

Calgon Carbon Corporation

Advanced Oxidation Technologies

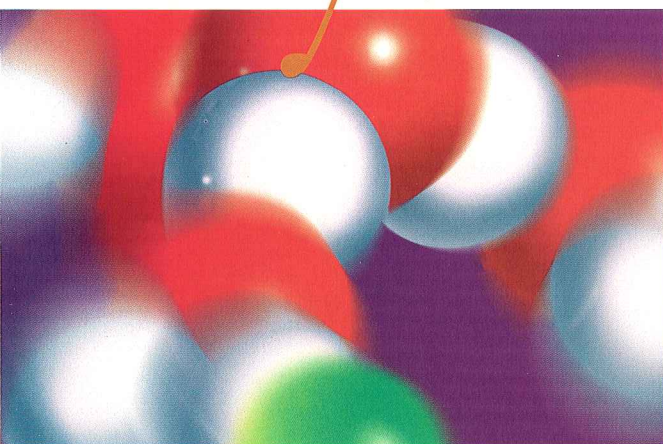


*Biological Treatment Not Doing the Job for You?
Disposal Difficulties? Need On-Site Destruction? Size Limitations?*

New Problem-Solving Technology Uses

Hydroxyl Radical

TECHNOLOGY

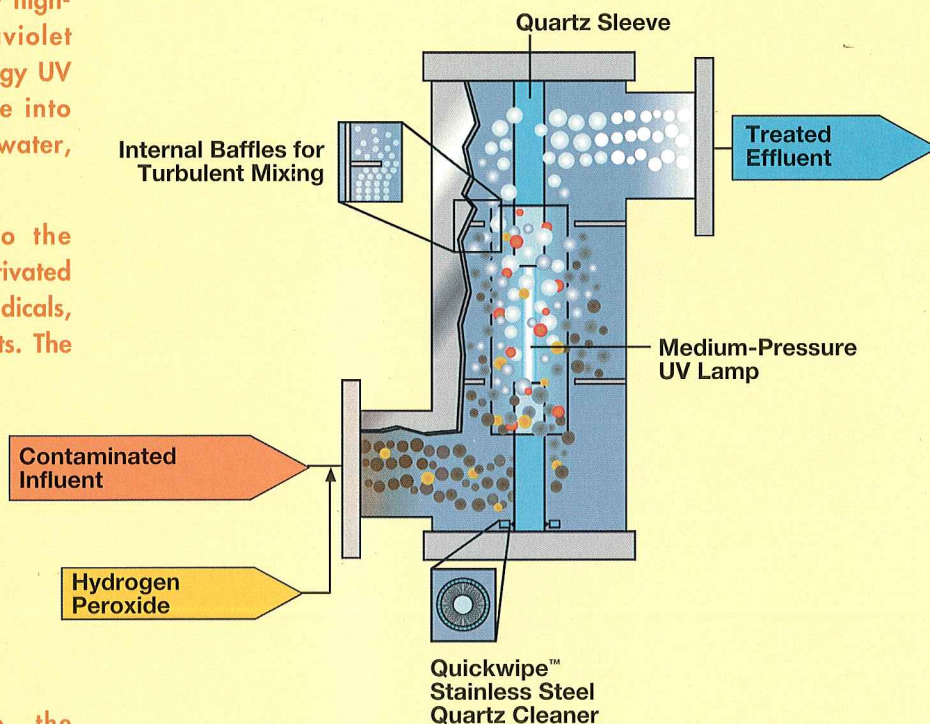


Need a better, faster and more cost-effective way to solve specific water treatment problems? Consider the advantages of Calgon Carbon Corporation's advanced oxidation technologies (AOT) based on hydroxyl radicals.

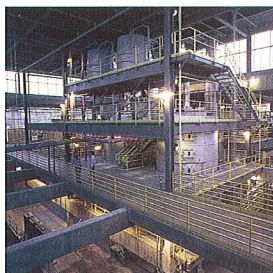
1. In the UV/H₂O₂ process, proprietary high-powered, medium-pressure ultraviolet lamps (up to 30 kW) emit high-energy UV radiation through a quartz sleeve into contaminated groundwater, wastewater, drinking water, or process water.

2. Hydrogen peroxide is added to the contaminated water and is then activated by the UV light to form hydroxyl radicals, which oxidize dissolved contaminants. The success of the process is based on the fact that the rate constants for the reaction of the •OH radicals with most organic pollutants are very high. Hydroxyl radicals typically react a million to a billion times faster than chemical oxidants such as ozone or hydrogen peroxide.

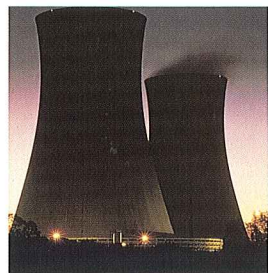
3. When the reaction is complete, the contaminants have been converted into water, carbon dioxide, and, if the contaminant was chlorinated, residual chloride.



When necessary, the addition of Calgon Carbon Corporation's patented photocatalysts can substantially reduce costs for highly contaminated waters.



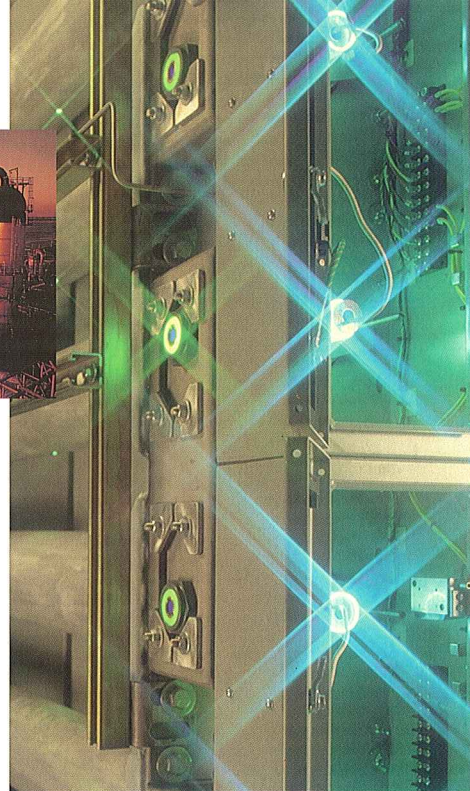
Drinking Water Plant



Power Plant



Chemical Processing Plant



ON-SITE TREATMENT

When on-site treatment is most practical, Calgon Carbon Corporation's advanced oxidation technologies offer advantages that begin with compact equipment and extend to compliance with POTW, surface water discharge standards, or drinking water standards.

Calgon Carbon Corporation's Rayox® Tower system (inset) and perox-pure™ 180 kW system (below) are easily located in compact spaces—indoors or outdoors.

Both systems require limited maintenance and are easily operated through remote controls.



EQUIPMENT

- ▶ The most powerful and efficient UV lamps in the industry
- ▶ The most reliable lamp wipers in the industry
- ▶ Skid-mounted units for transportability and ease of installation
- ▶ Fully automated controls
- ▶ Maintenance-free design with a track record of outstanding performance

LEADERSHIP

- ▶ Industry leadership in advanced oxidation technologies since 1986

SERVICE

- ▶ Full design, commissioning and maintenance capabilities
- ▶ Design tests and treatability studies performed in-house by Calgon Carbon Corporation



Calgon Carbon Corporation's AOT system is supported by industry-leading technical expertise.

THE CALGON CARBON CORPORATION DIFFERENCE



As a world leader in activated carbon and advanced oxidation technologies, Calgon Carbon Corporation has a proven reputation for providing better solutions for its customers' problems.

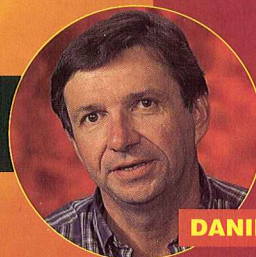
Calgon Carbon Corporation's research and development facilities in Pittsburgh and Toronto are staffed with nearly 80 R&D scientists and engineers, who have more than 100 degrees and almost 800 years of experience. The company draws upon its unmatched expertise and vast problem-solving capabilities to help customers every day.

Calgon Carbon Corporation's unique ability to be a partner, not just a vendor, is what distinguishes the company from its competitors. This distinction is what Calgon Carbon Corporation customers refer to as "the Calgon Carbon Corporation difference."

Advanced Oxidation Technologies

TRACK RECORD

Throughout the world, AOT has a proven track record of performance.



DANIEL J. TIERNEY

*... Principal Design Engineer,
EG&G Florida, Inc.*

"On-site destruction offers significant advantages."



IAN SOUTHEN

*... Special Projects Manager,
Forestry Corporation, New Zealand*

"The Calgon Carbon AOT system at our Waipa processing site has exceeded expectations. It has reduced our PCP levels by 99.95 percent."



FLORENCE REYNOLDS

*... Water Quality and Treatment
Administrator, Salt Lake City, Utah*

"We ultimately selected the Rayox® Tower System technology because it has several unique advantages that other treatment systems couldn't offer."

Calgon Carbon Corporation

Advanced Oxidation Technologies

FOR WATER TREATMENT

AHEAD OF THE FIELD

Today, no one in the field can offer the depth and breadth of knowledge and the worldwide applications track record of Calgon Carbon Corporation. To date, more than 250 advanced oxidation technology systems have been designed and installed by Calgon Carbon Corporation for:

Groundwater Remediation

Drinking Water Purification

Industrial Wastewater Treatment

Process Water

Ultrapure Water

ADVANTAGES

**ON-SITE DESTRUCTION
TREATMENT TECHNOLOGY**

**NO FORMATION OF
BROMATE ION IN BROMIDE
ION-BEARING WATERS**

**NONDETECTABLE LEVELS
ACHIEVED**

NO SECONDARY WASTES

NO OFF-GASES

**QUIET, COMPACT AND
UNOBTRUSIVE EQUIPMENT**

**LOW MAINTENANCE AND
OPERATING REQUIREMENTS**

**COST-EFFECTIVE FOR
A WIDE RANGE OF
CONTAMINANTS**

**INCREASES EFFLUENT
BIODEGRADEABILITY,
LOWERING CAPITAL AND
OPERATIONAL COSTS FOR
BIOLOGICAL TREATMENT**

**SINGLE-SOURCE
UV/OXIDATION AND
ACTIVATED CARBON COMBINE
TO EXPAND THE RANGE OF
EACH RESPECTIVE
TECHNOLOGY—RESULTING IN
REDUCED TREATMENT COSTS**

TYPICAL INSTALLATIONS/ APPLICATIONS:

HYDRAZINE,
N-NITROSODIMETHYLAMINE (NDMA)
Aerospace Company
Florida

METHYL ETHYL KETONE (MEK)
Aerospace Company
California

TRICHLOROETHYLENE (TCE)
Aircraft Parts Manufacturer
New Jersey

DICHLOROETHYLENE (DCE),
DICHLOROMETHANE (DCM), TCE
Army Base
California

1,4-DIOXANE, BENZENE
Chemical Manufacturer
North Carolina

CYANIDES
Chemical Manufacturer
Ohio

PHENOL
Chemical Manufacturer
Ontario, Canada

TETRACHLOROETHYLENE (PCE)
Dry Cleaning Operation
California

COD/BOD
Electronics Manufacturer
Puerto Rico

TNT
Explosives Manufacturer
Quebec, Canada

CHLOROTOLUENE,
VINYL CHLORIDE (VC)
Fabric Manufacturer
California

PCE
Municipal Drinking Water Plant
Salt Lake City, Utah

NDMA
Municipal Drinking Water Plant
Ontario, Canada

TOC
Nuclear Power Plant
Quebec, Canada

METHYL TERT-BUTYL
ETHER (MTBE)
Petrochemical Company
New York

BENZENE, TOLUENE,
ETHYLBENZENE, XYLENE (BTEX)
Petrochemical Company
Ontario, Canada

BTEX
Petroleum Terminal
New York

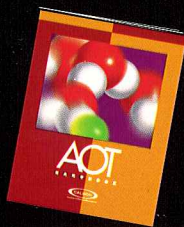
ISOPROPYL ALCOHOL (IPA),
ACETONE
Semiconductor Manufacturer
Texas

DCE, CHLOROBENZENE,
TCE, PCE, VC
Superfund Air Force Base
Texas

VC, DICHLOROETHANE (DCA),
TRICHLOROETHANE (TCA)
Superfund, Air Force Base
Texas

NITROGLYCERIN
US Navy
Maryland

PENTACHLOROPHENOL (PCP)
Wood Treater
Missouri



To receive the **AOT Handbook**
or other information,
please write to: P.O. Box 717,
Pittsburgh, PA 15230

Telephone: 800-422-7266 FAX: 412-787-6682

www.calgoncarbon.com



CALGON CARBON CORPORATION
A WORLD LEADER IN ACTIVATED CARBON AND ADVANCED OXIDATION TECHNOLOGIES



Recyclable
Paper

BF-015-09/98