EMISSIONS COMPLIANCE MONITORING PROGRAM
NEPTUNE LNG DEEPWATER PORT
Additional Information Submittal - Minor Source Preconstruction Air Permit Application

1.0 INTRODUCTION

This submittal to the U.S. EPA Region 1 provides additional information to the Minor Source Preconstruction Air Permit Application for the proposed Neptune LNG Deepwater Port[1]. This document describes the emissions compliance monitoring program for the Neptune Project, and provides information requested by the EPA with regard to the cost of a continuous emissions monitoring system (CEMS) for NO_x.[2]

Section 2.0 of this document presents background information with regard to the major/minor emission source classification for the Neptune LNG Deepwater Port project, a description of emission units, and a description of applicable regulatory requirements for compliance monitoring. The cost to install and operate a NO_x CEMS for each boiler and engine, and technical and logistical issues involving the application of CEMS for this deepwater port project are addressed in Section 3.0. Section 4.0 presents the proposed emissions compliance program for the Neptune Project. The summary and conclusions are presented in Section 5.0.

2.0 BACKGROUND

2.1 Potential to Emit - Major/Minor Source Classification

Emissions from the proposed Neptune Project classify the project as a minor emission source since potential emissions are below major source threshold levels for each applicable pollutant. Table 2-1 presents the potential emissions in tons per year (tpy) for the project in comparison to the applicable major source threshold levels for the various regulatory programs.

[1] Minor Source Preconstruction Air Permit Application for a Liquefied Natural Gas (LNG) Deepwater Port, Neptune LNG LLC, May 2006.
[2] Cost information for CEMS for NO_x was requested by Mr. Brendan McCahill of the U.S. EPA Region 1 during a June 6, 2006 meeting with Neptune LNG project representatives.

Table 2-1
Neptune LNG Deepwater Port
Potential Emissions in Comparison to Major Source Threshold Levels

	NO_x	CO	VOC	$PM_{10}/_{2.5}$	SO_2	NH_3	HAP
Potential Emissions (tpy)	45.0	49.7	35.3	30.3	1.5	12.1	5.4
Regulatory Program Major Source Threshold Levels (tpy)							
Nonattainment NSR [A]	50	NA	50	NA	NA	NA	NA
PSD [B]	100	100	100	100	100	100	100
Operating Permit [C]	50	100	50	100	100	100	25/10 [D]

[A] Nonattainment NSR: 310 CMR 7.00: Appendix A - Emission Offsets and Nonattainment New Source Review.
[B] PSD: 40 CFR 52.21 - Prevention of Significant Deterioration.
[C] Operating Permit: 310 CMR 7.00: Appendix C - Operating Permit Program.
[D] Hazardous air pollutant (HAP) major source threshold levels: 25 tpy of any combination of HAPs or 10 tpy of any individual HAP.
NA: not applicable

Potential annual emissions are conservatively estimated based on an average annual send-out rate of 500 mmscfd and include emissions from hotelling. Although the potential annual emission rates allow for some future increase of send-out, the average annual send-out rate is expected to be approximately 400 mmscfd. The potential annual emission rates are therefore considered conservative in comparison to the expected send-out.

As discussed during a June 6, 2006 meeting with the EPA, NO_x is the primary pollutant of concern with regard to compliance monitoring and maintaining emissions below the major source threshold level. Neptune LNG has proposed a facility-wide emission cap for NO_x of 45.0 tpy. The applicable major source threshold for NO_x under the Nonattainment NSR program is 50 tpy.[3] Potential emissions of NO_x are therefore 5 tpy below the major source threshold, and the send-out rate is expected to be below the potential emissions basis of 500 mmscfd as discussed above.

2.2 Emission Units

The Neptune LNG Deepwater Port consists of two unloading buoys and three shuttle and regasification vessels (SRVs). Emissions units onboard each SRV for the vaporization process consist of, two natural gas-fired vaporizing boilers and two natural gas-fired power generation

[3] The entire state of Massachusetts was redesignated from a serious nonattainment area for ozone to a moderate nonattainment area as of June 15, 2004. The federal major source threshold level for NO_x and moderate ozone nonattainment areas is 100 tpy. Although the ozone designation has improved, Massachusetts (per 310 CMR 7.00) has not changed the 50 tpy major source threshold level for NO_x.

engines.[4] Each boiler has low NO_x burners, a selective catalytic reduction (SCR) system and exhaust stack. Each engine has a SCR system, a CO oxidation catalyst system and exhaust stack. Hotelling emission sources onboard each SRV include a standby thermal oxidation system to provide safe venting of excess boil-off gas from the LNG storage tanks during periods of low send-out or no send-out when the boil-off gas cannot be used as fuel for the boilers and engines. In addition to supplying electricity for the vaporization process, the power generation engines will provide electricity for ship hotelling. Detailed descriptions of each emission unit are contained in Section 2.3 of the Minor Source Preconstruction Air Permit Application.

2.3 Regulatory Requirements for Compliance Monitoring

The vaporization boilers are regulated under New Source Performance Standard (NSPS), 40 CFR Part 60, Subpart D - Standards of Performance for Fossil-Fired Steam Generators. The applicable emission standard for NO_x from natural gas-fired boilers is 0.20 lb/mmBtu in comparison to the proposed emission rate of 0.012 lb/mmBtu. The NSPS requires an initial stack test for NO_x. The initial compliance stack tests, including testing for NO_x is discussed below in Section 4.1.

In accordance with §60.45(b)(2) of Subpart D, CEMS for NO_x is not required if it can be demonstrated during the initial stack testing that emissions of NO_x are less than 70% of the applicable emission standard. Since the proposed emission limit is well below the 70% criteria at only 6% of the emission standard, the NSPS does not require a NO_x CEMS for the vaporization boilers.

There are no other applicable federal or state compliance monitoring requirements for the vaporization boilers or power generation engines. As a minor source of emissions, the Operating Permit Program and related compliance monitoring requirements for major sources do not apply to the proposed Neptune Project.

3.0 CEMS ALTERNATIVE ANALYSIS

This section describes technical challenges and economic considerations related to implementing NO_x CEMS for the Neptune project.

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[4] In the gas-mode the engines operate on >99% natural gas and <1% low sulfur distillate fuel oil.

3.1 Technical Issues Involving the Application of CEMS

Continuous emissions monitoring systems (CEMS) consists of sample probes, heated sample line, pumps, gas cylinders and sensitive gas analyzers. The application of CEMS for the proposed Neptune LNG Deepwater Port would present several unique technical and logistical challenges as discussed below, which are vastly different from the application of CEMS on a traditional stationary land-based source:

(1) The facility will consist of three LNG marine vessels (referred to as shuttle and regasification vessels, SRVs) that would temporarily moor at the deepwater port for regasification of LNG and send-out of natural gas. The vessels would transport LNG from a foreign port to the deepwater port. The vessels would spend the majority of time at sea in transit to and from the deepwater port.

(2) Each vaporizing boiler and power generation engine onboard the SRVs would have a dedicated SCR system and exhaust stack. There are four emission units on each SRV; two boilers and two engines. Therefore, 12 CEMS monitoring equipment installations would be required.

(3) The CEMS would not operate while at sea. Thus, unlike a CEMS on a land-based stationary source that has a more stabilized, continuous operation, the SRV CEMS would be turned on and off for each delivery cycle. The on-off cycling of CEMS is not a typical operating mode, and the certification aspects of a CEMS that would not operate for extended periods of time for the majority of time in a given year would be a QA/QC issue.

(4) CEMS systems require daily checks and maintenance in order to maintain a high level of accuracy and availability. The management of CEMS with regard to software operation, data management, analysis and reporting would be required. A trained CEMS technician would be required onboard each SRV to operate and maintain the CEMS.

and, more importantly,

(5) In accordance with EPA requirements for continuous emissions monitoring systems, the CEMS would require quarterly QA/QC test audits consisting of calibration gas audits (CGAs) and an annual relative accuracy test audit (RATA). These audit tests would be conducted by a stack testing company. Completing these quarterly audit

tests for 12 CEMS onboard 3 SRVs that could moor for as few as several days in varying sea conditions, as well as transport of testing personnel and equipment would pose significant scheduling and logistic issues beyond reasonable control that could affect compliance with QA/QC requirements. For example:

- One or more SRVs has not moored at the deepwater port for an extended period of time, and therefore quarterly QA/QC audit testing has not be conducted. In this case, the certification status of CEMS would likely be questioned.

- Bad weather conditions prohibit the transport of equipment and testing personal to the moored SRV and the next scheduled arrival of this SRV is in the next audit quarter. In this case, the CEMS would not meet the requirements for quarterly QA/QC audit testing.

- Coordinating the scheduling of the stack testing firm to perform quarterly QA/QC audit tests with the variable SRV delivery schedules which are based on gas demand at the time, would be difficult. Neptune can not guarantee specific windows of time to avoid conflicts with other contracted projects which the stack testing firm has lined up.

These are just a few examples demonstrating the logistic problems for a deepwater port and multiple ships temporarily moored while attempting to meet stringent QA/QA CEMS requirements developed for land-based stationary sources.

3.2 CEMS Cost

As requested by the EPA, a preliminary cost estimate was prepared to purchase, install and operate a NO_x CEMS for each of the SRV vaporization boilers and power generation engines. The capital and annual costs estimates are detailed in Attachment 1. The costs presented below are total costs for CEMS on three SRVs, unless otherwise noted.

A budgetary cost estimate to purchase and install a CEMS for NO_x was obtained from Trace Environmental (see Attachment 2). The purchase cost of CEMS for three SRVs was estimated at \$920,000. Installation and certification of the CEMS would be conducted at the builder's ship yard in Korea. The cost for equipment shipping, installation, and certification testing of CEMS for three SRVs was estimated at \$317,000. Direct cost for shipyard installation cost including cost for a climate controlled space to house the CEMS equipment was estimated at $276,000. Indirect installation cost was estimated at $184,000. The total capital cost was estimated at $1.725 million.

Based on a budgetary estimate from Trace Environmental the annual cost to conduct quarterly QA/QC audit tests was estimated at $204,000. Additionally, there would be annual operational costs for calibration bottles, spare parts, and labor for an onboard technician to conduct daily checks of the CEMS, manage the CEMS software, data and reporting components, conduct preventative maintenance, and diagnose/ correct CEMS malfunctions as necessary. Annual operating/ maintenance labor and equipment costs are estimated at $89,000 based on cost estimated procedures for NO_x CEMS are described in EPA's Control Cost Manual. Annualized capital cost at an interest rate of 7% and a 10-year life for CEMS per the Control Cost Manual was estimated at $246,000. Indirect annual cost was estimated at $69,000. The total annual cost to purchase, install and operate a CEMS was estimated at $608,000.

> [As mentioned by the EPA, a telemetry system for communicating CEMS data to a land-based computer station appears to be feasible, however the cost for such a system was not investigated].

4.0 PROPOSED COMPLIANCE MONITORING PROGRAM

Alternatively, Neptune proposes a compliance monitoring program as described in this section.

4.1 Initial Compliance Stack Tests

A key component of the compliance monitoring program is the initial compliance stack tests for the boilers and engines. The initial stack tests will be conducted for NO_x, CO and NH_3 (ammonia slip from operation of the SCR systems) in accordance with EPA reference test methods specified in 40 CFR Part 60. As previously discussed, emissions of NO_x are the primary pollutant with regard to demonstrating that NO_x emissions are less than the major source threshold level. The use of SCR technology on the boilers and engines to reduce NO_x emissions will result in minimal emissions of ammonia. Testing for NH_3 and NO_x together will demonstrate the performance of the SCR as proposed. Emissions of CO will be tested to verify permitted CO emission levels, including proper combustion controls for the boilers and engines and CO emission reduction by the oxidation catalyst for the engines. Stack testing of the other pollutants is not necessary for new natural gas-fired boilers and engines especially considering that this project is a minor emission source and potential emissions for other pollutants are well below major source threshold levels.

Prior to the commencement of the stack testing, a test protocol will be prepared and submitted to the EPA for review and approval. The tests will be conducted at either the ship builder's yard (in Korea) or while the SRV's are operating at the Deepwater Port. After completion of the stack tests, a test report will be prepared and submitted to the EPA.

The timetable for conducting the initial compliance stack tests is typically tied to the commencement of commercial operation; for example, within 180 days after commercial operation. Neptune intends on addressing the timetable for conducting the initial compliance stack tests with the submittal of the test protocol, given that this project involves three SRVs to be constructed at a foreign shipyard, and that the facility is a Deepwater Port that operates only when SRVs are moored for LNG vaporization and gas send-out.

4.2 Operational Compliance Monitoring

4.2.1 Boiler and Engine Combustion Control Systems

Two boilers onboard each SRV will be utilized to heat a heat transfer fluid for regasification of LNG. The Aalborg Industries, Mission 120 (or equivalent) vaporization boilers will operate only on natural gas. Boiler emissions will be controlled by low NO_x burner combustion controls. Emissions of NO_x will be further reduced by use of a selective catalytic reduction (SCR) system.

The Boiler Control System (BCS) controls combustion by continuously modulating air and fuel to the burner for both quantity and mixture to satisfy the load demand while maintaining the desired oxygen concentration to control and maintain emissions within normal operating levels. The combustion control system is designed to operate according to a number of preset parameters (e.g., oxygen content, temperature, pressure, and air/fuel ratio) and its operation is controlled by continuously monitoring and adjusting those parameters to optimize combustion and thereby minimize emissions from combustion. In addition to the oxygen trim control loop, the combustion control system employs control loops for boiler steam pressure, combustion air flow, natural gas flow (fuel rate), and drum water level to maintain proper operation of the boiler.

The two power generation engines onboard each SRV will be utilized to provide electrical power for the regasification process and electricity for ship hotelling. Each 12 cylinder Wartsila 50DF dual-fuel engine (or equivalent) operating in the natural gas mode will be equipped with a SCR system for the reduction of NO_x emissions, and an oxidation catalyst system for the reduction of CO emissions.

The Wartsila Engine Control System (WECS) is a fully integrated engine management system for the continuous control of all engine functions. The control system optimizes engine performance and emissions by monitoring and controlling vital engine functions. The air/fuel ratio is monitored and controlled electronically by control of the fuel gas admission to each cylinder, the exhaust gas flow which in turn affects the combustion air, and the cylinder knocking intensity.

In summary, the boiler control system and the engine control system automatically monitor and control the combustion process to optimize boiler/engine performance and maintain emissions within normal operational levels.

4.2.2 SCR System Controls

Each vaporization boiler and power generation engine will be equipped with a SCR system for the reduction of NO_x emissions. The SCR system utilizes a urea/water reducing agent, a catalyst bed, and a NO_x exhaust gas analyzer. The SCR system reads signals from the boiler/engine combustion control system and the NO_x analyzer, and utilizes these data in a programmable controller to regulate the amount of urea reducing agent injected upstream of the catalyst bed. The controller is programmed to automatically adjust the urea injection rate based on the fuel rate or load signal. Readings from the process NO_x analyzer downstream of the catalyst are then used to trim or fine tune the urea injection rate to achieve the desired outlet NO_x concentration. Various operational parameters are monitored as part of the SCR's instrumentation and control system. Key parameters monitored to ensure proper operation of the SCR for NO_x reduction include:

- pressure indicators associated with the urea reducing agent delivery system;
- thermocouples to ensure SCR operation within the proper temperature range for optimum reduction of NO_x;
- pressure indicators to determine the pressure drop across the catalyst to monitor for any catalyst plugging; and
- process NO_x monitoring downstream of catalyst to adjust or trim the injection rate of the urea reducing agent to meet a preset NO_x level set below the permit limit. The process NO_x analyzer will be an Ultramat 23 (Siemens) gas analyzer (or equivalent). The analyzer measures NO_x using a non-dispersive infra-red (NDIR) detector.

4.3 Estimating Actual Emissions

Actual emissions will be estimated to determine compliance with annual emission limitations based on equipment specific emission factors and actual fuel usage.

Fuel use for the vaporization boilers, power generation engines, and thermal oxidizer will be monitored. Emissions factors equivalent to the proposed emission rates for NO_x, CO, VOC, $PM_{10/2.5}$, SO_2, and NH_3 for the boilers and engines will be determined. In a similar manner, the proposed emission rates will be the basis for determining emission factors for the standby thermal oxidizer. Emissions factors in units of lb/mmBtu or lb/mmscf will be multiplied by the actual fuel usage in mmBtu or mmscf to obtain a mass emission rate in tpy for comparison to the annual emission limitations. This method of estimating actual emissions is very conservative, in that vendor estimates of emissions are typically maximum emissions expected with a built-in margin to attain compliance.

Records of actual fuel use will be maintained for each SRV gas delivery. Actual emissions will be estimated and records maintained on a monthly and annual basis.

5.0 SUMMARY AND CONCLUSION

In summary, the proposed Neptune LNG Deepwater Port is classified as a minor source for all pollutants and the requirements for preconstruction review under the PSD and Nonattainment NSR regulations, as well as air permitting under the Operating Permit Program for major sources, do not apply to the project. The EPA has identified NO_x as the primary pollutant of concern with regard to compliance monitoring. Potential emissions of NO_x are proposed at 45.0 tpy; 5 tons below the applicable major source threshold level of 50 tpy. Neptune LNG has proposed initial compliance stack testing and operational compliance monitoring by monitoring fuel usage and estimating emissions using conservative emission factors set equal to the permitted emission limitations. It is reasonable to conclude that emission units and pollution control equipment operating and controlled within acceptable parameters, as they were designed to operate, will maintain emissions within emission limitations.

The cost to install and operate a CEMS for NO_x was investigated. The capital cost was estimated at more than $1.7 million. The annual operating cost was estimated at more than $600,000. These costs are excessive for the proposed minor emission source. Additionally, the application of CEMS to marine vessels that temporarily dock at sea as a stationary source presents a very difficult environment from which to operate and maintain multiple CEMS on multiple ships in accordance with EPA requirements. For these reasons, CEMS is not considered a reasonable alternative for compliance monitoring for the proposed deepwater port project.

In conclusion, Neptune LNG proposed a compliance monitoring program consisting of: initial compliance stack testing, operating emission units within normal operational parameters, monitoring fuel usage, and estimating emissions based on emission factors set equal to the permitted emission limitations. Neptune LNG believes that the proposed compliance monitoring program (described in Section 4.0) meets the level of monitoring expected for a minor emission source considering the unique offshore location, marine vessel application, and transit nature of the operations.

ATTACHMENT 1

PRELIMINARY COST ESTIMATE FOR NO_x CEMS

NEPTUNE LNG DEEPWATER PORT PROJECT

	Cost, $ [1]
CAPITAL COSTS	
Purchase Equipment Cost ($306,540 per ship) [2]	$ 920,000
Installation of CEMS Equipment ($48,000 per ship) [2]	$ 144,000
CEMS Certification Test ($19,000 per ship and $36,000 expenses [3]) [2]	$ 93,000
Shipping Cost (equipment shipping to foreign shipyard)[2]	$ 80,000
Shipyard Direct Construction/ Installation Cost (30% of purchase equipment cost) [4]	$ 276,000
Indirect Installation Cost (20% of purchase equipment cost) [5]	$ 184,000
Contingency (3% of purchase equipment cost) [6]	$ 28,000
Total Capital Cost	$1,725,000
ANNUAL COSTS	
Quarterly QA/QC Audit Tests and CEMS Support Services [2]	$ 204,000
Operating/ Maintenance Labor and Equipment (cost for 4 CEMS/ship)	$ 89,000
(3860 + (44.2 x k_9) + (390.3 x k_{10}) = $22,124 per NO_x CEMS) [7]	
where:	
k_9 = corporate environmental engineer hourly rate and overhead; $60/hour	
k_{10} = onboard plant technician hourly rate and overhead; $40/hour	
Annualized Capital (7% int., 10 yrs, CRF = 0.1424) [7]	$ 246,000
Indirect Annual Cost (4% of total capital cost) [6]	$ 69,000
Total Annual Cost	$ 608,000

[1] Capital and annual costs for NO_x CEMS are total costs for three ships.

[2] Budgetary Cost Estimate for NO_x CEMS for the Neptune Deepwater Port Project, Trace Environmental Systems, Inc., June 12, 2006 (see Attachment 2).

[3] The budgetary estimate included $18,000 for living expenses based on installing and certifying the CEMS for three ships during a single to the foreign shipyard. However, the ship construction schedule is staggered, and separate visits and expenses for each ship are assumed at $12,000 per ship.

[4] Direct shipyard installation costs for handling and erection, electrical, piping, insulation and painting; typical direct installation cost factor from the EPA Air Pollution Control Cost Manual.

[5] Indirect installation cost for engineering, and construction expenses and fees; typical indirect installation cost factor from the EPA Air Pollution Control Cost Manual.

[6] Typical costs factors for contingency cost and indirect annual cost from the EPA Air Pollution Control Cost Manual.

[7] EPA Air Pollution Control Cost Manual, Section 2, Generic Equipment and Devices, Chapter 4.4, Monitors – CEMS, EPA/452/B/02-011, (Chapter 4, October 2000).

ATTACHMENT 2
BUDGETARY ESTIMATE FOR NO_x CEMS
NEPTUNE LNG DEEPWATER PORT PROJECT

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June 12, 2006

Revision 1

This revision reflects the following:

- Each stack shall be monitored for NOx and O2 (CO and Ammonia not required)
- Showing of break out budget costs for installation of the systems on the ships in Korea, certifying the systems on the ships while in Korea, shipping costs to Korea, annual support contract for the systems on a quarterly basis while they are moored at the Neptune port off Massachusetts.
- Showing a break out option price for Trace to provide the systems in one Walk-in climate controlled shelter per ship

CEMs Budgetary Pricing
Neptune LNG Deepwater Port
Shuttle and Regasification Vessels

HOEGH LNG

For: Mr. Trym Tveitnes
Mr. Frank DiLiberto-Suez

Dear Trym,

Thank you for your consideration in working with us. Per my phone discussion with you and Frank Deliberto and his e-mail of June 7th, I have revised my overall system pricing for us to satisfy the stack monitoring requirements for this project.

It serves as a good coincidence that the systems we are currently fabricating and delivering for a project for Frank at Suez-Distrigas in Boston, MA, are very similar to what is required for your project.

I have listed my understandings and assumptions off which I based my pricing. Please don't hesitate to contact me if you notice any misunderstandings I may have or if you wish for me to clarify anything.

Understandings and Assumptions

- For this off shore LNG port project, there will a total of three ships
- Each ship will have four pollution sources that must be continuously monitored (2 Boilers and 2 Engines)
- The Trace supplied Continuous Emissions Monitoring Systems (CEMs) will reside on each respective ship

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- Each of the four sources on each ship needs to be monitored for NOx and O2 (CO and Ammonia not required)
- The monitoring shall comply with US EPA requirements for continuous stack monitoring per 40 CFR Part 60
- Each source/stack shall have a stack probe (Trace provides as part of the system) and a length of heated sample umbilical (also Trace supplied) to carry the sample back to the analyzer rack(s). For the purpose of pricing, a length of 150' was assumed for each heated sample line.
- It's assumed that the CEM racks (analyzers) for all four sources on each ship can be co-located in the same place on the ship
- The base pricing below assumes that our CEM racks will mount within an existing climate controlled room within the ship (if no such room is available, Trace can provide the CEMs in a walk-in climate controlled shelter that can reside on the ship deck and that pricing is shown as an option.

CEM System Overview:
The Continuous Emission Monitoring System (CEM) is comprised of a stack mounted probe along with a length of heated sample umbilical that carries the sample back to the analyzers. The analyzers are mounted and wired in a free-standing cabinet that needs to mount in a climate controlled room. The CEM cabinet contains the appropriate analyzers to monitor the necessary pollutants and these analyzers emit 4-20 ma signals proportional to the pollutant levels. These signals are input into a PLC that is also contained within the cabinet. The PLC performs calculations, controls automatic daily calibrations, and sends alarms contacts and has built in data storage. The PLC also communicates via Ethernet to the CEM PC on which is the Data Acquisition Software (DAS). This software provides monitoring, alarming, reporting and data storage in compliance with US EPA requirements.

In this case, on a per ship basis, Trace proposes to provide two, triple wide cabinets.
Each cabinet will house two CEMs and each cabinet will be 72"w x 31"d x 79"t). One PC with our Trace DAS 2000 will be provided for each ship and it will monitor, alarm, store data and generate reports for the four sources on that ship.

Pricing below represents a single ship and should be multiplied by the number of ships (3)

Total System Budgetary Price-Per ship: **$306,540**

Per ship pricing made up of the following:
- (4) Stack Probes (one probe for each stack)
- (4) Lengths of heated sample umbilical (one for each stack, 150' in length each)
- (2) CEM cabinets (72"w x 31"d x 79"t each)-Each cabinet will contain two CEM systems able to monitor two of the sources/stacks. The CEM cabinets need to situate in a climate controlled room
- Each CEM cabinet will contain analyzers for two stacks including:
  - (2) NOx/O2 analyzers-one per stack
  - (2) Sample conditioning systems
  - (1) PLC Controller/storage device

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    - (1) Lot of valves, regulators flowmeters, etc
- (1) Lot of calibration gases
- (1) PC with Printer
- (1) Copy of monitoring, alarming and reporting software
- Up to (8) Days On site for commissioning, start up and training
- System documentation to include electrical and mechanical drawings and manuals
- System Equipment Protocol Preparation and Monitoring Plan Preparation

Delivery: 12-14 weeks ARO (After Receipt of Order)

Options:

Certification in Korea

- The base pricing above does not include the certification of the systems. In the U.S., each CEM system that is installed must be certified per the U.S. EPA requirements in order to prove that it is compliant in how it measures the pollutants. This certification is called a Performance Specification Test (PST) and is sometimes referred to as a Relative Accuracy Test Audit (RATA). It occurs after the CEMs are installed and commissioned. Trace normally provides the certification of the systems within our scope of supply and if you wish for the certification to be contained within our scope, add $48,000 per ship. Please note that our stack probe requires a port that has a 4" 150# flange. On the same plane or close to it on the stack, you'll also need a second port that the stack tester will use for the PST. This pricing assumes all 12 CEMS on all three ships can be certified with a single visit and that the certification will occur immediately following installation.

Installation in Korea

- If you wish for Trace to install the systems in Korea, please add $19,000 per ship plus a total of $18,000 for Travel and living expenses to Korea . Installation consists of our technician mounting the probe in the stack and running the heated sample line (sample line supports by others) and providing all mechanical and electrical terminations into the CEM cabinets. It is assumed that others will receive and situate the cabinet(s) and run the necessary utilities to them. Each cabinet will require one line of 208 vac at 60 amps and one line of 115 vac at 40 amps. We also recommend a plant air line be run to each cabinet of 80 psig. This air will enable our system to automatically perform periodic blowback purges of the system. It's assumed that others would perform any welding or cutting of penetration holes and other would be responsible for installing any needed support brackets along which the sample umbilicals can run.

Shipping Costs to Korea

- The total cost to ship the 6 cabinets (2 per ship) plus the probes and sample lines is $80,000

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Annual Support Contract

Once the systems are in operating on the ships, Trace-as we do for most of our clients, will provide quarterly, on site PM as well as the annual RATA on the systems and quarterly report generation. Trace will visit the ships once per quarter while they are moored at the Neptune Station off of Massachusetts and conduct the required Cylinder Gas Audits (CGA's) and perform system check-outs which includes replacing consumable spare parts (probe filters, pump diaphragms, etc-consumable spare parts are included in the support agreement) and Trace will generate the required CGA reports. The support agreement will also consist of Trace generating the quarterly reports for all twelve sources. Trace will download the required data and generate the reports for all 12 sources in our offices and then e-mail the reports to you for review and submission. The support also consists of Trace providing phone and modem support for any questions that arise throughout the year. Finally the support agreement consists of Trace providing the annual Relative Accuracy Test Audit (RATA) and reports. The agreement would include mobilization costs, travel and living expenses and consumable spare parts. Total price is $203,553. We would request as much upstream notice as possible for when the ships will be moored and ready for us to conduct our quarterly work and annual RATA.

Walk-in, Climate Controlled Shelter

In the event that space in not available within the ship(s) to situate the CEM cabinets, Trace can provide the systems in shelters. There would be a single shelter per ship with dimensions of 10' x 20' and the price adder per ship for the shelters would be $60,000.

Should you have any questions, feel free to call.

Jim Toolen
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