

 Eskom	Scope Of Work	Generation
---	---------------	------------

Title: **Supply of particulate matter correlation and gaseous parallel tests on an “As and When” Required Basis For A Period Of five years at Kriel Power Station Main stores**

Unique Identifier: **EEP1015**

Alternative Reference Number: **N/A**

Area of Applicability: **Engineering**



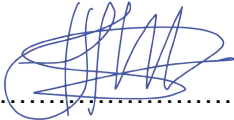

Documentation Type: **Scope of Work**

Revision: **1**

Total Pages: **15**

Next Review Date: **N/A**

Disclosure Classification: **CONTROLLED DISCLOSURE**

Compiled by	Reviewed by	Functional Responsibility	Authorised by
			
Spha Biyela Senior Advisor	Feyane Tivane System Engineer	Harry Mokabane Boiler Engineering Manager	Rofhiwa Nelwamondo Engineering Manager
Date: 18 March 2022	Date: 22 March 2022	Date: 28/03/2022	Date: 04/04/2022

CONTENTS

	Page
1. INTRODUCTION	3
2. SUPPORTING CLAUSES.....	4
2.1 SCOPE	4
2.1.1 Purpose	4
2.1.2 Applicability.....	5
2.2 NORMATIVE/INFORMATIVE REFERENCES.....	5
2.2.1 Normative	5
2.3 GENERAL ARRANGEMENT AND LOCATION DRAWINGS	6
Not applicable.....	6
2.3.1 informative	6
2.4 DEFINITIONS.....	6
2.4.1 Disclosure Classification	7
2.5 ABBREVIATIONS.....	7
2.6 ROLES AND RESPONSIBILITIES.....	9
2.7 PROCESS FOR MONITORING	11
3. THE <i>WORKS</i>.....	12
3.1 BACKGROUND	12
3.2 DESCRIPTION OF THE <i>WORKS</i>	12
3.2.1 Scope of work.....	12
3.2.2 Design Life.....	13
Documentation Submission And Recording.....	13
3.2.3 Plant Codification	13
3.3 STANDARDS, SPECIFICATIONS AND PROCEDURES	14
4. AUTHORISATION.....	16
5. REVISIONS	16
6. DEVELOPMENT TEAM	16
7. ACKNOWLEDGEMENT.....	16
8. APPENDIX A.....	17

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

1. INTRODUCTION

Kriel Power Station is categorised as a solid fuel combustion installation and is equipped with an Automated Measuring System (AMS) on both its north and south smoke stacks for the continuous online monitoring and reporting of several pollutants during operation as obligated by the National Environmental Management: Air Quality Act No. 39 of 2004. These pollutants include particulate matter, sulphur dioxide and oxides of nitrogen. Full Dust Correlation and Dust Correlation Spot Tests as well as Gaseous Parallel and Gaseous Verification Tests measurements of the emission monitors is necessary to maintain the integrity of data reported through AMS. To this end, a series of dust correlation and gaseous measurements is scheduled on all six (6) units at Kriel Power Station.

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document outlines the scope of work related to AMS AQL2 to be performed at Kriel Power Station to ensure compliance with the requirements for conducting Dust Emissions Correlations and Gaseous Parallel tests as outlined in the National Environmental Management: Air Quality Act 39, Listed activities, Minimum Emission Standards in terms of Section 21, Category 1.1 and Eskom's Emissions Monitoring and Reporting Standard 240-56242363.

2.1.1 PURPOSE

The purpose of the document is to provide technical governance in terms of a scope of work for the supply Dust Emissions Correlations and Gaseous Parallel tests as outlined in the National Environmental Management at Kriel Power Station in the Units 1-6 for Kriel Power Station. This document is intended to be the input to the NEC Part 3: Scope of Work.

2.2.1.1 General

The Contractor must provide for all the necessary equipment, tools, apparatus and consumables required for carrying out all tests. All relevant equipment used must be accompanied with a valid calibration certificates accredited by SANAS.

The Contractor must be a member STA-SA and be in the process of getting SANAS accreditation for scope related to emissions measurement.

Test facilities where test samples will be analysed must have ISO/ IEC 17025 standard accreditation, The Contractor must submit proof of accreditation in form of certificate.

The monitor shall be properly calibrated by qualified personnel supplied by Employer as close as possible to the commencement of the correlation and parallel tests activities. The Contractor undertaking the correlation and parallel tests is expected to witness this calibration exercise if available to do so when informed by the Employer of the calibration activity date. A calibration certificate will be issued for inclusion in the correlation and test report for each unit.

Before testing is carried out, the Contractor must ensure that all equipment to be used for testing are fully functional and reliable. Copy of calibration certificates of the equipment to be used must be submitted and checked by Employer before testing start.

1.2.2 Pre-Test Requirements

The Contractor shall provide the station with date and time, load bidding requirements and Technical Operating Instruction requirements (Method Statement) as a minimum and shall be separate for the Gaseous and Particulate Matter testing measurements activities.

1.2.3 After Test Completion Requirements

Detailed correlation and parallel test reports the content of which shall constitute, amongst others, all items listed in the relevant bullet point of the Maintenance section of the Eskom standard 240-56242363 must be submitted within two weeks of test completion for review and acceptance by Employer for tests conducted and must be submitted for each unit individually. An updated report for any adjustments and/or corrections is expected within a week following review by Employer. The report shall be authorized and signed off by personnel with relevant accreditation.

CONTROLLED DISCLOSURE

1.2.4 Period of Agreement

The services provided by the Contractor shall be annually for a period of 5 years, see section 1.2.1.5 of the document

Contractor Availability

According to Kriel power station Atmospheric Emissions Licence, PM Correlation and Gaseous parallel test must be conducted annually on all units. Depending on the availability and the performance of the units, the Dust and Gaseous test must be conducted annually on the Employers request. The Contractor must be able to conduct the test within 3 to 7 days of Employers notice.

The Contractor shall supply a testing programme as a tender returnable clearly indicating their availability for the above.

2.1.2 APPLICABILITY

This document is applicable to Kriel Power Station and services provide to Supply of Particulate Matter correlation and Gaseous parallel tests

NORMATIVE/INFORMATIVE REFERENCES

2.1.3 NORMATIVE

- [1] 240-53499108 Process Control Manual (PCM) for Perform Coal Power Plant Boiler Engineering
- [2] ISO 9001 – Quality Management Systems.
- [3] VDI 2066 – Particulate Matter Measurement.
- [4] VDI 3950 – Calibration of Automatic Emission Measuring Instruments
- ISO 9096 – Stationary Source Emissions — Manual Determination of Mass Concentration of Particulate Matter.
- [6] ISO 10155 - Stationary source emissions — automated monitoring of mass concentrations of particles: Performance characteristics, test methods and specifications
- [7] ISO 12141 – Determination of mass concentration of particulate matter (dust) at low concentrations. Manual gravimetric method.
- [8] EN 13284-1 Determination of low range mass concentration of dust.
- [9] BS EN 15259 – Requirements for Measurement Sections.
- [10] BS EN 14181 – Quality Assurance of Automated Measuring Systems.
- [11] BS EN 15267 – Certification of automated measuring systems.
- [12] US EPA Method 5 – Determination of Particulate Matter Emissions from Stationary Sources (External stack sampling).
- [13] US EPA Method 17 – Determination of Particulate Matter Emissions from Stationary Sources (Internal stack sampling).
- [14] BS EN ISO16911 – Stationary Source Emissions – Determinations of Velocity and Volumetric Flow Rates in Ducts.
- [15] ISO 14164 – Determination of volumetric flow-rate of gas streams in ducts.
- [16] EN 14790 – Determination of the water vapour in ducts.
- [17] EN 14789 – Determination of volume concentration of oxygen (O₂).

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

[18] EN 15058 – Determination of the mass concentration of carbon monoxide (CO).

[19] ISO 12039 – Determination of CO, CO₂ and O₂ – performance characteristics and calibration of an automated measurement system.

[20] EN 14791 – Determination of mass concentration of sulphur dioxide.

[21] EN 14792 – Determination of mass concentration of nitrogen oxides (NOX).

[22] SABS ISO 14001 – Environmental management Systems – Requirements with guidance for use.

[23] Notice 893 (Nov 2013): Listed Activities and Associated Minimum Emission Standards identified in terms of Section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).

2.2 General arrangement and location drawings

NOT APPLICABLE

2.2.1 INFORMATIVE

Not applicable.

2.3 DEFINITIONS

CEM	Continuous Emission Monitors refers to all equipment used in the measurement of flue gas constituent and parameters including particulate monitors, gaseous monitors and flue gas process monitors such as oxygen, velocity, temperature, pressure etc.
Correlated signals/readings	Signals or readings that have been corrected with SANAS periodic test values
Verified signals/readings	Signals or readings that have been corrected with SANAS periodic test values
Nm₃ @ 10% O₂ dry	Normalised cubic meters at 101.325 kPa, 0 °C at 10% O ₂ on a dry basis
Sm₃ @ actual O₂ wet	Standard cubic meters at 101.325 kPa, 0 °C at actual O ₂ on a wet basis
Dust Correlation	The process to correlate the mass emissions with the output of the dust monitor
Gaseous Verification / Parallel Test	The process to verify the online emission with a certified parallel tests monitor to produce a correction factor
Annual Surveillance Test / Spot Measurements	This is a shorter version of the full correlation or parallel tests and is used to verify the monitor and/or the validity of the correlation and parallel tests. These tests comprise of either 3 or 5 measurements point depending on the
Gaseous Stratification Test	The process to determine the most representative measuring point in the flue that is representative of the entire gaseous emissions
Availability	Is when the monitor is operational
Accuracy	Is when the monitor is operational and the output is credible
Reliability	Is the Availability (%) multiplied by the Accuracy (%)

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

Validation	Is the electronic calibration of a dust monitor in a clear path or the calibration of the gaseous monitors with certified test gas etc.
Relative Emissions	It is the absolute mass of the pollutant emitted divided by the official electrical units sent out usually expressed as kg/MWh SO, kg/GWh SO or tons/GWh SO. This can be calculated at a per unit level, per stack level, per station level or for Eskom as a whole.
Abatement Plant Control Utilisation	Utilisation is the amount of the time that the plant is in service. Since Eskom does not have bypass capability, the Utilisation is usually expressed at 100%.
Abatement Plant Control Efficiency	The Efficiency of the abatement control plant is expressed as a percentage of the pollutant emitted to that of the amount of pollutant entering the abatement control plant. The amount of pollutant can be expressed as concentration or absolute mass.
Air-To-Gas Regression Curve	This is the relationship of the amount of air going to the boiler in relation to the amount of flue gas volume being emitted by the boiler at the . This relationship is derived during the dust monitor correlation test and is produced by the Stack Testing Service Provider
Hot Start	A hot start is defined as the restart of the boiler within 8 hours after shutting it down.
Cold Start	A cold start is defined as the restart of the boiler more than 8 hours after shutting it down.
Quality Assurance Level 1 (QAL 1)	QAL1 certificate is like the driving license of a measuring system that it is fit for purpose: once a system has been proven to be acceptable, it is granted a QAL1 certificate by mCERTS and/or TÜV based on who carried out the performance trials, for the system that has undergone the laboratory and field performance trials. Parts that make up the certified measuring system are stated within the QAL certificate and or mCERTS Certificate
Quality Assurance Level 2 (QAL 2)	This stage of quality assurance specifies the procedures to ensure that the continuous emissions monitoring system has been correctly installed calibrated by comparing of measurements and are independently verified.
Quality Assurance Level 3 (QAL 3)	QAL3 is a process or procedure which maintains the quality of the Continuous Emission Monitoring (CEM) System to ensure reliability and accuracy of the emission data

2.3.1 DISCLOSURE CLASSIFICATION

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary)

2.4 ABBREVIATIONS

Abbreviations	Description
---------------	-------------

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

AKZ	Anlagen Kenn Zeichnungs
BOQ	Bill of Quantities
C&I	Control and Instrumentation
CAD	Computer Aided Design
ESP	Electro static precipitator
EMD	Electrical Maintenance Department
HAZOP	Hazard and Operability Analysis
NDT	Non-Destructive Testing
OHSA	Occupational Health and Safety Act
PEI	Production Engineering Integration
PPE	Personal Protective Equipment
PTW	Permit To Work
QA	Quality Assurance
QC	Quality Control
QCP	Quality control program/plan/procedure
SO ₃	Sulphur Tri-Oxide
RO	Reverse Osmosis
SHE	Safety, Health & Environmental
SHEQ	Occupational Safety, Health, Environmental, and Quality
SOW	Scope of Work
Unit	Description
AVR	Automatic Voltage Regulator
AC	Alternative Current

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

Kv	Kilovolts
MV	Medium Voltage
AEL	Atmospheric Emissions Licence
AMME	Asset Management Mechanical Engineering
AMS	Automatic Measurement System (AMS = CEMS)
APPA	Air Pollution Prevention Act
AST	Annual Surveillance Test
BS	British Standard
C&I	Control and Instrumentation
CEMS	Continuous Emissions Monitoring System (CEMS = AMS)
DCS	Distributed Control (or Data Computer) System
DEFF	Department of Environment, Forestry and Fisheries
EEM	Eskom Environmental Management
EIS	Executive Information System
ELC	Environmental Liaison Committee
ELV	Emission Limit Value
EN	European National Standard
EO	Environmental Officer
EPA (US)	Environmental Protection Agency (United States)
ESP	Electrostatic Precipitator
FD	Forced Draught
FFP	Fabric Filter Plant (also known as PJFF)

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

FGC	Flue Gas Cleaning
GTE	Group Technology Engineering
ISO	International Standards Organisation
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMAQA	National Environmental Management : Air Quality Act (Act No.39 of 2004)
mA	milliamp
MES	Minimum Emission Standards
NEMA	National Environmental Management Act
OEM	Original Equipment Manufacturer
PM	Particulate Matter
PJFF	Pulse Jet Fabric Filter (also known as FFP)
QAL	Quality Assurance Level
SABS	South African Bureau of Standards
SANAS	South African National Accreditation System
SE	System Engineer

2.5 ROLES AND RESPONSIBILITIES

Roles and responsibilities are as follows:

System Engineer – Compile the scope of work for the contract

System Technical Advisor – Compile contract strategy for the contract

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

2.6 PROCESS FOR MONITORING

The QCPs on incoming product and services rendered by the supplier will be done and all materials are to be signed off by the system engineer and hold/witness points should be marked to ensure the quality of the supplied goods is according to standard.

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

3. THE *WORKS*

The *works* is the supply Particulate Matter correlation and Gaseous parallel tests at Kriel Power Station in the Units 1-6 and common plant for Kriel Power Station.

3.1 BACKGROUND

Emission monitors are the “cornerstone” of Eskom’s emission management system. They provide vital data, which informs the formulation of environmental policy and compliance to relevant standards and monitoring requirements. This Standard also provides valuable direction in planning and implementing cost effective future abatement control technologies. It also ensures that all emissions monitoring conducted in Eskom complies with the Minimum Emission Standards.

3.2 DESCRIPTION OF THE *WORKS*

This process is also known as dynamic correlation or calibration. Eskom uses the term correlation as it distinguishes it from monitor calibration, where the electronic circuitry is calibrated against known values, set-points etc. Monitor correlations essentially compare iso-kinetically measured emissions over a period with monitor output over the same period. These measurements form one of many data points on a graph (regression curve).

3.2.1 SCOPE OF WORK

3.2.1.1. Particulate Matter Measurements Requirements

- a) Particulate Matter measurement shall be conducted using Isokinetic measurement method. The isokinetic measurements will be in accordance with an Eskom approved equivalent (VDI, EN or ISO Standards). This requires the use of a calibrated gas meter, standard pitot tube, thermocouple instrumentation and simultaneous flow measurement and sampling.
- b) The Contractor shall conduct full Particulate Matter monitor correlations tests and spot measurement on stack 1 (Unit 1, 2 and 3) and stack 2 (unit 4, 5 and 6) during normal operating conditions.
- c) For a Full Dust Correlation Test: A minimum of 15 successful tests per correlation shall be done. Three (3) additional tests shall be conducted to make provision for outliers, if required. The Contractor will be given 7 days’ notice to conduct the Full Correlation Test.
- d) For a Spot Dust Correlation Test: A minimum of 5 successful tests per correlation will be done. Two (2) additional tests will be conducted to make provision for outliers, if required.
- e) A Spot test may be requested anytime when the station deems it necessary. The Contractor will be given 7 days’ notice to this effect. Depending on the outcome of the Spot test, a Full Correlation test must be arranged and conducted by the Contractor within 3-months of Spot test.
- f) Velocity and Total Air flow tests shall be included with each test.

3.2.1.1. Gaseous Emission Measurement Requirements

- a. Determining AMS calibration function, calibration range and operational variability by conducting gaseous AMS QAL2 Parallel Measurements using the standard reference measuring method (SRM) in accordance with international standards (EN 14181, EN 14792 (EPA 7E), EPA 6C, EN 15058 (EPA method 10), EPA CTM-030 with NDIR and Zirconia, EPA methods 2 & 4, ISO 12141) and with due regard of Eskom’s Emissions Monitoring and Reporting Standard 240-56242363.

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

-
- b. A minimum of 15 successful tests per gaseous Parallel Test shall be done for purpose of determining gaseous AMS calibration function. Three (3) additional tests shall be conducted to make provision for outliers, if required. The Contractor will be given 7 days' notice to conduct the Parallel Test.
- c. A minimum of 5 successful tests per gaseous Surveillance test will be done. Two (2) additional tests will be conducted to make provision for outliers, if required.
- d. Gaseous Surveillance test may be requested anytime when the station deems it necessary. The Contractor will be given 7 days' notice to this effect. Depending on the outcome of the Surveillance test a Parallel test must be arranged and conducted by the Contractor within 3-months of Surveillance test.
- e. Tests must be done at a level closer or above the level of the currently installed gas monitors at Kendal Power Station. Samples analysed must be a representative of the gas stream being tested.
- f. The following pollutants must be measured and quantified as part of the Works:
- i. Oxides of Nitrogen (expressed as NO₂).
 - ii. Sulphur Dioxide (SO₂)
 - iii. Carbon Dioxide (CO₂)
 - iv. Carbon Monoxide (CO)
 - v. Oxygen (O₂)
 - vi. Velocity (m/s)
- g. The SOW for Parallel measurements shall include calibration function of AMS peripheral parameters of moisture concentration, gas temperatures and gas pressures used by AMS during its function

3.2.2 DESIGN LIFE

The design life of the plant is till end of Kriel Power Station life 2038.

DOCUMENTATION SUBMISSION AND RECORDING

The supplier is to provide the following documentation;

- Type test results certificates
- Medical and induction certificates
- Safety file
- Quality Control Process files (for quality assurance)
- Installation and Commissioning Manuals

3.2.3 PLANT CODIFICATION

Kriel Power Station uses the AKZ numbering system.

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

3.3 STANDARDS, SPECIFICATIONS AND PROCEDURES

Eskom has adopted the VDI 2066 Procedure. This procedure is in the process of being superseded by the EN 13284-1, ISO 9096 and/or ISO 12141 Standards. The uses of any of these standards are acceptable subject to the points below. ISO 10155 may also be considered in the development of the regression curves

Table 1: Relevant Standards and Codes

Document Number	Title
Eskom Standards	
240-28463367	SHE Organization
240-30008949	Safety, Health and Environmental Specifications for Contractors
240-49230111	Hazard and Operability Analysis (HAZOP) Guideline (Rev 1)
240-55944466	Supplier Contract Quality Requirement's Specification
240-56364545	Structural Design and Engineering Standards
32-421	Cardinal Rules
36-681	Generation Plant Safety Regulations
OPS 0158	AKZ Power Plant Classification System
QM 58	Supplier Contract Quality Requirements
General Standards	
7.1/ST/02	Quality Requirements for Engineering and Construction work
ISO 9001	Quality Management Systems.
OSH Act 85 of 1993	Occupational Health and Safety Act and Regulations Act 85 of 1993.
SANS 10064	The Preparation of Steel Surfaces for Coatings
SANS 10108 (2005)	Classification of Hazardous Location (Electrical Plant)

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

Document Number	Title
SANS 10142	The Code of Practice for the Wiring of Premises

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

4. AUTHORISATION

This document has been seen and accepted by:

Designation	Names
Senior Advisor	S Biyela
System Engineer	F Tivane

5. REVISIONS

Date	Rev.	Compiler	Remarks
Feb 2022	1	S Biyela	First revision

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- S Biyela
- D Molefe
- N Debeila

7. ACKNOWLEDGEMENT

- S Hlatshwayo

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.

8. APPENDIX A

CONTROLLED DISCLOSURE

When downloaded from the EDMS, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the system.