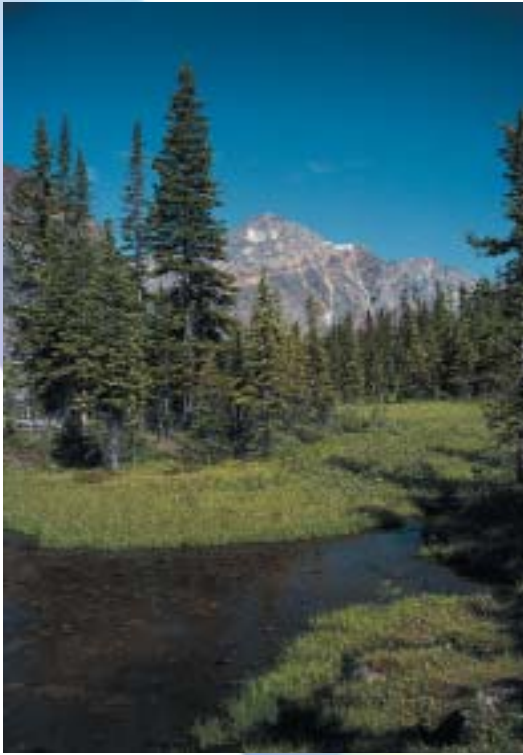




**CSM Worldwide**



**Cleaning Air  
Worldwide**



CSM Worldwide is a full-service, technology driven company dedicated to the design, manufacture and installation of air pollution control systems; providing our customers with economic and effective systems and solutions while achieving complete compliance.

The Catalytic Systems Company - CSM specializes in Catalytic Oxidizers for the abatement of Volatile Organic Compounds (VOC) and Carbon Monoxide (CO); and Selective Catalytic Reduction (SCR) Systems for abatement of Oxides of Nitrogen (NOx). Founded over 100 year ago, in the past 30 years CSM has been instrumental in helping our customers to satisfy their needs in *"Cleaning Air Worldwide"*.





# Industry Applications - Worldwide

With installations operating throughout the United States, Canada, Mexico, Latin America, Europe, Australia and the Far East; CSM Worldwide's experience and expertise span a wide range of manufacturers, businesses and

industries. Applications specific experience provides the "know-how" that customers expect and rely on when selecting CSM to design, manufacture and install a custom air pollution control system.

**Chemical Processing**



**Automotive**



**Electronics**



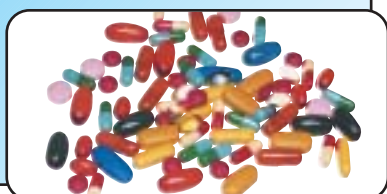
**Baking**



**Coating & Laminating**



**Pharmaceutical**



**Printing & Converting**



**Plastics**



**Industrial Process Boilers**



**Textile Manufacturing**



**Stationary Engines**



**Fired Heaters**



**Turbines**




















































































































**Left:** CSM's KALEX™ Recuperative Heat Exchanger stands tall at over 25 feet while minimizing footprint to only 4 square feet. KALEX achieves 70% heat recovery in almost all applications.

## Systems and Applications

CSM has installed over 500 systems worldwide in a broad variety of industrial applications. CSM systems for VOC and CO abatement include our specialty - the TORVEX™ Catalytic Oxidation System, as well as Thermal Oxidation Systems, VOC Concentrators, Carbon

Adsorption Systems and Scrubbers. CSM's NOx abatement technology is SCR - Selective Catalytic Reduction. Our unique REDOx™ System uses catalyst to simultaneously destroy NOx, VOC and CO.

Industry Application	CatOx	SCR Systems	REDOx SCR	Engine Systems	Thermal Oxidation Systems	VOC Concentrator Systems	Carbon Adsorption Systems
Automotive							
Baking/Food Processing							
Chemical Processing							
Coating & Laminating (Metal, Textile, Paper)							
Electronics/Semiconductor							
Fired Heaters							
Foam Manufacturing							
Industrial Process Boilers							
Paint Booths							
Pharmaceutical Processing							
Plastics (PET, PE, PP)							
Printing and Converting							
Stationary Engines (Diesel & Natural Gas)							
Turbine (Power Generation)							
<b>Type of Application</b>							
VOC Abatement							
NOx Abatement							
CO Abatement							
PM Reduction							
Solvent Recovery							
<b>Brochure Page Numbers</b>	5-8	9-11	9-10	11	12	12	12



Applicable



Process Dependent



Not Applicable

# Customer Service Programs

## Project Management

Project definition, planning and execution are the three main elements of a successful project managed by CSM Worldwide. CSM engineers meet several times with customers over the course of a project, which begins, of course, with the project kick off meeting. The CSM project team meets face-to-face with the customer's team to discuss all aspects of the project. Preliminary engineering drawings and the overall project schedule are reviewed and discussed. This meeting is critical to the successful launch of a project, and key to meeting project objectives, delivering quality equipment, on schedule and within budget.



CSM's Complete Compliance Program includes on-site engineering throughout the project.

## Complete Compliance Program



Project Kick-Off Meeting, a critical component for overall project success, is the first step in CSM's Project Management Program.

CSM offers its Complete Compliance Program (CCP) providing a unique "total system" approach to plant emission compliance. The CCP begins with an evaluation of compliance and permitting issues, continues through abatement equipment design and manufacture, and never really ends providing the customer with continuing Field Service & Engineering support over the life of the system. Installation services are available and site assessments are provided upon request. A Field Service option, which includes periodic audits of the CSM system, and where applicable, catalyst testing by a trained Field Service Engineer is also available.



# Catalytic Oxidation Systems

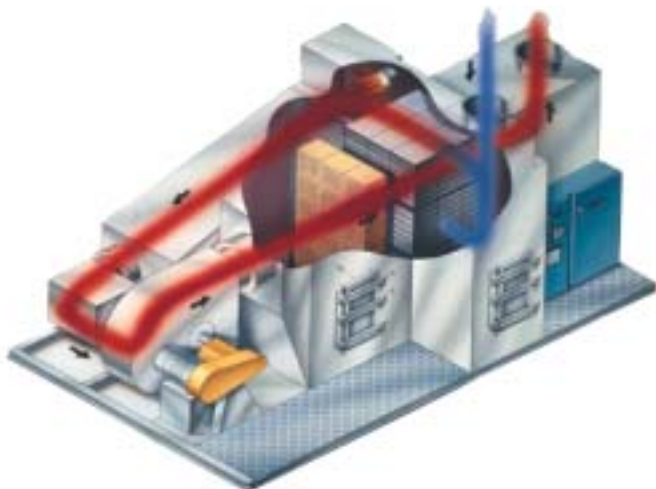
Small to Medium Scale Systems 200 to 20,000 SCFM



CSM pre-pipes, pre-wires and shop-tests its small- to medium-scale systems. Compact, lightweight and skid-mounted, they provide for easy and economical installation.



CSM Bakery Systems have achieved up to 99% destruction efficiency, use a PLC and interface smoothly with existing oven controls.



Hundreds of CSM systems have been installed because of proven reliability, compact design and easy installation. The KALEX heat exchanger recovers heat from the system exhaust to pre-heat the VOC laden air prior to the catalyst.

## Bakeries

Over the past dozen years, CSM Worldwide remains the world's leader in the design, manufacture and installation of catalytic oxidation systems for bakery oven emission control. CSM systems prove to be "edge-of-the-art" technology, that smoothly integrate with baking ovens and do not interfere with production. Our equipment destroys ethanol, oils, fats, greases and other VOCs from bakery oven exhaust. Expect 95 to 99% VOC destruction.

As the world leader for the supply of oven emission abatement systems to commercial bakeries, CSM boasts over a hundred catalytic oxidation systems and "first of a kind" bakery installations in the USA and Europe.

Recent technology advancements include integrating the CSM System with heating zones of new indirect fired bakery ovens and hybrid direct & indirect fired ovens. In addition, secondary heat recovery has been implemented to heat hot water, pre-heat boiler feed water, and provide comfort heat to the bakery facility.

### CSM Compact Skid Mounted Systems

Flow Rate (SCFM)	CSM Model Number	Length (feet)	Width (Feet)	Height (feet)	Weight (lbs.)
2000	20A	15	6	6	8000
5000	50A	20	8	8	12000
10000	100A	25	10	9	20000
20000	200A	35	10	10	50000

Note: CSM CatOx is skid mounted and uses CSM's KALEX air-to-air heat exchanger.

# Catalytic Oxidation Systems

Small to Medium Scale Systems 200 to 20,000 SCFM

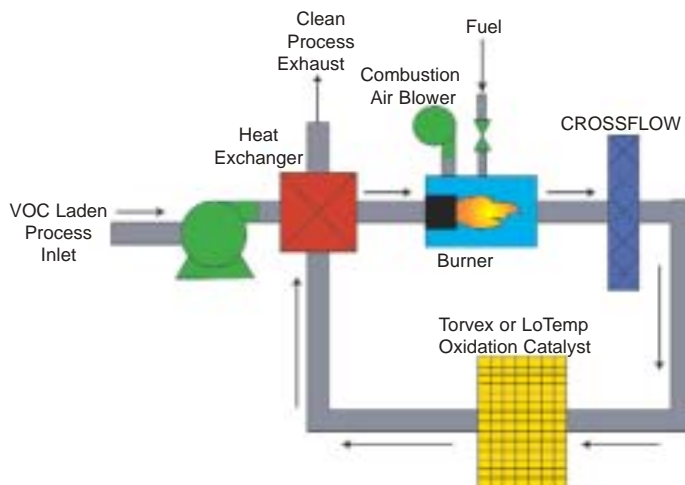
## Pharmaceutical Plants

Pharmaceutical manufacturers appreciate the low operating costs associated with CSM's catalytic oxidation systems used to destroy VOC including methanol, ethanol, isopropyl alcohol, cyclo-hexane, and methylene chloride. Pharmaceutical coating operations involving the use of an organic solvent as a carrier, requires the release of solvents once the coating is deposited. CSM has supplied catalytic oxidizers to the pharmaceutical industry for over 25 years.

## Heat Recovery Using KALEX® Heat Exchanger

CSM systems use the KALEX air-to-air heat exchanger to pre-heat the inlet VOC laden stream by recovering heat from the clean hot catalytic oxidizer exhaust. Operating costs are cut to a minimum!

KALEX (photo: inside front cover) is a fully welded, stainless steel, crossflow, fin and plate, air-to-air, recuperative heat exchanger proven through over 40 years of industrial application. Low pressure drop, compact and modular construction, and high heat recovery efficiency are the key features of this critical sub-component.



VOC laden gas is pre-heated by an air-to-air heat exchanger prior to entering the oxidation catalyst; where 99% of VOC is destroyed.



The economy of a multiple-unit purchase from CSM was right for this plastic foam manufacturer.

## CSM Energy Efficient Skid Mounted Systems

Flow Rate (SCFM)	CSM Model Number	Heat Exchanger Efficiency	Burner (MM Btu/Hr)	Blower (BHp)
2000	20A	70%	0.04	7
5000	50A	70%	0.09	17
10000	100A	70%	0.18	34
20000	200A	70%	0.37	69

Note: VOC assumed to have molecular weight of 80 and heat of release of 15000 Btu/lb. Concentration is assumed to be 1000 ppmv. Inlet temperature is 100 degrees F.



This highly mobile 99% DRE CSM catalytic oxidizer is supplied in a standard size 40 ft. container, one of several manufactured for this world class textile manufacturer.



# Catalytic Oxidation Systems

## Large-Scale Systems 20,000 to 70,000 SCFM

CSM Worldwide is the leader in catalytic oxidation systems for chemical processing applications, with more than 30 years of chemical plant experience. Systems process 20,000 to 70,000 SCFM of VOC or Carbon Monoxide (CO) laden gas. Chemical plants constitute a major portion of our large-scale experience. In fact, our chemical application success record includes more than 50 world-scale plants including plants for phthalic anhydride (PA), pure terephthalic acid (PTA), polyethylene terephthalate (PET), and various polymer applications such as polystyrene, formaldehyde resins, polyethylene and polypropylene plants.



Using CSM's HDC catalyst to destroy CO, VOC and halohydrocarbons, this 63,000 SCFM system serves a PTA plant in Taiwan.



This 60,000 SCFM catalytic oxidizer, supplied by CSM for a major PA manufacturer, was installed in 1991, and currently operates destroying 98% of CO and VOC.



CSM installed this 49,000 SCFM CatOx at a PA plant in Korea. Commissioned in 1992, today the system continues to operate and destroy 98% of VOC and CO.

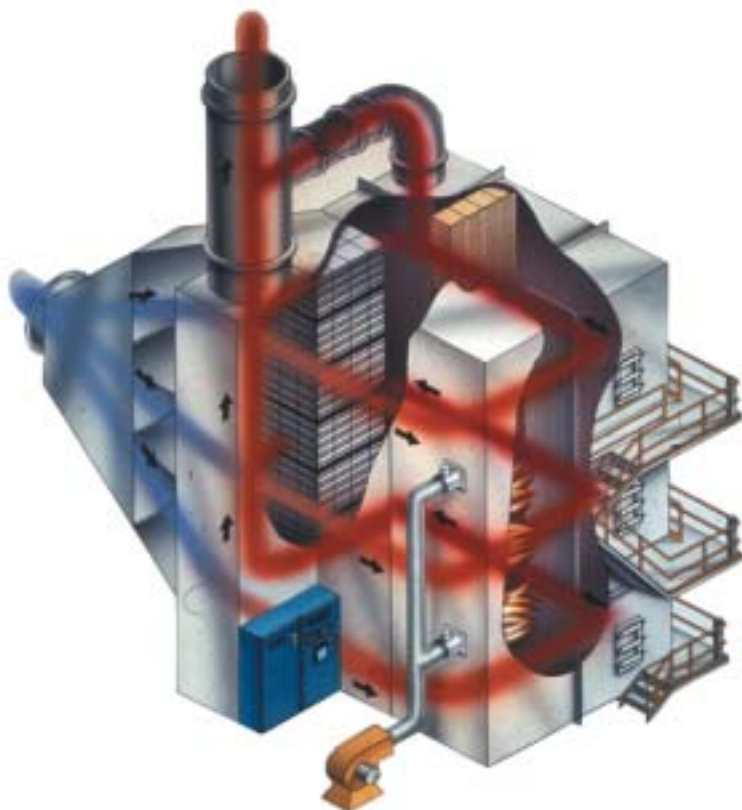


# Catalytic Oxidation Systems

## Large-Scale Systems 20,000 to 70,000 SCFM

CSM large-scale catalytic oxidation systems use the KALEX<sup>®</sup> heat exchanger for heat recovery, thereby minimizing operating costs. CSM's TORVEX<sup>®</sup> and LoTemp<sup>™</sup> catalysts provide low temperature oxidation of VOC and CO to very high levels - up to 99%. CSM systems apply to chemical manufacturing plants for:

- Phthalic anhydride (PA)
- Maleic anhydride (MA)
- Pure terephthalic acid (PTA)
- Formaldehyde
- Ethylene
- Phenol
- Polymers: polyethylene, polypropylene
- Acrylonitrile and acrylic acid
- Acetates and alcohols



CSM's large-scale catalytic oxidation system is a proven design successfully installed worldwide. The monolithic design minimizes heat loss and equipment footprint. CSM's KALEX heat exchanger achieves 70% heat recovery. 99% of VOC & CO are destroyed.



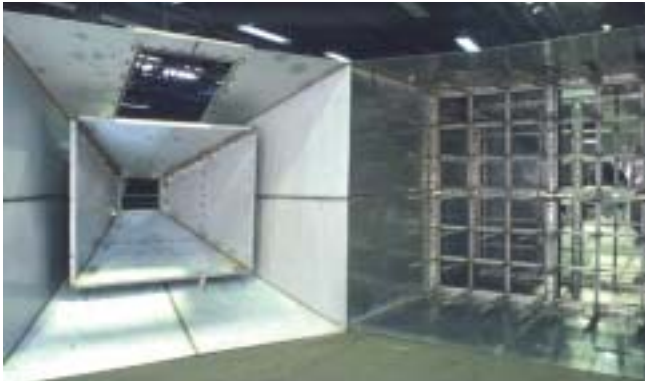
CSM CatOx at world-scale PTA plant in Taiwan destroys VOC and CO at 98% destruction efficiency.



CSM's 45,000 SCFM CatOx at a Taiwan based PTA plant uses this stainless steel water seal for pressure relief.

# SCR - Selective Catalytic Reduction Systems

## Large Scale Systems to 200,000 SCFM

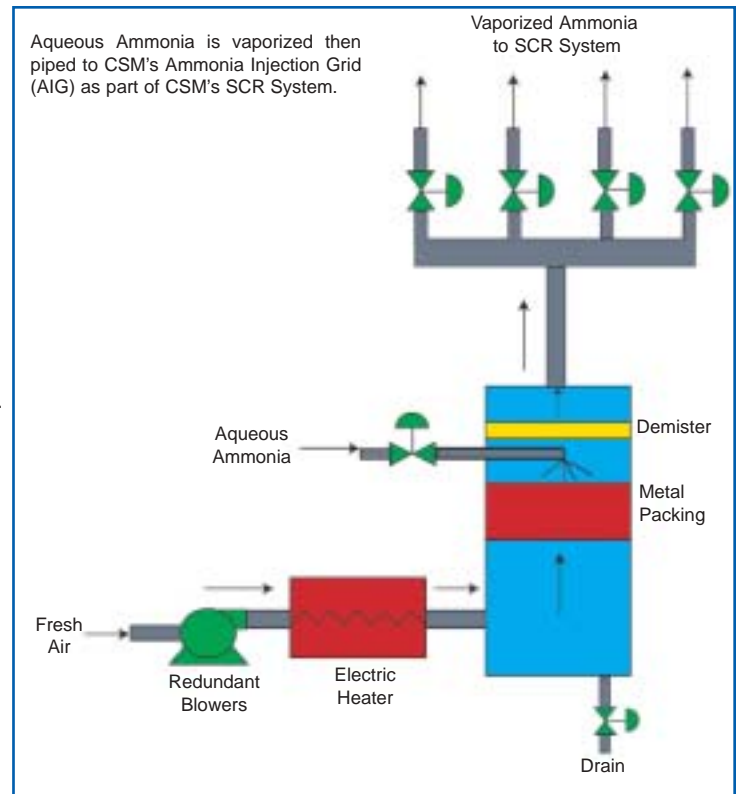


CSM's large-scale SCR system for NOx gives reduction in excess of 97%.



**Left:** Vanadium-Titanium SCR Catalyst selectively reacts NOx with ammonia to become nitrogen and water.

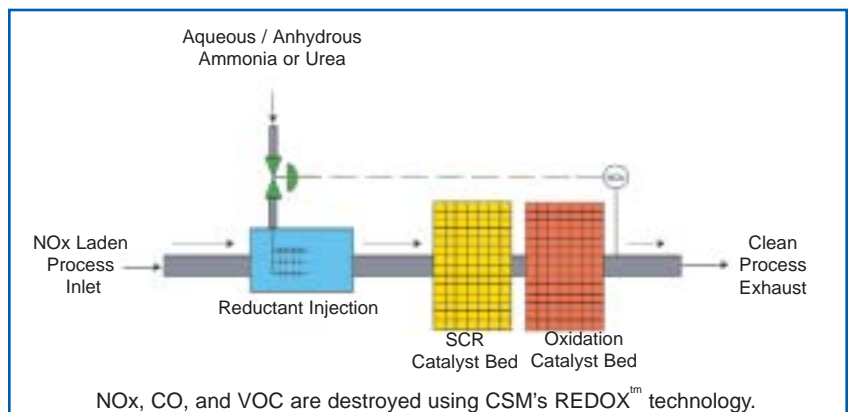
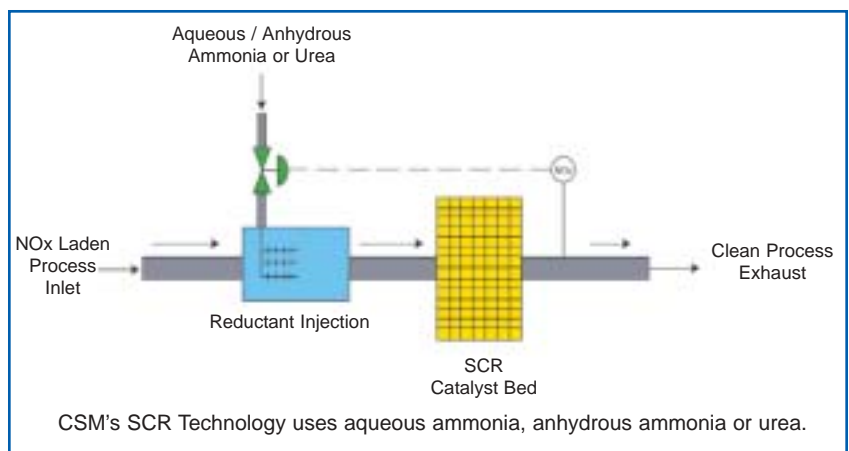
**Right:** This skid mounted ammonia vaporization system is equipped with inherent redundancy for high reliability.



SCR for the catalytic destruction of NOx (NO and NO<sub>2</sub>) is proven for the economic and efficient reduction of NOx.

For more than 20 years, CSM SCR Systems have destroyed up to 98% of NOx in applications such as:

- Industrial Packaged Boilers
- Stationary Engines (Diesel & Natural Gas)
- Turbines (Simple & Combined Cycle)
- Fired Heaters
- Combustion Processes
- Chemical Processes
- Thermal Incinerators
- Ovens, Kilns & Dryers
- High Temperature Sources





# SCR - Selective Catalytic Reduction Systems

Small to Medium Scale Systems 1,000 to 80,000 SCFM

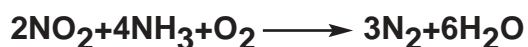
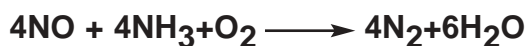


Less than 5ppm NOx and 5ppm ammonia achieved in the exhaust of an industrial process boiler by this CSM SCR System.

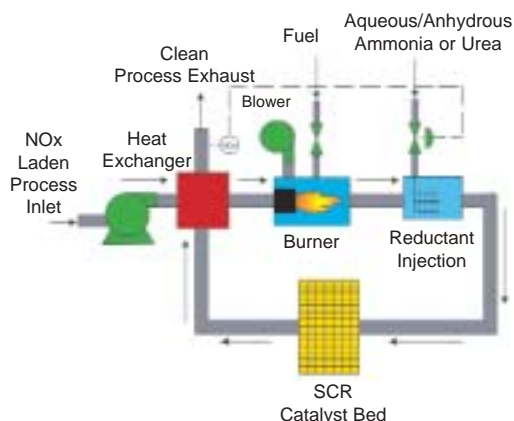
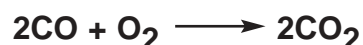
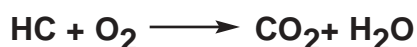


CSM's REDOX achieves destruction of VOC and NOx to levels that exceed 97%.

## SCR Catalyst Reactions



## Oxidation Catalyst Reactions



CSM specializes in small to medium sized, skid mounted systems typically associated with exhaust flow rates ranging between 1,000 and 80,000 SCFM. Customers appreciate the many benefits of these pre-piped, pre-wired and shop-tested SCR Systems including:

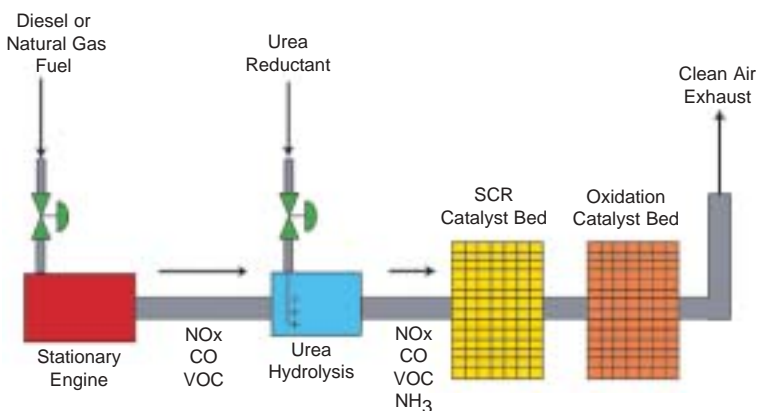
- NOx Emissions Below 5 ppm
- Ammonia Slip Below 5 ppm
- Lower Capital & Operating Cost
- Quicker Delivery
- Integrated Design
- Simpler Installation
- Lower Installation Cost
- Increased Engineering Support
- More Energy Efficient Design
- Increased Operational Flexibility

## Ammonia or Urea as Reductant

CSM SCR Systems use either ammonia or urea as the reductant. SCR catalyst selectively promotes the reaction of NOx (NO or NO2) with ammonia at the surface of the catalyst. The products are simply nitrogen and water vapor. Ammonia and urea in aqueous solution must be vaporized. CSM supplies the equipment to accomplish this. When urea is used, ammonia is made from the urea via hydrolysis.

# SCR - Stationary Engine Emission Control System

## Diesel & Natural Gas Fired



CSM's Stationary Engine Emission Control System uses SCR catalyst for NO<sub>x</sub> reduction, oxidation catalyst for VOC and CO reduction and soot filters for particulate (PM) reduction.

Urea is the preferred reductant with CSM's technology for stationary engine SCR.

Today, more than ever, industry demands access to lower-cost, more economical electric power. The need for Distributed Energy Generation has increased the installation and use of both diesel and natural gas fired stationary engines.

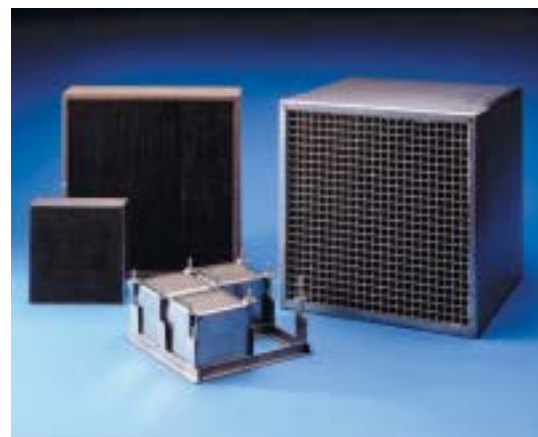
CSM leads the way by providing industry with the required Stationary Engine Emission Control Systems. CSM's systems use our unique SCR technology for NO<sub>x</sub> abatement, coupled with catalytic oxidation for destruction of CO and VOC. Where applicable, CSM also integrates its soot filter for particulate (PM) reduction.

Using a proprietary Urea Injection System and Urea as the reductant of choice, the CSM Stationary Engine Emission Control

technology achieves up to 99% reduction of NO<sub>x</sub> while maintaining ultra-low ammonia slip.

Control of urea is based on a load map of the engine; where knowledge of NO<sub>x</sub> emission rate changes, as a function of engine load, help regulate the amount of urea injected. Urea hydrolyzes to ammonia upstream of the SCR catalyst. CO and volatile organic reduction easily meet requirements of compliance.

Stationary engine emission control systems are compact and skid mounted. Short lead times and easy installation are critical advantages of this highly respected system. Finally, compliance is achievable; affordably, effectively and with no hassle!



Oxidation Catalyst is used to destroy VOC (unburned hydrocarbon) and CO from the engine exhaust.



SCR catalyst may be Vn-Ti (temperature to 880°F) or Zeolite (temperature to 1050°F) based for high levels of NO<sub>x</sub> reductions.



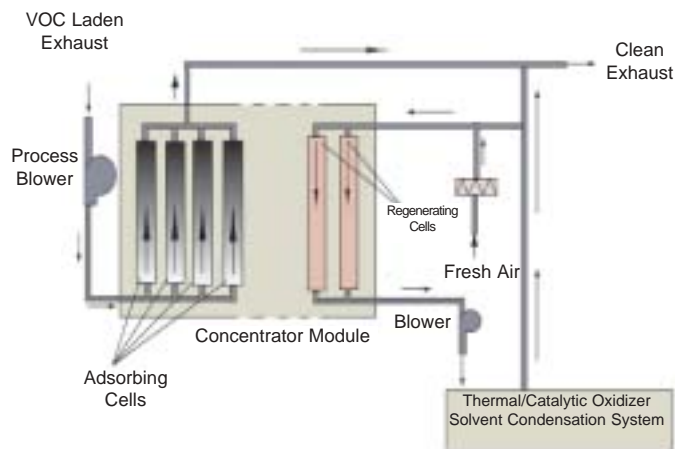
# Air Pollution Control Technologies



CSM's Thermal Combustor, an oxidation system, destroys VOC including chlorinated compounds by 99.9%. The attached caustic scrubber removes 99% of HCl in the exhaust.



Economical VOC destruction is achieved as this VOC Concentrator captures VOC and concentrates it into a lower flow stream.



Large flow, low concentration streams are converted to low flow, high concentration streams for lower cost destruction of VOC.

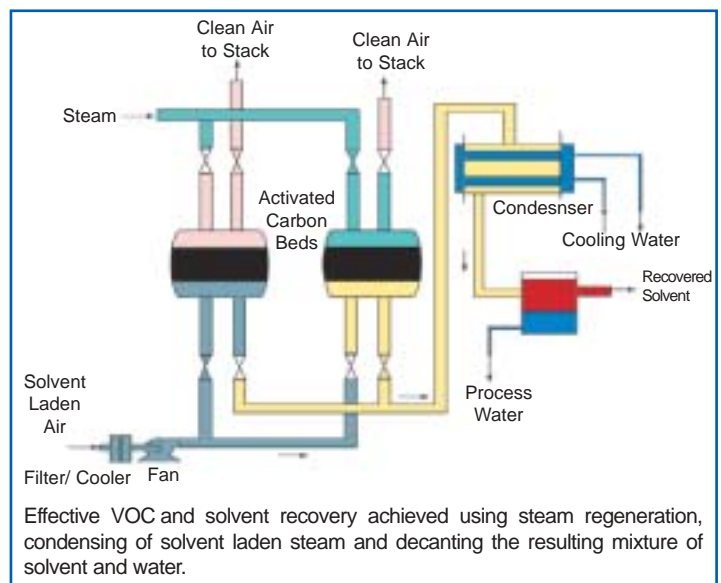
As a full service supplier of air pollution control systems to industry worldwide, CSM systems go well beyond those detailed in this brochure. Custom engineered CSM systems include:



Custom cooling coil cleaning system automates plant maintenance. This system is operating at a US based tape manufacturer.



CSM's Carbon Adsorption System recovers over 98% of solvents and VOC. This 10,000 SCFM system uses steam regeneration of carbon.



Effective VOC and solvent recovery achieved using steam regeneration, condensing of solvent laden steam and decanting the resulting mixture of solvent and water.

# Turnkey and Field Services

## Total Project Control From Start to Start Up

CSM Worldwide provides complete turnkey services from site review to permitting through system installation and startup. Throughout, you will have the combined resources of a company that stands by its commitment to quality and on-time delivery. This includes field repair, service maintenance contracts, spare parts kits, field audits and, to stay in touch for assistance and answers, [www.csmworldwide.com](http://www.csmworldwide.com)

### Engineering

CSM Worldwide will assist in defining the project and outlining the problems and solutions based on discussions and site visits.

### Manufacturing

After the project is defined, the system is designed and manufactured by CSM at our selected fabrication facility.



CSM catalyst module are easily removed, tested, cleared and replaced.

### Installation

CSM assumes the full responsibility of getting your manufacturing facility on-line in the most favorable time-frame. CSM's project manager and field supervisor is assigned to your project to assure schedules are met and the installation meets CSM's high standards.

### Start Up

On average, CSM will start-up your system within a week, and that includes operator orientation and training.

### Stack Testing

CSM takes on the critical task of stack testing to measure emissions and verify system performance; applying CSM's expertise regarding test protocols and methods and providing actual stack test services.



CSM's turnkey services include complete system installations.



CSM designs, manufacturers and installs ducts, dampers, supports, and stacks.



System audits are a critical part of CSM's Service Maintenance Contracts.



System startup and training, while your plant is in production, assure economic operation and reliable system performance.



# Cleaning Air Worldwide

---



United States



The Netherlands



Canada



Germany



Mexico



Portugal



Venezuela



Italy



Puerto Rico



Ireland



Taiwan



Wales



Korea



England



Singapore



Australia



***CSM Worldwide***

269 Sheffield St. • Mountainside, NJ 07092

Tel. (908) 233-2882 • Fax: (908) 233-1064

[www.csmworldwide.com](http://www.csmworldwide.com)