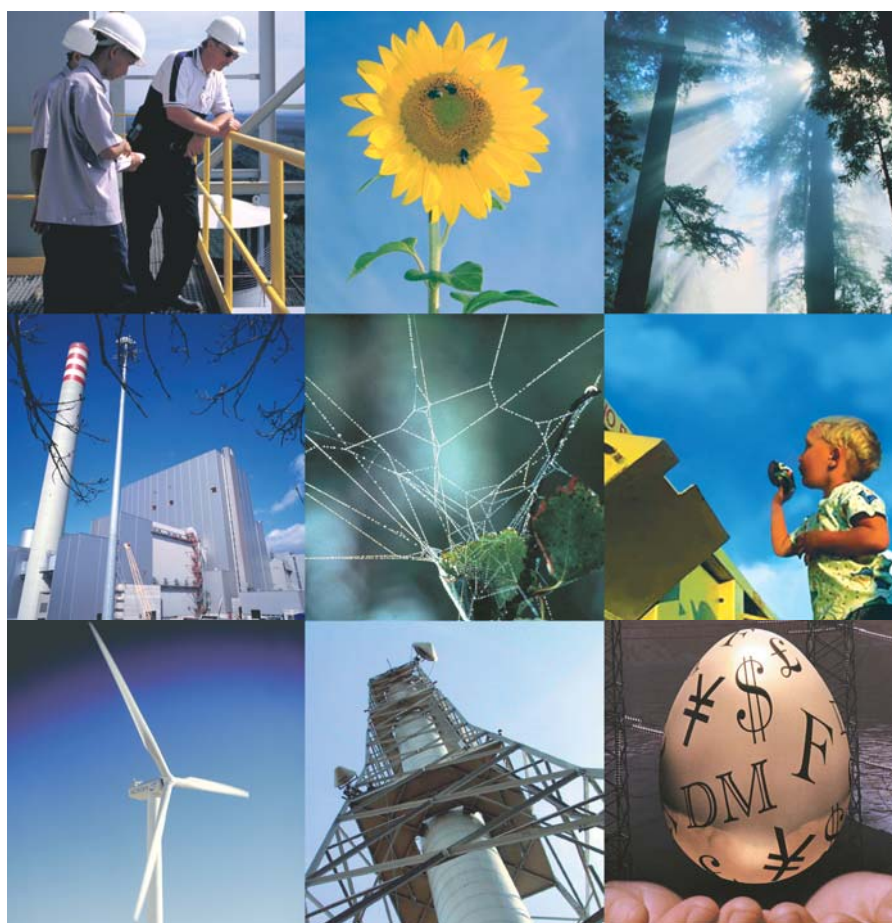


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WÄRTSILÄ FINLAND OY
Delivery Center Ecotech

Local requirements for emission monitoring

July 2011

Summary

The U.S. Environmental Protection Agency (EPA), the EU Council of Environment Ministers and the Japanese Ministry of Environment have passed stringent laws regulating emissions from diesel engines. Environmental agencies and ministries in several countries are developing their own legislation or adopting the U.S., EU or Japanese requirements.

Today diesel generating technology deliver clean, environmentally friendly energy along with its host of traditional attributes such as a proven reliability, high efficiency, operational flexibility and high quality electrical performance. Thus, diesel generators remain the number-one choice for standby and emergency power systems and are chosen for a steadily growing number of utility peaking and distributed generation applications.

Nitrogen oxides (NO_x), sulphur dioxide (SO₂) and particulate matter (PM) emissions are the air emissions of the main interest with respect to stationary diesel engines. SO₂ and PM emissions are mainly related to the quality of the fuel oil. The real challenge in designing a clean diesel engine has involved a trade-off between NO_x and PM emissions.

A questionnaire on the local requirements of emission monitoring was sent to eleven representatives of Wärtsilä offices, which stood for 12 different countries.

Thus, this report summarizes the requirements for emission monitoring at power plants in countries where diesel engines are applied more and more for power generation. The compliance with emission limit values (ELV's) are generally verified either by periodical measurements performed e.g. by a third party (i.e. accredited or certified test laboratory) or in some cases by personnel at power plants. These measurements can take place e.g. annually, very second year or even more seldom.

Another alternative is that the emissions are measured in real time continuously by a CEMS (Continuous Emission Monitoring System). CEMS measurements are obligatory nowadays in big power plants of the U.S. and EU states and are required more and more in developing countries. The quality of these continuous measurements is controlled in the U.S. and the EU states by accredited or certified test laboratories. The rules for the quality control are stated in quality assurance standards.

REPORT

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LOCAL REQUIREMENTS FOR EMISSION MONITORING

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Appendices

1	Questionnaire	7 pages
2	DENDR Administrative No 2007-22 (Philippines)	6 pages
3	The Gazette of India – Part II Sec3 (2002) (India)	3 pages

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TERMS AND DEFINITIONS

Measurement standards

Stationary source emission measurement standards, which are used in verifying the fulfilment of emission limit values (ELV's), are developed by different standardization organisations. Below is described a selection of standard methods.

Selection of standard methods

Standards developed by different organisations vary in the degree of validation work carried out as part of their development. Standards developed and published by CEN are generally accepted as being the most robust. However, other standards are still important, as there are substances that are not, as yet, covered by CEN standards. The choice of the method is often dictated by the requirements of a relevant EC directive, where, for example, the use of the relevant CEN standards is mandatory. If the standard is not dictated by mandatory requirements, then monitoring standards should be used in the following order of priority as given in the European IPPC Bureau's Reference Document on the General Principles of Monitoring:

- Comité Européen de Normalisation (CEN)
- International Standardisation Organisation (ISO)

If the substance cannot be monitored using standards covered by the above, a method can be selected from a national standard, such as the following:

- American Society for Testing and Materials (ASTM);
- Association Francaise de Normalisation (AFNOR);
- British Standards Institution (BSI);
- Deutsches Institut für Normung (DIN);
- United States Environmental Protection Agency (US EPA);
- Verein Deutscher Ingenieure (VDI).

Roles and responsibilities

Normally the operator of a power plant regulated by the Directives has the overall responsibility to comply with the requirements of the National Standards and legislation.

The operator is responsible for organizing the emission monitoring and possible functional tests, according to the requirements of the competent authority.

Automatic measuring system (AMS)

AMS is a measuring system permanently installed on site for continuous monitoring of emissions. The term AMS is commonly used in Europe.

Continuous Emission Monitoring Systems (CEMS)

CEMS is a measuring system permanently installed on site for continuous monitoring of emissions.

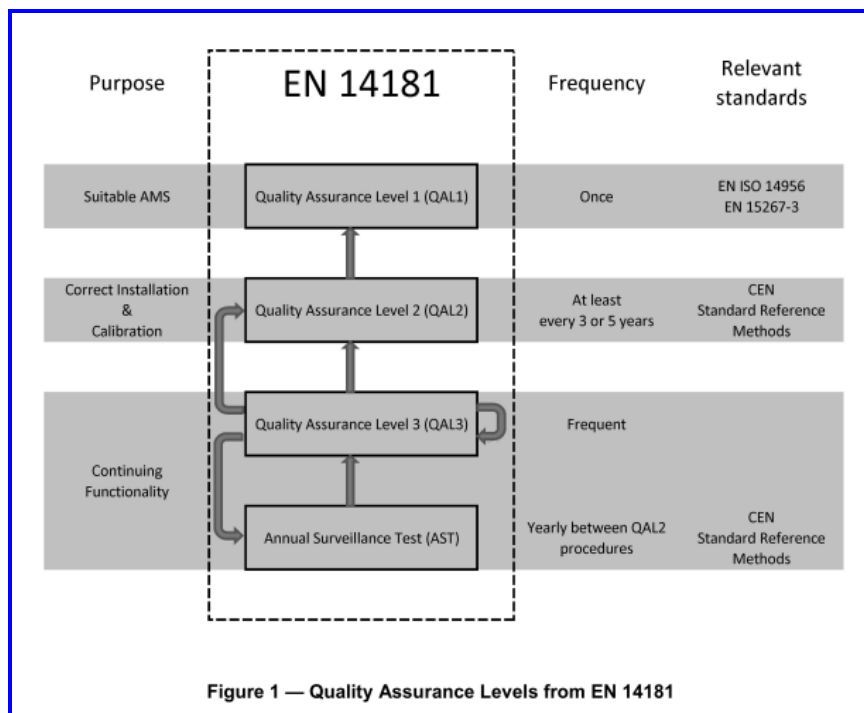
Continuous Opacity Monitoring Systems (COMS)

COMS refers to the equipment used to sample, measure, analyze, and provide, with readings taken at least once every 5 minutes, a permanent record of opacity or transmittance.

Quality Assurance for Continuous Emission Monitoring Systems (CEMS & AMS)

In Europe and the United States large stationary source air emissions are measured continuously by CEMS, the performance of which is audited periodically by an independent test laboratory. In EU in these audits is followed the standard EN 14181 *Stationary source emissions - Quality assurance of automated measuring systems (AMS)*, the structure of which is presented below. It is extracted from the final draft FprCEN/TR 15983:2009 (E) *Stationary source emissions – Guidance on the application of EN 14181:2004*. In the USA these audits (RATA tests) are described in the document US EPA 40 CFR Part 60 (Standards of Performance for New Stationary Sources) Appendix B (Performance Specifications).

In these measurements are applied emission measurement standards, which are mainly prepared for test laboratories and which comprise often the reference measurement methods. Internationally there are three main organisations (ISO, CEN and EPA) that prepare these standards and/or methods.



Components to be monitored continuously vary considerably from plant to plant – depending on the local legislation, the fuel composition and the plant design. In oil fired plants, the following emission limits are typically regulated: SO₂ (Sulphur dioxide), NO_x (Nitrogen oxides), and dust (i.e. particulates). In gas plants the regulated parameters are typically NO_x and sometimes CO.

Competent authority

Organisation which is responsible for implementing environmental policy and legislation.

Emission limit value (ELV)

numerical limit on an emission, which may not be exceeded during one or more periods of time.

Legislation

Directives, Acts, ordinances and regulations.

Monitoring report

Report containing measurement data from continuous emission monitoring systems that is provided for reporting purposes (typically to authorities)

Predictive Emission Monitoring System (PEMS) or Parametric monitoring

Predictive Emission Monitoring System or Parametric monitoring is an alternative approach to analyzer based emission monitoring. PEMS, in contrast to a Continuous Emissions Monitoring System (CEMS), do not use analyzers to measure emissions. PEMS calculate the momentary emissions with an emission model and existing measurements of process parameters.

*PEMS can also mean **Portable Emission Measuring System**, which is temporary installed on site for monitoring of emissions for a short period of time only. In this study PEMS does not refer to a portable analyzer.*

Relative Accuracy Test Method (RATA)

refers to an audit conducted to determine CEMS compliance. Specified by e.g. US EPA 40 CFR Part 60 and Part 75 (Standards of Performance for New Stationary Sources) Appendix B (Performance Specifications).

Standard reference method (SRM)

measurement method recognized by experts and taken as a reference by convention, which gives the accepted reference value of the concentration of the measurand to be measured.

Stationary source

fixed position industrial process from which emissions to the atmosphere are made.

Time-sharing

Time-sharing refers to a single set of analyzers cycling between measuring emissions from multiple stacks and connected to a single data acquisition system.

1 BACKGROUND

Air pollution is posing a threat to the health, quality of life and environment of urban population especially in Asia, but also in America and Europe. Millions of people living in the largest cities are being exposed to levels of air pollution which exceed World Health Organization (WHO) recommended guidelines and national air quality with fine particles (PM₁₀) being the main pollutant of concern.

Diesel engine manufacturers and suppliers of ancillary parts and equipment around the world are facing unprecedented challenges to their industry due to stringent new emission control requirements. These increasingly tough standards are the result of threats to human health. Manufacturers that fail to develop products that meet or exceed these standards will be effectively banned from the international markets in the near future.

The U.S. Environmental Protection Agency (EPA), the EU Council of Environment Ministers and the Japanese Ministry of Environment have passed stringent laws regulating emissions from diesel engines. Environmental agencies and ministries in other countries are developing their own standards or adopting the U.S., EU or Japanese standards. In some cases, international unions or industry associations are also developing emission standards.

Nitrogen oxides (NO_x), sulphur dioxide (SO₂) and particulate matter (PM) emissions are the air emissions of the main interest with respect to stationary diesel engines. SO₂ and PM emissions are mainly related to the quality of the fuel oil. Diesel engines in power industry have low carbon monoxide (CO) and hydrocarbon (HC) emissions.

This report summarizes the requirements for emission monitoring in power plants in countries where diesel engines are applied for power generation. The compliance with emission limit values (ELV's) are generally verified either by periodical tests e.g. by a third party (i.e. accredited or certified test laboratory). These measurements can take place e.g. quarterly, annually or even more seldom. Another alternative is that the emissions are controlled in real time continuously by a CEMS (Continuous Emission Monitoring System). Today CEMS is obligatory in modern big power plants of the U.S. and EU states and required more and more in developing countries. The quality of these continuous measurements is controlled in the U.S. and the EU states by accredited test laboratories. The rules for the quality control in Europe are stated in the quality assurance standards e.g. EN 14181.

This study focuses on national or local requirements for emission monitoring at power plants in the countries selected. Special attention is paid for the promotion of CEMS in different countries.

The questionnaire (Appendix 1) was sent to eleven (11) representatives of Wärtsilä marketing people, which stood for 12 different countries. The answers (totally 8) to the questionnaire were not commensurable due to a wide variety in their contents. The answers provide the interpretation of the local representatives. In some cases, the actual requirements may differ from this. The chapters 2 to 5 of this report summarize the answers.

2 RESULTS OF QUESTIONNAIRE CONCERNING ASIA

2.1 Japan

2.1.1 Emission legislation

Japanese national law for Air Pollution Control Law is found on web side: <http://www.env.go.jp/en/laws/air/air/index.html>. According to Article 5-2 of this law big cities such as Tokyo, Osaka, Yokohama and Kawasaki can require total mass emission control for power plants. This means CEMS, which are arranged to integrate the annual total mass emissions.

These requirements are valid both for new and old power plants in Japan.

2.1.2 Compliance with the current legislation

Emissions are measured by an authorized inspector and reported to the government agencies concerned at plant commissioning. Required measurements for gas engine are normally particulates, NO_x, exhaust gas volume with oxygen and formaldehyde contents.

The emission measurements are carried out periodically, which depends on the city, engine (plant) size etc. Emissions are reported every 2 or 6 months.

2.1.3 CEMS and its quality assurance

National and local legislation do not require CEMS generally, but densely populated areas apply special guidance for plant construction, which strongly recommend CEMS and every party follows to avoid further requirement.

When CEMS are required, there is no need to shut-down the plant, due to relationship of mutual trust.

The gas engine plant in Kawasaki city is sending real time emission data to the city office by telemeter.

No detailed information on quality assurance for CEMS in Japanese power plants is available. It is known that the measurement systems have automatic calibration functions. In case of improper readings plant operator can run the calibration procedure.

2.1.4 Requirements for monitoring system

For the time being no information about PEMS is available. Generally power plants in Japan are using authorized monitoring system such as HORIBA.

2.1.5 Requirements for emission data reporting

In case of Kawasaki city, 34SG emission data is sent to Kawasaki city office (environment dept) by telemeter on-line. If abnormal reading comes, plant operator is

contacted by the city office soon and required to countermeasure. In addition, documentation report is required every 2 months or 6 months.

For the emission report local government has their own format.

2.2 Philippines

Enclosed, Appendix 3, one can find the Administrative no. 2007-22 by Department of Environment and Natural Resources (DENR). It provides *the guidelines on the requirements for the CEMS and other acceptable protocols, thereby modifying and clarifying certain provisions of section 5, Rule X of DAO 2000-81 and other related provisions.*

2.2.1 Emission legislation

The Republic Act No. 8749 known as the “Philippine Clean Air Act of 1999,” and by virtue of Executive Order No. 192, Series of 1987, DENR adopts and promulgates the implementing rules and regulation of this Act.

DENR acts as overall of the lead agency; prepares a National Air Quality Status Report which shall be used as a basis in formulating the Integrated Air Quality Improvement Framework; and also issues rules and regulations in the implementation of the Act.

Under the Clean Air Act Part VII Rule XXV Section 3(a), the major industries are required to install continuous emission monitoring systems (CEMS) for particulates and sulphur dioxide emissions. Among these industries are also both new and old power plants firing fossil fuel over 10 MW rating (including also NO_x).

In pursuance of Section 5 (a)(3) a Rule XXV of DAO 2000-81, new and modified sources, with a potential to emit at least 750 tons/year for each applicable pollutant listed in Section 4, Rule IX of DAO 2000-81 must install a CEMS for that parameter.

Sources exceeding 750 tons/year of particulate must install a COMS for opacity.

2.2.2 CEMS and its quality assurance

The installation of CEMS is part of the Clean Air Act of 1999. Since almost all the Wärtsilä Power Plants were installed prior to the enactment of the Clean Air Act, CEMS were not installed with the exception of Western Mindanao Power Plant - 100 MW and Southern Power Corporation - 50 MW.

WPH has submitted before a proposal for CEMS to Wärtsilä Installation (APO Cement) and non-Wärtsilä installation (United Pulp and Paper Corporation)

2.2.3 Requirements for monitoring systems

So far, the CEMS from OPSIS is acceptable by the DENR and could be the model for the technical requirement. (See Section 6 of the attached DAO)

When CEMS is required, quality assurance and quality control procedures shall comply with 40 CFR Part 60 Appendix F(Quality Assurance Procedures). Each CEMS shall be audited and conducted in accordance to 40 CFR Part 60 Appendix F.

All sources with potential to emit more than 100 tons/year but less than 750 tons/year after the air pollution control installation may utilize a PEMS. Provided that sources with existing CEMS/COMS have the option to continue CEMS/COMS operation or shift to PEMS subject to the approval of the Bureau.

According to the Philippine DENR No 2007-22 section 5, Appendix 3, PEMS can be used, provided that audits and/or calibration of such systems shall be carried out at least annually.

When CEMS is required, time-sharing may be adopted subject to the approval of the Bureau.

File of records shall be maintained for a period of at least five (5) years in permanent form suitable for EMB inspection.

2.2.4 Requirements on Emission Data Reporting

Emissions are reported through Data Acquisition System (DAS) and interfacing with any DENR communicating system.

Owners or operators shall submit a written report for each calendar quarterly to the EMB Central Office and Regional Office. The report shall be part of the Quarterly Self-Monitoring Report (DENR-EMB (see section 6 of the DENR DAO 2007-22).

2.3 Indonesia

2.3.1 Emission legislation

The legislation on the requirements for emission limits and monitoring are defined in the Regulation No 21, 2008, by the Environment Minister of Indonesia.

The rules are for all new stationary power plants and for old stationary power plants, only if required by EIA (> 25 MW Power Plant)

2.3.2 Compliance with the current legislation

The emissions are measured by an independent third party at least once a year. The results of these emission measurements are reported to authorities. These emission controls are carried out for all fossil fuel plants.

Normally no continuous emission monitoring systems (CEMS) are required. CEMS is required only for some more tight requirements (if required by EIA)

- if old power plant only applied by PP above 25 MW
- New power plant: for all PP if the sulphur content in fuel is above 2 %.

2.3.3 CEMS and its quality assurance

There is no CEMS installed in Wärtsilä plants in Indonesia.

The emission measurements are normally carried out by an independent third party such as Sucofindo or Jasa Certificasi.

2.3.4 Requirements for monitoring systems

There are no technical requirements on the type of monitoring systems to be used in Indonesia. Nothing is regulated on PEMS or time-sharing of analyzers.

2.3.5 Requirements on Emission Data Reporting

Emissions are reported to Regent/mayors, cc. to governors and DoE every 6 months in case of no CEMS. In case of CEMS this reporting takes place quarterly.

The emissions are reported as tonnes per year divided by total KW produced. The plant reports the emissions in a standard format

2.4 Bangladesh

Bangladesh environmental guidelines are still in an unclear shape, but the issues are being debated more & more, and naturally the authorities have begun to wake up.

2.4.1 Emission legislation

The requirements for emission limits and monitoring are defined in the Environment Conservation Rules, 1997. These rules are both for new and old power plants.

2.4.2 Compliance with the current legislation

Emission report is required to be submitted to the Department of Environment (DoE) during plant commissioning for obtaining the clearance.

Required emissions are particulates, NO_x, SO₂ and CO.

DoE issues clearance valid for one year based on the satisfactory report on emission tests carried out annually by a third party and occasionally witnessed by DoE inspectors.

CEMS is not normally required but in case CEMS is installed it has to be agreed with DoE. For example, in the Khulna Plant (110 MW) emissions in stack are measured once a year.

2.4.3 CEMS and its quality assurance

No CEMS has been installed in Wärtsilä plants in Bangladesh. But lately Wärtsilä Bangladesh has got queries from some entrepreneurs on this since environmental issues which have been raised more and more in public forums in Bangladesh.

CEMS is not a requirement in Bangladesh. Stack emission tests are carried out annually by a third party. Emission result is being compared with the World Bank guidelines.

2.4.4 Requirements for monitoring systems

No technical requirements on type of emission monitoring systems are defined in Bangladesh.

2.4.5 Requirements on Emission Data Reporting

Environment monitoring report as a hard copy is submitted quarterly or annually to the local DoE by the plant owners. The reporting frequency is agreed upon with DoE.

Safety & Environment officer or Plant manager of O&M is responsible for implementing policy and legislation.

Emission data reported covers the emissions for NO_x, SO₂ and PM in mg/Nm³ at 15 % O₂ is reported.

Yearly stack emission report is submitted to DoE as per the format of the third party that has carried out the stack emission testing.

3 RESULTS OF QUESTIONNAIRE CONCERNING BRAZIL

3.1 Emission legislation

The requirements for emission limits and monitoring are defined by the National Environmental Council (= Concelho Nacional do Meio Ambiente i.e. CONAMA)

The rules for new stationary power plants are defined in the CONAMA 382/06, 05/89, 03/90 and 08/90 and the rules for old stationary power plants are presented in the CONAMA 382/06, 05/89, 03/90 and 08/90.

3.2 Compliance with the current legislation

During the performance test of the plant, emission measurements are carried out and they are reported to the local authorities.

Required emissions are Particulates, NO_x, SO₂ and CO.

In base-load cases annual measurements are run. For the stand-by plants it depends on the annual dispatch, this is analyzed case-by-case by the local authorities. These measurements are done by a third party that has to be registered in the local environmental authority.

No CEMS is required.

3.3 CEMS and its quality assurance

Case-by-case emission models are done and until now it has not been requested any CEMS. Probably, in the future CEMS will be required.

3.4 Requirements for monitoring systems

There is no CEMS required, only periodic measurements. The system to be applied is case-by-case.

PEMS is an optional monitoring system but is not used in Wärtsilä plants.

Time-sharing of analyzers is not applicable.

The emission reports are written by a third party company.

3.5 Requirements on Emission Data Reporting

The demands concerning emissions reported are not applicable.

4 RESULTS OF QUESTIONNAIRE CONCERNING INDIA AND PAKISTAN

4.1 India

4.1.1 Emission legislation

The central Environmental Protection Agency, which is mandated by the Ministry of Environment and Forest, is responsible for the emission regulations (Environment Protection Third Amendment Rules, 2002) (Appendix 4)

The rules are for new stationary power plants. For old stationary power plants only for Diesel engine based power plants but not for gas based power plants.

For Gas based power plants the EPA Notification (India) is GSR 7 dated 22.12.1998.

For Diesel Engines (engine rating more than 800 kW) for Power plant, Generator set applications and other requirements the Notification no. GSR 489 (E) dated 9th Jul 2002, effective from 1st July 2005.

The required emissions are particulates, NO_x, SO₂ CO and NMCH (non-methane hydrocarbon). The analyzing methods to be adapted are also given in the rules.

According to the regulations the standards are regulated by the State Pollution Control Boards or Pollution Control Committees, as the case may be.

4.1.2 Compliance with the current legislation

Observe the notes below on compliance with the emission limits verified:

- Liquid fuel engines: For plants > 50 MWe plant capacity the continuous emission monitoring equipment for NO_x emissions is required.

- Gas fuel engines: There are no written guidelines for continuous emission monitoring, but the State Environment Assessment committee, generally recommends the continuous emission monitoring equipments for measuring NO_x for plants > 25 MWe.

- It is mandatory for the project proponent to report the NO_x, CO and Oxygen content in the emissions once in every 6 months. Also the environment legislation also require the noise and ash (PM_{2.5} and PM₁₀) to be reported twice in year at the plant boundaries.

According to the regulations monitoring should take place at least once in six months for other parameters than NO_x.

4.1.3 CEMS and its quality assurance

Recently for 25 MWe gas based power plant at Bawal, the CEMS was requested by the committee, for which a request to reconsider has been given by Wärtsilä India.

For Maruti Suzuki India Ltd (1x16V34DF), customer has ordered CEMS for NO_x, CO and O₂ measuring equipment.

No requirements on the quality assurance system for CEM are defined.

4.1.4 Requirements for monitoring systems

The measurement methods and the typical analysers are mentioned in the G.S.R. 489(E) dated on July 9, 2002.

Generally the plants in India report mandatorily the emissions once in 6 months to the local authorities.

No requirements on PEMS or on time sharing of analyzers.

It can be stand-alone equipment. Data acquisition systems, will be looked upon as the additional features and an added UPS.

4.1.5 Requirements on Emission Data Reporting

Emissions are reported twice a year to the local District Pollution control office. The emissions are given as daily averages and presented in the prescribed formats.

4.2 Pakistan

There is not much interest in emission measurements in Pakistan at present; either legal, commercial or value based. However, there is a move towards stricter legislation. It is not possible to predict what they will use to benchmark. There is a US interest in Pakistan's energy sector rehabilitation. It is possible that they demand adherence to their EPA limits and standards¹⁾.

¹⁾ CEMS systems have delivered to recent big Wärtsilä diesel power plants.

4.2.1 Emission legislation

The requirements for emission limits and monitoring are defined in Pak-EPA Act 1997 (Pakistan Environmental Protection Act, 1997).

The Pakistan Environmental Protection Agency issued Environmental Assessment Guideline package in 1997 which included both general and sectoral guidelines. The EIA (Environmental Impact Assessment)/IEE (Initial Environmental Examination) regulations were issued in the year 2000. The category of projects for which an IEE or EIA is mandatory has been issued in the Regulations.

Pak-EPA has a Central Laboratory for Environmental Analysis & Networking (CLEAN), which is equipped with state-of-the-art computerized analytical equipment. Continuous air quality monitoring is being done by fixed and mobile stations installed by CLEAN. Stack Emission Monitoring Vans are used for monitoring of industrial emission of industries located close to Islamabad. National Surveillance Center has been established at CLEAN to collect data from Federal and Provincial EPAs and to generate daily reports and Air Quality Index.

Self Monitoring and Reporting Programme (SMART) was launched on National basis in March 2006 in order to gather and evaluate industry's environmental performance. About 120 industries have registered under SMART.

Pak-EPA has established a Green Library & Documentation Center to provide technical support to its staff and information to general public. The types of power plants (old or new) are not described in detail in the Pak-EPA Act 1997.

4.2.2 Compliance with the current legislation

The emission limits are verified by SMART Software and reported to Pak-EPA.

Continuous emission monitoring systems (CEMS) are preferred but not compulsory.

4.2.3 CEMS and its quality assurance

Verification of emission measurements are carried out by EPA on yearly/need basis. The measurements are handled by trained & qualified plant personnel.

4.2.4 Requirements for monitoring systems

Measurement method or specific types of analyzers recommended are Honeywell or GE, GHG Emission Monitoring System.

4.2.5 Requirements on Emission Data Reporting

The emission report will be sent monthly to the Director General Pak-EPA

Safety & Environment officer or Plant manager of O&M is responsible for implementing policy and legislation.

Data required for the reports are mentioned online in SMART Software, it is not a free format.

5 RESULTS OF QUESTIONNAIRE CONCERNING TURKEY

5.1 Emission legislation

The requirements for emission limits and monitoring are defined in the Industrial Air Pollution Source Control Regulations, which can be found:

Official Gazette Date : 03.07.2009 Number : 27277

(<http://www.cmo.org.tr/index.php/ulusal-cevre-mevzuat/yoenetmelikler/1165-sanayi-kaynakli-hava-kirliligi-yonetmelik>)

Official Gazette Date : 17.07.2008 Number : 26939 Regulation : EIA Regulation

Official Gazette Date : 08.06.2010 Number : 27605 Regulation : Regulation about some plants (not incl. Engines)

CEMS regulation is a draft at the moment. Opinions are accepted from related web site http://www.aso.org.tr/b2b/haber/haberoku.php?haber_no=2362

5.2 Compliance with the current legislation

Compliance with the emission limits are verified in the regulations mentioned.

Application will be done due to legislation of EIA to governorship (province) and site is visited by authorized commission members

CEMS are not mandatory. But if CEM system is installed and it fails for more than 10 days in a year, then some action has to be taken in order to improve it. Penalties have to be paid due to regulations.

5.3 CEMS and its quality assurance

No CEMS has been installed in Wärtsilä plants in Turkey. If CEMS is a requirement, the quality assurance system is TS EN 14181. A third party will be responsible for the emission measurements.

5.4 Requirements for monitoring systems

Are there any technical requirements on the type of monitoring systems to be used?

Measurement method or specific types of analyzers are mentioned in the regulations.

Five (5) years back up of the emission data is needed according to the regulations.

5.5 Requirements on Emission Data Reporting

The emissions reports will be sent on-line, monthly or yearly to the Province and Environmental Ministry

The emissions reported cover the yearly total SO₂, NO_x & total particle materials as dust and biomass other solid fuels, liquid fuels, natural gas and other gases in five fuel categories calculated from LHV yearly energy input.

The formats for the emission reports are defined by the Ministry.

6 SUMMARY ON RESULTS OF QUESTIONNAIRE

The answers to the questionnaire sent to eleven (11) representatives of Wärtsilä marketing people revealed that continuous emission monitoring systems (CEMS) are seldom required even at new power plants outside Europe and North America (table 1).

Table 1. Legislation, period of emission measurements and requirements of CEMS

Country	State of Legislation	Periodic Measurements	CEMS required
Japan	Air Pollution Control Law in internet: for both old and new power plants	every 2 or 6 month (varies locally) by an independent third party	not required but strongly recommended
Philippines	Clean Air Act of 1999 (DENR). for both old and new power plants	at least once a year by an independent third party	for new fossil-fired power plants over 10 MW
Indonesia	Env. Minister Reg. nr 21 (2008) for all new plants and for old plant only if EIA > 25 MW)	without CEMS every 6 months and with CEMS quarterly	not normally required
Bangladesh	Env. Conservation Rules (1997) for both new and old plants	Annually by an independent third party	not required
Brazil	CONOMAs (1989, 1990 and 2006) for both old and new power plants	Annually by an independent third party	not required
India	Env. Protection Third Amendment Rules (2002) for new power plants (diesel engines rating > 800 kW) and for old (not for gas based) power plants	Every 6 month	not required
Pakistan	Pakistan EPA Act 1997	Not known	not required
Turkey	Air Pollution Source Control Regulations (2009) in internet	Not known	not required

Because the answers of the questionnaire had a wide variety in the contents, the answers were not commensurable. Only a few answers mentioned the acceptance of time-sharing in measuring the emission data from different sources simultaneously (table 2).

Table 2. CEMS in use at Wärtsilä plants, quality for CEMS, time sharing for analyzers and period of emission reporting.

Country	CEMS in use at Wärtsilä plants	Quality for CEMS	Time sharing	Period of Reporting
Japan	at gas engine plant of Kawasaki (emission data on- line to city authority)	Not known	Not known	every 2 or 6 months
Philippines	- Western Mindanao Power Plant (100 MW) - Southern Power Corp. (50 MW)	PEMS should follow 40 CFR Part 60 Appendix F	with CEMS can be adopted	Quarterly
Indonesia	Not known	Not known	No	without CEMS every 6 months and with CEMS quarterly
Bangladesh	No installations	Not known	Not known	Annually
Brazil	No installations	Not known	Not known	Annually
India	A request for CEMS at Bawal power plant	Not known	Not known	Every 6 month
Pakistan	CEMS systems have been delivered to recent big power plants.	Not known	Not known	Not known
Turkey	No installations	Not known	Not known	Not known

Diesel generating technology can today deliver clean and environmentally friendly energy along with its host of traditional attributes such as a proven reliability, low life-cycle cost, high efficiency and ready availability. Therefore, diesel generators remain the number-one choice for standby and emergency power systems. The real challenge in designing a clean diesel engine has involved a trade-off between NO_x and PM emissions which are linked by combustion temperatures.

Development work on monitoring and removing air emissions from stationary sources will most probably become even more active in the near future. This stimulated R&D work on emission control of diesel engines will be based on the increasing awareness on emission control and healthy problems globally. The new requirements on emission control even in rural areas will be similar to the ones of urban requirements.

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APPENDIX 1

Questionnaire (7 pages)



Title: Emission Monitoring Study Doc.ID: DBAB628407

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Industrial Operations

Project : Error! Unknown document property name. – Error! Unknown document property name.

Emission_Monitoring_Study.docx

LOCAL / DOMESTIC REQUIREMENTS ON EMISSION MONITORING

EXHAUST EMISSION LEGISLATION IN GENERAL

- 1) Name of the legislation in which the requirements for emission limits and monitoring are defined? Are there rules for:
 - a) new stationary power plants?
 - b) old stationary power plants?

COMPLIANCE WITH THE CURRENT LEGISLATION

- 2) How is compliance with the emission limits verified?
 - a) As per suppliers guarantee only?
 - i) no verification at all of guarantee value?
 - ii) emission measurements at plant commissioning and report to authorities?
 - b) By periodic measurements? (For example annual measurements performed by a third party)
How often?
 - c) Using continuous emission monitoring system (CEMS)?
 - d) If CEMS is required, what are the consequences if the system fails?
 - i) Shut-down of plant until fixed?
 - ii) A time-frame to fix
 - iii) Other?
- 3) Has CEMS (Continuous Emission Monitoring Systems) been requested /installed in Wärtsilä plants in your area?

QUALITY ASSURANCE SYSTEMS FOR CEMS

- 4) If CEMS is a requirement, is there a quality assurance system, such as EN 14181 in Europe? (see TERMS AND DEFINITIONS)
 - a) The quality systems typically mean that the measurements by the CEMS need to be verified by comparison to reference test methods at installation and at regular intervals. How is this handled here?
 - b) If there is such a system, is there a requirement that this is handled by an independent third party, or can it be handled by plant's own personnel?

REQUIREMENTS FOR MONITORING SYSTEM

- 5) Are there any technical requirements on the type of monitoring systems to be used?
 - a) Measurement method or specific type of analyzer recommended?
 - b) Is PEMS (Parametric/Predictive Emission Monitoring System) an accepted way of monitoring emissions?

- PEMS in this case means a Parametric Emission Monitoring System, in which main process parameters followed in-real-time will be utilized for the calculation of the emission data verified. This kind of verification on exhaust emissions has been used in the United States more and more in recent years. In Europe it is still on the way.

- c) Is time-sharing of analyzers an accepted way of providing cost efficient monitoring?
- d) Are there any requirements on the data acquisition system, such as back-up storage, logging frequency, integrated to automation system vs. stand-alone?

REQUIREMENTS ON EMISSION DATA REPORTING

6) How are emissions reported?

a) To whom are the results from the continuous monitoring reported?

who is the competent authority who is responsible for implementing environmental policy and legislation?

b) Reporting frequency?

On-line, every month, once a year or once in two/ three/ five years ?

c) What kind of data is reported?

(e.g. Daily averages, tonnes per month, how is non-compliance reported, ...)?

Can the plant report the emissions in a free format, or are there strict specifications?

TERMS AND DEFINITIONS

Selection of standard methods

Standards developed by different organisations vary in the degree of validation work carried out as part of their development. Standards developed and published by CEN are generally accepted as being the most robust. However, other standards are still important, as there are substances that are not, as yet, covered by CEN standards. The choice of the method is often dictated by the requirements of a relevant EC directive, where, for example, the use of the relevant CEN standards is mandatory. If the standard is not dictated by mandatory requirements, then monitoring standards should be used in the following order of priority as given in the European IPPC Bureau's Reference Document on the General Principles of Monitoring:

- Comité Européen de Normalisation (CEN)
- International Standardisation Organisation (ISO)

If the substance cannot be monitored using standards covered by the above, a method can be selected from a national standard, such as the following:

- American Society for Testing and Materials (ASTM);
- Association Francaise de Normalisation (AFNOR);
- British Standards Institution (BSI);
- Deutsches Institut für Normung (DIN);
- United States Environmental Protection Agency (US EPA);
- Verein Deutscher Ingenieure (VDI).

Roles and responsibilities

Normally the operator of an industrial plant regulated by the Directives has the overall responsibility to comply with the requirements of the National Standards.

The operator is responsible for organizing the functional tests, according to the requirements of the competent authority.

Automatic measuring system (AMS)

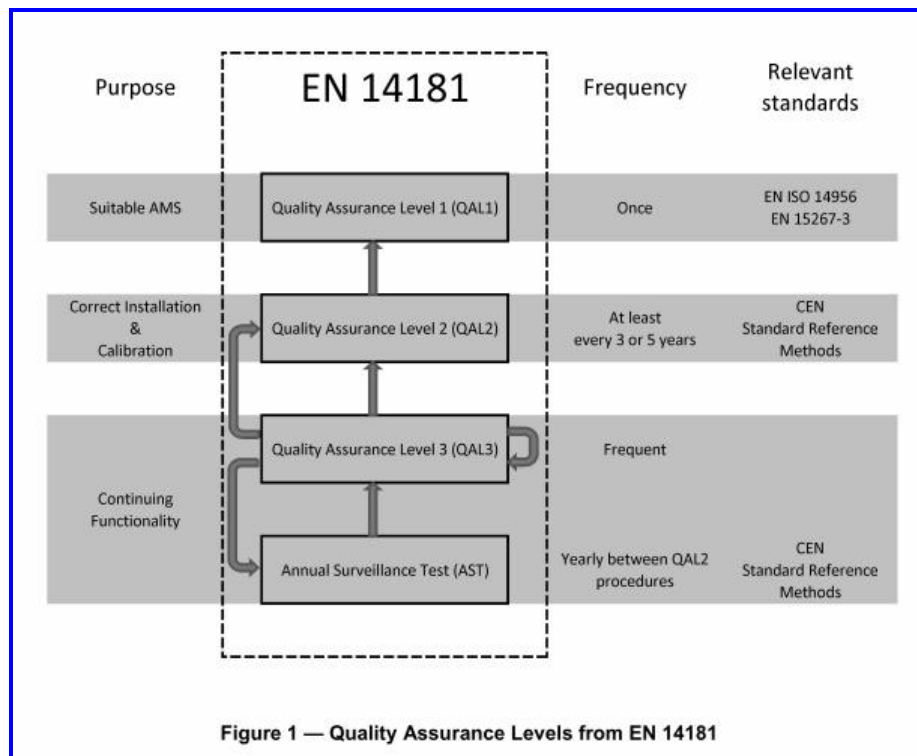
AMS is a measuring system permanently installed on site for continuous monitoring of emissions. The term AMS is commonly used in Europe.

Continuous Emission Monitoring Systems (CEMS)

CEMS is a measuring system permanently installed on site for continuous monitoring of emissions.

Quality Assurance for Continuous Emission Monitoring Systems (CEMS & AMS)

In Europe and the United States large stationary source air emissions are measured continuously by CEMS, the performance of which is audited periodically by an independent test laboratory. In these measurements are applied emission measurement standards which are mainly prepared for test laboratories and which comprise often the reference measurement methods. Internationally there are three main organisations (ISO, CEN and EPA) that prepare these standards and/or methods.



Both the components included in the emission guarantees and the guaranteed measured values vary considerably from plant to plant – depending on the local legislation, the fuel composition and the plant design. In oil fired plants, the following emission limits are typically guaranteed: SO₂ (Sulphur dioxide), NO_x (Nitrogen oxides), and dust (i.e. particulates). In gas plants the guarantee parameters are typically NO_x and sometimes CO.

Competent authority

Organisation which is responsible for implementing environmental policy and legislation.

Emission limit value (ELV)

numerical limit on an emission, which may not be exceeded during one or more periods of time.

Legislation

Directives, Acts, ordinances and regulations.

Measured value

estimated value of the air quality characteristics derived from an output signal; this usually involves calculations related to the calibration process and conversion to required quantities.

Monitoring report

Report containing measurement data from continuous emission monitoring systems that is provided for reporting purposes (typically to authorities)

(PEMS)

Parameter or Predictive Emission Monitoring System is an alternative approach to analyzer based emission monitoring. PEMS, in contrast to a Continuous Emissions Monitoring System (CEMS), do not use analyzers to measure emissions. PEMS calculate the momentary emissions with an emission model and existing measurements of process parameters.

Can also mean Portable Emission Measuring System, which is temporary installed on site for monitoring of emissions for a short period of time only. In this study PEMS does not refer to a portable analyzer.

Standard reference method (SRM)

measurement method recognized by experts and taken as a reference by convention, which gives the accepted reference value of the concentration of the measurand to be measured.

Stationary source

fixed position industrial process from which emissions to the atmosphere are made.

Time-sharing

A solution where one analyzer monitors several stacks in an automatically controlled sequence.

APPENDIX 2

DENDR Administrative No 2007-22 (Philippines) (6 pages)



JUL 31 2007

DENR ADMINISTRATIVE NO. 2007-22
Series of 2007

SUBJECT : GUIDELINES ON THE REQUIREMENTS FOR CONTINUOUS EMISSION MONITORING SYSTEMS (CEMS) AND OTHER ACCEPTABLE PROTOCOLS, THEREBY MODIFYING AND CLARIFYING CERTAIN PROVISIONS OF SECTION 5, RULE X OF DAO 2000-81 AND OTHER RELATED PROVISIONS

Section 1: Preamble

Section 5, Rule X and Section 5(a)(3) of Rule XXV of the Implementing Rules and Regulations of Republic Act No. 8749 (DAO 2000-81) requiring Continuous Emission Monitoring Systems (CEMS) for stationary sources, is hereby clarified and modified to allow the use of parametric or predictive methods approved by EMB and for the installation (if required) of the same, and for operation and data reporting thereof.

Section 2: Definition

Refer to Republic Act No. 8749 and DAO 2000-81 for all other terms not defined herein.

- 1) "Air Pollution Source" refers to any plant, equipment or installation in any trade, business or establishment which generates, emits or disposes air emissions.
- 2) "Air Pollution Control Installation" refers to any equipment, facility, device or other means which effectively prevents or reduces emissions.
- 3) "Alternative Method for Audit" refers to a CEMS or a system quarterly audit, which is specified in the Performance Specifications for each pollutant. The alternative audit shall be subject to approval by the Bureau.
- 4) "Alternative Monitoring System" refers to a system or a component of a system designed to provide direct or indirect data of mass emissions per time period, pollutant concentrations or volumetric flow as having the same precision, reliability, accessibility and timeliness as the data provided by a certified CEMS or certified CEMS component. As used in this definition "system" may refer to a procedure, protocol or program.
- 5) "Calendar Quarter" refers to any of the following four time periods during each year: January 1 to March 31; April 1 to June 30; July 1 to September 30; and October 1 to December 31. *APK*

- 6) "Capacity Factor" refers to either the ratio of the unit's actual output times the actual annual hours of operation to the unit's name plate capacity times 8,760 hours; or the ratio of a unit's annual heat input times the actual annual hours of operation to the unit's maximum design heat input times 8,760 hours.
- 7) "Continuous Emissions Monitoring System" (CEMS) refers to the equipment stipulated in the DAO 2000-81 used to sample, analyze, measure, and provide, by any means of readings recorded at least once every 15 minutes (using an automated data acquisition and handling system), a permanent record of relevant regulated pollutant emissions or stack gas volumetric flow rate.
- 8) "MSMEs" refer to Micro, Small, Medium Enterprises as defined by the Philippine law.
- 9) "Parametric Emission Monitoring System" refers to a mathematical model that predicts the gas concentration in a stack based on a set of operating data such as but not limited to fuel flow rate, temperature, stack excess oxygen, pressure, heat input, fuel analysis and others without requiring the CEMS specified under USEPA 40 CFR Part 60 Appendix B or equivalent.
- 10) "Predictive Emission Monitoring System" refers to a system that determines the gas concentration or mass emission rate based on process data and generates an output proportional to the gas concentration or emission rate without requiring the CEMS specified under USEPA 40 CFR Part 60 Appendix B or equivalent.
- 11) "Continuous Opacity Monitoring System" (COMS) refers to the equipment used to sample, measure, analyze, and provide, with readings taken at least once every 5 minutes, a permanent record of opacity or transmittance. The following components are included in the continuous opacity monitoring system: opacity monitor and an automated data acquisition and handling system.
- 12) "Discharger" refers to owner or person having charge, management or control of a facility to which this Order applies.
- 13) "Emissions" refers to air pollutants exhausted from a unit or source into the atmosphere, as measured, recorded, and reported to the Department by the designated representative and as determined by the Department through the Bureau, in accordance with the submission of self monitoring reports.
- 14) "Peaking Unit" refers to:
 1. a unit that has an average capacity factor of not more than 10 percent during the previous three calendar years and a capacity factor of not more than 20 percent in each of those calendar years;
 2. for purposes of this Order, a unit may initially qualify as a peaking unit provided it must meet the criteria in paragraph (1) of this definition each year in order to continue to qualify as a peaking unit. If such unit fails to meet such criteria for a given year, the unit no longer qualifies as a peaking unit starting January 1 after the year for which the criteria were not met. If a unit failing to meet the

criteria in paragraph 1 of this definition initially qualified as a peaking unit under this definition, the unit may qualify as a peaking unit for a subsequent year only if the designated representative submits the data required to demonstrate to the satisfaction of the Department that the paragraph (1) of this definition are met, or will in the future be met, through one of the following submissions:

- a) projected production output; or
- b) projected energy requirement in case of fossil fuel-fired power plants.

15) "Relative Accuracy Test Audit" (RATA) refers to an annual audit conducted to determine CEMS compliance to Section 6 (h) of this Order.

16) "Time-sharing" refers to a single set of analyzers cycling between measuring emissions from multiple stacks and connected to a single data acquisition system.

Section 3. Coverage

A. CEMS and COMS

1). Pursuant to Section 5 (a) (3) of Rule XXV of DAO 2000-81, the existing major industries with individual sources having the potential to emit at least 750 tons/year any of the regulated pollutants listed Section 4 of Rule IX of DAO 2000-81 measured after a pollution control installation are required to install continuous emissions monitoring system (CEMS) and continuous opacity monitoring system (COMS).

Sources exceeding 750 tons/year of particulate matter must install a COMS for opacity. The opacity measurements shall not exceed the applicable standard of 20% as measured by COMS averaged over a rolling six-minute period subject to the exceptions stated in Section 2 (b) of Rule XXV of DAO 2000-81.

2) New and modified sources, with a potential to emit at least 750 tons per year for each applicable pollutant listed in Section 4, Rule IX of DAO 2000-81 must install a CEMS for that parameter.

3) Industries engaged in emission trading or averaging are required to install CEMS for that parameter.

B. Predictive or Parametric Emissions Monitoring System (PEMS)

1) All sources with potential to emit more than 100 tons/year but less than 750 tons after the air pollution control installation may utilize a PEMS. Provided that sources with existing CEMS/COMS have the option to continue CEMS/COMS operation or shift to PEMS subject to the approval of the Bureau.

Section 4. Exemptions

The following air emission sources/facilities are exempted from Section 3 (A) and (B):

1. Standby, emergency, seasonal, and intermittently operating facilities that operate less than 500 hours per year. Provided that

these sources may be subject to third party monitoring or other means as approved by EMB. Considerations shall be afforded to MSMEs.

2. MSME facilities or support facilities that are dedicated to the operation of such MSMEs such as but not limited to own-power generating plant.
3. Refinery flares, as well as flares for volatile organic compounds, unless a specific provision requires CEMS or an alternate System for volatile organic compounds is required by EMB-Central Office and/or its Regional Offices, under certain circumstances that warrants its installation and operation.

Section 5: Criteria or Specifications When CEMS/COMS is Required

The requirements and criteria or specifications for CEMS when required and for each applicable pollutant emitted by a given source shall apply, but not limited to the following:

Pollutant	Criteria or Specifications
Opacity	USEPA 40 CFR Part 60 Appendix B, Performance Specification 1
Sulfur Oxides and Nitrogen Oxides	USEPA 40 CFR Part 60 Appendix B, Performance Specification 2
Carbon Dioxide and Oxygen	USEPA 40 CFR Part 60 Appendix B, Performance Specification 3
Carbon Monoxide	USEPA 40 CFR Part 60 Appendix B, Performance Specification 4 or 4A
Hydrogen Sulfide	USEPA 40 CFR Part 60 Appendix B, Performance Specification 7

Predictive or Parametric emissions monitoring systems can be used, provided that audits and/or calibration of such system shall be carried at least annually. The audit procedures for the PEMS are subject to approval of the Bureau.

Section 6. Installation of CEMS When Required

For purpose of this Order, the following requirements shall apply:

- 1) Installation and operation of CEMS/COMS for each applicable pollutant shall meet the criteria or specifications provided Section 5 hereof. Any deviation shall be subject to approval by the Bureau. Prior to installation of CEMS/COMS, the following shall be submitted to the Bureau:
 - a) Site location of the sampling port;
 - b) Technical description of the monitoring instrument (design specifications, sampling probe, conditioning system, softwares, flow rate measurement etc.);
 - c) Description of the data acquisition systems (DAS). It may be as flexible as needed depending on the availability and capability of the owner or operator. Capable of interfacing with any DENR communication system;

MP

- d) Information and drawings with regard to monitor specifications;
 - e) Brochures and operations manual;
 - f) A schedule of testing for certification of the system; and
 - g) Quality assurance and quality control plan (as described in 40 CFR Part 60 Appendix F).
- 2) All owners or operators of existing systems already in place prior to the promulgation of DAO 2000-81 and the issuance of this Order, shall configure these systems that do not meet the criteria in Section 5 hereof within 2 years from the approved of this DAO subject to agreement by the Bureau and the operator (or discharger) to conform and meet such criteria or specifications.
 - 3) Where several units whose emissions are discharged to the atmosphere through a single stack, a single CEMS or an acceptable equivalent system may be installed on that stack provided that by the use of relevant operating parameters, the unit specific emissions can be apportioned respectively.
 - 4) When CEMS is required, time-sharing may be adopted subject to the approval of the Bureau.
 - 5) When CEMS is required, quality assurance and quality control procedures shall comply with 40 CFR Part 60 Appendix F (Quality Assurance Procedures). Each CEMS shall be audited and conducted in accordance to 40 CFR Part 60 Appendix F.
 - 6) Relative Accuracy Test Audit (RATA) must be performed annually by industries in the presence of EMB personnel. A thirty (30) day notice should be presented to EMB prior to the conduct of audit.
 - 7) Calibration gases shall be subject to audit or relative accuracy audit test every quarter. Other alternative quarterly audits may be used as approved by EMB.
 - 8) The discharger shall notify the Bureau if any changes are made to any part of the CEM system, including its Quality Assurance and Quality Control Plan.
 - 9) The Director and the Regional Director shall be notified of any CEMS malfunction that lasts longer than seven (7) consecutive days.

Section 7. File of Records

Owners or operators subject to the provisions of DAO 2000-81 shall maintain for a period of at least five (5) years a record in permanent form suitable for EMB inspection. The record shall be made available upon EMB request and shall include the following:

1. occurrence and duration of any start-up, shut-down or malfunction in the operation of any source or control facility; and



- audits, performance testing, evaluations, calibration checks, adjustments and maintenance of any continuous emission monitors that have been installed pursuant to Rule IX Section 5 of DAO 2000-81.

Section 8. Reporting

Owners or operators shall submit a written report for each calendar quarter to the EMB Central Office and Regional Office. The report shall be part of the Quarterly Self-Monitoring Report and is due on the 15th day following the end of the calendar quarter and shall include the following:

- time intervals, date and magnitude of excess emissions, nature and cause of the excess, corrective actions taken and preventive measures adopted.
- averaging period used for data reporting corresponding to the averaging period specified in the emission test period used to determine compliance with an emission standard for the pollutant/source category in question.
- time and date for each period during which the continuous monitoring system was inoperative and the nature of system repairs and adjustments, in cases CEMS/COMS is required.
- the measurements shall comply with at least 75% data capture rate to become valid.

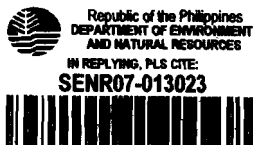
Section 9. Separability Clause

All orders, circulars and instructions inconsistent herewith are hereby repealed or amended accordingly.

Section 10. Effectivity

This Order shall take effect fifteen (15) days from the date of its publication in at least two newspapers of general circulation.


ANGELO T. REYES
Secretary



Publication: The Manila Times
August 6, 2007
The Philippine Star
August 6, 2007
Registration: UP Law Center
August 6, 2007

APPENDIX 3

The Gazette of India – Part II Sec 3 (2002) (India) (3 pages)

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 9th July, 2002

G.S.R. 489(E).— In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely :-

- 1 (1) These rules may be called the Environment (Protection) Third Amendment Rules, 2002.
- (2) They shall come into force on the date of their publication in the Official Gazette.
2. In the Environment (Protection) Rules, 1986, in Schedule I, after serial number 95 relating to Emission Limits for New Diesel Engines (up to 800 KW) for Generator Sets (Gensets) Applications and the entries relating thereto, the following serial number and entries shall be inserted, namely :-

"96 EMISSION STANDARDS FOR DIESEL ENGINES (ENGINE RATING MORE THAN 0.8 MW (800 KW) FOR POWER PLANT , GENERATOR SET APPLICATIONS AND OTHER REQUIREMENTS

TABLE

Parameter	Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Generator sets commissioning date		
			Before 1.7.2003	Between 1.7.2003 and 1.7.2005	On or after 1.7.2005
NO _x (as NO ₂) (AT 15% O ₂), dry basis, in ppmv	A	Upto 75 MW		970	710
	B	Upto 150 MW			
	A	More than 75 MW	1100	710	360
	B	More than 150 MW			
NMHC (as C) (at 15% O ₂), mg/Nm ³	Both A and B		150	100	
PM (at 15% O ₂), mg/Nm ³	Diesel Fuels - HSD & LDO		75	75	
	Furnace Oils-LSHS & FO	Both A and B	150		100

(1)	(2)	(3)	(4)	(5)	(6)
CO (at 15% O ₂), mg/Nm ³	Both A and B		150		150
Sulphur content in fuel	A			<2%	
	B			<4%	
Fuel specification	For A only	Up to 5MW	Only Diesel Fuels (HSD, LDO) shall be used.		
Stack height (for generator sets commissioned after 1.7.2003)	Stack height shall be maximum of the following, in meter				
	(i)	14 Q ^{0.3} ; Q=Total SO ₂ emission from the plant in kg/hr.			
	(ii)	Minimum 6 m. above the building where generator set is installed.			
	(iii)	30 m.			

Note :**1. Acronyms used :**

MW	Mega (10 ⁶)Watt	FO	Furnace Oil
NO _x	Oxides of Nitrogen	HSD	High Speed Diesel
NO ₂	Nitrogen Dioxide	LDO	Light Diesel Oil
O ₂	Oxygen	LSHS	Low Sulphur Heavy Stock
NMHC	Non-Methane Hydrocarbon	kPa	Kilo Pascal
C	Carbon	mm	Milli (10 ⁻³) metre
PM	Particulate Matter	kg/hr	Kilo(10 ³)gram per hour
CO	Carbon Monoxide	mg/Nm ³	Milli (10 ⁻³) gram per Normal metre cubic
SO ₂	Sulphur Dioxide		
ppmv	part per million (10 ⁶) by volume		

2. Area categories A and B are defined as follows :

Category A: Areas within the municipal limits of towns/cities having population more than 10 lakhs and also upto 5 km beyond the municipal limits of such towns/cities..

Category B: Areas not covered by category A.

- The standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees, as the case may be.
- Individual units with engine ratings less than or equal to 800 KW are not covered by this notification.
- Only following liquid fuels viz. High Speed Diesel, Light Diesel Oil, Low Sulphur Heavy Stock and Furnace Oil or liquid fuels with equivalent specifications shall be used in these power plants and generator sets.
- For expansion project, stack height of new generator sets shall be as per total Sulphur Dioxide emission (including existing as well as additional load).

For multi engine plants, fuels shall be grouped in cluster to get better plume rise and

8. Particulate Matter, Non-Methane Hydrocarbon and Carbon Monoxide results are to be normalized to 25°C, 1.01 Kilo Pascal (760 mm of mercury) pressure and zero percent moisture (dry basis).
9. Measurement shall be performed at steady load conditions of more than 85% of the rated load.
10. Continuous monitoring of Oxides of Nitrogen shall be done by the plants whose total engine capacity is more than 50 Mega Watt. However, minimum once in six month monitoring for other parameters shall be adopted by the plants.
11. Following methods may be adopted for the measurement of emission parameters,-

Sl.No.	Emission Parameters	Measurement Methods
1.	Particulates	Gravimetric
2.	SO ₂	Barium Perchlorate-Thorin indicator method
3.	NO _x	Chemiluminescence, Non Dispersive Infra Red, Non Dispersive Ultra-violet (for continuous measurement), Phenol disulphonic method
4.	CO	Non Dispersive Infra Red
		Paramagnetic, Electrochemical sensor
6.	NMHC	Gas Chromatograph – Flame Ionisation Detector

[F No. Q-15017/24/2002-CPW]

C. VISWANATH, Jt. Secy.

Note :- The principal rules were published in the Gazette of India vide number S.O. 844(E) 19th November, 1986 and subsequently amended vide S.O. 433(E) dated 18th April, 1987, S.O. 64(E) dated 18th January, 1988, S.O.3(E) dated 3rd January, 1989, S.O. 190(E) dated 15th March, 1989, G.S.R. 913(E) the 24th October, 1989, S.O. 12(E) dated the 8th January, 1990, G.S.R. 742(E) dated the 30th August, 1990, S.O. 23(E) dated the 16th January, 1991, G.S.R. 93(E) dated the 21st February, 1991, G.S.R. 95(E) dated the 12th February, 1992, G.S.R. 329(E) dated the 13th March, 1992, G.S.R. 475(E) dated the 5th May, 1992, G.S.R. 797(E) dated the 1st October, 1992, G.S.R. 386(E) dated the 28th April, 1993, G.S.R. 422(E) dated the 19th May, 1993, G.S.R. 801(E) dated the 31st December, 1993, G.S.R. 176(E) dated the 3rd April, 1996, G.S.R. 631(E) dated the 31st October, 1997, G.S.R. 504(E) dated the 20th August, 1998, G.S.R. 7(E) dated the 25th September, 2000, G.S.R. 72(E) dated 6th February, 2001, G.S.R. 54(E) dated 22.1.2002 and G.S.R. No. 371(E) dated 17.5.2002.