

# NEED/OPPORTUNITY STATEMENT (NOS)



KCR - ER0 33kV Tertiary Reactor Renewal

NOS- 000000001367 revision 4.0

**Ellipse project no.:** P0008002

**TRIM file:** [TRIM No]

**Project reason:** Capability - Asset Replacement for end of life condition

**Project category:** Prescribed - Asset Renewal Strategies

## Approvals

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Approved	Lance Wee	Manager / Asset Strategy
Date submitted for approval	23 November 2016	

## Change history

Revision	Date	Amendment
0		Not published
1		Not published
2	22 April 2016	Initial issue
3	14 November 2016	Updated risk cost.
4	23 November 2016	Update to format

## 1. Background

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Currently there are 2 sets of 33kV reactors at Kemps Creek (No.2 and No.3), composed of six (6) single phase 50MVar reactors, used for voltage control of the 5A1 and 5A2 transmission lines when under light load. Recently, one of the No.3 Reactor (CMSKCR6C2) units has failed. These reactors use Mylar insulation.

Issues with dry wound, Mylar insulated reactors became apparent very early after their commissioning in the mid-1980s. Similar units were installed at Eraring (3) at the same time.

Trench has manufactured replacement reactors (subsequent to service failure events between 1993 & 1998), using the same Mylar Class B insulation but using a wet type winding processes intended to eliminate previous known issues.

Initial investigations into the latest failure in August 2015 identified moisture ingress as the probable catalyst, consistent with the original findings noted soon after these units were first commissioned. Response to the latest failure included:

- > Physical inspection of the reactor assemblies, in particular the condition of the epoxy protective coating
- > Thermal imaging surveys to assess the thermal distribution of each winding assembly

## 2. Need/opportunity

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The condition reviews and inspections mentioned earlier; have identified anomalies in the thermal distribution on the No. 2 Reactor at Kemps Creek, which were not consistent with that found on the Eraring reactor.

All five remaining units in Kemps Creek, in addition to the three units at Eraring, have significantly degraded epoxy resin protective coating, with anomalies found on the No. 2 Reactor at Kemps Creek consistent with areas of significant deterioration. This presents a high risk of failure of the reactors.

The recent failure of the No.3 Reactor (CMSKCR6C2), and the bad physical condition of the No.2 Reactor at the same site, has highlighted the poor condition of these units, and triggered attention to the need for replacing them, in order to reliably meet the operational requirements for VAr supply at Kemps Creek.

The failure of the CMSKCR6C2 reactor had limited impact on network operations, until the No. 1 Reactor at Beaconsfield West Substation was removed from service due to abnormal dissolved gas content. The loss of this unit has increased operational reliance on the No. 2 Reactor at Kemps Creek which has been identified as being at greater risk of failure based on the results of recent thermal imaging surveys.

As a short term solution, a recently de-commissioned Kemps Creek SVC reactor has been used to supply approximately 200MVar (total for two SVCs). This solution is considered as a contingency to cover the continued loss of both the Kemps Creek No.3 reactor (CMSKCR6C2) and Beaconsfield West reactor (CMSBFW2N1), and the possible loss of the Kemps Creek No.2 reactor (CMSKCR6B2).

The risks associated with the failure of an air cored reactor are:

- > Reliability
  - Reliability of the remaining air cored Mylar insulated reactors is considered to be low, given the anomalies discovered in the recent thermal imaging survey. There is a likelihood of failure of one or more units in the remaining reactors
  - Any additional failure would have significant consequences for voltage control in the Sydney Metropolitan area network with a moderate risk of load loss as a result

- > Cost: Failure response costs for a reactor failure are likely to be moderate (limited to replacement and disposal issues only)
- > Safety: There is insignificant risk to staff following a failure (no porcelain or oil involved), however a fire may result which would have some associated risk

The timing required to address this need is driven by the necessity to prevent further reactor failures, which might have consequences for voltage control in the Sydney Metropolitan area network with a moderate risk of load loss as a result. This need should be addressed by 2023.

The risk costs associated with the existing Kemps Creek and Eraring Mylar insulated reactors is \$0.8m per annum.

### 3. Related Needs/opportunities

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NIL

### 4. Recommendation

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It is recommended that options be considered to address the identified need.

## Attachment 1 - Risk Costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment.

### Current Option Assessment - Risk Summary

Project Name: Air Cored Reactor - Kemps Creek

Option Name: 1367 - Base Case

Option Assessment Name: 1367 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)



Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Reactor (Air Core)	1	Reactor (Air Core)	Unplanned Outage - HV (Reactor (Air Core))	\$0.29	Failure	\$0.29	28.57%	\$0.08	\$0.00	\$0.00	\$0.08	\$0.00	\$0.00	\$0.00
Reactor (Air Core) KCR 6B2	1	Reactor (Air Core)	Unplanned Outage - HV (Reactor (Air Core) KCR 6B2)	\$2.57	Failure	\$2.57	28.57%	\$0.73	\$0.65	\$0.08	\$0.08	\$0.00	\$0.00	\$0.00
				\$2.86		\$2.86		\$0.82	\$0.66	\$0.16	\$0.00	\$0.00	\$0.00	\$0.00

Total VCR Risk: \$0.66      Total ENS Risk: \$0.00