

# Bench-Scale Process Optimization

## Process Evaluation Laboratories

Carollo Engineers maintains process evaluation laboratories to support process evaluations, pre-design studies, and applied research activities. These facilities serve three main functions:

- ▼ Provide adequate laboratory space for conducting bench-scale studies and performing basic water quality analyses.
- ▼ House a small office and work station for data analysis and interpretation of results.
- ▼ Provide space for storage and maintenance of testing equipment and pilot plants.

The laboratories have a broad range of equipment to optimize a wide range of drinking water and wastewater treatment processes. Jar testing equipment is used to optimize the type and dose of chemicals added during conventional pretreatment, enhanced

*Carollo's process evaluation laboratories offer the following benefits:*

- ▼ Provide testing approaches that are customized to solve each specific problem.
- ▼ Offer rapid turn-around time on key water quality parameters to optimize processes.
- ▼ Provide a dedicated facility for cost-effective process evaluation and applied research studies.

coagulation/softening evaluations, and powdered activated carbon (PAC) studies. A continuous flow bench-scale ozone system is used to develop ozone demand and decay relationships, contaminant oxidation efficiency, optimization of taste and odor removal, and by-product formation. Rapid small-scale column tests are provided for

granular activated carbon (GAC) evaluations, and to develop design criteria for other sorptive media such as ion exchange resins. Carollo also maintains capabilities for natural organic matter characterization and molecular weight fractionation. Microbial inactivation studies and ultraviolet light (UV) dose-response relationships are developed using a UV collimated beam apparatus. Annular reactors are used to perform bench-scale distribution system evaluations, and to quantify regrowth potential and pipe corrosion.

Carollo maintains analytical instrumentation for those parameters that require a rapid turn-around time during process optimization studies. For



example, a total organic carbon analyzer is used to measure total and dissolved organic carbon concentrations in order to evaluate the effectiveness of enhanced coagulation, and to quantify disinfection by-product precursor removal. We also maintain spectrophotometers which operate in both visible and UV light. UV absorbance and transmittance scans are used to develop design criteria for UV disinfection systems and also to develop correlations with other water quality parameters.



Carollo conducts these process evaluations and analytical testing using equipment that is specifically designed to be portable. Therefore, studies can be conducted within our laboratory facilities or at a treatment plant, at a well pump house, or at a raw water source for on-site testing analysis and problem-solving.

*"Dedicated to creative, responsive, quality solutions for those we serve."*



## Process Evaluation and Testing Capabilities

Equipment	Testing Capabilities
Jar Testing Apparatus	Treatment optimization, enhanced coagulation and softening, PAC evaluation
Continuous Flow, Bench-Scale Ozone System	Ozone demand/decay relationships, contaminant oxidation, taste and odor removal, by-product formation, disinfection studies
Rapid Small-Scale Column Tests	GAC treatment optimization, sorptive media evaluation
Stirred Ultrafiltration Cell	Natural organic matter molecular weight fractionation
UV Collimated Beam	Microbial inactivation studies, dose-response relationships
Annular Reactor	Bench-scale distribution system evaluations, microbial regrowth and pipe corrosion testing

## Analytical Capabilities

Total organic carbon analyzer
UV/visible spectrophotometer
Amperometric titration (chlorine residual speciation)
Turbidity, pH, temperature, alkalinity, color
Colorimetric analyses (iron, manganese, chlorine residual, hardness)