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ACOS BROCHURE

COVER I
ACOS Advanced Chemical Oxidation Systems

HEADLINE: Clearly. The Choice Is ACOS.

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COVER II
ACOS Advanced Chemical Oxidation Systems

SUBHEAD: In the O_3 Zone

ACOS is *the safe, smart solution* to remediating hazardous and toxic organic contaminants in wastewater.

Unlike other wastewater treatment processes, the advanced chemical oxidation system of ACOS is exceedingly effective and, as a result, highly efficient and economical. It is a sub-critical application of hydroxyl radicals and ozone oxidation of organic contaminants in liquid and solid phases of wastewater.

ACOS technology operates in a small footprint upstream, downstream, or anywhere along the waste treatment system making it an ideal solution for destroying and declassifying some of the most hazardous and toxic organic contaminants in wastewater. What's more, its patented, proprietary technology significantly minimizes, or in most applications, eliminates environmental risks and liabilities altogether.

As a Class I-Division I wastewater management and treatment technology, ACOS offers the highest quality process technology, meeting the highest specifications, with maximum cost-effectiveness well beyond other technologies, processes, and commercial disposal.

ACOS process technology produces hydroxyl radicals for treating wastewater in a precisely designed, precisely controlled environment comprised of one or more packed bed, plug flow, vertical reactors with process parameters perfectly and safely regulating the pressure, temperature, pH conditions, and concentration levels of contaminants in wastewater.

Because hydroxyl radicals are short-lived, about a millisecond of lifespan, ACOS designs its packed bed, plug flow, vertical reactors to extend the lifespan of hydroxyl radicals making them exceedingly more effective in generating higher levels of oxidation to maximize the overall rate of ozone mass transfer. With the combined factors of increased mass transfer and increased reaction rates, ACOS provides an exceedingly efficient treatment process for destruction of up to 99+% of contaminants as well as a faster oxidation duration, in contrast to other technologies, by as much as 60% by using a sequence of multiple reactors.

The result: hazardous and toxic contaminants in wastewater are destroyed rapidly, efficiently, and cost-effectively.

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SUBHEAD: The ACOS Advantage

Unlike any other processes, ACOS process technology offers four key advantages:

1. **ACOS Is Safe**

   ACOS technology does not require high operating pressures or high temperatures. And unlike other alternative technologies, ACOS is not a *partial-destruction solution* requiring additional forms of treatment, incineration, or disposal. ACOS is a *total solution* for wastewater treatment degrading hazardous and toxic contaminants to below 1 mg/L in wastewater. ACOS technology is ideal for the destruction of organic contaminants up to and exceeding about 3000 mg /L.

2. **ACOS Is Economical**

   ACOS technology is exceptionally cost-effective. Wastewater treatment costs can vary greatly depending on the type of contaminants and their concentration levels in the waste stream. Treatment costs vary also depending on operating and processing expenditures, equipment costs, and other expenses like off-site processing, hauling, and storage.

   Reagent costs, operating costs, and capital equipment costs are substantially less with ACOS relative to other processes, technologies, and commercial disposal. Total treatment costs for ACOS technology are clearly case-specific and yet, as a point of economic reference, they are about $1.75 per gallon at 10 gallons a minute, for a faster, more efficient destruction of up to 99+% of contaminants. For a more information, please refer to ACOS Economics Sheet.

3. ACOS Is Compact

   ACOS technology features a small footprint. Because contaminants and treatment requirements dictate best solutions, ACOS designs systems to meet the unique, individual needs of our customers. Unlike other processes and technologies, ACOS is not a cookie-cutter or a one-size-fits-all solution.

   ACOS solutions are smart solutions with each module and reactor designed to meet or exceed specific waste stream challenges. The modular design and arrangement of ACOS vertical reactors contribute to a very elegant and effective use of space allowing custom configurations along the waste treatment system to target contaminants where they are most concentrated. ACOS technology occupies substantially less space than other alternative technologies.

4. ACOS Is Reliable

   ACOS significantly reduces or eliminates environmental risks, liabilities, and regulatory enforcement. Minimizing and eliminating liability is absolutely critical. ACOS decreases the risks and hazards associated with treating wastewater and generating waste residual. Moreover, ACOS decreases the need for waste storage and hauling, off-site processing, and deep-well injection.

   ACOS technology is reliable; it transforms waste fluid into water that can be reclaimed, recycled (reprocessed), and reused without creating additional waste streams; ACOS treated water can be used for secondary purposes or further treated as needed. Complying with all EPA regulations for air emissions and liquid contaminant limits, ACOS technology effectively treats the off gas for safe emissions also.

SIDEBAR

What Makes ACOS So Unique?

ACOS is transformational technology; it changes the way we manage and treat hazardous and toxic contaminants in wastewater. ACOS patented, revolutionary process technology provides exceedingly efficient oxidation through its highly effective use of ozone and hydrogen peroxide and its simultaneous application of segregated waste fluid and ozone into a precisely designed and precisely controlled environment. ACOS provides a proven treatment process for the destruction of up to 99+% of contaminants with the combination of increased mass transfer and increased reaction rates.

- Packed Bed, Plug Flow, Vertical Reactors
  - Enhances Plug Flow and Eliminates Backwashing
  - Induces High Mass Transfer
- Ozone Diffuser Produces Micro Bubbles
  - Enhances Contact with Waste Stream and High Mass Transfer
  - Enhances Dissolution of Gas to Liquid for Faster Oxidation of Organic Contaminants
- Multiple, Pressurized Reactors
  - Effects Ozone Mass Transfer Coefficient between .005 and 2 sec Ô -1
  - Matches the Half-Life of Ozone Increasing Oxidation Potential
  - Provides Faster Oxidation Duration as Much as 60% Faster
  - Enhances Oxidation Efficiency with Improved Concentration in Liquid-Gas Interface

SUBHEAD: Determining if ACOS Is Right for You

How Does the ACOS Advanced Oxidation Process Work?

ACOS advanced oxidation process generates highly reactive, highly effective, hydroxyl radicals ($^{\bullet}OH$) which are produced during the spontaneous decomposition of ozone (O_3). ACOS accelerates the rate of ozone decomposition through its process technology by increasing the concentration of hydroxyl radicals for elevating the rate of oxidation.

ACOS process technology accelerates ozone decomposition by producing higher concentrations of hydroxyl radicals through an advanced oxidation process called peroxone (H_2O_3) in which hydrogen peroxide (H_2O_2) is added to ozonated water.

In treating contaminated wastewater, hydrogen peroxide and waste fluid are pumped into a mixing vessel. The mixed waste fluid is monitored for pH; amounts of sodium hydroxide (or like base) or hydrochloric acid (or like acid) are added to maintain a pH between 8 and 10 in the waste fluid. In addition, the temperature of the waste fluid is monitored for about 100°C and the amount of waste fluid passing through the system and the pressure, less than

100psi, are monitored and controlled as well as amounts of additional hydrogen peroxide, hydroxide, and ozone as required.

The flow of waste fluid and ozone are co-currently fed under pressure into a packed bed, plug flow reactor. With its multitude of surfaces created by the packed bed, the design of the reactor facilitates plug flow and functions as mass transfer sites. The design of a porous ozone diffuser together with the multitude of surfaces effects an ozone mass transfer coefficient between about 0.05 and about 2 secÔ-1 which complements the life of ozone and thus creating a most effective and efficient environment for treating contaminated wastewater.

For a more information, please refer to ACOS Process Description Sheet.

Who Are the ACOS Team Members?

The ACOS Team is a unique group of scientists, engineers, technicians, researchers, and executives who are committed to making a difference for our environment and for the companies we serve and create mutual partnerships. We offer experience and expertise in various industries and companies that have successfully developed and commercialized technologies in wastewater management, oxidation technology, biofuels, ethanol, activated carbon, polymers, and fluidized bed thermal destruction to name a few. The executives of ACOS are experienced senior management having held positions in Fortune 100 companies and having achieved annual sales up to $300 million. They also have experience in starting and financing companies with annual revenues of 10 to 30 million dollars. The ACOS Technical and Business Team is highly qualified in developing just the right solution for you wastewater treatment.

For a more information, please refer to ACOS Team of Experts Sheet.

What Testing Information Is Available for ACOS?

ACOS performs tests on wastewater containing various hazardous and toxic contaminants demonstrating technology effectiveness and efficiency. ACOS works with customers and Hazen Research of Denver Colorado in researching and testing unique and specific challenges in waste streams. Test results for dyes, toluene, acetone, ethanol, and other contaminants demonstrate highly effective and efficient destruction of contaminants in one or more passes in ACOS packed bed, plug flow, vertical reactors; individual test reports are available on request.

For a more information, please refer to ACOS Testing Information Sheet.

What Are Some of the Requirements for ACOS?

ACOS technology is effective in many industries for remediating hazardous and toxic organic contaminants in wastewater streams. The type of contaminant, its concentration and composition, and requirements for volume throughput and budget all help to determine the appropriateness and effectiveness of utilizing ACOS technology. Industries that benefit from ACOS technology include:

- Pharmaceutical and Healthcare Products
- Cosmetics and Personal Care Products
- Scents, Flavors, Colorants, and Dyes
- Food Processing and Manufacturing
- Oil and Gas Refining and Processing
- And Others

For a more information, please refer to ACOS Site Specification Sheet.

What Are the Steps to Evaluating ACOS?

ACOS technology may be exactly what is needed for your wastewater treatment needs. ACOS works with you every step of the way to evaluate the appropriateness and potential effectiveness of advanced chemical oxidation technology. *Assuring complete confidentiality*, we work with you in a seven-step process to evaluate your needs; perform testing and confirm results; provide a requirements document with recommendations and a proposal; perform on-site testing and pilot the application of technology in real time; evaluate results; design and install technology; and conduct ongoing services and support. The ACOS Evaluation Procedure creates opportunities for customer evaluation and proof, practical and actual application, and measureable and sustainable results.

For a more information and greater detail of the process, please refer to ACOS Evaluation Procedure Sheet.

COVER IV
TAGLINE: TBD

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CALL TO ACTION:
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