# DuPont™ BELCO®
# Marine Scrubbing Systems

## Controlling Air Emissions on Land and Sea


DuPont™ BELCO® Clean Air Technologies

The miracles of science™

## Capabilities and Experience

BELCO Technologies Corporation (BELCO®), is an industry leader in the supply of air pollution control systems to the oil refining, petrochemical, sulfur recovery, sulfuric acid, utility, chemical, pulp and paper, incineration and other industries.

Since 1969, BELCO® has designed and supplied air pollution control systems for clients all over the world. Headquartered in Parsippany, New Jersey (U.S.A.), BELCO® has been recognized by refiners worldwide as the leader in its field.

As an ISO 9001-2000 certified company, BELCO® is committed to designing and supplying the very best quality and value, providing durable, customized environmental solutions that optimize technical and economical considerations.

BELCO® has the capability and track record to provide systems that assist the customer in complying with the most stringent emission standards. BELCO® has an array of technologies that includes advanced processes for the control of particulate matter, ($PM_{10}$, $PM_{2.5}$), heavy metals, mercury, dioxins/furans, acid gases, $SO_2$, $SO_3$ and NOx.

BELCO® is committed to products and services that will help meet tomorrow's emission standards and improve process performance. Research and development efforts focus on state of the art technologies and extending the performance range of our systems to better serve our customers.

Extensive experience and capabilities allow BELCO® to provide a unified system to help meet your complete air pollution control needs.

## It's a BELCO® World... Industries Served

### Oil Refining

- A world leader in oil refinery air pollution controls industry
- Systems that reduce $SO_2$ and $SO_3$, Particulates and NOx from:
  - Fluid Cat Cracking Units (FCCU)
  - Sulfur Recovery Units (SRU)
  - Crude Distillation Units (CDU)
  - Power boilers
  - Fired heaters
  - Many other processes
- Provides scrubbing systems that use conventional reagents or buffers that can be regenerated
- Capability for turnkey work

### Metallurgical Plants

### Smelting and Mining

### Marine Scrubbing

- Systems that help clients comply regulations even when using high sulfur fuel
- Systems that can use seawater or caustic with fresh water as reagent
- Closed or open looped systems
- More than 40 years scrubbing systems experience

### Sulfuric Acid

- Wet Electrostatic Precipitators (WESP) for Collection of Sulfuric Acid
- SOx and NOx controls for various applications

## BELCO® Marine Scrubbing Systems

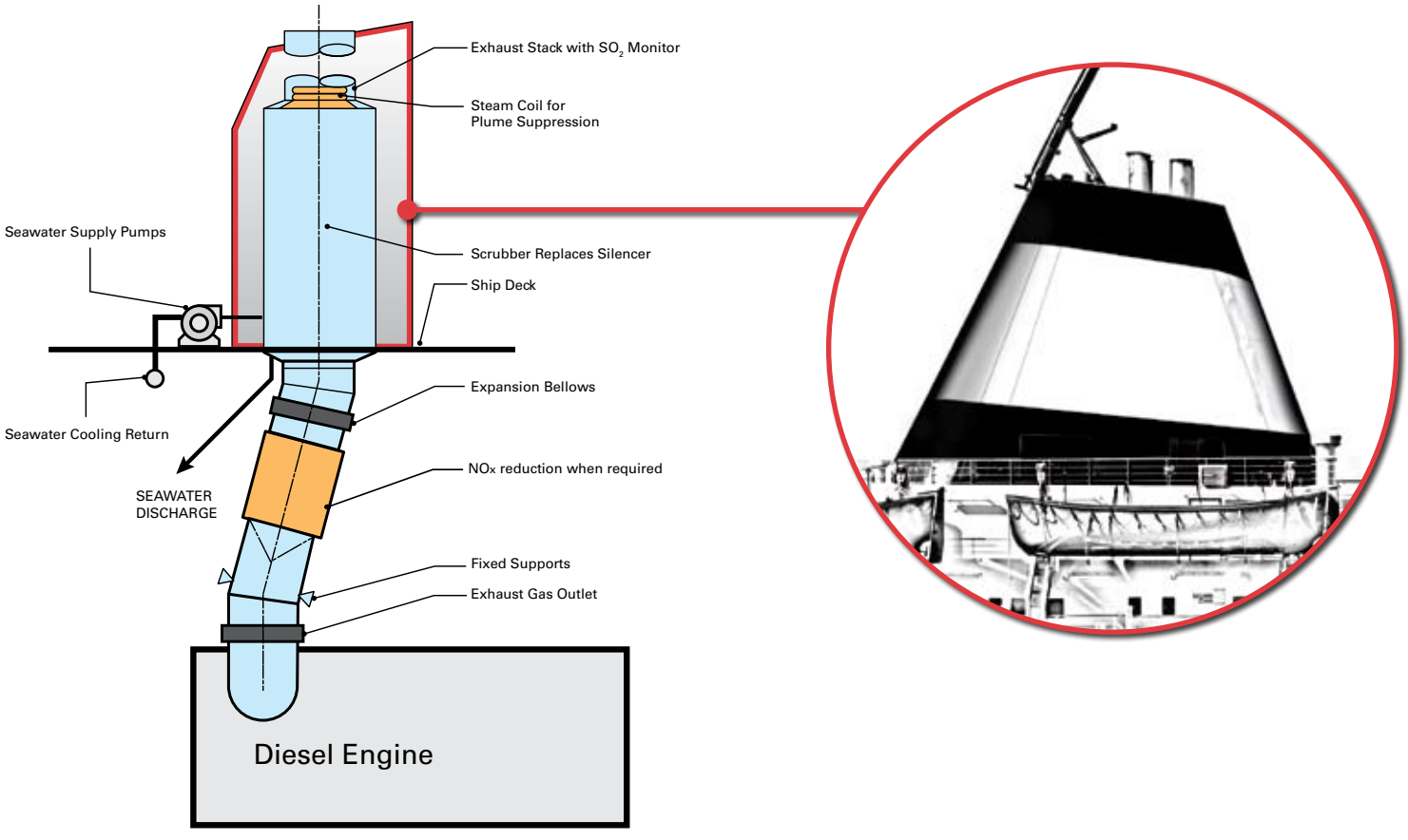
### The Benefits of BELCO® Marine Scrubbing Systems

- Reliable and cost effective design — designed specifically for your vessels in conjunction with your engineering staff
- Open tower design. Able to operate uninterrupted for many years concurrent with required dry-dockings. No concern with plugging or maintenance shutdowns while at sea
- No hot by-pass required
- High efficiency of pollutant removal
- Helps meet all IMO, SECA, EPA regulations, even when using high sulfur fuels
- Designed to withstand upset conditions and temperature excursions
- Designed to operate without shut-downs for periods in excess of 5 years
- Able to use various reagents and regenerative buffers
- Low pressure drop design
- High reliability and durability
- High efficiency

### Aftermarket Services and Spare Parts

- Proprietary components
- Replacement parts
- Start-up support
- Troubleshooting
- Construction advisors

## The BELCO® Ship Pollution Control Scrubbing System Design



## What has been approved by IMO...

- Increased sensitivity toward environmental issues may impact the choices your customers will make.
- The main changes to MARPOL Annex VI will see a progressive reduction in sulfur oxide (SOx) emissions from ships, with the global sulfur cap reduced 0.50%, effective from January 1, 2020, subject to a feasibility review to be completed no later than 2018.
- The limits applicable in Sulfur Emission Control Areas (SECAs) will be reduced to 1.00%, beginning on July 1, 2010 (from the current 1.50%); being further reduced to 0.10%, effective from January 1, 2015.
- A progressive reduction in SOx and NOx emissions from marine engines between now and 2020 with the most stringent controls on so-called "Tier III" engines, i.e., those installed on ships constructed on or after January 1, 2016, operating in Emission Control Areas.
- The revised Annex VI will allow for an Emission Control Area to be designated for SOx and particulate matter, or NOx, or all three types of emissions from ships. Subject to a proposal from a Party or Parties to the Annex, which would be considered for adoption by the Organization, if supported by a demonstrated need to prevent, reduce and control one or all three of those emissions from ships.
- The revised Annex VI will go into effect on July 1, 2010.

## Worldwide DuPont Sales and Support

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## BELCO® Marine Scrubbing – Example

| | Inlet | Outlet |
|---|---|---|
| Gas Flow (ACFM) | 51,286 | 30,572 |
| Flue Gas Temperature (°F) | 400 | 77 (note 1) |
| SOx (lb/hr) | 314 | 9.15 |
| $SO_2$ Reduction Efficiency | | > 97% |
| Fuel Sulfur Equivalent | 3.0% | 0.1% |
| Back Pressure (inches WC) | 2.4 | 0 |

***Basis:*** *11,349 kW Engine at 514 RPM using 3% Sulfur Diesel*
***Note:*** *without re-heat and at 3% water vapor*

## New Regulations Are Requiring Cleaner Smokestacks

The BELCO® Marine Scrubber can help reduce emissions without switching to expensive low sulfur fuel.



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