

Solutions and Technology for Today's Marine Industry

The major feature to the Procal system is that the entire operating system is windows based. Currently you can choose the MK4 which is an industrial based system with a touch screen or a standard PC. The ACWn software can operate on Microsoft Xp Pro or Windows 7. Incorporated in the system is both a test screen that is used to calculate the concentrations but it also controls temp, sample conditioning and trend screens. The Procal system can be supplied with Analog and digital inputs and outputs, It can also be configured to operate by modbus and supports OPC digital system. The software can be programmed to automatically save data on a remote drive or network and all data using obi console can be put into Excel format. The new systems will be delivered with a G3 card that will allow access via I-Pad or PC. The intent is to allow remote support both from Procal and or technicians.



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Using Emission Monitoring To Meet New Regulatory Requirements and Energy Reductions

Over the last 30 years that we have been designing and supplying Continuous Emission Monitoring Systems (CEMS) to power stations worldwide, the emission limits have been driven down. This has been brought about by legislation, public demand and the industries' desire to reduce their environmental impact. It has been achieved by improvements in process and technological advances in exhaust gas cleaning equipment.

Reasons to Monitor Gaseous Emissions

This is the case in the Caribbean where one of the regional primary industries is tourism making the environment a key factor in developing and maintaining the image of the country. This is demonstrated by many islands' environmental policy of adopting ISO 14001.

To achieve this certification it is necessary to implement environmental planning. An integral part of this process is to understand the environmental impact of activities such as power generation on the environment. It is therefore essential that emissions into the atmosphere are continuously monitored and recorded to an internationally verifiable standard, this enables countries to report and compare National Pollution Inventories (NPI). This also allows countries to initiate verifiable programs to continuously improve their environmental performance.

Benefits Derived from Monitoring Emissions

- Demonstrating compliance with current operating licences under all load conditions and fuel types.
- Generating an operational base line to enable an accurate model to allow interpretation in advance of regulation orders for future plant emissions.
- Fuel optimisation and identification of high sulphur loads.
- Reduction of stack testing audit costs

In the Caribbean the majority of power is generated by diesel engine powered stations relying on bunker or heavy fuel oil, these fuels contain high levels of sulphur which contribute to higher than acceptable levels of Sulphur Dioxide (SO₂) NOx.

Close parallel to Diesel Power Generation

The marine industry has parallels with the Diesel Power Generation given that they both use diesel engines fuelled by bunker / heavy fuel oils or marine diesel. The IMO (International Marine Organisation) has been instrumental in process of reducing the pollution caused by world shipping. There is now a process underway to dramatically reduce the levels of SO₂ with the introduction of ECA control areas, first example being the Baltic & North Sea in July 2010.

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This has now been followed by the USA/Canada Emission Control Area (ECA) was adopted at MEPC 60 and is scheduled to enter into force on 1 August 2011. It will become effective 12 months later, i.e. 1 August 2012, from which date ships transiting the area will have to use fuel with a sulphur content of no more than 1.0%..reducing the pollution caused by world shipping. There is now a process underway to reduce dramatically the levels of SO₂ with the introduction of ECA control areas, first example being the Baltic & North Sea in July 2010. This has now been followed by the USA/Canada Emission Control Area (ECA) was adopted at MEPC 60 and is scheduled to enter into force on 1 August 2011. It will become effective 12 months later, i.e. 1 August 2012, from which date ships transiting the area will have to use fuel with a sulphur content of no more than 1.0%.. The ECA covers an area 200 miles from the coasts of the United States and Canada. In addition to the ECA areas the global allowed sulphur content of the fuel used in the shipping industry will be progressively reduced.

Table 1: International Ship Engine and Fuel Standards (MARPOL Annex VI)

	Year	Fuel (Sulphur Content)	NOX
Emission Control Area	Today to July 2010	1.5%	
	2010	1%	
	2015	0.1%	
	2016		Tier III (After treatment-forcing)
Global	Today to January 2011		Tier I (Engine-based controls)
	2011		Tier II (Engine-based controls)
	Today to January 2012	4.5%	
	2012	3.5%	
	2020 ^a	0.5%	



Given that the SO₂ emission concentration of the exhaust gas is a function of the Sulphur content of the fuel, by reducing it the concentration SO₂ emitted into the atmosphere will be reduced. Here lies a problem, the technical challenge and the cost of reducing the Sulphur content of the fuel at the refineries would be prohibitive. To comply, the ship owners would have to use more expensive fuels which would obviously increase shipping costs. This may even have a knock on effect in the running costs of Diesel Power Stations as the lack availability of low sulphur fuel will undoubtedly increase their cost. A solution which many ship operators are now actively pursuing is to continue to use the high sulphur fuel but remove the SO₂ from the exhaust after the engine and before emitting it to atmosphere. One of the techniques of exhaust gas cleaning system used in ocean going vessels is Sea Water Scrubbers (SWS).

Why fit Sea Water Scrubbers (SWS).

- They Continue to use the cheaper high sulphur fuel and operate the SWS in ECA areas.
- As regulations increase, so does the use of the SWS In the case of cruise ships there is the added benefit demonstrating environmental credentials to your customers, especially in environmentally sensitive areas. The main driver for the installation of a exhaust gas cleaning system is undoubtedly financial .

Cost Analysis - Example for Land Based Diesel Power Generation:

A Diesel PS located in the Caribbean has two 14.6 MW diesel engines. At 80-85% load each engine in 2010 consumed 131,079 bbls. Combined they consumed 262,158 bbls. Based on conversions from BP for Gas oil/diesel this would equate to 34,867 Metric/tons of fuel. Based on Bunkerworld listing for fuel prices the current average for IFO180 @ 4.5% sulphur is \$ 697 US per metric tone. Fuel with a low concentration of sulphur @ 1% the current cost would be around \$996.00 US/metric tone. Based on these numbers and if this client was using low sulphur fuel their yearly fuel cost would be \$34,727,532 for one year of production. Assuming they were to invest in scrubber technology and monitor the CEMs for reporting it is feasible that they could use a fuel at a higher sulphur content. Based on this assumption their yearly cost of fuel would be reduced to \$24,302,299.00 US.
...This would give them a yearly net savings of \$10,425,233 US per year.

Continuous Emission Monitoring – Marine

On selecting a CEM system it is important to fully specify the requirements of the system, not only the required performance but also acceptability to the local Environmental Protection Agency. In marine applications were the installation is and location of the CEMS is not only demanding but highly regulated and therefore requiring extensive certification.

CEMS Requirement

The standard of performance of Continuous Emission Monitoring Systems have improved significantly, this has been driven by the requirements of National Environmental Agencies. Analysers used to report to these agencies are required to demonstrate compliance. For example : In the USA ,CEMS installed on power plants are required to comply with US EPA 40 cfr Part 75 whereas in Europe all CEMS have to be type approved in accordance with EN14181

Monitor Scrubbed & Un-Scrubbed Emissions

Where scrubber technology is utilized, the CEMS must be capable of monitoring scrubbed and un-scrubbed exhaust gases enabling the emissions to be monitored when the scrubber is taken out of service. This normally requires the CEMS to have two ranges for SO₂.

Minimal System Maintenance

Typically when specifying CEMs, there is an availability requirement which is predominantly a function of the reliability of the system. This is normally laid down in the performance standard that the equipment has to comply with. In the case of EN14181 the CEMS has to have an availability of >95%.

In Marine and remote Diesel Power Station applications, the reliability of the system is critical. The cost and practicality of carrying out break down maintenance other than planned annual service is expensive.

Compliant with Relevant International Standard

As already mentioned, it is essential that any analyzer installed on a land based application is compliant with the relevant national standards. In Marine applications, given that the vessel will pass between national jurisdictions, the International Maritime Organisation (IMO) which is a United Nations agency with 170 member states, is setting the international standard to which member states will implement. These are laid out in IMO publication, "Revised Marpol Annex VI" regulations for the prevention of air pollution from ships.

Operate Without the Need for Consumables

For logistical, storage and operator intervention reasons, it is desirable that any monitoring system used in marine applications and remote land based power stations do not require consumables.

Certified For Marine Installation

Any equipment that is supplied for use on ships has to comply and be certified to stringent standard. The environment that the equipment has to operate in is demanding; i.e. high vibration and ambient temperatures. The equipment has to be extensively tested by an independent test lab to ensure that it complies with the relative regulations. The report from the test lab is then submitted with supporting documentation to one or more of the 13 Classification Societies. The Classification Society will then examine the submissions before issuing Certificate of Design Assessment and then visit and audit the applicants manufacturing facilities before issuing Certificate of Manufacturing Assessment. Therefore the similarities between the Marine and Land based power generation are extremely similar.

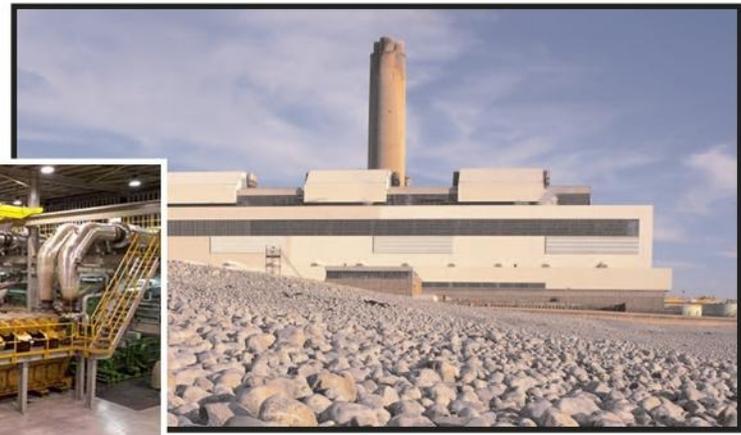
Land Based Sea Water Scrubber

SWS are also used on land based applications including large coal fired Power Stations

For example:

Aberthaw Power Station Operated by RWE nPower Coal Fired Power Station Capacity 1,455 MW There is a scrubber for each of the three 500MW units. The Scrubber is controlled by both feedback and feed forward signals from Procal 2000 analysers on the input and output of the Sea Water Scrubbers.

Scrubber Inlet Three Procal 2000			Scrubber Outlet Three Procal 2000		
Gas Species		Range	Gas Species		Range
Sulphur Dioxide	SO ₂	0 - 1000ppm	Sulphur Dioxide	SO ₂	0 - 100ppm
Nitric Oxide	NO	0 - 1000ppm	Nitric Oxide	NO	0 - 100ppm
Water Vapour	H ₂ O	0 - 10%	Water Vapour	H ₂ O	0 - 20%



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