



NEC3 Professional Services Contract (PSC3)

Contract between Eskom Holdings SOC Limited
(Reg No. 2002/015527/06)

and
(Reg No. _____)

for Professional Engineering Services for the Monitoring of Critical Structures in Kriel Power Station: Cooling Towers, Chimney Structures, Boiler Structure, coal staithes, and Turbine Buildings for a period of 3 years

Contents:	No of pages
Part C1 Agreements & Contract Data	13
Part C2 Pricing Data	5
Part C3 Scope of Work: The Scope	18
Part C4 Site information	2

CONTRACT No.

PART C1: AGREEMENTS & CONTRACT DATA

Document reference	Title	No of pages
C1.1	Form of Offer & Acceptance [to be inserted from Returnable Documents at award stage]	3
C1.2a	Contract Data provided by the <i>Employer</i>	10
C1.2b	Contract Data provided by the <i>Consultant</i>	2

C1.1 Form of Offer & Acceptance

Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

Professional Engineering Services for the Monitoring of Critical Structures in Kriel Power Station: Cooling Towers, Chimney Structures, Boiler Structure, coal staithes, and Turbine Buildings for a period of 3 years

The tenderer, identified in the Offer signature block, has

<i>either</i>	examined the documents listed in the Tender Data and addenda thereto as listed in the Returnable Schedules, and by submitting this Offer has accepted the Conditions of Tender.
<i>or</i>	examined the draft contract as listed in the Acceptance section and agreed to provide this Offer.

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Consultant* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

The offered total of the Prices exclusive of VAT is	R
Value Added Tax @ 14% is	R
The offered total of the Prices inclusive of VAT is	R
(in words)	

If Option E or G apply, for each offered total insert in brackets, "(Not Applicable – Cost reimbursable)"

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Consultant* in the *conditions of contract* identified in the Contract Data.

Signature(s)

Name(s)

Capacity

**For the
tenderer:**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Acceptance

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the tenderer's Offer. In consideration thereof, the Employer shall pay the Consultant the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the Employer and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Scope of Work: The Scope

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any).

Signature(s)

Name(s)

Capacity

**for the
Employer**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Note: If a tenderer wishes to submit alternative tenders, use another copy of this Form of Offer and Acceptance.

Schedule of Deviations

Note:

1. To be completed by the Employer prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		
4		
5		
6		
7		

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the tenderer:

For the Employer

Signature

Name

Capacity

On behalf
of

(Insert name and address of organisation)

(Insert name and address of organisation)

Name &
signature
of witness

Date

C1.2 PSC3 Contract Data

Part one - Data provided by the *Employer*

Clause	Statement	Data
1	General	
	The <i>conditions of contract</i> are the core clauses and the clauses for main Option	
	dispute resolution Option	A: Priced contract with activity schedule
	and secondary Options	W1: Dispute resolution procedure
		X1: Price adjustment for inflation
		X2: Changes in the law
		X9: Transfer of rights
		X10: Employer's Agent
		Z: Additional conditions of contract
	of the NEC3 Professional Services Contract (June 2005) ¹ with amendments June 2006	

¹ Available from Engineering Contract Strategies Tel 011 803 3008 Fax 011 803 3009

10.1	The <i>Employer</i> is (Name):	Eskom Holdings SOC Limited (reg no: 2002/015527/06), a juristic person incorporated in terms of the company laws of the Republic of South Africa	
	Address	Registered office at Megawatt Park, Maxwell Drive, Sandton, Johannesburg	
	Tel No.	017 615 2843	
	Fax No.	086 661 2690	
11.2(9)	The <i>services</i> are	Professional Engineering Services for the Monitoring of Critical Structures in Kriel Power Station: Cooling Towers, Chimney Structures, Boiler Structure, coal staithes, and Turbine Buildings for a period of 3 years	
11.2(10)	The following matters will be included in the Risk Register		
11.2(11)	The Scope is in	Part 3: Scope of Work	
12.2	The <i>law of the contract</i> is the law of	the Republic of South Africa	
13.1	The <i>language of this contract</i> is	English	
13.3	The <i>period for reply</i> is	1 week	
13.6	The <i>period for retention</i> is	N/A. Employer to retain all the documents	
2	The Parties' main responsibilities		
25.2	The <i>Employer</i> provides access to the following persons, places, and things	access to	access date
		Kriel Power Station as per the required scope of work	
3	Time		
31.2	The <i>starting date</i> is.	03 July 2023	
11.2(3)	The <i>completion date</i> for the whole of the <i>services</i> is.	03 July 2026	
4	Quality		
42.2	The <i>defects date</i> is	52 weeks after Completion of the whole of the <i>services</i> .	
5	Payment		
50.1	The <i>assessment interval</i> is	On the 25 th day of each successive month.	

51.1	The period within which payments are made is	30 days from the tax invoice receipt
51.2	The <i>currency of this contract</i> is the	South African Rand
51.5	The <i>interest rate</i> is	0%
8	Indemnity, insurance and liability	
81.1	The amounts of insurance and the periods for which the <i>Consultant</i> maintains insurance are	
	Event	Cover
	Liability for failure by the <i>Consultant</i> to use the skill and care normally used by professionals providing services similar to the <i>services</i>	Whatever the <i>Consultant</i> deems necessary in respect of each claim, without limit to the number of claims
	death of or bodily injury to a person (not an employee of the <i>Consultant</i>) or loss of or damage to property arising from or in connection with the <i>Consultant's</i> Providing the Services.	Whatever the <i>Consultant</i> deems necessary for any occurrence or series of occurrences arising out of one event without limit to the number of claims.
	death of or bodily injury to employees of the <i>Consultant</i> arising out of and in the course of their employment in connection with this contract	As prescribed by the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 and the <i>Consultant's</i> common law liability for people falling outside the scope of the Act with a limit of indemnity of not less than R500 000-00 (five hundred thousand) in respect of each claim, without limit to the number of claims
81.1	The <i>Employer</i> provides the following insurances	Refer to Annexure A for details of insurance provided by the <i>Employer</i> .
82.1	The <i>Consultant's</i> total liability to the <i>Employer</i> for all matters arising under or in connection with this contract, other than the excluded matters, is limited to	The total of the Prices
	The <i>Consultant</i> provides these additional insurances.	

	1	Insurance against:	Whatever the <i>Consultant</i> deems necessary including cover provided for payment of deductibles
10	Data for main Option clause		
A	Priced contract with activity schedule		
21.3	The <i>Consultant</i> prepares forecasts of the total of the <i>expenses</i> at intervals of no longer than		3 weeks.
11	Data for Option W1		
W1.1	The <i>Adjudicator</i> is (Name)		the person selected from the Eskom Panel of Adjudicators listed in Annexure C to this Contract Data by the Party intending to refer a dispute to him.
W1.2(3)	The <i>adjudicator nominating body</i> is:		the Chairman of the Joint Civils Division of the South African Institution of Civil Engineering or its successor body. (See www.jointcivils.co.za).
W1.4(2)	The <i>tribunal</i> is:		arbitration
W1.4(5)	The <i>arbitration procedure</i> is		the latest edition of Rules for the Conduct of Arbitrations published by The Association of Arbitrators (Southern Africa) or its successor body.
	The place where arbitration is to be held is		[•] South Africa
	The person or organisation who will choose an arbitrator		
	<ul style="list-style-type: none"> if the Parties cannot agree a choice or if the <i>arbitration procedure</i> does not state who selects an arbitrator, is 		the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.
12	Data for secondary Option clauses		
X1	Price adjustment for inflation		
X1.1	The staff rates are		Fixed at the Contract Date and are not variable with changes in salary paid to individuals
X2	Changes in the law		
X2.1	The law of the project is		Any law within the republic of South Africa which applies to the Consultant's providing the Services
X9	Transfer of rights		There is no reference to Contract Data in this Option and terms in italics used in this Option are identified elsewhere in this Contract Data
X10	The Employer's Agent		

X10.1	<p>The <i>Employer's Agent</i> is</p> <p>Name: Neo Muthavhine</p> <p>Address Eskom Kriel Power Station Private Bag X5009, Kriel, 2271, Republic of South Africa</p> <p>The authority of the <i>Employer's Agent</i> is To carry out all the actions of the Employers in this contract</p>	
Z	The <i>Additional conditions of contract</i> are	

Z1 Cession delegation and assignment

Z1.1 The *Consultant* does not cede, delegate or assign any of its rights or obligations to any person without the written consent of the *Employer*.

Z1.2 Notwithstanding the above, the *Employer* may on written notice to the *Consultant* cede and delegate its rights and obligations under this contract to any of its subsidiaries or any of its present divisions or operations which may be converted into separate legal entities as a result of the restructuring of the Electricity Supply Industry and the Electricity Distribution Industry.

Z2 Joint ventures

Z2.1 If the *Consultant* constitutes a joint venture, consortium, or other unincorporated grouping of two or more persons or organisations then these persons or organisations are deemed to be jointly and severally liable to the *Employer* for the performance of this contract.

Z2.2 Unless already notified to the *Employer*, the persons or organisations notify the *Employer* within two weeks of the Contract Date of the key person who has the authority to bind the *Consultant* on their behalf.

Z2.3 The *Consultant* does not substantially alter the composition of the joint venture, consortium or other unincorporated grouping of two or more persons without the consent of the *Employer* having been given to the *Consultant* in writing.

Z3 Change of Broad Based Black Economic Empowerment (B-BBEE) status

Z3.1 Where a change in the *Consultant's* legal status, ownership or any other change to his business composition or business dealings results in a change to the *Consultant's* B-BBEE status, the *Consultant* notifies the *Employer* within seven days of the change.

Z3.2 The *Consultant* is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the *Employer* within thirty days of the notification or as otherwise instructed by the *Employer*.

Z3.3 Where, as a result, the *Consultant's* B-BBEE status has decreased since the Contract Date the *Employer* may either re-negotiate this contract or alternatively, terminate the *Consultant's* obligation to Provide the Services.

Z3.4 Failure by the *Consultant* to notify the *Employer* of a change in its B-BBEE status may constitute a reason for termination. If the *Employer* terminates in terms of this clause, the procedures on termination are those stated in core clause 91. The payment on termination includes a deduction of the forecast of the additional cost to the *Employer* of completing the whole of the *services* in addition to the amounts due in terms of core clause 92.1.

Z4 Ethics

Z4.1 Any offer, payment, consideration, or benefit of any kind made by the *Consultant* which constitutes or could be construed either directly or indirectly as an illegal or corrupt practice, as an inducement or reward for the award or in execution of this contract constitutes grounds for terminating the *Consultant's* obligation to Provide the Services or taking any other action as appropriate against the *Consultant* (including civil or criminal action).

Z4.2 The *Employer* may terminate the *Consultant's* obligation to Provide the Services if the *Consultant* (or any member of the *Consultant* where the *Consultant* constitutes a joint venture, consortium, or other unincorporated grouping of two or more persons or organisations) is found guilty by a competent court, administrative or regulatory body of participating in illegal or corrupt practices.

Such practices include making of offers, payments, considerations, or benefits of any kind or otherwise, whether in connection with any procurement process or contract with the *Employer* or other people or organisations and including in circumstances where the *Consultant* or any such member is removed from the an approved vendor data base of the *Employer* as a consequence of such practice.

Z4.3 If the *Employer* terminates in terms of this clause, the procedures on termination are those stated in core clause 91. The payment on termination includes a deduction of the forecast of the additional cost to the *Employer* of completing the whole of the *services* in addition to the amounts due in terms of core clause 92.1.

Z5 Confidentiality

Z5.1 The *Consultant* does not disclose or make any information arising from or in connection with this contract available to Others. This undertaking does not, however, apply to information which at the time of disclosure or thereafter, without default on the part of the *Consultant*, enters the public domain or to information which was already in the possession of the *Consultant* at the time of disclosure (evidenced by written records in existence at that time). Should the *Consultant* disclose information to Others in terms of clause 23.1, the *Consultant* ensures that the provisions of this clause are complied with by the recipient.

Z5.2 If the *Consultant* is uncertain about whether any such information is confidential, it is to be regarded as such until notified otherwise by the *Employer*.

Z5.3 In the event that the *Consultant* is, at any time, required by law to disclose any such information which is required to be kept confidential, the *Consultant*, to the extent permitted by law prior to disclosure, notifies the *Employer* so that an appropriate protection order and/or any other action can be taken if possible, prior to any disclosure. In the event that such protective order is not, or cannot, be obtained, then the *Consultant* may disclose that portion of the information which it is required to be disclosed by law and uses reasonable efforts to obtain assurances that confidential treatment will be afforded to the information so disclosed.

Z5.4 The taking of images (whether photographs, video footage or otherwise) of the *Employer's* project works or any portion thereof, in the course of Providing the Services and after Completion, requires the prior written consent of the *Employer*. All rights in and to all such images vests exclusively in the *Employer*.

Z6 Waiver and estoppel: Add to core clause 12.3:

Z6.1 Any extension, concession, waiver or relaxation of any action stated in this contract by the Parties, or the *Adjudicator* does not constitute a waiver of rights, and does not give rise to an estoppel unless the Parties agree otherwise and confirm such agreement in writing.

Z7 Provision of a Tax Invoice. Add to core clause 51

Z7.1 The *Consultant* (if registered in South Africa in terms of the companies Act) is required to comply with the requirements of the Value Added Tax Act, no 89 of 1991 (as amended) and to include the *Employer's* VAT number 4740101508 on each invoice he submits for payment.

Z8 Notifying compensation events

Z8.1 Delete from the last sentence in core clause 61.3, "unless the *Employer* should have notified the event to the *Consultant* but did not".

Z9 *Employer's* limitation of liability

Z9.1 The *Employer's* liability to the *Consultant* for the *Consultant's* indirect or consequential loss is limited to R0.00 (zero Rand)

Z10 Termination: Add to core clause 90.1, at the second main bullet point, fourth sub-bullet point, after the words "against it":

Z10.1 or had a judicial management order granted against it.

Z11 Delay damages: Addition to secondary Option X7 Delay damages (if applicable in this contract)

Z11.1 If the *Consultant's* payment of delay damages reaches the limits stated in this Contract Data for Option X7 or Options X5 and X7 used together, the *Employer* may terminate the *Consultant's* obligation to Provide the Services.

Z11.2 If the *Employer* terminates in terms of this clause, the procedures on termination are those stated in core clause 91. The payment on termination includes a deduction of the forecast of the additional cost to the *Employer* of completing the whole of the *services* in addition to the amounts due in terms of core clause 92.1.

Annexure A: Notes to Consultants

1. For the purpose of works contracts, insurance provided by Eskom (the *Employer*) has been arranged on the basis of “project” or “contract” value, where the value is the total of the Prices at Completion of the whole of the works including VAT.

A “project” is a collection of contracts or work packages to be undertaken as part of a single identified capital expansion or refurbishment of a particular asset or facility.

A “contract” is a single contract not linked to or being part of a “project”.

2. There are three main “formats” of cover and deductible structure; Format A, Format B and Format Dx.

Format A is for a project or contract value less than or equal to R350M (three hundred and fifty million Rand) inclusive of VAT.

Format B is for a project or contract value greater than R350M (three hundred and fifty million Rand) inclusive of VAT.

In the case of contracts / packages within a project:

- For a contract / package of R50M which is part of a R400M project, Format B will apply
- For a contract / package of R250M which is part of a R6 billion project, Format B will apply;
- For a contract / package of R120M which is part of a R350M project Format A will apply;

For a contract which is not part of a project the same limits apply:

- For a contract of R50M, Format A will apply
- For a contract of R355M, Format B will apply.

Format Dx applies only to Distribution Division projects and contracts. If a Distribution Division project or contract exceeds the Format A limit, the Eskom Insurance Management Services [EIMS] need to be contacted for advice on how to formulate the insurance cover. Cover and deductibles for Distribution Division are per the relevant policy available on the internet web link given below.

Format A generally applies to Transmission Division projects and contracts. If a Transmission Division project or contract exceeds the Format A limit, the Eskom Insurance Management Services [EIMS] need to be contacted for advice on how to formulate the insurance cover.

3. **Further information and full details of all Eskom provided policies and procedures may be obtained from:**

http://www.eskom.co.za/live/content.php?Item_ID=9248

4. The Insurance which the *Consultant* is to provide against his liability for claims made against him arising out of his failure to use reasonable skill and care (first row in the Insurance Table of clause 81.1 in the PSC3) should also indemnify the *Consultant* for those sums which he could become legally liable to pay as damages arising from any claim first made against him and reported to Insurers some time after Completion of the whole of the *services*. Hence the *Consultant* needs to ensure that his cover is in place at least until all his liabilities under the contract have expired. Such claims could arise out of any negligent act, error or omission committed or alleged to have been committed by the *Consultant* in the conduct of professional services in connection with the contract.

Annexure B: The *Employer's* Panel of Adjudicators

The following persons listed in alphabetical order of their surname have indicated their willingness to be included in the Eskom Panel of Adjudicators. Their CV's may be obtained by using the contact details provided.

Name	Location	Contact details (phone & e mail)
Nigel ANDREWS	Gauteng	+27 11 836-6760 nigela@quoin.net
Andrew BAIRD	Gauteng	+27 11 803 3008 andrewbaird@ecsconsult.co.za
Christopher BINNINGTON	Gauteng	+27 11 888-6141 cdb@bca.co.za
Peter HIGGINS	UK	+44 1293 873 868 peterhiggins@pdconsult.co.uk
Bruce LEECH	Gauteng	+27 11 290 4000 leech@counsel.co.za
Nigel NILEN	Gauteng	+27 11 465 3601; nilences@global.co.za
Peter THURLOW	Gauteng	+27 11 787 6226 info@thurlowassoc.com

Information about the Panel and appointment of the selected *Adjudicator* is available from Eskom Supply Chain Operations management, by contacting Leighton.ltholeng 011 800 4031 or [Leighton.ltholeng@eskom.co.za]

C1.2 Contract Data

Part two - Data provided by the *Consultant*

[Instructions to the tendering consultant: (delete these notes in the final draft of a contract)]

1. The tendering consultant is advised to read both the NEC3 Professional Services Contract (April 2013) and the relevant parts of its Guidance Notes (PSC3-GN)² in order to understand the implications of this Data which the tenderer is required to complete. An example of the completed Data is provided on pages 146 to 150 of the PSC3 Guidance Notes. The number of the clause in the PSC3 which requires the data is shown in the left-hand column for each statement however other clauses may also use the same data.
2. Whenever a cell is shaded in the left-hand column it denotes this data is optional and would be required in relation to the option selected. The *Employer* should already have made the selection and deleted the rows not required.

Completion of the data in full, according to Options chosen, is essential to create a complete contract.

Clause	Statement	Data
10.1	The <i>Consultant</i> is (Name): Address Tel No. Fax No.	
22.1	The <i>Consultant's</i> key persons are: 1 Name: Job: Responsibilities: Qualifications: Experience: 2 Name: Job Responsibilities: Qualifications: Experience:	
11.2(3)	The <i>completion date</i> for the whole of the services is	
11.2(10)	The following matters will be included in the Risk Register	
11.2(13)	The <i>staff rates</i> are:	name/designation rate

² Available from Engineering Contract Strategies Tel 011 803 3008 Fax 011 803 3009

	Either complete here or cross refer to a schedule in Part C2.2		
25.2	The <i>Employer</i> provides access to the following persons, places and things	access to	access date
		1	
		2	
		3	
31.1	The programme identified in the Contract Data is		
50.3	The <i>expenses</i> stated by the <i>Consultant</i> are	item	amount
A	Priced contract with activity schedule		
11.2(14)	The <i>activity schedule</i> is in		
11.2(18)	The tendered total of the Prices is	(in figures)	
		(in words), excluding VAT	
C	Target contract		
11.2(14)	The <i>activity schedule</i> is in		
11.2(18)	The tendered total of the Prices is	(in figures)	
		(in words), excluding VAT	
G	Term contract		
11.2(25)	The <i>task schedule</i> is in		

PART 2: PRICING DATA

PSC3 Option A

Document reference	Title	No of pages
C2.1	Pricing assumptions: Option A	2
C2.2	The <i>activity schedule</i>	1

C2.1 Pricing assumptions: Option A

How work is priced and assessed for payment

Clause 11 in NEC3 Professional Services Contract, April 2013 (PSC3) Option A states:

Identified and defined terms	11	
	11.2	(14) The Activity Schedule is the <i>activity schedule</i> unless later changed in accordance with this contract.
		(15) The Price for Services Provided to Date is the total of the Prices for the activities which have been completed. A completed activity is one which is without Defects which would delay immediately following work.
		(18) The Prices are the lump sum prices for each of the activities on the Activity Schedule unless later changed in accordance with this contract.

This confirms that Option A is a lump sum form of contract where the work is broken down into activities, each of which is priced by the tendering consultant as a lump sum. Only completed activities are assessed for payment at each assessment date; no part payment is made if the activity is not completed by the assessment date.

Function of the Activity Schedule

Clause 53.1 in Option A states: "Information in the Activity Schedule is not Scope." This confirms that instructions to do work or how it is to be done are not included in the Activity Schedule but in the Scope. This is further confirmed by Clause 21.1 which states, "The *Consultant* Provides the Services in accordance with the Scope". Hence the *Consultant* does **not** Provide the Services in accordance with the Activity Schedule. The Activity Schedule is only a pricing document.

Link to the programme

Clause 31.4 states that "The *Consultant* provides information which shows how each activity on the Activity Schedule relates to the operations on each programme which he submits for acceptance". Hence when compiling the *activity schedule*, the tendering consultant needs to show each activity on the programme he submits with his tender.

Preparing the activity schedule

The tendering consultant prepares the *activity schedule* and should study the PSC3 Guidance Notes pages 2 and 24 before doing so. The *Employer* may have instructed the tendering consultant to include particular activities which he has specified and requires the *Consultant* to identify them in his *activity schedule*.

1 Generally it is the *Consultant* who prepares the Activity Schedule as part of his tender by breaking down the work described within the Scope into suitable activities which can be well defined, priced as a lump sum and shown on the programme. The *Employer*, in his Conditions of Tender or in a Tender Schedule, may have listed some items that he requires the *Consultant* to include in his *activity schedule* and be priced accordingly.

2 The Prices are defined in clause 11.2(18) as the lump sum for each activity in the activity schedule and the Price for Services Provided to Date (PSPD) (the amount due to the *Consultant*) is defined in clause 11.2(15) as the total of the Prices for each activity that has been completed. Hence activities in the activity schedule should be structured so as to provide an acceptable monthly cash flow as they are only

assessed for payment on the assessment date if they have been completed.

3 As the *Consultant* has an obligation to correct Defects (core clause 41) the lump sum Prices must also include for the correction of Defects except if the Defect is one for which the *Consultant* is not liable which is compensation event 60.1(12).

4 If the *Consultant* has decided not to identify a particular activity, the cost to the *Consultant* of doing the work must be included in, or spread across, the other Prices in order to fulfil the obligation to complete the services for the tendered total of the Prices.

5 There is no adjustment to the lump sum activity schedule price if the amount, or quantity, of work within that activity later turns out to be different to that which the *Consultant* estimated at time of tender. The only basis for a change to the Prices is as a result of a compensation event. See Clause 60.1.

6 Hence the Prices tendered by the *Consultant* in the *activity schedule* are inclusive of everything necessary and incidental to Providing the Services in accordance with the Scope, as it was at the time of tender, as well as correct any Defects except those for which he is not liable.

7 However, the *Consultant* does not have to allow in his Prices for matters that may arise as a result of a compensation event.

Expenses

Expenses are not included in the activity schedule items and are assessed separately at each assessment date.

Expenses associated with employing a staff member in Providing the Services are listed separately either by the *Employer* in Contract Data provided by the *Employer* or by the *Consultant* in Contract Data provided by the *Consultant*. As only the *expenses* listed may be claimed by the *Consultant*, all other cost to the *Consultant* associated with Providing the Services must be included within the activity schedule or *staff rates*.

Rate adjustment for inflation of *expenses* is explained on page 13 of the Guidance Notes.

Staff rates

When a compensation event occurs changes to the affected Activity Schedule item or new priced items in the Activity Schedule are assessed as the actual Time Charge for work already done and the forecast Time Charge for work not yet done. (See clause 63.1 and 63.14 in Option A)

The Time Charge is the sum of the products of each of the *staff rates* multiplied by the total staff time appropriate to that rate properly spent on work in this contract. (Clause 11.2(13))

Tendering consultants are advised to consult the NEC3 Professional Services Contract (April 2013) Guidance Notes and Flow Charts page 28 before entering *staff rates* into Contract Data, or in C2.2 below.

This is because *staff rates* can be established in one of three ways:

- rates for named staff,
- rates for categories of staff or
- rates related to salaries paid to staff.

Rate adjustment for inflation, if necessary, can be based either on actual salary adjustments or by using Option X1: Price adjustment for inflation. See pages 13, 14 and 28 of the Guidance Notes.

C2.2 the *activity schedule*

This contract will be for a period of 3 years.

CPA will be applicable to this Contract

MONITORING OF CRITICAL STRUCTURES IN KRIEL POWER STATION: COOLING TOWERS, CHIMNEY STRUCTURES, BOILER STRUCTURE, COAL STAITHES, AND TURBINE BUILDINGS FOR A PERIOD OF 3 YEARS										
ITEM NO.	DESCRIPTION	RESOURCES								Total Amount (R)
		Project Director (hrs)	Rate/hr	Senior Structural Engineer (hrs)	Rate/hr	Structural Engineer (hrs)	Rate/hr	Civil Technician (hrs)	Rate/hr	
1	PROJECT INCEPTION									
1.1	Initial Site visit	6		6		6		6		
1.2	Project planning	4		18		18		0		
	Sub-Total A		R		R		R		R	R
2	COOLING TOWER INSPECTIONS									
2.1	Visual inspection	0		0		96		96		
2.2	Testing Supervision	0		6		6		12		
2.3	Proposed Remedial measures including costing	0		6		18		3		
	Sub-Total B		R		R		R		R	R
3	CHIMNEY INSPECTIONS									
3.1	Visual inspection	0		0		48		48		
3.2	Testing Supervision	0		0		6		12		
	Proposed Remedial measures including costing	0		12		32		3		
	Sub-Total C		R		R		R		R	R
4	BOILER & TURBINE HOUSE: EXTERNAL FACE MAPPING									

4.1	Visual inspection	0		0		144		144		
4.2	Testing Supervision	0		0		24		24		
4.3	Proposed Remedial measures including costing	0		6		48		12		
	Sub-Total D		R		R		R		R	R
5	COAL STAITHES									
5.1	Visual inspection	0		0		48		72		
5.2	Testing Supervision	0		0		24		24		
5.3	Proposed Remedial measures including costing	0		48		24		6		
	Sub Total E		R		R		R		R	R
6	BOILER STRUCTURE									
6.1	Visual inspection	0		12		108		144		
6.2	Testing Supervision	0		0		24		24		
6.3	Proposed Remedial measures including costing	0		12		36		6		
	Sub-Total F		R		R		R		R	R
7	REPORTING									
7.1	Compilation of Annual Report	2		24		72		18		
7.2	Internal Review	8		24		24		24		
7.3	Client Review	6		6		24		24		
7.4	Incorporating Client Comments	6		12		24		24		
7.5	Final Submission	3		3		3		0		
	Total Hours	35		201		1073		906		
	Sub-Total G		R		R		R		R	R
7	DISBUREMENTS	UNIT	QUANTITY	RATE						
7.1	Travelling	km	7500	R						R

7.2	Accommodation within 100km of site	day	75	R	R
7.3	Subsistence	day	75	R	R
7.4	Printing and binding	Sum	3	R.....	R.....
7.5	Specialist Testing (NDT and DT)	Sum	3	R.....	R.....
7.6	Specialist monitoring Equipment (incl. drones)	Sum	3	R.....	R.....
					Sub-Total R
					Contingencies (10%) R
					Sub-total 1 R
					VAT (15%) R
					Total R

****NB: Tenders are required to populate the shaded areas in the activity schedule above. Should there be clarity sought on how the schedule is structured, with regards to formulas, clarity will be provided at the clarification meeting and through written communication with the relevant Eskom procurement representative.***

PART 3: SCOPE OF WORK

Document reference	Title	No of pages
C3.1	This cover page	1
	<i>Employer's Scope</i>	8
	Total number of pages	9

Part 3: Scope of Work

3.1 The Scope

The **Scope of Work for the Monitoring of Critical Structures in Kriel Power Station**: includes the assessment of the Cooling Towers, Chimney Structures, Boiler Structure, coal staithes, and Turbine Buildings. The Employer requires the *Consultant* to perform detailed inspections and full structural assessment as well as providing a repair scope of work for the critical structures as defined above. The Critical Structures to be assessed include the following:

- Four (4) Cooling towers and the respective structural elements.
- Two (2) Chimney structures including and associated structural elements
- Two (2) Coal Staithes, concrete shell and supporting structural elements
- Six (6) Boiler Structures
- Six (6) turbine structures

Based on the operations of the Kriel Power Station, several areas within the structures discussed above would either be inaccessible due to height limitations and normal generation processes or. During the detailed inspections and structural assessment, the *Consultant* is expected to perform the following tests:

- Readings of surface hardness.
- Depth of carbonation, tested at critical/ key points (Key points to be documented in method statement).
- Concrete strength by taking core samples.
- Concrete cover, tested at critical/ key points.
- Brick and mortar testing
- Potential half-cell method for corrosion testing.
- Sulphate/ Nitrate/Chloride attack.
- Environmental factors, as detailed below.
- Analysis of concrete samples (chemical analysis).
- Life expectancy under normal and abnormal conditions (e.g.: extreme chemical attack, major cracks, loss of concrete cover).

3D laser scan survey and model to measure the deformations, possible settlement, and loading patterns of the as-built structures and report on the deformations found. Excessive deformations will be highlighted for further investigation.

The "Consultant" will be appointed for a period no longer than three (3) years.

3.2. OBJECTIVES

Listed below are the main objectives of inspection/maintenance management of the critical structures at Kriel Power Station:

- To comply with the Occupational Health and Safety Act 85 of 1993 and the Construction Regulations 2014 inspections requirements.
- To proactively prevent structural failures that may result in loss of life and financial loss.
- Providing a detailed reference point to be able to follow the ageing of the structure (periodical control) and warranty of their operability to end of asset life.
- From the list of recorded defects, prioritising the defects which should be repaired (remedial works) or monitored in short to medium term to plan and optimise maintenance costs.
- Based on the prioritised list of defects prepare a bill of quantities (BOQ) and cost estimates for immediate and urgent repairs.

3.3. MOTIVATION AND OBJECTIVES

When civil engineering related infrastructure are designed, relevance is given to its stability and durability taking into consideration the life of the assets, its environment and maintenance. It is also assumed that it will be properly maintained during its life. As with any infrastructure within the built environment, during the service life of the structural assets, structures will be subjected to an array of factors that would generally

affect the integrity of the structure if such effects are not timeously identified and addressed. These factors include, but not limited to, the following:

- Cyclic loading- this can result in material deformations
- Environmental factors – Exposure to extreme weather conditions and highly corrosive environments
- Impact loads – Deformations to structures due to impacts during regular maintenance.

The motivation for the monitoring of critical structures at Kriel Power station is to detect potential structural decay that could have adverse impacts on the health and safety of exposed persons, the environment, and production at Kriel Power Station. The objective of this scope of works is to ultimately identify maintenance requirements and provide the necessary preventative maintenance solutions for the critical structures at Kriel Power Station.

3.3.1 Safety and Legislation

(a) By legislation, owners of structures are required to conduct inspections of all structures during the life of the plant asset in terms of the OSHA Construction regulations.

(b) The OHS Act in Regulation R 1010 of 18/07/2003 states the following:

"(4) Any owner of a structure shall ensure that inspections of that structure upon completion are carried out periodically by competent persons in order to render the structure safe for continued use: Provided that the inspections are carried out at least once every six months for the first two years and thereafter yearly and records of such inspections are kept and made available to an inspector upon request."

(c) Construction Regulations (2014) with regards to existing structures Regulation 11(2) states that "An owner of a structure must ensure that:

inspections of that structure are carried out periodically by competent persons in order to render the structure safe for continued use;
that the inspections contemplated in sub-regulation (a) are carried out at least once every six months for the first two years and thereafter yearly;
the structure is maintained in such a manner that it remains safe for continued use;
the records of inspections and maintenance are kept and made available on request to an inspector."

3.3.2 Inspections Objectives

The primary objective of conducting inspections and the development of maintenance management strategy is to assess the current condition of civil engineering assets with reference to their strength and condition and to ensure that appropriate maintenance is carried out where significant deterioration has occurred. The secondary objective may be related to the development of civil and structural engineering maintenance budgets. This is done by comparing the current condition of the assets with its original condition (or reference point condition) and specifying what is necessary to maintain the safe structural integrity.

It is envisaged that the Consultant will conduct comprehensive inspections based on the requirements outlined in the ensuing subsections or guided by their experience, in the interest of meeting the requirements of "the Act". The Consultant will be required to compile and submit a comprehensive annual report for the assessment of critical structures in Kriel Power Station for a period, no longer than three (3) years. In addition to the above, where the severity of deterioration of a structural element has reached critical levels, the Consultant will be required to provide interim reports that provide recommendations of the required repairs.

The report shall indicate, depending on the type of the asset to be inspected, how the inspection was carried out, supported by photographs and sketches; it must provide recommendations on possible repair methods. The investigation and report must be sufficiently detailed to allow for adequate maintenance to commence or to deem the structure structural sound and safe to operate. Where access is limited due to station processes, provision for further inspections during planned outages will be arranged.

3.4. GENERAL INSPECTION AND MONITORING REQUIREMENTS

The fundamental purpose of Power Station inspections is to confirm that the plant remains safe to use productively.

3.4.1. Structure Health Monitoring

The main objective of preventive maintenance is to detect, quantify and localise any defects which can affect in a short, medium, and long term the structural integrity of a structure. To meet this objective means recording and quantifying at the same time, all the significant defects as well as any evolution of the defect. It is only the evolution of a cracking pattern or corrosion mechanism that could alert and prevent any risk of structural impact which could occur in the next years. To be able to record this evolution, to compare one state with another, sufficient information should be captured (identification, location, and characterisation) of each defect.

Also, it is only with a full record of all the defects that a structural health indicator can be established for comparison with a structural zone, the whole structure or to benchmark with international reference data. This full data system (identification, characterisation, location) will provide the required information to also quantify, specify, and supervise any repair work.

To follow the ageing of a structure a full and complete mapping and characterisation of each apparent defect has to be performed. This means acquiring data of each defect in order to estimate the present structural health of the structure. These methods provide the opportunity to control any evolution of a defect of the structure from its current state and will provide a good support/reference for any preventive maintenance to be implemented. This means that:

- Inspections needs to be "exhaustive" and each defect precisely localised (in order to be able to look at them again in the next few years or decades), well characterised and pictured (in order to notice any evolution). Each visual inspection deliverable should include a reference map of defects.
- The methods should be based on inspection procedures to deliver a reference point with an accurate and exhaustive bill of defects (quantity, size, characteristics) in order to not only build a robust and economical strategy for maintenance and repair work but also further monitoring in order to save costs.

3.4.2. Previous Reports

Because it is only the evolution of a cracking pattern or corrosion mechanism that could alert and prevent any risk of structural impact it is important to study previous reports in order to establish which information, if any, could be used to track this evolution. It must be noted that there might be gaps in historical reports that the Employer will provide. Where reports are not available, the appointed consultant will be expected to treat the investigation as a new investigation with no historical data.

3.4.3. Geographic Information System

In order to detect, quantify and localise any defects which can affect in a short, medium and long term the integrity of the structure means that a comprehensive data management system should be established. Referencing spatial data with field data will further assist with the management of the system. A Geographic Information System (GIS) is an ideal tool to achieve this. The GIS system could then also be used to query, sort and abstract relevant data for the planning and development of maintenance programme going forward.

Should a GIS System be used then all the data could be merged with different layers. For instance;

- One layer could contain HD pictures adapted to become a scaled picture, also called "orthophoto"
- Another layer could contain all the defects as per the inspection.

Data should then be geo-referenced. This means that every defect is accurately located as well as its features (length, crack-width, etc.):

- Total length of cracks.
- Total length of corroded bars.
- Number of corroded bars.
- Number of cracks presenting a length superior to a given length.
- Total length cracks presenting a width superior to a given crack-width.

This information then allows conducting statistical evaluations and to calculate health indicators of the asset (to benchmarks with global reference database, etc.)

3.4.4. Condition Categories

In order to ensure consistency of reporting and common understanding of the severity of deterioration of plant structures, six condition categories are used, as defined in Table 1

Table 1: Condition Categories

Category	Description	% Original Strength	Typical Remedial Action
0	The plant assets are in excellent condition with no deterioration evident. Safe use of the plant assets is assured.	100	None Required
1	The plant assets have slight evidence of surface deterioration, but to an extent that there is no reduction in strength.	100	None Required
2	The plant assets have some deterioration to an extent that there is slight reduction in strength. Safe use of the plant assets is assured.	95-100	Repaint, tighten bolts, other minor work
3	The plant assets show deterioration, to an extent that there is some reduction in strength. There is some compromise to safe use of the plant structure. Repair must receive attention in maintenance scheduling.	75-95	Repair, repaint, tighten bolts, other minor work
4	The plant assets show severe deterioration, to an extent that there is a major reduction in strength. Safe use of the plant is severely compromised. Urgent attention must be given to repair.	50-75	Repair or replace components
5	The plant assets show severe deterioration, to an extent that they have little useful residual strength. Safe use of the plant is impossible. Urgent attention must be given to repair.	< 50	Repair or replacement of components required urgently

3.4.5. Visual Inspections Specific Safety

The purpose of this section is to define safety requirements for a visual inspection.

3.4.5.1 Accompanying Person

When the visual inspection is carried out by any person who is not normally employed on the plant, the “Employer” will provide an Engineer, who is familiar with the plant being inspected. The Engineer provided by the Employer will be required to accompany the “Consultant” to areas that have restricted access on the first inspection. For the preceding inspections, it would be assumed that the Consultant has adequately familiarized themselves with the site. The “Consultant” will be required to undergo inductions and adhere to all safety requirements applicable to Kriel Power Station and Eskom in general. All necessary permits are to be obtained prior to accessing any restricted area, in line with the Kriel Power Station requirements.

3.4.5.2. Induction

Where an induction is required, the “Employer” will advise the “Consultant” of all induction requirements and processes within a reasonable time. The “Employer” will communicate requirements for personal protective equipment to the “Consultant” for the various areas to be accessed.

3.4.5.3 Risk Assessment

The “Consultant” conducting the visual inspection must also conduct a risk assessment prior to commencement of the inspection, to identify any hazards and risks that may be encountered, and to develop risk mitigation measures.

3.4.5.4. Access and Lighting

The visual inspection will generally be conducted from the ground or from easily accessible floors, stairs, and walkways. Where access is required to inspect inaccessible or hidden areas, the “Employer” will provide safe access in line with Kriel Power Station requirements and “the Act”. All inspections conducted to be conducted will commence only with prior notification of the “Employer” by the “Consultant”. No inspection will commence where the necessary safety requirements are in doubt or have not been confirmed.

Where access is required during outages, the Employer will make provisions for the necessary permits to be provided to the appointed Consultant. The lighting provided by the client will be based primarily on outage requirements. Additional lighting requirements will be agreed upon with the Employer once such areas have been accessed.

3.5. STRUCTURAL INSPECTIONS

3.5.1. Cooling Towers

The cooling tower system comprises of the following structures:

- Cooling Towers 1 and 2, located on the northern side of the power station.
- Cooling towers 3 and 4, located on the southern side of the power station

The cooling system also comprises 2 cooling pump houses, with 1 pumphouse located on either ends of the station.

3.5.1.1 Description

The cooling system in use at Kriel Power Station is a wet cooling system. A wet-cooling system follows the counter-flow concept in which air flows upward through the fill section and interfaces counter-currently with falling hot water.

Typically cooling towers are measured at the foundation annular ring beam. The foundation ring beams are typically supported on augered reinforced concrete piles as in the case of Kriel Power Station. In other cases they may be supported by mass concrete bases under diagonal columns taken to the bedrock. Typically pond floors, in areas of made-up or back-filled ground, are supported on augered piles.

Based on the age of the Power Station and the deficiencies in storage of historical records, drawings will be issued based on their availability. Typical layout and elevation of the power station's cooling towers will be made available on building plans/contract drawings, if available. Power Station reinforcement drawings, which illustrate the typical reinforcement arrangement both at the columns and the shell, can be made available on request.

3.5.1.2. Typical Problems in Cooling Tower Structures

The mode of operation will certainly have an effect on the structural performance. Frequency of starting and shutdown as well as low-load operation has an impact on the concrete exposure conditions and will influence the long-term performance of the concrete.

The reinforcement on the cooling tower shell contributes to factors such as crack control of due to temperature differential, lateral loads such as wind and seismic loads. Severe reduction in the steel area due

to corrosion, or a drastic decrease of the concrete section because of spalling, which would ultimately compromise the integrity of the structure. It is relevant to highlight some of the possible stress-related problems in cooling tower structures.

The hyperbolic shape of a cooling tower is rather a constructional than a thermal parameter. Membrane forces essentially take up the self-weight and the wind loads. The cooling towers are, therefore, very sensitive to geometric imperfections. These imperfections disturb the stress pattern and result in high local compressive and tensile stresses, which may cause cracking.

The skirt of a cooling tower's shell is only supported at concentrated points. High local stresses will cause edge shearing strain, which may lead to a state of distress, if disregarded.

The hyperbolic shell is also very sensitive to differential settlement of the foundations. Differential settlement will induce partial edge effects, which, according to research in cooling towers of this magnitude, could spread up to 1/20 to 1/5 of the height of the tower.

Temperature variations, and in particular differential temperatures across the thickness of the shell wall, can also cause considerable stresses. Apart from exposure, the degree to which these stresses result in structural problems will also depend on the quality of the concrete and, in particular, on the type of aggregate employed.

3.5.1.3. Inspections

Visual inspections should be performed on all cooling towers up to a height not exceeding 10m; above this height, mechanised systems, such as drones, should be used. The visual inspection shall comprise of:

- (a) Inlet structure
- (b) Shell
 - Outer and Inner surface for the first;
 - Where access is limited, the consultant must implement mechanisms such as drones to capture images of the shell's structural conditions.
- (c) Supporting columns.
- (d) Cooling pond wall
 - Water distribution channels.
 - Packing and drift eliminators supports.
 - Outlet structures
- (e) Walkways.
- (f) Cooling Pond floor – only applicable in cases where production is reduced, and ponds are emptied.
- (g) Assess Crawl beam and supporting structure for structural integrity and advise on loading adequacy

Photographic records should be compiled to assist and document the inspection. Observations should be referenced to the photographs.

Typically, inspections of cooling towers should include, but not limited to, the following:

- a) Check for major geometrical imperfections in any of the cooling tower shells. Edge shearing strain effects will generally be noticeable in cooling towers and manifested in the form of hairline bending cracks at the skirt level. These may be of lessor concern.
- b) Check for signs of cracks in the shell. Cracking at the skirting is usually specifically ascribed to temperature from solar radiation. Shells are generally provided with reinforcement at both faces (some of the old cooling towers are reinforced with a single layer of reinforcing placed in the centre of the shell) to cater for horizontal bending moments that could be caused by the distribution of wind pressure and/or

an uneven rise in temperature. Localised bulging; meridional bulging; as well as circumferential bulging due to bad setting out of shutters during construction; may be evident. Large meridional or vertical cracks in the shell will be cause for concern. Cracking on the outer surface of the shell, attributable to inadequate concrete compaction, may also be evident. In addition, during concrete casting, large aggregate may have been retained between the upper shutter and the diagonal reinforcement and, as a result, voids could have formed underneath it. From these voids hairline cracks might develop and propagate to the surface.

- c) Check for water seeping through the shell. This takes place where grout leakage has occurred, and generally occurs at the horizontal construction joints at the concrete casting lifts. It can be particularly noticeable on the negative slopes.
- d) Check for any signs of localised spalling. Spalling is typically more evident lower in the shell and up to the sixth construction ring. The probable cause is reduced cover in parts of the shell where the reinforcement is very congested. The typical concrete cover on the outer surface of the shell should be established from the drawings.
- e) Check the cooling tower components for signs of biochemical attack by algae or other micro-organisms.
- f) Check the condition of the shell-supporting columns. Where scale deposits (presumably calcium sulphate) are evident on the surface; this is caused by wind-driven falling water. It may then be necessary to scratch the surface with a sharp instrument in order to reveal the quality of the concrete underneath. Concrete samples are usually sent to a laboratory to analyse the percentage of sulphate in the concrete. Check for cracks in the columns and plinths or column blocks. Some columns may display minor cracks. Concrete spalling may be evident because of the small cover provided to the hoop steel.
- g) Check the joints between the foundation and the cooling water duct inlets for spalling. Check for visible signs of sandpaper texture formation as a result of condensate attack.
- h) Check water-distribution channels and drainage trenches for blockages by grass, leaves and other debris.
- i) Check the condition of the packing support structure. Check the condition of column and beam system supporting the drift eliminators for any awkward eccentricities or movement caused by the volume changes in the louvers. Check damage to the fill, distribution pipes or sprayers. Misalignment can result from a best-achievable fit at the time of construction. In such cases, check for visible sliding movement at the interface. Also swelling of asbestos components can push the ribbed beams away from their original position. Check for blockage of drift eliminators because of algae growth. Check for localised spalling in the precast columns. Check for cracks in the connections of bracing components. As the drift eliminators expand during the normal operation of the cooling tower, and contract when not in operation, check whether the allowance for expansion has been reached and whether the drift eliminators bear directly onto the eliminator support beams. (Any movement in the drift eliminators may then result in a lateral push on the support beam and over a period, especially during periods of rapid expansion immediately after an outage, and the induced force may be sufficient to push the support beam from its support.)
- j) Check safety of walkways, handrails and cat ladders, even though safety issues are regarded as a part of the normal plant operating procedures. Check whether walkway support beams rest fully on their supports, or whether they slide on them. If in timber, deterioration is usually the result of the intermittent dry and wet conditions experienced.
- k) Assess the pond wall and the precast packing supports. If the cooling pond is emptied for the purpose of inspection, check the pond walls for shrinkage cracks. Pond wall expansion joints generally require replacement at certain intervals. Check the pond floor slab for cracks.

3.5.1.4. Vertical Cracks – Possible Causes

Vertical cracks in the top third of cooling towers tend to occur as a consequence of wind-induced vibration; foundation movements; and thermal conditions inherent in the operation of the towers. There are many unknown factors affecting a Cooling Tower, which could in fact affect the integrity and result in the collapse of the structure.

The principal factors are:

- a) The wind speed on its own is already an uncertainty:
- b) The wind uprating factor, which is applied to the tower, may be different. The Design Engineer normally decides on this value from certain values, which are given in the Code.
- c) The distribution of the wind around the tower could be influenced by the position of the towers and the materials of the tower could differ from those accepted i.e. the crushing and tensile strength of the concrete; the effect of the reinforcing on the concrete; and the reinforcing on its own.
- d) The lengths, depths and spacing of the existing vertical cracks in the shell.

3.5.1.5 Non-Destructive Testing (NDT)

A representative sample of NDT testing is required for each structure. These tests shall comprise of but not limited to the following:

- a) Concrete Surface Hardness
- b) Concrete cover to reinforcement
- c) Depth of Carbonation
- d) Sulphate attack
- e) Concrete Strength of Cored Samples
- f) Chemical Tests on the Cooling Water and Condensate
- g) Chemical tests of concrete samples.
- h) GPR Scanning, or similar approved.

The NDT discussed above are applicable to all concrete structures within the scope of works.

3.5.2. CHIMNEY STRUCTURES

Kriel Power Station has two chimney structures, referred to as the north and south smokestacks, that service three generating units each. The Chimney Structures consist of a concrete shell, with an interior brick-lining supported at regular intervals on corbels on the shell. A non-accessible air space exists between shell and lining. Kriel Power Station has two chimneys (referred to as South and North) each serving three generating units. Each structure has a total height of 213m above the ground level.

At Kriel Power Station access to the top of chimneys is provided by means of a cat-ladder attached to the external concrete shell. Many of Eskom's chimney shells were cast in rings by means of a climbing formwork system in 1.20m high sections. The shell has a cylindrical shape at the base and rests on a ring-shaped foundation. The annular ring beam is founded on a piled foundation.

The brickwork lining was constructed in free-standing cylindrical lifts. These lining lifts are supported directly on concrete corbels in the shell. Where the quality of the brick is not specified on drawings, it is assumed that high quality acid resistant bricks laid in acid resistant cement mortar were used. The minimum space between the lining and the shell differs from station to station and typically varies between 60mm and

115mm. Cast-iron capping rings are provided at the top of the chimneys. The chimneys are also equipped with lightning protection.

3.5.2.1. Typical Problems in Chimney Structures

Some of the specific problems as well as the possible problems that may be encountered in chimney structures are:

- a) A sudden high rise in flue gas temperature leads to a fluctuating transmission of heat through the brick lining. As a result of uneven heating and large temperature gradients through the brick lining, ultimate stress values can be exceeded and cracks may develop.
- b) Should flue gas temperature drop below its dew point, acid attack of the bricks, and especially the mortar, may take place. The severity of the attack depends on operating conditions and particularly on the frequency of start-ups and shutdowns.
- c) During certain operating conditions, especially during start-ups, over-pressure in the flue can result. Flue gases can penetrate the structure through corroded spots in the brick lining; gaps at expansion joints; or through cracks; and cause excessive thermal stresses in the shell.
- d) Fly ash may also enter the space between lining and shell and cause cold spots, which can lead to acid condensation and subsequent deterioration of the concrete.
- e) Under certain operating conditions, a flue gas plume is blown onto the concrete windshield and, as a result, downwash of flue gasses occurs on the top portion of the windshield. Acid attack at the outer surface of the concrete on the top 20m to 30m of the windshield may then take place as a consequence off this downwash.
- f) Cracking of the windshield, as a result of uneven distribution of temperature or ovalisation due to the harmonic motion of the wind, may occur.
- g) Signs of distress in the windshield as a result of local stresses at the corbels, or at other concrete sections weakened by corrosion, are also traditional problems.
- h) Flaking or scaling of the brick lining could indicate that serious corrosion is in process.

3.5.2.2 Inspections

The aim of this inspection is to locate all possible degradation peculiar to chimney structures and their operational environmental conditions.

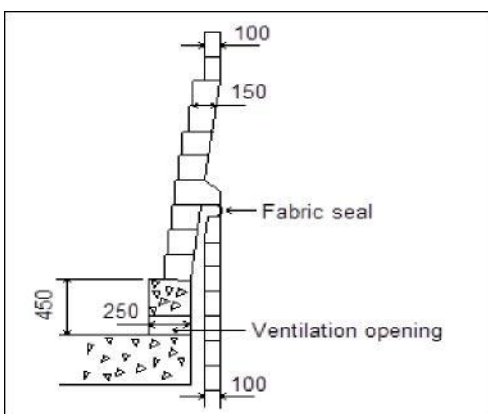


Figure 1: Typical cross section of a flue lift at support slab level

The following elements are generally included in the visual inspection:

- a) the concrete windshield;
- b) the brick cap;
- c) the lightning protection system;
- d) the steel inlet duct into the chimney;
- e) the brick lining.

Both external and internal inspections are undertaken.

3.5.2.3. External Inspections

The external structure can be visually inspected up to 10m at most. Due to the age of the structure and the need to ensure that there is adequate information for any remedial works to be conducted, the Consultant will be required to provide mechanised alternatives, such as remote-controlled drones or other mechanism approved by the Employer

3.5.2.4. Internal Inspections

The Chimney structures service three units each and the only time internal inspections can be carried out, to the full extents of the internal structure, is during half station shutdown. These are generally undesirable and rare shutdowns that provide a small window of opportunity to inspect the internal structure.

Based on the possibility of unreasonable time frames to obtain resources; inspections during half station shutdown, will be at the Consultant's discretion, if the Employer could not notify the Consultant within a reasonable time frame.

The Consultant is still required to carry out internal inspections where access is not dependent on outages or half station shutdown.

3.5.2.5. Testing

NDT, as detailed in Section 3.5.1.5 above, will be required for the accessible areas of the Chimney structure. Where information on concrete strength is not available, the Consultant will be required to carry out concrete coring for sampling purposes.

3.5.3. BOILER AND TURBINE HOUSE: EXTERNAL FACE MAPPING AND BOILER STRUCTURE

In addition to the critical structural assessment, and to assist the maintenance department with repairs, a general panoramic view of the external facing of the main building (boiler and turbine house) will be conducted. A coloured laser-scan cloud points should be used to detect any disconnections, rupture or corrosion of outer metal cladding, windows and external elements (current maintenance quantification). Turbine house structures.

3.5.3.1 Boiler Structure

The assessment of the boiler structure must be conducted in two phases. These phases include the following:

- a) External boiler structure.
- b) Internal boiler structure

The internal boiler structural assessment requires the respective unit to be offload. The Consultant is therefore required to make provision for inspections during planned outages. The Employer will provide the Consultant, within reasonable time, the planned outage schedule.

Should an unplanned outage occur for a unit that has not been inspected or is not scheduled for outage within the required annual inspection, the Employer will advise the Consultant of such an outage. Based on the possibility of unreasonable time frames to obtain resources, inspections during unplanned outages will be at the Consultant's discretion

3.5.4. COAL STAITHES

A detailed structural investigation of the coal staithes will be required from the appointed Consultant. The Consultant is required to provide NDT tests as detailed in Section 3.5.1.5 of this

scope of works. In addition to the NDT, the Consultant will be required to obtain concrete cores for sampling purposes on areas they deem critical on the Coal Staithes. The Consultant "must" also assess the structural steel elements within the Coal Staithes.

3.6. QUALITY REQUIREMENTS

3.6.1. Method Statement

The "Consultant" must develop a detailed Method Statement for each component of the work to be assessed. The method statement must be approved by the "Employer" prior to the commencement of any activity.

3.6.2. Quality Control Plan

The Consultant must develop a detailed quality control plan for the complete works. The Employer will approve the quality plan before any work commences. The quality control plan should also contain a detailed programme for all the identified activities to complete the inspections within the annual inspection. A revised programme is to be provided at the beginning of each calendar year.

The Employer will witness all tests and inspections and sign of the relevant documentation before the next phase of work commences.

3.6.2. Documentation and Record Drawings

The Consultant shall submit a signed (by a professionally registered structural engineer) detail inspection report in PDF and hardcopy format to the Employer. The Service Provider shall also submit the captured data to the Plant Engineer.

3.7. SHEQ REQUIREMENTS

- (h) The "*Consultant*" is required to ensure safety awareness at all times through continuous training.
- (i) The "*Consultant*" is appointed to act on behalf of the "*Employer*" in terms of "the Act" for this contract.
- (j) The staff of the "*Consultant*" are required to comply with the Eskom health and safety requirements specific to Kriel Power Station
- (k) The "*Consultant*" is required to comply with the "SHE Requirements for the Eskom Commercial Process", 32726 Rev 1.
- (l) The "*Consultant*" is also required to comply with the Eskom "SHE Specification Template", 32-524 Rev 0.
- (m) The "*Consultant*" and all his personnel are required to attend a Health and Safety Induction Course prior to starting with the *Works*.
- (n) In carrying out its obligations in terms of this contract; in providing the *Works*; in using Plant, Materials and Equipment; and while at the Site for any reason, the "*Consultant*" is required to comply and ensure compliance by its employees, agents, Sub -Service Providers and mandatory with:
 - The provisions of "the Act" (as amended) and all regulations in force from time to time in terms of that Act; and
 - The Eskom "Safety, Health and Environmental Requirements for *Service Providers*"

document attached to the *Works* Information (as amended from time to time) and such other Eskom Safety Regulations as are applicable to the *Works* and are provided in writing to the “*Consultant*” (collectively “the Eskom Regulations”). The Eskom Regulations may be amended from time to time by the “*Employer*” and all amendments will be provided in writing to the “*Consultant*”. The “*Consultant*” must comply with the provisions of the latest written version of the Eskom Regulations with which it has been provided; and

- The health and safety plan prepared by the *Service Provider* in accordance with the SHEQ Requirements.
- (o) The “*Consultant*”, at all times, consider itself to be the “*Employer*” for the purposes of “the Act” and does not consider itself under the supervision or management of the “*Employer*” with regard to compliance with the SHEQ Requirements. The “*Consultant*” furthermore does not consider itself to be a subordinate or under the supervision of the “*Employer*” in respect of these matters. The “*Consultant*” is, at all times, responsible for the supervision of its employees, agents, subcontractors and mandatory’s and takes full responsibility and accountability for ensuring that they are competent, aware of the SHEQ Requirements and execute the *Works* in accordance with the SHEQ Requirements.
- (p) The “*Consultant*” ensures that all statutory appointments and appointments required by any Eskom Regulations are made and that all appointees fully understand their responsibilities and are trained and competent to execute their duties. The “*Consultant*” supervises the execution of their duties by all such appointees.
- (q) The “*Employer*”; or any person appointed by the “*Employer*”, may, at any stage during the currency of this contract:
 - Conduct health and safety audits regarding all aspects of compliance with the SHEQ requirements, at any on-site place of work.
 - Refuse any employee, subcontractor or agent of the “*Consultant*” access to the premises if such person has been found to commit an unsafe act or any unsafe working practice or is found not to be qualified or authorised in terms of the SHEQ Requirements;
 - Issue the “*Consultant*” with a stop order should the “*Employer*” become aware of any unsafe working procedure or condition or any non-compliance with any provision of the SHEQ Requirements.
- (r) The “*Consultant*” immediately reports any disabling injury as well as any threat to health or safety of which it becomes aware at the *Works* or on the Site.
- (s) The “*Consultant*” is required to appoint a person, qualified in accordance with the SHEQ Requirements, as the liaison with the Eskom Safety Officer for all matters related to health and safety.
- (t) The “*Consultant*” confirms that it has been provided with sufficient written information regarding the health and safety arrangements and procedures applicable to the *Works* to ensure compliance by it and all employees, agents, subcontractors or mandatory with the SHEQ Requirements while providing the *Works* in terms of this contract. As such, the “*Consultant*” confirms that this contract and the relevant Eskom Regulations referred to in this contract constitute written arrangements and procedures between themselves and the “*Employer*” regarding health and safety for

the purposes of section 37(2) of “the Act”.

- (u) The “*Consultant*” agrees that the “*Employer*” is relieved of any and all of its responsibilities and liabilities in terms of Section 37(1) of “the Act” in respect of any acts or omissions of the “*Consultant*”, and their employees, agents or subcontractors, to the extent permitted by the “the Act”..
- (v) The “*Consultant*” hereby indemnifies the “*Employer*” and holds the “*Employer*” harmless in respect of any and all loss, costs, claims, demands, liabilities, damage, penalties or expense that may be made against and/or suffered or incurred by the “*Employer*” (as the case may be) as a result of, any failure of the “*Consultant*”; its employees, agents, subcontractors and/or mandatory to comply with their obligations in terms of this clause, and/or the failure of the “*Employer*” to procure the compliance by the “*Consultant*”, its employees, agents, subcontractors and/or mandatory with their responsibilities and/or obligations in terms of or arising from “the Act”.

3.8. CONSULTANT’S PERSONNEL

3.8.1 People

The Consultant is required to ensure that the people appointed for the works are adequately qualified and experienced to complete the works in line with the scope of works or further requests from the Employer.

3.8.2. Sub-Consultants

All sub-consultants or contractors appointed by the Consultant remain the Consultant’s responsibility. All works provided by the said sub-consultants or contractors must be presented by the Consultant as if they had undertaken the works themselves.

3.9. Constraints on how the *Consultant* Provides the Services.

The *Consultant* is to keep record of all of his personnel on site, including those of any sub Consultant he appoints. The Employer is to have access to these records at all times. Regular meetings of a general nature may be convened and chaired by the *Employer’s Agent* as follows:

Meetings of a specialist nature may be convened as specified elsewhere in this Scope or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *services*. Records of these meetings shall be submitted to the *Employer’s Agent* by the person convening the meeting within five days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

3.9.1. *Consultant’s key persons*

The Consultant “must” provide an organogram indicating all personnel involved in the project and their lines of authority/communication within their submitted tender documentation. The Consultant is required to provide the relevant qualifications and experience for all key personnel employed for the purposes of executing the works as defined in the scope of works. Should, for any reason, the Consultant decide to change or remove any of his key personnel, the replacement “must” be similarly or more qualified and experienced than the person being replaced.

3.9.2. Provision of bonds and guarantees

The form in which a bond or guarantee required by the *conditions of contract* (if any) is to be provided by the *Consultant* is given in Part 1 Agreements and Contract Data, document C1.3, Sureties.

The *Employer* may withhold payment of amounts due to the *Consultant* until the bond or guarantee required in terms of this contract has been received and accepted by the person notified to the *Consultant* by the *Employer's Agent* to receive and accept such bond or guarantee. Such withholding of payment due to the *Consultant* does not affect the *Employer's* right to termination stated in this contract.

3.9.3. Documentation control and retention

3.9.3.1. Identification and communication

The *Consultant* is responsible to plan the supply of the documentation during the various project stages and to provide the documentation in accordance with the key scheduled project milestone dates. A document is thus any written or pictorial information describing, defining, specifying or certifying activities, requirements, procedures or results.

3.9.3.2. Retention of documents

The *Consultant* submits all hard copies of documentation on a formal transmittal form in duplicate to the Project Manager, as well as a soft copies for electronic filing. All documentation submitted must have a unique numbering system.

3.9.4. Records and forecasting of expenses

The *Consultant* prepares forecasts of the total *expenses* for the whole of the *services* and submits them to the *Employer*. Forecasts are prepared at the intervals stated in the Contract Data from the *starting date* until Completion of the whole of the *services*

3.9.4.1. Invoicing and payment

The Contractor submits payment requests to the Employer. The Project Manager sends the payments certificate to the Contractor within 5 working days of receiving a payment request. The Contractor provides the Employer with a Valid Tax Invoice showing the amount due for payment equal to that stated in the Project Manager's payment certificate within 3 working days. The Contractor sends back the signed payment certificate and copy of the invoice.

The *Contractor* shall address the tax invoice to:
Eskom Holdings SOC Ltd
Reg. No. 2002/015527/30
Accounts Payable
Kriel Power Station
Private Bag X5009
Kriel 2271

The *Contractor* keeps records of all invoices submitted and paid up to the end of the project, as well as details of Actual Costs.

All invoices are hand delivered to the Kriel Finance Department (Account payables) and include on each invoice the following information:

- Name and address of the *Contractor* and the *Service Manager*;
- The contract number and title;
- Contractor's* VAT registration number;
- The *Employer's* VAT registration number 4740101508;
- Description of service provided for each item invoiced based on the Price List;
- Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT

Contractor is required to follow the correct process to ensure the payment is effected in accordance with contractual payment terms.

Contractor is required to follow the correct process to ensure payment is effected in accordance with contractual payment terms:

Service-related invoices

- a) Once the *service* have been delivered/completed both parties have to agree that the *service* has been delivered/completed successfully prior to invoicing
- b) An assessment payment certificate must be completed between the *Contractor* and *Service Manager* according to the *service* performed. Both parties have to sign the assessment/certificate
- c) A copy of assessment/payment certificate must be obtained by the *Contractor* to enable the creation of an invoice and to prevent any discrepancies. A copy of the assessment/payment certificate must be attached to the original invoice
- d) *Service Manager* performs a service entry and Goods Receipt on the SAP system. (Assessment/Payment Certificate issued as a source document for Service Entry Goods Receipt)
- e) *Service Manager* will forward the Service entry and Goods Receipt Note number to the *Contractor* within 3 working days after the service has been rendered and the Assessment/Payment certificate signed
- f) *Contractor* must forward the original invoices together with a copy of the Assessment/Payment certificate to the Eskom Documentation Centre.

General Information related to Eskom Invoices

- a) *Contractor* must ensure that the Service Entry and Goods Receipt Note number appears on the invoice. (It can be printed or hand written on the invoice).
- b) Eskom Purchase Order number must appear on invoice.
- c) Invoices must be VAT compliant in line with the VAT Act requirements.
- d) Invoices submitted must reflect the bank account details. A once off copy of the banking details may be forwarded to the Documentation Centre and it will be attached to each scanned invoice.
- e) Invoices must be original or certified as an original in line with the VAT Act. No electronic invoices will be accepted.
- f) Eskom's correct name "**Eskom Holdings SOC Ltd**" must appear on the invoice.
- g) The Eskom VAT registration number: **4740 101 508** must appear on the invoice.
- h) No pro-forma invoices will be accepted.
- i) *Contractor* cannot be utilized by Eskom for more than 3 times without a contract being established.

Note:

1. Invoices must be delivered to the Eskom Documentation Centre, as this will speed up the payment process and ensure that invoices are not lost and payments delayed. There is no need for *Service Manager* to sign invoices as they perform Goods Receipt in the system. The assessment certificate and Goods Receipt serves as the approval of payment.
2. Eskom Documentation Centre will review invoices according to a checklist and on completion scan the documentation into Accounts Payable processing system (Documentation can only be scanned where the Purchase order no. and Goods Receipt Note no. is reflected on the invoice, and the invoice complies with the VAT Act).
3. Invoices are processed and released for payment by Accounts Payable Section only where the source documentation is 100% correct.

3.9.10. Contract change management

All relevant NEC documents will be provided to the *Consultant* on request.

Quality management

System requirements

Clause 40.1 requires that the *Consultant* operate a quality management system as stated in the Scope. Include your requirements here

Information in the quality plan

Clause 40.2 requires that the *Consultant* provide a quality policy statement and quality plan which complies with requirements stated in the Scope. Include your requirements here

The Parties use of material provided by the *Consultant*

Employer's purpose for the material

Clause 70.1 states that the *Employer* has the right to use the material provided by the *Consultant* for the purpose stated in the Scope. State here what your intended purpose is.

Restrictions on the *Consultant's* use of the material for other work

Read clause 70.4 first and if you want to restrict the *Consultant's* use of material provided by him for this contract on other work state these here.

Transfer of rights if Option X 9 applies

The *Employer* owns the *Consultant's* rights over material prepared for this contract by the *Consultant* except as stated otherwise in the Scope. The *Consultant* obtains other rights for the *Employer* as stated in the Scope and obtains from a Sub-consultant equivalent rights for the *Employer* over the material prepared by the Sub-consultant. The *Consultant* provides to the *Employer* the documents which transfer these rights to the *Employer*.

The *Consultant* shall not challenge or assist any other party challenging at any time the validity or ownership of any of the intellectual property rights relating to the material created and developed for this contract.

Health and safety

Clause 25.4 states that the *Consultant* acts in accordance with the health and safety requirements stated in the Scope. It is suggested that this part of the Scope address how the *Consultant* acts when doing his services. These requirements may be no more than just complying with the law. However if the *Consultant* is required to work on Eskom premises, then whatever requirements which personnel working in those premises need to comply with should be included here or referred to in an Annexure.

If when doing his services the *Consultant* is required to carry out a design which needs to take account of certain health and safety criteria, then this should be included in the specification of that design service stated elsewhere in the Scope. A draft for this section could start as follows:

The *Consultant* shall at all times comply with the health and safety requirements prescribed by law as they may apply to the services.

[If the *Consultant* may be required to work on Eskom premises, such as a power station, where health and safety requirements additional to those prescribed by law apply, specify these here or state, The *Consultant* shall comply with the health and safety requirements contained in Annexure _____ to this Scope.]

Procurement

BBBEE and preferencing scheme

Specify constraints which *Consultant* must comply with after contract award in regard to any Broad Based Black Economic Empowerment (B-BBEE) or preferencing scheme measures.

Other constraints

Delete if not required or state any other constraints that may be applicable to people employed by the *Consultant* and change the heading to suit the subject matter.

Preferred subconsultants

PSC3 does not make use of nominated subconsultants but the *Employer* may list which subconsultants or suppliers the *Consultant* is required to enter into subcontracts with. This is usually only required where very specialist services need to be obtained from a particular supplier or group of suppliers in order to comply with operational standards.

Subcontract documentation, and assessment of subcontract tenders

Specify any constraints on how the *Consultant* is to prepare subcontract documentation, whether use of the NEC3 system is compulsory or not (compulsory is recommended) and how subcontract tenders are to be issued, received, assessed (using a joint report?) and awarded.

Limitations on subcontracting

The *Employer* may require that the *Consultant* must subcontract certain specialised work, or that the *Consultant* shall not subcontract more than a specified proportion of the whole of the contract.

Attendance on Subconsultants

State requirements for attendance on Subconsultants, if any

Correction of Defects

First read clause 41.2 and if any particular additional constraints are required when correcting Defects, state them here. Otherwise delete this heading.

Working on the *Employer's* property

Employer's entry and security control, permits, and site regulations

No firearms, weapons, alcohol, illegal substances and cameras (including cell phones with cameras) are permitted on Site. No 'Private Work' is carried out for or on behalf of any Eskom employee. Any person suspected of being under the influence of alcohol is tested and if proven positive, is refused entry to the security area.

People restrictions, hours of work, conduct and records

The *Consultant* will comply with the following working hours: Monday to Thursday from 07:00 to 16:15 and Fridays from 07:00 to 12:00. The *Consultant* is to keep record of all of his personnel on site, including those of the sub *Consultant*. The Employer is to have access to these records at all times.

Things provided by the *Employer*

Provide details of any facilities and equipment made available by the *Employer* for the *Consultant's* use during performance of the *services*. State any conditions relating thereto.

List of Documents

Documents issued by the *Employer*

This is the list of documents issued by the *Employer* at or before the Contract Date and which apply to this contract.

Document number	Revision	Title
JN786-NSE-7953	0	Kriel Power Station Structural Inspection Report
JN786-NSE-R-ESK-7956	0	KPS Coal Staithes Inspection
JN786-NSE-R-ESK-7957	0	KPS Cooling Towers Inspection
JN786-NSE-R-ESK-7958	0	KPS Smokestacks Inspection
JN786-NSE-R-ESK-7959	0	KPS Boiler Units 1 to 6 Inspection

Drawings in respect of the critical structures discussed above will be made available to the Consultant should the records still exist. It must be noted that due to the age of the station, not all drawings are available or might not be legible enough to assist in the assessments.

PART 4: SITE INFORMATION

Document reference	Title	No of pages
C4	This cover page	30
	Site Information	31
	Total number of pages	3

1. General

The Kriel Power Station is situated approximately midway between Bethal and Ogies on the R545, being just over 30 km from each town and 10 km north-west of Kriel town.

2. Climate

Kriel Power Station is situated in a summer rainfall area with an average annual precipitation of about 750-mm falling almost entirely during the months of October to April. The average rainfall per month generally exceeds 40 mm during this period, although drought periods do occur which can last for 20 days or longer. Drought periods occur most frequently during the months of October/November and March/April. January is statistically the highest rainfall month with an average monthly rainfall of about 130-mm. June has the lowest rainfall with an average monthly rainfall of about 7 mm.

Approximately 85% of the annual rainfall occurs in the summer months and heavy falls of 125 to 150 mm occasionally occur in a single day. The annual average number of thunderstorms is about 75. These storms are often violent with severe lightning and strong (but short-lived) gusty winds and are sometimes accompanied by hail. This region has among the highest hail frequencies in South Africa; about 4 to 7 occurrences (depending mainly on altitude) may be expected annually.

January is normally the hottest month with an average daily maximum temperature of 27°C with a mean daily temperature in winter being about 16°C. Winter average daily temperatures vary from 18,5°C maximum to -1°C minimum. The extreme temperatures recorded range from 34,7°C to minus 12,4°C for the period 1920 - 1984. (Source: Weather Bureau, Pretoria)

Winds are generally light to moderate except during thunderstorms. Generally, the prevailing wind directions are from the North West during the day and from the east at night. During daytime, the prevailing winds are from the north-western direction. During night-time, the prevailing winds are from the north-eastern direction. The highest recorded average wind speed is 17, 6 km/hour. The average wind velocity over the year is 14, 5 km/hour.

(Source: MSN weather & Weather 24, average records 2008 - 2009.)

3. Weather Data – Refer to Annexure A

4. Relative Humidity

Records for Bethal (2008 - 2009)

The average relative humidity on an annual base is as follows:

For 08:00 = 80%
 14:00 = 52%
 20:00 = 73%

5. Prevailing Winds

Records for Bethal (2008 - 2009)

Winds are mostly north-westerly except for February and March when they are easterly to south-easterly. The highest wind speeds are recorded from the south-east: on average 14km/h.

6. Other Climatic Factors

Records for Bethal (2008 - 2009)

Thunder occurs mostly from November to January with average of 35.7 days annually.

- a) Hail occurs mostly in December with average of 2.8 days annually.
- b) Fog occurs mostly in the winter months with an average of 19 days annually.
- c) Snow rarely occurs
- d) Cloud coverage is highest in the summer months with annual average as follows:
 - 08:00 = 2.8/8

- 14:00 = 3.8/8
 - 20:00 = 3.1/8
- e) Evaporation for the area is in range of 75mm to 190mm per month. The highest evaporation occurs in December, and the lowest in June.

7. Topography

The surface topography of the Kriel area is typical of the Mpumalanga Highveld consisting in the main of a gently undulating plateau. The flood plains of the local streams are at an average elevation of ± 1540 meters above mean sea level and drainage generally is a northerly direction.

8. Air Quality

The existing and potential sources of air pollution in Kriel area are the following:

- Kriel Power Station stack emissions
- Kriel Power Station dry dust (fly ash) handling plant
- Dust blow from the Eskom coal stock yard
- Dust blow from the roads in the area
- Seasonal dust blow caused by ploughing of farmlands, and dust blow off denuded fields
- Dust blow from dried out exposed surfaces of the wet ash dam.

However, Eskom utilises the majority of the top surface of the ash dam as an evaporation pan for polluted water, which means that the exposed surface is constantly wet. The sides of the ash dam have largely been rehabilitated, with the result that dust blow from the ash dam.