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Guidance on Practice for Continuous Emission Monitoring Systems (CEMS)

GP 31-03

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 31-03.

The term “Continuous Emission Monitoring System” (CEM System) is used to describe a variety of methods for measuring pollution emissions on a continuous basis. Numerous regulatory bodies both national and local influence the extent and type of monitoring required. The exact regulations are not dealt with in detail in this document but failure to comply with these regulations may result in plant/unit closures and/or prosecutions under local and national laws.

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1. Scope

This GP provides guidance on practice for Continuous Emission Monitoring Systems (CEMS) for BP facilities including:

- a. Required performance.
- b. Selection.
- c. Design.
- d. Installation.
- e. Operation/maintenance.
- f. Commissioning.
- g. Auditing and benchmarking.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GIS 31-011	Guidance on Industry Standard for Analyser Houses to IEC TR 61831.
GIS 31-012	Guidance on Industry Standard for Analyser Sample Systems.
GIS 31-013	Guidance on Industry Standard for Gas Chromatographs.
GIS 31-014	Guidance on Industry Standard for Physical Property Analysers.
GIS 31-031	Guidance on Industry Standard for Continuous Emission Monitoring Systems (CEMS).
GP 30-25	Guidance on Practice for Field Instruments – General.
GP 30-75	Guidance on Practice for Safety Instrumented Systems (SIS) - Management of the Safety Lifecycle.
GP 31-04	Guidance on Practice for Analyser House Entry.
GP 31-02	Guidance on Practice for Analyser Validation.

American Petroleum Institute (API)

API RP 555	Process Analyzers.
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International Electrotechnical Commission (IEC)

IEC 61832	Analyser systems: Guide to technical enquiry and bid evaluation.
IEC 62010	On-line analyser maintenance management.

3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:



Sample system

Complete sample transportation system. Includes all of the following, when used, up to the point of entering the analyser and from the point leaving the analyser.

- a. Sample probe.
- b. Sample filters.
- c. Sample transportation lines (to and from analyser).
- d. Sample conditioning system.
- e. Sample recovery unit.

Analyser house

Building or shelter that gives environmental protection to an analyser and/or the people maintaining an analyser.

Analyser

Process monitor that measures and transmits information about chemical composition, physical properties, or chemical properties.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

EPA	Environmental Protection Agency
SIL	Safety integrity level

5. General**5.1. Legislative regulations, local codes, and standards**

- a. If analyser legislative requirements for an area conflict with guidance given in this GP, legislative requirements shall take precedence.
- b. CEMS equipment shall comply with local/ national codes and standards.
- c. Specification of performance requirements should include expectations and assumptions of:
 1. Risk assessors.
 2. Safety teams.
 3. Maintenance crews.
 4. Auditors.
 5. System designer.
 6. Local EPA agencies.

5.2. Safety management

Processes for competency of people, planning activities, documentation, and verification should be in accordance with GP 30-75. GP 30-75 shall be followed if any of the CEMS or analysers requires SIL 1 or higher integrity.



5.3. Specifier role

- a. Specifiers of CEMS performance requirements should have the following capabilities:
 1. Be experienced in design of analyser systems.
 2. Have a familiarity with other engineering disciplines (in particular, process, electrical, and instrumentation) and how they interact with one another.
 3. Have an understanding of site operations.
- b. Specifiers shall ensure that analyser systems comply with:
 1. Local and international EPA codes and standards.
Failure to comply with these codes and standards may result in plant being shutdown and/or BP being fined by the local EPA.
 2. Safety requirements for the site.
Compliance with local/ international codes and standards is important. However, the Specifier's role is to ensure that the performance of the analyser system complies with the safety requirements for the site and not just the minimum to comply with code.
- c. Specifier's role shall include coordination and communication.
- d. Required level of performance for all parts of the CEMS shall be recorded.
- e. Measurement techniques utilised in CEMS.
Many analytical techniques are used in CEMS. Several of the most commonly used are listed below. API RP 555 gives a description of each technique.
 1. Non-dispersive Infrared (NDIR).
Mainly used for flue gas emission measurements CO, CO₂, NOX, SOX, etc.
 2. Electrochemical analysers.
In general, these devices require clean stream gases.
 3. Chemiluminescent/ UV Fluoresence Analysers.
In general, these devices are used to measure low level flue gas emission monitoring or atmospheric contaminants.
 4. Paramagnetic Analysers.
Flue gas oxygen analysis.
 5. Gas chromatography.
 6. In-situ analysers.
This technique offers measurements without the need for sampling; they are usually used only where the measurement is on a "wet gas basis". Oxygen or optical analysers are the most commonly used. The optical technique is again usually split into two different types:
 - *Across stack; this type of analyser can be very difficult to accurately calibrate due to interference from gases in the stack. This technique is usually only used for particulate and opacity monitoring.*
 - *Probe type; Again can be difficult to calibrate and probe lengths may have to be quite long to get accurate readings in large ducts.**Consideration should be given to maintainability of in-situ sensors particularly if the sensor is placed in a furnace or other hot gas stream.*

