOS **

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An EPA health advisory calls for a combined limit of no more than 4 ppt (parts per trillion) of PFOA and PFOS in drinking water. These contaminants are highly resistant to degradation and will accumulate in the body. Testing by Calgon Carbon indicated that coal based significantly outperforms coconut and is the best solution for PFC removal. Acid rinsed Filtrasorb 600 or Filtrasorb 400 are suggested for these applications.

Empty Bed Contact Time for PFC's is AT LEAST 10 minutes

[Calgon Guide PFC](#)

6. Pesticides

As of 2010 under the Safe Water Act MCL limits have been set for 79 contaminants including 24 pesticides, some of which are no longer in use. Adsorption of pesticides using Activated Carbon is a common removal method.

<https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/finalization-guidance-incorporation-water-treatment>

Empty Bed Contact Time – **Caution - Call Urbans Aqua with type and levels of exact pesticide.**

7. VOC- Volatile Organic Contaminants **

Volatile Organic Contaminants include a very broad category of chemicals. Some are naturally occurring in the environment, others are man-made. There are 23 regulated compounds with 8 considered carcinogens. Activated Carbon reduces and removes VOC's from water.

It's unlikely you will find high levels of VOC's in your municipally supplied tap water. If you are still concerned use of a carbon filter is recommended.

Ground water should be tested regularly by a certified laboratory. In the event the well is contaminated with VOC's contact Urbans Aqua or a water professional with the analysis to determine the best method of treatment.

Empty Bed Contact Time for VOC's is 7 minutes.

**** Multiple tank configurations known as lead-lag, worker-guard or worker-polisher are recommended. A sample point is placed between the tanks for periodic testing for contaminant breakthrough. A totalizing water meter is highly recommended after critical application carbon tanks to monitor carbon life. It is not necessary to use gravel under bedding in VOC treatment tanks. The gravel will utilize tank space needed for carbon.**

Additional Resources

- Table of Regulated Drinking Water Contaminants

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- <https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants>
- Table of Secondary Standards
 - <https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals>

Contaminant	EBCT	Suggested Carbon
Chlorine	2 minutes	Any type of GAC works.
Chloramine	10 minutes	Standard GAC
Chloramine	4 minutes	Catalytic
Disinfection-by-Products	7 minutes	Coconut Base
Organics		Post-treatment only
PFC Perfluorinated Compounds PFOA & PFOS	10 minutes	Coal Base
Pesticides	Call	
VOC Volatile Organic Contaminants	7 minutes	Coal or coconut shell based