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2 November 2010

Mr Lyndon Rowe
Chairman
Economic Regulation Authority
Level 6, 197 St Georges Terrace
Perth WA 6000

Dear Lyndon

SUBMISSION OF PROPOSED CAPITAL PROJECT FOR NFIT PRE-APPROVAL

In accordance with s6.71(b) of the Electricity Networks Access Code 2004, I am pleased to submit Western Power's request for the Authority to determine that the attached proposed distribution capital work program meet the requirements of the *new facilities investment test*.

The proposed investment relates to the replacement of overhead customer service connections in the period 2009/10 to 2011/12. The estimated cost of this work program is $71.1M, of which Western Power submits that $71.1M satisfies the *new facilities investment test*.

The formal submission comprises this covering letter and the business case document. A paper copy and an electronic version are enclosed, suitable for publication by the Authority.

Electronic copies of two supporting documents are also provided for the Authority's use in its assessment, but these are <u>not</u> for publication.

This and other similar submissions will provide Western Power with confidence about the quality of its project justification in advance of the Authority's future assessment of the efficiency of actual capital expenditure during the current regulatory period.

I look forward to receiving the Authority's determination on this work program.

Yours sincerely,

PHIL SOUTHWELL
GENERAL MANAGER REGULATION & SUSTAINABILITY

DM# 7653545

UA1041

Business Case for the Replacement of Overhead Customer Service Connections 2009/10 to 2011/12

June 2010

Glossary of Terms

This submission uses the defined terms and acronyms detailed below:

Acronym / Term	Meaning
AA1	Access Arrangement 1 (July 2006 to June 2009)
AA2	Access Arrangement 2 (July 2009 to June 2012)
Act	Electricity Corporations Act 2005 (WA)
DDP	Distribution Delivery Partner
DFIS	Distributed Facilities Information System – Western Power's Geographic Information System
DFMS	Distributed Facilities Management System – Western Power's Distribution Asset Management Database
DM	Western Power's Document Management System
OCS Connection	Overhead Customer Service Connection
POA	Point of Attachment
PVC	Polyvinyl Chloride
SDD	Service Delivery Division – Western Power
SWIS	South West Interconnected System
Twisties	Preformed Steel Helical Terminations

1 Executive Summary

This business case proposes the replacement of potentially unsafe Overhead Customer Service (OCS) connections in the SWIS network over the period 2009/10 to 2011/12. Western Power owns the connections and it is Western Power's responsibility to maintain them in a safe condition. Even with customer funded connections, Western Power retains ownership of the power line and associated assets up to the point of attachment.

Investigation of two incidents in 2003 established that they were due to service wire insulation and/or insulator failure.

Both investigations following these incidents included recommendations for an inspection regime and proactive replacement of identified defective OCS connections with either underground connection or with the current standard cross-linked polyethylene cable service and wedge type termination clamps.

Replacement will significantly reduce the safety risk to the public from electric shocks from OCS connections. These can occur due to the following failure modes:

- Preformed steel wire helical terminations (Twisties) used to terminate PVC wires tend to abrade over time and perforate the deteriorated PVC insulation. As a result, they can come in contact with the live wires. This may result in the Point of Attachment (POA) and any other metallic objects in the vicinity (such as gutters and metal roofs) becoming live, hence posing an electric shock hazard to the occupiers of the properties.
- Goose neck terminations, which were commonly used with Twisty OCS connections, are also prone to fail with age due to abrasion resulting in similar hazards to those discussed above.
- Wrapped conductors used on OCS connections are prone to fail or open circuit with age. This can result in either supply cuts, if it occurs on a live wire, or a neutral break if the neutral conductor is affected. The latter can create a significant shock hazard throughout the premises, with all connected appliances with metallic covers potentially becoming live.

This corporate risk is categorised as "High" in the legal and safety categories. Public safety is at high risk as electric shocks can cause injury or death. Incidents are reportable to EnergySafety and may lead to regulatory inquiries and subsequent fines, hence the high rating in the legal category.

Approximately 25% of the total OCS connections exceed their expected physical life of 30 years and require replacement before they become a hazard or jeopardise the integrity of supply to customers. The Industry Safety Steering Committee in NSW has advised that replacement of OCS connections and associated equipment before they become dangerously deteriorated is consistent with the industry's duty of care[1].

Priority will be given to the proactive replacement of OCS connections that use Twisties. They will be replaced with a new cross-linked polyethylene cable in accordance with current Western Power standards.

The following options were considered for OCS replacement:

- Replace all the remaining number of the identified unsafe/defective OCS connections within the AA2 period.

[1] Expected average service life of PVC service cables, Electrical Safety Bulletin No 49, September 1996

- Replace the identified unsafe/defective OCS connection at the rate achievable over the AA2 timeframe. (Recommended Option).
- Replace a lesser number of the identified unsafe/defective OCS connections.
- Underground the services, replacing each OCS connection with an underground cable.
- No proactive replacement. This option is to cease any proactive replacement and only carry out reactive work.
- Deploy a new device that detects potentially fatal electrical conditions at customers' premises.

Expected outcomes of these options in terms of cost, number of OCS connections replaced, deliverability and impact on the current risk are shown in Table 1.

Table 1: Summary of Option Results

Option	Cost ($ million)	Units Replaced	Deliverable?	Risk	
				Impact	Ranking (1=Lowest)
1. Replace all unsafe units on a like-for-like basis	$163	240,000	No	Maximum risk reduction	1
2. Replace like-for-like at rate achievable	$71.1	104,600	Yes	Moderate reduction in risk	2
3. Replace like-for-like at reduced level	$47.6	67,100	Yes	Limited risk reduction	3
4. Replace by undergrounding	> $750	104,600	No	Maximum risk reduction	1
5. No Proactive Replacement	Nil	Nil	Yes	No change	4
6. Deploy warning device	n/a	Nil	Under trial	Unknown	5

The above table show that the options:

- for replacement of a limited number of OCS connections over the AA2 period; or
- only replacing them on failure

have the lowest cost but these options will not significantly reduce the risk of electric shock. On the other hand, the options for:

- undergrounding the OCS connections; or
- replacing all unsafe units

will reduce the risk by the greatest amount but at significantly higher costs. These two options are also beyond the capacity of Western Power and contractor resources and could not be delivered by June 2012.

Deploying a warning device does not eliminate the risk of electrical faults but does have the potential to substantially reduce the consequences. As this is still undergoing trials it is not considered as an option for implementation in this timeframe.

The recommendation is to replace 104,600 OCSs at a cost of $71.1m, as provided for in the AA2 submission. This option represents the maximum improvement that can be delivered using available resources. Assuming that the number of OCS-related shock incidents will reduce in line with the number of potentially unsafe connections, the recommended level of replacement should lower the total number of such incidents associated with Western Power assets by 37%. Based on the incidence of shocks in 2008/09, this should result in around 96 fewer shock incidents.

There is some project risk as the replacement of a large number of OCS connections will require significant resources. This risk will be mitigated by adopting a delivery approach that prioritises the bundles of OCS connection replacements to include as many compromised connections as possible.

Western Power’s internal assessment is that the proposed program of replacement satisfies the New Facilities Investment Test (NFIT) on the basis of the option selection, efficient project delivery and the need for the program to provide a safe network.

2 Background

An Overhead Customer Service (OCS) connection incorporates an aerial service cable from the overhead low-voltage 'street mains' to a connection box at the customer's Point of Attachment (POA) for connection to the electricity meter. The POA may be mounted on either: the barge board; a Goose Neck Bracket (see Appendix C, Figure 7); the fascia at the customer's premises; or a wooden or metal pole on the customer's property. In the last case, the pole is used to achieve ground and road clearances. The service cable is then fixed to these structures using 'reel' type insulator fittings and terminations (see Appendix C, Figure 3).

The majority of connections use preformed steel wire helical terminations, consisting of a piece of wire wound round the service wire and then looped over the bracket or an insulator attached to the bracket. These are referred to as 'Twisties' (see Appendix C, Figures 4 and 5). In some cases, Twisties use wrapped conductors, with the insulation from the neutral or phase conductor of the OCS stripped off and the bare wire wrapped around the neutral or phase of the street mains supply (see Appendix C, Figure 6).

2.1 Primary Project Driver

The primary driver of this project is to reduce the risk to public safety[2] from electric shock incidents that can occur with OCS connections.

The replacement of these potentially unsafe connections lies within Western Power's responsibility due to Western Power's ownership of the assets potentially triggering the unsafe incidents. This also applies for customer funded connections as, in these circumstances, Western Power still retains ownership of the power line and associated assets up to the point of attachment.

Investigation of two incidents in 2003[3], one of which was a dual fatality, established that the incidents were due to service wire insulation and/or insulator failure. The fatalities resulted from the metal roof becoming live and electrocuting two children. Subsequent investigations established that the insulation failure was due to the Twisties abrading and puncturing the aged and deteriorated PVC cables.

Both investigations following these incidents included recommendations for an inspection regime and proactive replacement of identified defective OCS connections with either underground connection or with the current standard cross-linked polyethylene cable service and wedge type termination clamps.

Following the 2003 incidents, all SWIS OCS connections were inspected. As well as the above mode of failure it was discovered that, in some instances, the steel termination had also slipped over the reel insulators and made contact with the steel support bracket, increasing the risk of electric shock from the bracket and from any metal items near or in contact with the bracket such as gutters, fascias and roofs.

Electric shock hazards also exist when wrapped conductors are used with Twisties. These can fail or open circuit with age resulting in either supply cuts, if the failure occurs on a live conductor, or a neutral break if the neutral conductor is affected. The latter can create a significant shock hazard throughout the affected premises with all connected appliances with metallic covers potentially becoming live.

[2] Electricity Act 1945, Sections 25(1) &(2)
[3] Incident Investigation Reports: DM#1401453 and 1752248

2.2 Extent of Problem

Western Power currently has 410,000 OCS connections in the SWIS Network. The inspection following the 2003 incidents established that approximately 300,000 had the potential to cause electric shock. Western Power has replaced approximately 60,000 OCS connections during the AA1 period (July 2006 - June 2009), leaving 240,000 potentially unsafe connections at end of June 2009. A total of 31,100 are expected to be replaced by the end of June 2010, leaving 210,000 yet to be replaced.

2.3 Impact of Faulty OCS Connections

The number of electric shock incidents in the SWIS network is increasing, as shown in Figure 1.

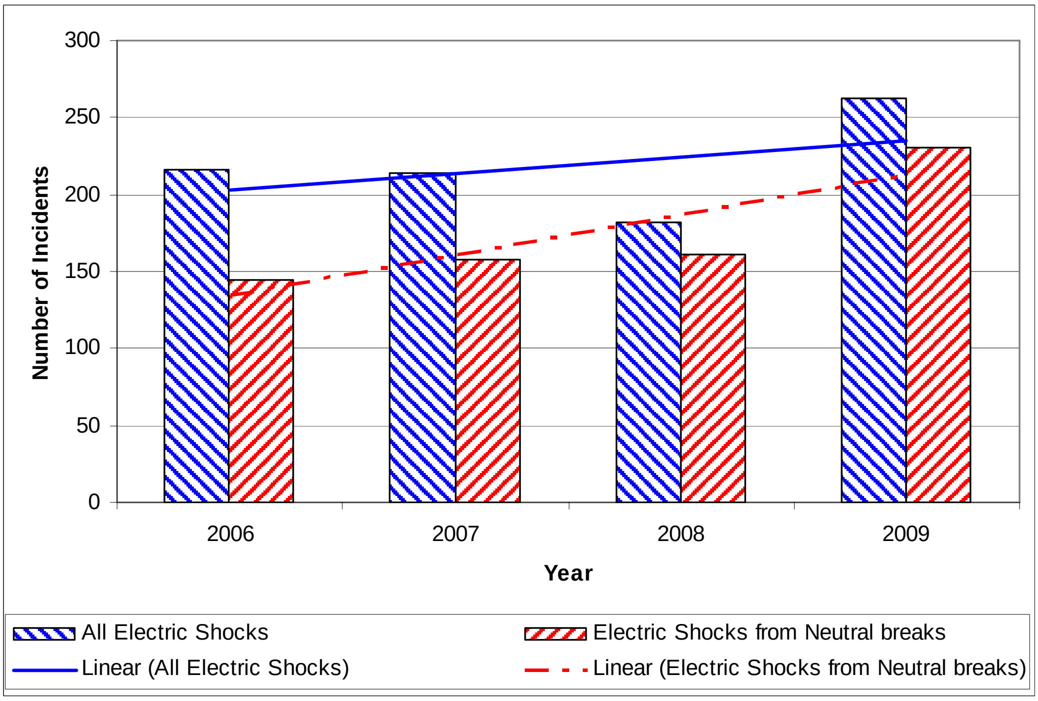

Figure 1: Electric Shock Incidents Recorded in the SWIS

The number of electric shock incidents in 2009 was 21% more than in 2006. The main contributor to the increase was neutral breaks at the OCS connection, causing 88% of all electric shocks in 2009. A recent OCS Connection Fault Analysis[4] concluded that Twisties were involved in the majority of these incidents, estimating that historically around 86% of shock incidents occurred due to issues associated with unsafe customer service connections.

The neutral breaks related to OCS connections can occur when:

- Twisties abrade over time and perforate the PVC insulation, making contact with the live wires. This may result in the POA and any other metallic objects in the vicinity (such as metal roofs and gutters) becoming live as the neutral connection can short to the metal structure and hence become grounded through it.

[4] OCS Connection Fault Analysis DM#6484819

- Goose-neck terminations abrade at the point of entry leading to insulation failure with similar consequences to abrasion in Twisties.
- Inferior connection arrangements and accelerated ageing of the neutral or active phases at the joint on wrapped conductors cause highly resistant or open neutral/active connection. If the neutral conductor is affected, all connected appliances with metallic covers can potentially become live.

Each of these situations can result in electric shocks through metal roofs, metal structures attached to the roof or, in the case of failures in wrapped conductors, connected appliances becoming live, creating significant risks for occupants of the affected properties. Replacing the Twisty OCS connections will eliminate these risks.

The trend illustrated in Figure 1 shows that the risk of serious or fatal injury is increasing with a growing proportion of the total caused by neutral breaks. Fault analysis indicates that potentially unsafe OCS connections are a significant factor in this regard. This risk is categorised as "High" in terms of Western Power's Risk Management Framework.

Approximately 25% of the total OCS connections exceed their expected life of 30 years[5]. Using age as an indicator of condition the expectation is that these require replacement before they become a hazard or jeopardise the integrity of supply to customers. In addition to the need to clear the backlog of OCSs which have exceeded their expected life, it is important that the replacement rate is increased to ensure that in the future OCS connections are replaced before they reach their expected life.

The old type of OCS connection using PVC insulation has been shown to be prone to failure resulting in an interruption to supply or exposure to electric shock hazard. It is appropriate to replace these connections proactively as part of a risk reduction strategy rather than simply replacing them reactively. The Industry Safety Steering Committee in NSW has advised that "… the electricity industry must … exercise an appropriate duty of care … [by] … Service cable, connectors, clamps, termination boxes, etc must be replaced before they become dangerously deteriorated, and to this end, the industry should consider: determining regular replacement periods for all components of insulated overhead service mains and replacing components with those periods; …"[6].

The following actions are recommended to reduce the number of electric shock incidents:

- The rate of replacement of OCS connections should be increased to negate the increase in the rate of failure of the ageing OCS connections.
- The method of selecting the OCS connections for replacement should be reviewed to give more weight to the presence of wrapped connections and gooseneck terminations.

2.4 Hazard detection trials

Wire Alert (previously called Cable PI) is an instrument that has been designed to allow customers to monitor the electrical characteristics of their installations and

[5] Expected average service life of PVC service cables, Electrical Safety Bulletin No 49, September 1996 and 'Average lifetime, PVC cable' in End-of-life Environmental Issues with PVC in Australia, Environment Australia, June 2003
[6] Electrical Safety Bulletin No 49, September 1996

detect potentially fatal conditions before they materialise in electric shock incidents. These conditions include defective neutrals and high and low voltages. The instrument was developed by Aurora Energy in Tasmania for this purpose and is currently being evaluated by Western Power.

In addition to Western Power, several other utilities in Australia are conducting field trials to evaluate the usefulness of the devices including:

- Country Energy (NSW)
- Energy Australia (NSW)
- Aurora Energy (TAS)
- Ergon Energy (QLD)
- Energex (QLD)
- Horizon Power (WA)

Western Power is evaluating the Wire Alert devices to determine:

- their robustness;
- the range of electric shock hazards that they can identify;
- the best deployment approach; and
- the overall cost of the recommended program.

This is being done through a targeted approach[7] which involves using fault crews to test the equipment when attending shock incidents at customer premises with OCS connections.

The Western Power trial is scheduled to conclude in June 2010. If the trial is successful, Wire Alert could be utilised as a defective neutral detection device for fault crews, or by customers in high risk overhead areas and houses that are not fitted with a safety device such as a Residual Current Device.

Notwithstanding the potential benefits of Wire Alert, it is only a detection system used for identification of potentially fatal conditions at a premise and will not eliminate the risk or the root cause of the condition. Once a fault has been detected, remedial action must be taken to resolve the issue which will generally include replacement of an unsafe Twisty OCS connection.

EnergySafety is aware of the trial being undertaken by Western Power.

2.5 Risk Mitigation Strategy

The initial risk mitigation strategy targeted the replacement of only the compromised OCS connections. This was found to be neither cost effective nor labour resource effective due to the relatively high proportion of unproductive time spent travelling and setting up the work. Consequently, a study[8] on the effectiveness of the replacement and inspection strategy was conducted. This resulted in revisions to achieve cost effectiveness and improved labour utilisation.

[7] DM# 6264675: Work instruction for fault crews for evaluating the Cable PI neutral break detection device.
[8] DM# 3753673 Report on the review of the OCS Connection replacement project.

Under the new arrangement, the OCS connections to be replaced are bundled to include a group of compromised connections in any given area, and the bundles of work are then prioritised according to the volumes and severity of compromised connections. Any OCS connections found to be severely compromised are treated as ‘faults’ and replaced urgently. This approach has proved to be very cost effective and labour productivity has improved significantly in situations where it has already been used. The approach is referred to as the ‘combined contiguous/standalone’ strategy.

3 Purpose

3.1 Project Purpose

The purpose of this project is to identify and replace unsafe OCS connections. As at 30 June 2009 there remained in the SWIS network 240,000 OCS connections identified as having the potential to cause electric shock[9].

The OCS connections regarded as unsafe and to be replaced under this program are primarily PVC insulated cables terminated at a connection box at the POA.

4 Scope

The scope of the proposed work is to:

- Inspect all overhead service connections not inspected as part of the 2003 inspection or where available inspection data is not considered sufficient to assess condition and safety.
- Replace unsafe OCS connections in the SWIS network, including supporting equipment, during 2009/10, 2010/11 and 2011/12.
- Update DFMS records to record condition and replacement.

4.1.1 Inspection of OCS Connections.

Detailed inspections of OCS connections will be conducted during 2010/11 to accurately assess their condition and the presence of items such as Twisties, wrapped conductors and gooseneck terminations that are considered unsafe. This information will be used to determine priorities for the replacement of OCS connections that are identified as potentially prone to the faults. Where inspection data is already available and deemed sufficient to assess the condition and safety of the OCS connection, no additional inspection will be conducted for these connections.

Also, only the OCS connections that have not recently been replaced will be inspected as connections replaced during the past four years comply with current standards and are assumed to be in good condition. The inspection program is estimated to cost $5 million during 2010/11. Inspections will not be required during 2011/12.

[9] The AA2 submission assumed replacement of 112,857 OCS connections however the cost of inspection was not included in the forecast. The revised program involves inspection of all OCS connections and replacement of 104,600 OCS connections.

4.1.2 Replacement OCS Connections

OCS connections will be replaced with cross-linked polyethylene cable and wedge type clamps in accordance with current Western Power standards.

In addition, all other OCS connection components will also be replaced to comply with current Western Power standards as the old components will generally either be single use items, unsuitable for the new cable type, or will have a remaining life less than the new service. These items include service protection devices, carry-over poles, consumer poles, street mains connectors, wrapped conductor connections, gooseneck terminations, mains connection boxes and consumer mains.

The replacement will adopt the contiguous/stand alone replacement strategy described above.

4.1.3 Other work

The connection replacement work will also include the following tasks to ensure no other potential safety risks, associated with the OCS connections, remain within the SWIS network:

- Customer Earth Mains: Test and resolve any earthing issues associated with customer earth mains. This applies to the customer mains earth from the customer meter to the earth rod. This ensures the electrical installation is safe and meets standards.
- Vegetation Clearance: Clear vegetation to meet minimum acceptable standards for each OCS connection replaced so that vegetation does not damage the OCS.
- Height over Ground / Road: Ensure that the OCS connections meet current height and span requirements to provide safe clearance for vehicles and pedestrians.
- Updating of Data: Update the Corporate Enterprise System (Ellipse) and the Distributed Facilities Management System (DFMS) with installation dates so that relevant asset data is available to manage the assets.

4.1.4 Delivery Date

As shown in Table 2, the required in-service date for this project is June 2012.

Table 2: Key milestone dates

Project Start date	1 July 2009
Project Required-In-service date	30 June 2012

4.2 Benefits

The recommended option is consistent with Western Power's overriding value of safety and specifically is aligned with its commitment to ensure public safety. In particular, it is expected to reduce the incidence of electric shocks to the public. As noted above, 86% of these are currently associated with customer service connections and under the recommended option, 104,600 will be replaced, representing 43% of the total number of compromised connections. (The capacity of available resources is able to ramp up to, at most, approximately 41,100 replacements per annum.) Assuming that the number of OCS-related shock incidents will reduce in line with the number of potentially unsafe connections, the recommended level of replacement should lower the total number of incidents by 37%. Based on the incidence of shocks in 2008/09, this would result in around 96 fewer incidents.

This will enable Western Power to fulfil its obligation as a network operator to comply with the Electricity Act 1945, particularly Sections 25 (1) (a), (c) and 25 (2). Any breach of the regulation may result in a regulatory inquiry leading to adverse corporate reputation and potential compensation for damage or loss to property or injury.

As a secondary benefit, the replacements will also reduce operation and maintenance costs to some extent as the number of services requiring maintenance due to faults will reduce. Due to insufficient data on the cost and extent of maintenance specifically associated with unsafe OCS connections, these savings have not been estimated.

5 Other Considerations

5.1 Key Constraints:

This project is a continuation of previous work to progressively replace all Twisty OCS connections in the SWIS. Recognised constraints are:

- The availability of materials or equipment. This issue is now well managed by project and procurement processes. A formal assessment of the deliverability of the program has been completed.
- The availability of experienced labour resources. This issue is discussed in Section 9.
- The combination of the above constraints has resulted in an estimated maximum rate of replacement of 41,100 units per annum by 2012. On this basis, the estimated replacement capacity is 104,600 units by 30 June 2012.

5.2 Key Issues/Assumptions:

- Cost estimates for the inspection of OCS connections are based on field trials.
- The cost estimate for replacement is based on average actual costs incurred to date on this project. The inspection cost is estimated separately.

6 Options Analysed

The following options have been considered:

- **Option 1:** Replace all unsafe / defective OCS connections.
- **Option 2**: Replace the identified unsafe / defective OCS connection at the rate achievable over the AA2 timeframe (Recommended Option)
- **Option 3**: Replace a reduced number of the identified unsafe / defective OCS connection. This is similar to Option 2 with the exception of a 3-year deferral of the completion date to 2019 and a 33% reduction in the funding requirement compared to Option 2.

- **Option 4**: Underground the services, replacing each OCS connection with an underground cable.
- **Option 5**: No proactive OCS connections replacement. This option is to cease any proactive replacement and only carry out reactive replacement.
- **Option 6:** Deploy new warning device.

6.1 Option 1: Replace all unsafe / defective OCS Connections

This option involves replacing all 240,000 at-risk OCS connections between 2009/10 and 2011/12 at an estimated cost of $163M. The method of replacement would be similar to that described for Option 2.

This will give the greatest reduction in the safety risk (86%) and would be preferred if sufficient resources were available to replace 80,000 units per annum. The expected replacement capacity over the remaining AA2 period is, at most 41,100 per annum.

With the current conditions in the labour and material markets, Service Delivery Division has confirmed that it is not possible to gear up to the required levels due to the lead time required to train staff, acquire plant and manufacture materials.

As a result, it would not be possible to replace all unsafe or defective OCS conditions in the time frame and, for this reason, the option cannot be implemented and hence is not recommended.

6.2 Option 2: Replace OCS Connections at the rate achievable over the AA2 timeframe

This option involves:

- Inspecting all overhead service connections to assess condition and safety at an estimated cost of $5 million;
- Replacing 104,600 unsafe OCS connections, including supporting equipment, in the SWIS network between 2009/10 and 2011/12 at an estimated cost of $66.1 million prioritised in accordance with the inspection results (refer to

Table 3 for a breakdown over the AA2 period); and

- Updating DFMS to record condition and replacement.

This option is as for Option 1: 'replace all unsafe units in a like-for-like basis' but constrained by the maximum rate of replacement that can be achieved within the AA2 timeframe.

Unit rates used to estimate the costs were developed as follows:

- OCS replacement - derived from actual costs incurred in the past year. Appendix D details the estimates and the unit rates.
- Inspection - based on actual field trials and budgetary price obtained informally from prospective service providers.

Table 3: Quantity and Cost of OCS Connections Replaced

		2009/10	2010/11	2011/12	Total
Replacement of OCS connections	**Quantity**	31,100	32,400	41,100	104,600
	$ million	19.6	20.5	26.0	66.1
Inspection of OCS connections	**$ million**	-	5.0	-	5.0
Total	**$ million**	19.6	25.5	26.0	71.1

The work will include carrying out tests, measurements and inspections to locate all unsafe/defective OCS connections and adopt a contiguous/standalone approach to the replacements. The inspections will also collect information on OCS connections that do not comply with current Western Power Standards for subsequent action.

The replacement work under this option will be coordinated with plans for undergrounding through the State Underground Power Project (SUPP) to ensure that OCS connections are not replaced in areas planned for upgrading in the near future.

By replacing the OCS connections to meet current technical standards, the number of electric shock incidents is expected to reduce by 37%, or around 96 incidents per annum based on the 2008/09 level. Replacement will also improve operational performance and supply reliability. Overall, this option represents the lowest cost achievable means of significantly reducing the potential risk of electric shock and providing a safer, more reliable network and, accordingly, it is recommended.

6.3 Option 3: Replace a limited number of OCS Connections

This option is for the replacement of a lesser number of OCS connections over the AA2 period. The quantity evaluated for this option is 67,000 services (28% of total potentially unsafe OCS connections) over the period 2009/10 to 2011/12 at an estimated cost of $47.6 million (including inspection cost). The method of replacement would be similar to that described for Option 2.

The cost of this option is 33% less than Option 2 over the AA2 period with 37,600 fewer unsafe or defective OCS connections replaced. The lower level of replacement will result in a projected reduction in the number of electric shock incidents by 24% (compared to 37% under Option 2). Based on 2008/09 results, this see around 62 fewer incidents per annum, or 34 more than under Option 2.

This level of replacement is less than the capacity of currently available resources and consequently may lead to Western Power breaching the Electricity Act 1945 Section 25 (1)[10] in that it has sufficient resources to achieve higher levels of public safety. For this reason this option is not recommended.

6.4 Option 4: Undergrounding the OCS Connections

Undergrounding the OCS connections at the same rate as for Option 2 has similar benefits to Option 2 (the recommended option) in terms of complying with the technical standards, reducing the risk of further shock incidents occurring and the number of faults. In addition, this option will also improve network performance and is

[10] See footnote 10.

more aesthetically and environmentally acceptable to both the community and to customers.

A number of services are being undergrounded under SUPP; however this rate of replacement is too slow to effectively mitigate the electric shock hazard from OCS connections. Accordingly, the extent of undergrounding would need to be increased substantially to achieve the required level of replacements.

As the cost of additional undergrounding is significantly more expensive than Option 2 (eleven times as much)[11] it is not recommended. Although the ability to increase the rate of undergrounding has not been assessed it is unlikely that a replacement rate similar to that of Option 2 could be achieved.

6.5 Option 5: No proactive OCS Connection replacement

This option involves only replacing services when they fail, that is, when a customer reports a supply outage or when a person has received a shock.

The option will not address the safety risk and, if it is pursued, it is highly probable that the number of electric shock incidents will increase. This view is supported by the fact that even with the past proactive activity (60,000 of the 300,000 potentially unsafe connections replaced by the end of June 2009) the number of electric shock incidents has increased and is now 21% higher than the number of incidents in 2006. As noted above 86% of the electric shock incidents are attributed to unsafe OCS connections.

Accordingly, this option is inconsistent with Western Power's corporate objectives: specifically, it does not address the safety issues or reliability concerns; it will potentially expose Western Power to liability; and it may result in Western Power breaching the Electricity Act 1945 Section 25 (1)[12].

This option is therefore not recommended.

6.6 Option 6: Deploy new warning device

As discussed above, Western Power is currently trialling Wire Alert devices. These only provide a warning system however, and are not an alternative to replacing unsafe OCS connections.

The trial will conclude in June 2010 and will include a recommendation as to the use of the device, including its integration with the OCS connection program, cognisant of regulatory, budget and logistical issues.

This option cannot be considered for implementation in the AA2 timeframe. This option may have a role in hazard reduction but does not address the root cause of the hazard and is, at best, a supplement to the other identified options and not an alternative.

6.7 Conclusion of options analysis

Option 2 is recommended as it meets Western Power's objectives to provide a safe and reliable supply to customers in the context of the identified delivery constraints.

[11] DM#6937723: Trial Estimate for Undergrounding an Overhead Customer Service connection.
[12] s25: Duties as to supply of electricity (1):" A network operator shall (a) at all times maintain all service apparatus belonging to the network operator which is on the premises of any consumer, in a safe and fit condition for supplying electricity;"

The results of the assessment of the options in terms of total cost, level of replacement, deliverability and impacts on the current level of risk are summarised in Table 4. This shows that Option 2 represents the greatest improvement that can be delivered using available resources.

Table 4: Summary of Option Results

Option	Cost ($ million)	Units Replaced	Deliverable?	Risk	
				Impact	Ranking (1=Lowest)
1. Replace all unsafe units on a like-for-like basis	$163	240,000	No	Maximum risk reduction	1
2. Replace like-for-like at rate achievable	$71.1	104,600	Yes	Moderate reduction in risk	2
3. Replace like-for-like at reduced level	$47.6	67,100	Yes	Limited risk reduction	3
4. Replace by undergrounding	> $750	104,600	No	Maximum risk reduction	1
5. No Proactive Replacement	Nil	Nil	Yes	No change	4
6. Deploy warning device	n/a	Nil	Under trial	Unknown	5

7 Recommended Option

The recommended option is Option 2: Replace OCS Connections at the rate achievable over the AA2 timeframe. This requires the inspection and replacement of 104,600 OCS connections at an estimated total cost of $71.1 million over the period July 2009 to June 2012.

7.1 Business Impacts

The project work for the recommended option will:

- Improve Western Power's safety performance by improving safety and supply reliability, reducing the likelihood of potential serious / fatal injury and the loss or damage to property.
- Improve customer satisfaction by increasing the reliability of OCS connections.
- Reduce maintenance costs due to reduction in fault repairs.
- Enhance Western Power's reputation through a demonstrated commitment to the establishment of a safe, reliable and efficient electricity network.

There are no negative impacts on the business as a result of the proposed work.

Conversely, if the project funding is restricted or progress of work impacted by other issues, it will result in:

- An increase in the risk of electric shock to people in properties with compromised OCS connections as the installed base of connections ages.
- Damage / loss to customer property (due to equipment failure caused by high voltage).
- Reduction in reliability with possible damage to Western Power's reputation.
- Potential regulatory issues arising from non-compliance with Electricity Act 1945, Section 25 (1) (a), (c) and 25 (2).
- Possible action by Energy Safety[13].

7.2 Risk Analysis

A detailed corporate and project risk analysis using Western Power's risk framework is shown in Appendix B.

The existing corporate risk is rated as 'High' in the legal and safety categories. Public safety is at high risk as electric shock can cause injury or death. Incidents may lead to regulatory breaches and subsequent fines, hence the same rating in the legal category.

At the nominated volumes, resourcing is a moderate project risk, potentially preventing the project from meeting the targeted volumes. However, the proposed level of replacement is within the currently projected capabilities of available resources. To further mitigate this risk, a suitable long term contracting strategy will be implemented with productivity improvements achieved through work packaging. This will involve:

- The replacement work being carried out in accordance with Western Power's work practices and safety requirements to manage exposure to electrical hazards.
- Continuous monitoring and review of data capture processes to ensure that they are operating effectively and efficiently.
- Ensuring only competent personnel and contractors are used to minimise the risk associated with the replacement work.
- Job Risk Assessments being carried out at each phase of the project.
- Western Power's Technical Standards being met. The consequence of not following the design standards may affect system integrity and reliability.
- Ensuring that effective project planning is undertaken so project completion on budget and time is achieved.

7.3 Financial Cost / Benefit Assessment

The total nominal cost of the recommended option is estimated to be $71.1 million as shown in Table 5. This expenditure is classified as capital expenditure under the Distribution Regulatory Compliance Regulatory Category.

Western Power's current budget allocation for the Distribution Regulatory Compliance Regulatory Category is $198.8 million of which $47.6 million is currently allocated to the replacement of overhead customer service connections.

[13] Compliance with Electricity Act 1945, Section 25 (1) & (2)

Western Power's approved Access Arrangement for the period 2009/10 to 2011/12 provides for expenditure of $303.2 million for the Distribution Regulatory Compliance Regulatory Category, of which $71.1 million is allocated to OCS replacement.

A financial evaluation model has been prepared for the recommended option, including the net present cost – refer Appendix A.

A detailed cost estimate has been prepared based on several key assumptions described in section 3.2 – refer to Appendix D.

Table 5: Expenditure profile ($ million)

Replacement of Overhead Customer Service Connections ($ million, Nominal)	**2009/10**	**2010/11**	**2011/12**	**Total**
Business case value (recommended option)	$19.6	$25.5	$26.0	$71.1
Current budget allocation	$19.6	$15.0	$13.0	$47.6
Regulatory Compliance Regulatory Category ($ million, Nominal)	**2009/10**	**2010/11**	**2011/12**	**Total**
ERA approved expenditure	$80.6	$105.0	$117.6	$303.2
Current budget allocation	$80.6	$60.1	$58.1	$198.8

As the business case value currently exceeds the current budget allocation, the risk that there will be insufficient funds for this program should be addressed. This will involve:

1. Identifying activities in the Works Program where forecast expenditure requirements are less than originally budgeted and reallocate the available budget where possible within the constraints of the Access Arrangement; or
2. Seeking additional funding beyond that currently allocated to the works program through a submission to Government.

If the above are not successful, expenditure constraints on this and other projects/programs will need to be considered.

7.4 Procurement Strategy

Western Power's "balanced portfolio" delivery strategy allows the business to utilise three resource pools to deliver its approved works program:

- The internal workforce;
- Strategic alliances; and
- Distribution Delivery Partner (DDP) arrangements.

This strategy will drive delivery efficiency, both internally and externally by:

- Maintaining competitive pressure on pricing across our alternative delivery agents;
- Balancing work volumes between mechanisms to ensure reliable delivery and efficient utilisation of resources;

- Creating larger packages of work that result in more competitive pricing, thereby delivering savings and productivity gains (e.g. reducing de-mobilisation costs); and
- Creating the ability to scale up through access to external resources via partners with national and international connections.

To achieve efficiencies across the distribution network, Western Power has established the DDP utilising performance based contracts. The performance based contracts are a robust platform that improve contract performance by implementing controls to measure and manage DDP performance. These include:

- Rigorous planning requirements;
- Key performance indicators;
- Auditing (Distribution Partner self-auditing, and Western Power auditing);
- Reporting;
- Remedy plans; and
- Suspension / removal of work.

The incentive for DDPs is that if they meet and/or exceed KPIs they will be better placed to receive further packages of work.

OCS inspection and replacement activity will be carried out both by DDPs and Western Power internal resources based on cost competitiveness and demonstrated ability to meet safety and delivery requirements.

All materials and equipment required to undertake this program are sourced in accordance with Western Power's corporate and procurement policies. This ensures compliance with the following requirements:

- Western Power's agreements are established via a competitive process to meet business requirements and deliver value for money.
- The selection, evaluation and award process is supported by the engagement of relevant subject matter experts, meeting Western Power's standards including safety, environmental, technical, commercial, and qualitative.
- All distribution inventory and equipment procurement is facilitated by panel agreements, short form contracts or strategic alliance agreements.

7.5 Communications Strategy

The OCS connection replacement program is routinely conducted on an annual basis and has well established communication practices in place.

These involve management of:

- environmental issues;
- stakeholder liaison including land access;
- communications for network outages as required;
- communication with Plant & Standards for design standards;
- communication with Service Delivery for work practice standards and procedures; and

- communication addressing safety that includes all personnel involved in this project, including contractors.

7.6 Access Code Considerations

The key code consideration is the NFIT. Section 6.52(a) of the Electricity Networks Access Code 2004 (the Code), requires Western Power to demonstrate that the amount invested in the proposed program does not exceed the amount that would be invested by a service provider efficiently minimising costs.

Western Power has considered a range of options and is proposing the option that best balances its commitment to replace OCS connections with the financial and labour resources available to deliver the program. The program of OCS connection replacement will be efficiently delivered through a combination of competitive tendering, work packaging and outsourced delivery.

Western Power considers that the combination of option selection and efficient project delivery demonstrates the requirement of Section 6.52(a) of the code.

Section 6.52(b) of the code requires Western Power to satisfy one or more of three conditions:

- Incremental revenue
- Net benefits
- Safety and reliability.

This program is necessary to maintain network safety and therefore should satisfy the requirement of Section 6.52(b)(iii).

Appendix A - Financial Evaluation Model

Copy from Financial Evaluation Model DM# 6875940

Project Title Distribution	Replacement of overhead service connections in SWIS network during AA2	
Project Title Transmission	Project Title	
Option (Distn - no. and/or description)	Option 2	
Option (Tran - no. and/or description)	1	
Option Status	Recommended Option	
Expenditure Start Fin Year	2010	
In Service Fin Year	2012	
Base Year Dollars	2010	
	Distn	*Tran*
Project Number	94508, 294517,294110	xxxx
Business Case Number	194604	xxxx

Financial Analysis	Distn	Tran	TOTAL	
NPV $M - Nominal Post Tax @ 7.45%	(52.691)	-	(52.691)	
Project Post Tax IRR %	N/A	N/A		
NPV $M - Nominal Pre Tax @ 10.65%	(57.733)	-	(57.733)	
Project Pre Tax IRR %	N/A	N/A		
Pre 30/06/2009 Capital Expenditure $M	-	-	-	
Post 30/06/2009 Capital Expenditure $M	71.100	-	71.100	
Risk Allowance ($M)	-	-	-	
Total Capital Cost ($M)	**71.100**	-	**71.100**	*** See pro-forma line 55*
Capitalised Interest ($M)	2.760	-	2.760	
Total Capital ($M)	-	-	-	
Capital Contributions ($M)	-	-	-	*** See pro-forma line 55*
Annualised Rev. ($M)	-	-	-	*** See pro-forma line 55*
Annualised Opex ($M)	-	-	-	*** See pro-forma line 55*
Asset Impairment Value ($M)	-	-	-	

Assumptions	Distn	Tran
Annual Labour	2.58%	2.58%
Annual Material	1.66%	1.66%
Annual CPI	1.40%	1.40%
Rate of Return Pretax	10.65%	10.65%
Rate of Return Post Tax	7.45%	7.45%

Business Case Sign Off	
Senior Business Analyst	
Date	

Appendix B - Risk Analysis

This appendix provides an assessment of both corporate risk[14] and project risk. Table 6 presents a summary table of the corporate risks under the current situation and following the recommended replacement of OCS connections. The risk profile matrix indicates that risk is currently 'High' in the safety and legal categories. After the project has been completed the likelihood of an event that leads to the safety and legal consequences will decrease but the risk will remain 'High'. If, as anticipated, the replacements continue into the AA3 period the risk is expected to reduce from 'High'.

Table 6: Corporate Risk Assessment

RISK CRITERIA	CURRENT RISK			RISK DESCRIPTION & IMPACT	TARGET RISK		
	Consequence	Likelihood	Current Rating		Consequence	Likelihood	Target Rating
Safety	4	B	High	Unsafe OCS connections can cause fatality and/or multiple serious injuries. Based on historical results, the likelihood of this is low, and will be further reduced (but not eliminated) by the recommended replacement program.	4	B	High
Supply	1	A	Low	The effect and likelihood of supply failure to the premises on day-to-day activities is low	1	A	Low
Legal	4	B	High	While significant electric shock incidents are rare, regulatory inquiries on these can result in adverse findings for Western Power if it is concluded that inadequate steps were taken to mitigate the hazard. This can lead to substantial fines and possible civil action.	4	B	High
Reputation	2	B	Low	While significant electric shock incidents are rare, they can be widely reported leading to one-off adverse media coverage and consequent impacts on the corporate reputation	2	B	Low
Environment	1	A	Low	OCS connection faults are unlikely to have any adverse environmental impacts	1	A	Low
Financial	2	B	Low	In the (unlikely) event of major failures, Western Power could be exposed to financial claims for loss of property or injury. Maintenance costs to restore OCS connection failures are relatively low and will be related to the number of failures.	2	B	Low

[14] DM#3536273 In accordance with Corporate Risk Assessment Criteria (Part of Western Power's Risk Management Framework)

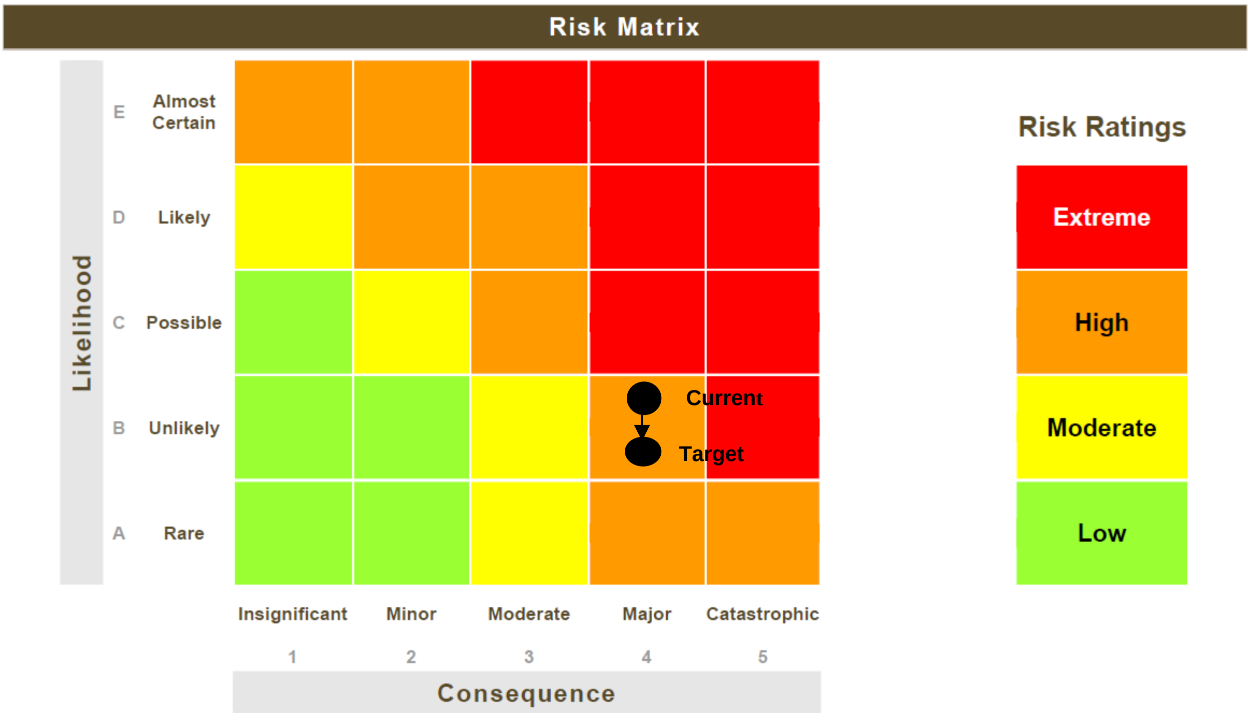

Figure 2 Risk movement of recommended option.

Table 7 presents a summary assessment of the project risks of implementing the replacement Option.

Table 7: Project Risk Assessment

Risk	Assessment	Mitigation
Management Experience Risk	M	Project Managers with extensive experience in similar projects will be employed, with safety being a major aspect in undertaking the replacement work. Appropriate safe work practices must be followed and Job Risk Assessments completed during the replacement and the commissioning phases of the project.
Technology Risk	L	The technology to replace OCS connections has been used before and considered to be of low-level complexity.
Construction and Completion Risk	M	Suitably trained, competent personnel will be employed to carry out the replacement work. Relevant work practices, guidelines and technical standards will be utilised. Project Managers will plan and organise the work with adequate resources to ensure the successful completion of the project.
Market Structure Risk	L	Not Applicable. Western Power is likely to remain the dominant network operator and the replacement of these facilities is considered essential for maintaining quality supply to customers.
Marketing Risk	L	Not Applicable.

Risk	Assessment	Mitigation
Environmental Risk	L	The work associated with this project will be undertaken on public and private property. Western Power has had experience in minimising the environmental impact of this activity.
Stranded Asset Risk	L	Not applicable
Regulated Pricing Risk	L	Not applicable.
Resource Shortage Risk	M	Shifting to a combined standalone / contiguous approach will allow improvement in productivity through effective forward planning lower cost contracting and transparent long term contracting. It will reduce contractor mobilisation costs.
Economic Risk	M	Proper project planning and organising will ensure an on time, on budget project completion.

Appendix C – Illustrations of OCS Connection / Items

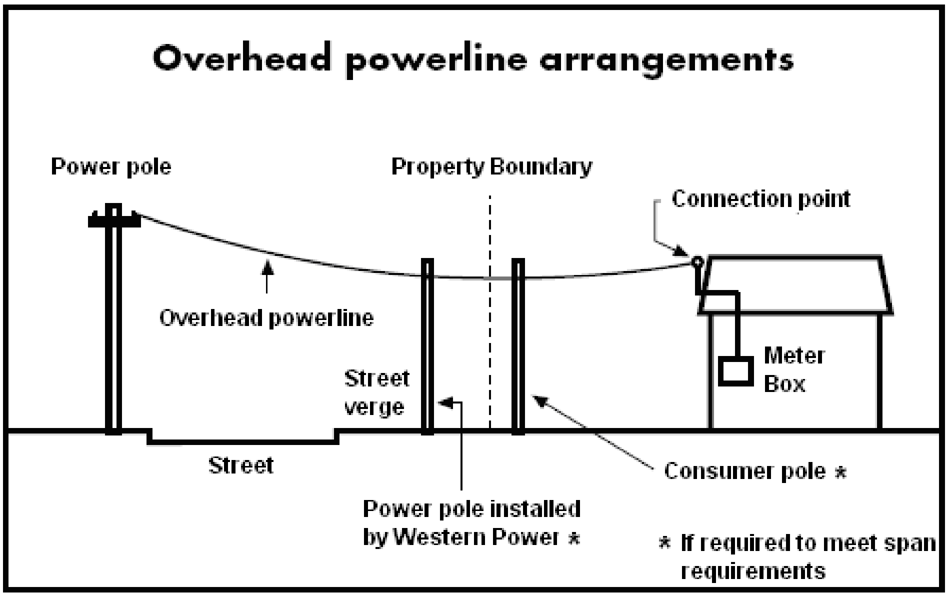

Figure 3: OCS Connection Arrangement

Figure 4 Example of a compromised service. The helical clamp is directly connected to the supporting bracket and, being too close to the metal roof, can make this live when wet and become a hazard

Figure 5: Example of a preformed steel termination (helical). The ends tend to perforate the insulation and become live and if the steel termination slips over the insulator, there is potential for the roof to become live and become a hazard.

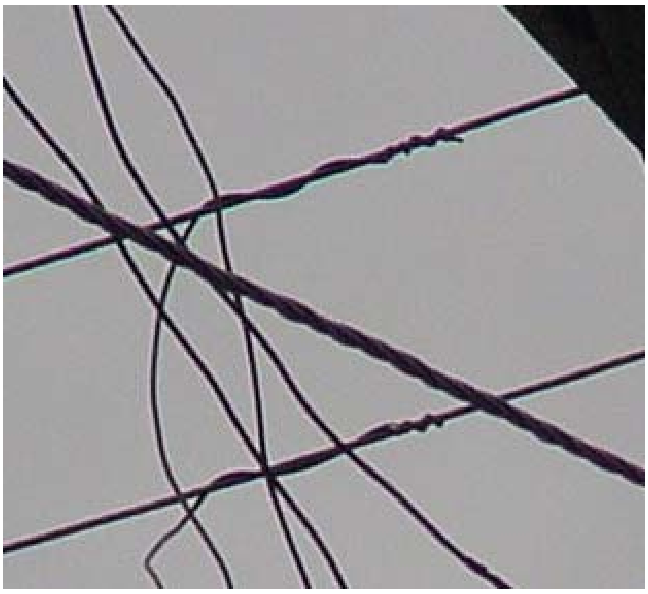

Figure 6: Example of wrapped conductor connections. The connection deteriorates with time, particularly if the environment is corrosive, leading to resistive joints or breaks resulting in no supply or a neutral break. The latter causes any appliance with metallic covers to become live.

Figure 7: Example of a goose neck termination and preformed steel termination. The insulation on the wires entering the goose neck may be abraded, resulting in the goose neck becoming live. Under certain conditions the roof can also become live and hence be a further hazard.

Appendix D – Replacement of OCS Connections Cost Estimate

ESTIMATES FOR THE INSPECTION AND REPLACEMENT OF OCS CONNECTION 2009/10 - 2011/12
DM#6907887
All estimates are in 'Nominal Terms'

REPLACEMENT OF OVERHEAD CUSTOMER SERVICE CONNECTION _ESTIMATE 2009/10

Cost Components Key Components	Labour	Vehicles	Equipment $	Materials$	Contractor$	Travel & Accomod'n$	Locality Factor$	Total $
Dist Project Management								
Provision for expanded activity in the country								
Dist Planning								
Dist Design								
Dist Procurement								
Construction and installation								
Commisioning								
Elms								
Sub-Total								
Cost Driver Simple								
TOTAL								

REPLACEMENT OF OVERHEAD CUSTOMER SERVICE CONNECTION _ESTIMATE 2010/11

Cost Components Key Components	Labour $	Vehicles	Equipment $	Materials$	Contractor$	Travel & Accomod'n$	Locality Factor$	Total $
Dist Project Management								
Provision for expanded activity in the country								
Dist Planning								
Dist Design								
Dist Procurement								
Construction and installation								
Commisioning								
Elms								
Expected Total								
Cost Driver Simple								
TOTAL								

REPLACEMENT OF OVERHEAD CUSTOMER SERVICE CONNECTION _ESTIMATE 2011/12

Cost Components Key Components	Labour $	Vehicles	Equipment $	Materials$	Contractor$	Travel & Accomod'n$	Locality Factor$	Total $
Dist Project Management								
Provision for expanded activity in the country								
Dist Planning								
Dist Design								
Dist Procurement								
Construction and installation								
Commisioning								
Elms								
Expected Total								
Cost Driver Simple								
TOTAL								

INSPECTION OF OVERHEAD CUSTOMER SERVICE CONNECTION _ ESTIMATE 2010/11

Cost Components Key Components	Labour $	Vehicles	Equipment $	Materials$	Contractor$	Travel & Accomod'n$	Locality Factor$	Total $
Dist Project Management								
Provision for expanded activity in the country								
Dist Planning								
Dist Design								
Dist Procurement								
Inspection								
Commisioning								
Elms								
Expected Total								
Cost Driver Simple								
TOTAL								

TOTAL NOMINAL BUDGET FOR INSPECTION AND REPLACEMENT OF OCSC

Cost Components Key Components	Labour $	Vehicles	Equipment $	Materials$	Contractor$	Travel & Accomod'n$	Locality Factor$	Total $
Dist Project Management								
Provision for expanded activity in the country								
Dist Planning								
Dist Design								
Dist Procurement								
Construction and installation								
Commisioning								
Elms								
Expected Total								
Cost Driver Simple								
TOTAL								