

# Bench-Scale Testing Plan

## EPA Ferrate Project

**Materials and Methods:** A set of 17 drinking water systems was selected with the intent of capturing a range of water quality types, treatment objectives and treatment technologies. Raw water is collected from each and treated in the laboratory for the purpose of assessing oxidant exposure (i.e., CT), carbon oxidation, organic and inorganic contaminant oxidation, DBP precursor oxidation, and impacts on subsequent removal by coagulation. All of these are determined as a function of ferrate dose and pH (Figure 1).

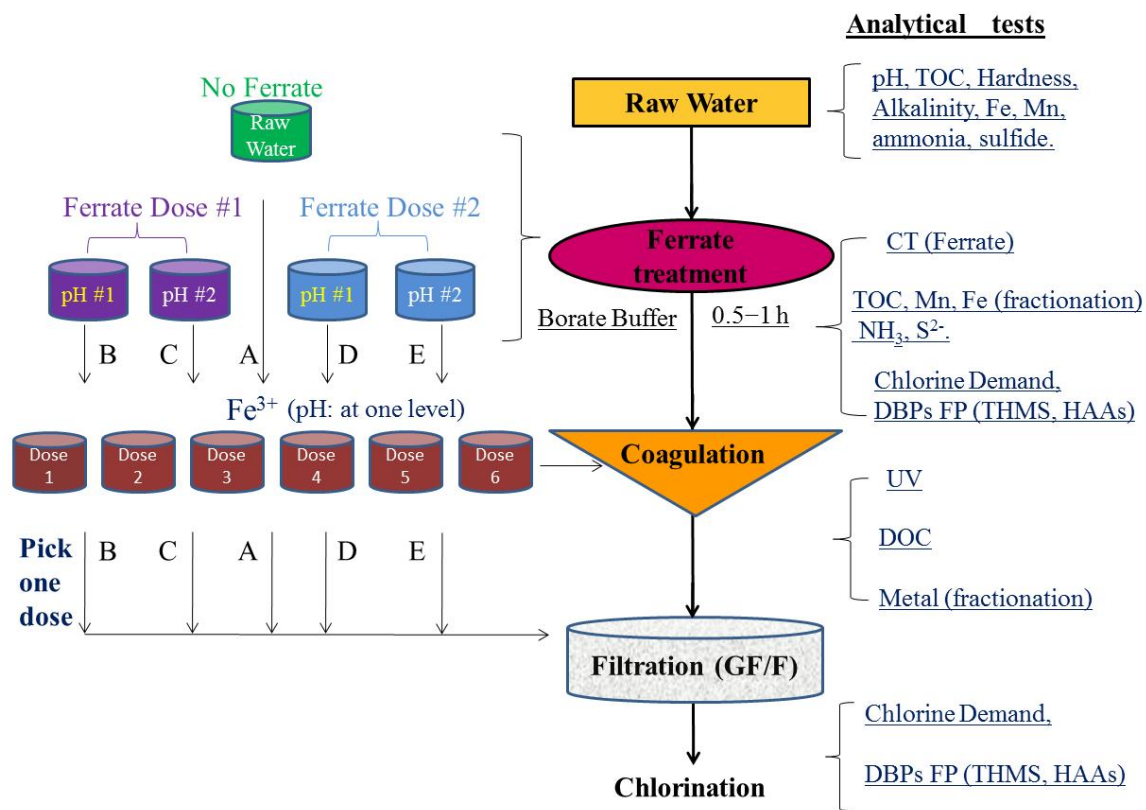


Figure 1. General Experimental Design for Laboratory Studies of Ferrate and Raw Waters

## Detailed Procedures

1. Measure water quality parameters and determine specific treatment goals:
  - pH;
  - TOC;
  - Hardness;
  - Alkalinity;

- Inorganic contaminants (e.g., Ammonia; Sulfide, Mn; Fe);
  - Chlorine demand, DBPs Formation Potential;
  - Trace organics.
2. Determine the effect of ferrate dose on treatment performance (Ferrate dose can affect the oxidation process of NOM and their subsequent adsorbability to ferric floc).
- Fractionation after treatment (GF/F, UF), measure the concentrations of TOC, Mn, Fe, etc., in different forms.
  - Determine the effect of ferrate dose on chlorine demand and the formation potential of DBPs (THMs; HAAs)
  - Determine the effect of ferrate dose on trace organics removal.
  - Is there a regular relationship between TOC, the expected treatment performance and the suitable ferrate dose?
3. Determine the effect of pH: (Ferrate reactivity is highly pH-dependent. At low pHs, ferrate is in the more reactive monoprotated form and has higher redox potential).
- Compare the treatment efficiency with and without buffer;
  - Determine the effect of pH on oxidation and coagulation. (Lower pH favors oxidation but higher pH favors coagulation?)