

BHP BILLITON IRON ORE NEWMAN TOWNSHIP ELECTRICITY SUPPLY

ANNUAL AUDIT REPORT ON COMPLIANCE MONITORING SYSTEMS 2013/2014

REVISION A

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1. Executive Summary

1.1. Audit Overview

In accordance with Division 3 – Performance reporting Section 26 Annual report on monitoring systems Item (1) of the Western Australia Electricity Industry (Network Quality and Reliability of Supply) Code 2005, APD were engaged by BHP Billiton Iron Ore Supply Authority (BHPBIOSA) to carry out independent audit on the compliance monitoring process and systems that are currently used to ensure compliance with the Code.

There is no significant improvement to the existing compliance monitoring processes and systems compared to the previous financial year.





















BHPBIOSA have adequate guidelines, procedures and resources in place to ensure compliance with the reliability standards specified in the Code. Appropriate documented procedures and record systems are available to manage and keep track of interruptions on the township network. The power quality monitoring process has room for improvement to ensure compliance with the Code requirements.

1.2. Audit Comparative Performance






While clear inspection plan and procedure manuals have been created for the staff involved in administering and carrying out technical inspections of consumer's electrical installations in the township of Newman in 2013/2014, other monitoring processes and systems that BHPBIOSA have in place to ensure compliance with the Electricity Code 2005 have shown little or no improvement.

Therefore, the 2013/2014 overall audit ratings remain the same as the previous year's ratings, as shown in Section 1.3 Audit Scorecard.

1.3.Audit Scorecard

Item	Audit Description	Audit Overall Rating	
		2012/2013	2013/2014
6.2	<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Section 6 - Voltage Fluctuations</i>		
6.3	<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Section 7 - Harmonic Distortion</i>		
6.4	<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Voltage Level</i>		
6.5	<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Frequency</i>		
6.6	<i>The Electricity Industry Code 2005 Part 2 Division 1 – Quality Standards – Section 8 - Duty to Disconnect</i>		
6.7	<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 9 – General standard of reliability</i>		
6.8	<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 10 – Duty to reduce effect of interruption</i>		
6.9	<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 11 – Planned Interruptions</i>		
6.10	<i>The Electricity Industry Code 2005 Part 2 Division 2 – Standards for the interruption of supply to individual customers – Section 12 – Significant Interruptions to Small Customers</i>		
6.11	<i>The Electricity Industry Code 2005 Part 2 Division 3 – Standards for the duration of interruption of supply in particular areas – Section 13 – Standard for Other Areas (Newman Township electricity system 290mins)</i>		

RATING DESCRIPTION:

Overall Compliance Rating	Description	
	High	Best practice quality systems and processes
	Medium – High	Above average quality systems and processes
	Medium	Adequate quality systems and processes
	Low – Medium	Quality systems and processes require further development
	Low	Quality systems and processes require major further development

2. Introduction

BHP Billiton Iron Ore (BHPBIO) is one of the world's major suppliers of iron ore and is based in the Pilbara region of Western Australia.

The township of Newman is located approximately 1200km to the north of Perth, within the Shire of East Pilbara. It is the main town for the Mt Whaleback iron ore mine, Mining Area C and several smaller satellite mines.

The electricity network is owned, governed and operated by BHP Billiton Iron Ore Supply Authority (BHPBIOSA). The network encompasses the township of Newman, Newman Airport, Capricorn Roadhouse, town water supply bore field, Mt Whaleback iron ore mine, and several smaller mine leases in the adjacent areas.

At present, the township of Newman has approximately 2886 premises comprised of a mixture of residential and commercial customers.

Under Division 3 – Performance reporting Section 26 Annual report on monitoring systems Item (1) of the Western Australia Electricity Industry (Network Quality and Reliability of Supply) Code 2005, an electricity distributor must arrange for an independent expert to audit, and report on, the operation of the systems that the distributor has in place for monitoring its compliance to Part 2 – Quality and Reality Standards of the Electricity Code 2005.

APD were engaged by BHPBIOSA to undertake the required audit and report on the current compliance monitoring processes and systems that BHPBIOSA have in place to ensure compliance with the Code.

3. Scope of Audit

The scope of audit was limited to the review of the policies, guidelines, processes, systems and procedures that BHPBIOSA currently have in place to ensure that the network is complying with the following performance requirements specified in the Code:

- Part 2, Division 1 – Quality Standards, Section 6(2) – Voltage Fluctuations
- Part 2, Division 1 – Quality Standards, Section 7 – Harmonics
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (a) Voltage Levels Compliance
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (b) Frequency Levels Compliance
- Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 9 – General standard of reliability
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 10 – Duty to reduce effect of interruption
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 11 – Planned interruptions
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 12 – Significant interruptions to small use customers
- Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 13 - Standards prescribed for particular areas

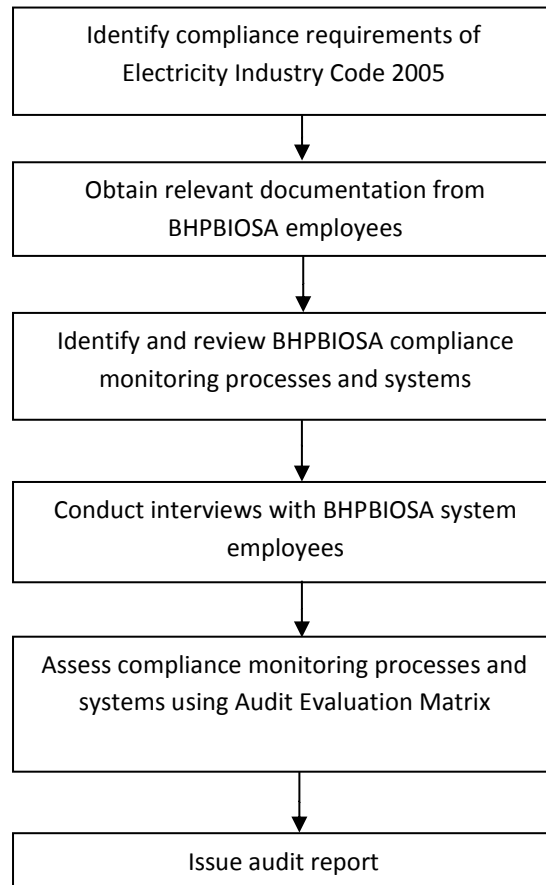
The audit scope covered the electricity network supplying the gazetted township of Newman, Newman Airport and the town water supply bore field. The electricity network supplying the mining infrastructures at Mt Whaleback Iron mine and all other mine leases in the surrounding of the township of Newman were not evaluated in the audit.

Refer to Appendix A for the geographical map of the township of Newman.

4. Audit Methodology

4.1. Audit Flowchart

The methodology applied to perform the audit is as per the following flowchart:



4.2. Audit Evaluation Matrix






The audit assessment was carried out as per the following procedures:

1. Review if BHPBIOSA have adequate systems, documented processes and guidelines, plans, and procedures in place to ensure compliance with each of the performance provisions defined in the Code. Assess the current monitoring processes and systems using the ten criteria shown in Table 1 below. Assign a performance ranking of Low, Medium, or High to each criterion.
2. Based on the ten performance rankings assigned, determine the overall compliance rating. The overall compliance rating indicates the effectiveness of the monitoring processes and systems in achieving compliance with each of the provisions.
3. Compare all overall compliance ratings with the preceding year's results. Improvements are measured in percentage. A 33% improvement means the overall rating has improved either from Low to Medium, or from Medium to High. An improvement from Low to High is equivalent to 66% of improvement.

Table 1 | Audit of compliance management systems and processes evaluation matrix

Item		Description	Ranking			Description of Ranking		
			Low	Medium	High	Low	Medium	High
1	Process	Documented Process				Process in place documentation requires further development	Process is documented	Strong documentation and may comply with ISO9001
2		Process fully integrated with corporate management systems				Requires development	Linkage with management reporting	Full integration with corporate IT system
3		Demonstration of operator understanding of the documented process				Training required	Employee understanding	Strong employee understanding and evidence of training systems
4		Evidence that the process is followed and records are kept as per process				Records available but not easily accessible or auditable	Adequate records available over full compliance periods	Auditable records available over full compliance periods with mandatory defined fields
5	Continuous Improvement	KPIs are in place				KPIs in place	KPIs are in place with some understanding by operators	Evidence that KPIs are in place and comprehensively understood by all operators
6		Reporting system supports continuous improvement				Requires development	Reporting systems exist at some levels	Reporting systems in place clearly showing gaps and trends of performance
7		Evidence action taken				Requires development	Evidence of reactive response	Evidence that gaps and trends are proactively actioned
8	Measurement Tools	Suitability of PQ measurement devices				PQ device has partial PQ functions and not fully compliant to AS61000.4.30	PQ device has full PQ functions but not fully compliant to AS61000.4.30	PQ device has full PQ functions and fully compliant to AS61000.4.30
9		Data collection methodology of the PQ measurement devices				Data manually extracted and analysed	Data extracted automatically over communications link. Data collection only.	Data extracted automatically over communications link with data analysis at the device.
10		Method of PQ measurement devices deployment				Portable devices not permanently fixed to the network.	Devices permanently installed on the network at strategic locations	Permanently fixed to the network and integrated into the network management control on a real time basis.
11		Overall Ranking				Refer to Table 2 for descriptions		

Table 2 | Overall compliance rating table

Overall Compliance Rating	Description	
	High	Best practice quality processes and systems
	Medium – High	Above average quality processes and systems
	Medium	Adequate quality processes and systems
	Low – Medium	Quality systems and processes require further development.
	Low	Quality systems and processes require major further development

5. Audit Results


The audit assessed the performance and suitability of the compliance monitoring systems and processes that BHPBIOSA have in place to ensure compliance with each of the provisions under the Western Australia Electricity Industry (Network Quality and Reliability of Supply) Code 2005 Part 2 Quality and reliability standards Divisions 1, 2 and 3.

5.1.Part 2, Division 1 – Quality Standards, Section 6(2) – Voltage Fluctuations

According to this provision, the voltage fluctuation of electricity supplied must not exceed the compatibility levels of Pst=1.0 and Plt=0.8 set out in Part 3.7 clause 3 of AS/NZS 61000:2001.

Appropriate process and system are required to identify and record any breaches of the voltage fluctuation compatibility levels, and to keep track of the remedies undertaken to eliminate the breaches.

Table 3 | Part 2 Division 1 Section 6(2) Voltage Fluctuations Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the process		1		0%	No change
4		Evidence that the process is followed and records are kept as per process	1			0%	No change
5	Continuous Improvement	KPIs are in place		1		0%	No change
6		Reporting system supports continuous improvement	1			0%	No change
7		Evidence action taken - continuous improvement		1		0%	No change
8	Measurement Tools	Suitability of PQ measurement devices			1	0%	No change
9		Data collection methodology of the PQ measurement devices	1			0%	No change
10		Method of PQ measurement devices deployment	1			0%	No change
11		Overall Ranking					

Audit Observations:


1. The BHPBIOSA employees that are involved in managing power quality understand the need to ensure compliance with the Code requirements and rectify network disturbances that will affect the quality of supply to customers.
2. To measure the system characteristics that will affect power quality (PQ), temporary HIOKI power quality logging devices were installed at 12 padmount transformers located at the beginning and the end of each of the township feeders (i.e. TA, TB, TC1, TC2, TC3 and TC4). The recording devices measured the voltage fluctuations, voltage levels, frequency of supply, and harmonic distortions at the low voltage (LV) side of the padmount transformers, in accordance to AS6100.4.30. The PQ logging process was carried out from 16/01/2014 to 24/01/2014 during the peak summer period, in consistent with the measuring periods of the previous years. The power quality measurements method and duration were in accordance to AS/NZS61000.4.30:2007 Annex A (informative) Power quality measurements – Issues and guidelines.
3. The engineering team possesses good understanding of the various network interferences that will affect the power supply quality.
4. The engineering team provides reactive response by carrying out investigations when breaches of the power quality standards are identified during the logging period, or when a customer complaint is received.
5. In the last two financial years, BHPBIOSA has successfully replaced several of the old transformers with new padmount transformers. To measure the power quality parameters of the township network, BHPBIOSA are proposing to implement permanent power quality meters at the new padmount transformers in 2014/2015.

5.2.Part 2, Division 1 – Quality Standards, Section 7 – Harmonics

The total harmonic distortion (THD) level of electricity supplied must not exceed the THD compatibility level of 8% set out in the Code.

Appropriate process and system are required to identify and record any breaches of the THD compatibility level, and to keep track of the remedies undertaken to eliminate the breaches.

Table 4 | Part 2 Division 1 Section 7 Harmonics Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the process		1		0%	No change
4		Evidence that the process is followed and records are kept as per process	1			0%	No change
5	Continuous Improvement	KPIs are in place		1		0%	No change
6		Reporting system supports continuous improvement	1			0%	No change
7		Evidence action taken - continuous improvement		1		0%	No change
8	Measurement Tools	Suitability of PQ measurement devices			1	0%	No change
9		Data collection methodology of the PQ measurement devices	1			0%	No change
10		Method of PQ measurement devices deployment	1			0%	No change
11		Overall Ranking					

Audit Observations:


1. The BHPBIOSA employees that are involved in managing power quality understand the need to ensure compliance with the Code requirements and rectify network disturbances that will affect the quality of supply to customers.
2. To measure the system characteristics that will affect power quality (PQ), temporary HIOKI power quality logging devices were installed at 12 padmount transformers located at the beginning and the end of each of the township feeders (i.e. TA, TB, TC1, TC2, TC3 and TC4). The recording devices measured the voltage fluctuations, voltage levels, frequency of supply, and harmonic distortions at the low voltage (LV) side of the padmount transformers, in accordance to AS6100.4.30. The PQ logging process was carried out from 16/01/2014 to 24/01/2014 during the peak summer period, in consistent with the measuring periods of the previous years. The power quality measurements method and duration were in accordance to AS/NZS61000.4.30:2007 Annex A (informative) Power quality measurements – Issues and guidelines.
3. The engineering team possesses good understanding of the various network interferences that will affect the power supply quality.
4. The engineering team provides reactive response by carrying out investigations when breaches of the power quality standards are identified during the logging period, or when a customer complaint is received.
5. In the last two financial years, BHPBIOSA had successfully replaced several of the old transformers with new padmount transformers. To measure the power quality parameters of the township network, BHPBIOSA are proposing to implement permanent power quality meters at the new padmount transformers in 2014/2015.

5.3.Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (a) Voltage Levels Compliance

Under Section 2 of AS60038-2000 Standard Voltages, the voltage level of electricity supplied must be maintained at +10% and -6% of the nominal voltage of 230V single phase, or 400V three-phase.

Appropriate process and system are required to identify and record any breaches of the voltage levels limits, and to keep track of the remedies undertaken to eliminate the breaches.

Table 5 | Part 2 Division 1 Section 8 Note (a) Voltage Levels Compliance Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems		1		0%	No change
3		Demonstrated operator understanding of the process		1		0%	No change
4		Evidence that the process is followed and records are kept as per process	1			0%	No change
5	Continuous Improvement	KPIs are in place		1		0%	No change
6		Reporting system supports continuous improvement	1			0%	No change
7		Evidence action taken - continuous improvement		1		0%	No change
8	Measurement Tools	Suitability of PQ measurement devices			1	0%	No change
9		Data collection methodology of the PQ measurement devices	1			0%	No change
10		Method of PQ measurement devices deployment	1			0%	No change
11		Overall Ranking					

Audit Observations:


1. The BHPBIOSA employees that are involved in managing power quality understand the need to ensure compliance with the Code requirements and rectify network disturbances that will affect the quality of supply to customers.
2. To measure the system characteristics that will affect power quality (PQ), temporary HIOKI power quality logging devices were installed at 12 padmount transformers located at the beginning and the end of each of the township feeders (i.e. TA, TB, TC1, TC2, TC3 and TC4). The recording devices measured the voltage fluctuations, voltage levels, frequency of supply, and harmonic distortions at the low voltage (LV) side of the padmount transformers, in accordance to AS6100.4.30. The PQ logging process was carried out from 16/01/2014 to 24/01/2014 during the peak summer period, in consistent with the measuring periods of the previous years. The power quality measurements method and duration were in accordance to AS/NZS61000.4.30:2007 Annex A (informative) Power quality measurements – Issues and guidelines.
3. The engineering team possesses good understanding of the various network interferences that will affect the power supply quality.
4. The engineering team provides reactive response by carrying out investigations when breaches of the power quality standards are identified during the logging period, or when a customer complaint is received.
5. In the last two financial years, BHPBIOSA had successfully replaced several of the old transformers with new padmount transformers. To measure the power quality parameters of the township network, BHPBIOSA are proposing to implement permanent power quality meters at the new padmount transformers in 2014/2015.

5.4.Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result, Note (b) Frequency Levels Compliance

Under Section 25(1)(d) of the Electricity Act 1945, the frequency of electricity supplied must be maintained at +/-2.5% of the nominal frequency of 50 cycles per second.

Appropriate process and system are required to identify and record any breaches of the frequency limits, and to keep track of the remedies undertaken to eliminate the breaches.

Table 6 | Part 2 Division 1 Section 8 Note (b) Frequency Levels Compliance

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the process		1		0%	No change
4		Evidence that the process is followed and records are kept as per process	1			0%	No change
5	Continuous Improvement	KPIs are in place		1		0%	No change
6		Reporting system supports continuous improvement	1			0%	No change
7		Evidence action taken - continuous improvement		1		0%	No change
8	Measurement Tools	Suitability of PQ measurement devices			1	0%	No change
9		Data collection methodology of the PQ measurement devices	1			0%	No change
10		Method of PQ measurement devices deployment	1			0%	No change
11		Overall Ranking					

Audit Observations:

1. The BHPBIOSA employees that are involved in managing power quality understand the need to ensure compliance with the Code requirements and rectify network disturbances that will affect the quality of supply to customers.
2. To measure the system characteristics that will affect power quality (PQ), temporary HIOKI power quality logging devices were installed at 12 padmount transformers located at the beginning and the end of each of the township feeders (i.e. TA, TB, TC1, TC2, TC3 and TC4). The recording devices measured the voltage fluctuations, voltage levels, frequency of supply, and harmonic distortions at the low voltage (LV) side of the padmount transformers, in accordance to AS6100.4.30. The PQ logging process was carried out from 16/01/2014 to 24/01/2014 during the peak summer period, in consistent with the measuring periods of the previous years. The power quality measurements method and duration were in accordance to AS/NZS61000.4.30:2007 Annex A (informative) power quality measurements – issues and guidelines.
3. According to BHPBIOSA, the frequency of supply is controlled and monitored at the Alinta Newman Power station that supplies the Whaleback, Town and South Town substations. The frequency data is recorded and documented in monthly reports.
4. The engineering team possesses good understanding of the various network interferences that will affect the power supply quality.
5. The engineering team provides reactive response by carrying out investigations when breaches of the power quality standards are identified during the logging period, or when a customer complaint is received.
6. In the last two financial years, BHPBIOSA had successfully replaced several of the old transformers with new padmount transformers. To measure the power quality parameters of the township network, BHPBIOSA are proposing to implement permanent power quality meters at the new padmount transformers in 2014/2015.


5.5.Part 2, Division 1 – Quality Standards, Section 8 – Duty to disconnect if damage may result

Under Section 5 Obligation to observe standards of the Code, a distributor must, so far as is reasonably practicable, ensure that electricity supplied to a customer’s electrical installations, as measured at the point of connection of those installations to the network, at all times complies with the standards prescribed by Sections 6(2) and 7.

According to Section 8, if a distributor is, or will be, unable to comply with Section 5 in relation to a standard prescribed by Section 6(2) or 7; and the failure may result in damage to customer’s electrical installations or property, the distributor must, so far as is reasonably practicable, disconnect the supply of electricity to those installations or property, unless it is in the interests of the customer to maintain the supply.

Appropriate processes and systems must be in place to monitor the voltage fluctuations and harmonic voltage distortions of the network. Any breaches of the compatibility levels set out in the Code must be identified and recorded to enable the impact of the breaches on the customer’s equipment to be assessed. If damage occurs due to a breach of the quality standards, BHPBIOA must implement a disconnection process to prevent damage to the customer’s equipment or property.

Table 7 | Part 2 Division 1 Section 8 Duty to Disconnect if Damage may Result Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the documented process		1		0%	No change
4		Evidence that the process is followed and records are kept as per	1			0%	No change
5	Continuous Improvement	KPIs are in place		1		0%	No change
6		Reporting system supports continuous improvement	1			0%	No change
7		Evidence action taken - continuous improvement	1			0%	No change
8		Overall Ranking					


Audit Observations:

1. The BHPBIOSA employees interviewed are aware of the requirement to carry out supply disconnection when network disturbances are significant enough to cause damage to customer's property or electrical installations.
2. There is no continuous monitoring process in place to ensure compliance with the power quality standards, other than relying on customer complaints and the occurrence of equipment failure to initiate investigation.
3. The annual PQ measuring process that occurs during the peak summer period helps identify any breaches of PQ standards and enables the engineering team to carry out investigations to rectify the non-compliant issues.
4. BHPBIOSA did not carry out any disconnection of supply due to complaints related to network disturbance in 2013/2014.

5.6.Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 9 – General standard of reliability

According to this provision, a transmitter or distributor must, so far as is reasonably practicable, ensure that the supply of electricity to a customer is maintained and the occurrence and duration of interruptions is kept to a minimum.

Table 8 | Part 2 Division 2 Section 9 General Standard of Reliability Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the documented process			1	0%	No change
4		Evidence that the process is followed and records are kept as per			1	0%	No change
5	Continuous Improvement	KPIs are in place			1	0%	No change
6		Reporting system supports continuous improvement			1	0%	No change
7		Evidence action taken - continuous improvement			1	0%	No change
8		Overall Ranking					

Audit Observations:

1. The BHPBIOSA employees interviewed demonstrated a clear understanding of their roles and responsibilities in maintaining supply reliability and minimising the duration and frequency of interruptions to the customers.
2. BHPBIOSA have shown great initiatives in improving the reliability of supply to the customers, such as constructing the new South Town Substation to cater for future load growth, and replacing old consumer poles that are not compliant with the legislative requirements. The consumer mains of the old dwellings in the township are below the standard minimum height. To improve safety and eliminate the occurrence of supply interruption due to old or non-compliant equipment, BHPBIOSA are replacing all the non-compliant consumer poles to achieve the required height. A new fuse will also be installed at every new consumer pole.
3. To oversee and monitor the 11kV township network using real-time data, a new role, Network Controller, has also been implemented in this financial year.


4. The processes and systems of managing both planned and unplanned outages are well understood by those involved.
5. The formal document “Supply Authority Procedure” provides safety guidance to employees that deal with live equipment.
6. The Level 1 and Level 2 filled out by the linesmen and supervisors respectively are stored in the 1DOC system accessible to all BHPBIOSA authorised personnel. The fault records keep track of all the planned and unplanned interruption. However, some important information such as work order, fault location, outage duration, cause of fault, and protection device involved were sometimes overlooked and not filled out accurately by the linesmen.
7. Fault recording system and KPI documents are in place to monitor the reliability performance of the township network and ensure compliance with the Code.
8. The Security Gate Officer at the Mt. Whaleback security gate is no longer responsible for answering calls related to electrical faults and emergencies outside business hours. The ESS contractors who have taken over this role demonstrated a clear understanding of the after hours fault handling and contractor call out procedures. There are documented guidelines and procedures in place for the contractors. All after hours faults are documented in the system and handed over to the Housing officer in the morning on a daily basis.
9. Handover between supervisors is still carried out verbally. However, the supervisors have ascertained that they have a very good working relationship with each other and hence no miscommunications on any matters have occurred.
10. An electrical inspection system plan has been created this year to ensure that all new consumers’ electrical installations are compliant with all relevant Act, Regulations and Codes. An Inspection System Procedure Manual has also been created, which specifies the requirements and responsibilities of the employees involved in technical inspections of the new network installations.
11. To minimise the effect of interruption to customers, portable standby generators are available for use in the event of prolonged interruption (i.e. longer than 4 hours). BHPBIOSA reported 2MVA of standby generation capacity available to cater for extended outages, electrical emergencies and overload incidents within the township. None of the standby generators had been used in 2013/2014.
12. The monthly Level 1 fault sheets filled out by the linesmen were not transferred to the Electrical Faults Log on a monthly basis in 2013/2014 due to miscommunication between the former and current office administrator. As a result, the August 2013 and January 2014 fault sheets are missing and not stored in the system.

5.7.Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 10 – Duty to reduce effect of interruption

According to this provision, BHPBIOSA must so far as is reasonably practicable, reduce the effect of any interruption on a customer.

If the length of interruption is expected to exceed 6 hours, and the effect of the interruption on the customer’s business is likely to be substantial or the customer’s premises has a person that requires electricity for the operation of equipment that caters for special health needs, alternative electricity such as backup generators should be provided to the customer.

Table 9 | Part 2 Division 2 Section 1 Duty to Reduce Effect of Interruption Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the documented process			1	0%	No change
4		Evidence that the process is followed and records are kept as per			1	0%	No change
5	Continuous Improvement	KPIs are in place			1	0%	No change
6		Reporting system supports continuous improvement			1	0%	No change
7		Evidence action taken - continuous improvement			1	0%	No change
8		Overall Ranking					

Audit Observations:


1. To minimise the effect of interruption to customers, portable standby generators are available for use in the event of prolonged interruption (i.e. longer than 4 hours). BHPBIOSA have 2MVA of standby generation capacity available to cater for extended outages, electrical emergencies and overload incidents within the township. None of the standby generators had been used in 2013/2014.
2. The engineering team, electrical supervisors and linesmen are based in the township and are able to react more quickly to faults and equipment breakdowns in the town area.
3. For critical after hours faults that occur before 9pm, the electrical contractor Lend Lease will be called out to resolve the fault. All electrical faults that are considered critical that happen after 9pm will be addressed immediately by the NPI linesmen. This arrangement ensures that power interruptions outside the normal business hours are dealt with in an efficient way and the effect of interruption to customers is minimised.
4. To minimise disruption to businesses, planned interruptions for routine maintenance or new installations that will affect the industrial and commercial customers are carried out on the weekends.

5.8.Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 11 – Planned interruptions

According to this provision, it is not a breach of section 9 of the Code for BHPBIOSA to interrupt the supply of electricity to a customer for the purpose of maintaining or alter the network if the length of the interruption does not exceed 6 hours and BHPBIOSA have given notice of the proposed interruption to the customer not less than 72 hours before the start of the interruption. If it is not reasonably practicable to provide more than 72 hours of notice, notice should be given at the earliest practicable time before the start of interruption.

An appropriate system is required to record all the scheduled outages that BHPBIOSA plan to undertaken in each year. An efficient process should be in place for providing notifications to each of the customers that will be affected by planned interruptions in compliance with the provision.

Table 10 | Part 2 Division 2 Section 11 Planned Interruptions Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems		1		0%	No change
3		Demonstrated operator understanding of the documented process			1	0%	No change
4		Evidence that the process is followed and records are kept as per		1		0%	No change
5	Continuous Improvement	KPIs are in place			1	0%	No change
6		Reporting system supports continuous improvement			1	0%	No change
7		Evidence action taken - continuous improvement			1	0%	No change
8		Overall Ranking					

Audit Observations:

1. The BHPBIOSA employees interviewed demonstrated a clear understanding of the need to limit planned outages to 6 hours or less and to provide notifications to customers at least 3 days prior to the start of work, in accordance to Electricity Code 2005.
2. BHPBIOSA have a dedicated team of planners who allocate appropriate time and resources to carry out routine maintenance works, overhead line connections for new subdivisions and repair works in the township. All scheduled outages are stored in the electronic system.
3. To minimise disruption to businesses, planned interruptions for routine maintenance or new installations that will affect the industrial and commercial customers are carried out on the weekends.
4. BHPBIOSA have portable standby generators in place to cater for extended planned interruptions.


5.9.Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 12 – Significant interruptions to small use customers

The prescribed standard of this provision requires the supply of electricity for 9 years in every 10 without the interruption of supply exceeding more than 12 hours continuously or more than 16 times.

If the distributor considers that the prescribed standard is unlikely to be met in respect of the customer, the distributor must either remedy the cause or causes of interruption so that the prescribed standard is met, or enter into an alternative arrangement to the small use customer's satisfaction for the supply of electricity to the customer.

The audit endeavours to assess the systems that are currently in place to keep track of the customers that have more than 16 interruptions in a year or have been interrupted for more than 12 hours continuously. The audit also endeavours to assess the actions that have been undertaken to eliminate the breaches of this provision.

Table 11 | Part 2 Division 2 Section 12 Significant Interruptions to Small use Customers Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems		1		0%	No change
3		Demonstrated operator understanding of the documented process			1	0%	No change
4		Evidence that the process is followed and records are kept as per		1		0%	No change
5	Continuous Improvement	KPIs are in place			1	0%	No change
6		Reporting system supports continuous improvement			1	0%	No change
7		Evidence action taken - continuous improvement			1	0%	No change
8		Overall Ranking					


Audit Observations:

1. The Level 1 and Level 2 faults and scheduled outages records keep track of the frequency and duration of the interruptions experienced by the small use customers.
2. Based on the electrical fault data provided by BHPBIOA, no small use customers had experienced more than 16 interruptions in 2013/2014. There were two occasions where a small number of residential customers had experienced power interruption more than 12 hours continuously. However, BHPBIOA did not receive any formal complaints from the affected customers.

5.10. Part 2, Division 2 – Standards for the interruption of supply to individual customers, Section 13 - Standards prescribed for particular areas

According to this provision, a transmitter or distributor must, so far as is reasonably practicable, ensure that the average total length of interruptions of supply to customer premises does not exceed 290 minutes.

Table 12 | Part 2 Division 2 Section 13 Standards Prescribed for Particular Areas Evaluation Matrix

Item	Category	Description	Ranking			% of Improvement Compared to the Preceding Year Results	Comments
			Low	Medium	High		
1	Process	Process in place and documented	1			0%	No change
2		Process fully integrated with corporate management systems	1			0%	No change
3		Demonstrated operator understanding of the documented process			1	0%	No change
4		Evidence that the process is followed and records are kept as per	1			0%	No change
5	Continuous Improvement	KPIs are in place			1	0%	No change
6		Reporting system supports continuous improvement			1	0%	No change
7		Evidence action taken - continuous improvement			1	0%	No change
8		Overall Ranking					

Audit Observations:

1. The Level 1 and Level 2 fault records enable the supervisors and linesmen to identify areas that have frequent interruptions. The identified areas are marked with coloured pins on the township map in their office. The supervisors aim to put extra effort in the problematic areas, such as carrying out upgrade or repair works to improve supply reliability.
2. All 11kV and above outages are recorded and stored in the 1DOC system. This record shows the location, cause and duration of all 11kV feeder outages that affect a significant number of customers in the township. It also keeps track of the investigation or repair works that have been carried out by the engineering team and identifies if further reinforcement work is required.
3. To minimise the occurrence of electrical faults due to old or defective equipment, BHPBIOA plan and carry out routine and preventative maintenance on the township network.
4. To minimise interruption due to non-compliant new installations to the network, BHPBIOA have developed the Inspection System Plan and Inspection System Procedures Manual in this financial year.
5. Standby generators are in place for prolonged interruptions longer than 4 hours. However, there are no records of businesses with critical processes and customers with special health needs that require continuous power supply.
6. A new role has been introduced to monitor the township network infrastructures using real-time data. The SCADA system enables the Network Controller to identify and respond quickly to breakdowns or faults on the 11kV network (e.g. under/over voltage, circuit breaker tripping). The introduction of this new role is expected to reduce the duration of interruption and hence improve supply reliability to the customers.

6. CONCLUSION

The following are the conclusions

1. The Newman township network is considered a robust network with inherently good reliability performance.
2. The processes for managing interruptions seem to be effective however the electrical faults are still not properly documented and stored in the IT system. Some important information such as fault location, duration, and cause were sometimes missed and the lack of complete information of all the faults occurred in every financial year had reduced the accuracy of the power reliability indices calculated. Two months of fault records are missing and hence the record keeping practices need to be improved.
3. BHPBIOSA are relying on the temporary HIOKI power quality loggers that are installed at the padmount transformers on each supply feeders to measure the power quality performance of the network. No permanent recording device has been implemented to monitor power quality on a continual basis. However, BHPBIOSA have plans to implement performance PQ measuring device at the new padmount transformers in the township in the next financial year.
4. There is no clear documentation of the processes and systems used to monitor and analyse power quality, and no indication of any plans that will be implemented to improve the power quality and ensure compliance with the Code.
5. BHPBIOSA have shown great initiatives in improving the reliability of supply to the customers, such as constructing the new South Town Substation to cater for future load growth, and replacing old consumer poles that are not compliant with the legislative requirements. A new role has also been implemented to oversee and monitor the 11kV township network using real-time data.
6. BHPBIOSA have created the Electrical Inspection Plan and Inspection System Procedures Manual which are deemed important in ensuring compliance with the relevant legislative requirements and improve work efficiency of those involved in technical inspection of new installations.

7. RECOMMENDATION

The following recommendations include both short and long term solutions that will improve the compliance monitoring processes and fault documentation systems.

7.1. Electrical faults monitoring system

It is recommended that:

1. The linesmen are given clear guideline on how to fill out the fault details in the Level 1 fault sheets correctly. A complete faults record is crucial for more accurate assessment of the network reliability using the power reliability indices, and ensures compliance with the reporting requirements of the Code. To ensure that all details are not missed or forgotten at a later time, the fault record should be updated immediately once the fault is rectified.
2. Fault management plan, procedures manual and fault handling flow chart be developed and to identify the roles and responsibilities of those involved in managing power interruptions in the township.
3. The handover process between supervisors is documented to effectively manage interruptions that occur at the end of a shift period.
4. Smaller size standby portable generators are on standby for small use customers which experience interruption longer than 4 hours. This approach will reduce the occurrence and duration of prolonged interruptions and thus improve supply reliability.

7.2. Power quality monitoring system

It is recommended that:

1. Permanent power quality devices that are compliant to AS61000.4.30 be implemented to collect power quality data on an ongoing basis.
2. A record system be developed to keep track of non-compliant power quality issues on a regular basis so that the engineering team can carry out investigations and implement adequate solutions in a timely manner, rather than relying on customer complaint to initiate inquiry.

7.3. Total number of customers and network equipment

It is recommended that:

1. BHPBIOSA implement a process and/or a record system to keep track of the number of customers being supplied by each of the township feeders.
2. The electronic CAD or DGN copy of the township electrical reticulation plan be updated whenever a new customer or network equipment is connected to the network, or when the open points on the network are altered. Each premise on the site plan should be annotated with the name of the supply transformer with each 11kV feeder identified with a unique colour.

7.4. Formal documentation and key performance indicators (KPI)

It is recommended that:

1. BHPBIOSA establish formal KPI documents to proactively monitor and assess the quality of supply on an ongoing basis using permanent power quality measurement instruments.
2. Training is provided to new BHPBIOSA employees so that they understand the Electrical Code 2005 requirements and their roles and responsibilities in ensuring the network's compliance with the Code.

