

ZEROS Facts

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Briefly, How Does ZEROS Work?

ZEROS (Zero-Emission Energy Recycling Oxidation System). is a two-stage “oxy-fuel” system that oxidizes organic or hydrocarbon wastes with pure oxygen (which can be purchased or generated on-site with an oxygen separation unit). The first stage uses a sealed, oxygen-starved rotary kiln to produce a synthesis gas composed primarily of steam, methane, carbon monoxide, and carbon dioxide. A portion of the synthesis gas that is produced is then completely oxidized in the second oxygen-rich stage to pure carbon dioxide, and steam. The steam can be used to drive motors needed to operate the ZEROS system and off-site industrial processes, drive turbines to generate electricity, and distill large amounts of waste water. The carbon dioxide produced by oxidation is typically cooled and pressurized to its supercritical form. It can then be sold into the robust international market for carbon dioxide where it may be used in a variety of industrial processes, including production of industrial dry ice and recovery of petroleum from oil reservoirs. A portion of the synthesis gas can also be used to feed a modified refinery cracking tower designed to selectively produce only sulfur-free diesel or jet fuel.

What are a ZEROS Plant’s Environmental Impacts?

A ZEROS plant has major environmental benefits.

- Because it is an oxy-fuel system, ZEROS uses no ambient air for oxidation. As a result, no ambient nitrogen gas enters the oxidation chambers and no oxides of nitrogen are produced. In fact, ZEROS plants have no smoke stacks, and no air or water emissions of any kind are produced.
- When its fuel is derived from coal or petroleum wastes and the carbon dioxide produced is sequestered in oil reservoirs, ZEROS produces no net carbon dioxide emissions. If a portion of the fuel is derived from renewable sources like agricultural biomass or paper products in municipal solid wastes, ZEROS actually has a net negative impact on atmospheric carbon dioxide!
- ZEROS plants can be designed to dissipate excess steam energy by flash distilling municipal or industrial waste waters and using the residual organic or hydrocarbon sludge as fuel.
- Because ZEROS oxidizes all organic materials at very high temperatures, denatures asbestos, and captures for sale any and all metals in the fuel mix, it is the ideal system to eliminate toxic and hazardous wastes (such as dioxins, asbestos, and heavy metals).

The lack of air and water emissions, sequestration of 100% of the carbon dioxide produced in the oxidation process, production of distilled water from waste water, and destruction or capture of hazardous wastes make ZEROS the most environmentally friendly system available.

What Experience Does Steve Clark (SIG) Have?

Since 1972, Mr. Clark, through his companies Systems International (SI), Oilwell Control Services (OCS), and Blowouts And Failures (BAF), has controlled, remediated, and/or cleaned

up 2,023 oil well blowouts, down hole failures, fires, oil spills, and other environmental disasters.

Mr. Clark began developing ZEROS in 1993 as part of a contract to clean up a large crude oil spill near Ventura, California. Over the past 20 years ZEROS has evolved into a collection of patented, interrelated processes that thermally oxidize a wide variety of hydrocarbon and lignocellulose materials to eliminate organic and hydrocarbon waste materials and produce commercial quantities of electricity, sulfur-free diesel fuel, distilled water, and pure (supercritical) carbon dioxide, nitrogen, and argon.

Four component ZEROS processes have been patented:

- **ZEROS Power Generation** uses steam from the ZEROS process to drive turbines and electric generators, typically producing approximately 50 MW of continuous electric power from approximately 1000 tons per day of municipal solid waste or similar fuels.
- **ZEROS Liquid Fuel** uses synthesis gas generated by ZEROS to produce sulfur-free diesel or jet fuel, using a closed, recycling refining equipment similar to the Fischer-Tropsch process. A typical 1000 ton-per-day ZEROS unit will produce approximately 40 million gallons of diesel fuel per year.
- **ZEROS STOP** (Soil Thermal Oxidation System) is a patented process that uses hydrocarbon and/or organic wastes like oil-contaminated soils as fuels. It can also use municipal solid waste, pet coke, scrap tires, low quality lignite or poor quality coal mining residues as fuel.
- **ZEROS Biodynamics** is the patented process that uses supercritical carbon dioxide (generated from waste by the ZEROS process) to dissolve and remove (“dry clean”) hydrocarbon and other organic contaminants from soils.

How Could the ZEROS System Be Used in Chambers County?

In Chambers County, the ZEROS process could use a variety of municipal and industrial solid and liquid wastes as fuel. The project could consume as little as 1000 tons per day of this fuel (or much more, if available) to produce the steam energy needed to produce industrial and electrical power, transportation fuel, distilled water, and pure carbon dioxide, nitrogen, and argon gases.

High temperature steam produced by the ZEROS oxy-fuel process could be used to flash distill industrial and/or municipal waste water. After flash distillation, the remaining lower temperature steam energy would be used to drive turbines to generate electricity for use by the ZEROS system itself and for sale using the ZEROS Power Generation process. Typical ZEROS systems are sized to produce approximately 50 MW of continuous electrical power. In addition, a portion of the synthesis gas produced by ZEROS can be diverted to a modified sealed oil refinery cracking tower to produce sulfur free diesel fuel using the ZEROS Liquid Fuel process (typically about 40 million gallons per year).

The carbon dioxide produced by the ZEROS process can be cooled and pressurized to a supercritical state. This supercritical carbon dioxide is a super solvent for hydrocarbons, and can be sold for tertiary recovery in existing oil fields or many other industrial processes.

To summarize, primary products of an HC&S ZEROS system could be steam, electricity, transportation fuel, distilled water, supercritical carbon dioxide (or dry ice), and pure nitrogen and argon gases. The relative amounts of these products will depend on their prices in available markets.

How Many of the 2,023 Projects That Mr. Clark Has Completed Used the ZEROS System?

Most of the over 2,000 projects completed by SI have involved remediation of oil-contaminated soil. Most of these were small enough to use simple separation technologies and landfilling to accomplish the goals. However, since ZEROS was invented in 1993, it has been used in over ten major waste remediation projects. For these projects, four separate but similar ZEROS units were constructed and operated for a total of approximately 25 unit-years. These projects cleaned up soils contaminated by petroleum hydrocarbons, as well as other hazardous wastes such as dioxins, asbestos, and heavy metals. These projects have also demonstrated that ZEROS can use municipal solid wastes, low quality coal, scrap tires, agricultural wastes, and sewage sludge as fuels, completely eliminating these wastes.

What Are the Largest Projects for which ZEROS Has Been Used?

- The first application of ZEROS STOP was an oil spill cleanup in the **San Miguelito Grub** north of Ventura, California in 1993-1995. A lightning strike split a Conoco oil storage tank, and 200,000 barrels of crude oil spilled on a hill above the Pacific Ocean. It ran down the hill toward the Santa Barbara Channel and eventually contaminated about 250 acres. At the time of the spill, Mr. Clark's company (Oilwell Control Services, Inc.) was on site repairing a down-hole failure, and he was able to mobilize the resources to halt and contain the spill. He then constructed and employed the first ZEROS unit to clean up the contaminated soil without trucking it to a landfill or producing air emissions, neither of which were permitted by California environmental agencies.
- In 1996-2000 ZEROS STOP was used at **Hunters Point Naval Shipyard** in California to clean soil contaminated with paint residues containing lead, zinc, and hydrocarbons --- a total of 19 compounds of concern. Some had leached up to 50 feet into the soil. ZEROS was used to oxidize the hydrocarbons. The heavy metals remaining in the thermally oxidized soil were dissolved and leached with acid, then neutralized with base and precipitated as salts for proper disposal.
- In 1997-1998 ZEROS was used at **Alameda Naval Air Station** in California. The project resulted from the decommissioning of the Air Station and the resulting cleanup of 40 years of accumulated wastes, including hydrocarbons, vinyl chloride and other chlorinated hydrocarbons, heavy metals, asbestos, mercury, lead, and other contaminants. This was the first application of the combined ZEROS STOP + Biodynamics system and led to the patent on that process. The soil was washed with supercritical carbon dioxide generated by the ZEROS primary and secondary oxidation chambers. The continuous flow soil washing process involved auguring the contaminated soil into a series of five

frac tanks equipped with agitators and baffles. The carbon dioxide from the carbon dioxide purification unit and contaminated soil were introduced into the tanks and the slurry (at low temperature and several hundred psi to maintain supercritical state) moved through the five tanks and over the baffles, allowing the dry cleaned soil to settle to the bottom where it was removed. The hydrocarbon-carbon dioxide solution was removed as supernatant from the last frac tank. The carbon dioxide was volatilized, and the remaining hydrocarbon was disposed of properly. The heavy metals remaining in the soil removed from the primary rotary kiln (and in the washed soil) were dissolved and leached with acid, then neutralized with base and precipitated as salts for proper disposal.

- In 1998-1999 ZEROS was used to clean up soil contaminated by a major (400 acres, 175,000 bbl) oil spill from a Pennzoil pipeline on Delta Logging land near **Tensley, Mississippi**. A ZEROS STOP + Biodynamics system similar to that use at the Alameda Naval Air Station was used to clean some of the soil, and some of it was buried in a landfill. The separated hydrocarbon was returned to Pennzoil, and the carbon dioxide was recaptured and, with steam, injected into the nearby oil field to enhance recovery.

Seven smaller projects that used ZEROS Biodynamics and/or ZEROS STOP to eliminate industrial, agricultural, and/or hazardous wastes are briefly described below.

- Cherry Valley, California. 1997. Used ZEROS STOP to destroy dairy manure.
- Morengo Tribal Landfill, Thermal, California. 1998. Used ZEROS STOP to destroy municipal solid waste, construction waste, scrap tires, and agricultural waste.
- US Army Manufacturing Facility, Indio, California. 1999. Used ZEROS STOP to destroy nitocellulose, napalm, and mortar rounds.
- Rural Northwest Louisiana. 2000. Used ZEROS STOP to decontaminate soil contaminated by a 100,000 gallon spill of gasoline additive from a pipeline.
- Mineral Wells, Texas. Used ZEROS STOP + Biodynamics to clean TPH from soil on 250 acres contaminated by multiple flow line spills from well heads and tank batteries.
- Southeastern Texas. 2004. Used ZEROS Biodynamics with purchased carbon dioxide to clean TPH from 800,000 cubic yards of soil contaminated with crude oil from tank batteries damaged by Hurricane Rita.
- Southeastern Texas. 2009. Used ZEROS Biodynamics with purchased carbon dioxide to clean 500,000 cubic yards of soil contaminated by crude oil and condensate spilled from tank batteries damaged by Hurricane Ike.

Why Were We Unaware of ZEROS and These Projects?

ZEROS has been a proprietary process that was operated under strict confidentiality agreements with the oil companies and government agencies involved. It was and still is impossible to disclose the details of these projects. However, beginning in 1999 ZEROS processes have

received 13 US Patents. Unfortunately, in 1999 Mr. Clark was diagnosed with cancer. As a result, he sold the existing ZEROS plants to interests who broke them down into their component parts rather than continuing to use them for ZEROS projects. Fortunately, Mr. Clark fully recovered, and has decided to role ZEROS out worldwide for emission-free, sustainable production of transportation fuel, electricity, pure water, pure carbon dioxide, and other valuable products from wastes such as municipal and industrial solid wastes.

How Many Jobs Would Be Created to Operate Each ZEROS Plant?

Each ZEROS plant requires approximately 130 workers and supervisors working in four shifts.

How Soon Could You Begin?

From the effective date of a contract, full plant operation could begin within three years.