

COHPAC brings SEMASS facility into air quality compliance

SEMASS, a municipal waste combustion facility in Rochester, MA, owned and operated by American Ref-Fuel Company of Houston, recently completed a very successful upgrade of the plant's air quality control systems. This project allowed SEMASS to meet the recently enacted State of Mass. Environmental Protection Agency's Municipal Waste Combustor (MWC) Rule, which is known as the Maximum Achievable

Control Technology (MACT). This included a very stringent mercury emissions reduction of 28ug/dscm @ 7% O₂, which is significantly lower than required by the Federal EPA for similar applications.

The SEMASS facility is a processed refuse fuel (PRF) waste-to-energy facility serving much of the Southeastern Mass., Cape Cod, and surrounding areas. Each unit is



capable of processing a design value of 1000 tons/day of municipal solid waste (MSW). Units 1 and 2 were originally equipped with spray dryers (DFGD) for acid gas control and ESP's for particulate collection. Unit 3 was equipped with both a spray dryer and pulse jet filter collector.

While Unit 3 was able to meet the new required emission levels, Units 1 & 2 could not meet all the requirements with just the

ESP present. Various compliance options were evaluated by SEMASS and the decision to install the Compact Hybrid Particulate Collector (COHPAC) technology, provided by Hamon Research-Cottrell, was made base upon the following advantages as viewed by SEMASS.

- * A reduction in capital cost by about 50% versus that of a full-size, conventional fabric filter system.

INSIDE HIGHLIGHTS

- REDKOH - EMBEDDED COMPUTER TR CONTROLS (page 2)
- CHEMITHON - RETRIFITS FGC SYSTEMS (page 3)
- COORSTEK - ELECTROSTATIC PRECIPITATOR INSULATORS (page 4)
- LURGI - FGD SYSTEM FOR CEMENT PLANT (page 5)

- * The required plant outage time required for installation would be less than 1/2 that of a conventional pulse jet system.

- * The required footprint was less than 1/2 that of a conventional pulse jet system and could fit the available space with less difficulty.

- * The COHPAC technology is similar to that of a typical fabric filter system and therefore would not require extensive operator training.

- * COHPAC at SEMASS was expected to meet or exceed all of the new MACT requirements based upon

Continued on page 7

US utility works to regain lost megawatts by modifying fly ash resistivity

A southern US utility was forced to derate from 770 MW to 700 MW due to opacity excursions during the summer heat wave. The Electrostatic Precipitator (ESP) had originally been designed for fly ash from local medium to high sulfur coal. Because of SO₂ emission regulations, a switch was made to lower sulfur coal. An SO₃ system was installed to condition the fly ash.

EPSCO International was retained by the utility to study the

problem and to recommend actions which would regain all or part of the lost generation due to the derate. The boiler was equipped with two, tri-sector Ljungstrom air preheaters, which rotate in opposite directions. Temperature variations at the outlet of the air preheaters carry through to the inlet of the ESP, as shown in the graphic on page 7.

EPSCO studied the ash characteristics and the gas temperature profile at the air

preheater and the ESP inlet. The fly ash from the low sulfur coal had a high silica and alumina content, ranging from 77% to 81%. An analysis of the resistivity characteristics of this ash with various SO₃ conditioning rates indicated that the ash resisted conditioning at temperatures above 325°F. After discussions with the utility, it was decided to use zone cooling.

This technique carefully adds

Continued on page 7

Embedded Computer TR Controls Reduce ESP Wire Electrode Breakage Peter Aa - Redkoh Industries

Precipitator electrical bus sections out of service due to electrical grounds, resulting in reduced collection efficiency and in some cases reduced production, are the bane of precipitators containing wire type discharge electrode. Although most precipitators built today incorporate rigid discharge electrodes, there are still many hundreds, if not thousands, of older precipitators where operators must contend with broken wire electrodes.

Luckily, life does not have to continue under the cloud of past conditions. Well-designed micro-processor transformer rectifier controls, with their inherently fast response, innovative spark sensitivity and arc detection circuits, and follow-on spark elimination circuitry, reduce both the severity of a spark and the number of occurrences. This substantially reduces wire breakage.

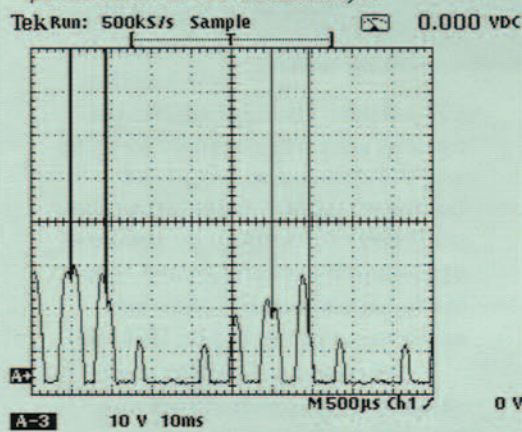
The problem with poorly designed controls, whether they are analog or digital, is their inability to accurately and consistently detect and react to sparks and arcs. Since every spark and arc between a discharge electrode and a grounded surface (typically the collecting plate) removes a small amount of the metal electrode material, missed sparks relate to faster metal removal, local hot spots, wire stretching, and faster breakage. And conversely, detected and properly controlled sparks relate to less metal loss, no hot spots, and longer discharge wire life.

Embedded computer transformer rectifier controls contain

innovative and patented algorithms that insure each and every spark and arc is detected and acted upon. This, coupled with each Original Equipment Manufacturer's (OEM) proprietary operating routines, insures minimal spark rate and extended discharge wire life.

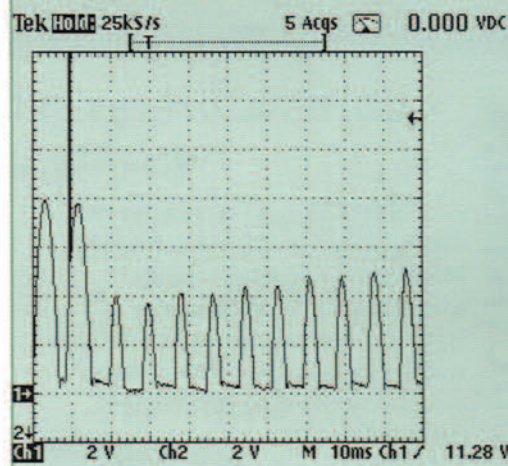
Embedded computer controls not only detect electrical discharges that occur in peak area, but also those that are in the non-peak area of the current and voltage waveform. These discharges that occur in the low levels of the waveform are typically missed by many other controls on the market. Missing these low level discharges will often result in an arc occurring on the next electrical half cycle, and an arc discharge is many times more destructive than a spark discharge.

Sparks that are not recognized by a control are not quenched resulting in a second spark. Often the missed spark will result in an arc on the next half cycle.



Many controls have to wait for a specific place within the half cycle in order to differentiate between electrical noise from the SCRs and a legitimate electrical discharge - not new embedded computer controls.

Proper spark detection prevents a second spark from forming on the next half cycle by reducing power below the spark threshold.



These controls look for sparks across the entire half cycle of supply - not just where the peak is expected to occur. In addition, the arc detection system is separate from the spark detection system. Both primary and secondary signals are used for detection and control, resulting in a control that protects the precipitator while maximizing collection.

The proof is in the pudding. Numerous Utility and Industrial ESP installations that have had their controls replaced with an embedded computer control, such as Redkoh Industries controls, have experienced substantially reduced discharge wire breakage. Since no structural, mechanical, or other electrical work was performed on these precipitators, and no boiler operating conditions or fuel had changed, the resultant reduction in wire breakage can be solely attributed to the operation of the new embedded computer controls.

Continued on page 5



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*Listening comes
before understanding
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comes before wisdom*

ESKOM hosts 2nd WPCA conference in South Africa

Loskop Dam, Mpumalanga, South Africa was the venue for the 2nd conference jointly hosted by the WPCA and ESKOM, the South African utility. The 1st day ESP/FF dual-track conference was attended by over 120 users (utility and industrial). The presentations were directed at ESP/FF fundamental theory, operation and special maintenance focuses.

The speakers were a mixture of WPCA presenters (utility and suppliers), ESKOM plant and corporate personnel and TSI (the R&D division of ESKOM). This conference was a return performance for the WPCA, who participated in a similar conference with ESKOM in January 1998.



Rod Hansen, ESKOM Corporate Consultant Air Pollution Technology, was the Conference Chairman, interfacing with the WPCA to customize the agenda for ESKOM's needs and selecting the SA speakers. He also arranged for Mr. Ehud Matya, Executive Director Generation – ESKOM, to be the Guest speaker. The conference was ended with a typical South African Braai (barbeque to some).

FGC Systems Upgraded to Modern Designs

Flue Gas Conditioning (FGC) systems have been installed since 1970 with almost 800 units to date worldwide. At this time almost 75% of the units are over ten years old and do not offer the reliability and performance of the newest designs. With spot power prices occasionally exceeding \$1000/MW plants can not take risks of de-rates caused when the FGC systems are non operational. In many cases a cost effective solution to this problem is to upgrade the FGC equipment. These upgrades can take many forms from replacing old analog controls to new gas generator skids or new sulfur storage and metering systems.

Brief descriptions of the retrofits Chemithon performed in the last year are:



Case 1

The plant was no longer able to keep the external sulfur pumping and metering system running reliably. The piston type metering pumps were difficult to maintain and without an accurate mass flow meter to measure the sulfur flow the plant did not know what the actual treat rate was. The result was that emissions were difficult to keep in compliance. Housekeeping in the sulfur pumping and metering room had become a nightmare with numerous steam and sulfur leaks. Generally repairs did not restore the insulation and lagging to 'new condition' causing problems with cold spots and subsequent sulfur pumping problems.

Both SO₃ gas generator skids had an old ratio control, analogue instruments, and outdated electrical equipment. In addition, the catalyst in the catalytic converter was old and the plant suspected that the conversion efficiency was very low.

Chemithon replaced the entire control systems and motor control panels on each SO₃ gas-generating skid. The control was replaced with an Allen Bradley SLC 5/04 PLC with a full graphic interface. The entire sulfur storage and metering system was replaced with a new sulfur storage tank with in-tank metering pumps. The sulfur flow is measured by a coriolis type mass flow meter and regulated to the required rate by varying the speed of the pumps. At this time the first unit is operating well and the second should be complete in a few weeks.

Case 2

Some FGC

systems have sulfur trioxide injectors that are simply open 1-1/2" pipe. Usually these injectors have staggered lengths. They offer the advantage in that they do not have a plugging problem but with only single point injection per probe they do not equately distribute

ad- the sulfur trioxide. To obtain reasonable distribution of sulfur trioxide it should be injected into the center of approximately square equal areas within the duct. Typically a duct should have at least 24 injection points.

Chemithon has replaced the 'single point' injectors on three projects to date. The first project has achieved dramatically higher electrical readings with the new sulfur trioxide injection grid and even with two precipitator bus sections out of service the plant is able to stay in opacity compliance. The other two plants have yet to complete startup.

Case 3

The customer wanted to test sulfur trioxide FGC and if successful to retain as much as the equipment as possible for a permanent system.

Chemithon Continued from page 3

The traditional approach for a test system is to install a temporary system that used sulfur dioxide as a feedstock. If successful, the test system is removed and replaced with a system that uses molten sulfur as a feedstock. The only equipment that is often retained in this case is the hot gas piping and injectors.

For the test, Chemithon supplied a 35-ton sulfur storage tank that was shipped complete with the steam distribution system, sulfur pumps, and metering system. When the tank arrived at the site, the installation of the sulfur storage and metering system consisted only of connecting the sulfur line, steam line, a few control signals and power.

This approach avoided the safety issues of on site storage of sulfur dioxide and when the tests were successful all of the equipment was left in place. This greatly reduced the total project costs.



Chemithon is a multinational technology, engineering and construction company that supplies chemical process equipment and services to the detergent and power generation industry.

Chemithon's customers vary from multinational, Fortune 500 companies to small family enterprises. Much of the equipment and technology of the company involves generating sulfur trioxide that is used either to produce surfactants for the detergent industry and for flue gas conditioning at power

generation plants.

In the last forty years, Chemithon has supplied over 350 SO₃ generating systems to date. About one third of these are installed and operating at power generation plants.

Other environmental equipment products are ammonia conditioning equipment, and ammonia systems for NO_x removal utilizing anhydrous ammonia, aqueous ammonia, and Chemithon's SafeDeNO_xTM urea to ammonia process.

In each of these cases, the plant achieved high reliability at minimal cost in both capital dollars and downtime. These experiences

demonstrate that retrofits are a viable way of increasing plant operability with out incurring major capital expenses. ❖

Electrostatic Precipitator Insulators – Fundamentals of Design and Selection

The removal of particulates and mists from gas streams involves the generation of corona by discharge electrodes. Full-wave rectified 60 Hz voltage of 35 to 70 kV, average, is applied to the discharge electrodes. Both the power supply and the discharge electrodes must be isolated from electrical ground. The isolation is accomplished by components constructed of a dielectric material that can withstand the electrical and mechanical stresses encountered in this service. These components are generally referred to as ESP insulators.

The design and selection of ESP insulators requires evaluation or four criteria; Material of construction, Function, Service conditions and operating environment, Design, i.e. configuration and size.

▲ Dielectric materials that are

suitable for ESP insulators comprise a relatively short list. Most are ceramics – alumina, standard electrical porcelain, special (high-strength) electrical porcelain, and fused silica. Another material, a composite of an organic resin and



fiberglass, has limited application.

Two major materials dominate the ESP insulator fields, alumina and porcelain.

The grade of alumina used in ESP insulators has a nominal content of 85% AL₂O₃ and is classified as C-780, high alumina ceramic, by the European IEC.

Porcelains are identified as C-100 materials and are classified as alkaline aluminosilicates. Grade C-130, aluminous porcelain, high strength, has generally replaced the earlier use of standard electrical porcelain in ESP insulators. Therefore, the following applies the alumina and grade C-130 porcelain.

ESP insulators require a material of construction that exhibits a combination of good mechanical and electrical properties. Other requirements include corrosion resistance, thermal-shock resistance, and zero absorption of gases and liquids.

▲ Typical functions of ESP insulators include discharge electrode support, discharge

Continued on page 6

FGD system supplied for Cementsa AB Slite cement plant



After almost all western European coal- or oil-fired power plants have been desulfurized by means of scrubbers based on the limestone principle, cement plants are now also gradually being equipped with this desulfurization process.

In this context Lurgi received a contract in 1997 to supply a desulfurization plant in Slite on the island of Gotland, Sweden. Slite is the largest cement plant in Europe, having a gas volume of 770,000 Nm³/h

Compared to power plant desulfurization systems, cement plant desulfurization boasts a few special features:

1) as absorbent, raw meal with a CaO content of 42% is used instead of limestone, 2) the gypsum generated during the process is not further dewatered, but released as a near sludge to the clinker cooler, reducing the gypsum quantity to be added. Lurgi succeeded in building an fiberglass reinforced plastic (FRP) scrubber, which provides long term chemical flexibility.

The concept of gypsum sludge disposal into a clinker cooler offers the advantages that the system is virtually wastewater free, and the quantity of the natural gypsum normally required by the plant is substantially reduced. ❖

Lurgi Lentjes Bischoff, a member of the mg technologies group of companies, is among the world suppliers of desulphurisation, denitrification and de-dusting.

Lurgi Lentjes Bischoff (LLB) was founded in 1910 as one of the earliest engineering companies. LLB has the resources to offer a complete service from concept designs and financial engineering through to after-sales services. This takes in overall planning and installation, as well as process engineering, delivery, construction, commissioning and the

mg engineering
Lurgi

training of operator's personnel.

Lurgi Bischoff GmbH is a worldwide supplier of gas cleaning technologies and air quality control systems to the industrial process industries. Lurgi Bischoff is an operating company of Lurgi Lentjes AG, which provides process engineering and plant contracting worldwide as the engineering arm of mg technologies AG.

Lurgi Bischoff designs, supplies, and builds tailored air quality control plants on a turnkey or equipment supply basis and has a complete portfolio of leading technologies and products for: dust collection, dry and wet SO₂ removal systems, NO_x abatement, heavy metal separation, separation of dioxins and furans, removal of acid gas components. The company operates in the following fields: non-ferrous metallurgy, iron and steel industry, cement and minerals, glass industry, chemical & petrochemical industries, and other industries.

Redkoh Continued from page 2

In addition to the reduction in wire breakage, increased reliability, and increased availability, stack opacities have averaged 10 to 60% lower, again attributed solely to the new controls. Redkoh Industries is a global supplier of the controls. ❖

Redkoh Industries is a global manufacturer of transformer, rapper, and remote / central control systems for electrostatic precipitators. Over the past 20 years, it has been private labeling ESP control systems for leading

REDKOH
MEGAnation

Original Equipment Precipitator Manufacturers on five continents.

Redkoh's consistent investment in R&D has resulted in extremely cost effective and innovative control circuits that keep cost down and reliability up. It is the only company in the United States that has repair facilities for almost every manufacturers type

of control. This helps companies prolong the life of essentially obsolete existing controls while evaluating and/or budgeting

for new systems.

As a company dedicated to customer service, Redkoh offers fully documented commissioning services as well as customized training sessions concentrating on electrostatic precipitator control philosophy, maintenance, and operation.

CoorsTek Continued from page 4

electrode rapping, feed-through of power supply for discharge electrodes, and anti-sway for discharge electrodes.

Support insulators carry the weight of the discharge electrode internals; therefore, mechanical strength is important. Styles include cylinders, truncated cones, pedestals, and hybrid suspension-inlet insulators.

Rapping insulators are available for two different systems – electromagnetic (solenoid) and mechanical. Solenoid rapper systems use insulator rods.

Mechanical rapper system insulators function either in a rotating drive or in a lift-release mode.

Feed-through insulators

(inlet bushings) are used to handle the power supply to the pent-house or enclosure for the support insulators.



Anti-sway insulators are installed inside the ESP box to stabilize the discharge electrode internals.

▲The first service condition is operating voltage. Of almost equal importance is temperature. Mechanical stress must also be considered.

The operating environment must also be known and accounted for in the design and selection of ESP insulators. Is the system dry or wet? And if the ESP is to be operated dry, could condensation wet the insulator surfaces? Costly repairs and downtime can be avoided if these service conditions are defined so

that the proper ESP insulators can be selected for the job.

Dry ESP's operate within a range of 150 to 450°C so insulators must withstand these temperatures for extended periods of time, generally up to 20 years.

Wet ESP's operate in lower temperature ranges but pose special requirements to prevent electrical creep and flashover. Almost without exception, shedded designs are recommended for wet duty.

Operating environment entails the nature of the particulate and gas that the ESP is handling. The term 'particulate' commonly is used to refer to dry particles. Wet EP's handle mists and gases.

The most important property of a dry particulate is its electrical resistivity. High resistivity favor ESP insulators with straight surfaces, which are generally more economical. Low

resistivities and wet service both may require shedded surfaces to break up or dissipate the electrical charge.

▲The final criterion involves actual design and sizing. These three factors must be evaluated; adequate cross-section to withstand electrical puncture, adequate electrical clearance around the insulator, and adequate creep distance to avoid power leakage and or flashover to ground.

Puncture is the breakdown of the dielectric material when electrical stress exceeds the material's resistance to electrical stress. High volume resistivity and high dielectric strength

permit more economical designs with thinner walls. A safe guideline in ESP insulator design is that of 0.5 inch (12.7 mm) of alumina ceramic will resist puncture at typical ESP operating voltages.

Adequate electrical clearance between power and ground depends on the gas surrounding the insulator. Obviously, the higher the operating voltage, the larger the required electrical clearance.

By far the most important consideration in the sizing of an ESP insulator is the electrical creep over the surface of the insulator between power and ground. The condition of the insulator surface is critical. The resistivity of any material fouling the insulator surface must be known.

Currently over 125 different ESP insulator designs can be supplied by ceramic manufactures, such as CoorsTek – a leading global ceramic manufacturer. ❖

If you would like more information regarding the WPCA, please detach and return the lower half of page 8.

COORSTEK
Amazing Solutions.

CoorsTek is a leading designer and manufacturer of critical components and assemblies for the semiconductor capital equipment market and for other high tech applications. Using precision-machined metals, technical ceramics, and engineered plastics, our solutions enable our customers' products to overcome technological barriers and enhance performance.

Hamon Continued from page 1



The Hamon Group has grown, since its inception in 1906, to become an international company that designs, engineers, fabricates, installs, repairs and maintains cooling systems, chimneys, heat exchangers, heat recovery systems and air pollution control systems.

With more than 2,500 employees worldwide, Hamon can provide access to global technology coupled with an understanding of each region's individual needs.

Hamon works with a wide array of industries, including power generation, utility, pulp and paper, petrochemical, chemical, glass, cement, steel and pharmaceutical industries.

the success of a 1-MW pilot scale system. To achieve the required mercury reduction levels across the combined DFGD/ESP/COHPAC system, a common carbon injection system was installed to serve Units 1 & 2. Carbon can be injected at various locations in the system and it is now currently being installed at the inlet to the DFGD system as the best overall location for both performance and safety.

Since initial startup in June 2000, the operation of this newly enhanced COHPAC system, SEMASS has demonstrated the effectiveness of COHPAC to meet and/or exceed all required compliance levels, including particulates, metals, and most importantly mercury and dioxin levels. Mercury reduction levels of greater than 97% have been demonstrated with the use of the

COHPAC technology and carbon injection systems.

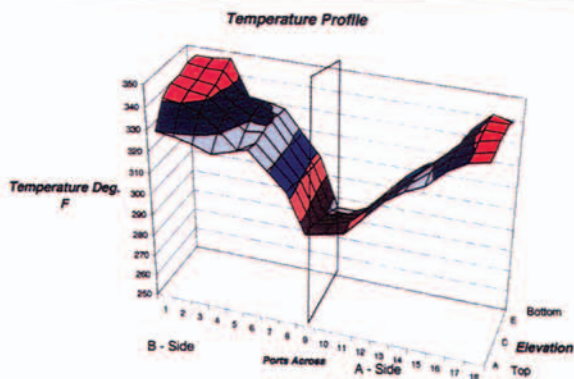
COHPAC incorporates the use of a high velocity pulse jet fabric filter system in series with an existing undersized or poorly operating ESP. It is designed to enhance the operation of the ESP system, and allow it to meet and/or exceed all particulate control requirements, including future air toxics (mercury) and fine particulate control legislations.

While originally developed for the coal-fired boiler electric power industry by EPRI, Hamon Research-Cottrell has demonstrated the effectiveness of COHPAC technology on alternative fuels such as fires in waste-to-energy combustors. In addition, there are COHPAC installations currently in operation on two 272 MW coal-fired boilers in Alabama and on two 575 MW ignite fired boiler in Texas. ❖

EPSCO Continued from page 1

highly atomized water droplets to the highest temperature zones of the flue gas. Zone cooling differs from humidification, which treats the entire flue gas system. A temporary system was installed to prove the concept of zone cooling, while a permanent system was designed.

By using the temporary zone cooling system, the unit was able to generate 780 MW without opacity excursions throughout the summer heat wave. This provided an additional 80 MW of power for the summer cooling season demand. The utility avoided the purchase of the additional power at high costs. ❖



EPSCO is a worldwide air pollution control consulting company. Their internationally renowned technical consultants are knowledgeable in all pollution control equipment, with specializations in particulate control devices.

The company's strength is in its knowledge and understanding of the electrostatic precipitation process with an expertise in virtually all electrostatic precipitator (ESP) applications.

EPSCO

The theoretical expertise and practical hands-on experience provided by EPSCO's consultants give the company the ability to meet the customers most simple or most complicated requirements. The following are some examples of the services provided by EPSCO International, Ltd.

❖ Studies and Evaluations – Evaluations of fuel switching

❖ Trouble-shooting and Problem Solving – Determine root causes of problems

❖ Annual and Special Inspections – Inspect equipment in dirty and clean condition

❖ Equipment Purchase Support – Performance specifications

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WPCA Members

Chemithon

William Hankins
5430 West Marginal Way S.W.
Seattle, WA 98106 USA
Phone - +1.206.937.9954
Fax - +1.206.932.3786
Email - bhankins@chemithon.com
Website - www.chemithon.com

CoorsTek

John Cook
600 9th Street
Golden, CO 80401 USA
Phone - +1.303.277.4368
Fax - +1.303.277.
Email - jcook@coorstek.com
Website - www.coorstek.com

Hamon Research-Cottrell

Luca Finzi
P.O.Box 1500
Sommerville, NJ 08876 USA
Phone - +1.908.333.2013
Fax - +1.908.333.
Email - luca.finzi@hamonusa.com
Website - www.hamon.com

EPSCO International, Ltd.

Robert Crynack
304 South Maginolia Drive
Glenshaw, PA 15116 USA
Phone - +1.412.487.1164
Fax - +1.412.487.9715
Email - rcrynack@worldnet.att.net
Website - www.epsco.biz



REDKOH

Paul Ford
P.O. Box 801
7 Ilene Court, Units 8 & 10
Belle Mead, NJ 08502 USA
Phone - +1.908.874.5588
Fax - +1.908.874.7994
Email - paulford@redkoh.com
Website - www.redkoh.com

Reinhold Enviromental Ltd.

Susan Reinhold
853 Sanders Road
Suite 308
Northbrook, IL 60062 USA
Phone - +1.847.291.7396
Fax - +1.847.498.1512
Email - sreinhold@reinhold-env.com
Website - www.reinhold-env.com

Lurgi Lentjes

Gernot Mayer-Schwinning
Gwinnerstrasse 27-33
Frankfurt am Main 60, D-60388
Germany
Phone - +011.49.69.40.11.262
Fax - +011.49.69.40.11.519
Email - gernot_mayer-schwinning@lurgi.de
Website - www.lurgi.com

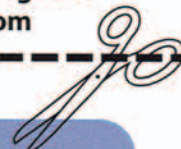
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WPCA News Information Request

Tamra Hartley
Managing Editor
Reinhold Environmental

1284 Hwy. 17
Montevallo, AL
35115
USA

Phone/Fax-
+1.205.665.9842
Email-
thartley@reinhold-env.com