

	Scope of Works	Generation
---	----------------	------------

Title: **Kriel Power Station Scope of Work for Coal Bunkers Unit 1 to 6 CO Gas Monitors Installation and Interface to WinCC and DCS SCADA Systems** Document Identifier: **559-891970663**

Alternative Reference N/A
Number:

Area of Applicability: **Engineering**

Functional Area: **Scope of Work**

Revision: **02**

Total Pages: **24**

Next Review Date: **NA**

Disclosure Classification: **Controlled Disclosure**

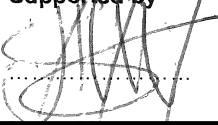
Compiled by



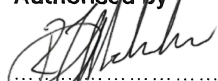
Functional Responsibility



Supported by



Authorised by



[Redacted signature area]

Date: 11.03.2026

Date: 11.03.2026

Date: 16/03/2026

Date: 23/04/2026...

TABLE OF CONTENTS

1. Introduction.....	1
2. Supporting Clauses	2
2.1 Scope.....	2
2.1.1 Purpose.....	2
2.1.2 Applicability	2
2.2 Normative/Informative References	2
2.2.1 Normative.....	2
2.2.2 Informative.....	2
2.3 Abbreviations	4
2.4 Definitions	5
2.5 Roles and Responsibilities	6
2.5.1 Employer	6
2.5.2 Contractor	6
3. Current Design Specification ^[22]	7
3.1 Coal Bunkers CO Gas Monitors Specification.....	7
3.1.1 Standards and their significance.....	7
3.1.2 Technical Data	7
3.1.3 Compliances.....	7
3.1.4 Electrical Protections.....	7
3.1.5 Laws, standards, guidelines complied	7
4. Scope of Work.....	8
4.1 Background	8
4.2 Electrical Scope of Work	9
4.2.1 General electrical requirements.....	9
4.2.2 Test and commissioning of electrical equipment.....	9
4.2.3 Classification of Hazardous Location	9
4.3 Control and Instrumentation Design	10
4.3.1 Control and Instrumentation Scope	10
5. Works Execution.....	15
5.1 Sequencing of Works	15
5.2 Setting Out	15
5.3 Existing Services	15
5.4 Temporary Works.....	16
5.5 As- Built Drawings.....	16
6. Acceptance.....	17
7. Revisions.....	18
8. Development Team	18
APPENDIX A: DRIVE HOUSE VISUAL ASSESSMENT IMAGES.....	19

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30.

APPENDIX B: CONVEYOR BELT VISUAL ASSESSMENT IMAGES	19
--	----

LIST OF TABLES

Table 1: Abbreviations	4
Table 2: Definitions	5
Table 3: Pulley Details	5
Table 4: 18A and 18B ash conveyor failures	5
Table 5: Concrete Specifications.....	5
Table 6: Structural Steel Specifications.....	5

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd.
Reg No 2002/015527/30.

1. Introduction

Kriel Power Station comprises of 6 (six) 500 MW Units, giving the station an installed capacity of 3000 megawatts. A Unit consists of one boiler, a turbine and a generator set. Construction and commissioning of the station was completed in 1979. Therefore, during combustion ash is formed coarse ash and fly ash, a pneumatic system conveys the PFA from the ESP hoppers to transfer Silos, from where it is, again, transferred pneumatically to the Main Fly Ash Storage Silos. The PFA is then conditioned and conveyed with two (2) overland conveyor systems to a distribution box on top of the Ash Dam, where it is sluiced with AWR. The PFA slurry can then be distributed to the required areas of the Ash Dam, by either sluicing or pumping it.

Further, on the Coal Staithe are used as a storage facility for the coal that is being supplied by the mine. There are two coal staithe with staithe 1 having a capacity 80 000 Tons for underground quality coal and staithe 2 having a capacity of 56 500 Tons for open cast quality coal staithe 1 has 99 bays whereas staithe 2 has 77 bays.

Coal discharges from staithe 1 through a series of clamshell gates (duplex doors) onto conveyor 5A – D via mobile manual chutes (duplex cars) and from Coal Staithe 2 through a series clamshell onto conveyors 5E-G. There are three duplex cars per conveyor. The duplex cars can be positioned under any of the staithe bays to enable the coal to be loaded onto the conveyor belts to their maximum capacity. There are mass meters on each of the under-staithe conveyors (5A – 5G). Under staithe conveyors 5A-G feed incline conveyors 6A-G respectively. Each incline conveyor feeds mill bunkers of 2 different boilers except conveyors 6A and 6G. The incline conveyors feed the mill bunkers.

- ❖ Kriel Power Station Unit 1 and 2 shared bunkers having above limit particles count of CO per million particles.
- ❖ Contractors working on GO have been exposed to harmful gasses such as carbon dioxide, carbon monoxide and other unidentified gasses likely methane judging from the smell.
- ❖ The gas exposure resulted in loss of working time due to employees having to be evacuated every time the gas level increases.
- ❖ The gases were found to be coming from smouldering coal from the shared bunkers of unit 1 and unit 2.
- ❖ There were reports of employees experiencing dizziness/headache and at some point, an employee was reported to have fainted due to these gasses.
- ❖ Kriel Power Station Coal Bunkers does not have CO Gas Monitors or Gas Analysers to monitor when the gas level is high and evacuate the employees.
- ❖ Therefore, this modification aims at addressing the unavailable of Coal Bunkers CO Gas Monitors with the Latest Laser Detector Technology and Siren Alarm Reflection Lights to evacuate employees in the event of gas level increases beyond its specification and interface Gas Monitor to the DCS T3000 and WinCC SCADA Systems.

This document outlines the scope of work for the supply, installation, commissioning and design of the Coal Bunkers CO Gas Monitors and interface to WinCC/DCS SCADA System, including electrical work and control automation instrumentation.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Ref No 2002/015527/30

The full details of the works are described in Section 3.

2. Supporting Clauses

2.1 Scope

This *scope of work* outlines the tasks and requirements to supply, installation, commissioning, and design of Coal Bunkers Unit 1 to 6 CO Gas Monitors and Interface to WinCC SCADA System at Kriel Power Station.

2.1.1 Purpose

The purpose of this document is to provide a clear understanding of the requirements, deliverables, and *scope of work* to be performed.

2.1.2 Applicability

This document applies to Kriel Power Station.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [40] ISO 9001 Quality Management Systems
- [41] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy
- [42] 240-105658000 (QM58) - Supplier Quality Management: Specification
- [43] Occupational Health and Safety Act No. 85 of 1993
- [44] Environmental Aspects and Impacts Register
- [45] Method Statement Template-Ref 240-126469599
- [46] ISO 45001 Occupational Health and Safety Management Standard

2.2.2 Informative

- [1] SANS 1574 - Electric cables-flexible cords
- [2] SANS 9000 to 9004 - Quality management systems and standards.
- [3] SANS 60269 - Low-Voltage Fuses
- [4] SANS 10142-1 - The wiring for premises Part 1: low-voltage installations.
- [5] SANS 10177-2 - Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

[6] SANS 10198-1 - The selection, handling, and installation of electric power cables of rating not exceeding 33kV Part 1: Definitions and statutory requirements, South African Bureau of Standards, Pretoria.

[7] SANS 10198-2 - The selection, handling, and installation of electric power cables of rating not exceeding 33kV Part 2: Choice of cable type and methods of installation, South African Bureau of Standards, Pretoria.

[8] SANS 10198-3 - The selection, handling, and installation of electric power cables of rating not exceeding 33kV Part 3: Earthing systems - general provisions, South African Bureau of Standards, Pretoria.

[9] SANS 10198-4 - The selection, handling, and installation of electric power cables of rating not exceeding 33kV Part 4: Current ratings, South African Bureau of Standards, Pretoria.

[10] SANS 10198-5 - The selection, handling, and installation of electric power cables of rating not exceeding 33kV Part 5: Determination of thermal and electrical resistivity of soil, South African Bureau of Standards, Pretoria.

[11] Installation of earthing system, South African Bureau of Standards, Pretoria.0.00/10335 Power and control wiring terminations

[12] 0.00/1310 - Standard Power and Control Cable Code

[13] 0.00/2713 - Instrument Cable Code

[14] 0.54/393, P6 - Earthing: Control equipment and local motor starters

[15] 0.54/393, P7 - Earthing: Power station auxiliary bay signal earth terminal box

[16] 0.54/393, P9 - Earthing of smaller 3-phase consumer without neutral with 4-core cable

[17] 0.54/393, C1, C2 & C3 - Earth mat and details

[18] 0.66/3355 - Cable route marker

[19] 0.66/3356 - Typical section of cable trenches

[20] 240-56355754: Field Instrument Installation (FIIS 1)

[21] 240-56355815: Junction Boxes and Cable Termination (FIIG 2)

[22] 240-56355843: Pressure Measurement Systems Installation (FIIS 6)

[24] 240-57859210: Alarm System performance of Control Systems Applied in Fossil Plant Standard

[25] 240-56355466: Alarm Management System Guideline

[26] PG/201/001: Water Received Calculation Method

[27] 240-56227443 - Requirements for Control and Power Cables for Power Stations Standard

[28] 240-40643427 - Coding and Labelling Standard

[29] IEC 62381 – Automation Systems – FAT, SAT & SIT

[30] IEC 62382 – Electrical and Instrumentation Loop Checks

[31] 240-56356396 Earthing and Lightning Protection Standard

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

2.3 Abbreviations

Table 1: Abbreviations

Abbreviation	Meaning given to the abbreviation
AFC	Approved for construction
OBL	Outside battery limits
3PSR	3rd Party System Replacement
AC LvdT	alternating Current Linear Voltage Diff. Transmitter.
AET	Architect Engineer's Tool
AF	Automation Function
AFC	Automation Function Container. Container, which provides the runtime environment for AFIs and HPIs. An AFC controls the execution of AFIs and HPIs.
AFI	Automation Function Instance. Instance of a component, which executes an automation function. Examples are controllers, motors and integrators.
AFT	automation function type. Type of an AFI. The AFT is the template to instantiate an AFI
AI	Analog Input
AO	Analog Output
API	Application Programming Interface
AS	Automation System
ASD	Alarm Sequence Display
ASP	Application Service Provider
B2B	Business 2 Business
BOP	Balance of Plant
CCPP	Combined Cycle Power Plants

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

CI	Communication Interface
Client	A client is a piece of software and/or a hardware that utilizes certain resources provided by a remote server.
COM	Component Object Model (Microsoft)
COTS	Components of the shelf
CT	Combustion Turbine
DCOM	Distributed Component Object Model (Microsoft)
DCS	Distributed Control System
DDS	Digital Data Storage. An industry standard for data storage on tape drives.
DF	Double Fuel

2.4 Definitions

Table 2: Definitions

Item	Description
Contractor	For the purposes of this scope of work, Contractor refers to any appointed service provider or relevant Eskom Maintenance Department that will be responsible for the execution of the works.
Employer	Refers to Eskom SOC Limited represented by Kriel Power Station Management.
Employers Agent	Kriel Power Station personnel responsible for addressing all technical queries that emanate from the works
Project Manger	Refers to the Eskom representative delegated by the Eskom Projects department to administer the contract.
SHE	Safety, Health & Environmental
SI Units	International System of Units

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

2.5 Roles and Responsibilities

2.5.1 Employer

In general, roles and responsibilities will be as stipulated in the ECM ([12]) and Design Review ([13]) procedures. More specifically for this project:

General

- The project will be driven by Kriel Power Station Projects, with input required the various disciplines at Kriel PS.
- In terms of Engineering, the Engineering Design Work Lead (EDWL) and Lead Discipline Engineer(s) (LDE's) will be assigned from 01 November 2025 – these resources will be responsible for the Engineering work, which will include, among others, attendance of design & progress meetings, design reviews, compilation of design reports and compilation of works information.
- The Engineering resources from Kriel PS will also be required to assist in all these Engineering activities.

2.5.1.1 Project Manager

- Project Management of the complete project.
- Supervise the installation activities.
- Financial control of the project.
- Discuss any deviations from the Works Information.
- Agree with the Contractor and relevant stake holders on an acceptable program for the complete implementation of the project per outage plan.

2.5.1.2 Technology Engineering

- Ensure that the technical requirements are met according to Generation policies and standards.

2.5.1.3 C&I Engineering Manager

- Authorize the designs and ensure that the scope is fully implemented.

2.5.1.4 C&I System Engineers

- Implement the changes on the DCS.

2.5.1.5 C&I Maintenance Department

- Maintenance on the installed equipment.

2.5.2 Designated Contractor

- Redline the drawings to indicate the changes to be done and
- Generate the as required and as built drawings.
- Test, Design, Evaluate, Supply, Install, Commission and handover of a complete CO Gas Monitors for Coal Bunkers
- Supply the complete design information to the Kriel C&I Engineering

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd
Reg No 2002/015527/30

3. Current Design Specification ⁰

3.1 Coal Bunkers CO Gas Monitors Specification

3.1.1 Standards and their significance

Short description	Document No
Directive 2006/95/EC	RL 2006/95/EC
EMC Directive/2004/108/EC	RL 2004/108/EC
Safety Requirements Electrical Equipment	EN 61010-1
Electrical Equipment for Measurement	EN61326

3.1.2 Technical Data

Technical overview	data	VICOTEC411	VICOTEC412	VICOTEC414
General Data				
Measured variable	Extinction coefficient: Heat transmission coefficient		CO concentration: ppm	Extinction coefficient: Heat transmission coefficient CO concentration: ppm
Measuring principle	Scattered light		Negative gas correlation	VIS. Scattered light CO: Negative gas correlation
Measuring path	10 m (±0.5 m)			
Measuring range	VIS: K = 0 to 15 1/km		CO: 0 .. 300 ppm	VIS: K = 0 .. 15 1/km CO: 0 ... 300 ppm
Repeat accuracy	VIS: ± 0.1 1/km		CO: ± 2 ppm	VIS: ± 0.1 1/km CO: ± 2 ppm
Ambient temperature	-30 to +60 °C			
Storage temperature	-30 to +85 °C			
Connections				
Interfaces	CAN bus, sensors electrically isolated, RS422 electrically isolated, RS 232 PROFIBUS DP			
Analog outputs1	2 channels, 0 - 20 mA, Live Zero selectable 0, 2, 4 mA			
Relays1)	3 outputs for CO malfunction, visibility malfunction, display maintenance/contamination/ warning Switching voltage 125 V AC; max. switching current 60 VA Switching voltage 150 V AC; max. switching current 30 VA			
Digital input	5 V max., 2 mA. External maintenance switch			
Power supply				
Connection unit2	190 V to 260 V AC, 50 Hz or 95 V to 130 V AC; 60 Hz			
Evaluation unit	190 V to 260 V AC; 50 Hz or 95 V to 130 V AC; 60 Hz			
Power input	Max. 45 VA		Max. 80 VA	Max. 90 VA

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

for evaluation unit with sensor	typical 20 VA	typical 45 VA	typical 50 VA
Protection class, dimensions			
Protection class	IP65		
Dimensions (W x H x D)	190 x 259 x 541 mm		
Sensor	230 x 110 x 280 mm		
Evaluation unit			

3.1.3 Compliances

- ❖ The technical version of this device complies with the following EU directives and EN standards:
- ❖ EU Directive: LVD (Low Voltage Directive)
- ❖ EU Directive: EMC (Electromagnetic Compatibility)
- ❖ Applied EN standards:
- ❖ EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use
- ❖ EN 61326, Electrical equipment for measurement, control and laboratory use – EMC requirements

3.1.4 Electrical Protections

- ❖ Insulation: Protection class 1 in accordance with EN 61010-1
- ❖ Insulation coordination: Measuring category II in accordance with EN61010-1.
- ❖ Contamination: The device operates safely in an environment up to contamination level
- ❖ 2 in accordance with EN 61010-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).
- ❖ Electrical energy: The wiring system to the mains supply voltage of the system must be installed and fused according to the relevant regulations.

3.1.5 Laws, standards, guidelines complied with

- ❖ EC Directive 2006/95/EC
- ❖ EC Directive EMC 2004/108/EC
- ❖ EN61010-1
- ❖ EN61326

and usable in accordance with guidelines and recommendations of the

- ❖ RABT (Directive for Construction and Operation of Road Tunnels)

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd.
Reg No 2002/015527/30

- ❖ ASTRA (Swiss Federal Roads Authority)
- ❖ RVS (Standards and Regulations for Road Traffic)
- ❖ EC Directive 2004/54
- ❖ PIARC (Permanent International Association for Road Construction)

4. Electrical Scope of Work

4.1 General electrical requirements

The *Contractor* designs all electrical system in accordance with applicable National regulations and standards and Eskom standards, specifications and design codes as specified in section 2.2.2

4.1.1 220 V AC bulk power supply

The *Employer* shall provide the 220 V AC bulk supply to *Contractor* at the bunker level point of consumption. The *Contractor* is required to supply, deliver, and install, and commission the distribution board (DB) for the supply. The DB shall adhere to 240-55714363 - Eskom Generation Power Station Lighting and Small Power Installation Standard.

4.1.2 Power and control cabling

The *Contractor* supplies, installs and terminates all power and control cables at the point of supply and point of consumption. All power and control cables as well as racking shall be in accordance with 240-56227443. Type test and Routine test certificates shall be provided to the Employer prior to the delivery of cables to site. The *Contractor* utilises the existing cables trays and where additional cable racking is required, the *Contractor* provides the cable racking.

The *Contractor* procures power and control cables within the borders of South Africa as directed by the Department of Trade and Industry. The *Contractor* applies for an exemption in the case of special cables that are not available in South Africa.

4.1.3 Earthing

The *Contractor* bonds all newly installed electrical equipment to the existing earth bars. The bonding conductor shall be 50 x 3.15 mm flat copper or 70mm² bare round copper. Earthing shall be in accordance with 240-56356396 Earthing and Lightning Protection Standard.

4.2 Testing and commissioning of electrical equipment

Power and control cabling shall be tested in accordance with 240-56227443 Generation Requirements for Control and Power cables for Power Stations Standard.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd
Reg No 2002/015527/30

4.3 CLASSIFICATION OF HAZARDOUS LOCATIONS

The coal bunkers are classified Zone 22 in accordance with the Kriel Standard EEP001 - CLASSIFICATION OF HAZARDOUS LOCATIONS. The contractor is required to supply and install equipment in accordance with this standard.

4.4 Control and Instrumentation Design

Supply, Install, Commissioning and Design a complete Coal Bunkers CO Gas Monitoring and Interface it to WinCC/DCS SCADA Systems. The objective is to ensure the efficient and safe integration of CO Gas Monitoring Systems at Kriel Power Station. It is to ensure that there are no discrepancies on Coal Bunkers CO Gas Monitoring Systems and Interface to WinCC/DSC SCADA to have an accurate readings of C&I field CO Gas devices to our SCADA System and the (calibrations, fault findings etc) are done as per PM's.

4.4.1 Control and Instrumentation Scope

Coal Bunkers CO Gas Monitor Installations:

Material	Quantity
CO detections at Coal Bunkers unitized all analysers.	
VICOTEC412 Set	30
Installation for all units	6
Calibration checks (test set)	1
Delivery	1
Commissioning (Cold and Hot)	1

4.2.2 Coal Bunkers CO Gas Monitors Interface to WinCC and DCS SCADA Systems:

- ❖ Interface engineering design of the CO Gas Monitor to the SPPA-T3000 system.
- ❖ Interface engineering design of the CO Gas Monitor to the Outside Plant WinCC SCADA system.
- ❖ Procurement of the UVG20.
- ❖ Procurement of the UVG16.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

- ❖ Procurement of the heavy-duty fibre optic cable, splice boxes and patch lead.
- ❖ Procurement of Junction Boxes.
- ❖ Installation of Junction Boxes at a Coal Bunker Plant.
- ❖ Installation of UVG20 cable to the CO Gas Monitor analysers.
- ❖ Installation of UVG20 from the CO Gas Monitor Junction Boxes to the equipment room.
- ❖ Cable termination of CO Gas Monitor Junction Boxes.
- ❖ Procurement of terminal connectors.
- ❖ Procurement of Unistrut.
- ❖ Procurement of Galvanised steel tubing.
- ❖ Procurement of Galvanised steel saddles.
- ❖ Procurement of compressor gland size 2.
- ❖ Procurement of 20AWG terminal point pins.
- ❖ Procurement of 20AWG hook-up wire 100m.
- ❖ Procurement of 12 Port ST Multimode Demarcation Box.
- ❖ S7 Analog Card 6ES7331-7KF02-0AB0.
- ❖ S7 Digital Card 6ES7331-7KF02-0AB0.
- ❖ S7 Digital output Card 6ES7321-1BL00-0AA0.
- ❖ S7 Digital input Card 6ES7321-1BL00-0AA0.
- ❖ S7 Digital input Card 6ES7321-1BL00-0AA0.
- ❖ Phoenix contacts 8 level Marshalling terminal block (10 piece per Box) PTRV 8 /GY - Marshalling panel.
- ❖ Fibre optic installation and commissioning from the Unit Equipment Room to the Outside Plant Control Room.
- ❖ DCS SPPA-T3000 I/O interface engineering of the CO Gas Monitors signals.
- ❖ DCS SPPA-T3000 HMI development and updating for CO Gas Monitors signals.
- ❖ Commissioning and Testing of Alarm Siren lighting from DCS SPPA-T3000.
- ❖ Software engineering of the Marshalling PLC to the Outside Plant Control Room.
- ❖ HMI development of the Outside Plant Control Room.
- ❖ Commissioning and testing of the CO Gas Monitors I/O from the Outside Plant Control Room.
- ❖ Backups of the WinCC and DCS systems.
- ❖ Strobe Lights.
- ❖ Quality Inspections.
- ❖ Safety Inspection.
- ❖ Project Management.
- ❖ Training of Eskom Kriel Power Station Employees.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Ref No 2002/015527/30.

- ❖ Hand-over of documentations.

4.2.3 General C&I Requirements:

The following general design requirements are applicable to all aspects of the C&I design:

- ❖ All field equipment is installed in a suitable location.
- ❖ The Contractor shall ensure field equipment operates in an environment within the parameters stipulated by the manufacturer.
- ❖ Where harsh environmental conditions are unavoidable, the field equipment shall be designed for operation in that environment.
- ❖ All IP ratings are as per SANS 60529
- ❖ All supplied field equipment, excluding Junction Boxes (JBs) and their electrical connections are rated IP 65 or better.
- ❖ Field equipment situated outdoors, or in adverse environments, must be provided with additional protection hoods and enclosures.
- ❖ The equipment layout shall be such that when mechanical work is performed, no C&I equipment shall be damaged.
- ❖ The supplied field equipment provided shall be standardized to the maximum extent possible.
- ❖ The Contractor as part of the scope of work provides a detailed design report prior to execution of the works during the detail design scope freeze.
- ❖ All the documents required to be submitted by the Contractor during the design freeze shall be supplied as part of design data pack.
- ❖ The detail design report shall be in line with Eskom detail design report template (240-49910707).
- ❖ All field equipment installations are required to comply with Field Instrument Installation Standard, 240-56355754.

4.2.4 Instrumentation

- ❖ The Contractor shall execute the work presented in the Instrument Schedule supplied – Instrument Schedule.
- ❖ The Contractor shall identify the location of the new instruments based on the requirements of the Employer.
- ❖ The chosen location shall ensure optimal performance of the new instruments.
- ❖ The Contractor provides an interface from the instrumentation to C&I control system.
- ❖ The Contractor requests C&I control system existing interface connection details from the Employer.
- ❖ The Contractor provides instrumentation suitably accurate for measurement of all major and minor streams applicable to the Kriel PS Coal Bunkers CO Gas Monitors.
- ❖ The Contractor submits detailed instrumentation information to the Project Manager for acceptance before procurement or installation.
- ❖ Instruments are installed according to 240-56355754: Field Instrument Installation Standard.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd.
Reg No 2002/015527/30

- ❖ The Contractor is responsible for interfacing the Coal Bunkers CO Gas Monitors instrumentation with existing WinCC/ DCS T3000 SCADA system
- ❖ All supplied instruments shall have a built-in diagnostic that constantly monitor and alarm any faults.
- ❖ All installed instruments shall be wired to the appropriate junction box (JB).

4.2.5 C&I Cabling

- ❖ The Contractor shall provide the design, supply, installation, termination, labelling, testing, and commissioning of all cabling.
- ❖ The Contractor provides cabling to interface the C&I plant to the C&I control system.
- ❖ The Contractor interfaces C&I field cables to the C&I control system via a C&I junction box.
- ❖ Cables are according to 240-56227443 Requirements for Control and Power Cables for Power Stations according to SANS 1507-1 and SANS 1507-3.
- ❖ Existing cable routes, racking, trunking, conduits, and cabling shall be used where possible, without compromising the integrity of the installation.
- ❖ Cable routes are of a consistent and integrated design.
- ❖ New cable routes shall be designed such that equipment can be removed for maintenance without causing damage to the cables.
- ❖ Cable conduits shall be provided, if not existing.
- ❖ Durable cable numbering/labelling shall be provided for all installed cables entering junction boxes.
- ❖ The cable numbering/labelling shall be such that cable maintenance is easily achieved.
- ❖ Cable numbering per access way is restricted.
- ❖ All cables, as a minimum, shall be insulated with flame-retardant, halogen-free PVC outer sheath.
- ❖ All field cabling shall have a minimum of 2 pairs (UVG2ACM).
- ❖ Internal cores of all multi-core cables shall be colour coded.
- ❖ The management, design expertise, supply and installation for all cables, cabling and routing shall be provided by the Contractor.
- ❖ All installed cables are tested, and Certificates of compliance are issued prior to commissioning of any instrument.
- ❖ All cables provided are secured with suitable cable glands, straps, or clamps on racks, in cubicles, switchgear rooms, control rooms, equipment rooms etc.
- ❖ Transducer cabling is required to be installed with due respect for safety, reliability, access, maintenance, environmental conditions, and best practice.
- ❖ All cabling is required to be suitably protected against mechanical damage, chemicals, dust build-up and heat.
- ❖ Cables are required to only be terminated in instruments, junction boxes or other approved equipment.
- ❖ No intermediate cable joints are permitted.

CONTROLLED DISCLOSURE

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

*No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd
Reg No 2002/015527/30*

- ❖ Cables connected to instruments are required to be installed with a loop of cable to provide sufficient slack for re-making the cable connection if the instrument is removed and to allow for removing the instrument without electrical disconnection.
- ❖ Cables are required to be routed separately from electrical power cables and crossovers that bring signal and power cables into proximity shall be made at right angles.

4.2.6 Control System

- ❖ The Contractor ensures all work performed to the control system is done by an OEM authorized service provider.
- ❖ The Contractor provides all S7 PLC and I/O modules required for interfacing C&I plant, specified in this Detail Design, to the C&I control system.
- ❖ The Contractor provides all C&I control system logic, HMI and alarm changes and additions.

4.2.7 Cable Glands

- ❖ The Contractor provides stainless steel cable glands for use with cable installations.
- ❖ The Contractor uses cable glands for all cable entries.

4.2.8 Cable Racks

- ❖ The Contractor uses existing C&I cable racks as far as possible.
- ❖ The Contractor provides cable racks according to 240-56227443 Requirements for Control and Power Cables for Power Stations.
- ❖ The Contractor determines if new C&I cable racks are required to complete the interface requirements.

4.2.9 Cable Conduit/Trunking

- ❖ The Contractor provides cable conduit or trunking where cables may be exposed to damage during normal plant operation.
- ❖ The Contractor provides galvanised cable conduit or trunking where necessary.
- ❖ The cable conduit or trunking is according to 240-56227443 Requirements for Control and Power Cables for Power Stations.

4.2.10 Junction Boxes and Terminations

- ❖ The Contractor uses spare terminals in the existing junction box for interfacing the C&I plant to the C&I control system.
- ❖ The Contractor uses compression cable glands for cable entries on junction boxes to maintain the junction box IP rating.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

- ❖ The Contractor provides additional terminals in the junction box if necessary to complete the C&I interface requirements.
- ❖ The Contractor uses terminal lugs for C&I cables according to 240-56227443 - Requirements for Control and Power Cables for Power Stations.
- ❖ The Contractor shall supply and install new junction boxes where required in accordance with Eskom standards. Junction boxes shall conform to SANS 10108 for hazardous location Zone 22 for coal dust. Minimum IP rating to be IP66.
- ❖ Junction boxes shall conform to SANS 10108 for hazardous location Zone 22 for coal dust. Minimum IP rating to be IP66

4.2.11 Standardization of equipment

- ❖ The Contractor maintains standardization of C&I plant (new and existing) as far as practically possible. Labelling
- ❖ The Contractor provides instrument and cable numbers according to 240-40643427 - Coding and Labelling Standard.
- ❖ The Contractor requests available AKZ number from the Employer.

5. Works Execution

5.1 Sequencing of Works

The *Contractor* must provide an implementation plan which will detail the sequence of works and should allow for the use of incline conveyor belt as and when required, while the installation and commissioning continues on the Coal Bunkers.

5.2 Setting Out

The *Contractor* is responsible for all setting out and is responsible for conducting all additional surveys required for providing accurate investigation outcomes and As-built information. The *Contractor* must perform initial investigations on the alignment of the conveyor belt structure using and provide a detailed survey report. All survey information must be based on WGS84, Hartebeeshoek 94.

5.3 Existing Services

It is the duty of the *Contractor* to identify all existing services within his work area and ensure that all services are adequately protected. Where relocations are required, the contractor must inform the *Employer*. Liability for damages to all services, that a reasonably skilled and qualified *Contractor* ought to have identified, will be to the *Contractor's* account.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder: Eskom Holdings SOC Ltd
Reg no 2002/015527/30

5.4 Temporary Works

The *Contractor* shall be required to maintain all existing access roads, tracks and pipe crossings used by him throughout the contract period. In addition, the *Contractor* shall ensure that all access roads provided for regular operations and maintenance activities remain accessible to the respective teams.

In line with Clause 12 of the Construction regulations, the contractor shall be responsible for the design of all temporary works required to carry out the construction of the permanent works including but not limited to temporary formwork, ramps, access platforms, scaffolding, ladders, and the like. The *Contractor* must, at the *Employer's* request or any other authorised inspector, timeously provide the temporary works design to the Employer or inspector. The submission must contain all drawing details, erecting instructions, method statements, risk assessments etc. These details must demonstrate compliance with applicable SANS loading capacities and stability requirements.

The cost of all temporary works as well as the required design, drawings, certification, and additional safety inspections required on site to ensure compliance in this regard, shall be deemed to be included in the *Contractor's* rates and overhead costs.

5.5 As - Built Drawings

Upon completion of the works, in line with this SOW, the *Contractor* must provide as built drawings. The drawings must be provided in the following formats:

- Two (2) sets of hard copies (Paper size A0) (Signed by a competent and registered person)
- Two (2) Sets of hard copies (Paper Size A2) (signed by a competent and registered person)
- All Drawings in PDF format, signed by a competent and registered person (Both A0 and A2 paper size).
- A file of DWG drawings, that match the hardcopies must be submitted.
- All Drawings must have the Eskom logo.

With the exception of signatures, DWG drawings must match the PDF and hardcopies discussed above. All coordinates to be in WGS84, Hartebeeshoek 94 format.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd.
Reg No 2002/015527/30

6. Pricing Data

For the purpose of this Contract, the works will be priced, and paid, in accordance with NEC 3 ECC (2014) Option A of the Main Option Clauses. Option A is a lump sum form of contract where the work to be done in the Work Area (See Clause 11.2 (18)) is broken down into well-defined activities each listed in the activity schedule and priced by the Contractor as a lump sum. Only completed activities which are without defects are assessed for payment at each assessment date; no part payment is made if the activity is not completed by the assessment date. A typical activity schedule is provided in Appendix C.

The activity schedule may change after the Contract Date because of compensation events. (See clause 11.2(14)). Where the Contractor deems additional activities are to be added, or descriptions changed, the Contractor must amend the activities and price accordingly.

Although the Contract is a lump sum contract, the Employer will not pay for any activities that have not been done, this includes works removed from the Contractor's scope because of site findings or design requirements agreed with the Employer. By accepting this Contract, the Contractor is aware and accepts all conditions detailed in this Scope of Work.

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd
Reg No 2002/015527/30

This document has been seen and accepted by:

[illegible][illegible]

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

[illegible]

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

APPENDIX A:

Activity Schedule Breakdown

Below is the activity schedule for the multi-disciplinary team as outlined below:

ITEM NO	ACTIVITY	Quantities	COST
1	Preliminaries and Generals		
1.1	Travelling		
1.2	Medicals and safety file		
1.3	Site supervision		
1.4	Storage of materials		
1.5	Accommodation		
1.5	Tools and equipment		
1.5	Site establishment		
1.6	First Aid		
1.7	Fat Testing		
4.	C&I CO detections at Coal Bunkers unitized all analysers	Quantities	Cost
4.1.1	VICOTEC412 Set		
4.1.2	Installation for all units		
4.1.3	Calibration checks (test set)		
4.1.4	Delivery		
4.1.5	Commissioning (Cold and Hot)		
4.2	WinCC/DCS SCADA System Interface		
4.2.1	Interface engineering design of the CO Gas Monitor to the SPPA-T3000 system		
4.2.2	Interface engineering design of the CO Gas Monitor to the Outside Plant WinCC SCADA system		
4.2.3	Procurement of the UVG20		

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder Eskom Holdings SOC Ltd
Peg No 2002/015527/30

Kriel Power Station Scope of Work for Coal Bunkers Unit 1 to 6 CO Gas Monitors Installation and Interface to WinCC and DCS SCADA Systems

Unique Identifier: **559-891970663**

Revision: **02**

4.2.4	Procurement of the UVG16		
4.2.5	Procurement of the heavy-duty fibre optic cable, splice boxes and patch lead		
4.2.6	Procurement of Junction Boxes		
4.2.7	Installation of Junction Boxes at a Coal Bunker Plant		
4.2.8	Installation of UVG20 cable to the CO Gas Monitor analysers		
4.2.9	Installation of UVG20 from the CO Gas Monitor Junction Boxes to the equipment room		
4.2.10	Cable termination of CO Gas Monitor Junction Boxes		
4.2.11	Procurement of terminal connectors		
4.2.12	Procurement of Unistrat		
4.2.13	Procurement of Galvanised steel tubing		
4.2.14	Procurement of Galvanised steel saddles		
4.2.15	Procurement of compressor gland size 2		
4.2.16	Procurement of 20AWG terminal point pins		
4.2.17	Procurement of 20AWG hook-up wire 100m		
4.2.18	Procurement of 12 Port ST Multimode Demarcation Box		
4.2.19	S7 Analog Card 6ES7331-7KF02-0AB0		
4.2.20	S7 Digital Card 6ES7331-7KF02-0AB0		
4.2.21	S7 Digital output Card 6ES7321-1BL00-0AA0		
4.2.22	S7 Digital input Card 6ES7321-1BL00-0AA0		
4.2.23	Phoenix contacts 8 level Marshalling terminal block (10 piece per Box) PTRV 8 /GY - Marshalling panel		
4.2.24	Fibre optic installation and commissioning from the Unit Equipment Room to the Outside Plant Control Room		

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30

**Kriel Power Station Scope of Work for Coal
Bunkers Unit 1 to 6 CO Gas Monitors Installation
and Interface to WinCC and DCS SCADA Systems**

Unique Identifier: **559-891970663**

Revision: **02**

4.2.25	DCS SPPA-T3000 I/O interface engineering of the CO Gas Monitors signals		
4.2. 26	DCS SPPA-T3000 HMI development and updating for CO Gas Monitors signals		
4.2.27	Commissioning and Testing of Alarm Siren lighting from DCS SPPA-T3000		
4.2.28	Software engineering of the Marshalling PLC to the Outside Plant Control Room		
4.2.29	HMI development of the Outside Plant Control Room		
4.2.30	Commissioning and testing of the CO Gas Monitors I/O from the Outside Plant Control Room		
4.2.31	Backups of the WinCC and DCS systems		
4.2.32	Strobe Lights		
4.2.33	Quality Inspections		
4.2.34	Project Management		
4.2.35	Training of Eskom Kriel Power Station Employees		
4.2.36	Hand-over of documentations		
5.	Electrical	Quantities	Cost
5.1	Electrical reticulation design of the DB and cable systems		
5.2	Supply and Installation of the Electrical Distribution Box		
5.3	Supply and installation of the LV cables from the DB to each component (point of consumption)		
5.4	Supply and installation and all required cable accessories (conduits, cable rack)		
5.5	Core drilling where required		

CONTROLLED DISCLOSURE

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

No part of this document may be reproduced without the expressed consent of the copyright holder, Eskom Holdings SOC Ltd
Reg No 2002/015527/30