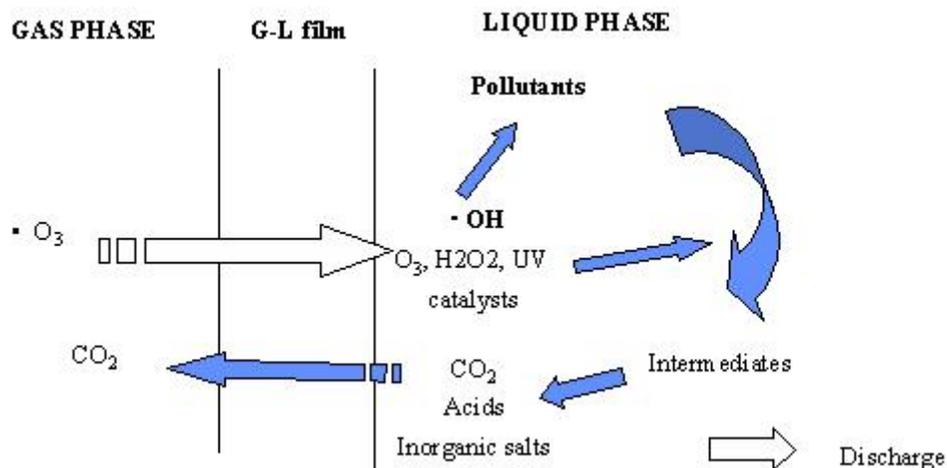


Advanced Oxidation Processes (AOP)

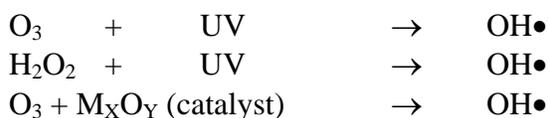
Advanced catalytic oxidation processes (AOP) have gained attention as an emerging clean and efficient technology for air and water treatment. The major advantage of this technology is that it can completely or partially destroy organics at ambient temperature by converting them into various harmless intermediates and end products, such as carboxylic acids, carbon dioxide and halide ions.

The major oxidants of AOP are hydroxyl radicals and ozone which can react with organic compounds at very high reaction rates. In particular, hydroxyl radicals can attack most organics non-selectively at a reaction rate constant as high as $10^9 \text{ M}^{-1} \text{ sec}^{-1}$ through hydrogen atom abstraction or by addition of the hydroxyl radical. The process offered by Spartan Environmental Technologies uses a unique combination of ozone, hydrogen peroxide, a proprietary catalyst and UV oxidation, as shown in the following figure.

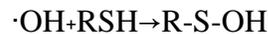


The catalytic advanced oxidation system is designed to ensure that high concentrations of dissolved ozone (which is the main oxidant) are maintained in the oxidation chamber. The high ozone mass transfer and residual ozone concentrations are made possible by the use of specifically designed ozone injection devices.

The *CATADOX* system involves three main components for the effective generation & optimum use of hydroxyl free radicals for the enhanced oxidation of pollutants, COD and TOC:



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Phone : 800-492-1252, Fax : 440-368-3569, e-mail : info@SpartanWaterTreatment.com
Web : www.SpartanWaterTreatment.com



R: organic compounds

EI Catalytic AOP System

The new generation of catalytic advanced oxidation technology (CATADOX) was developed, designed and tested by ESCO International.

OZONO ELETTRONICA INTERNAZIONALE S.r.l. (OEI) (www.ozono.it) and ESCO International (EI) (www.escouk.com), the CATADOX Group, have partnered to market and supply the new CATADOX process as well as all other conventional AOP systems.

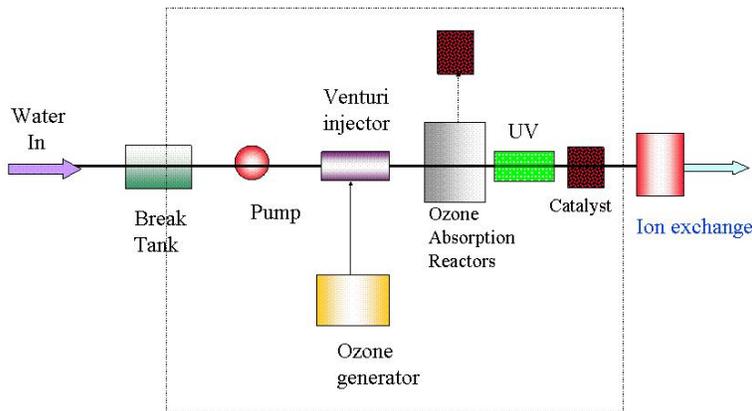
The technology described here has been recently developed and has been demonstrated both in the laboratory and at commercial sites.

OEI is based in Milan, Italy and has been involved with ozone based systems for 35 years. They have hundred of installation in place throughout the world for a wide variety of municipal, commercial and industrial applications.

ESCO International is a leading knowledge-based solutions provider and an equipment supplier. The company provides technical services, specializing in ozone, UV, AOP and catalytic oxidation processes.

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Advanced oxidation processes are reliable means of meeting the new environmental standards. They also offer capital and operating cost savings compared with conventional treatment processes. The *CATADOX* process (shown in the schematic to the left) combines



to the left) combines treatment by ozone, UV, hydrogen peroxide and proprietary catalyst to enable industrial customers to meet the tightening environmental standards for wastewaters and gases. This new process is very effective in challenging applications such as micro-pollutant oxidation, non-

biodegradable COD removal, TOC reduction, VOC abatement, toxicity reduction, color and odor removal. The CATADOX process can efficiently treat a wide range of contaminant types and concentrations ranges including IPA, TMAH, NMP, DMSO, Glycols, VOCs, PAHs, PCBs, Alcohols, Ethers, MTBE, and others.

The photo below shows an CATADOX system.



Depending on the inlet and outlet TOC or COD concentrations and content, the most suitable process design is selected. The ozone to TOC or COD mass ratio depends on a number of factors. The CATADOX process uses much less ozone than other AOP systems. The CATADOX process therefore can be a cost effective technology to reduce TOC or COD in process water. The use of just O₃/UV would be more expensive from the capital cost stand point due to high ozone requirements.

Other advantages of the multiple oxidant system are better oxidant availability, shorter contact reaction times, higher TOC/COD reduction performance and much lower operating costs.

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The CATADOX process provides unique benefits:

- Significant cut down in ozone demand, hence smaller ozone generators
- Important reduction in oxygen and dry air requirements, hence lower power consumption
- Major reduction in cooling water capacity and power consumption
- Reduction in plant size
- Higher flexibility in oxidants dosing vs incoming TOC or COD
- Better process performance and reliability
- No oxidant residual problems
- Optimal combination of ozone, H₂O₂, UV and catalyst available depending on water quality and treatment requirements before recycle, reuse or discharge
- Lower ozone, H₂O₂ and UV power requirements when compared to conventional H₂O₂/UV, O₃/UV and O₃/H₂O₂ AOP processes.
- Much lower overall power consumption, hence lower operating costs

Spartan Environmental Technologies

Spartan is the sole distributor of OEI products in the US and Canada. If you have a challenging wastewater or air treatment application let us help you evaluate the application of ESCO International's catalytic AOP system. Spartan has representatives throughout the country to serve you.

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