

# Allocation of Principal Contractor for TransGrid projects

### Summary

This procedure sets out clear guidelines for how TransGrid manages construction activities in relation to WHS and specifically the allocation of Principal Contractor and Site Management in line with TransGrid's corporate risk appetite.

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## Contents

| 1. | Purpose3   |                |   |              |  |  |  |  |
|----|--|----------------|---|--------------|--|--|--|--|
| 2. | Sco  | Scope          |   |              |  |  |  |  |
| 3. | Risk   | Risk Framework |   |              |  |  |  |  |
| 4. | Allocation of a Principal Contractor for Construction Work |                |   |              |  |  |  |  |
| 5. | Sub  | station C      | onstruction Works   | 5            |  |  |  |  |
|    | 5.1  | Substat        | ion Brownfield Construction Risk Assessment   | 5            |  |  |  |  |
|    | 5.2  | Risk Ra        | ıtings  | 5            |  |  |  |  |
|    | 5.2  | Specific       | s Scenario Analysis   | 9            |  |  |  |  |
|    | 5.3  | Non-PC         | Brownfield Substation Works   | 13           |  |  |  |  |
| 6. | Tran   | smissio        | n Line & Cable Construction Works   | 16           |  |  |  |  |
|    | 6.1  | Transm         | ission Line & Cables Brownfield Construction Risk Assessment  | 16           |  |  |  |  |
| 7. | Refe   | erences        |   | 18           |  |  |  |  |
| 8. | Atta   | chments        |   | 18           |  |  |  |  |
|    | 8.1  | Attachm        | nent 1 – Substation Brownfield Scenario Analysis  | 18           |  |  |  |  |
|    |  | 8.1.1          | Scenario 1 – Brownfield Substation Bench Extension  | 19           |  |  |  |  |
|    |  | 8.1.2          | Scenario 2 – Brownfield Substation Additional Earth within Existing Switchy (new footing)                 | ′ard<br>20   |  |  |  |  |
|    |  | 8.1.3          | Scenario 3 –Earth Grid Augmentation Within Existing Switchyard  | 22           |  |  |  |  |
|    |  | 8.1.4          | Scenario 4 – Disconnected Apparatus Transformer   | 24           |  |  |  |  |
|    |  | 8.1.5          | Scenario 5 – Disconnected Apparatus - New Switchbay   | 26           |  |  |  |  |
|    |  | 8.1.6          | Scenario 6 – Remove and Replace Existing HV Equipment   | 28           |  |  |  |  |
|    |  | 8.1.7          | Scenario 7 – DNSP/Customer works within TG Switchyard   | 30           |  |  |  |  |
|    |  | 8.1.8          | Scenario 8 – Remote End Secondary System Works Associated With<br>Greenfield Installations                | 32           |  |  |  |  |
|    |  | 8.1.9          | Scenario 9 – Secondary System Replacement   | 33           |  |  |  |  |
|    |  | 8.1.10         | Scenario 10 – Works on LV Panels (not associated with greenfield works of secondary system installations) | r full<br>34 |  |  |  |  |
|    |  | 8.1.11         | Scenario 11 – Greenfield Site Transfer to Brownfield Substation   | 35           |  |  |  |  |
|    |  | 8.1.12         | Scenario 12 – New Comms Installation Work in Brownfield Substations                                       | 37           |  |  |  |  |
|    |  | 8.1.13         | Scenario 13 – LV Cabling Works  | 38           |  |  |  |  |
|    |  | 8.1.14         | Scenario 14 – Security Equipment Installation   | 40           |  |  |  |  |

### 1. Purpose

The purpose of this document is to provide:

- 1. Clear requirements for when TransGrid is to be the Principal Contractor (PC).
- 2. The risk management framework to be followed for the management of construction activities, specifically in regards to when TransGrid performs the role of Principal Contractor.
- 3. Clear requirements for TransGrid site management and site presence during construction activities.

### 2. Scope

This procedure applies to all TransGrid infrastructure and communication projects, to enable clear rules on how construction risks are managed.

These projects can be Greenfield or brownfield projects, substation, transmission line or communications projects and cover a range of values and timeframes.

### 3. Risk Framework

Every project delivered by TransGrid contains hazards. These hazards are minimised by controls specified in safety systems (SWMS, Pre-Work Risk Assessments, Toolbox talks etc.) and via Work Health Safety Management Plans (WHSMPs).

TransGrid engages contractors to deliver projects on a regular basis. These are a mix of Greenfield and brownfield projects.

Generally it is accepted that the contractors engaged for this work are from our Construction Panel, are prequalified. That panel members are suited to manage all WHS risks (and hence be the PC) on Greenfield sites. All of the contractors on the TransGrid Construction Panel have certified WHSEQ systems and deliver this type of work safely on a regular basis for TransGrid. The hazards present on Greenfield construction sites are general construction hazards and require no special consideration in regards to TransGrid's Power System Safety Rules (PSSR) or operational control of site.

This document does not consider general construction risks on Greenfield sites.

Brownfield construction sites have additional hazards present that may not always be most suited to being managed by a contractor. There are a range of factors that need to be considered when making a decision on who is most suited to monitor and control the hazards present:

- Location of the construction work
- What the hazard is
- Potential consequence of the hazard
- Familiarity with control of the hazard
- Length of exposure to the hazard
- Ongoing operation control of site

Where there is the potential for significant disruption, control or influence on the part of TransGrid, then the PC novation question is rhetorical.



### 4. Allocation of a Principal Contractor for Construction Work

The allocation of a PC is required for all construction work with a value of \$250K or more. The elements that make up this value can be summarised in Table 1 – Principal Contractor Construction Costs. Further detail on the costs that make up the construction costs can be found in the WHS document Legal Communication – WHS Construction Project on the Work Health Safety and Environment page on the Wire.

| On-site activities included in cost   | Off-site activities NOT included in cost  |
|---|---|
| Work by architects or engineers in on-site buildings<br>and conducting site inspections during construction<br>work             | Work by architects or engineers away from site (e.g. design work in an office away from site)   |
| Labour on-site (e.g. employees, traffic control costs)  | Labour off-site (employees working on ancillary aspects of the project)   |
| Fixing any faulty plant on the construction site  | Maintenance of plant off-site at an isolated service area   |
| Moving materials around to different points within the construction site  | Delivering materials to a single designated delivery area (e.g. pole storage area at an off-site location)  |
| Supervisors/managers conducting site inspection<br>(e.g. project management costs associated with<br>construction work on site) | Project management costs for managing general<br>project delivery from the office (e.g. aspects of the<br>project not directly related to construction, e.g.<br>legal review of contracts ) |
| Surveying a construction site after construction work<br>commenced (e.g. to ensure TL location corresponds<br>with the plan)    | Surveying a Greenfield site before construction has commenced (e.g. survey for proposed TL location)  |

**Table 1- Principal Contractor Construction Costs** 



### 5. Substation Construction Works

The Substations and Communications construction works are considered in this section.

### 5.1 Substation Brownfield Construction Risk Assessment

The purpose of this assessment is not to evaluate all risks on a construction site. This section details the identification, evaluation and nominates the most suited party to manage the critical risks present on TransGrid brownfield projects.

This assessment will inform various brownfield construction scenarios in regards to who shall perform the duties of PC.

**Full Time TransGrid Site Manager Presence**: The definition of full time site presence means that the TransGrid site manager shall be on site whenever the following is occurring:

- Whenever critical risk activities are undertaken or whenever works detailed in the scenarios are being undertaken and full time site management is required.
- During all outage works
- It does not mean they are the first person at site and the last to leave.

### 5.2 Risk Ratings

Each scenario presented will be allocated a risk ranking. This ranking provides clear guidance to the novation or allocation of the PC role:

- High Risk TransGrid cannot novate the PC role and must remain the PC.
- Medium Risk Typically TransGrid cannot novate the PC role, but will depend on the particular circumstances and assessed on a case by case basis. Recommendations are provided in this framework and Snr Program Managers should be consulted for these scenarios.
- Low Risk TransGrid is able to novate the role of PC



| Hazard                  | Definition   | Controls  | Risk<br>Rating | Managed<br>by | TG Site<br>Presence | Reasoning   |
|-------------------------|--|---|----------------|---------------|---------------------|---|
| Work on HV<br>Apparatus | <ul> <li>Any work on HV apparatus presents<br/>multiple electrical hazards.</li> </ul> | <ul> <li>High Voltage Access Authorities<br/>(HV AA) – are issued when work<br/>on HV apparatus is required or<br/>for clearance to live conductors.</li> <li>PSSR training Cat 5.5</li> <li>PSSR training Cat 5.2/5.3</li> </ul>                       | High           | TransGrid     | Full Time           | <ul> <li>Contractors do not have access to Cat 5.5 training.</li> <li>TransGrid staff familiarity with the PSSR.</li> <li>TransGrid Cat 5.5 provides safe access to the network.</li> <li>Contractor's unfamiliarity with the PSSR – contractors can be trained in the rules, however with little experience working within a TransGrid switchyard there is significant risk of PSSR breaches if not managed by TransGrid staff, where there are multiple or complex AAs to be issued.</li> <li>Contractors can still hold HV AAs, however the construction area should be managed by TransGrid to ensure safe access and full compliance with the PSSR.</li> </ul> |
| Work on LV<br>Apparatus | • Any work on LV apparatus presents multiple electrical hazards.                       | <ul> <li>Low Voltage Access Authorities<br/>(LV AA) – are issued when work<br/>on LV apparatus is required and<br/>no HV access or clearance to HV<br/>conductors is required.</li> <li>PSSR training Cat 4.3</li> <li>PSSR training Cat 4.1</li> </ul> | High           | TransGrid     | Full Time           | <ul> <li>Contractors do not have access to Cat 4.3 training.</li> <li>TransGrid staff familiarity with the PSSR.</li> <li>TransGrid Cat 4.3 provides safe access to the network.</li> <li>Contractor's unfamiliarity with the PSSR – contractors can be trained in the rules, however with little experience working within a TransGrid switchyard there is significant risk of PSSR breaches if not managed by TransGrid staff, where there are multiple or complex AAs to be issued.</li> <li>Contractors can still hold LV AAs, however the construction area should be managed by TransGrid to ensure safe access and full compliance with the PSSR.</li> </ul> |



| Hazard                       | Definition  | Controls   | Risk<br>Rating | Managed<br>by                | TG Site<br>Presence | Reasoning  |
|------------------------------|---|--|----------------|------------------------------|---------------------|--|
| Electricity –<br>Earth Grid  | <ul> <li>Dangerous voltages can be present<br/>when in-service earth grid is broken<br/>or cut if not properly controlled.</li> </ul>   | <ul> <li>Apply bridging lead when completing excavations or cutting of earth grid.</li> <li>PSSR training Cat 3.3.</li> </ul>  | High           | TransGrid                    | Full Time           | <ul> <li>A Cat 5.5 or Cat 5.5B PSSR trained person must apply and remove all bridging leads.</li> <li>Cat 3.3 PSSR trained personnel are trained in the hazards presented by the earth grid.</li> <li>Experienced staff with a high level of familiarisation with the PSSR controlling the works.</li> </ul>   |
| Electricity –<br>Excavations | <ul> <li>Dangerous voltages can be present<br/>when in-service earth grid is broken<br/>or cut if not properly controlled.</li> <li>Buried services pose a significant<br/>electrical risk if not positively<br/>identified prior to excavations<br/>commence.</li> </ul> | <ul><li>Excavation permit.</li><li>PSSR training Cat 3.3.</li></ul>  | High           | TransGrid                    | Full Time           | • The excavation permit's purpose is to ensure all<br>known buried services (including earth grid) are<br>positively identified. This does not guarantee that<br>all buried services have been identified. It is<br>impossible for TransGrid to hand this risk to a<br>contractor as there will always be a chance of<br>unidentified buried services being encountered.   |
| Mobile<br>Plant              | <ul> <li>Inadvertent contact with live<br/>overhead conductors can occur if<br/>SAD are not maintained.</li> <li>Electrical hazards present if mobile<br/>plant collapse trenches and damage<br/>cabling.</li> </ul>  | <ul> <li>PSSR training Cat 3.3.</li> <li>Use of spotter (Cat 3.3).</li> <li>Traffic Movement Plan (TMP) within the substation identifying safe paths to traverse.</li> </ul> | Medium         | TransGrid<br>&<br>Contractor | Full Time           | <ul> <li>TransGrid is unable to eliminate the risk to the contractor in regards to the hazards presented by operating mobile plant in a high voltage switchyard.</li> <li>However a risk based approach is required to assess whether TransGrid can accept access to the contractor site via the live switchyard.</li> <li>If access can be safely provided by the following means then it is acceptable for the Contractor to manage these hazards:         <ul> <li>Access to the work area is via the main Tx runway and all conductor heights are known and documented on the TMP.</li> <li>Access paths to the work area are clear from live overhead conductors (e.g. bunting or flagging to indicate low conductors). And safe clearance heights are clearly documented, understood and visible on site</li> <li>A Cat 3.3 PSSR trained person is assigned to monitor the switchyard</li> </ul> </li> </ul> |



| Hazard | Definition | Controls | Risk<br>Rating | Managed<br>by | TG Site<br>Presence | Reasoning   |
|--------|------------|----------|----------------|---------------|---------------------|---|
|        |            |          |                |               |                     | gates and ensure the gate is secured when not in immediate use. |

Table 2 - Substation Brownfield Construction Risk Assessment



### 5.2 Specific Scenario Analysis

This section details multiple brownfield construction scenarios and analyses the hazards and risk as outlined in the Substation Brownfield Construction Risk Assessment and makes an assessment of the following:

- 1. Who the Principal Contractor shall be for the particular scenario
- 2. What level of TransGrid site management is required

The scenarios below assume the value of the work or associated project is >\$250K, hence requiring the allocation of a PC in regards to health and safety obligations.

This section is not exhaustive, however the type of work undertaken in most brownfield substation works can be aligned with one of the following scenarios and the analysis of this scenario shall be followed.

This section only considers substation brownfield PC works.

Table 3 details the summary findings of the various scenarios considered. Attachment 1 contains the detailed analysis of each scenario.

### **Delineation**

Where Delineation is mentioned this means separation of the PC work area from the operational substation by either of the following:

- Temporary Fencing
- Flagging
- Bunting

### Interpretation of Transmission Installation Earthing Augmentations to Substations Design Standard

The Transmission Installation Earthing Augmentations to Substations Design Standard lays out the requirements when installing new earth grid or augmenting the existing. The standard is not a PSSR related document or work procedure but is rather design advice on how to mitigate the hazards presented when performing this work.

Substation Bench Extensions – The design standard calls for electrical isolation between an existing earth grid and a new earth grid prior to bonding the two together. This is achieved by maintaining a minimum 3m air gap between the existing earth grid (including switchyard fence and grading ring) and the newly laid earth grid prior to the connection being made.

Earth Grid Augmentations Inside the Switchyard – The design standard does not make any specific recommendations regarding controls when augmenting the earth grid within the switchyard. There is no requirement to maintain a 3m air gap between existing earth grid and newly installed earth grid prior to the connection being made for works inside the switchyard fence.

### **Site Manager Qualifications**

Where a site manager is required to be deployed to a site to enact the role of, control works or supervise contractor led PC construction works they must possess the relevant qualifications. The below are the minimum requirements that a site manager must possess:

- For all site manager's managing PC works where TransGrid is the PC, Cert IV in WHS is a pre-requisite.
- Cat 3.3 PSSR qualified as a minimum.

The specific scenarios outline the PSSR qualifications that the site managers must possess for that particular scenario. These are the minimum requirements for that particular scenario.

### TransGrid the PCBU

TransGrid is a Person Conducting Business or Undertaking PCBU whether we engage a contractor to perform works or perform works internally. When contractors are PC for a scope of works and this scope of works comes to an end by completion of the works, operational control of the site is transferred to TransGrid as the PCBU. For Greenfield sites this typically occurs when the construction works are completed and the PSSR are invoked at the site. The contractor shall ensure that all known and outstanding risks are identified and details of these risks provided to TransGrid.



| Scenario | Risk<br>Rating | Work Description                                   | PC  | TG Site Management   | Qualifications   |
|----------|----------------|--|---|--|--|
| 1        | Medium         | Substation Bench Extension                         | Contractor – works outside the switchyard.<br>TransGrid – when works commence within the existing<br>switchyard | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 5.5B – for bridging<br>works   |
| 2        | High           | Install New Footing within existing substation     | TransGrid   | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 5.5B – for bridging<br>works   |
| 3        | High           | Earth Grid Augmentation within existing switchyard | TransGrid   | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 5.5B – for bridging<br>works   |
| 4        | Low            | Disconnected Apparatus –<br>Transformer            | Contractor – when safe access as per the Risk<br>Assessment can be achieved (otherwise TransGrid)               | Required when AAs are required<br>(before and after Disconnected<br>Apparatus) | Cat 5.2 – when required<br>on site<br>(Cat 5.5 required to<br>declare apparatus as<br>"Disconnected" as per<br>PSSR requirements)  |
| 5        | High           | Disconnected Apparatus – New<br>Switchbay          | TransGrid   | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 5.5B – for bridging<br>works<br>Cat 5.2 – for electrical<br>works<br>(Cat 5.5 required to<br>declare apparatus as<br>"Disconnected" as per<br>PSSR requirements) |
| 6        | High           | Remove & Replace HV<br>Equipment                   | TransGrid   | Full Time  | Cat 3.3 – for non-<br>electrical works   |



| Scenario | Risk<br>Rating | Work Description  | PC   | TG Site Management                                     | Qualifications  |
|----------|----------------|---|--|--|---|
|          |                |   |  |  | Cat 5.2 – for electrical<br>works<br>Cat 5.5B – for bridging<br>works   |
| 7        | Medium         | DNSP/Customer works within<br>TransGrid Switchyard  | DNSP / Customer  | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 5.2 – for electrical<br>works<br>Cat 5.5B – for bridging<br>works     |
| 8        | Medium         | Remote End Secondary System<br>Works Associated With<br>Greenfield Installations                          | Contractor   | Full Time  | Cat 4.1   |
| 9        | High           | Secondary Systems<br>Replacement  | TransGrid  | Full Time  | Cat 3.3 – for non-<br>electrical works<br>Cat 4.1/5.2 – for electrical<br>works<br>Cat 5.5B – for bridging<br>works |
| 10       | High           | Works on LV Panels (not<br>associated with greenfield works<br>or full secondary system<br>installations) | TransGrid  | Full Time  | Cat 4.1   |
| 11       | Medium         | Greenfield Site Transfer to<br>Brownfield Substation  | Contractor – when greenfield<br>TransGrid is the PCBU at the time the site becomes<br>under PSSR (TransGrid has operational control) –<br>Contractor to "handover" any construction risks. | Full Time (during commissioning and once PSSR at site) | Cat 3.3 – for non-<br>electrical works<br>Cat 4.1/5.2 – for electrical<br>works<br>Cat 5.5B – for bridging<br>works |
| 12       | Medium         | New Comms Installation Work in Brownfield Substations   | <ul> <li>Running of new fibre cables outside TransGrid<br/>switchyard (including excavations) – Contractor</li> </ul>  | Full Time  | Cat 3.3 – for non-<br>electrical works  |



| Scenario | Risk<br>Rating | Work Description                | PC   | TG Site Management | Qualifications   |
|----------|----------------|---------------------------------|--|--------------------|--|
|          |                |                                 | <ul> <li>Running of new fibre cables inside TransGrid<br/>switchyard (including excavations) – TransGrid</li> </ul>  |                    | Cat 5.5B – for bridging<br>works                               |
|          |                |                                 | <ul> <li>Installation of new hardware associated with new<br/>comms installations – Contractor</li> </ul>  |                    |  |
|          |                |                                 | • Running of new cabling – Contractor (if area is delineated, no excavations and access to the area is as per the Substation Brownfield Construction Risk Assessment) / TransGrid (otherwise)  |                    | <ul> <li>Cat 3.3 – Running of<br/>new cabling</li> </ul>       |
| 13       | Medium         | LV Cabling Works                | Removal of redundant cabling – TransGrid   | Full Time          | <ul> <li>Cat 5.2 – Removal of<br/>redundant cabling</li> </ul> |
|          |                |                                 | <ul> <li>Termination of new cabling – TransGrid (for<br/>existing equipment or if inside existing control<br/>rooms or ASBs) / Contractor (for new equipment,<br/>within a delineated area, no excavations and<br/>access is as per Substation Brownfield<br/>Construction Risk Assessment)</li> </ul> |                    | <ul> <li>Cat 4.1 – Termination<br/>of new cabling</li> </ul>   |
|          |                |                                 |  |                    | Cat 3.3 – for non-<br>electrical works                         |
| 14       | High           | Security Equipment Installation | TransGrid  | Full Time          | Cat 5.5B – for bridging<br>works                               |
|          |                |                                 |  |                    | Cat 5.2 – for electrical works                                 |

 Table 3 – PC Allocation and Site Management for Substation Brownfield Works



### 5.3 Non-PC Brownfield Substation Works

This section details the requirements for all works that are not considered PC works. Where the cost of the construction work is valued under \$250K there is no requirement to allocate a PC. However these works still require supervision from a site manager.

For all of these types of construction works in brownfield substations TransGrid is the PCBU and has control of the works. Safe systems of work shall be employed (e.g. SWMS, Daily Pre-Starts etc.) to ensure the hazards associated with the work are controlled.

Generally these types of works are small in nature and are shorter duration. Table 4 below details the different types of work and the site manager requirements.

The scenarios presented in Table 4 all assume internal delivery. If at any stage a Contractor is involved on site, full time site management is required.

Table 4 only identifies the critical risks and hazards specific to brownfield substation works (i.e. it is not a comprehensive risk assessment for these works) as the purpose of this table is to identify the site management requirements.

| Work  | Hazards   | Controls   | Site Management   | Qualifications  |
|---|---|--|---|---|
| Asset Replacement – Non Outage<br>(secondary panel prep works, civil<br>works)                      | <ul> <li>Other live cables within the trenches</li> <li>Electrical – HV &amp; LV SAD</li> <li>Excavations</li> <li>Earth grid</li> </ul>                          | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Site Manager presence</li> <li>Isolations</li> <li>Excavation permit</li> <li>LV/HV AA</li> <li>Bridging of earths</li> </ul> | Full Time – excavations or bridging works<br>Full Time – whenever AAs are required<br>Not Required - Others   | <ul> <li>Cat 3.3 for civils</li> <li>Cat 5.5B for bridging of earths</li> <li>Cat 5.2/4.1 for HV/LV AA</li> </ul> |
| Asset Replacement – Non Outage<br>(Prot Relay testing/prep prior to<br>outage, running new cabling) | • Electrical – low LV risk  | <ul> <li>PSSR trained personnel undertaking the work.</li> <li>Isolations</li> </ul>   | Not Required<br>(allocated SM must ensure appropriate<br>safe systems of works are in use during<br>the works)<br>This work is performed by highly skilled<br>and competent staff trained in the hazards<br>and risks associated with the work. | NA  |
| Asset Replacement – All Outage<br>Work  | <ul> <li>Electrical – HV &amp; LV SAD</li> <li>Excavations</li> <li>Earth grid</li> <li>AA process (familiarity with the AAs &amp; commissioning plan)</li> </ul> | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Site Manager presence</li> <li>Isolations</li> <li>Excavation permit</li> <li>LV/HV AA</li> <li>Bridging of earths</li> </ul> | Full Time   | Cat 5.2 and Cat 5.5B if<br>bridging of earths<br>required   |
| All other HV/LV Outage work<br>(includes any other construction<br>work that requires AAs)          | <ul> <li>Electrical – HV &amp; LV SAD</li> <li>Excavations</li> <li>Earth grid</li> <li>AA process (familiarity with the AAs &amp; commissioning plan)</li> </ul> | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Site Manager presence</li> <li>Isolations</li> <li>Excavation permit</li> <li>LV/HV AA</li> <li>Bridging of earths</li> </ul> | Full Time   | Cat 5.2 and Cat 5.5B if bridging of earths required   |



| Civil Works<br>(running of new fibre cables,<br>running of new AC/DC circuits,<br>other civil works <\$250K))  | <ul> <li>Excavations</li> <li>Earth grid</li> <li>Electrical – HV &amp; LV SAD</li> </ul> | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Site Manager presence</li> <li>Isolations</li> <li>Excavation permit</li> <li>LV/HV AA</li> <li>Bridging of earths</li> </ul> | Full Time   | Cat 3.3 and Cat 5.5B<br>where bridging of earths<br>is required |
|--|---|--|---|---|
| Comms work (Internal Delivered)<br>(installation of hardware, patching,<br>cutting over services etc.)   | • Electrical – LV SAD   | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Isolations</li> </ul>   | Not Required<br>(allocated SM must ensure appropriate<br>safe systems of works are in use during<br>the works)<br>This work is performed by highly skilled<br>and competent staff trained in the hazards<br>and risks associated with the work. | NA  |
| Control Works (Internal Delivered)<br>(RTU Replacement, defects,<br>database uploads)<br>This work considers small<br>standalone works required such<br>as IWRs or defects. Control works<br>associated with large projects in-<br>flight construction projects should<br>revert to the scenarios for PC<br>works. | • Electrical – LV SAD   | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Isolations</li> </ul>   | Not Required<br>(allocated SM must ensure appropriate<br>safe systems of works are in use during<br>the works)<br>This work is performed by highly skilled<br>and competent staff trained in the hazards<br>and risks associated with the work. | NA  |
| Protection Setting Changes<br>This work considers small<br>standalone setting change jobs,<br>akin to maintenance works.   | • Electrical – LV SAD   | <ul> <li>PSSR trained personnel undertaking the works</li> <li>Isolations</li> </ul>   | Not Required<br>(allocated SM must ensure appropriate<br>safe systems of works are in use during<br>the works)<br>This work is performed by highly skilled<br>and competent staff trained in the hazards<br>and risks associated with the work. | NA  |

### Table 4 – Non PC Substation Brownfield Works



### 6. Transmission Line & Cable Construction Works

The transmission line (TL) & cable brownfield construction works are considered in this section. Historically the Contractor has always been the PC for all TL & cable works due to the nature of the works.

### 6.1 Transmission Line & Cables Brownfield Construction Risk Assessment

Generally the hazards specific to TL & Cable brownfield works can be controlled effectively by the Contractor once they have been provided safe access to the network. During the process of providing safe access all undercrossings are isolated and earthed (removing the associated hazard), the circuit to be worked on is isolated and earthed (removing the associated hazard) and a Field AA is issued providing the formal safe access permit.

Unlike a substation environment, where there are many other live in-service operational hazards present, TL & Cable works are typically more isolated from other operational equipment and TransGrid is able to hand operational control over to the Contractor whilst they are conducting work on the line or cable.

TL & Cable works can be split up into multiple work groups and field AAs along the circuit. The risk of unfamiliarity of the PSSR is high in these circumstances. This is controlled via allocating a full time TL & Cables site manager to each portion of the circuit to manage/supervise the access to the network process.

Scenarios are not presented for TL & Cable works as the risk assessment in Table 5 illustrates that the Contractor is suitable to be PC for all TL 7 Cable brownfield works. However full time site management is required during all works to allow safe access to the network.



| Hazard                               | Definition   | Controls   | Managed<br>by | TG Site<br>Presence | Reasoning   |
|--------------------------------------|--|--|---------------|---------------------|---|
| Work on<br>Transmission<br>Lines     | <ul> <li>Any work on Transmission<br/>Lines presents multiple<br/>electrical hazards.</li> </ul>                   | <ul> <li>Field Access Authorities (Field AA) – are issued when work on TL &amp; Cables is required.</li> <li>PSSR training Cat 6.4/7.5</li> <li>PSSR training Cat 6.3/7.3</li> </ul> | Contractor    | Full Time           | <ul> <li>Contractors do not have access to Cat 6.4 training.</li> <li>TransGrid Cat 6.4/7.5 provides safe access to the network.</li> <li>Due to the lower complexity of these Field AAs it is considered the contractor is capable of managing the hazards present for works on a TL or cable.</li> </ul>  |
| Electricity –<br>Earthing<br>Systems | <ul> <li>If in-service structure earthing<br/>systems are damaged<br/>dangerous voltages may occur</li> </ul>      | <ul> <li>Apply bridging lead when completing excavations or cutting of earth grid.</li> <li>PSSR training Cat 6.3/7.3.</li> </ul>  | Contractor    | Full Time           | <ul> <li>A Cat 6.3/7.3 PSSR trained person must apply and remove all bridging leads.</li> <li>Cat 6.3/7.3 PSSR trained personnel are trained in the hazards presented by the earth grid.</li> <li>Once the area is made safe by the Cat 6.3/7.3 person the hazard has been controlled and the contractor is able to manage the residual risks associated with this work.</li> </ul>   |
| Mobile Plant                         | <ul> <li>Inadvertent contact with live<br/>overhead conductors can occur<br/>if SAD are not maintained.</li> </ul> | <ul> <li>PSSR training Cat 6.3/7.3.</li> <li>Use of spotter (Cat 3.3).</li> <li>Traffic Movement Plan (TMP) within the work area identifying safe paths to traverse.</li> </ul>      | Contractor    | Full Time           | <ul> <li>TransGrid can minimise as far as reasonably practicable the hazards associated with live overhead conductors. The circuit to be worked on shall be isolated and earthed and safe access provided by a Cat 6.4/7.5 trained person.</li> <li>Access to the sites is hazardous, but these hazards are not specific to brownfield TL &amp; Cable works (i.e. these hazards would exist on Greenfield sites also). Access via live-operational equipment is not required for TL &amp; Cable works.</li> </ul> |

Table 5: Transmission Lines & Cables



| Revision no | Approved by                         | Amendment      |
|-------------|-------------------------------------|----------------|
| 0.0         | Krista-Lee Fogarty – Head of<br>HSE | First Revision |

### 7. References

Contract Management Risk Framework Quality Risk Framework Project Delivery Manual Design Standard Transmission Installation Earthing Augmentations to Substations Design Work Instruction Class 1 – Construction Project over \$250,000 where the Contractor is the Principal Contractor Work Instruction Class 1a – TransGrid engages a Subcontractor to Work under an External Principal Contractor Work Instruction Class 2 – Construction Project over \$250,000 where TransGrid is the Principal Contractor Work Instruction Class 3 – Construction work under \$250,000 Project Risk Management procedure Principal Contractor Guidelines for Health and Safety

### 8. Attachments

8.1 Attachment 1 – Substation Brownfield Scenario Analysis



### 8.1.1 Scenario 1 – Brownfield Substation Bench Extension

#### Step 1 – Prior to removing switchyard fence



#### Step 2 – Removing switchyard fence and erecting new temp or permanent switchyard fence

### Scenario 1 – Analysis

Up to the point of removing the original fence (i.e. outside of the switchyard) the hazards present are such that the contractor can control the risk and hence be the PC. The contractor shall:

- 1. Control the hazard of overhead conductors outside the switchyard
- 2. Control the hazards presented by the in-service earth grid

Due to the requirement of the excavation permit a full time site presence of a TransGrid Cat 5.5 or Cat 5.5B trained Site Manager is required where bridging is required.

Once the works proceed to Step 2 and beyond, the works must be completed in accordance with PSSR. As specified in the Substation Brownfield Construction Risk Assessment if excavations are continuing within the switchyard, HV or LV Access Authorities are required, separate access through the switchyard cannot be maintained and/or other PSSR related activities are being undertaken the Principal Contractor shall be TransGrid

#### Scenario 1 – Conclusion:

- Principal Contractor: Contractor (for work outside the switchyard) / TransGrid (for work inside the switchyard).
- Site Manager Presence: Full time Cat 3.3 (for non-electrical works), 5.5B (for bridging works)
- Rating: Medium



### 8.1.2 Scenario 2 – Brownfield Substation Additional Earth within Existing Switchyard (new footing)



### Scenario 2 Analysis

The work in scenario 2 involves brownfield excavations, earth grid, mobile plant and possibly HV AA. Due to this for scenario 2 TransGrid shall be the PC.



### Scenario 2 – Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 3.3 (for non-electrical works), 5.5B (for bridging works)
- Risk Rating: High



### 8.1.3 Scenario 3 – Earth Grid Augmentation within Existing Switchyard





### Scenario 3 – Analysis

This scenario assumes there are no HV or LV AAs required to complete the work safely. This work involves excavations, earth grid and potentially other unknown services within the ground. Excavation permits are required and a TransGrid Cat 5.5B is required to bridge earths. This scenario presents a number of risks that are controlled by TransGrid staff as per the Substation Brownfield Risk Assessment. This scenario requires a high level of understanding of the PSSR and hazards associated with the earth grid. Typically there are multiple earths to be bridged in this scenario.

TransGrid is best suited to manage these hazards and hance be the PC.

An excavation permit may be required and there are multiple earths to be bridged, therefore full time site presence of a TransGrid Cat 5.5 or Cat 5.5B trained Site Manager is required where bridging is required.

### Scenario 3 – Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 3.3 (for non-electrical works), 5.5B (for bridging works)
- Risk Rating: High



### 8.1.4 Scenario 4 – Disconnected Apparatus Transformer

### Step 1 – Site Establishment



Work area delineated prior to declaring Disconnected Apparatus (fencing, flagging or bunting).

### Step 3 – Declare Tx Disconnected Apparatus



Declare the Tx as Disconnected Apparatus as per the Disconnected Apparatus procedure (including earthing of fencing)

Step 2 – HV/LV AA to remove conductors to declare Disconnected Apparatus



HV & LV AAs required to remove HV & LV conductors to enable declaring of Disconnected Apparatus

### Step 4 – Complete work under Disconnected Apparatus procedures



Works completed under Disconnected Apparatus procedures – Cat 3.3 PSSR trained personnel and at least one Cat 5.2 PSSR trained person.





### Scenario 4 – Analysis

This scenario assumes there are no civil works or other works associated with the earth grid (except for the earthing of the Disconnected Apparatus fence). The HV/LV AAs in this scenario are not complex and there are only a minimal number of these to be issued. Access to the Tx area will generally always be via the main Tx runway. Considering that no earthing is being disturbed in the ground, the low complexity and number of AAs and the clear access to the work site it is considered that the contractor can be the PC in this scenario.

During all steps, apart from Step 4 – Complete work under Disconnected Apparatus procedures a TransGrid Site Manager presence is required at all times to ensure access to the network is provided safely and that the Disconnected Apparatus procedures are being adhered to.

### Scenario 4 – Conclusion:

- Principal Contractor: Contractor (if access to the work area as per Substation Brownfield Construction Risk Assessment).
- Site Manager Presence: Full time Cat 5.2 (Cat 5.5B where excavations are required) up until the area is declared Disconnected Apparatus and full time Cat 5.2 again once the Disconnected Apparatus area is to be removed. Site Management may persist during the work depending on specific project requirements (quality inspections etc.).
- Risk Rating: Low



#### 8.1.5 Scenario 5 – Disconnected Apparatus - New Switchbay



**TransGrid** 

PC Work



### Scenario 5 – Analysis

This scenario consists of all hazards present in a switchyard, especially those outlined in the Substation Brownfield Construction Risk Assessment. There will be excavations, earth grid, mobile plant and multiple, complex HV/LV AAs. Generally the earth grid augmentation will be carried our prior to the declaration of Disconnected Apparatus. However if earth grid augmentation or excavations are still required after declaring the area as Disconnected, excavation permits and/or bridging of earths is still required. Risks still remain in the ground that TransGrid is unable to fully eliminate. Access to the area will be dependent upon where the new switchbay is located, but will not always be available from the main Tx runway.

During all steps a TransGrid Site Manager presence is required at all times to ensure access to the network is provided safely and that the Disconnected Apparatus procedures are being adhered to. Excavation permits and bridging of earths are required at multiple times during the work. If all excavations and new earth connections have been made to the existing earth grid by Step 3 then Site Manager presence may not be necessary during this time, however this should be considered on a case by case basis.

### Scenario 5 – Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 3.3 for non-electrical works (Cat 5.5B for bridging) and/or Cat 5.2 for electrical works
- Risk Rating: High





### 8.1.6 Scenario 6 – Remove and Replace Existing HV Equipment







### Scenario 6 – Analysis

This scenario considers replacement of a full switchbay by means of declaring the area Disconnected Apparatus. The analysis below is still valid for single equipment replacements or if the work is to proceed under HV and LV AAs. The hazards are still relevant for the work being undertaken in this way.

This scenario potentially consists of all hazards present in a switchyard, especially those outlined in the Substation Brownfield Construction Risk Assessment. There may be excavations, earth grid, mobile plant and multiple, complex HV/LV AAs. The risks associated with underground services is not eliminated due to the Disconnected Apparatus declaration. This coupled with and unfamiliarity of contractors with the Disconnected Apparatus procedure and multiple/complex AAs suggests TransGrid is the most suited as the PC in this scenario. Access to the area will be dependent upon where the new switchbay is located, but will not always be available from the main Tx runway.

During all steps a TransGrid Site Manager presence is required at all times to ensure access to the network is provided safely and that the Disconnected Apparatus procedures are being adhered to. Excavation permits and bridging of earths are required at multiple times during the work. If all excavations and new earth connections have been made to the existing earth grid by Step 3 then Site Manager presence may not be necessary during this time, however this should be considered on a case by case basis.

### Scenario 6 – Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 3.3 (non-electrical works), 5.2 (electrical works), Cat 5.5B (for bridging works)
- Risk Rating: High



### 8.1.7 Scenario 7 – DNSP/Customer works within TransGrid Switchyard





### Scenario 7 – Analysis

This scenario typically arises from a DNSP request or customer request. Most hazards in the Substation Brownfield Construction Risk Assessment are present in this scenario. However where this scenario differs from the others is that the equipment being worked on is owned and operated by the DNSP or customer. It is considered in this case that the DNSP or customer is best placed to control the hazards present on their equipment.

Full time site management is essential to ensure excavation permits and safe access to the network is completed in accordance with the PSSR at all times.

#### Scenario 7 – Conclusion:

- Principal Contractor: DNSP/Customer
- Site Manager Presence: Full time Cat 3.3 (non-electrical works), 5.2 (electrical works), Cat 5.5B (for bridging works)
- Risk Rating: Medium



### 8.1.8 Scenario 8 – Remote End Secondary System Works Associated With Greenfield Installations

No diagrams are presented in this scenario. This scenario considers a single protection panel (No.1 & No.2) and single control panel, and associated comms work for remote end works on a Greenfield substation project. No excavations or HV equipment works are considered. If these works exist refer to these scenarios for guidance. The Contractor is assumed to be the PC of the Greenfield site.

### Scenario 8 – Analysis

In this scenario the Contractor is responsible for the remote end works. They are the PC on the Greenfield site and have a WHSMP that considers risks associated with their responsible scope of works. The length of exposure to the LV hazards present is low compared to a full secondary system replacement. Another thing to take into consideration is to avoid multiple WHSMPs or multiple PCs on a project to avoid confusion of personnel on site. This poses a risk in itself as workers will be tuned into the Contractors WHSMP and requirements from the Greenfield site. Changing the WHSMP at another site poses the risk of non-compliance to either WHSMP.

The number of LV/HV AAs required during this work is minimal compared with a full secondary systems replacement (being confined to a single bay only).

TransGrid will require full time site management at each remote end in this scenario to provide safe access to the network and ensure the PSSR is complied with at all times.

TransGrid cannot give full operational control to the Contractor at these remote brownfield sites, however considering the length of the exposure, the full time site management and the risks posed with changing WHSMPs between sites it is considered in this scenario that the Contractor can effectively manage the hazards and be the PC.

### Scenario 8 Conclusion:

- Principal Contractor: Contractor
- Site Manager Presence: Full time Cat 4.1
- Risk Rating: Medium



### 8.1.9 Scenario 9 – Secondary System Replacement

No diagrams are presented in this scenario. This scenario considers all work associated with secondary system works including protection/control panel replacements, AC/DC boards work and any associated LV cabling installations. This scenario considers the least hazardous case only, i.e. it does not consider excavations, earth grid augmentation or mobile plant. If these hazards are present then this reinforces the analysis and conclusions.

### Scenario 9 – Analysis

This scenario potentially only presents the HV AA and LV AA hazard as per the Substation Brownfield Construction Risk Assessment. The exposure to the hazard must be taken into account in this scenario. There are multiple and complex HV/LV AAs associated with this work and the length of exposure to the hazard is high. Due to the brownfield nature of the works interpretation of old drawings and familiarity with the site is necessary to minimise risks.

There are substantial cabling works associated with this scenario which present another electrical hazard with removing of redundant cabling and installation of new cabling in and around in-service cabling.

All work in this scenario is associated with multiple, complex and sequenced LV or HV AAs. A high degree of familiarity with the PSSR is required to manage the hazards present in this scenario. Therefore it is considered that TransGrid is best suited to manage these hazards as the PC.

#### Scenario 9 Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 4.1/5.2 (for secondary electrical works), Cat 3.3 (for non-electrical works), Cat 5.5B (for bridging works)
- Risk Rating: High



### 8.1.10 Scenario 10 – Works on LV Panels (not associated with Greenfield works or full secondary system installations)

This scenario considers works in TransGrid's secondary systems panels not associated with Greenfield works or full secondary system installations. This scenario could be a one off installation of a new 415VAC or DC system, multiple secondary system ARS projects or any other works required on TransGrid secondary system panels within TransGrid's substations. This scenario does not consider a single panel replacement, but rather a larger installation of multiple panels or equipment and assumes the time exposed to the hazards is greater than a month.

### Scenario 10 – Analysis

This scenario will always generally contain the requirement for LV AAs. These works may also involve some of the other hazards present in the Substation Brownfield Construction Risk Assessment. The length of time exposed to these hazards is taken into account and assumes that there are multiple instances of this work occurring at the site. Effective delineation of the work area is difficult to achieve due to the location of the works (usually within TransGrid 415V rooms, control buildings or ASBs). Hazards associated with access to these work areas cannot be aligned with the Substation Brownfield Construction Risk Assessment and TransGrid is unable to hand over operational control of these areas to the Contractor.

Familiarity with TransGrid's PSSR is a key factor in controlling the hazards present in this scenario due to the

### Scenario 10 Conclusion:

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 4.1
- Risk Rating: High



### 8.1.11 Scenario 11 – Greenfield Site Transfer to Brownfield Substation

No diagrams are presented in this scenario. This scenario considers the situation of a Greenfield substation build and its transition from a construction site to an operational, in-service substation.

#### Scenario 11 Analysis

#### Stage 1 – Greenfield Construction Site

At this stage the Contractor has full control over their construction site. TransGrid is involved providing commissioning assistance and planning the overall energisation sequence, liaising with Network Operations and providing advice to the contractor in regards to energisation.

- Principal Contractor: Contractor
- Site Manager Presence: As required by the project (not full time). Full time during the commissioning stage.

### Stage 2 – Site Becomes an Operational Substation

The Greenfield construction site at some stage will need to be connected to the network. At this stage the site then becomes an operational substation and all works must be in accordance with the PSSR.

This can occur a number of ways;

- 1. Connection of an existing earth grid to the new earthing system.
- 2. Connection of a conductor that is connected to the network at its remote end.

Generally most commissioning tests are completed under greenfield conditions, however if the site is progressively energised and placed on load (i.e. feeders placed on load sequentially over weeks or months) there is a need for HV and LV AAs. These AAs are low complexity and will be standalone in nature such that each AA is for a particular energisation of a bay.

Once the transition to an operational substation is completed the majority of the scope of the contractor is completed, construction works have ceased and the majority of the site hazards are no longer present.

At this stage it is considered that the Contractor is no longer the Principal Contractor rather that the site is handed over to TransGrid as the PCBU of the new operational substation. Essentially from this point onwards the energisation works are brownfield commissioning/energisation works and the hazards can be managed by TransGrid as the PCBU (i.e. by engaging a Contractor to complete the works on their behalf, but retain operational control).

TransGrid site presence is required at all times when an AA is required to ensure safe access to the network.

### Scenario 11 Conclusion:

Principal Contractor:

- Stage 1 Greenfield Construction: Contractor
- Stage 2 Site Operational (under PSSR): TransGrid is the PCBU (no requirement for a new WHSMP). A formal handover from the Contractor to TransGrid shall
  occur which details any of the remaining construction hazards present at this time.
- Risk Rating: Medium

#### Site Manager Presence:



- Stage 1 Greenfield Constriction: As required by the project (not full time). Full time Cat 5.2 during the commissioning stage.
- Stage 2 Full time Cat 4.1/5.2 (for electrical works), Cat 3.3 (for non-electrical works), Cat 5.5B (for bridging works)



### 8.1.12 Scenario 12 – New Comms Installation Work in Brownfield Substations

No diagrams are presented in this scenario. This scenario considers the following works in relation to comms:

- Running of new fibre cables outside TransGrid switchyard (including excavations)
- Running of new fibre cables inside TransGrid switchyard (including excavations)
- Installation of new hardware associated with new comms installations

### Scenario 12 Analysis

### Running of new fibre cables outside TransGrid switchyard (including excavations)

Running of new fibre cables outside a TransGrid switchyard is considered low risk due to the works involving only minor excavations outside the switchyard. An excavation permit is required to be implemented when excavations are on TransGrid property or if in the vicinity of the earth grid including the grading ring.

### Running of new fibre cables inside TransGrid switchyard (including excavations)

The running of new cables inside TransGrid switchyard presents hazards outlined in the Substation Brownfield Construction Risk Assessment such as excavations and earth grid. Both these hazards are most appropriately controlled by TransGrid personnel in this situation. Excavation permits and/or bridging of earthing is required to be implemented in this scenario.

### Installation of new hardware associated with new comms installations

The hazards present in this scenario are minimal and only concern LV AAs. The only AC present on these installations is power supply installations. For a small power supply installation the Contractor is suited to manage these hazards. There are no excavations or earth grid augmentations. The works are confined to the comms room which already has restricted access to Cat 3.3 trained personnel.

### Scenario 12 Conclusion

Principal Contractor:

- Running of new fibre cables outside TransGrid switchyard (including excavations) Contractor
- Running of new fibre cables inside TransGrid switchyard (including excavations) TransGrid
- Installation of new hardware associated with new comms installations Contractor
- Risk Rating: Medium

### Site Manager Presence:

- Running of new fibre cables outside TransGrid switchyard (including excavations) Full time Cat 3.3 if on TransGrid property or in vicinity of earth grid
- Running of new fibre cables inside TransGrid switchyard (including excavations) Full time Cat 3.3 (for non-electrical works), Cat 5.5B (for bridging works)
- Installation of new hardware associated with new comms installations Full time Cat 3.3 (for non-electrical works), Cat 5.5B (for bridging works)



### 8.1.13 Scenario 13 – LV Cabling Works

This scenario involves LV cable removal, installation and terminating within a brownfield site. This scenario is for cable works that are not covered by other scenarios.

### Scenario 13 Analysis

#### Installation of new Cabling

The risk is considered low if it is only new cabling installation. No HV/LV AAs are required for installation of new cabling. Therefore if the scenario involves installing of new cabling in cable trenches only then a contractor would be well placed to control the associated hazards. However the installation of new cabling does present electrical and operational hazards. Other live control, protection, AC and DC cables are present in trenches that have the potential to be damaged during installation of new cabling.

For cabling that requires new conduits and other associated civil works the introduction of the earth grid and excavation hazard means that TransGrid is best placed to control these hazards.

If the location of the cabling works is such that the whole area can be delineated, access to the work area is as per the Substation Brownfield Construction Risk Assessment and no civil works are required then the Contractor may be the PC.

### Removal of Redundant Cabling

Removal of old cabling presents similar risks to the installation of new cabling, apart from the excavations and earth grid. Typically the cables have to be positively identified, isolated, disconnected and tagged. This process involved TransGrid Cat 5.5 trained staff. At most TransGrid older substations the state of cable marshalling is very complex to unravel and a good knowledge of the TransGrid systems (DC rings, AC supplies, Prot and Control) and the PSSR is required to control these hazards adequately. Therefore TransGrid personnel are best placed to control this work and hence be the PC.

#### Termination of Cabling in Brownfield Panels

Terminating of cabling within brownfield panels requires a LV AA and typically LV isolations to be undertaken. This process is controlled by a TransGrid Cat 4.3 trained person. This work typically takes place within TransGrid operational control rooms or auxiliary service buildings (ASBs). TransGrid cannot eliminate the risks within these areas or hand operational control over to the Contractor.

If the terminations are on new equipment within a delineated area with access as per the Substation Brownfield Construction Risk Assessment and no AAs are required then the Contractor is suited to control these hazards and hence be the PC.

### **Scenario 13 Conclusion**

**Principal Contractor:** 

- Running of new cabling Contractor (if area is delineated, no excavations and access to the area is as per the Substation Brownfield Construction Risk Assessment) / TransGrid (otherwise)
- Removal of redundant cabling TransGrid
- Termination of new cabling TransGrid (for existing equipment or if inside existing control rooms or ASBs) / Contractor (for new equipment, within a delineated area, no excavations and access is as per Substation Brownfield Construction Risk Assessment)
- Risk Rating: Medium

#### Site Manager Presence:



- Running of new cabling Full time Cat 3.3
- Removal of redundant cabling Full time Cat 5.2
- Termination of new cabling Full time Cat 4.1



### 8.1.14 Scenario 14 – Security Equipment Installation

This scenario includes the installation of new CCTV systems, card readers, motion detectors and associated hardware/software at a brownfield substation.

### Scenario 14 Analysis

### **CCTV Installation and Motion Detector Systems**

The installation of new CCTV/motion detector systems involves works across the entire switchyard, making it difficult to delineate the area effectively. The works may involve excavations to run new cabling to the new equipment. Depending upon the positioning of the cameras the work may also involve HV AAs due to SAD to live equipment. The hardware is installed within TransGrid's control rooms or ASBs. TransGrid cannot hand over operational control to the Contractor. This scenario considers a major installation of new CCTV/motion detector systems meaning the Contractor will be on site for an extended time. Considering these factors TransGrid is best placed to manage the hazards on site and hence be the PC.

### **Card Reader Installation**

The installation of card reader systems involved works within TransGrid switchyard, buildings and car parks. Excavations may be required if new cabling is to be installed. The hardware is installed within TransGrid's control rooms or ASBs. The areas that works are undertaken presents challenges in effectively delineating the area or providing access in accordance with the Substation Brownfield Construction Risk Assessment. Considering these factors TransGrid is best placed to manage the hazards on site and hence be the PC.

### **Scenario 14 Conclusion**

- Principal Contractor: TransGrid
- Site Manager Presence: Full time Cat 3.3 (for non-electrical works), Cat 5.5B (for bridging works), Cat 5.2 (electrical works)
- Risk Rating: High

