CO$_2$ Injection Methods and Equipment for pH Control
What is CO$_2$?

How is it Made?

- Carbon Dioxide is a gas at normal atmospheric temperature and pressure. It is a colorless, odorless gas that is about 1.5 times more dense than air. It dissolves in water to form carbonic acid; H$_2$CO$_3$. Carbon dioxide gas is formed from the combination of two elements: carbon and oxygen.

- CO$_2$ is produced from the combustion of coal or hydrocarbons, the fermentation of alcohols, the production of anhydrous ammonia, by-product of other chemical processes, occur naturally in deep CO$_2$ wells and the breathing of humans and animals. Found in small proportions in the atmosphere, it is assimilated by plants which in turn produce oxygen.
Why Do We Adjust pH?

- Stabilize Water Chemistry.
- Corrosion Control.
- Discharge Wastewater (Permit).
- To reduce or prevent Carbonate Scaling.
- To enhance a chemical reaction or process
  - Polymers, Chlorine, Lime, Filtration, Contaminant removal
Carbon Dioxide pH Control Equipment

- CO₂ Storage
- Vaporizer
- Vapor Heater
- Pressure Regulator
- CO₂ / H₂CO₃ Feed Panel
- Diffuser
CO$_2$ Bulk Storage

- **E-Style Series**
  - 3.75 Tons – 120 Tons Capacity

- **C-Style Series**
  - 3.75 Tons – 60 Tons Capacity

- **V-Style Series**
  - 6 Tons – 75 Tons Capacity
CO$_2$ Vaporizers

Variety of Vaporizers

- Electric Pressure Build
  - 245 #/hr – 2150 #/hr
- Direct to Process
  - 375 #/hr – 2250 #/hr
- Steam
  - 500 #/hr – 18,000 #/hr
- Water
  - 500 #/hr – 20,000 #/hr


**CO₂ Vapor Heaters**

- **Electric**
  - 720 #/hr to 1440 #/hr (Wall)
  - 2000 to 6000 #/hr (Floor)

- **Steam**
  - 500 #/hr to 6,000 #/hr
General Tank Layout

E-STYLE TANKS

VERTICAL-STYLE TANKS

C-STYLE TANKS
CO₂ Feed Equipment

- CO₂ Gas Feed
  - 60% - 85% efficiency of the carbon dioxide
  - Needs deep contact or holding basins.
  - Able to reduce the pH to 7.0

- Carbonic Acid (PSF)
  - Minimum 95% efficiency of the carbon dioxide
  - Able to reduce the pH to 5.5 – 6.0
  - Can be injected in a pipe, basin, tank or shallow channel.
  - Eliminates the need for deep contact or holding basins.
CO$_2$ Gas Injection

- Gas (CO$_2$) + Liquid (water) reaction takes time
- Requires tremendous surface area (fine bubbles)
- Interference of other gases; i.e. air
- Requires mixer or baffles to hold the gas down in the water
- Lower efficiencies due to gas bubbles at the surface
TOMCO₂'s Pressurized Solution Feed System offers the state-of-the-art CO₂ injection system that provides a constant pH level. Patent #5,487,835 and 5,514,264
Carbonic Acid Injection (PSF)

- CO₂ pre-reacted to form Carbonic Acid
- Liquid / Liquid (Carbonic Acid / Water) Reaction
- Immediate reaction (Requires less time)
- Close to 100% efficiency
- Higher pressure improves CO₂ solubility
- More effective pH control
- Faster reaction time reduces scale potential.
CO₂ Diffusers

- **Gas Feed**
  - Uses fine porous diffuser to disperse the CO₂ into a deep basin.

- **Carbonic Acid**
  - Disperses Carbonic Acid into a water stream to form the chemical reaction desired. Designed to fit in any situation.
Carbonic Acid Diffuser

- Counter Current
- Cross Sectional Coverage
- Pressure
- Efficient Mixing
- Immediate Reaction
Other CO$_2$ Storage & Sources

- Dewars (Mini Bulk)
  - 400 # Liquid CO$_2$
- High Pressure Cylinders
  - Multiple Size Gas
- Stack Gas
  - Contains 10 % - 12 % CO$_2$
- Submerged Combustion Burners
  - Uses natural gas, butane, propane or digester gas to produce CO$_2$. 
Areas to Use CO$_2$

- Municipal Water Plants
  - Lime Softening
  - Enhanced Coagulation
  - Stripping – H2S
  - Corrosion Control
  - Membranes including RO
  - Disinfection – Sodium Hypochlorite
  - Filter Backwash
  - Bromate Reduction
  - Arsenic Removal
  - Waste Water
Other pH Control Methods

- Liquid CO₂ Feed Systems
- Gas Eductor / Vacuum Feeder
- Chlorinator / Solution Feeder
- Carbonated Water Feeder
- Mineral Acids
Manufacturer’s Qualifications

- Experience in CO₂ and Water Treatment Systems
- Number of systems installed
- Active member of CGA
- Engineering Capability
- Optimized pH control and CO₂ utilization
- Total System Responsibility
- ASME Pressure Vessel shop
- Service Capability
- Made in the USA @TOMCO₂
  – Loganville, GA
TOMCO₂ Systems
Water Technologies