High Voltage Systems
Safety Management Plan

Curtin University
Properties, Facilities & Development

Details of revisions			
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Contents

1 Introduction

Curtin University of Technology is a large consumer of electrical energy; its operations are 24/7, safety, reliability and quality of supply are paramount to its business. Curtin owns and operates an extensive High Voltage Network on its Bentley Campus, this network is supplied from the Western Power Bentley Zone Substation via four 22,000V dedicated feeds to the Curtin Terminal Substation at Building 156. The Western Power Bentley Zone Substation currently has a capacity of 70MW this capacity is potentially expandable to 105MW at Western Powers discretion, Curtin's current Maximum Demand on the Western Power Bentley Zone Substation is around 10.8 MW.

Curtin's High Voltage distribution network is robust in nature but flexible in its design and operation, this flexibility creates a high degree of complexity within the Curtin network. The network currently has two 22,000V and three 11,000V open rings feeding 21 area substations across the campus.

The complexity within Curtin's High Voltage network requires careful consideration regarding additions to the asset and in the day-to-day operational requirements. Any action in respect of the network must be considered in the wider context of the university and Western Power operations. In support of this need Western Power and Curtin University have a Customer Switching Agreement (CSA) in place that must be adhered to at all times. Failure to comply with the CSA can have serious consequences in terms of personal safety, reliability of supply and or the quality of supply to the campus.

This Safety Management Plan is intended to support Curtin's business and operational needs which relate to the High Voltage Network whilst ensuring compliance with current legislation, national industry guidelines (National Code of Practice) and the Western Power Customer Switching Agreement.

This Safety Management Plan covers basic safe access requirements for persons working on, near or in the Vicinity of High Voltage assets. For more detailed information, reference should be made to the legislation and industry guideline ENA NENS 04 2006 - 'NATIONAL GUIDELINES FOR SAFE APPROACH DISTANCES TO ELECTRICAL APPARATUS' and the Western Power Customer Switching Agreement (CSA) Curtin File Reference P72 686 9 1.

1.1 Scope

This Safety Management Plan has been prepared to ensure electrical safety in isolation practices and meet statutory requirements that govern work on or near high voltage assets by electrically trained personnel, whether alive, isolated and disconnected, out of commission or where the status of the equipment or asset is unknown.

The document has also been prepared so that damage to equipment should be avoided and to maintain continuity of supply by means of safe and efficient switching, isolation and restoration of power to electrical assets.

This Safety Management Plan is not intended to replace or alter any legal requirement or Australian Standard(s). It is intended to be used in addition to any such requirements or standards.

Whilst this Safety Management Plan is intended to cover high voltage assets it may also be applied to other operational voltages or high energy sources as applicable.

2 Definitions & Abbreviations

2.1 Definitions & Abbreviation Details

High Voltage Electrical Access Permit (AP)	A document which when issued in accordance with the Safe Access Procedures allows specified work on High Voltage Electrical Assets.
Approved	Approved means having appropriate organisation endorsement in writing for a specific function and approved by the Manager, Electrical Infrastructure or Nominee.
Authorised Person	Means a trained and competent person recognized by the Manager Electrical Infrastructure and has the documented authority to act on behalf of Curtin University and is authorized by the Manager Electrical Infrastructure or their delegated representative to take responsibility for and carry out specific High Voltage Switching functions.
Barriers	Barriers are a fixture indicating Safe Approach Distance(s). They may consist of natural boundaries, temporary erected structures or flagging, bunting or tape as appropriate to the work area.
Competent Person	Means a person possessing theoretical knowledge, practical skills, experience or a combination of all these to correctly perform the task required. Minimum selection criteria are identified in Section 3.
Curtin University	Curtin University of Technology
De-energised	Means not connected to any source of electrical supply but not necessarily isolated
Discharged	Electrical apparatus, which has been electrically connected to earth to remove any residual electrical energy.
Earthed	Means directly electrically connected to the general mass of earth so as to ensure and maintain the effective dissipation of electrical energy.
Electrical Apparatus	Means any electrical equipment, not limited to, but including underground cables, transformers, switchgear, electric motors, current transformers, voltage transformers and protection relays, the conductors of which are live or can be made live.
Employee	Means a worker engaged by Curtin University (whether under a contract of employment or apprenticeship) and includes a contractor or sub-contractor, and a person employed by a contractor or sub-contractor who carries out work for Curtin University.

Energised	Means connected to a source of electrical supply
Equipotential	Means that apparatus and equipment are kept at the same voltage potential
Hazard	Means a source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of all these
High Voltage (HV)	A voltage in excess of 1000 Volts AC or 1500 volts DC
High Voltage Enclosure	Means an area surrounded by fences, screens, walls or a cubicle to prevent access to exposed High Voltage conductors. Any entrances must be kept locked unless in immediate use. A High Voltage enclosure has DANGER HIGH VOLTAGE signs on all entrances and at intervals around the perimeter
High Voltage Operator	Means a trained and competent person authorised by the Manager Electrical Infrastructure and has the documented authority to act on behalf of Curtin University to take responsibility for / and carry out specific High Voltage switching functions.
Isolated	Means disconnected from all sources of electrical supply by means that will prevent unintentional energisation of apparatus.
Live	Means connected to a source of electrical supply or subject to hazardous induced or capacitive voltages.
Locked	Arranged so as to prevent any operation of electrical switches/apparatus and requires deliberate action with a key or tool to defeat the locked status.
Low Voltage (LV)	Means nominal voltage exceeding 50V AC / 120V DC but not exceeding 1000v AC / 1500v DC.
Off	Any operation of a circuit breaker, isolator, switch, link, dis-connector or the removal of approved earthing equipment, so as to break the associated electrical circuit.
On	Any operation of a circuit breaker, isolator, switch, link, dis-connector or the application of approved earthing equipment, so as to connect the associated electrical circuit.
Operational Agreement	Written Operational Agreement issued by Western Power stating the current condition of equipment and the safety precautions taken prior to handing over equipment to Curtin University
Recipient	A person carrying out work under an High Voltage Electrical Access Permit, High Voltage Electrical Vicinity Permit or High Voltage Sanction to Test Permit
Recipient Managing the Permit	A Recipient who is issued and takes charge of the Permit through the management of the site works and ensuring the Permit instructions are met by all recipients. This position may also be known as Recipient in Charge (RIC) within other organisations.
Safe	Means not posing an unacceptable risk to life, health or property
Safety Observer	A competent person whose sole duty is to observe and warn personnel against unsafe approach to live apparatus and other safety hazards while a worker or work party is engaged in their works.
High Voltage	A special form of permit allowing the livening of apparatus and / or

Sanction to Test Permit	the connection of test equipment, and other work on or near apparatus which does not comply with the conditions for the issue of an access permit.
Will or Shall	Throughout this procedure the word “Will or Shall” is to be interpreted as “mandatory”, unless an alternative course of action that achieves the same or better safety outcome is adopted
Should	Throughout this procedure the word “should” is used in an “advisory or discretionary sense”
Substation	Means a place where an electrical supply enters and can be Isolated or re directed, converted or transformed to other voltages weather in the High or Low voltage range
Switching Operation	Any action involved in de-energising, energising or earthing a portion of electrical apparatus in accordance with a prepared Switching Program
Switching Program	A chronological sequence of events which shall be followed to make changes to the status of the network or make specific electrical apparatus safe prior to work commencing; and/or during restoration of apparatus following completion of work
High Voltage Electrical Vicinity Permit (VP)	The form of authorisation which allows visual inspection of apparatus or work in the vicinity of high voltage electrical apparatus. It does not allow work on high voltage electrical apparatus
Voltage	Means a potential difference between conductors or between conductors and Earth

3 Roles and Responsibilities

There are six (6) classifications of personnel involved in switching operations:

- Switching Program Writer
- Switching Program Checker
- High Voltage Operator
- Safety Observer
- Recipient Managing the Permit
- Recipient

The responsibilities and minimum credentials for personnel performing aspects of work in relation to Curtin's High Voltage network are detailed below.

3.1 Recipient Managing the Permit and Recipient

3.1.1 Responsibilities

Recipient Managing the Permit

A Recipient Managing the Permit has additional responsibilities over and above those of a Recipient, in terms of working under a High Voltage Electrical Access Permit, High Voltage Vicinity Permit or High Voltage Sanction to Test Permit. These additional responsibilities are as follows:

- Has a clear understanding of the isolation points
- Has a clear understanding of all adjacent live points
- Completely understands the permitted area of access
- Has a clear understanding of where the earthing has been carried out and be satisfied that it is adequate
- Takes charge of the Permit and its ongoing site management
- Ensure that he or she signs onto the permit as the Recipient Managing the Permit and attaches a personal danger tag at all isolation and earthing points before the work under their control commences
- Ensure all Recipients operate within the constraints of the Permit

- Ensure that he or she relinquishes the permit where necessary and removes their personal Danger Tag(s) after completion of work and prior to leaving the site

Recipient

The Recipient carries out work under an Electrical Access Permit, Vicinity Permit or Sanction to Test Permit and is responsible for:

- Ensuring that he or she completely understands the permitted area of access
- Demonstrates an understanding of the isolation points
- Understands which are the adjacent live points
- Understands where the earthing has been carried out and be satisfied that it is adequate
- Ensure that he or she signs onto the permit
- Notify the Recipient Managing the permit prior to leaving site
- Check the current conditions or status of the permit with the Recipient Managing the Permit after his/her temporary absence and returning to the site
- Ensure that he/she wears appropriate personal protective equipment

3.1.2 Minimum Selection Criteria

The Recipient Managing the Permit:

- Shall demonstrate a clear understanding of the work to be performed
- Shall demonstrate a clear understanding of the environment in which they are operating including the associated hazards and risks within such areas
- Shall demonstrate sound communication skills with the High Voltage Operator to show a clear level of understanding of their responsibilities within the confines of the Permit
- Shall be sanctioned by a High Voltage Operator under the Permit to undertake the works within the confines of the Permit

3.2 Permits

The Recipient

- Shall demonstrate an understanding of the work to be performed
- Must be inducted
- Shall be fit for work
- Shall preferably be experienced in first aid and CPR
- Shall demonstrate an understanding of the danger around the working area
- Shall have qualifications and experience appropriate to the type of work being undertaken.
- Shall be sanctioned by a High Voltage Operator under the Permit

3.2.1 High Voltage Electrical Access Permit (AP)

Responsibilities

The Recipient Managing the Access Permit shall have the overall responsibility for the work party's safety under the terms of the High Voltage Electrical Access Permit and shall be known as the Recipient Managing the Permit

- Prior to the issue of the Electrical Access Permits, the Recipient Managing the Permit must:
  - Understand the apparatus to be covered under the permit and be satisfied that the permit meets the work party's safety and operational needs to perform their authorised task
  - Understand what is to be done, how it will be done and what equipment will be used
  - Be involved and contribute to the Safe Work Method Statement
  - Be broadly familiar with the experience of each member of the work party and be satisfied they can work safely within the limits of the Electrical Access Permits issued. Just prior to the issue of the Electrical Access Permit, discuss with the High Voltage Operator and reach agreement on all aspects relating to the work and the Permit being issued and in particular the earthing requirements. If this agreement is not reached, the Recipient Managing the Permit has a right and responsibility to reject the Access Permit being proposed to be issued
  - The conditions of the isolation and earthing detailed within the permit shall not be changed for the duration of the Permit
- At the issue of the Electrical Access Permit, the Recipient Managing the Permit must:
  - Be satisfied that all safety precautions that have been taken are satisfactory
  - Ensure that all Recipients understand and are satisfied with the safety precautions taken
  - Confirm any instruction given by the High Voltage Operator to the Safety Observers
  - Ensure any special request regarding additional isolation, earthing, fuse removal etc. are detailed in writing on the Access Permit prior to taking receipt of the Access Permit
  - Sign on the Access Permit as a Recipient Managing the Access Permit and apply their Danger Tags as appropriate
  - Ensure that all Recipients sign on to and off the Access Permit as required
  - Have checked all points of isolation. Particular consideration should be given to assets that are unearthed at the site of work i.e. underground cables
  - Ensure that any additional working earths are applied before any work commences and record them in the appropriate section of the Access Permit
  - Indicate to the work party the duration of the permit and when the Recipients may commence work

- During the currency of the Electrical Access Permit, the Recipient Managing the permit must:
  - Ensure that the Access Permit is displayed or accessible at the work site at all times during the periods of work
  - Ensure that appropriate personal protective equipment (PPE) is worn by all Recipients
  - Ensure that any additional Recipients engaged to work within the area defined by the Access Permit are signed on as Recipients prior to commencing work
  - In the case of additional Recipients or Recipients returning after a temporary absence, ensure that those Recipients are given full and complete instruction in respect of the permit limitations and the status of the work being carried out
  - Ensure that no Recipients leave the work area on completion of their work without signing off the Access Permit
  - Provide on request, a suitable Recipient to accompany visiting supervisory staff while inspecting the work
  - Ensure that in the event of a changeover of the Recipient Managing the Access Permit, that the outgoing Recipient Managing the Access Permit signs off the permit and explains the isolations and work status to the new Recipient Managing the Access Permit. The new Recipient Managing the Access Permit shall sign onto the permit and take responsibility for all Recipients
- Prior to cancellation of the Electrical Access Permit, the Recipient Managing the Access Permit shall:
  - Remove all working earths that were applied after the Access Permit was issued and record their removal in the appropriate section of the Access Permit
  - Inspect the work site for hazards in order to allow for safe restoration of assets after the permit cancellation
  - Ensure that all Recipients sign off the permit
  - Notify the High Voltage Operator responsible for the issue of the Access Permit with regard to any missing Recipients that have not signed off the Access Permit

<u>Minimum Selection Criteria</u>

The Recipient Managing the Access Permit must have:

- Electrical trade qualifications with 3 years' experience or proven suitable experience in the industry they are undertaking work in
- Familiarity of equipment covered by the Access Permit
- A positive interest in safety procedures
- Be assessed by a High Voltage Operator as meeting a satisfactory criteria to undertake the prescribed work
- Preferably have a Current Senior First Aid certificate with CPR training
- Demonstrated understanding of High Voltage isolation and access procedures

3.2.2 High Voltage Electrical Vicinity Permit (VP)

Responsibilities

The Recipient Managing the Vicinity Permit is responsible for ensuring the following:

- That all Recipients understand and are satisfied with the precautions taken and conditions of the permit
- All members of his or her work party are trained and fully capable of working safely
- In the case of additional Recipients, ensure that they are given full and complete instruction and sign onto the permit
- All Recipients are informed of any change in conditions under which the Recipients are working
- Ensure that no Recipients leave the work area on completion of their work without signing off the Vicinity Permit
- Notifying the High Voltage Operator that work has ceased, all personnel have left the work site and the permit is ready to be relinquished

Minimum Selection Criteria

The Recipient Managing the Vicinity Permit:

- Must be inducted
- Shall be fit for work
- Preferably have a Current Senior First Aid Certificate and CPR training
- Shall demonstrate an understanding of the hazards around the working area
- Shall have qualifications and experience appropriate to the type of work being undertaken
- Shall be sanctioned by a High Voltage Operator to undertake the intended works

3.2.3 High Voltage Sanction to Test Permit

Responsibilities

The Recipient Managing the Permit is the ‘Authorised Tester in Charge’ to whom a Sanction to Test Permit can be issued. The Recipient Managing the Permit is responsible for the following:

- Ensuring that all preceding Access Permits have been relinquished prior to accepting a Sanction to Test Permit
- Ensuring that isolation (including secondary isolation) and earthing has been carried out and is adequate for the safe performance of the intended work or tests
- Sign on the permit as the Authorised Tester in Charge and ensure that all Recipients sign onto the permit
- Ensure that any additional persons engaged in the work within the area defined by the permit are signed on as Recipients prior to commencing work

- Be responsible for the suitable placement of test barriers and signage for the protection of the work party and other employees around the test site
- Ensure that no Recipients leave the work area at or before the completion of the work without signing off the permit
- Ensure that adequate updated instruction or re-instruction is given to new Recipients or Recipients returning to the site after a temporary absence from the site
- Obtain permission from the High Voltage Operator if equipment is to be operated, earths are to be removed or additional earths are to be fitted, within the zone approved by the High Voltage Operator. This approval may be given in writing on the permit when it is first issued. (The issuing High Voltage Operator must ensure that the zone is isolated to allow for safe testing within the zone)
- Relinquishing the apparatus in the same condition in which it was received, whenever possible, or advising the High Voltage Operator and entering details of any changes on the 'relinquishment' section of the permit
- Ensuring that all Recipients sign off on the completion of the work/tests. Similar conditions apply as for the cancellation of an Access Permit
- Notifying the High Voltage Operator that work has ceased and all personnel have left the work site

  Note: The Tester in Charge has full responsibility of the work site during the test procedures.

Minimum Selection Criteria

- Trade or Tertiary qualifications
- Authorised to carry out High Voltage Testing if testing with voltages greater than 1000V AC/1500V DC are to be carried out
- Qualifications and or suitable experience in:
  - protection
  - fault finding; and/or
  - the testing and assets covered by the Sanction to Test Permit
- Positive involvement in safety practices and procedures
- Preferably have a Current Senior First Aid certificate with CPR training
- Demonstrated understanding of high voltage isolation and access procedures

3.3 High Voltage Operator

3.3.1 Responsibilities

- Maintain/update Single Line Diagrams status.
- Maintain/update network status on the master Single Line Diagrams drawing
- Good communication skills so as to liaise with other parties, regarding safety, roles and functions etc.

- Task assessment and preparation of Safe Work Method Statements.
- Preparation of Switching Program(s),
- Checking of Switching Programs written by other switching program writers
- Switching of High Voltage assets checked by others
- Application of Program Earths
- Prove de-energised
- Installing barriers where necessary, to clearly define the work zone
- Issue the following:
  - Vicinity Permit
  - Electrical Access Permit
  - Sanction to Test Permit
- Describe and where practicable, show the Recipient Managing the Permit the following:
  - Limits of the work zone
  - Isolating arrangements
  - Location of the applied programed earths and adjacent live points
- Cancellation of the Permit, first ensuring that all Recipients have been accounted for and that the Permit is relinquished by the Recipient Managing the Permit
- Inspection of High Voltage assets
- Reporting of malfunctions, damage or hazards
- Maintain and test Personal Protective Equipment (PPE)
- Authorising the Recipient(s) managing the Permit and Recipients through the permit process
- Approval of Safety Observers

3.3.2 Minimum Selection Criteria

- Trade or Tertiary qualifications with relevant experience in the electrical industry.
- Must have a high degree of familiarity and experience in the work being undertaken
- Must have successfully complete qualification requirements including:
  - Approved High Voltage Switching Course.
  - High Voltage equipment familiarity and thorough understanding of High Voltage networks and systems to be operated
- A positive involvement in safety practices and procedures.
- Preferably have a Current Senior First Aid Certificate with CPR training
- Thorough understanding of relevant codes, regulations and operating procedures

- Minimum of 3 years' experience in the areas of Switching as well as being fully conversant with the network being operated
- Be approved and authorised in writing by the Manager Electrical Infrastructure to Switch High Voltage Equipment at Curtin University

3.4 Safety Observer

3.4.1 Responsibilities

- Same as for Recipient
- Contribute to Safe Work Method Statement where required
- Observe and warn personnel against unsafe approach to live apparatus and other safety hazards

3.4.2 Minimum Selection Criteria

- Same as for Recipient

4 Procedure

4.1 General

No person shall approach any exposed, normally live conductor, except as provided in these procedures. Each person shall assure themselves of their own safety and the safety of those working under their direction by following the approved procedure for ensuring that conductors are Isolated and Earthed and an Electrical Access Permit is issued before work commences.

A failure of the supply does not render electrical apparatus safe to be worked upon without these measures being implemented. Approaching live conductors or electrical apparatus not confirmed as isolated shall be avoided at all times. Work shall not be performed on live High Voltage conductors.

For the purposes of these procedures, work of an operational nature such as opening or closing circuit breakers, switches, isolators or similar control devices shall not be regarded as work on live electrical apparatus.

4.1.1 Permission to Work

Permission to work upon or within the vicinity of any High Voltage electrical apparatus shall be obtained before any work is commenced.

Work in the vicinity of live electrical apparatus, but not requiring actual work to be performed on the apparatus, shall be carried out under an Electrical Vicinity Permit.

Work on electrical apparatus which can be unintentionally energised by a switching operation, or by any other means shall be carried out under an Electrical Access Permit.

Permission to work shall be authorised by means of the duly completed and issued Electrical Access Permit, Vicinity Permit or Sanction to Test Permit. Every person involved in the area of work shall be included in the authorisation.

The Electrical Access Permit, Vicinity Permit or Sanction to Test Permit shall include details of the work location and a clear and legible description of the electrical assets, which is the subject of the work to be performed. The work area, including adjacent live apparatus and hazards will be pointed out to ensure that such work can be safely performed. This will be the duty of the High Voltage Operator.

4.1.2 Safe Approach Distance

No part of a person’s body and no material or equipment not insulated for the voltage concerned must come closer than the following Safe Approach Distance for live exposed

electricity works specified as in Table 2 unless specific procedures approved by the High Voltage Operator, including barriers or live working techniques, are utilised.

Table 1 - Minimum Safe Approach Distances For Work Near Exposed Live High Voltage Equipment

Normal Voltage (U) - Distance (Volts)	Minimum Safe Working (mm)
From 1000 to 33,000	1000
From 33,000 to 66,000	2000

Note: The clearances referred to in Table 2 refer to people who have specialised training and authorisation to an appropriate level so as to perform work tasks in the vicinity of High Voltage apparatus

Table 2 - Minimum Distances For Working Near High Voltage cables

Normal Voltage (U) - Distance (Volts)	Minimum Safe Working (mm)
From 1000 to 33,000	3000 Excavators and Drilling
From 1000 to 33,000	500 for hand excavation

Note: The clearances referred to in Table 2 row 1 for Excavators and Drilling may be reduced if a Safe Work Method Statement is provided to the university and agreement is reached between both parties to ensure the safety and property protection matters are fully addressed to mitigate the risk associated with any works

4.1.3 Reporting of Hazards and Incidents

Incidents

All electrical incidents shall be immediately reported to the High Voltage Operator and or the Manager, Electrical Infrastructure

The above persons are then responsible to notify Western Power and Energy Safety of any incident that may have occurred

4.1.4 Cables

Before work on an insulated cable can commence:

- It must be positively identified at the work site
- Positive Identification shall be carried out by:
  - physically tracing the cable, through the use of cable plans showing cable route, and or
  - by an approved test method from a point of isolation
- A low voltage cable must be confirmed as low voltage or otherwise be treated as a High Voltage cable
- A High Voltage cable must be isolated and earthed

A cable which is thought to be faulty or which cannot be identified must be proved de-energised by the use of an approved spiking gun at the work site before it can be handled.

Precautions must be taken to avoid danger from induced voltages or transferred earth potential when working on or near insulated cables

Before excavating or digging appropriate Dig Permits must be in place and a check must be made to locate all underground cables and services, including services of other areas or organisations, in the vicinity of the works. All services must be clearly marked on the ground as well as shown on a scan of the area prior to any works commencing.

If working near live cables precautions must be taken to prevent disturbance of or damage to the cables. This may require a suitably trained person to closely supervise the work. Dig Permit limits must be maintained at all times.

High voltage cables may only be moved under the direction and supervision of a cable specialist and with the permission of the Manager, Electrical Infrastructure.

Each cable shall be positively identified in the presence of the High Voltage Operator.

A High Voltage cable must be isolated and earthed and an Access Permit issued before work commences on or adjacent to the cable.

4.1.5 Application of Isolation Tags

Each switch or isolator which is switched to the off position for the purpose of isolating electrical assets shall have an Isolation Tag attached. Furthermore,

Any earths either switched or of the portable type shall have an Isolation tag attached.

Isolation Tags shall be signed by the High Voltage Operator and shall include details of the Permit Number and a clear and legible description of the Asset to be worked on.

4.1.6 Repair or Replacement of Electrical Assets

Any cable tails exposed when electrical assets are removed for repair shall be shown to be dead by the visible application of shorting and earthing conductors bolted solid to cable terminals.

An ‘Out of Service’ Tag shall be fitted to the earthed cable tails of cables that are removed from service

Repaired or replaced electrical assets shall pass appropriate tests before being energised. Such tests shall be recorded and filed.

4.1.7 Testing Instruments

All test instruments used to test whether electrical apparatus is alive or de energised shall be proved to be in correct working order before and after each use.

Test instruments and test apparatus shall be tested and calibrated by an approved and qualified testing authority on a routine basis. Records of such tests shall be recorded and filed.

Familiarity with Installation

The High Voltage Operator shall maintain constant monitoring of the electrical network so as to verify the validity of the relevant single line system diagrams. Action shall be taken to have any discrepancies rectified as a matter of urgency.

Any discrepancies on the campus single line diagram shall be immediately reported to the Manager Electrical Infrastructure.

The High Voltage Operators shall maintain familiarity with the electrical assets which they have isolated and issued Access Permit(s) on.

The Recipient managing a Permit and Recipients shall maintain familiarity with the electrical assets on which they have been authorised under an Access Permit issued to them to work.

4.1.8 Operating Records

High Voltage Operators shall be responsible for maintaining a central file of:

- Completed switching programs
- Vicinity Permits
- Electrical Access Permits
- Sanction to Test Permits

The High Voltage Operator shall be responsible for the control of keys and any key box system that is in operation

4.1.9 Posting of Safety Observers

When deemed necessary by the High Voltage Operator or requested by the Recipient Managing the Permit a Safety Observer(s) shall be posted and a record made on the permit.

4.2 Personal Protective Equipment

All High Voltage switching of Ring Main or Primary Switchgear units requiring the switchgear to be faced during the switching process requires the following (in date) Safety Equipment to be worn:

- Safety Boots
- Cotton Trousers
- Approved and Appropriately Rated Switching Suit
- Safety Helmet
- Long Sleeved Cotton Shirts
- Approved Insulating Gloves
- Over Protection Leather Gloves

4.3 Switching Program

Prior to preparing a Switching Program, a notification may be submitted if necessary which takes into account all available information regarding the current status of the electrical assets concerned.

The Switching Program Writer shall clearly describe the intent of the Switching Program in the title of the Switching Program.

The Switching Program Writer shall clearly describe each step necessary to make dead specific electrical apparatus and shall include details of the equipment, its location and identification and the switching operation required. The program shall be written in such a manner that the required switching operation causes the minimum disruption to the university electrical networks.

The switching program may be prepared by either a Switching Program Writer or the High Voltage Operator.

A switching program shall be checked by another Switching Program Writer, from time to time a Switching Program may also be counter checked by the Manager, Electrical Infrastructure.

A Switching Program may only be executed once approved by the checker. If the execution of the Switching Program is not immediately after its approval, then a re-approval may be required if the network configuration has changed since the initial program was written.

Any difficulties encountered in carrying out a Switching Program, and where safe, possible and practical to do so, shall be rectified by the High Voltage Operator.

All difficulties in the exercising of a Switching Program shall be reported to the Manager Electrical Infrastructure. Any program changes shall be noted on the file copy of the Switching Program and must be checked by an authorised person prior to any modified Switching actions being undertaken.

The time that each step, as detailed on the switching program, is performed, shall be written into the appropriate column on the Switching Program.

A switching program may be filed as a Master Switching Program. For specific switching circumstances a Master Program may be repeated. However, prior to the approval of a Master Program, the network conditions shall be verified as being consistent with the program steps and shall be approved for use on such occasion by the Switching Program Writer and the High Voltage Operator.

4.4 Switching Operations

4.4.1 Isolating

Switching operations shall be carried out only in accordance with the prepared switching program.

After switching, the correct operation of the switch or isolator shall, where practicable, be visually confirmed. The electrical asset shall, be tested with approved testing instruments to prove that the electrical apparatus is de energised.

Switches and isolators operated to de-energise electrical apparatus shall be securely locked in the off position.

Isolation Tags shall be placed on each switch or isolator.

When electrical assets are equipped with remote or automatic operation, the control circuits shall be rendered inoperative and Isolation Tags attached

4.4.2 Earthing - General

Earthing is the short circuiting and connecting of the conductors of electrical assets to the system earth (or general mass of earth) using an approved earthing device in a way that ensures and maintains an effective discharge of electrical energy.

Under no circumstances shall the neutral or earth of a low voltage distribution system be used, or be regarded, as a suitable electrode.

Earths must be placed so that there is an earth between the point of work and each possible source of supply.

Earthing equipment must be able to carry the maximum fault current for the backup protection clearing time at the earthing point.

Earthing equipment shall only be connected after the electrical apparatus has been proved to be de-energised by approved test equipment and after the test instrument has been proved to operate correctly. The earth must then be immediately applied.

Earths must be placed so that they will remain effective during the course of the work and not be disturbed by the work to be carried out.

An equipment Isolation Tag must be attached to each earth after the earth application and removed following the removal of the earth and prior to restoration.

Program Earths

Must only be applied or removed by the High Voltage Operator.

Program Earths must be applied between the apparatus to be worked on and the points of isolation and as close as practical to the site of the work

For access to busbars, earths must be applied adjacent to and on either side of the part of the busbar being worked on. This means that working earths would not be generally required unless part of the busbar will become disconnected from the programed earths during the work. For access to short sections of busbar, a single earth applied adjacent to the point of access is sufficient. All programmed earths must be applied prior to issuing an Electrical Access Permit or Sanction to Test Permit.

Working Earths

Must only be applied or removed by the Recipient Managing the Permit. They must be applied at the site of the work if a program earth is not in clear view of the recipients, or on both sides of the break such that apparatus to be worked on always remains earthed. If it is not possible to place a working earth in clear view of the Recipients, it must be placed as close as practical to the work site. In this case the asset must be proved de energised and connected to the system earth immediately before work starts. A Safety Observer or Recipient locks may be used if security of the working earth is in doubt.

Whenever practicable, earthing shall be accomplished by the use of the equipment integral earthing switches. These earthing switches shall be locked in position and Equipment Isolation tags shall be placed as specified in Section 4.1.5.

Approved earthing equipment shall be used to short circuit and earth all conductors where integral earthing switches are not incorporated.

Approved portable earthing equipment shall first be connected to a High Voltage earthing system or to an earth electrode driven for this purpose, before connection to de-energised conductors.

The Recipient Managing the Permit is responsible for the application and removal of all working earths on the work site, which may be applied after the issue of the Electrical Access Permit but shall be removed prior to the rescinding of the Electrical Access Permit.

4.4.3 Earthing Removal

Earthing equipment detailed in the Switching Program, shall only be removed under the supervision of a High Voltage Operator.

Portable earthing equipment shall be first disconnected from the conductors before being disconnected from the earthing system.

4.4.4 Energising

Switching operations on high voltage electrical apparatus shall only be performed under the direct control of a High Voltage Operator

The High Voltage Operator shall ensure that the electrical asset is clear and ready for energising and that any associated Electrical Access Permits, Vicinity Permits, or Sanction to Test Permits have been cancelled in accordance with procedures

Switching operations necessary to energise the electrical assets shall be carried out in accordance with the Switching Program(s)

If any electrical assets become de-energised due to automatic opening or other cause(s) it must be assumed by all personnel that it may immediately be re-energised by the automatic or manual re-closure of a switch

4.5 Permits

There are three permit types described in this document:

- High Voltage Electrical Vicinity Permit (VP)
- High Voltage Electrical Access Permit (AP)
- High Voltage Sanction to Test Permit

Each of these permits are equivalent to Clearance Certificates as defined under the procedures in this Safety Management Plan. These permits are required to function as a hand over and hand back permit process

4.5.1 Vicinity Permit

Before approaching or commencing work within the vicinity of any High Voltage electrical assets the following shall be observed:

- A High Voltage Vicinity Permit shall be issued by the High Voltage Operator.
- The High Voltage Operator shall ensure that the Recipient Managing the Permit is advised of the limits of the safe working area and of any danger points.
- All Recipients shall satisfy themselves concerning earthing or other precautions taken, the location of the points of supply and the proximity of any adjacent live conductors.
- Where possible, the area that is alive must be clearly defined by the use of barriers
- The High Voltage Operator may request the appointment of a Safety Observer(s) where necessary
- Prior to the commencement of work, the High Voltage Operator shall ensure that wherever practical, the safe working area is defined by barriers, together with warning signs indicating the area and nature of the danger

4.5.2 Electrical Access Permit

<u>High Voltage Access Permit - Issuing</u>

A High Voltage Operator shall issue and cancel all Electrical Access Permits.

Multiple working parties shall be under the overall control of the High Voltage Operator who shall be responsible for co-ordination of the work to ensure the actions of one working party does not endanger other working parties.

The High Voltage Operator issuing Electrical Access Permits to multiple working parties shall ensure that references to other overlapping permits are made on each permit.

The High Voltage Operator shall describe and indicate the isolation and earthing arrangements made to the electrical apparatus described in the Electrical Access Permit to all initial Recipients that are engaged in the work.

Having completed sections ‘A’, ‘B’ and ‘C’ of the Electrical Access Permit the High Voltage Operator shall issue the permit to a Recipient Managing the permit who shall sign on the Permit in section ‘C’. The Recipient Managing the Permit may only sign onto one permit at any one time.

Any Recipient may request that additional precautions be taken during the course of work and they shall be advised of this right prior to the commencement of work by the High Voltage Operator and the Recipient Managing the Permit.

Working earths may only be applied within the safe working zone as directed by the Recipient Managing the Permit and shall be recorded in Section ‘C’ of the Electrical Access Permit.

Recipients who have been absent from a particular work site during the currency of an Electrical Access Permit shall, upon their return, report to the Recipient Managing the Permit and obtain confirmation of the status of the electrical asset covered by the permit prior to commencing works on the asset.

If at the point of issue of the permit, a Recipient or Recipient Managing the Permit request additional isolation or earthing measures, then the High Voltage Operator shall accommodate these requirements after seeking approval from the Manager Electrical Infrastructure then a re issue of the Access Permit shall occur.

Working Alone

To work alone under a permit in the vicinity of exposed live high voltage apparatus or other similar sources of danger is forbidden. A person must be accompanied by another member of the work party or be under the observation of another Recipient or the High Voltage Operator.

High Voltage Access Permit - Cancelling

As various stages of the work are completed, the Recipient Managing the Permit shall advise those Recipients that are not required to carry out any further work that the electrical asset is no longer to be considered dead.

These recipients are to then sign off in column ‘B’ of section ‘C’ of the Electrical Access Permit and leave the working area.

The Recipient Managing the Permit shall ensure that any working earths which may have been connected as specified in Section ‘C’ are disconnected and removed. The number of working earths removed shall be recorded in section ‘C’ of the Electrical Access Permit.

If, due to exceptional circumstances, it is not practical for a Recipient to sign off from the Electrical Access Permit, the Recipient Managing the Permit will need to obtain authorisation from the Manager Electrical Infrastructure or his delegated representative before signing off in their absence. The High Voltage Operator shall ensure that the Recipient Managing the Permit has taken adequate precautions to prevent such a Recipient from making any further approach to the electrical asset. The Recipient Managing the Permit shall record the details of the absent Recipient and measures that were taken to establish contact and prove absence from site.

The Recipient Managing the Permit shall relinquish the Electrical Access Permit by signing off in Section ‘C’ and promptly passing the Electrical Access Permit on to the High Voltage Operator.

The High Voltage Operator shall ensure, by personal inspection or, where this is not possible, by information obtained from the Recipient Managing the Permit that the electrical asset is clear of personnel. The High Voltage Operator shall then cancel the Electrical Access Permit.

4.5.3 Sanction to Test Permit

All testing shall be authorised by the High Voltage Operator who will need to be satisfied that all necessary safety precautions have been observed. Before any test is performed a Sanction to Test Permit shall be issued to the Authorised Tester in Charge who will receive the permit in Section ‘C’.

All associated outstanding Vicinity Permits and Access Permits will be cancelled prior to issuing a Sanction to Test permit. If switching is required to set up the asset for testing, then the High Voltage Operations shall form part of the switching program.

The Sanction to Test Permit shall be issued by the High Voltage Operator responsible for the switching. Each person involved in the testing must sign on to the Sanction to Test Permit in

column ‘A’, Section ‘D’ before commencing the test and sign off on completion of the tests in column ‘B’, Section ‘D’.

The Sanction to Test Permit may allow any work on primary or secondary switchgear required in order to perform the tests.

4.5.4 Operational Agreement

Is a written Operational Agreement issued by Western Power to a Curtin High Voltage Switching Operator stating the current condition of Western Power asset(s) feeding Curtin University High Voltage asset(s). Its purpose is to inform Curtin of the Western Power asset status and restrict the Western Power asset(s) operation until such time that Curtin work(s) on Curtin’s asset(s) has been completed and the Operational Agreement is cancelled.

4.5.5 Record Keeping

A record of all Permits shall be kept in a safe and secure area by the High Voltage Operator

4.6 Telephone Communications.

Approval of switching programs may be conducted by a Phone Call or SMS.

Switching operations or instructions may be issued by telephone in accordance with an approved Switching Program. High Voltage Operators are authorised to issue and follow switching instructions by telephone e.g. switching program communications with Western Power Network Operations Control Centre (NOCC).

4.7 Safe Access Procedures and other Organisations

4.7.1 Control of Work

In all cases where other organisations are involved, special care must be taken to ensure that differences in procedures are explained and understood by all persons.

Persons from other organisations working in operational areas under Curtin control must work under safe access procedures and be supported by associated operational documentation. If another organisation for whatever reason considers the precautions taken may be inadequate, they may request additional precautions to be taken.

If Curtin employees are to work in areas under the operational control of another organisation, they must work in accordance with the safety procedures. If the precautions are considered to be inadequate, additional safety precautions must be taken before work proceeds.

4.7.2 Emergency Work

In special circumstances or emergencies, and where it is safe to do so, Curtin may allow:

Persons from other organisations to work under their own safety procedures and under the direction of their own officers in operational areas under the control of Curtin.

5 References & Related Documents

The following documents contain useful reference material when considering this procedure:

- Guideline for Personnel Protective Equipment used in High Voltage Switching Operations
- Guidelines for Electricity Transmission and Distribution Work in Western Australia
- General Duty of Care in Western Australian Workplaces
- Electricity Act 1945
- Electricity Act Regulations 1947
- Electricity (Licensing) Regulations 1991
- Occupational Safety and Health Act 1984
- Occupational Safety and Health Regulations 1996
- Safe Management of High Voltage Electrical Installations Government of Western Australia Department of Commerce Energy Safety
- Australian and (in the absence of Australian Standards), International Standards
- AS 2067 Substations and high voltage installations exceeding 1 kV a.c.
- AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- National Guidelines for Safe Approach Distances to Electrical & Mechanical Apparatus - ENA, NENS 04 - 2006
- Code of Practice - Guidelines for design and Maintenance of Overhead Distribution and Transmission ESAA C (b) 1
- W.A. Electrical Requirements (WAER)
- Western Power, Electrical System Safety Rules (ESSR)
- Western Power Customer Switching Agreement (CSA) Curtin File Reference P72 686 9 1

6 Appendix A - High Voltage Electrical Access Permit

7 Appendix B - High Voltage Electrical Vicinity Permit

8 Appendix C - Sanction to Test Permit