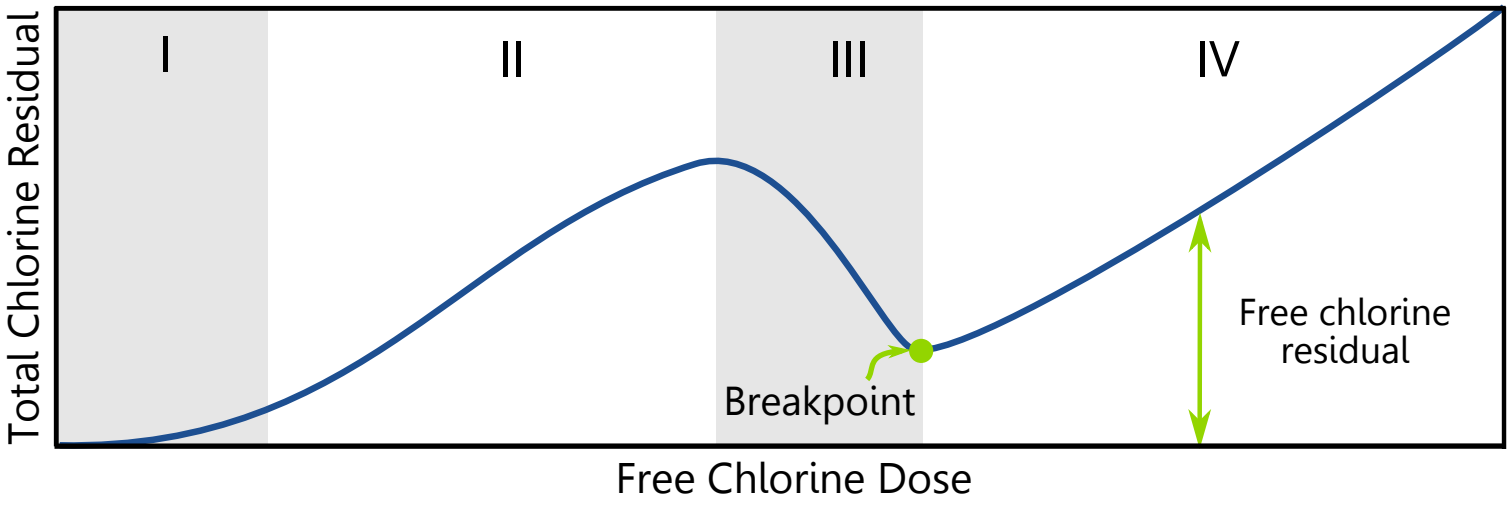
Understanding Breakpoint Chlorination

Breakpoint Chlorination – Important Definitions

•Breakpoint chlorination is important to understand for systems using chloramination, or in chlorination systems where ammonia might be present.
•**Free chlorine:** the sum of molecular chlorine (Cl_2), hypochlorous acid (HOCl), and hypochlorite ion (OCl^-) in a solution.
•**Chloramines:** a form of combined chlorine formed when an amine-containing molecule (e.g. ammonia) is added to free chlorine.
•**Total chlorine:** the sum of free and combined chlorine in a solution.



Zone I

•Most free chlorine added here is reduced by transition metals.
•Total chlorine residual increases minimally with added free chlorine.

Zone II

•As the dose is increased, free chlorine reacts with ammonia to form chloramines.
•Total chlorine residual increases as more free chlorine is dosed.

Zone III

•Total chlorine residual decreases as more chloramines form and leave solution.
•Eventually, the chlorine dose overcomes the oxidant demand, called the **breakpoint**.

Zone IV

•Once breakpoint is reached, total chlorine residual increases with added free chlorine.
•There is now a free chlorine residual for disinfection purposes.

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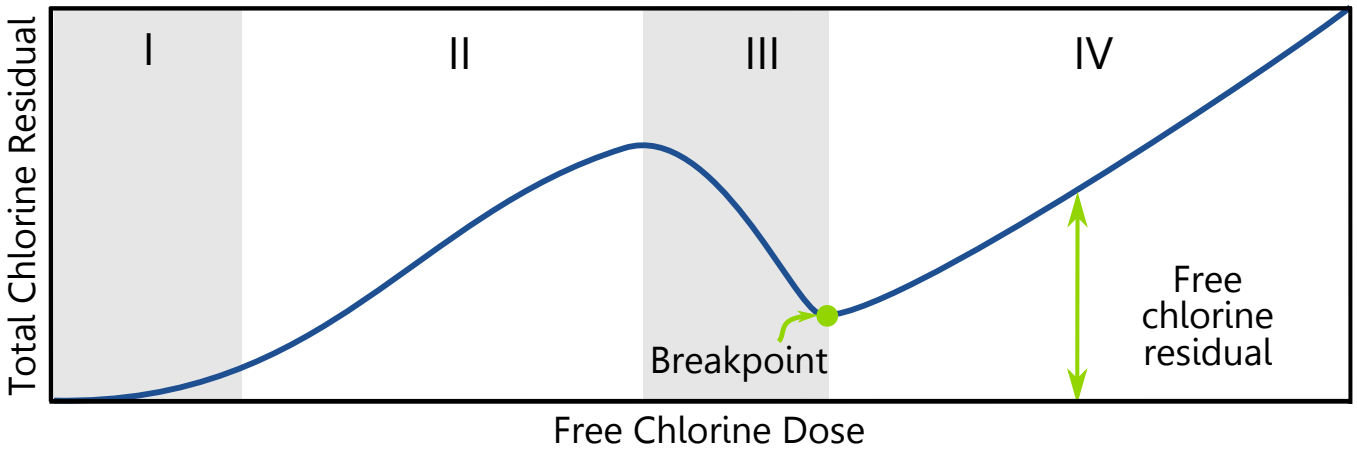

Zone	Reaction(s)	What Makes Up the Total Chlorine Residual?
I	$HOCl + M^{n+} \rightarrow Cl^- + M + OH^-$	HOCl
II	$HOCl + NH_3 \rightarrow NH_2Cl + H_2O$	$HOCl + NH_2Cl$
III	$NH_2Cl + HOCl \rightarrow NHCl_2 + H_2O$ $NHCl_2 + HOCl \rightarrow NCl_3 + H_2O$	$HOCl + NH_2Cl + NHCl_2 + NCl_3$
IV	–	HOCl

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- Want more help on this topic? Scan this QR code to learn more.

CHEM102: Introduction to Total Chlorine

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- More questions? Check out the Kuntze Support Center.

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