PR-NET-OSM-059

MANAGEMENT OF WORK AND ACCESS TO TOWERS

OPERATIONAL SAFETY MANUAL – SECTION 7.2

Scottish & Southern Electricity Networks

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CONTENTS

1 Introduction 3
2 Scope 3
3 References 3
4 Definitions 4
5 Identification 4
6 Personal Protective Equipment 4
7 Dangers 5
8 General Requirements 5
9 Identification of Work Location 6
10 Access to Structures Carrying Live Conductors 7
11 Access to Conductors, Insulators and Fittings 7
12 Access to Towers Containing Telecommunications Equipment 9
13 Earthing 12
14 Induced Voltages 15
15 Crossing Points 17
16 Work on Earth Wires 20
17 Revision History 21
Appendix A Earthing Schedule Example 22
Appendix B Crossing Log 23

1 Introduction

SSEN-D own and operate a large and complex **High Voltage** Distribution **Systems**. This document details the procedures and methods that must be adopted to ensure work and access on **High Voltage** overhead line towers and structures is completed in a controlled and safe manner.

2 Scope

2.1 This document compliments the relevant safety precautions specified in the **Operational Safety Rules (OSR)** and applies to all **SSEN-D** owned/operated overhead line tower and structure assets, and its requirements must be followed by all employees and contractors working on behalf of **SSEN-D**.

NOTE: Third-party access requirements for telecoms providers is detailed in PR-NET-OSM-060 Management of Telecoms Work on Overhead Lines - Operational Safety Manual Section 7.3.

2.2 It is designed to ensure that following appropriate risk assessment, all work on **High Voltage** overhead tower lines and structures is undertaken safely, with correct equipment and PPE, and is in compliance with the relevant rules and procedures.

3 References

The documents detailed in Table 3.1 - Scottish and Southern Electricity Networks Documents, and Table 3.2 - External Documents, should be used in conjunction with this document.

Table 3.1 - Scottish and Southern Electricity Networks Documents

Reference	Title
PR-NET-OSM-006	SSEN Distribution Operational Safety Rules – Operational Safety Manual – Section 1.1
PR-NET-OSM-028	Switching Terminology and Approved Abbreviations - Operational Safety Manual - Section 4.4
PR-NET-OSM-011	Management of Work or Testing in Substations with Exposed Live Busbars and/or Gas Insulated Apparatus - Operational Safety Manual - Section 6.2
PR-NET-OSM-060	Management of Telecoms Work on Overhead Lines – Operational Safety Manual – Section 7.3
PR-NET-OSM-061	Management of Faults on High Voltage Overhead Lines - Operational Safety Manual - Section 7.4
PR-NET-OSM-012	Design and Use of Temporary Scaffold Guards and Conductor Support Systems for Crossing Overhead Lines with Conductors Live and in Service
PR-NET-OSM-101	Management of Induced Voltages on steel tower lines operating at 33kV and above including pole lines operating at 132kV and above – Operational safety Manual – Section 7.7
WI-NET-ENG-038	High Voltage Apparatus Decommissioning Procedure
WI-NET-OSM-002	Personal Protective Equipment and Workwear for Live Environments
SP-NET-OHL-001	Portable Earthing Equipment for High Voltage Overhead Lines on Steel Towers (up to and Including 400kV)
REF-NET-OSM-101	Approved Earthing Schemes for Tower Lines at 33kV and above – Operational safety Manual – Section 7.7.1
N/A	SSEN SHE Handbook (Held in Safety, Health and Wellbeing SharePoint Site)

Table 3.2 - External Documents

Reference	Title
ENA SHE 006	Earth wire Replacement with One Circuit Live on 132kV Towers

4 Definitions

4.1 The words printed in bold text within this document are either headings or definitions. Definitions used within this **Approved** procedure are defined within the list presented immediately below, or within Section 2 of the **Operational Safety Rules**.

4.2 **Circuit Identification Flags**

Flags of an **Approved** type with a base which will only fit the corresponding bracket fitted to the associated tower leg, usually carrying the unique colour and symbol of the tower circuit.

4.3 **Crossing Log**

An **Approved** form used in conjunction with a **Permit-to-Work** to exclude work between specific tower numbers where overhead lines cross under or over the **Conductors** in that span.

4.4 **Crossing Point**

A location where one overhead line crosses above or below another overhead line.

4.5 **Earthing Party**

A party consisting of a **Competent Person** in charge, accompanied by one or more **Competent Persons** whose duty it is to apply and remove **Additional Earths** and **Pennants** at towers or other structures as appropriate.

4.6 **Earthing Schedule**

An **Approved** form indicating the **Additional Earth** requirements for each stage of the work or testing.

4.7 **Operational Safety Rules (OSR)**

The **SSEN-D** Distribution set of rules, as read with related documents and procedures, that provide generic safe systems of work on the **System** therefore ensuring the health and safety of all who are liable to be affected by any **Danger** that might arise from the **System**.

4.8 **Pennant**

An **Approved** flag type device of specific Red or Green colouring which when attached to a tower or structure conveys a specific warning (detailed in the text).

4.9 **Wristlets**

Items which carry the unique colours of a specific tower circuit. Issued to **Working Party** members as a visual reminder of the tower line which has been made safe for work. The unique colours match those on the **Circuit Identification Flags** for the respective tower circuit.

5 Identification

Apparatus associated with the overhead tower line on which work, or testing is to be carried out, **Shall** be readily identifiable and have fixed to it, a means of identification that will remain effective throughout the course of the work.

6 Personal Protective Equipment

6.1 Persons who are required to work or carry out work on or near the **System Shall** wear suitably **Approved** Personal Protective Equipment (PPE). Furthermore, where warning

labels or signs identify the existence of a particular hazard, additional and appropriate PPE **Shall** be worn.

6.2 As a minimum, PPE **Shall** meet the requirements of WI-NET-OSM-002.

6.3 **Approved** full body harnesses and fall arrest equipment **Shall** be used when accessing towers and structures.

7 Dangers

The main **Dangers** to personnel when working on **High Voltage** overhead line towers and structures are electric shock, burns or falls arising from:

- Personnel mistaking that part of the **High Voltage Apparatus** on which it is safe to apply **Earths** from that in which it is unsafe so to do, thus inadvertently encroaching **Safety Distances**
- Inadequate precautions taken to control induced voltages from other adjacent **Live Apparatus**
- Touch potentials due to inadequate application of **Earths** and bonds
- Proximity of a lightning storm
- Inadequate clearance from **Live Apparatus**
- Insufficient allowance for insulator and **Conductor** movement caused by wind and gales when assessing **Safety Distances**
- Radio Frequency (RF) hazards associated with telecommunications equipment. (See PR-NET-OSM-061 Management of Faults on High Voltage Overhead Lines - Operational Safety Manual Section 7.4)
- Work at height and failure to make proper use of climbing aids and PPE including fall arrest equipment

8 General Requirements

8.1 Emergency preparedness and response arrangements **Shall** be established as part of a robust planning process. Typically, controls are recorded in the Emergency Response Plan. All members of the **Working Party Shall** have a full understanding of the arrangements made.

8.2 The following requirements **Shall** be met when working on steel towers of any design and voltage. Requirements are additional to the existing detail in the **OSR** regarding work on steel towers:

NOTE: These additional requirements do not normally apply to work on steel poles

- Only **Competent Persons** with written authorisation **Shall** work on steel towers
- **Competent Persons** who work on steel towers **Shall** have received training / refresher training in tower rescue procedures within the last 3 years
- All work at height **Shall** be in accordance with an **Approved** procedure
- **Competent Persons** who work on steel towers **Shall** have received basic emergency first aid training
- An **Approved** first aid kit **Shall** be available to the **Working Party** when work is being completed on steel towers
- When working at height on a steel tower, a minimum of two **Competent Persons Shall** be present at the tower, i.e. the second person at the base of the tower or also

working on the tower. The second person **Shall** be prepared and available to render assistance in the event of an emergency. Each person **Shall** maintain regular visual/verbal contact

- All pre-work risk assessments associated with work on steel towers **Shall** consider if there is a need for more than two **Competent Persons** to be present during the work
- Before and after every climb, all safety equipment used while working at height **Shall** be thoroughly examined by the user for any signs of excessive wear, damage or malfunction. Any item found to be defective, suspect or subject to a fall **Shall** be marked-up and withdrawn from service immediately
- Work on and access to steel towers positioned in substation compounds containing **Live** exposed **High Voltage Conductors**, **Shall** be carried out in accordance with the **OSR** in particularly Rule 4.5.1(c) and PR-NET-OSM-011 Management of Work or Testing in Substations with Exposed **Live** Busbars and/or Gas Insulated Apparatus - Operational Safety Manual Section 6.2
- Additional precautions are required when telecommunication equipment is fitted to steel towers. Information regarding these precautions can be found within Section 12 of this document and PR-NET-OSM-060 Management of Telecoms Work on Overhead Lines - Operational Safety Manual – Section 7.3

9 Identification of Work Location

9.1 General

It is a requirement of the **Operational Safety Rules** 5.11.1 and 5.12.1 (b), that the Overhead Line circuit to be worked on and the point of work **Shall** be identified in an **Approved** manner. Section 9 sets out the minimum arrangements to satisfy this requirement.

9.2 Responsibilities

9.2.1 When determining which process is most appropriate to the circumstances, the Senior **Authorised Person Shall** consider the general competence of the recipient of the **Safety Document** together with the recipient's geographical knowledge of the area around the work location(s).

9.2.2 It remains the duty of the **Senior Authorised Person**, to satisfy themselves that the recipient of the **Safety Document** can correctly identify the work location and successfully set the **Working Party** to work under that document, in accordance with the requirements of **OSR** sections 5.11 – 5.15 inclusive.

9.2.3 The recipient/person responsible for the work site, **Shall** confirm that the **Working Party** is in the correct location, if there is any doubt this **Shall** be discussed with their Manager or **Control Engineer**.

9.2.4 This procedure **Shall** also be used when identifying a location for **Live** Line working.

9.3 Procedure

9.3.1 When issuing a **Safety Document**, the preferred methods are detailed below and are arranged in order of descending preference:

1. Where a **Safety Document** is to be issued, the **Senior Authorised Person Shall** firstly attend the work location of issue followed by any subsequent work locations accompanied by the **Safety Document** recipient prior to the commencement of work.

NOTE: Under exceptional circumstances, in very remote or island situations when a **Senior Authorised Person** cannot get to site, an alternative procedure may be agreed by the **Control Engineer** in accordance with **OSR** 4.6.2.

2. Where it is not reasonably practicable for the **Senior Authorised Person** to visit every point of work, where there are multiple work sites over a large geographic area and / or multiple **Working Parties**, then an arrangement which ensures that the **Safety Document** recipient can correctly identify the succeeding work locations, and successfully move to them, **Shall** be adopted. Where visual contact with the overhead line can be maintained because the recipient can travel along or adjacent to its route, the **Senior Authorised Person Shall** issue corresponding instructions to the **Safety Document** recipient specifying that visual contact **Shall** be maintained at all times, noting these in the additional precautions on the **Safety Document**.

3. Where the requirements of the above cannot be met, then the **Senior Authorised Person Shall** identify the work location(s) on a geographical map of the area which is of a suitable scale and size to ensure that the **Safety Document** recipient can find the way to the correct location(s).

9.3.2 The map provided for the **Safety Document** recipient **Shall** have the overhead line route marked on it together with any other details which help to distinguish it from other overhead lines in the vicinity. These may include pole, tower or support numbers, air break numbers etc.

9.3.3 When a geographical map is provided for the above purpose, the **Senior Authorised Person Shall** confirm that the recipient understands how to read the map and interpret any additional information provided about the work location(s).

9.3.4 An up to date schematic diagram appropriately colour coded to show **Live**, **Dead**, points of isolation and **Earths** should also be provided. (A legend is required to explain colour coding.)

9.3.5 Where the pole, tower or support has a method of unique identification marked on it because of the combination of Circuit Designation Colour(s), Safety Step Bolts, Keyed Flag Brackets and number, the **Senior Authorised Person Shall** record this information on the **Safety Document** and instruct the recipient to work in accordance with **OSR** 5.10.2.

10 Access to Structures Carrying Live Conductors

Access by a **Competent Person** above the anti-climbing device on a tower or structure carrying **Live Conductors**, for work or inspection where the **Safety Distance** is maintained, **Shall** be carried out in accordance with an **Approved** procedure and the requirements of the **OSR**. A **Limitation-of-Access Shall** be issued, listing additional precautions where appropriate.

11 Access to Conductors, Insulators and Fittings

11.1 General

11.1.1 Where work on overhead **Conductors**, insulators or associated fittings is to be carried out, the relevant circuit(s) **Shall** be **Isolated** and **Earthed** in accordance with the **OSR** and a **Permit-to-Work** issued.

11.1.2 The **OSR** also require the use of **Circuit Identification Flags**, **Pennants** (markers) and **Wristlets** where they are available.

11.2 Circuit Identification Flags

11.2.1 Where there is the facility to use **Circuit Identification Flags**, the **Senior Authorised Person Shall** issue a sufficient quantity to the **Safety Document** recipient.

11.2.2 The number of **Circuit Identification Flags** issued **Shall** be recorded on the **Permit-to-Work** and the recipient **Shall** provide their initials against the number as confirmation.

11.2.3 **Circuit Identification Flags Shall** be fitted by the recipient of the **Safety Document** in accordance with the **OSR**.

11.3 Pennants

11.3.1 When **Pennants** are to be used to indicate **Working and Access Clearances**, the **Senior Authorised Person Shall** ensure that a sufficient quantity are available to the **Safety Document** recipient.

11.3.2 Where **Pennants** are used, they **Shall** be controlled in accordance with the **OSR**.

11.4 Wristlets

11.4.1 Where circuit identification **Wristlets** are used to confirm the identity of the line to be worked on, the **Senior Authorised Person Shall** issue sufficient quantities to the **Safety Document** recipient.

11.4.2 The **Wristlets Shall** be issued by the **Competent Person** in charge of the **Working Party** / **Earthing Party** before approach is made to any structure or tower. Usually this will be done at the pre-work briefing. Members of the **Working Party** / **Earthing Party Shall** confirm their understanding by signing, timing and dating the **Working Party** log as appropriate

11.4.3 A record of the number of **Wristlets** issued **Shall** be recorded on the **Safety Document** and the recipient **Shall** provide their initials against the number as confirmation.

11.5 Tower Access

Each person climbing the tower **Shall**:

- Check that the **Circuit Identification Flag** is correctly fitted
- Wear the **Wristlet** in such a manner that it will at all times be readily visible whilst climbing
- Ensure that the **Wristlet** matches the circuit identification plate on the circuit on which they are to access

11.6 Loss of Wristlets or Circuit Identification Flags

If the **Wristlets** or **Circuit Identification Flags** are lost, the procedure for clearance and cancellation of a **Safety Document** is as follows:

- The recipient of the **Safety Document Shall** personally advise the **Senior Authorised Person** the circuit identification colours, and the numbers of the flags and/or **Wristlets** lost. Full details of any lost identification equipment **Shall** be recorded on the **Safety Document** as appropriate .
- The **Senior Authorised Person Shall** ensure that a thorough search is carried out in order to recover the lost **Wristlet(s)** or **Circuit identification Flags**.
- The clearance and cancellation of the **Safety Document Shall** then be carried out using the normal procedure.

- The recipient of the **Safety Document Shall** inform all members of the **Working Party** that the **Safety Document** has been cancelled with a missing **wristlet(s)** and it is no longer safe to access any towers.
- The **Senior Authorised Person Shall**, prior to continuing, discuss and agree with the **Control Engineer** how to proceed.

12 Access to Towers Containing Telecommunications Equipment

12.1 Introduction

12.1.1 Telecommunications equipment is fitted to some **SSEN-D** towers. This equipment introduces an additional hazard and therefore risk as Electromagnetic fields (EMFs) and Radio Frequency (RF) waves are generated by the antenna.

12.1.2 The potential hazardous region is immediately in front of the antenna sometimes extending up to 17m. The hazardous region also applies around the sides and the rear of the antenna extending to 0.6m. These areas are known as the 'Exclusion Zone' where it may be possible for RF exposure levels to exceed the national recommended guidelines.

NOTE: The typical antenna installation has been designed such that the antenna is offset from the face of the tower, such that the Exclusion Zone from the rear of the antenna does not intersect the tower body.

12.1.3 RF Monitors **Shall** be worn by any person working on or near a tower where equipment that can emit non-ionising radiation is installed.

12.1.4 The antennae and dishes are usually mounted on the upper portion of the tower. On heavier construction or large extension towers, equipment might be positioned below the bottom crossarms.

12.1.5 At each site where this equipment is fitted, the following information **Shall** be prepared and available from the asset record:

- Drawings, detailing the location and position of the equipment and all the relevant exclusion zones
- A Site Access Schedule detailing the necessary tower access and safety requirements for all potential tower activities. The Site Access Schedule **Shall** indicate whether the antennae must be powered down for work to be undertaken

12.1.6 Access to any towers carrying telecommunications antennae **Shall** not be permitted unless the documents specified in clause 12.1.5 have been consulted by the **Senior Authorised Person** responsible for planning and initiating work activities on the towers.

12.1.7 Where the Site Access Schedule indicates that the antennae does not need to be powered down, the planned work **Shall** be carried out in accordance with the tower access and work requirements of the schedule.

12.1.8 Under no circumstances **Shall** the Exclusion Zone be entered without the antennae being powered down and **Isolated** locally.

12.1.9 Local Isolation **Shall** be achieved by opening the mains isolation switch for the RF equipment, which is located within the meter cabinet on site. A **Safety Lock** and **Caution Notice Shall** be attached. It is important that the telecommunications equipment owner or operator performs a controlled shutdown before the mains isolation switch is operated, failure to do so may result in equipment damage.

NOTE: Confirmation **Shall** be sought from the telecommunications equipment owner or operator that there is no battery back-up which could continue to supply power the equipment in the cabinet and on the tower.

12.1.10 Where local Isolation is required, details of the Isolation **Shall** be included on the **Safety Document**.

12.2 Access Procedure – Planned and Emergency Work

12.2.1 Where work can be planned in advance, the telecommunications equipment owner / operator requires a minimum notice period (typically five days). Once this has been completed, the station can be powered down remotely before the local on-site RF Isolation switch is opened and a **Safety Lock** and **Caution Notice** fitted. On the day of the planned work the station can be remotely powered down within a few minutes (Figure 12.1).

12.2.2 Emergency work is classified as situations where **SSEN-D** reasonably consider it necessary to **Isolate** the supply to site as soon as possible to minimise the risk of reduced service levels or security of supplies to its customers or on safety grounds. The telecommunications equipment owner / operator will then power down the site remotely (Figure 12.2).

12.2.3 The contact details for the telecommunications equipment owners / operators are detailed in the Site Access Schedule and will also be available on site.

12.2.4 The following **Approved** procedures detailed in Figure 12.1 and Figure 12.2, have been agreed with the telecommunications equipment owner / operator for all sites and **Shall** be followed by the **Senior Authorised Person** in charge of the work. The requirements of the **OSR Shall** also be followed.

12.3 Access Procedure – Third Party Telecoms Providers

12.3.1 Where a third-party telecoms provider requires access to telecoms equipment on a tower, the persons involved in the work **Shall** be suitably authorised by **SSEN-D**. Should this not be the case, they **Shall** be under the **Personal Supervision** of a suitably authorised person.

12.3.2 At all times, the requirements of **OSR** 5.10.5 and 5.10.6 as well as this **Approved** procedure **Shall** be adhered to.

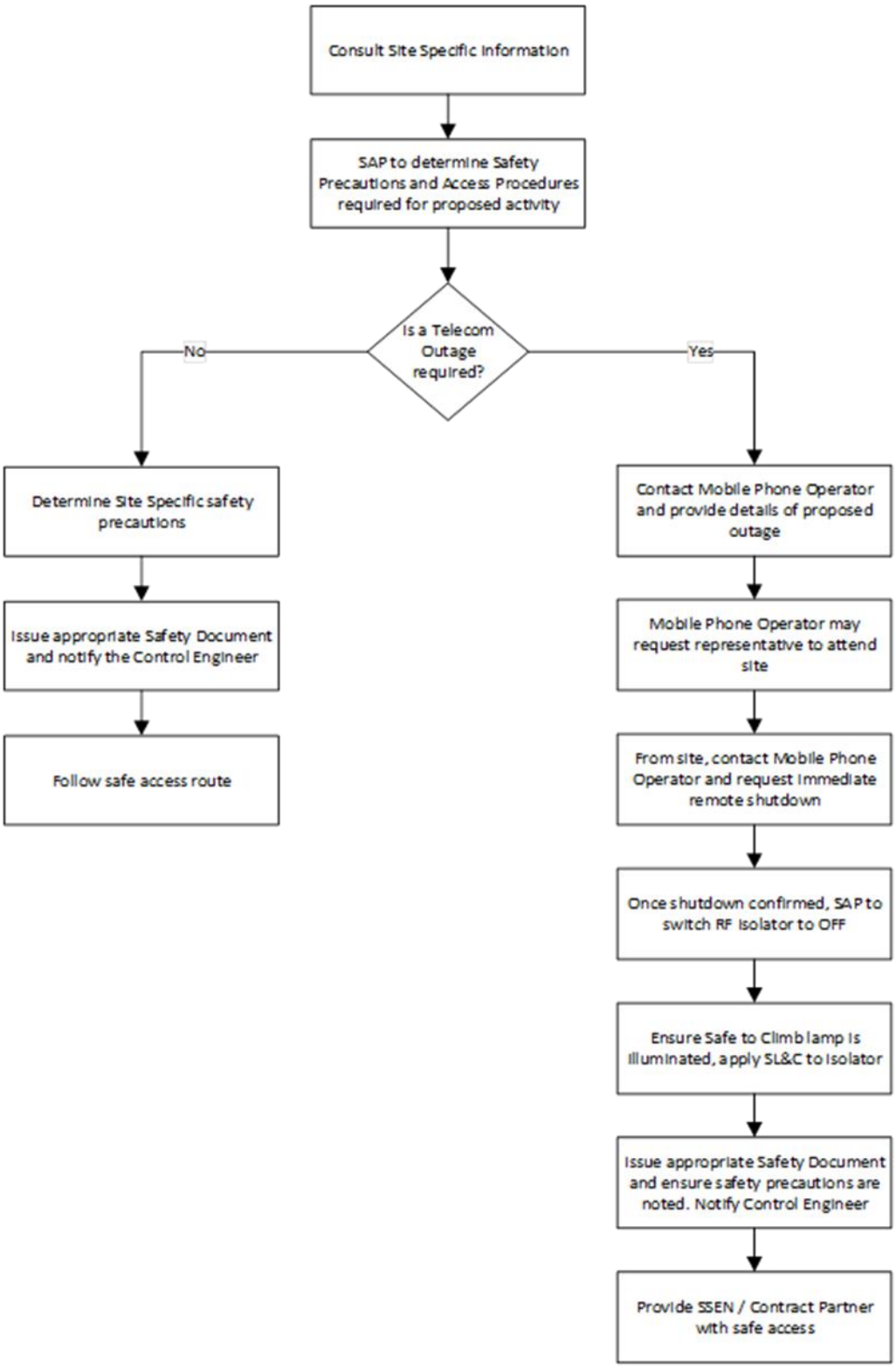

Figure 12.1 - Access Procedure for Planned Work

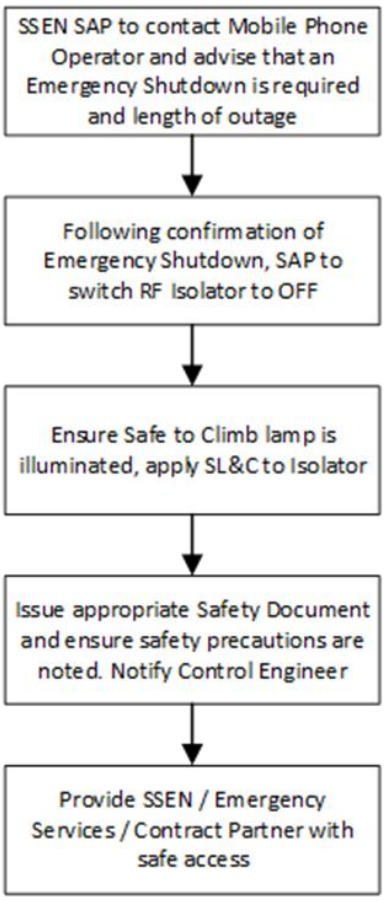

Figure 12.2 - Access Procedure for Emergency Work

13 Earthing

13.1 General

13.1.1 All portable **Earths Shall** be applied using the procedure **Approved** for the particular type and in accordance with the **OSR**. If the design permits, trailing leads should be kept away from the body until all of the connections are made.

13.1.2 All portable earthing equipment **Shall** be of an **Approved** type (see SP-NET-OHL-001).

13.1.3 Where there are multiple **Conductors** per phase, each **Conductor Shall** be **Earthed**.

13.1.4 Only portable **Circuit Main Earths** and **Additional Earths** which are designed for use on tower line circuits, which have been maintained in accordance with an **Approved** procedure **Shall** be used.

13.1.5 When applying portable **Earths**, the connection with **Earth Shall** be made first, before the **Earth Conductor** clamp is offered to the **Conductor**, the **Earth Conductor** end clamps should then be applied to the **Conductors**. This procedure **Shall** be reversed when removing portable **Earths**.

13.1.6 REF-NET-OSM-101 contains **Approved Earthing** schemes for use on tower lines and guidance on the application of **Earths** for common tasks with additional notes of guidance.

13.2 Earthing Party

13.2.1 Where practicable **SSEN-D** staff **Shall** form the **Earthing Party**.

13.2.2 A contractors **Earthing Party** may be used, provided that at least one **SSEN-D Competent Person** is included to supervise the application of the **Additional Earths**. The **Senior Authorised Person** in charge may relax this requirement subject to a risk assessment which considers the competence of the contractors **Earthing Party**.

13.3 Circuit Main Earths

13.3.1 Where reasonably practicable, **Circuit Main Earths Shall** be applied or removed by the use of an **Approved Earthing** Switch.

13.3.2 Where this is not possible, on each side of the point of work the following procedure may be used:

1. The circuit **Shall** be **Isolated** in accordance with **OSR** 4.1.1(b) and 4.2.
2. The **Senior Authorised Person Shall** confirm that isolation has been achieved.
3. Where practicable, at least one **Circuit Main Earth Shall** be applied by fixed **Earthing** Switches where available, as required by the **OSR** 4.1.1(c) and 4.3.1(a).
4. The **Senior Authorised Person Shall** confirm the circuit identification colours and symbols with the **Control Engineer** and **Shall** issue an appropriate number of **Circuit Identification Flag(s)** and **Wristlet(s)** to the **Competent Person**.
5. The **Competent Person**, under the **Personal Supervision** of the **Senior Authorised Person**, **Shall** climb to a suitable position (but maintaining the **Safety Distance**) ready to test that the **Conductors** are not **Live** using an **Approved** voltage testing device. Prior to offering up to the **Conductors**, the test device **Shall** be tested using an **Approved** proving unit. Once each **Conductor** has been tested, the test device **Shall** again be tested before the **Circuit Main Earth** is applied.
6. The **Circuit Main Earth Shall** be applied immediately following the testing using an **Approved Earthing** pole. Where there is a delay in the application of the **Circuit Main Earth**, the **Conductors Shall** be re-tested.
7. With the exception of testing, removal of the **Circuit Main Earths** is the reverse of the above procedure, taking care that the **Earths** applied by any fixed **Earthing** Switches are removed last.

13.4 Additional Earths

13.4.1 **OSR** 5.10.3 allow the **Competent Person** receiving a **Permit-to-Work** to apply **Additional Earth(s).** These provide additional protection against accidental energisation from either the **System**, induced voltages, or by other means (e.g. private generation).

13.4.2 The **Senior Authorised Person** may specify the requirements for, and locations of **Additional Earths** on the **Permit-to-Work** or in an **Earthing Schedule**.

13.4.3 **Additional Earths Shall** be applied at or as near as practicable to the point of work.

13.4.4 Before applying any **Additional Earth**, the **Competent Person Shall** ensure that at least one of the following conditions has been met:

- The circuit is proved **Dead** by an **Approved** voltage testing device at the location where the **Earth** is to be applied
- A **Circuit Main Earth** or an **Additional Earth** is connected to the same circuit **Conductor** and can be visibly traced to the point at which the **Additional Earth** is to

be applied. (If visibility is impaired by mist or other problem, then the circuit **Shall** be tested as above)

13.4.5 **Additional Earths Shall** be applied at the point of work, in addition, an **Approved** procedure may require **Additional Earths** to be applied to the nearest tower each side of the work.

13.4.6 Where it is difficult to detail the number and use of **Additional Earths** on a **Safety Document**, an **Earthing Schedule Shall** be used.

13.4.7 The **Competent Person** applying the **Additional Earths Shall** confirm their removal before cancelling the **Permit-to-Work**.

13.4.8 In circumstances where an **Additional Earth** cannot be accounted for, the **Competent Person Shall** report this immediately to the **Senior Authorised Person** responsible for cancelling the **Safety Document**, to determine how to proceed. This may require a visual patrol to confirm the circuit is free of any **Additional Earths**.

13.4.9 Where **Conductors** are to be broken, then an **Earth Shall** be applied to each side of the intended break and connected together before **Conductors** are broken/cut.

13.5 Earthing Schedules

13.5.1 An example of an **Earthing Schedule** is included in Appendix A

13.5.2 **Earthing Schedules** are normally required for tower line work at 132kV and above, but should also be used when:

- An **Approved** procedure requires it
- Multiple **Additional Earths** are being used and the **Senior Authorised Person** decides, due to the complexity to use one

13.5.3 The purpose of an **Earthing Schedule** is to ensure that **Additional Earths** are:

- Fixed at the correct locations and in the correct sequence
- Kept track of throughout a task
- All removed in the correct sequence at the end of the job

13.5.4 The **Senior Authorised Person Shall** complete and issue the **Earthing Schedule** with the **Safety Document** and record the **Earthing Schedule** number on the **Safety Document**.

13.5.5 The **Senior Authorised Person** can endorse the **Earthing Schedule** if necessary (because a particular hazard exists): “To be applied and removed only under the **Personal Supervision** of a **Senior Authorised Person**.”

13.5.6 An **Earthing Schedule** can be prepared before the task or completed on site as **Additional Earths** are applied / removed during the course of the work.

13.5.7 If **Additional Earths** cannot be planned to be applied stage by stage, the **Senior Authorised Person** might need to endorse the **Earthing Schedule** (and/or the **Safety Document** if appropriate): “To be applied and removed only under the instruction of a **Senior Authorised Person**.”

13.5.8 The **Earthing Schedule** should be held by the **Competent Person** in charge of the **Earthing Party** when **Earths** are being applied / removed and by the **Competent Person** in receipt of the **Safety Document** during the work.

14 Induced Voltages

14.1 Introduction

14.1.1 Induced voltages can occur on overhead lines which have been made **Dead**, **Isolated** and **Earthed** in accordance with the **OSR.**

14.1.2 The levels of induced voltages which can occur, vary depending on the following:

- The proximity to other overhead lines
- The distance the overhead lines run close together
- Adjacent / dual circuit construction lines
- The electrical loading of the adjacent circuit
- Atmospheric / weather conditions

14.1.3 The higher voltages occur when a line runs parallel to another and is lowest when the lines cross at right angles.

14.1.4 A lightning strike can also cause **High Voltages** to appear on the line, although an overrunning **Earth** wire can provide some protection from a direct strike to the **Conductors**.

14.1.5 Multi-circuit tower lines are often considered to offer the greatest risk of induced voltage, because of the distance that they can run in parallel, the proximity of the lines and the span length, which means there can be a considerable distance to the nearest tower **Earth**.

14.1.6 Single circuit tower lines are also susceptible to induced voltages where they run close together.

14.1.7 In the case of tower painting where no work is to be carried out on the actual **Conductors**, but the **Safety Distance** might be encroached, **Additional Earths** are required to protect against induced voltages.

14.1.8 The **Senior Authorised Person Shall** decide the appropriate actions to eliminate or minimise the risk of induced voltages e.g. by the application of **Additional Earths** or by Isolating the other circuit.

14.1.9 Further guidance on the management of induced voltages can be found in PR-NET-OSM-101.

14.2 Procedure for avoiding Danger from Induction when Constructing New Overhead Line Circuits on Steel Towers.

14.2.1 The following procedure defines the safety considerations and requirements when constructing new overhead line circuits on steel towers adjacent to **Live** circuits operating at 66kV or above. Its objective is to avoid exposure to the **Dangers** from induction.

14.2.2 This procedure is written in support of the **OSR**, PR-NET-OSM-101 and other relevant **Approved** Procedures.

14.2.3 Where overhead line works are contracted out by **SSEN-D**, the appointed Principal Contractor **Shall** be responsible for compliance with this procedure and for ensuring that all staff under their responsibility are suitably trained on the requirements of PR-NET-OSM-101. This requirement for training will be included within the contract documents.

14.2.4 Electricity at Work Regulations

The Electricity at Work Regulations 1989 (Regulation 14) regulates the work on or adjacent to **Live Conductors** as follows:

*"No person **shall** be engaged in any work activity on or so near any **Live Conductor** (other than one suitably covered with insulating material so as to prevent **Danger**) that **Danger** may arise unless–*

*(a) It is unreasonable in all the circumstances for it to be **Dead**; and*

*(b) It is reasonable in all the circumstances for a person to be at work on or near it while it is **Live**; and*

(c) Suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury."

14.2.5 These principles apply during the construction of new overhead line circuits on steel towers with adjacent and nearby **Live** circuit(s). The **Danger** from induction during a project **Shall** also be assessed at the planning stage, as well as during design, survey and contract approval.

14.2.6 Crossing of existing lines **Shall** be avoided where reasonably practicable. This may require changing routes and undergrounding existing circuits prior to construction. Where this is not reasonably practicable the construction **Shall** commence in such a way that, where possible, avoids **Conductor** stringing of crossings on existing overhead line circuits until the majority of the construction is completed clear of the induction risks.

14.2.7 Where possible avoid **Conductor** stringing adjacent to **Live** circuits until the majority of the construction is completed, clear of the induction risks.

14.2.8 When such proximity works are necessary, they should proceed in accordance with the processes set out in section 14.3.

14.3 Construction of a New Circuit on Towers Supporting a Previously In-Service Circuit

14.3.1 The following processes **Shall** be included in the construction method statements.

14.3.2 For construction on towers supporting a previously in-service circuit, a **Limitation-of-Access** is applicable for the new or replacement circuit works, with reference made to PR-NET-OSM-101 and relevant **Approved Earthing Schedules** for each section worked on.

14.3.3 For construction on towers supporting a previously in-service circuit and crossing existing Transmission or Distribution overhead circuits, a **Permit-to-Work** is applicable quoting **Circuit Main Earths** applied to the existing circuit(s) being crossed, with the work to be carried out and other precautions identifying the new circuit spans to be erected, with reference to the construction method statement.

14.3.4 The section jumpers on the new circuit at a suitable point on either side of the crossing, will be left unmade on completion of the works with the **Conductors** heading back towards the crossing **Earthed** to the tower and **Safety Notices Shall** be attached to the access gateway on every tower on the new line between section points spanning the crossing.

14.3.5 All crossing sections **Shall** be excluded from the rest of the circuit for further construction works. When working on adjacent sections this exclusion **Shall** be stated on the **Limitation-of-Access** for these further works.

14.4 Construction of a New Single or Dual Circuit Line

14.4.1 For the construction of entirely new single or dual circuits lines, work **Shall** be undertaken in accordance with the construction method statements. The route **Shall** be surveyed for proximity to existing circuits, existing circuit crossings and any specific precautions required to prevent **Danger** from any **Live Apparatus**, **Shall** be agreed with the responsible **Senior Authorised Person**.

14.4.2 For the construction of entirely new single or dual circuits that cross existing Transmission or Distribution circuits, a **Safety Document,** issued by the operator of the existing asset quoting the **Circuit Main Earths** applied to the existing circuit(s) being crossed, with the work to be carried out and other precautions identifying the new circuit spans to be erected with reference to the construction method statement, and any other special instructions to prevent **Danger.**

14.4.3 The section jumpers on the new circuit at a suitable point on either side of the crossing, **Shall** be left unmade on completion of the works. The **Conductors** heading back towards the crossing **Shall** be **Earthed** to the tower and **Safety Notices** (See Figure 14.1) **Shall** be attached to the access gateway on every tower on the new line between section points spanning the crossing.

Figure 14.1 - No Tower Access Safety Notice

14.4.4 For the adoption of new circuits, these **Shall** not be adopted or shown on the Control **System** Diagram, until they approach a recognised credible source and at least 1 span and 1 set of jumpers remain as a separation between existing (adopted) **Apparatus** and the new build, in accordance with WI-NET-ENG-038.

14.4.5 The **Control Engineer** has no responsibilities for the new **Apparatus** until after it has been declared as **High Voltage** equipment by a Safety Rules Declaration (FO-NET-OSM-006) and is under the **SSEN-D Operational Safety Rules**.

15 Crossing Points

15.1 Planned Work Near Non-Electrical Crossings

15.1.1 Where work, that might alter the sag of a **Conductor** or interfere with the permanent fixing points of **Conductors** or fittings, is to take place at locations where the **Conductors** cross features such as roads, waterways or non-electrified railways etc. either within that span or that section, then additional precautions need to be considered.

15.1.2 When deciding the method of work and/or the type of protection to be used, every crossing **Shall** have a specific written risk assessment produced aiming to reduce the risk to As Low As Reasonably Practical.

15.1.3 Where **Danger** to the feature being crossed cannot be removed completely, then the risk assessment should consider the hierarchy of precautions detailed below and justify any move down the hierarchy on the grounds of practicalities, time, cost, resources, trouble, logistics and the likelihood of an incident occurring whilst using the chosen option.

15.1.4 The hierarchy of measures is:

1. SkyCradle or similar **Approved** purpose designed mechanical protection system.
2. Scaffold with netting.
3. Scaffold without netting.
4. An **Approved** self-supporting **Conductor** replacement system or another system acceptable to the Operational Safety Manager.

15.2 Planning Work Near Electrical Crossing Points

15.2.1 Where work on **High Voltage** circuits is to take place, there will be locations where other **Low Voltage** or **High Voltage** circuits will either cross under or over the circuit being worked on.

15.2.2 Where reasonably practical, under passing circuits at **Crossing Points** should be undergrounded before work commences. The process for undergrounding Shall ensure that:

- The **Senior Authorised Person** who is completing the undergrounding of the under passing circuit **Shall** ensure the **System** diagram and GIS diagram are updated.
- The **Senior Authorised Person** who has completed the undergrounding of the under passing circuit **Shall** formally inform the Project Manager responsible for the work on the over passing circuit that work has been completed.
- Before any work on the over passing span may begin, the **Senior Authorised Person** in charge of the over passing line **Shall** confirm that the undergrounding work has been completed.
- The briefings given by both the **Senior Authorised Person** and the **Competent Person Shall** fully explain the precautions taken to enable work to commence on this specific span.

15.2.3 **Crossing Points** which remain at the commencement of the works **Shall** be identified and control measures established that consider safety and **System** security at each location. The hierarchy of measures is:

1. Underground (in this case one of the options below may be required for **Conductor** removal).
2. SkyCradle or similar **Approved** purpose designed mechanical protection system.
3. Scaffold with netting.
4. Scaffold without netting.
5. An **Approved** self-supporting **Conductor** replacement system or another system acceptable to the **Designated Engineer** or their delegated representative.

15.2.4 If any crossings at any voltage are encountered which do not appear on the **Permit-to-Work** or **Crossing Log**, then the work **Shall** cease until the **Senior Authorised Person** with sufficient knowledge of the work to maintain safety, has investigated and given permission for the work to proceed.

15.3 Preparing to Work on Overpassing Overhead Lines Near Crossing Points

15.3.1 The **Senior Authorised Person Shall** be satisfied that all crossings have been identified and fit **Approved** Notices at the towers/poles on either side of all **Crossing Points** on the line to be worked on.

15.3.2 Prior to issuing the **Permit-to-Work** on the overpassing overhead line, **Shall** be made safe for work in accordance with **OSR** 4.1.1 (a) – (f), and the following additional control measure **Shall** be carried out:

- The **Senior Authorised Person Shall** specifically identify the **Crossing Points** and any restriction(s) in the work activity, in the Issue section of the **Permit-to-Work**. Where numerous **Crossing Points** are identified, a **Crossing Log** (see Appendix B) may be used to support the **Permit-to-Work**.

15.3.3 No work **Shall** be carried out in any span identified as a **Crossing Point** on the **Permit-to-Work** or **Crossing Log** until a briefing covering the requirements of clause 15.4.2 has been carried out by the **Senior Authorised Person**.

15.3.4 No work **Shall** be carried out on poles / towers immediately adjacent to a Crossing Point that will either increase or decrease the tension in the overpassing span, until permission is granted by the **Senior Authorised Person** responsible for that span.

15.4 Working on Overpassing Spans at Crossing Points

15.4.1 The **Competent Person** in charge of the **Working Party Shall** notify the **Senior Authorised Person** that work is required at a **Crossing Point**.

15.4.2 Before any work is carried out by the recipient of the **Permit-to-Work** or persons under his charge on any span identified as a **Crossing Point** on the **Permit-to-Work** or **Crossing Log**, a **Senior Authorised Person Shall** ensure the under passing line is either:

- Permanently / temporarily undergrounded
- Under a temporary outage
- Covered by **Live** Line scaffolding
- Subject to another **Approved** Procedure sanctioned by the Operational Safety Manager

15.5 Procedure for a Temporary Outage of the Under Passing Line

15.5.1 The under passing line **Shall** be made safe in accordance with **OSR** 4.1.1 (a) – (f) with a **Permit-to-Work** issued for proximity work only.

15.5.2 To ensure sufficient control of the works, a **Permit-to-Work** for proximity work only **Shall** be issued to the **Senior Authorised Person** responsible for the over passing line.

15.5.3 The **Senior Authorised Person** issuing the **Permit-to-Work** for the over passing line **Shall** cross reference the relevant **Permit-to-Works**, specifically identifying that the under passing line has been made safe for proximity work.

15.5.4 The briefings given by both the **Senior Authorised Person** and the **Competent Person Shall** fully explain the precautions taken to enable work to commence on this specific span.

15.5.5 When the work is completed on the overpassing span, the **Permit-to-Work** recipient **Shall** instruct his **Working Party** that it is no longer safe to work on that span.

15.5.6 The **Senior Authorised Person Shall** include the following standard wording within the Clearance section of the **Permit-to-Work** for the under passing line: "*I confirm that all over passing work has been completed".*

15.6 Procedure for Use of Live Line Scaffolding

15.6.1 Once **Live** Line scaffolding is in place, the **Senior Authorised Person Shall** ensure it complies with the requirements of PR-NET-OSM-012 Design and Use of Temporary Scaffold Guards and Conductor Support Systems for Crossing Overhead Lines with Conductors Live and in Service – Section 7.5

15.6.2 The **Senior Authorised Person** who has completed the scaffolding over the under passing circuit **Shall** formally inform the Project Manager responsible for the work on the over passing circuit that work has been completed.

15.6.3 Before any work on the over passing span may begin, the **Senior Authorised Person** in charge of the over passing line **Shall** confirm that the scaffolding work has been completed.

15.6.4 Before any work on the over passing span can begin, the **Senior Authorised Person** in charge of the overpassing line **Shall** check the “Scafftag” and visually confirm the scaffolding is satisfactory.

15.6.5 The briefings given by both the **Senior Authorised Person** and the **Competent Person Shall** fully explain the precautions taken to enable work to commence on this specific span.

15.6.6 When the work is completed on the span, the **Permit-to-Work** recipient **Shall** instruct his team that it is no longer safe to work on the relevant span.

15.7 Working on Under Passing Spans at Crossing Points

15.7.1 Even if the work is assessed as being permissible with no additional or specific safety precautions, the briefing will make clear reference to the presence of the overhead **Conductors**.

15.7.2 Assessment might indicate that the work may only proceed under the **Personal Supervision** of the **Senior Authorised Person**, or that precautions similar to the overpassing case above be applied, by the issue of a **Permit-to-Work**, or by other means such as the erection of a suitable barrier.

15.7.3 Particular care should be taken in assessing reconductoring work, whether under or even close to other lines, i.e. should the overpassing overhead line be **Isolated** and **Earthed,** or can the **Danger** be controlled whilst work is in progress?

16 Work on Earth Wires

16.1.1 Work may be carried out on the **Earth** wire under the direction of a **Senior Authorised Person** provided that there is no possibility of infringing **Safety Distances.**

16.1.2 Care should always be taken to ensure the continuity of **Earth** wire **Conductors** throughout any work irrespective of any outages, as the **Earth** wire will provide a low impedance return path for stray fault currents etc.

16.1.3 Work that may alter the sag of an **Earth** wire **Shall** only be carried out with all the phase **Conductors** attached to that support **Isolated** and **Earthed**, unless carried out in accordance with an **Approved** procedure.

16.1.4 Lowering, raising or re-stringing of the **Earth** wire where phase **Conductors** are not **Isolated** and **Earthed Shall** be carried out in accordance with the requirements of ENA SHE 006.

16.1.5 Standard **SSEN-D** deviations to the requirements of ENA SHE 006 are **Approved** by the **Designated Engineer** and are contained within PR-NET-OSM-061 Management of Faults on **High Voltage** Overhead Lines - Operational Safety Manual - Section 7.4.

16.1.6 When lowering, raising or re-stringing of the **Earth** wire where phase **Conductors** are not **Isolated** and **Earthed**, the **Designated Engineer** or nominated deputy **Shall** provide specific site by site Approval.

17 Revision History

No	Overview of Amendments	Previous Document	Revision	Authorisation
01	New document created	TBC	1.00	Richard Gough
02				

Appendix A Earthing Schedule Example

Scottish & Southern Electricity Networks

Earthing Schedule

FO-NET-OSM-101 Rev: 1.00

Fitting and Removal of Additional Earths on on steel tower lines operating at 33kV and above including pole lines operating at 132kV and above.

Earthing Schedule Number: ***Safety Document Number:***

(i)	Location	
(ii)	Plant/Appraratus Identification	
(iii)	Work or Testing to be carried out	

Sequence or Scheme of Application from PR-NET-OSM-101			Points of Application	Tower Type:	No. of Additional Earths	Remarks/Process

Type and Number of earths required **Normal:** **Bridging:** **Running:** **Bridles:**

Prepared By:
Name (print): Signature : Time : Date:
Approved By: SAP
Name (print): Signature : Time : Date:
Receipient:
Name (print): Signature : Time : Date:

Appendix B Crossing Log

This **Crossing Log** forms part of **Permit-to-Work** No……. Circuit Reference……

No work, access, or infringement of **Safety Distance Shall** be made to any under or overpassing **High Voltage** or **Low Voltage Apparatus** in the spans identified below and that:

No work, (other than the application or removal of **Earths** & positioning or removal of tools within the tower body), **Shall** be attempted by me or any person under my charge on the spans identified below, until columns 2, 3, 4 and 5 (for the appropriate span), have been completed by the relevant personnel.

No work, (other than the application or removal of **Earths** & positioning or removal of tools within the tower body), **Shall** be attempted by me to any person under my charge on the spans identified below, once columns 6, 7, and 8 (for the appropriate span), have been completed by the relevant personnel.

In the event that control of the **Conductors** is lost, the holder of the **Permit-to-Work** (for crossing overhead line) **Shall** be notified and **Shall** be on site before any attempt is made to recover the **Conductors**.

1		2	3	4		5	6		7	8
Span between Tower No's		PTW No	Signature of SAP releasing span for work	Permission Received		Signature of PTW recipient accepting span for work	Permission Clearance		Signature of PTW recipient clearing work on span	Signature of **SAP** clearing work on span
				Time	Date		Time	Date		