Ministry of Commerce, Industry and Labour
Matagaluega o Pisinisi, Alamanuia ma Leipa

Occupational Safety and Health Guide

"Managing Electrical Risks in the workplace".

ACKNOWLEDGEMENT

In the ongoing efforts of the Government of Samoa through the Ministry of Commerce Industry and Labour *('MCIL')* and the Samoa National Occupational Safety and Health Taskforce *('NOSH'*) to raise the profile of Occupational Safety and Health *('OSH')* nationally, this Guideline was developing to support the business community in particularly employers and employees in complying with requirements of OSH Legislation.

In that regard, MCIL would like to recognise and acknowledge the financial support of the Government of Australia through the Samoa Governance Support Program who have made this project becomes a reality.

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Last but not the least, the following key stakeholders who have been involved in the development of this Guideline and have contributed immensely their time, feedback and advice on the compilation of this document.

Government Representatives;

- Central Bank of Samoa
- National University of Samoa
- Electric Power Corporation

Private Sector Representatives:

- G.Y Electrical Services
- BC Electrical Services
- All Electrical Services
- WECS International
- M.I.E Electrical Services

This Guide was developed using guidance from both the Australian Model Code of Practice for Managing Electrical Risks and the New Zealand Electrical Risks Compliance Code contextualise to the Samoa content.

Disclaimer:

- *MCIL has made every effort to ensure that the information in this Guide is reliable but makes no guarantee as to its completeness.*
- *Note this guide may be changed at any time without notice.*

Contents

Key Definitions

Best Practice Approach refers to suggested actions which currently go beyond specific legal obligations pursuant to the Occupational Health and Safety Act, 2002 and the Occupational Health and Safety Regulations, 2017.

Commissioner means the Commissioner of Labour, or a person lawfully acting in the role of the Commissioner

Competent person, for electrical work on energised electrical equipment or energised electrical installations a licensed or registered electrician under the Electricity Act (2010)

De-energised means separated from all sources of supply but not necessarily isolated, earthed, discharged or out of commission.

Duty holder A person, either an individual and includes a body of persons corporate or non-corporate who holds a legal obligation under the Occupational Health and Safety Act, 2002 and the Occupational Health and Safety Regulations, 2017.

Electrical equipment any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that:

is used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra-low voltage

is operated by electricity at a voltage greater than extra-low voltage

is part of an electrical installation located in an area in which the atmosphere presents a risk to health and safety from fire or explosion, or

Electrical equipment does not include any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that is part of a motor car or motorcycle if:

the equipment is part of a unit of the vehicle that provides propulsion for the vehicle,

the electricity source for the equipment is a unit of the vehicle that provides propulsion for the vehicle

Electrical installation any electrical wiring, accessory, fitting, consuming device, control or protective gear, or other equipment associated with wiring situated in or on a workplace

Electrical work connecting electricity supply wiring to electrical equipment or disconnecting electricity supply wiring from electrical equipment. Installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment or an electrical installation.

Electrical work does not include:

- work that involves connecting electrical equipment to an electricity supply by means of a flexible cord plug and socket outlet
- work on a non-electrical component of electrical equipment if the person carrying out the work is not exposed to an electrical risk
- replacing electrical equipment or a component of electrical equipment if that task can be safely performed by a person who does not have expertise in carrying out electrical work (e.g. replacing domestic fuses or light bulbs)
- assembling, making, modifying or repairing electrical equipment as part of a manufacturing process

- building or repairing ducts, conduits or troughs where electrical wiring is or will be installed if:
- the ducts, conduits or troughs are not intended to be earthed
- the wiring is not energised, and
- the work is supervised by a licensed or registered electrical worker
- locating or mounting electrical equipment, or fixing electrical equipment in place, if this task is not performed in relation to the connection of electrical equipment to an electricity supply
- assisting a licensed electrician to carry out electrical work if:
- the assistant is directly supervised by the licensed electrician, and
- the assistance does not involve physical contact with any energised electrical equipment
- carrying out electrical work, other than work on energised electrical equipment, in order to meet eligibility requirements in relation to becoming a licensed electrician.

Energised (live) means connected to a source of electrical supply or subject to hazardous induced or capacitive voltages.

Isolated means disconnected from all possible sources of electricity supply and rendered incapable of being made energised without premeditated and deliberate action.

Residual current device (RCD) means a device intended to isolate supply to protected circuits, socket outlets or electrical equipment in the event of a current flow to earth that exceeds a predetermined value. The RCD may be fixed or portable.

Reasonably practicable A requirement upon duty holders to do what they are reasonably able to do. It requires the duty holder to decide is it REASONABLE in the circumstances to do ALL that is possible or given the circumstances is it REASONABLE to do LESS based on consideration of

a) the likelihood of the hazard or the risk concerned occurring
b) the degree of harm that might result from the hazard or the risk
c) what the person concerned knows, or ought reasonably to know, about the hazard or risk, and ways of eliminating or minimising the risk
d) the availability and suitability of ways to eliminate or minimise the risk, and
e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

Socket outlet is a device for detachably connecting electrically operated equipment to a power supply. The term 'socket outlet' includes a cord-extension socket attached to a flexible cord that is permanently connected to installation wiring.

Step-touch hazard, the potential for electrical voltage to move between the ground or a conductive item whereby voltage can injure a person nearby

Transitional Period A specified period of time in which duty holders are given time to ensure compliance with the law, during which the law will not be enforced with any deterrent penalty. The transitional period is 1st January 2022.

Scope and Aim of this Guide

This guide is intended for duty holders under the Occupational Safety and Health Act, 2002 (the OSH Act) and Occupational Safety and Health Regulations, 2017 (the OSH Regulations) and provides guidance on what is required to comply with their duties under this legislation.

In addition, this guide provides supplemental information for a '**best practice approach**'* for the management of risks associated with hazardous substances used, handled or stored in Samoan workplaces. Although the best practice approach **may go beyond a strictly legal obligation**, duty holders are encouraged to work towards best practice. It is anticipated that future regulatory changes to Samoan OSH law will reflect aspects of 'best practice approach' found in this guide.

This Guide is broken into two parts-

Part 1 General Electrical Hazards in a workplace,

Part 11 Specific Electrical Hazards.

In addition, this Guide provides supplemental information of a '**best practice approach**'* for the management of risks associated with hazardous substances used, handled or stored in Samoan workplaces. Although the best practice approach **may go beyond a strictly legal obligation**, duty holders are encouraged to work towards best practice. It is anticipated that future regulatory changes to Samoan OSH law will reflect aspects of the 'best practice approach' found in this Guide.

A key duty holder is the employer. However, the law provides that designers, manufacturers, and suppliers of electrical equipment and installations in Samoa also have legal obligations. The prime focus on this guide is to assist employers to manage electrical safety in the workplace, so far as is reasonably practicable. In addition, sections, 1.2 and 1.3 outline the legal obligations and best practice approach for manufacturers, suppliers and importers regarding their legal obligations for electrical equipment and installations in the workplace.

To identify which are **current legal obligations**, compared to those which are **suggested best practice**, the following symbols are used.

*Denoted with the symbol:

current mandatory legal obligations, duty holder must ensure they comply

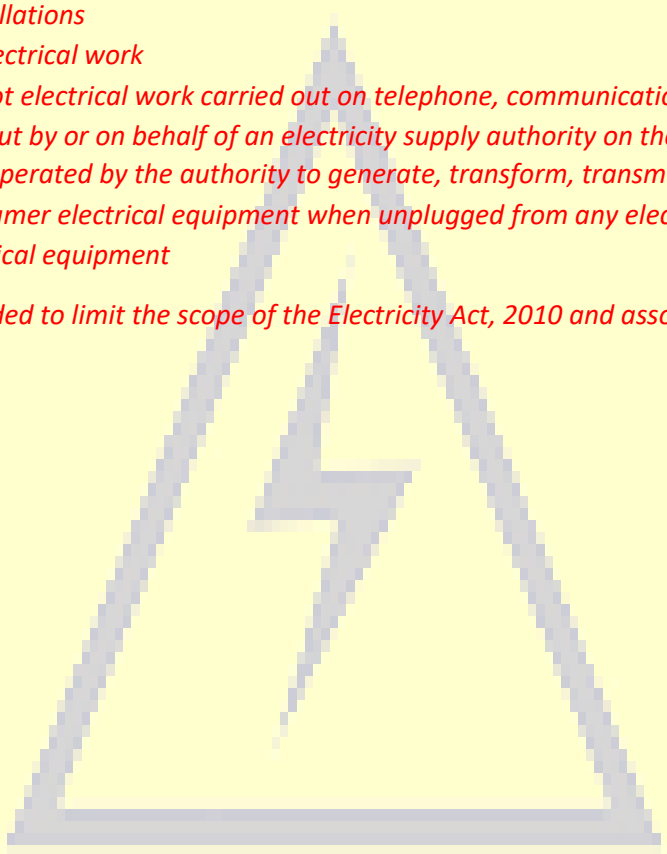
recommended best practice approach, a recommended approach

Exclusions

This Code does not apply to:

- *electrical work on extra-low voltage electrical equipment, including extra-low voltage electrical installations*
- *automotive electrical work*
- *work that is not electrical work carried out on telephone, communication and data systems*
- *work carried out by or on behalf of an electricity supply authority on the electrical equipment controlled or operated by the authority to generate, transform, transmit or supply electricity*
- *repair of consumer electrical equipment when unplugged from any electrical socket outlet.*
- *Medical electrical equipment*

This guide is not intended to limit the scope of the Electricity Act, 2010 and associated regulations in any way.



1.0 Introduction

This guide provides information on how to ensure compliance with the current Samoan law regarding:

- Managing general risks created by electricity in the workplace, and
- Managing specific risks which may occur when working directly on or near energized electrical equipment or installations.

This guide focuses on the **employer's duty** to ensure employees and the workplace are free, **so far as is reasonably practicable**, from risks to safety and health associated with electricity.

This guide also includes the **duties of designers, manufacturers and suppliers** of electrical equipment or installations.

This guide does not limit the obligations imposed by the Electricity Act 2010 (and associated Regulations). The Electricity Act 2010 and associated regulations also creates legal obligations which should be read in conjunction with this guide.

1.1 What kind of risks do electrical hazards pose in the workplace?

Electrical risks can be caused either directly or indirectly by electrical hazards.

Common electrical risks in workplaces include:

- **electric shock** causing injury or death, directly touching an energised part, indirect contact due to equipment fault which energises a conductive part and arcing. Electric shock may cause burns, damage to internal organs, unconsciousness and may cause a worker to falls, injuring them further,
- **arcing, explosion,**
- **electric shock from 'step-and-touch'** potentials, e.g. voltage flow through the ground or through another device into the worker,
- **toxic gas release** causing illness or death. Burning and arcing associated with electrical equipment may release various gases and contaminants,
- **fire** resulting from an electrical fault.

1.2 Who has safety and health obligations to employees and workplaces? Employers and Designers, Manufacturers and Supplies

Under both the OSH Act and OSH Regulations employers, as well as designers, manufacturers and suppliers have legal obligations surrounding the management of electrical risks.

OSH Act Part 3 General Duties of Care, Section 11

General duty of employers to employees:

An employer must take all reasonably practicable steps to protect the safety, health and welfare, at work of employees and to provide and maintain a safe and healthy work environment including;

substances,

systems of work,

and,

any building or public or private area in which work takes place.

Current law requires the employer to take 'reasonably practicable' steps to protect the safety, health and welfare of employees, in the context of electrical safety this includes developing safe systems of work (safe operating procedures). The employer's decision on what is 'reasonably practical' is discussed in detail in section 5.1, hazard control.

OSH Act 2002, Section 19:

Duty of <u>designers, manufacturers and suppliers</u>-

A person who designs, manufacturers or supplies any article, or substance or machinery for use at a place of work, shall:

a) **ensure so far as is reasonable that the article, substance or machinery is so designed and constructed and manufactured as to be safe and without risk to health and safety when it is used properly and under relevant information or advice relating to its use which has been provided by the designer, manufacture or supplier**
b) **take any steps as are necessary to ensure the provision of adequate information in the English and Samoan language to purchasers and users about the use of which the article, substance or machinery has been designed and about any requirements necessary to ensure that it will be safe and without risk to health and safety when properly used**

Current law requires designers, manufacturers or suppliers, in the context of electrical equipment and installations to ensure 'so far as is reasonable' that the equipment is safe when properly used and requires adequate safety information to be supplied about use.

2.0 Step One of the Hazard Management Process- Identify Hazards

The hazard management process is a five step approach to managing risk in the workplace for legal compliance. Figure 1, below outlines the steps for legal compliance, namely:

- identify which workers are at **risk of exposure to electrical hazards**
- determine what **tasks, situations and sequence of events** that could cause harm
- evaluate the hazards**, assess** the risk
- identify and decide what kind of **control measures** should be implemented,
- implement
- record, monitor and review to **check the effectiveness** of existing control measures

Note that penalties may apply if this process is not undertaken.

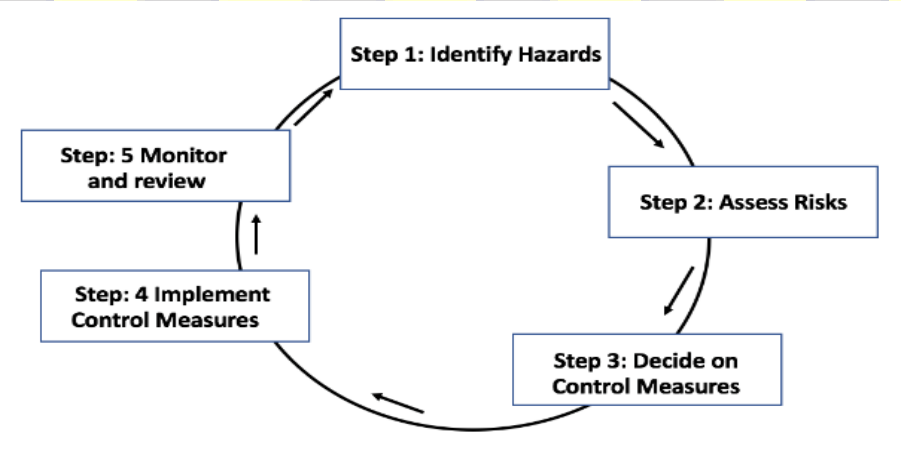


Figure 1 hazard management process steps

OSH Act Part 3 General Duties of Care, Section 11

General duty of <u>employers</u> to employees:

An employer must take all reasonably practicable steps to protect the safety, health and welfare, at work of employees and to provide and maintain a safe and healthy work environment including;

substances,

systems of work,

and,

any building or public or private area in which work takes place.

OSH Act Part 3 General Duties of Care, Section 12:

An employer must establish and maintain effective methods for:

a) **systematically identifying existing and potential hazards to employees:**
b) **systematically identifying at the earliest practicable time, new hazards to employees,**
c) **regularly assessing the extent to which a hazard poses a risk to employees**

(2) The methods may include but not necessarily be limited to self-inspection and hazard identification process approved by the Commissioner and notified or published in the Savali, and shall be carried out in cooperation with workplace representatives and Committees…

OSH Regulations Part 11 Regulation 3 Hazards and Risk Assessments:

(3) Hazard identification and risk assessment

1. **An employer must ensure that appropriate steps are taken to identify all reasonably foreseeable hazards arising from work which may affect the health or safety of employees or other persons in the workplace**

2. **If a hazard is identified under sub regulation (1), an employer must ensure that an assessment is made of the risk associated with the hazard**
3. **In carrying out an assessment under sub regulation (2) an employer must, as far as reasonably practicable, determine a method of assessment that adequately addresses the hazard identified, including one or more of the following:**
    a) **a visual inspection**
    b) **auditing**
    c) **testing**
    d) **technical or scientific evaluation**
    e) **an analysis of injury or near miss data;**
    f) **discussions with designers, manufacturers, suppliers, employers or other relevant parties**
    g) **a quantitative analysis**
4. **Without limiting sub regulations (1) and (2) the identification of hazards and the assessment of associated risks must be undertaken:**

    before the introduction of any plant or substance;

    or

    before the introduction of a work practice or procedure; or

    before changing the workplace, a work or work practice, or an activity or process, where to do so may give risk to a risk to health or safety.
5. **An employer who contravenes this regulation commits an offence and is liable on conviction:**

    (a) For a corporation, to a fine not exceeding 1000 penalty units; and

    (b) For any other case, 100 penalty units.

Regulation 34 General Requirements for hazard identification at the workplace; An employer must ensure:

(1) that any electrical hazard at the workplace is identified and assessed by a competent person; and
(2) that any risks to health or safety arising out of an electrical hazard identified under paragraph (a) are eliminated, or minimised and controlled in a reasonably time and manner.

Current law, in the context of electrical hazards, requires employers to have a PLAN to identify electrical hazards in the workplace both generally and when working with electricity, and regularly assess the risk and taking all *reasonably practicable steps* to protect the health and safety of persons by controlling exposure to electrical hazards.

*Note identification and assessment must be undertaken by a 'competent person'.


A similar requirement exists for Designers, Manufacturers and Suppliers. The focus of this guide, however, is on the employer's obligations in workplaces.


It is also a legal requirement that the inspection and risk assessment process should be carried out with the co-operation of workplace safety and health representatives and committees.


Even if a workplace does not have safety and health representatives or committees it is good practice to involve employees when identifying and assessing hazards

2.1 Typical hazards arising from electrical equipment or installations

Hazards from electrical equipment or installations may arise from:

- the design, construction, installation, maintenance and testing of electrical equipment or electrical installations
- design change or modification
- inadequate or inactive electrical protection (e.g. circuits, residual currency devices)
- **operating conditions** that are likely to result in damage to the equipment or a reduction in its expected life span, greater risk of damage if used outdoors or in a factory or workshop environment
- electrical equipment being used in an area in which the atmosphere presents a risk to health and safety from fire or explosion, for example confined spaces
- type of electrical equipment. For example, 'plug in' electrical equipment that may be moved around from site to site, including extension leads, are particularly liable to damage
- the age of electrical equipment and electrical installations
- work carried out on or near electrical equipment or electrical installations, including electric overhead lines or underground electric services, for example work carried out in a confined space connected to plant or services.

2.2 Methods for identifying electrical hazards in the workplace

a) Consulting with workers and their representatives
b) Observing how electrical equipment is used
c) Seeking advice and assistance from a competent person
d) Regular inspection and testing
e) Reviewing manufacturer designer or supplier instructions regarding equipment usage and testing
f) Reviewing incident reports

3.0 Step Two of the Hazard Management Process- Assess the risk

Assess risks—understand the nature of the harm that could be caused by the hazard, how **serious** the harm (consequence) could be and the **likelihood** of it happening to determine the level of risk and prioritise the required action.

A risk assessment can help determine:

- the severity of an electrical risk
- deciding whether existing control measures are effective and based on legal requirements and manufacturers, designers or supplier recommendations
- what action you should take to further control the electrical risk
- how urgently the action needs to be taken

A risk assessment should also consider foreseeable failures or unexpected occurrences or rare events which could create new hazards from the electrical equipment or installation, for example:

- water/liquid spills could create a 'step and touch' risk
- sharp equipment or constant movement could break insulation

Planning a risk assessment

Dividing up the workplace- If a workplace is really large use floor plans, or buildings or rooms and to break up the task.

Create a register- of all electrical equipment including the location, when purchased, when testing is required

Sourcing other information—The law requires employers to keep a record of accident/incident in the workplace. These can be reviewed to see electrical hazards have been involved in any incidents or accidents.

Ensuring a '**competent person**', undertakes the risk assessment. Depending on **the nature** of the hazard an assessment of risk may need to be undertaken by a person licensed under the Electricity Act, 2010.

Risk assessment actions consist of:

Reviewing information and instructions- from manufacturers, designers or suppliers about the usage and testing of electrical equipment and installations,

Examining work practices and conditions, consult with employees—

It is important to observe and consult with employees because they might not adhere strictly to standard operating procedures for certain task, are they following the de-energised procedure, is the PPE being used effectively?

Consult those doing the work, have they experienced any concerns about electrical safety?

Consider also changes to 'normal work' during cleaning, maintenance, breakdowns and during staff absences or shortages.

Considering what is the potential impact of the hazard? The consequence

- How severe could the consequence of the electrical hazard be? For example, direct contact causing electrocution, fire or explosion causing serious burns, death or is it less serious, e.g. first aid.
- How many people are exposed to the hazard? The more exposure the higher the consequence.

Determine who could be exposed, and when this could occur, the Likelihood

Workers can come in contact electrical hazards when the

- work with it directly
- are in the vicinity of where it is used or likely to be generated

An employer should also consider all people at the workplace, as well as those beyond within a radius of harm of any potential electrical, such as:

- ancillary or support/services workers (cleaning staff, maintenance workers)
- contractors
- visitors, and,
- supervisors and managers.

Consider:

- how specific tasks or processes are carried out in the workplace by observing and consulting employees or workers you can find out if they are not adhering strictly to standard procedures or if procedures are not adequately providing protection to workers
- the risk controls in place and their effectiveness,
- workers who may be working alone with electricity whether it is appropriate to have supervision

How likely is the hazard to cause harm, how often is exposure likely to occur and for how long?

Seek information from your workers and their health and safety representatives to find out:

- Which work activities involve routine and frequent exposure to electricity (for example, daily exposure, including during end-of-shift cleaning) and who are the people performing these activities?
- What happens when non-routine work, production of one-off items or isolated batches, trials, maintenance or repair operations are performed?
- What happens when there are changes to work practices in events such as cleaning, breakdowns, adverse weather conditions?

Other factors that may affect consequence and likelihood include:

- the conditions under which the electrical equipment is used, for example wet conditions outdoors or confined spaces
- work practices and procedures, for example isolation, to carry out maintenance
- the capability, skill and experience of relevant workers

It is a legal requirement that the inspection and risk assessment process should be carried out with the co-operation of workplace safety and health representatives and committees

4.0 Step 3 of the Hazard Management Process Determine Suitable Controls

After the risk has been assessed a decision about suitable controls is required based on consideration of 'what is reasonably practicable' in the circumstances.

OSH Act Part 3 General Duties of Care, Section 11

General duty of <u>employers</u> to employees

An employer must take *all reasonably practicable steps* to protect the safety, health and welfare, at work of employees and to provide and maintain a safe and healthy work environment including;

substances,

systems of work,

and,

any building or public or private area in which work takes place.

OSH Act Part 3 General Duties of Care, section 13

Management of identified risks

(1) An employer must take appropriate steps to control hazards which are identified and assessed as posing a threat to the safety, health or welfare of employees, and where practical the hazard must be eliminated.
(2) If elimination is impracticable then steps must be taken to isolate hazards from employees
(3) If elimination or isolation is impracticable, then employers must take steps:
a) To minimise the likelihood that the hazard will be a cause or source of harm to the employees; and
b) To ensure that protective clothing and gear is provided, such as meets the standards outlined in this Act, including Codes of Practice and regulations issued by this Act; and
c) To monitor the exposure of employees to the hazard; and
d) To monitor with the employees informed consent, the health of employees in relation to exposure of the hazard
(4) The steps taken under this section include action to protect the environment, and persons in the environment from emissions, leakage or spillage from any machine process or substance used or stored in the course of the employer's business or operations.

5 Control of risk (1) An employer must on the basis of a risk assessment under regulation (3) ensure that any risk to health and safety arising out of work are eliminated or if that is not reasonably practical minimised.

(2) An employer must, in the implementation of sub regulation (1) ensure that the minimisation of any risk is achieved by the application of the following hierarchy of control measures

a) Firstly, the application, so far as is reasonably practicable, of engineering controls, including substitution, isolation, modifications to design, guarding and mechanical ventilation
b) Secondly, if steps taken under paragraph (a) do not minimise the risk, the application, so far as is reasonably practical of administrative control. Including safe work practices
c) Thirdly if steps taken under paragraph (a) and (b) do not minimise the risk, the provision of appropriate protective equipment,

(3) An employer who contravenes this regulation commits an offence and is liable on conviction:

(a) for a corporation, to a fine not exceeding 1000 penalty units: and

(b) for any other case, to a fine not exceeding 100 penalty units.

Regulation 35 Electrical installations Hazard identification, risk assessment and control

(1) An employer must ensure

(a) That hazards are identified, and risks are assessed in accordance with regulation 34(a) –

i. **before the connection and supply of electricity to a new electrical installation at a workplace; and**

ii. **before the modification, maintenance or repair of existing supply of electricity to or at a workplace or of an existing electrical installation at a workplace; and**

(b) That any risks to health or safety arising out of a hazard identified under paragraph (a) are eliminated, minimised and controlled, in a reasonably time and manner.

(2) All electrical installations must be designed, constructed, installed, protected, maintained and tested so as to comply with a standard as may be specified or promulgated under the Electricity Act 2010 and any regulations made under that Act.

4.1 Reasonably practicable and the hierarchy of control

Current law requires the employer to take 'reasonably practicable' steps to protect the safety, health and welfare of employees and the work environment. The employer's decision on what is 'reasonably practical'. It requires the duty holder to decide is it REASONABLE in the circumstances to do ALL that is possible or given the circumstances is it REASONABLE to do LESS based on consideration of:

a. the likelihood of the hazard or the risk concerned occurring,
b. the degree of harm that might result from the hazard or the risk
c. what the person concerned knows, or ought reasonably to know, about the hazard or risk, and ways of eliminating or minimising the risk
d. the availability and suitability of ways to eliminate or minimise the risk, and
e. after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

The employer must decide what controls are suitable. Note that although the final decision is with the employer employees and their representatives best practice suggests employees should be consulted prior to final decision making.

The law requires elimination of the hazard where reasonably practicable, and, where elimination is not practicable, a 'sliding scale' of controls and combination of controls should be used based on what is reasonably practicable. It is a hierarchy because the further from elimination the

less effective the controls.

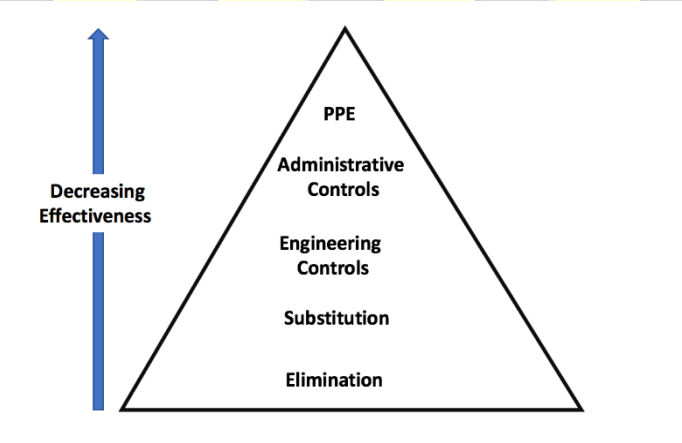


Figure 2 The Hierarchy of control

Employers must manage hazards based on the hierarchy of control:

First consider, based on the risk assessment, if it is necessary to eliminate risks so far as is reasonably practicable, then decide on **control measures** and implement—if it is not reasonably practicable to eliminate the risk, implement the most effective control measures that are reasonably practicable in the circumstances in accordance with the hierarchy of control measures, and ensure a plan is in place to **review control measures** to ensure they are working as planned and are not introducing new hazards.

Control Example- Electrical

Control	**Examples- Electrical**
Personal Protective Equipment (PPE) **LEAST EFFECTIVE**	PPE includes protective eyewear, insulated gloves, hard hats, aprons and breathing protection. Most forms of PPE are not relevant to minimising electrical risks in workplaces, except in relation to energised electrical work. Administrative controls and PPE do nothing to change the hazard itself. They rely on people behaving as expected and require a high level of supervision. **Exclusive reliance on administrative controls and PPE must only occur where other measures are not reasonably practicable** or as an interim control while the preferred control measure is being implemented. Check that the chosen control measure does not introduce new hazards All of which can fail or not be used effectively. PPE will likely be used in combination with other controls.
Administrative Control **Only effective if followed**	**Written rules and policies including safe operating procedures** in terms of working on energised electrical equipment are essential for safety, failure to follow a safety operating procedure may have fatal consequences around electricity. Permits to work, exclusion zones may protect others.

	Administrative controls should only be considered when other higher order control measures are not practicable, or to supplement other control measures. Testing according to the electrical testing register.
Engineering Control Isolation	De-energising electrical equipment or isolating employees from the source is effective but only if strict work procedures are followed. Residual Current Devices may also fall in this category. Preventing workers from coming into contact with the source of an electrical hazard will reduce the relevant risks.
Substitution	Replacing a hazardous process or material with one that is less hazardous will reduce the hazard, and hence the risk. For example, it may be reasonably practicable to use extra low voltage electrical equipment such as a battery-operated tool rather than a tool that is plugged into mains electricity.
Elimination **MOST EFFECTIVE**	Where possible, this is the ideal control, a decision of whether elimination is necessary will depend on answering the question of 'what is reasonably practicable' in the circumstances. The most effective control measure is to remove the hazard or hazardous work practice. By designing-in or designing-out certain features, hazards may be eliminated.

OSH Act Part 3 General Duties of Care, section 15

Protective Clothing and Equipment PPE

An employer shall:

a) **provide, maintain and make accessible to employees the protective clothing and equipment necessary to avoid injury and damage to their health; and**

b) **take all reasonably practical steps to ensure that the employees use that protective clothing and equipment whenever the circumstances for which it is provided arise; and**

c) **make provision in the place of work, for protective clothing and equipment so provided to be cleaned and securely stored without risk of damage when not required.**

Current law requires employers to provide appropriate PPE to the employee, however this should be the 'last' resort or included with other controls.

5.0 Steps 4 and 5 of the Hazard Management Process Implement and monitor and review

Once risk control measures are decided upon based on step 3, action must be taken to implement the control measure. It is important that there is assign person from the organisation/business that is responsible for the implementation of the measure within a reasonable timeframe.

Arrangements are needed to monitor the effectiveness of the control measures and this can be done through;

- Regular workplace inspections
- review of workplace accidents data
- Regular auditing processes

Control measures need regular review to ensure that they are reducing the level of risk to a suitable level as well as not introducing new hazards.

PART TWO - SPECIFIC GUIDANCE and CONTROLS for ELECTRICITY HAZARDS

In addition to the 5 steps of the hazard management process which has been provided in this guide, are a variety of specific legal obligations regarding electrical safety. These are detailed below.

6.0 Only a competent person to undertake electrical work

OSH Regulation 31

Work in the vicinity of electrical hazards

If work must be carried out in proximity to exposed live equipment or cables, or to any other electrical hazard, steps must be taken to ensure compliance with any relevant requirements of the Electricity Act 2010 and the regulations made under that Act.

OSH Regulation 32 Competency Requirements

An electrical work performed on any electrical installation or electrical plant at a workplace must be carried out by a competent person

Current law requires electrical work to be carried out by a competent person. Competent is defined in accordance with the Electricity Act, 2010 and associated regulations.

It is noted that in cases where work is required on 'live or energised' equipment that specific documentation must be completed by that competent person in accordance with the Electricity Act, 2010 and associated regulations.

7.0 Maintenance and testing of electrical installations and plant (equipment)

OSH Regulation Reg 33 Electrical installations etc

An electrical installation, plant etc must be so designed, constructed, installed protected and *maintained and tested* to minimise the risk of injury, electrical shock or fire.

In most workplaces the design, construction and installation of electrical installations will be the duty of the competent person, who may be a designer, manufacturer or supplier with legal obligations according to the section 19 of the OSH Act, 2002.

OSH Regulation 36 Inspection and testing of electrical plant (1)

Regular inspection and testing must be performed on electrical plant in the workplace if the supply of electricity is through a socket outlet (plug in equipment) to

a) **hand held electrical plant; or**
b) **electrical plant which is moved while in operation; or**
c) **electrical plan that is moved between operations in circumstances where damage to the electrical plant or to a flexible supply cord could reasonably occur; or**
d) **electrical plant where electrical safety could be affected by the operating environment.**

(2) If electrical plant is fixed, it must be inspected and tested after taking into account;

a) **information provided by the designer or manufacturer of the electrical plant; and**
b) **any hazard identification and risk assessment process that is relevant to the use of the electrical plant in its intended work environment.**

Current law requires employers to put in place a system or plan to **regularly test** electrical installations and equipment (plant) in the workplace.

Plug in equipment includes:

- electrical equipment which forms part of, or is used in connection with, an amusement device.
- hand-held electrical equipment, includes drills, saws, hair dryers, curling wands and electric knives
- electrical equipment that is moved while in operation, includes jackhammers, electric lawn mowers, floor polishers and extension cords

- electrical equipment that is moved between jobs in ways that could result in damage to the equipment, for example electric welders, electric cement mixers, portable bench saws and extension cords.

An **Electrical Testing Register** documents equipment when new to service, and when first and subsequent tests are due. Other options include using a durable **Tag** which documents the test date.

RECORDS of tests should be kept

- the name of the person who carried out the testing
- the date of the testing
- the outcome of the testing
- the date on which the next testing must be carried out
- The record may be in the form of a tag attached to the electrical equipment tested making clear when tested or an Electrical Testing Register

The **regularity** of testing is dependent on whether the electrical plant is moved as well as the nature of the operating environment.

A hazardous operating environment may include moisture, heat, vibration, mechanical damage, corrosive chemicals or dust, particularly in high risk environments such as outdoor, workplaces where there are corrosive substances, or commercial kitchens and manufacturing environments. In these cases, testing should occur on a more regular basis.

Visual inspection may include looking for wear and tear on cords, leads, cables or any damage due to modifications, heat, chemicals, moisture to connectors, plugs, cord extension sockets.

However, a competent person should undertake a specific test of the integrity of earth and insulation resistance, voltage ….

Where equipment fails a test, it must be immediately taken out of service, and a tag 'lock out' be used.

8.0 Use of Residual Current Devices

The risk of electric shock often results from people making contact with unprotected energised parts of electrical equipment and earth.

Contact with energised parts may occur by touching:

- bare conductors
- internal parts of electrical equipment
- external parts of electrical equipment that have become energised because of an internal fault
- metallic or other conductive equipment that has inadvertently become live.

PORTABLE residual current devices (RCDs) be used in relation to workplaces where electrical equipment supplied with electricity through a socket outlet (plug-in electrical equipment) is used or may be used in certain higher-risk workplaces. These are workplaces with operating conditions where the normal use of electrical equipment exposes the equipment to hazardous operating conditions that are likely to result in damage to the equipment or a reduction in its expected life span, including conditions that involve exposure to moisture, heat, vibration, mechanical damage, corrosive chemicals or dust.

Portable RCD's should be tested daily via the 'trip test'.

Non-portable RCDs should be installed at the main switchboard to protect the wiring connected to the RCD and electrical equipment plugged into the protected circuit

Non-portable RCDs should be tested according to the manufacturer's requirements.

Risks associated with electrical work

Activity	Risks
Isolation and access	– Correctly isolating supply but not discharging residual energy, for example a capacitive charge may be present in power supplies, single-phase motors or high power factor fluorescent fittings. – Insulation and equipment failing or partially breaking down. – Earth connection failing to stop an electric shock in earthed conductive parts when step and touch potentials exist. – Carrying out the task causes a person, something a person may be handling or something a person is in contact with to intrude into minimum safe approach distances. – A power system conducting fault current or being subject to high inrush currents. – Instructions or markings on the parts being inadequate, incorrect or both. – Using equipment not designed for, or incapable of, an operation, for example opening a 'no load – bus tie' under load conditions or relying on an open circuit breaker as an isolation point. – Another person energising circuits while a worker is working on them, or a vehicle hitting a pole. – Natural elements (for example lightning or wind) causing static charges, overhead mains to clash or a high voltage circuit to fall onto a low-voltage circuit. – The inter-core capacitive effects of long multi-phase cables. – Changes to wiring not being reflected in drawings i.e. the drawings are not 'as built', for example a live control or supervision circuit being present though the drawing indicates otherwise. – If there has been an error in wiring, opening the isolator may not de-energise the switchboard, for example if incorrect connection (incorrect polarity) occurred in the service to an installation, opening the main switch will open the neutral circuit rather than the active circuit.

Activity	Risks
	– Intentionally disabling an interlock to perform a task, for example opening the shutter of a 'rackable' circuit breaker for testing to prove it has been de-energised in the orifice. – Inadvertently disabling an interlock while performing a task, for example in a switchboard with an integrated circuit breaker, isolator and earth switch, the operator accidentally moving the isolator into the earthed position. – Poor direction and insufficient knowledge. For example, a worker is instructed to apply a set of earths and short circuits at a Ring Main Unit (RMU). The worker correctly observes the isolator is open, however, they assume the earth switch can be closed because the isolator is open. As most RMUs are configured so the earth switch earths the cable, not the busbar, the worker could be earthing and short-circuiting a live circuit. – When applying a set of portable earths and short-circuits, accidental or inadvertent contact is made with live parts. If this occurs, the worker is using a device that is conducting fault current. – The threshold value (lowest level of indication or reading) of a test device causing a misleading interpretation of a test to prove it is de-energised. Depending on the device used, an indication that parts are not energised in a high voltage situation does not mean that low-voltage and direct current voltages are absent. – Application of earthing and short-circuiting devices that depend on a conductive path through a fuse or circuit breaker that is not fit for purpose. – Ineffective connection to the general mass of the earth, for example the electrode, grid or temporary electrode that the earth and short circuits relies upon in a situation where a single phase becomes energised. – Application of the short circuit portion of portable earthing devices prior to the earth tail being connected to the earth. – Arcing and splattering associated with the application of earths and short circuits. The arcing or splattering may result from using the device in situations that range from energised conductors to residual energy such as capacitance. If the parts are energised, the worker can draw the arc from one phase to the other, causing a phase-to-phase fault. – A potential electric shock path existing once the earth tail is connected to earth. A worker may touch another live part and the earthed connector at the same time, for example, in a Common Multiple Earthed Neutral (CMEN) area. Even when working on high voltage, contact between the earthed connector and a low-voltage phase can cause an electric shock.
Working near sources of arcing, explosion or fires	Arcs, explosions and electrical faults can cause burns. Workers should be protected from the effects of burns. Examples of situations where arcs, explosions and electrical faults can cause burns include: – materials providing a conductive path between sources of potential, for example uninsulated tools falling across busbars – abnormal conditions on circuits such as: • lightning striking mains • circuits of different voltages touching each other, for example high voltage contacting low-voltage circuits

Activity	Risks
	• high voltage in the secondary circuit of a current transformer if an open circuit occurs when current is flowing in the primary circuit. – abnormally high voltages when synchronising different supplies. For example, if the waveforms are 180° out of phase, twice the peak-to-peak voltage may be imposed. – voltage multiplication effects, including: • ferro-resonance where the capacitive and inductive components of underground cables and transformers can significantly increase voltages when single-phasing occurs • re-strike can occur if capacitors are energised, de-energised and re-energised in rapid succession. – leakage or electrical discharge causing insulation to be compromised, for example a combination of a build-up of contaminants on insulators, wet weather or tracking through air voids in pitch filled insulating chambers. – failure of insulating mediums.
Working in unsafe atmospheres	After faults and fires, often in emergencies, electrical workers may be exposed to unsafe atmospheres. Toxic gases and lack of oxygen can cause illness and death. General workplace health and safety control measures should be used in these situations. The method of extinguishing fires should be addressed. Typically, carbon dioxide or powder type devices are used against electrical fires. Extinguishers including water, foam and wet chemical should not be used as they significantly increase the risk of electric shock.
Modifying or repairing existing low-voltage electrical installations	– Electrical drawings/tables not reflecting ‘as installed’ installations. – More than one source of supply or energised circuit available on the premises or at the equipment. – The supply becoming energised during the work. – Machinery starting automatically after supply is restored. – Managing metallic shavings (swarf) ingress into conductive parts of equipment. – A conductor considered to be de-energised is found to be energised. – Old installations (for example where several modifications have been made, circuits have not been identified, or insulation has deteriorated). – Voltages on disconnected conductors, particularly neutrals. – The rise in the earth potential due to a high impedance return path to the distribution neutral in installations where the Multiple Earthed Neutral (MEN) system is used, – Lack of information about isolation, sources of supply or the location of electrical conductors. – Lack of clear safe access to locate electric cables (other hazards may be present such as exposed conductors). – Damage to conductors in metallic conduits where earthing continuity of the conduit has not been maintained.

Activity	Risks
	– Equipment located in hazardous areas, which includes bolt-on or screw-on covers, can be dangerous if opened without obtaining specialist advice. – Working alone on energised equipment. – Drilling into switchboards/electrical enclosures. – Contact with cables in walls, floors or roof spaces. – Contact with cables during excavation work or cutting/drilling concrete. – Exposure to asbestos material/switchboards. – Variable frequency devices. – Multiple circuits located within the one conduit. – Use of conductive/flammable cleaning solvents creating an explosive atmosphere.
Testing and fault finding low-voltage equipment and installations	Risks arise as it is difficult to find faults or malfunctions in electrical equipment when the circuits are not energised or when the equipment is not operating, especially if feedback circuits or sensors are involved. Risks can include: – electrical drawings/tables not reflecting 'as installed' installations – exposed energised terminals or conductors – terminals or conductors being energised under different conditions of operation of the equipment – loose or disconnected test leads or wiring becoming energised – test equipment and leads bringing electrical hazards closer to the worker – test equipment inappropriate for the task (particularly test probes) – inadequate test points – inadvertent attempts by other people to start machinery – incorrect or poorly maintained testing instruments – inadequate knowledge of equipment or causes of faults – lack of information about circuits or equipment – equipment located in hazardous areas, which includes bolt-on or screw-on covers, can be dangerous if opened without obtaining specialist advice – testing or fault finding alone on energised equipment – testing or fault finding in cramped or restricted work situations – rotating or moving machinery (crush hazards) – overriding interlocks or forcing control equipment – re-setting protective devices in energised switchboards, and – electrical installations where unauthorised electrical work has been undertaken.
High fault currents —working, testing or fault finding energised	When working, testing or fault finding on energised electrical equipment, a fault current of up to 20 times the rated current of the supply transformer can flow for a short duration during fault conditions. Arcs can have the energy to cause an explosion and/or melt metallic switchboard cubicles and equipment. Arcs may cause severe burns to the skin and flash burns to the face and eyes. Inhaled hot gases and molten particles can cause serious internal burns to the throat and lungs. Injury can also occur through the impact from flying debris and dislodged components. Circuit protection devices may not operate in such circumstances.

Activity	Risks
Testing, fault finding or working on or near low voltage equipment	– Voltages between phases and between phases and neutral. – Voltages between phases and earth. – Voltages across open switch contacts, for example voltage across a light switch on an incandescent lighting circuit or the voltage across a bus tie where one side is de-energised. – Voltages on disconnected conductors (particularly neutrals). – Voltages from sources near the work being performed, for example: • working on a remote area power supply where both a.c. and d.c. voltages may be present • repairing lights on a shop fascia when overhead powerlines are nearby • working on transducer circuits when other a.c. and d.c. circuits are present • working on a power system with multiple circuits that may be of multiple potentials. – Voltages on the circuit being worked on from other sources including: • illegal connections or reconnections • Uninterruptible Power Supplies (UPS) and backup supplies • motor generators or alternators • d.c. on a.c. circuits or a.c. on d.c. circuits • harmonics, for example 3rd harmonic 150 Hz in neutrals and earths where there is a large fluorescent light load and switch mode power supplies • back Electromotive Forces (EMF) from collapsing magnetic fields or rotating machinery • solar panels or photovoltaic. – Voltages across undischarged capacitors. – Voltages across the secondary terminals of transformers, including current transformers. – Voltages caused by static electricity, leakage or discharge, or lightning. – Voltages between energised exposed conductors and the surrounding environment (including metalwork, damp situations, other conductive surfaces and persons nearby). – Voltages between parts, or open-circuited parts of one earth system, or voltages between different earthing systems. – Induced voltages from sources other than the circuit being worked on, for example nearby circuits or radio frequency transmitters. – Multiple supply sources (more than one source of supply or energised circuit may be available on the premises), for example ‘essential services’ on a switchboard, emergency backup generators or UPS. – Electrical testing or operating equipment with open enclosures in hazardous areas, as defined by AS/NZS 3000:2007: *Electrical installations* (known as the Australian/New Zealand Wiring Rules). – The potential (voltage) between parts of the earth in MEN systems can change, sometimes causing electric shocks. The changing earth potential can be due to a number of causes including a high impedance return path to the low-voltage distribution neutral, faults on other parts of the power system or lightning strikes.

Activity	Risks
	– Incorrect wiring connections, for example transposing active and neutral, commonly referred to as incorrect polarity. – Switched off circuits becoming energised. – Faulty equipment, for example the frame of faulty equipment becoming energised. – Step and touch potentials and transferred earth potentials. Transferred earth potentials often result from system faults. – Hygroscopic materials that become conductive, for example fertiliser dust.
Other hazards	– Working at heights and danger of falling objects. – Removal of cover plates near energised equipment, for example escutcheon plates. – Confined spaces (where there may be a hazardous atmosphere). – Inadequate light to work safely. – Lack of ventilation leading to uncomfortable, hot and humid working conditions. – Excessive worker fatigue (for example due to pressure of deadlines or other factors). – Obstacles to getting the equipment switched off. – Using a gas flame near exposed electrical conductors (a flame is a conductor). – Using conductive or flammable cleaning solvents. – Temperature rise as a result of combustion. – Cramped working conditions, including cable trenches and cable pits. – Explosive atmospheres. – Use of conductive tools and equipment, for example metallic tape measures and rulers. – Electric tools and equipment (for example hand lamps, drills, saws, torches and test instruments). – Personal effects (for example rings, jewellery, watches, pens, cigarette lighters, matches, hearing aids, mobile phones and pagers, transistor radios and similar). – General work activities (for example welding, cutting, brazing, using hand saws, drilling of all types, hammering and chiselling). – Hot metal surfaces due to drilling, grinding or welding. – Excavation associated with electrical work. – Molten metal from arcs. – Asbestos material/switchboards. – Polychlorinated biphenyl (PCB) in transformers, capacitors, electric motors.

Appendix One: Employers Risk Check – Electrical Safety

Ministry of Commerce, Industry and Labour
Matagaluega o Pisinisi, Alamanuia ma Leipa

		Comment
Is all electrical work done by a 'competant person'?	**Yes No** ☐ ☐	
Is there evidence that recent electrical work was done by a competant person?	**Yes No** ☐ ☐	
Are procedures for *identifying* electrical hazards in the workplace effective?	**Yes No** ☐ ☐	
If any work is done near overhead powerlines, underground cables, electrical wiring has a risk assessment been done		
Is there an electrical equipment register or system (eg tagging) to ensure regular inspection and testing as appropriate (based on type, conditions) **Is there a plan to have electrical equipment regularly inspected and maintained?**	**Yes No** ☐ ☐ Yes No ☐ ☐	
Are circuits being overloaded?	**Yes No** ☐ ☐	
Are suitable protections in place Fuses, circuit breakers?	**Yes No** ☐ ☐	
Are 'plug in' devices protected with site RCD (residual currency devices)		

Is portable electrical equipment protected with an RCD?	**Yes No** ☐ ☐	
Are RCD subject to regular testing	**Yes No** ☐ ☐	
Are all cords and plugs regularly inspected for damage?	**Yes No** ☐ ☐	
Is all electric equipment used outdoors or in wet conditions suitable for purpose?		
Are leads/cords kept off the ground where appropriate and kept away from damage?	**Yes No** ☐ ☐	
Is all electrical equipment in good condition?	**Yes No** ☐ ☐	
Have risk assessments been done for the workplace generally?	**Yes No** ☐ ☐	
Has attention been paid to conditions in which electrical work undertaken, eg outside, wet, dusty	**Yes No** ☐ ☐	
Are controls in place 'so far as reasonably practicable'?	**Yes No** ☐ ☐ **Yes No** ☐ ☐	
Have controls been reviewed?	**Yes No** ☐ ☐	

Have safe operating procedures been developed?	**Yes** **No** ☐ ☐	
Are safe operating procedures always followed?	**Yes** **No** ☐ ☐	
Is there a *safe work method statement* prepared *when high risk work (eg energised) is involved?*	**Yes** **No** ☐ ☐	
Are lock out/tag out procedures utilised when identified?	**Yes** **No** ☐ ☐	
Have employee's been trained in safe operating procedures? **Is there evidence of training?**	**Yes** **No** ☐ ☐ Yes No ☐ ☐	
Is suitable PPE available and being used by employees?	**Yes** **No** ☐ ☐	
Are identified electrical hazards fixed in a suitable time?	**Yes** **No** ☐ ☐	
Is suitable PPE available and being used by employees?	**Yes** **No** ☐ ☐ Yes No ☐ ☐	

Contact Information

For further information about Electrical Hazards and OSH Compliance contact MCIL/OSH Unit on Telephone: (685) 20441/20442/20882, Facsimile: (685) 20443. P.O. Box 862, Apia, Samoa. Level 4 ACC House, Apia. Email: mpal@mcil.gov.ws