UTILITIES COMMISSION OF THE NORTHERN TERRITORY

PWC Technical Audit 2017

FOLLOW UP FROM THE 2014 AUDIT

CONFIDENTIAL

APRIL 2017

WSP | PARSONS BRINCKERHOFF

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Utilities Commission of the Northern Territory

Confidential

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AUTHOR, REVIEWER AND APPROVER DETAILS

Prepared by:	M Van Doornik, D Downing	Date: 31 May 2017
Reviewed by:	P Walshe	Date: 31 May 2017
Approved by:	M Van Doornik	Date: 31 May 2017

WSP | Parsons Brinckerhoff
Level 15, 28 Freshwater Place
Southbank VIC 3006

Tel: +61 3 9861 1111
Fax: +61 3 9861 1144

www.wsp-pb.com

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ABBREVIATIONS

AEMO	Australian Energy Market Operator
CIPS	Channel Island Power Station
DGA	Dissolved gas analysis
DNSP	Distribution network service provider
GRACE	Governance, Risk, Audit, Compliance, Event (PWC information management system)
HSE	Health, safety and environmental
KPS	Katherine Power Station
L&D	Learning and development
MGAF	Management Governance and Assurance Framework
MW	Megawatt
NEM	National Electricity Market
NTC	Network Technical Code
OSPS	Owen Springs Power Station
PSC	Power System Control(ler)
PWC	Power and Water Corporation
SCADA	Supervisory control and data acquisition
SCI	Statement of Corporate Intent
SCOD	System Control Operational Documentation
SKM	Sinclair Knight Merz (now acquired by Jacobs)
SVC	Static VAR compensator
TCPS	Tennant Creek Power Station
UFLS	Under-frequency load shedding
VAR	Volt-amperes reactive (aka reactive power or imaginary power)
WPS	Weddell Power Station

EXECUTIVE SUMMARY

In 2014, following a system black incident that occurred where all electrical supply was lost to the Darwin-Katherine power system, the Utilities Commission undertook a special technical audit of Power Water Corporation's compliance against its System Control Licence, Generation Licence and Network Licence.

The audit was undertaken by WSP (then known as Parsons Brinckerhoff) and identified a number of areas of either compliance, part compliance or non-compliance with the licence conditions.

The Utilities Commission has engaged WSP to follow up the audit undertaken in 2014 to re-assess Power and Water Corporation's and Territory Generation's compliance with their licence conditions. The audit scope was focused on the items previously found as part or non-compliant in 2014.

System Control Licence

The focus of the audit of the System Control Licence is on key obligations pertaining to maintaining a secure electricity system, including overall governance arrangements, switching procedures, and the under frequency load shedding schemes, and those obligations for when a secure system cannot be maintained including black start procedures.

The auditor examined 12 obligations contained in the licence and the System Code Technical Code that were identified to be part compliant or non-compliant in 2014. The new audit findings are set out in Table E.1.

Table E.1 Summary of System Control Licence audit findings

Item	2017 Audit finding	Comment
Establish and maintain a compliance process	Part Compliant	Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the System Control Technical Code or System Control Licence
Establishment of operating protocol and arrangements for generation dispatch and to maintain power system security	Part Compliant	The service level agreement (SLA) needs to be updated to reflect the separation of Territory Generation.
Ensuring the accuracy of technical parameters - Ensuring that the technical parameters of Network equipment and System Participants' equipment comply with the standards set out in the Network Technical Code or as set out in an Access Agreement.	Compliant	
Coordinating the plant maintenance program	Compliant	
The power system security responsibilities of the Power System Controller and System Control	Part Compliant	Several incidents where post-trip management was not optimal were identified.
Power system security – Responsibility for maintaining power system security	Part Compliant	Dynamic model of the Darwin Katherine and Tennant Creek systems are not available.

Item	2017 Audit finding	Comment
Power system security - Assess the availability and adequacy of contingency capacity reserves and reactive power reserves	Compliant	
Power system security - Coordinate and direct any rotation of widespread interruption of demand	Part Compliant	A load shedding protocol is available in draft form. The System Control Technical Code needs to be amended so timeframes for rotational load shedding suit restrictions imposed by external factors and practicalities of operating the system.
Power system Security- Investigate and review all major power system operational incidents and to initiate action plans	Part Compliant	35% of minor incident reports are not issued within the 14 day time period
Power system stability – Handling single contingency events	Part Compliant	The dynamic model is required to model a full set of single contingencies. The economic constraints result in loss of supply to customers (Katherine) in the case of a transmission line outage single contingency.
Maintenance of a secure system	Compliant	
Approval of System Black Procedures	Compliant	

Overall, the auditor found a good level of compliance with the System Control Licence and a significant improvement from the finding of the 2014 Audit.

Generation Licence

The focus of the audit of the Generation Licence is on key obligations related to the provision of:

- ancillary services, in particular, black start capability
- the organisation's responsiveness to the directions of the System Controller, and the recommendations of technical audits and investigations performed by or on behalf of the System Controller
- the maintenance and operation of its facilities in accordance with good electricity industry practice.

The auditor examined five obligations contained in the Generation Licence and System Control Technical Code that were identified to be part compliant or non-compliant in 2014; the audit findings are summarised in Table E.2.

Table E.2 Summary of Generation Licence audit findings

Audit item	2017 Audit finding	Comments
Establish and maintain a compliance process	Compliant	
Approval of black system procedures	Compliant	
Amendment of black system procedures	Compliant	

Audit item	2017 Audit finding	Comments
Operations and maintenance of black start equipment in accordance with good electricity industry practice	Compliant	
Implementation of Power System Controller directions	Compliant	

Overall, the auditor found a good level of compliance with the Generation Licence and a significant improvement from the finding of the 2014 Audit.

Network Licence

The Network Licence audit focused on key obligations relating to its compliance system, third party access and maintenance forecasts.

The auditor examined three key obligations contained in the licence and the System Control Technical Code that were identified to be part compliant or non-compliant in 2014. The audit findings are set out in Table E.3.

Table E.3 Summary of Network Licence audit findings

Item	2017 Audit finding	Comment
Establish and maintain a compliance process	Part Compliant	Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the Network Licence
Third-Party Access compliant with good electricity industry practice	Compliant	
Preparation of maintenance forecast	Compliant	

Overall, the auditor found a good level of compliance with the Network Licence and an improvement from the finding of the 2014 Audit.

1. INTRODUCTION

1.1 The 2017 Technical Audit of PWC

In 2014, following a system black incident that occurred where all electrical supply was lost to the Darwin-Katherine power system, the Utilities Commission undertook a special technical audit of Power and Water Corporation's (PWC) compliance against its System Control Licence, Generation Licence and Network Licence. During the period of the audit, the generation activities were transferred to a new company called Territory Generation.

The audit was performed by WSP (then known as Parsons Brinckerhoff) and identified a number of areas of either compliance, part compliance or non-compliance with the licence conditions.

The Utilities Commission has engaged WSP to follow up the audit undertaken in 2014 to re-assess PWC's and Territory Generation's compliance with their licence conditions. The audit scope was focused on the items previously found as part-compliant or non-compliant in 2014.

1.2 Scope

The audit will follow up on the 2014 audit and focus on whether the areas identified to be part-compliant or non-compliant have been addressed by the respective licensee, or whether there are specific initiatives presently underway that will lead to compliance.

In conducting the audit, the auditor will:

- review the findings and evaluation from the 2014 audit
- undertake a desktop review of current (as at the date of the audit) policies, procedures and other documentation
- conduct interviews with PWC and Territory Generation staff
- consider system black incidents that have occurred in the Northern Territory's regulated networks since 2014, and
- consider the extent to which new procedures or initiatives have been implemented.

1.3 Approach

The audit approach included the following actions.

1. Identify licence obligations that pertained to the required scope of work
2. Undertake a desktop review:
   - information requested
   - analysis of information against the licence requirements
3. Discussions with PWC/Territory Generation:
   - clarify issues identified in the desktop review
   - seek further information on areas not covered by the desktop review
4. Consideration of system black incidents that have occurred in the Northern Territory since 2014 and evidence of improvements based on lessons learnt from previous events
5. Draft report:
   - issue draft report to the Commission, PWC and Territory Generation for comments

6. Revise the draft report to incorporate feedback from the Commission, PWC and Territory Generation and any further information provided to support their compliance with licence conditions.
7. Final report.

1.4 Audit grading

The audit was conducted in accordance with ASAE 3000 *Assurance Engagements Other than Audits or Reviews of Historical Financial Information* to provide a reasonable level of assurance.

A three part grading system was adopted as shown in Table 1.1.

Table 1.1 Audit grading system

Grade	Description
Compliant	All requirements are met.
Part Compliant	Most requirements are met. Those requirements that are not met have an immaterial impact on the reported information.
Not Compliant	Not all requirements are met.

2. SYSTEM CONTROL

2.1 Background

The System Control Licence is held by Power and Water Corporation (PWC). The responsibility for meeting all obligations lies with the General Manager System Control.

2.2 Summary

The focus of the audit of the System Control Licence is on key obligations pertaining to maintaining a secure electricity system, including overall governance arrangements, switching procedures, and the under frequency load shedding schemes, and those obligations for when a secure system cannot be maintained including black start procedures.

The auditor examined 12 obligations contained in the licence and the System Code Technical Code that were identified to be part compliant or non-compliant in 2014. The audit findings are set out in Table 2.

Table 2 Summary of System Control Licence audit findings

Item	2017 Audit finding	Comment
Establish and maintain a compliance process	Part Compliant	Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the System Control Technical Code or System Control Licence.
Establishment of operating protocol and arrangements for generation dispatch and to maintain power system security	Part Compliant	The service level agreement (SLA) needs to be updated to reflect the separation of Territory Generation
Ensuring the accuracy of technical parameters - Ensuring that the technical parameters of Network equipment and System Participants' equipment comply with the standards set out in the Network Technical Code or as set out in an Access Agreement.	Compliant	
Coordinating the plant maintenance program	Compliant	
The power system security responsibilities of the Power System Controller and System Control	Part Compliant	Several incidents where post-trip management was not optimal were identified
Power system security – Responsibility for maintaining power system security	Part Compliant	Dynamic model of the Darwin Katherine and Tennant Creek systems are not available.
Power system security - Assess the availability and adequacy of contingency capacity reserves and reactive power reserves	Compliant	
Power system security - Coordinate and direct any rotation of widespread interruption of demand	Part Compliant	A load shedding protocol is available in draft form. The System Control Technical Code needs to be amended so timeframes for rotational load shedding suit restrictions imposed by external factors and practicalities of operating the system.

Item	2017 Audit finding	Comment
Power system Security- Investigate and review all major power system operational incidents and to initiate action plans	Part Compliant	35% of minor incident reports are not issued within the 14 day time period
Power system stability – Handling single contingency events	Part Compliant	The dynamic model is required to model a full set of single contingencies. The economic constraints result in loss of supply to customers (Katherine) in the case of a transmission line outage single contingency.
Maintenance of a secure system	Compliant	
Approval of System Black Procedures	Compliant	

2.3 Establish and maintain a compliance process

The following System Control Licence clauses relate to compliance process and compliance reporting:

11.1 The licensee is to establish and maintain a compliance process

11.1 (a) A licensee must establish, document, maintain and comply with appropriate auditable internal policies, procedures and systems ("compliance process") for ensuring that it complies with its obligations under this licence, and all applicable laws, codes, rules or standards.

2.3.1 2014 Audit finding

Not Compliant.

Corporate compliance system ‘GRACE’ currently does not provide granularity required. Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the System Control Technical Code.

2.3.2 2017 Audit procedure

The audit of this obligation was focused on the compliance system as it related to enabling PWC meet its System Control Technical Code and System Control Licence obligations.

Documented compliance reporting policy, process, and procedures were requested and compared to AS3806 Compliance Programs as a guide to good practice. Understanding of the compliance process was discussed with staff, including:

- Interview with General Manager - System Control, at Hudson Creek Control Centre.
- Meeting and interview with PWC’s Risk and Compliance Group. The meeting included a brief demonstration of the compliance monitoring system (GRACE).
- Discussion of the Management Governance and Audit Framework (MGAF) project that is developing and implementing a new compliance management framework, and investigation reporting and monitoring software.

The Auditor made information requests both prior to the interviews and when further information requirements were identified during the evaluation process. The following types of information were requested:

- Structure, roles and responsibilities of its Regulatory team (staff involved in managing regulatory compliance matters).
- Policies, procedures, and frameworks that describe the governance and process for monitoring compliance with licence, statutory and code obligations.
- Evidence of the policy and procedural documentation held in the 'System Control Operational Documentation' (SCOD) system.
- Descriptions of any IT and other support systems used to monitor compliance with licence obligations, including specific procedures or training material for use of the systems.

2.3.3 2017 Audit finding

Part compliant

2.3.4 Reason for audit finding

PWC has improved the level of granularity of the obligations related to the System Control Technical Code and System Control Licence within their compliance system. In the 2014 audit only one item was found for the code; today, we found 377 items. We also found 32 items for the licence. We conclude that the requirements for the System Control Technical Code and System Control Licence obligations were found to be entered into GRACE at a suitable level of granularity that would be required to enable establishing and monitoring compliance with the code and licence.

We note that, at the time of the audit, PWC is in the process of assessing its compliance system and the potential for moving to a new compliance software package and framework. The project investigating the change is the Management Governance and Assurance Framework (MGAF) project. We have been advised that MGAF has been approved by the PWC Board and is underway.PWC stated that GRACE is no longer considered the master register for recording compliance obligations but is still used for the day to day monitoring and notification processes. Due to the MGAF project, the master register is a spreadsheet that is being used to review all obligations, as PWC has found GRACE unsuitable for that purpose.

Each obligation requirement held in GRACE has responsibility allocated to two people, entered as the primary control owner who has overall accountability for compliance and a secondary control owner who has responsibility to ensure compliance is maintained, and to address any notifications of non-compliance or events related to the obligation. If no secondary control owner is entered, the notifications default to the primary owner. Evidence was provided to support this functionality of GRACE and demonstrate its operation in practice. However, all obligations related to the System Control Technical Code and System Control Licence were allocated to the same person and there was no procedure or other evidence provided that demonstrated how the notifications are actioned or if any actions had occurred. We consider this lack of an auditable process results in PWC not fully meeting the requirement to have auditable internal policies, procedures and systems.

An annual compliance audit is incorporated and funded on PWC's Internal Audit program. The scope is changed each year to focus on different licence or code obligations. According to PWC's Review Register, recent audits undertaken were:

- 2011 – Review of compliance of PWC's licences issued by the Utilities Commission; the Ring-fencing Code; the System Control Technical Code; and the Network Connection Technical Code.
- 2013 - Compliance with Licensing requirements, the Ring-fencing Code and the Electricity Retail Supply Code
- 2013/14 - Licensing requirements relating to Compliance framework; Guaranteed Service Level (GSL) Code; Government T4 Pricing Order; Electricity Standards of Service (ESS) Code; and Prior Year Management Action Items
- 2014/15 - GSL Code, ESS code, Compliance management system and prior years management actions

→ 2015/16 – External audit requested by UC and conducted in 2014 by Parsons Brinckerhoff.

We note that the last audit of licence requirements was undertaken in 2013 and the last audit of the System Control Technical Code requirements was undertaken in 2011, not including the external audit required by the Utilities Commission in 2014. Based on this information, we do not consider that PWC has an effective internal audit program relating to its compliance with the System Control Technical Code and System Control Licence and that this results in PWC not fully meeting the requirement to ensure that it complies with its obligations. PWC noted that the internal audit functionality within GRACE did not work and as a result audits have been undertaken on an ad-hoc basis only.

We note that compliance obligations need not all be subject to internal audit as a means of ensuring compliance. Networks and System Control both embed compliance obligations in their standard work practices including the following:

- → Networks demonstrated their ProMapp document management software system that contains all their procedures and processes. It was demonstrated in the context of preparation of maintenance plans. Networks noted that it is early in the implementation process of ProMapp and processes are currently being reviewed. No evidence of the documentation review was provided.
- → Many of the compliance obligations managed by System Control are embedded in procedural documents and hence maintenance of these documents is important. System Control uses System Control Operational Documentation (SCOD) and an interview with General Manager System Control identified that relevant procedures have been reviewed and updated since the 2014 audit.

These standard work practices are also subject to internal audit and review and indicate that PWC has in place effective procedures and systems that ensure that it complies with many of its obligations.

Table 2.3 shows a comparison of the compliance process against AS3806 Compliance Programs as a guide to good practice. Overall, the compliance process appears sound. We note that gaps identified in the 2014 audit have been addressed.

Table 2.3 Comparison against AS3806 Compliance programs

Principal	Item	Assessment 2017
COMMITMENT	Commitment by the governing body and top management to effective compliance that permeates the whole organization	PWC has shown commitment and is currently in the process of investigating a new compliance framework. The Board of Directors signs off on an annual compliance declaration, as required by the Compliance Framework and Reporting Guidelines set by the Utilities Commission in 2015.
	The compliance policy is aligned to the organisation's strategy and business objectives, and is endorsed by the governing body.	PWC has a compliance policy that is aligned to the organisation's strategy and business objectives. It is endorsed by the Chair and CEO[1].
	Appropriate resources are allocated to develop, implement, maintain and improve the compliance program.	The organisational structure relevant to GRACE was provided and appeared adequate to manage the system. Evidence was provided showing notifications, entry of data and correction of entries. A separate project team has been established to investigate a replacement framework. Networks is setting up its own compliance team that will work within the Networks business separately to the existing compliance team that reports to the CFO.

[1] Provided as part of the MGAF supporting documentation

Principal	Item	Assessment 2017
	The objectives and strategy of the compliance program are endorsed by the governing body and top management.	The objectives and strategy the existing compliance program were not provided to the Auditor, nor evidence to show they had been endorsed.
	Compliance obligations are identified and assessed.	There are currently two compliance registers. The master spreadsheet with is stated as being most up to date and is currently being used for a review of the business as part of the MGAF project. GRACE does not contain the full set of compliance obligations but is used as the day to day reference and source for reporting.
IMPLEMENTATION	Responsibility for compliant outcomes is clearly articulated and assigned.	Responsibility is assigned for each obligation. However, each of the obligations are allocated to the same responsible person and no procedure was provided to demonstrate how the notifications, corrective actions or other actions are allocated to the appropriate person within System Control or Networks.
	Competence and training needs are identified and addressed to enable employees to fulfil their compliance obligations.	Evidence was provided to demonstrate that training related to the use of the compliance system GRACE is provided to staff. Audit of the full training system was out of scope of the audit.
	Behaviours that create and support compliance are encouraged and behaviours that compromise compliance are not tolerated.	In general System Control and Networks demonstrate this behaviour. A concerted effort was demonstrated to improve the granularity of requirements in GRACE and monitoring of their obligations.
	Controls are in place to manage the identified compliance obligations and achieve desired behaviours.	While internal audit, monitoring and reporting processes have been established, their implementation with respect to the System Control Technical Code and System Control Licence obligations appears inadequate to ensure compliance.
MONITORING AND MEASURING	Performance of the compliance program is monitored, measured and reported.	PWC provides monthly reporting through GRACE covering the number of events, investigations, corrective actions and due dates. It has also demonstrated used of the internal notifications that are generated in response to events. However, They have not adequately demonstrated the use of internal auditing programs to proactively monitor the System Control Technical Code or System Control Licence obligations.
	The organization is able to demonstrate its compliance program through both documentation and practice.	PWC can demonstrate evidence for some aspects of its compliance program.
CONTINUAL IMPROVEMENT	The compliance program is regularly reviewed and continually improved.	The program is currently under review through the MGAF project. This project is reviewing the current state in detail, defining a desired future state and determining the steps, including possible new compliance software, to achieve the desired future state.

Documents reviewed:

→ Sample of email notifications from Action Manager and Event Manager (screen shots)

- System Control Licence and Technical Code - System Control (Obligation Manager)
- Network Licence - Power Networks (obligation Manager)
- Event Register - Power Networks - 01.01.2016 to 27.03.2017 (with detail)
- Event Register - Power Networks - 01.01.2016 to 27.03.2017 (with workflow)
- Event Register - System Control - 01.01.2016 to 27.03.2017 (with detail)
- Event Register - System Control - 01.01.2016 to 27.03.2017 (with workflow)
- GRA043 - All Investigations Report - PN SC 01.01.2016 to 27.03.2017
- GRACE System Administration - Event errors and changes to events – Samples
- GRACE System Governance - Performance Report Samples
- GRACE Assessor Training as at 22 March 2017
- GRACE Training as at 22 March 2017
- Management, Governance and Assurance Framework Project 2017 (business case, ELT presentation)
- Extract from LIVE MASTER - Obligations Review - 2017 (SC and PN)
- Internal Audit Schedule
- KPMG, 2017, Review of Power and Water Corporation's Compliance with the 2014-19 Network Price Determination

2.4 Establishment of operating protocol and arrangements for generation dispatch

Clause 1.7.4 (d) of the System Control Technical Code states:

> 1.7.4 (d) System Control is responsible for the establishment of operating protocol and arrangements for generation dispatch and to maintain power system security.

2.4.1 2014 Audit finding

Part Compliant.

The service level agreement (SLA) describing the generator dispatch is out of date.

2.4.2 2017 Audit procedure

The audit involved:

- Interview with Real Time Operations Manager - System Control, at Hudson Creek Control Centre.
- Interview with Operations Planning Manager - System Control, at Hudson Creek Control Centre
- Interview with the on-shift power system controller responsible for generation dispatch

2.4.3 2017 Audit finding

Part Compliant.

2.4.4 Reason for audit finding

The generator dispatch process is set out in clause 5.3(a) of the Service Level Agreement (SLA) between Power Networks and the former generation business unit. This SLA has been extended until June 2017, however, the SLA is outdated and needs to be reviewed and modified to suit the structural changes resulting from the formation of Territory Generation.

The operating protocol and arrangements to maintain power system security are adequately set out in the Secure System Guidelines.

Documents reviewed:

- SLA between Power Networks and generation business units
- Letter - Extension of Service Level Agreement (SLA) between PWC and Territory Generation – Extension to 30 June 2016 (this letter extends the SLA to 30 June 2017)
- Territory Generation_System Control SLA - Extension to 30 June 2017 (email notifying Utilities Commission of the SLA extension to June 2017)
- PWC Power System Controller Reference, Secure System Guidelines, Version 2.6, August 2008.

2.5 Ensuring the accuracy of technical parameters

Clause 1.7.4 (f) of the System Control Technical Code states:

> 1.7.4 (f) System Control is responsible for ensuring that the technical parameters of Network equipment and System Participants' equipment comply with the standards set out in the Network Technical Code or as set out in an Access Agreement with the System Participant.

2.5.1 2014 Audit finding

Part Compliant.

No specific actions undertaken. Considered a responsibility of PWC Networks. Some commissioning tests monitored.

2.5.2 2017 Audit procedure

The audit involved interviews with System Control staff - Real Time Operations Manager, Operations Planning Manager and Operations Support Coordinator, at Hudson Creek Control Centre.

2.5.3 2017 Audit finding

Compliant

2.5.4 Reason for audit finding

System Control has undertaken technical audits on assets owned by Power Networks and Territory Generation. The outcomes of the audits are reported in the biannual reports and are distributed to the Utilities Commission and system participants.

System Control stated that testing was undertaken in response to changes to the network, such as changes to generator governors or AVR, or when System Control becomes aware of an issue on the network. They also undertake formal assessment of network access agreement when third parties comment to the network.

System Control has also stated they have started an audit process. Currently the audits are random, but are planned to become periodic as the process matures. No further evidence of this process was provided.

Documents reviewed:

- Alice Springs Half Yearly Report January - June 2015
- Alice Springs Half Yearly Report January - June 2016
- Alice Springs Half Yearly Report July - December 2015
- Alice Springs Half Yearly Report July - December 2016
- Darwin-Katherine Half Yearly Report July - December 2016
- Darwin-Katherine Half Yearly Report January - June 2015
- Darwin-Katherine Half Yearly Report January - June 2016
- Darwin-Katherine Half Yearly Report July - December 2015
- Tennant Creek Half Yearly Report January - June 2015
- Tennant Creek Half Yearly Report January - June 2016
- Tennant Creek Half Yearly Report July - December 2015
- Tennant Creek Half Yearly Report July - December 2016

2.6 Coordinating the plant maintenance program

Clause 2.1 of the System Control Technical Code states:

2.1	The general responsibilities of the Power System Controller and System Control are:
2.1 (b)	Coordinating the plant maintenance programme.

2.6.1 2014 Audit finding

Part Compliant.

Opportunity to undertake a broad review when Annual plans received - not done due to resource constraints.

2.6.2 2017 Audit procedure

The audit involved interviews with System Control staff - Operations Planning Manager at Hudson Creek Control Centre.

2.6.3 2017 Audit finding

Compliant

2.6.4 Reason for audit finding

Networks and Territory Generation submit maintenance forecasts (as spreadsheets) annually. System control compiles them into a single spreadsheet to identify and manage any conflicts. There is no formal procedure for this process.

The following communication procedures are utilised for planning outages at short term:

- Generation Outage/Test Request (GOTR) forms are used for short term (5 week notice) requests for Territory Generation.
- Request For Access (RFA) forms are used for short term (10 weeks' notice) requests for Networks.
- Risk Notices (RN) are formal communication procedures of works going ahead to notify participants of changes to system.

Documents reviewed:

- 17-03-06 RN GOTR 1702049 - C7 - Code Compliance Testing - Version 2.0
- 201617 Preventative Maintenance Handover for System Control
- 201516 Preventative Maintenance Handover for System Control
- 201516 Outage ID definition and proposed outage dates
- Email evidence of changing plans and coordination
- Territory Generation maintenance plans for DK and AS systems
- Medium Term 12 Months Generation Network Chart – showing generator shutdowns)

Suggested improvement:

Establish a formal process of the coordination activities and store it on SCOD so it can be tracked and updated. A formal process would also ensure the process can be repeated adequately in the event of change of staff.

2.7 Responsibilities of the Power System Controller and System Control

Clause 2.2 of the System Control Technical Code states:

2.2	The power system security responsibilities of the Power System Controller and System Control are set out in clause 3.3 and include:
2.2 (a)	maintaining the continuity and security of electricity supply
2.2 (b)	post trip management on network tripping or generation tripping
2.2 (c)	coordinating and sanctioning plant outage requests
2.2 (d)	regulating system Voltages to the required operation and performance standards
2.2 (e)	maintaining system frequency to the required operation and performance standards
2.2 (g)	arranging High Voltage busbar & feeder configurations for optimum system security
2.2 (k)	designing under-frequency load shedding schedules and allocate load to each stage of the schedule
2.2 (l)	issuing major incidents reports
2.2 (m)	instigating post-mortem investigations of major plant/power failures

2.7.1 2014 Audit finding

Not Compliant.

Post-trip management is not always optimally performed. No review of Under Frequency Load Shedding scheme. Late submission of preliminary incident reports.

2.7.2 2017 Audit procedure

This audit focused on the areas of non-compliance that were identified during the 2014 Audit. The specific clauses audited were 2.2 (b), 2.2 (k) and 2.2 (l).

The audit involved interviews with System Control staff - Operations Planning Manager and Real Time Operations Manager, at Hudson Creek Control Centre.

2.7.3 2017 Audit finding

Part Compliant

2.7.4 Reason for audit finding

System Control have a process for investigating and reporting on major and minor incidents as evidenced by the reports provided to the Auditor for the calendar year 2016.

The auditor reviewed the final major incident reports to identify whether post-incident management was effective. We found several incidents where post-trip management was not optimal as required under clause 2.2(b):

- Alice Springs System Black 30 January 2016 – Sensitive Earth Leakage protection was not restored in a timely manner
- McMinns zone substation 4 September 2016 – 22kV bus restored without waiting for 15 minutes prior to energising to allow reports of public danger to be received.

We acknowledge that operating the power system in NT is a complex undertaking and that it would be unrealistic to expect that no incidents would occur. In our view, the post-trip management incidents represent minor braches of the established operating protocols.

In undertaking the review, we also found several incidents where continuity of electricity supply was not maintained as required under clause 2.2(a):

- Pine Creek island system black 9 March 2016 – accidental closure of a circuit breaker when attempting to synchronise the Pine Creek Island to the Darwin-Katherine Island resulting in the system black of the Pine Creek Island
- Pine Creek and Katherine system black 10 August 2016 – reactive power flows not reduced to zero prior to separating the Pine Creek/Katherine Islands from the Darwin Island resulting in a System Black in the Pine Creek/Katherine Islands
- Katherine UFLS stage 2 operation 22 August 2016 – following the failure of a circuit breaker to close, System Control did not initially follow the optimal process to seek assistance from Test and Protection staff.

While only three incidents occurred that resulted in major outages from the hundreds of switching procedures undertaken, these incidents were avoidable and we conclude that System Control does not fully comply with the obligation to maintain the continuity and security of electricity supply.

With respect to clause 2.2(k), System Control undertook a detailed review of their Under Frequency load Shedding Scheme. The outcomes have included changing the structure of the load blocks that are shed and inclusion of a frequency rate of change setting to prevent load shedding when the system is starting to recover. Entura noted that more precise knowledge of the generator characteristics and system inertia will enable more optimal ULFS settings. Information provided indicates the implementation of the revised settings is still in progress.

Documents reviewed:

- ENTURA-AA37C Revised UFLS settings v2.0
- Emails related to UFLS scheme implementation
- Preliminary Fault Reports – reports for major incident that occurred during the 2016 calendar year
- Final Incident Reports – reports for major incident that occurred during the 2016 calendar year
  - Final Incident Report PWC - 22 August 2016 - 132kV PK-KA Line Separation - KA UFLS Stage 2
  - Final Incident Report ADVISIAN - 30 January 2016 - Alice Springs System Black Final
  - Final Incident Report AECOM (x 3) - 02 D~ 2015, 08 December 2015, 24 January 2016 (Darwin-Katherine System Major Events)
  - Final Incident Report ENTURA (x 4) - 20 ~ary 2016, 09 January 2016, 04 March 2016 (Alice Springs Major Network Events)
  - Final Incident Report PWC - 04 August 20~Palmerston Zone Substation - 4 x Events - TF2 (11PA20) and TF3 (11PA05) Tripped
  - Final Incident Report PWC - 04 September 2016 - McMinns Zone Substation - Loss of Supply
  - Final Incident Report PWC - 08 April 2016, 05 June 2016 - Alice Springs UFLS Events
  - Final Incident Report PWC - 09 April 2016 - Katherine Black
  - Final Incident Report PWC - 09 March 2016 - Synchronisation of PK Island with DK Island Event
  - Final Incident Report PWC - 10 August 2016 - Katherine and Pine Creek System Black
  - Final Incident Report PWC - 10 August 2016 - Katherine and Pine Creek System Black
  - Final Incident Report PWC - 13 March 2016 - Katherine Black
- Preliminary Fault Reports – reports for minor incidents occurring in the 2016 calendar year

2.8 Responsibility for maintaining system security

Clause 3.3.1 of the System Control Technical Code states:

> 3.3.1 The power system security responsibilities of the Power System Controller are exercised by System Control and are to:
>
> 3.3.1 (a) maintain power system security

2.8.1 2014 Audit finding

Not Compliant.

At times, do not meet all requirements of Secure System Guidelines.

2.8.2 2017 Audit procedure

The audit involved interviews with System Control staff - Real Time Operations Manager and Operations Planning Manager, at Hudson Creek Control Centre.

2.8.3 2017 Audit finding

Part Compliant

2.8.4 Reason for audit finding

The dynamic model for the Alice Springs system has been updated and Territory Generation is comfortable to use it for network studies.

The dynamic model for Tennant Creek has not yet been updated. However, a new HV Board and new generators are planned for installation and System Control has stated the model will be completed once the new assets are commissioned.

The current electrical model for the Darwin – Katherine system is suitable for steady state analysis and System Control is in the process of refining the system dynamic model. In place of the dynamic model, System Control currently uses event history to analyse system security under some scenarios. However, without the refined model it is not possible to fully assess the system security against the Secure System Guidelines and assess the risks.

An adequacy assessment of their dynamic model is currently underway and the model is expected to be updated by June 2018. Once the Darwin Katherine system dynamic model is updated and fit for use, System Control will be compliant with this obligation.

Documents reviewed:

- PWC Power System Controller Reference, Secure System Guidelines, Version 2.6, August 2008.
- PWC Power System Controller Reference, Secure System Guidelines, Draft 3, February 2017.
- Letter of Offer DK Model Assessment (Entura)
- Emails replated to the dynamic models

2.9 Assess the availability and adequacy of contingency capacity reserves and reactive power reserves

Clause 3.3.1 of the System Control Technical Code states some of the power system security responsibilities of the Power System Controller thus:

3.3.1 The power system security responsibilities of the Power System Controller are exercised by System Control and are to:

3.3.1 (j) assess the availability and adequacy, including the dynamic response, of contingency capacity reserves and reactive power reserves in accordance with the power system security and reliability standards and to ensure that appropriate levels of contingency capacity reserves and reactive power reserves are available to:

(1) ensure the power system is, and is maintained, in a satisfactory operating state; and

(2) arrest the impacts of a range of significant multiple contingency events to allow a prompt restoration or recovery of power system security, taking into account under-frequency initiated load shedding capability provided under connection agreements or otherwise;

2.9.1 2014 Audit finding

Not Compliant.

No formal assessment and not escalating these problems to Networks.

2.9.2 2017 Audit procedure

The audit involved interviews with System Control staff - Real Time Operations Manager and Operations Planning Manager, at Hudson Creek Control Centre.

2.9.3 2017 Audit finding

Compliant

2.9.4 Reason for audit finding

The capacitors at Katherine substation now provide sufficient reactive support to the network, and generally the required level of spinning reserve available. As shown in the Biannual reporting, the system is operated in a non-satisfactory state several times per year, but generally as a result of a forced outage of a transmission or sub transmission line, rather than due to lack of contingency capacity reserves or reactive reserves.

System Control is still in the process of developing the Darwin Katherine system dynamic model. Without this model it is not possible to fully assess the system security against the system security guidelines and assess the risks. System Control stated it has undertaken assessment of the required amount of reactive and contingency capacity reserves based on actual historical data from real events.

In the auditors view, this approach is sufficient to be compliant with this obligation.

Documents reviewed:

- PWC Power System Controller Reference, Secure System Guidelines, Version 2.6, August 2008.
- PWC Power System Controller Reference, Secure System Guidelines, Draft 3, February 2017.
- Alice Springs Half Yearly Report – 2015 and 2016
- Darwin-Katherine Half Yearly Report – 2015 and 2016
- Tennant Creek Half Yearly Report January – 2015 and 2016

2.10 Coordinate and direct any rotation of widespread interruption of demand

Clause 3.3.1 of the System Control Technical Code states some of the power system security responsibilities of the Power System Controller thus:

3.3.1	The power system security responsibilities of the Power System Controller are exercised by System Control and are to:
3.3.1 (t)	co-ordinate and direct any rotation of widespread interruption of demand in the event of a major supply shortfall or disruption;

2.10.1 2014 Audit finding

Part Compliant.

No procedure.

2.10.2 2017 Audit procedure

The audit involved interviews with System Control staff - Real Time Operations Manager and Operations Planning Manager, at Hudson Creek Control Centre.

2.10.3 2017 Audit finding

Part Compliant

2.10.4 Reason for audit finding

The rotational load shedding is performed manually by the system controllers during a supply shortfall or disruption. A written procedure has been developed, however, it is still in draft form. A set of schedules outline the load available to be shed from feeders along with the load type connected has been developed to assist manual load shedding.

The Auditor expects System Control to become compliant with this obligation once the protocol is finalised and put into operational use.

Documents reviewed:

- Load Shedding Protocol (Draft)
- Alice Springs Manual Load Shed Schedule Jan 2017
- Manual Load Shed Schedule 2014-2015
- Northern Suburbs - Residential Load Shed

Suggestion for improvement:

- Amend the System Control Technical Code to allow appropriate durations of load shedding to suit practical limitations observed from experience.

2.11 Investigate and review all major power system operational incidents and initiate action plans

Clause 3.3.1 of the System Control Technical Code states some of the power system security responsibilities of the Power System Controller thus:

3.3.1 The power system security responsibilities of the Power System Controller are exercised by System Control and are to:

3.3.1 (v) investigate and review all major power system operational incidents and to initiate action plans to manage any abnormal situations or significant deficiencies which could reasonably threaten power system security. Such situations or deficiencies include without limitation:

(1) power system frequencies outside those specified in the definition of satisfactory operating state;

(2) power system voltages outside those specified in the definition of satisfactory operating state;

(3) actual or potential power system instability; and

(4) unplanned/unexpected operation of major power system equipment;

2.11.1 2014 Audit finding

Part Compliant.

Late submission of incident reports. Lack of tracking of action plan outcomes. Had the audit been performed prior to March 2014, it is likely that PWC would have been found not compliant.

2.11.2 2017 Audit procedure

The audit involved:

- Interview with Real Time Operations Manager - System Control, at Hudson Creek Control Centre.
- Interview with Operations Planning Manager - System Control, at Hudson Creek Control Centre.
- Review of a sample set of major and minor incident reports submitted by PWC
- Review of Operations Planning Statistics submitted by PWC.

2.11.3 2017 Audit finding

Part Compliant.

2.11.4 Reason for audit finding

A review of the sample of minor incident reports demonstrated that they are 65% were submitted within the required 14 day timeframe.

Discussion with System Control and a sample of reports demonstrate that major events are being investigated and reported as required by this obligation. A spreadsheet was provided that shows the tracking of recommendations made as outcomes of investigations.

Documents reviewed:

- Major Incidents Recommendation List - System Control
- Preliminary Fault Reports – reports for major incident that occurred during the 2016 calendar year
- Final Incident Reports – reports for major incident that occurred during the 2016 calendar year
- Preliminary Fault Reports – reports for minor incidents occurring in the 2016 calendar year

2.12 Handling of single contingency events

Clause 3.4.1 (g) of the System Control Technical Code relates to Power system instability:

3.4.1 (g) The sudden failure or forced outage of any major single power system item such as a generator, transmission line, transformer, etc. is known as a single contingency event. System Control will manage the power system and generator dispatch process such that, in the event of a single disruption:

(1) all plant and equipment would operate within ratings in a reasonable period following the initial transient impacts of the disruption;

(2) customer load would not be unnecessarily disconnected;

(3) the power system would remain in synchronism;

(4) damping of any power system instabilities or oscillations would be adequate;

(5) voltage control criteria would be satisfied; and

(6) frequency control criteria would be satisfied.

2.12.1 2014 Audit finding

Not Compliant.

System Dynamic models in developing stage. Hence, a full range of stability studies has not been done.

2.12.2 2017 Audit procedure

The audit involved interviews with System Control staff Operations Planning Manager, at Hudson Creek Control Centre.

2.12.3 2017 Audit finding

Part Compliant

2.12.4 Reason for audit finding

System Control has undertaken the following actions to ensure it can manage the power system and generator dispatch process during a single contingency event:

- reviewed of the UFLS scheme and ongoing implementation of the recommendations
- reviewed ancillary services
- revised the System Secure Guidelines
- developed tools in Excel and Matlab to assess the level of ancillary services required
- commenced development of tools to be used by operators for the purposes of generation dispatch and managing the frequency control ancillary services
- revised the spinning reserve policy at Alice Springs

The studies and analysis listed above have been used to develop the System Secure Guidelines version 3 (draft) which specifies the frequency control ancillary services / spinning reserve requirements for each of the three networks. The requirements for the spinning reserve on the Darwin Katherine systems, as set out in the draft guidelines, have been implemented through the issue of a Short Term Advice.

A dynamic model is available for the Alice Springs system and models are under development for the Darwin Katherine and Tennant Creek systems. Once these models are finalised, System Control will be able to provide additional analysis to ensure the power system is managed appropriately under a broader range of single contingency events.

The Auditor notes that supply is often lost to Katherine as a result of the loss of the 132 kV line that connects it to Darwin. Generation is available at Katherine, but not operated under normal conditions due to economic considerations, but the generators are used to restore power quickly post separation.

The Auditor understands that System Control operates the network on a security constrained economic dispatch basis. In this case, due to the network topology and economic considerations, the Auditor considers that short outages in Katherine due to faults do not constitute ‘unnecessary’ disconnection of customer load.

Documents reviewed:

- 2016 Incidents overview inc Non Satisfactory state
- Preliminary Fault Reports – reports for major incident that occurred during the 2016 calendar year
- Final Incident Reports – reports for major incident that occurred during the 2016 calendar year

2.13 Maintenance of a secure system

Clause 3.5.5 (a) of the System Control Technical Code relates to the System Control's obligations:

3.5.5 (a) Maintenance of a secure system:

(1) System Control shall endeavour to maintain a secure system.

(2) If the power system is no longer secure, then System Control shall minimise the risk to public safety and power supplies at points of Connection to the High Voltage networks.

2.13.1 2014 Audit finding

Part Compliant.

System does not always meet all requirements specified in the system secure guidelines. However, in a contingency event, controllers take action to minimise safety risks.

2.13.2 2017 Audit procedure

The audit involved an interview with Real Time Operations Manager - System Control, at Hudson Creek Control Centre and three on-shift power system controllers.

2.13.3 2017 Audit finding

Compliant

2.13.4 Reason for audit finding

System Control generally maintains a secure system, and in case of insecurity following contingency events, the system controllers will take action to minimise the risk to the public safety and to the network. This is evidenced by statistics provided in biannual reports and a sample of the performance report that is issued monthly and confirmed through discussion with the Manager Real Time Operations.

Documents reviewed:

- 2016 June - System Control and Market Operations Performance Report
- Alice Springs Half Yearly Report – 2015 and 2016
- Darwin-Katherine Half Yearly Report – 2015 and 2016
- Tennant Creek Half Yearly Report January – 2015 and 2016

2.14 Approval of system black procedures

Clause 5.7.2(c) of the System Control Technical Code states:

5.7.2 (c) Generators' Black System Procedures shall be:

(1) submitted by the Generator to System Control; and

(2) approved by System Control.

2.14.1 2014 Audit finding

Not Compliant.

No formal approval given.

2.14.2 2017 Audit procedure

The audit involved requesting evidence of approval of the System Black Procedures and an interview with the General Manager - System Control, at Hudson Creek Control Centre.

2.14.3 2017 Audit finding

Compliant

2.14.4 Reason for audit finding

System control has provided evidence that that the Black Start procedures are either approved or that they are in the process of being approved.

The Auditor considers that the evidence provided demonstrates that the approval process is working and will lead to all procedures being approved.

Documents reviewed:

- Territory Generation - GK-003 Katherine Power Station Automated Black Start Procedure – 10032017
- Territory Generation - GR-074 RGPS Black Start Procedure – 10032017
- Territory Generation - W-041 Weddell Power Station Black Start Procedure - 10032017
- CI-131 CIPS Black Station Operating Procedures
- Owens Springs Power Station Black Start (OSPS BS) Testing - Latest follow up (email)

3. TERRITORY GENERATION

3.1 Background

On 1 July 2014, PWC underwent a structural separation in which most of the generation and retail business units of PWC became separate government owned corporations: Power Generation Corporation (trading as Territory Generation), and Power Retail Corporation (trading as Jacana Energy) respectively. The licence obligations in respect of the following power generation facilities were invested in Power Generation Corporation (Territory Generation):

- Channel Island Power Station, Darwin
- Weddell Power Station, Darwin
- Katherine Power Station, Katherine
- Tennant Creek Power Station, Tennant Creek
- Ron Goodin Power Station, Alice Springs
- Owen Springs Power Station, Alice Springs
- Yulara Power Station, Yulara
- Minor Commercial Power Station:
  - Kings Canyon

Following structural separation, PWC remained responsible for Generation Licence obligations in respect of Berrimah Power Station, Darwin, most minor commercial power stations in the Northern Territory, and the generation facilities supplying Indigenous communities under the Indigenous Essential Services (IES) program. Territory Generation retained responsibility for Kings Canyon.

3.2 Summary

The focus of the audit of the Generation Licence is on key obligations related to the provision of:

- ancillary services, in particular, black start capability
- the organisation's responsiveness to the directions of the System Controller, and the recommendations of technical audits and investigations performed by or on behalf of the System Controller
- the maintenance and operation of its facilities in accordance with good electricity industry practice.

The auditor examined five obligations contained in the Generation Licence and System Control Technical Code that were identified to be part compliant or non-compliant in 2014; the audit findings are summarised in Table E.2.

Table E.1 Summary of Generation Licence audit findings

Audit item	2017 Audit finding	Comments
Establish and maintain a compliance process	Compliant	
Approval of black system procedures	Compliant	
Amendment of black system procedures	Compliant	

Audit item	2017 Audit finding	Comments
Operations and maintenance of black start equipment in accordance with good electricity industry practice	Compliant	
Implementation of Power System Controller directions	Compliant	

3.3 Establish and maintain a compliance process

The following Generation Licence clause relates to compliance process and compliance reporting:

10.1 The licensee is to establish and maintain a compliance process

(a) Licensee must establish, document, maintain and comply with appropriate auditable internal policies, procedures and systems ("compliance process") for ensuring that it complies with its obligations under this licence, and all applicable laws, Codes, rules or standards.

3.3.1 2014 Audit finding

Not Compliant.

Corporate system 'GRACE' currently does not provide granularity required. No active internal compliance program for licence obligations or obligations arising from the System Control Technical Code.

3.3.2 2017 Audit procedure

Understanding of the compliance process was discussed with staff, including Territory Generation's Compliance Manager and General Manager. In response to the interviews, additional information was requested and reviewed.

3.3.3 2017 Audit finding

Compliant.

3.3.4 Reason for audit finding

Territory Generation formerly used the GRACE system to manage its compliance obligations. Following the "hard" separation of Territory Generation from PWC, Territory Generation has been managing its compliance obligations by more traditional means, using a Microsoft Excel workbook as a means to record their obligations, assign responsibilities, and to monitor and record the periodic reviews that are undertaken on each obligation. Territory Generation has appointed a manager to manage its compliance obligations and risks, who is solely responsible for maintaining the workbook, and for routine follow-ups with the business's key staff that have been assigned responsibility for each obligation.

Territory Generation is in the process of procuring the implementation of a new compliance monitoring platform using a web-based application from Intelex Pty Ltd, and provided the scope of supply for the procurement for our information[2].

Territory Generation engaged PricewaterhouseCoopers (PwC) in 2016 to perform a review of its compliance framework. In its report of October 2016[3], PwC concluded that whilst Territory Generation met the minimum requirements of its Generation Licence, there were still many improvements to be made that would be required for it to conform to the requirements of AS ISO 19600:2015 – Compliance management systems – Guidelines.

Based on our own observations and the conclusions of the PwC review of 2016, we find that Territory Generation is now compliant with its licence obligation to establish and maintain a compliance process, and is actively engaged in continuing to improve its processes.

Documents reviewed:

- Territory Generation, 2016 – RFT HQG018-16, All centres – Provision of an incident, risk and compliance management system with ongoing maintenance and support, Part C Contract Details
- PricewaterhouseCoopers 2016, Territory Generation Internal Audit Report Compliance Framework Review
- Compliance Register Working Copy

3.4 Approval of black system procedures

Clause 5.7.2(c) of the System Control Technical Code states:

> 5.7.2 (c) Generators' Black System Procedures shall be:
>
> (1) submitted by the Generator to System Control; and
>
> (2) approved by System Control.

3.4.1 2014 Audit finding

Part Compliant.

Territory Generation could provide evidence of submission of procedures to System Control for approval, but could not provide evidence that they had been approved.

3.4.2 2017 Audit procedure

Evidence of the submission to System Control of the Black System Procedures was requested, together with their corresponding approvals from System Control.

3.4.3 2017 Audit finding

Compliant.

---

[2] Territory Generation, 2016 – RFT HQG018-16, All centres – Provision of an incident, risk and compliance management system with ongoing maintenance and support Part C Contract Details

[3] PwC 2016, Territory Generation Internal Audit Report Compliance Framework Review

3.4.4 Reason for audit finding

Territory Generation provided documentary evidence of the revision and approval status and currency of the black start procedures for each of the generating stations on the Darwin-Katherine system. The most recent versions of the procedures include boxes in the Document Review History table specifically for PWC System Control as an organisation and the System Controller as a nominated individual to indicate their approval of the procedure.

Territory Generation also provided copies of the Black Start Compliance Audit reports for each generating station where black start compliance testing had been performed and witnessed by PWC System Control.

GENERATING STATION	BLACK START PROCEDURE		DATE OF BLACK START COMPLIANCE TEST
	PROCEDURE RELEASED	NEXT REVISION DUE	
Channel Island	20 June 2014	June 2017	May 2016
Weddell	27 March 2014	March 2017 (in progress)	March 2016
Katherine	21 November 2016	November 2019	March-May 2016

Documents reviewed:

- Territory Generation
  - CI-131 CIPS Black Station Operating Procedures
  - W–041 Weddell Power Station Black Start Operation
  - K-003 Katherine Power Station Automated Black Start Procedure
- PWC System Control
  - Channel Island Power Station Black Start Compliance Audit 4th May 2016
  - Weddell Power Station Black Start Compliance Audit 13th March 2016
  - Katherine Power Station Black Start Compliance Audit 23rd March 2016

3.5 Amendment of black system procedures

System Control Technical Code clause 5.7.2 Black System Procedures, parts (d)-(h) state:

5.7.2 (d) At any time, System Control may request amendments to the Black System Procedures.

5.7.2 (e) If a Generator disagrees with an amendment requested by System Control then it may so notify System Control and the parties shall promptly meet and attempt to resolve the disagreement. In the event that there is failure to resolve the disagreement, the matter shall be referred to the Utilities Commission for resolution.

5.7.2 (f) A Generator shall be deemed to have agreed to an amendment to Black System Procedures unless giving notice to the contrary to System Control within 20 Business days of receiving the amendment notice from System Control.

5.7.2 (g) A Generator shall review Black System Procedures for each of its power stations at least once every three years.

5.7.2 (h) A Generator may propose changes to Black System Procedures for one or more of its power stations by notice in writing to System Control.

3.5.1 2014 Audit finding

Part Compliant.

Each document has been reviewed and reissued within the last six months. However, it is unlikely that procedures have been reviewed every three years as required, prior to the system black event, so it is likely that PWC (licence holder at the time) would have been non-compliant at that time.

3.5.2 2017 Audit procedure

Evidence of Black System Procedures amendment requests and the amendment process was requested.

Evidence of a three-yearly formal review cycle was requested.

3.5.3 2017 Audit finding

Compliant.

3.5.4 Reason for audit finding

The current black start procedure documents all bear dates of issue within the last three years, and all bear dates for their next review that are three years after their respective dates of issue. Furthermore, Territory Generation provided copies of emails pertaining to the review process being undertaken, in which PWC System Control was identifying and requesting amendments that Territory Generation was undertaking to incorporate.

Documents reviewed:

- Territory Generation
  - CI-131 CIPS Black Station Operating Procedures
  - W–041 Weddell Power Station Black Start Operation
  - K-003 Katherine Power Station Automated Black Start Procedure
- PWC System Control
  - Channel Island Power Station Black Start Compliance Audit 4th May 2016
  - Weddell Power Station Black Start Compliance Audit 13th March 2016
  - Katherine Power Station Black Start Compliance Audit 23rd March 2016
  - Email dated 7th March 2017 Subject: Amendments to Black Station Procedures (Northern Region)
  - Email dated 8th March 2017 Subject: black start procedures awaiting approval

3.6 Operations and maintenance of black start equipment in accordance with good electricity industry practice

System Control Technical Code clause 1.7.1 Obligations of System Participants states:

1.7.1	All System Participants shall maintain and operate all equipment being part of their facilities in accordance with:
1.7.1 (c)	good electricity industry practice and applicable Australian Standards

For the purposes of this audit, the auditor has used the definition of “good electricity industry practice” given in the National Electricity Rules:

> The exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from a significant proportion of operators of facilities forming part of the power system for the generation, transmission or supply of electricity under conditions comparable to those applicable to the relevant facility consistent with applicable regulatory instruments, reliability, safety and environmental protection. The determination of comparable conditions is to take into account factors such as the relative size, duty, age and technological status of the relevant facility and the applicable regulatory instruments.

3.6.1 2014 Audit finding

Part Compliant.

Territory Generation has inherited PWC’s Corporate Asset Management Manual, together with its own suite of asset management plans and procedures. Territory Generation should prioritise the development of a structured asset management system appropriate to its business in order to manage its assets in accordance with good electricity industry practice.

3.6.2 2017 Audit procedure

The auditor requested evidence of the following:

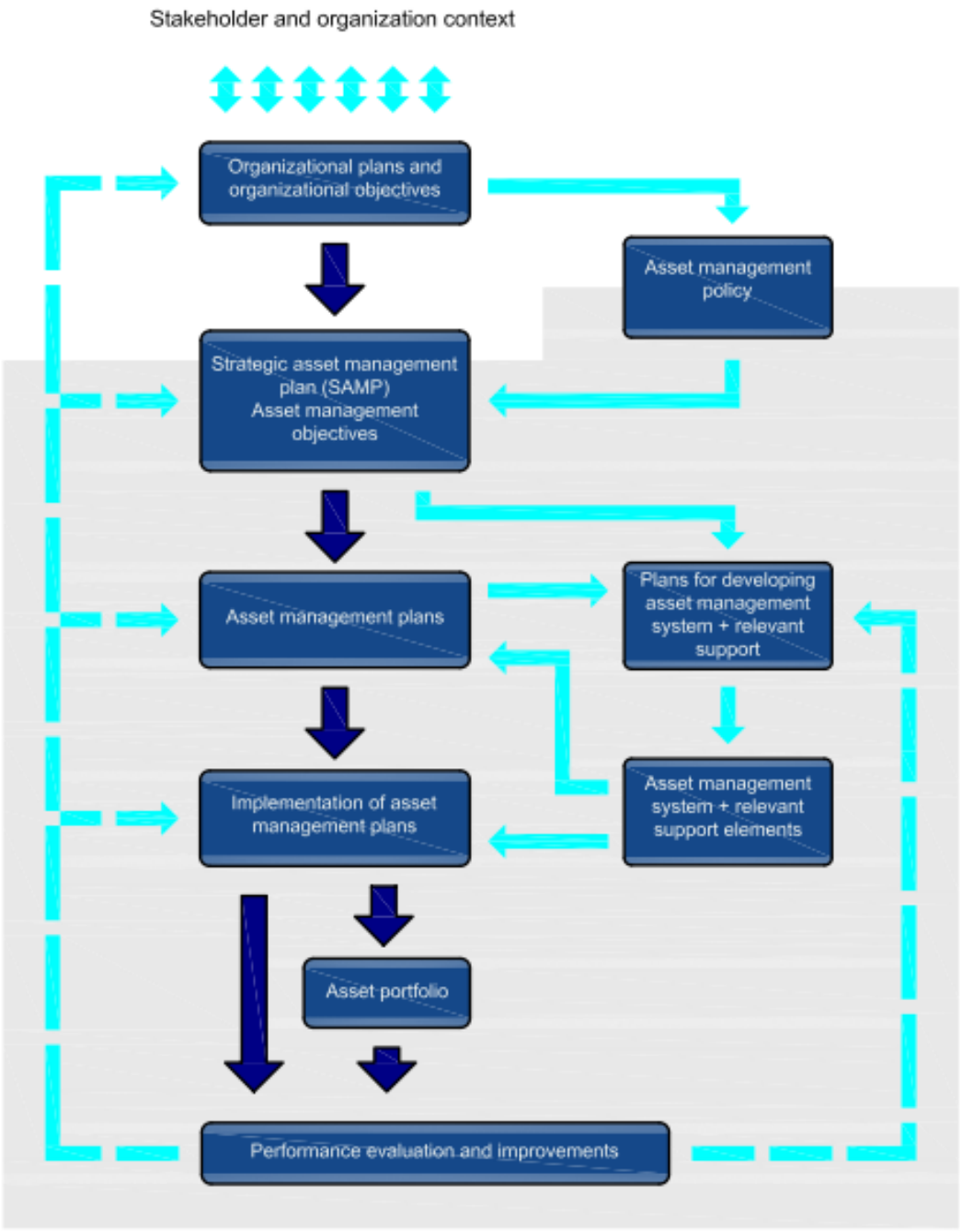
- a corporate-level asset management policy and strategy
- asset management plans for black start generating equipment
- operating and maintenance procedures/plans for black start generating equipment
- operating and maintenance records for black start generating equipment.

3.6.3 2017 Audit finding

Compliant.

3.6.4 Reason for audit finding

The auditor is of the opinion that good electricity industry practice would nowadays include the implementation of a structured asset management system, based on the principles and guidelines set out in modern standards such as ISO 55001:2014 Asset Management. One of the basic requirements of such a system is it should have a relationship hierarchy resembling that in Figure 3.1.



Source: ISO 55000:2014 Figure B.1

Figure 3.1 Relationship between key elements of an asset management system (Source: ISO 55000:2014 Figure B.1)

The "organisational plans and organisational objectives" shown in Figure 3.1 are, for Territory Generation, set out in its Statement of Corporate Intent (SCI), which is a statutory requirement of the Government Owned Corporations Act. Territory Generation issued its SCI for FY 2016/17 in May 2016[4], and included an overview of its key result areas and objectives in section 6.4.

Since the original review, Territory Generation has made significant progress in the development of a wide-ranging asset management system. Whilst it is outside the scope of this review to determine whether the asset management system conforms to the principles and guidelines set out in ISO 55001:2014, it is clear

[4] Power Generation Corporation (Trading as Territory Generation), May 2016, 2016-17 Statement of Corporate Intent

from the documents provided to us for our review that the system has a logical structure, and appears to contain all the elements required of a conforming asset management system. As the establishment of an asset management system was identified as a means by which Territory Generation might demonstrate its compliance with the license requirement to "… maintain and operate all equipment … in accordance with good electricity industry practice and applicable Australian Standards", we believe that Territory Generation can now be deemed to comply with its licence conditions in this regard.

Documents reviewed:

- AMS-001 Asset Management Policy dated 17 June 2016
- AMS-002 Strategic Asset Management Plan dated 17 June 2017
- Numerous asset-specific asset management plans for all power stations and major asset classes.

3.7 Implementation of Power System Controller directions

System Control Technical Code clause 3.3.4 Responsibility of System Participants states:

3.3.4 (b)	System Participants shall respond to any direction or reasonable request of the Power System Controller issued in accordance with clause 3.3.
3.3.4 (c)	System Participants shall participate in any audit or investigation of system technical matters by Power System Controller.
3.3.4 (d)	A System Participant shall rectify any technical non-compliance identified by the Power System Controller within the time specified by the Power System Controller.

3.7.1 2014 Audit finding

Part Compliant.

Recommendations of incident investigation not implemented within a reasonable time. Had this matter been audited prior to March 2014, it is most likely that PWC would have been found non-compliant with its licence obligations.

3.7.2 2017 Audit procedure

The following information was requested:

- evidence of participation in and cooperation with System Control's system stability investigations
- evidence of implementation of recommendations resulting from earlier system stability investigations (e.g. earlier system black events such as January 2010).

The auditor sought to answer the following questions:

- What role did the licensee play in earlier investigations?
- What recommendations were made by earlier investigations?
- Were recommended actions allocated to a responsible party (business group or individual), and given a timetable for their implementation, and did the licensee implement the recommendations within the stated timeframe?

3.7.3 2017 Audit finding

Compliant

3.7.4 Reason for audit finding

Following the system black event of March 2014, PWC appointed AECOM to undertake a comprehensive review of the recommendations made by the investigations into system black events that had occurred on the Darwin-Katherine, Tennant Creek, and Alice Springs power networks over the past several years. During the course of the project, it became clear that many of the earlier investigation reports' recommendations had only been partly implemented. The purpose of the project, therefore, became to review and consolidate the recommendations of the system black investigations since the Darwin-Katherine system black event of 30 January 2010; to identify and prioritise tasks to implement the recommendations; and to allocate responsibility and deadlines for performance of the tasks to the relevant business units of PWC (i.e. System Control, Generation, or Networks).

The final progress report of the AECOM review dated 22 October 2015 indicated that Territory Generation had completed the implementation of the recommended actions relating to generating equipment by February 2015, well ahead of the July 2015 completion date anticipated in our original review.

There was a subsequent system black event that affected the Alice Springs system on 30 January 2016. The event was investigated initially by PWC System Control and Territory Generation, and later independently by Advisian. The investigations identified the sequence of events and the root causes of the system black incident, and made several recommendations regarding changes to several components of the Alice Springs system.

The Advisian report recommended implementing the recommended actions identified in the Territory Generation Plant v Failure Investigation Report entitled Alice Springs System Black Event 2016-01-30 – Cause dated 22 February 2016. Advisian also made several more recommendations concerning control and protection settings of the generating units in the Alice Springs system, each of which Territory Generation has either investigated, implemented or has planned for implementation at the next opportunity.

The auditor considers, therefore, that Territory Generation is now fully compliant with its licence obligations in respect of sub-clauses 3.3.4(b)-(d).

Documents reviewed:

- Utilities Commission of the Northern Territory, Independent Investigation into the Darwin-Katherine System Black Incident 12 March 2014, April 2014
- Evans & Peck, Independent Investigation into the 12 March 2014 Darwin Katherine System Black, April 2014
- Power and Water Corporation, System Black Recommendation Implementation, undated Microsoft® PowerPoint® presentation as 'Presentation ver 3 201408 19.pdf'
- Power And Water Corporation/AECOM, Progress Report Implementation of the System Black Recommendations revision 14, 22 November 2015
- Power and Water Corporation (Chan), (Internal Report on) Findings of the Investigations into the Darwin-Katherine System Blackout on 12 March 2014, undated report as 'Findings_of_12_March_2014_(Michael Chan Report).pdf
- Advisian, Alice Springs System Black Review of Electricity Supply Major Incident 30 January 2016, dated June 2016
- Territory Generation, PLANT FAILURE INVESTIGATION REPORT Alice Springs System Black Event 2016-01-30 – Cause, dated 22 February 2016

4. POWER NETWORKS

4.1 Background

The Network Licence is held by Power and Water Corporation (PWC). The responsibility for meeting all obligations lies with the General Manager Networks.

4.2 Summary

The Network Licence audit focused on key obligations relating to its compliance system, third party access and maintenance forecasts.

The auditor examined three key obligations contained in the licence and the System Control Technical Code that were identified to be part compliant or non-compliant in 2014. The audit findings are set out in Table E.3.

Table E.1 Summary of Network Licence audit findings

Item	2017 Audit finding	Comment
Establish and maintain a compliance process	Part Compliant	Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the System Control Technical Code or Network Licence
Third-Party Access compliant with good electricity industry practice	Compliant	
Preparation of maintenance forecast	Compliant	

4.3 Establish and maintain a compliance process

The following Network Licence clause relates to compliance process and compliance reporting:

10.1 The licensee is to establish and maintain a compliance process

10.1 (a) Licensee must establish, document, maintain and comply with appropriate auditable internal policies, procedures and systems ("compliance process") for ensuring that it complies with its obligations under this licence, and all applicable laws, Codes, rules or standards.

4.3.1 2014 Audit finding

Not Compliant.

Corporate system 'GRACE' currently does not provide granularity required. Lack of Internal Audit. No active internal compliance program for licence obligations or obligations arising from the Network Technical Code.

4.3.2 2017 Audit procedure

Documented compliance reporting policy, process, and procedures were requested and compared to AS3806 Compliance Programs as a guide to good practice. Understanding of the compliance process was discussed with staff, including:

- Meeting and interview with PWC's Risk and Compliance Group. The meeting included a brief demonstration of the compliance monitoring system (GRACE).
- Meeting with PWC's HR staff and demonstration of the training register.

- In response to the initial audit findings a subsequent review of PWC's compliance monitoring capability was undertaken. The following information was requested:
- Structure, roles and responsibilities of its regulatory team (staff involved in managing regulatory compliance matters).
- Policies, procedures, frameworks that describe the governance and process for monitoring compliance with licence, statutory and code obligations
- Descriptions of any IT and other support systems used to monitor compliance with licence obligations, including specific procedures or training material for use of the systems.

4.3.3 2017 Audit finding

Part compliant.

4.3.4 Reason for audit finding

PWC uses the GRACE system (Governance, Risk, Audit, Compliance, Event Management) to manage and monitor their compliance obligations, however, their master compliance register is currently held in an Excel spreadsheet as they are undergoing a compliance review of the business in preparation for updating their compliance systems as part of the Management, Governance Audit Framework (MGAF) project.

PWC has improved the level of granularity of the obligations related to the Network Licence within their compliance system GRACE since the 2014 audit. We found 22 items relating to the Network Code and 377 items relating to the System Control Technical Code. We conclude that the requirements for Network Licence obligations were found to be entered into GRACE at a suitable level of granularity that would be required to enable establishing and monitoring compliance.

We also found that:

- there was no procedure or other evidence provided that demonstrated how notifications from GRACE are actioned or if any actions had occurred with respect to the Network Licence or the System Control Technical Code
- the internal audit program does not effectively cover the obligations in the Network Licence or System Control Technical Code
- some compliance obligations are embedded in standard work practices which are subject to internal audit and review and indicate that PWC has in place effective procedures and systems that ensure that it complies with many of its obligations.

For these reasons, we have assigned an audit grade of part compliant. Power Networks and System Control use the same compliance system. A full discussion of PWC's compliance system assessment is in section 2.3.3.

Documents reviewed:

- Sample of email notifications from Action Manager and Event Manager (screen shots)
- System Control Licence and Technical Code - System Control (Obligation Manager)
- Network Licence - Power Networks (obligation Manager)
- Event Register - Power Networks - 01.01.2016 to 27.03.2017 (with detail)
- Event Register - Power Networks - 01.01.2016 to 27.03.2017 (with workflow)
- Event Register - System Control - 01.01.2016 to 27.03.2017 (with detail)
- Event Register - System Control - 01.01.2016 to 27.03.2017 (with workflow)
- GRA043 - All Investigations Report - PN SC 01.01.2016 to 27.03.2017

- GRACE System Administration - Event errors and changes to events – Samples
- GRACE System Governance - Performance Report Samples
- GRACE Assessor Training as at 22 March 2017
- GRACE Training as at 22 March 2017
- Management, Governance and Assurance Framework Project 2017 (business case, ELT presentation)
- Extract from LIVE MASTER - Obligations Review - 2017 (SC and PN)
- Internal Audit Schedule
- KPMG, 2017, Review of Power and Water Corporation's Compliance with the 2014-19 Network Price Determination

4.4 Third-party access

Schedule Electricity Networks (Third Party Access) Code, Part 2 Access framework, Chapter 1 Obligations of network provider, Section 9 Publication of network technical code and criteria, requires the following:

(1) The network provider must comply with good electricity industry practice when providing network access services and in planning, operating, maintaining, developing and extending the electricity network.

4.4.1 2014 Audit finding

Part Compliant.

Access documentation does not capture assessment of all technical compliance obligations. Further coordination with System Control is required.

4.4.2 2017 Audit procedure

Evidence of third-party access arrangements was requested, staff members were interviewed and documentation compared against good electricity industry practice.

4.4.3 2017 Audit finding

Part Compliant

4.4.4 Reason for audit finding

The 2014 audit found under the System Control Technical Code 1.7.4(f), it is the responsibility of the Power System Controller to ensure that all technical parameters of System Participant's equipment comply with the Network Technical Code, but in practice, this responsibility is managed by Power Networks. It also found that further work was required to ensure that access arrangement documentation addresses all aspects of the Network Technical Code requirements.

The following comments acknowledge that there have been few system participant enquires since 2014.

During the interview, Networks discussed their approach to network connection applications, noting that the majority were for residential PV connections. Their approach separates the connection applicants into 4 classes based on generator or inverter size. The technical detail required increases as the generator capacity increases. Classes 1 and 2 cover small generators such as residential PV and focus on safety requirements. Class 3 covers generators greater than 30 kW and required bespoke but simple modelling and

engineering assessment. Class 4 applies to generators greater than 1 MW and also requires full dynamic modelling.

The information provided is assessed by Networks to ensure compliance with Technical Code requirements and System Control undertakes compliance testing of the machines to ensure they match the model characteristic. The same approach is taken for large loads.

Power Networks provided the connection application for the LMS Shoal Bay Renewable Energy Facility, a 1.1 MW landfill gas generator. The documents provided show correspondence that forms part of the connection application process and provision of the technical specifications of the generator, including all details that would be required to ensure compliance with the technical code and to undertake dynamic system models.

Power Networks also provided documentation regarding a connection application to connect a large solar PV facility to the Darwin-Katherine system near Katherine. Correspondence sighted between PWC Power Networks, PWC System Control, the applicant and a technical consultant indicates that an appropriate Connection Enquiry/Response to Connection Enquiry/Application to Connect process is being followed, which broadly conforms to the requirements of clause 5.3 of the National Electricity Rules. In particular, the comments and clarifications detailed in the email correspondence entitled "25 MW Katherine Solar PV - Response to Questions and Previous System Control Comments", dated 18 May 2016[5] shows that the assessment was being performed to a high level of detail, as would be expected for a connection of this scale.

On the basis of the evidence received and the discussions held, the Auditor believes that PWC Power Networks is compliant with the requirement.

Documents reviewed

- Generator User Agreement: Formal Instrument of Agreement (template)
- Embedded Generator User Agreement: Formal Instrument of Agreement (template)
- Embedded Generator User Agreement: General Conditions (PWC Doc Ref D2017/35726 version 2.1 dated 23 January 2017)
- Network Access Application – Class 4 Photovoltaic System (example)
- Rooftop PV Application – Workflow Check Sheets
- Customer Connection Agreement (Connection Services Only) (template)
- Customer Connection Agreement (Infrastructure Works) (template)
- Email PWC System Control to PWC Power Networks dated 4 December 2015, "RE: Katherine PV - Initial Response"
- Email PWC Power Networks to Entura dated 18 May 2016, "25 MW Katherine Solar PV - Response to Questions and Previous System Control Comments"
- TRIM document, file name "RE Initial Response Letter From Power Networks To Epuron Katherine 25 MW.vmbx", date unknown, file size 16.6 MB, comprising:
  - Email PWC System Control to PWC Power Networks dated 21 March 2016, "RE: Initial Response Letter From Power Networks To Epuron Katherine 25 MW" and
  - Microsoft Excel attachment "Katherine_Expected_Daily_Profile_sent to PWC 17Mar16.xlsx"

[5] Filename: Email_25 MW Katherine Solar PV - Response to Questions and Previous System Control Comments.html

4.5 Maintenance forecasting

Clause 6.10.2 of the System Control Technical Code requires Network Operators to forecast future maintenance requirements as follows:

6.10.2	On or before 15 May each year, each Network Operator shall submit to System Control:
6.10.2 (a)	a maintenance programme for its transmission and High Voltage networks for the following financial year; and
6.10.2 (b)	an indicative maintenance programme for each of the three subsequent financial years.

4.5.1 2014 Audit finding

Part Compliant.

Maintenance forecasts submitted to the Power System Controller do not include HV distribution. However, System Control does not require the HV distribution assets maintenance schedule as the additional data reduces the clarity of the schedule. It may be appropriate to revise the requirements of the Code to align with the actual needs of System Control.

4.5.2 2017 Audit procedure

Evidence of maintenance planning documents was requested and staff interviews.

4.5.3 2017 Audit finding

Compliant

4.5.4 Reason for audit finding

Networks provided the maintenance plans that were sent to System Control, which included the HV assets, and an evidence of the submission. System Control confirmed the information had been received and provided evidence of communication to manage the works program, such as correspondence to reschedule maintenance to suit other network participants.

The systems and processes used to develop the maintenance plans were established and easy to follow in the ProMapp software tool.

Documents reviewed:

- 201617 Preventative Maintenance Handover for System Control
- 201516 Preventative Maintenance Handover for System Control
- 201516 Outage ID definition and proposed outage dates
- Email evidence of changing plans