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MANAGEMENT OF RISE OF EARTH POTENTIAL AT NEW AND REFURBISHED TOWERS

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PURPOSE AND SCOPE

New OHL tower routes and existing legacy OHL tower routes that are to undergo structural analysis as part of a refurbishment or uprating scheme should be the trigger for the implementation of this technical guidance document.

The objective of this TGN is to comply as far as is reasonably practical with BS EN 50341[1] and that the associated cost of mitigation chosen to comply with the above standard be capitalised as part of necessary safety works against that scheme.

This document details the process which should be used to determine the need for and choice of mitigation when managing risks to third parties from rise of earth potential (ROEP) seen during local circuit fault conditions on or adjacent to NGC owned 'Often Frequented' towers (see Figure 1).

Legacy OHL routes that are not subjected to tower structural analysis as part of a refurbishment or uprating scheme should not be considered as falling within the scope of this document. In cases such as this, identification, verification and implementation will be by other means.

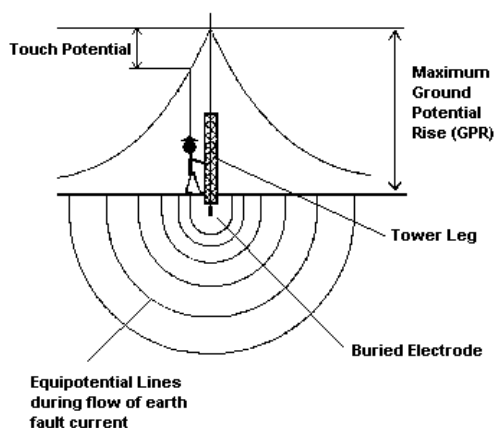
For in-depth detail associated with touch, step and transferred potentials see EA TS 41-24 [2]

PART 1 – GUIDANCE

1 MANAGING TOUCH, STEP AND TRANSFER POTENTIALS

1.1 Touch potentials

Touch potential is taken as the potential difference between the tower leg and the ground surface 1m out from that point.

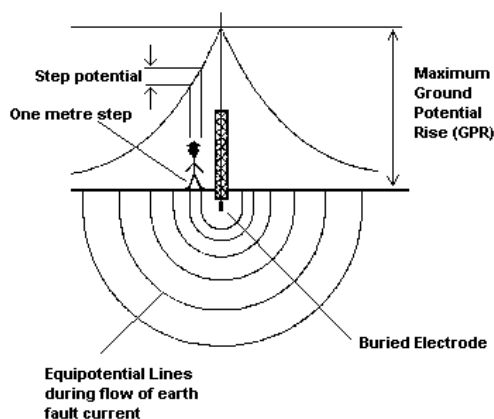


- 1.1.1 BS EN 50341 requires that touch potentials at Often Frequented Towers (OFTs), see section 1.4, are maintained below specified limits.

- 1.1.2 It should be assumed that touch potentials at all towers (with the exception of most terminal towers that should be directly connected to the associated substation earth mat) exceed the safe limit prescribed in EA TS 41-24 of 1.0kV on a soil surface.

1.2 Step Potentials

- 1.2.1 Step potential is taken as the ground surface potential difference between 1cm from edge of tower leg and 1m out from that point.

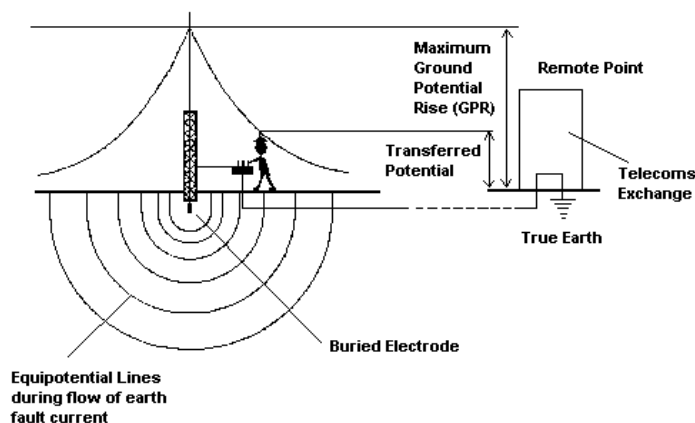


- 1.2.2 Step voltage permissible limits are not defined in BE EN 50341, but are defined in EA TS 41-24 as 3.1kV on a soil surface.

- 1.2.3 Step potentials at some towers on the system may be hazardous, depending on the earth return current, tower type and ground resistivity.

1.3 Transfer Potentials

- 1.3.1 Where a tower is to be sited in the vicinity of third party infrastructure, there may be a hazard due to transferred potentials associated with metallic services supplying the property.



- 1.3.2 The established threshold voltages (for a 200ms max. fault clearance time) corresponding to different third party infrastructure are provided in Table 1.

Cat.	Third Party Infrastructure	Threshold Limit Voltage (via proximity effect)
A	Domestic residence or commercial property	1700 [3]
B	Hazardous process plant e.g. refinery	650 [1]
C	Railways	1150 [4]

Table 1 – Transferred Potential Threshold Limit Voltages

- 1.3.3 The voltages in Table 1 are those impacting via proximity effect i.e. via the ground rather than by direct conduction that is assumed not to be applicable for most towers. These threshold voltage limits are based on the industries current understanding of the hazards associated with ROEP.
- 1.3.4 Occasionally, towers will be identified during the assessment process, which may present hazards to 3rd parties from conducted transfer potentials (e.g REC supplied aircraft warning lights sited on tower structures). Where this is discovered, a means of eliminating the hazard should be discussed if necessary with the Asset Policy Manager of Asset Strategy.

1.4 Often Frequented Towers (OFTs)

- 1.4.1 OFTs are defined in the Standard as towers at locations which are freely accessible to people and where people can be expected to be either for a relatively long time (some hours per day) during some weeks, or for a short time but very frequently (many times a day). For example close to residential areas or play grounds are included and shall be reviewed in more detail, whereas locations which are only occasionally occupied such as forests, open country sides etc are not included.
- 1.4.2 Advanced risk assessment techniques have been applied at a number of potential OFTs, which has provided more detailed guidance as to what is and what is not an OFT. Table 2 gives some examples of towers that have been assessed as OFTs and some that have not.

- 1.4.3 As part of the recording of information, Form 1 has been included within this TGN to record towers assigned an OFT status following a site visit at the scheme development stage. This form should be returned to the Scheme Development Engineer for records and co-ordination.
- 1.4.4 Note that the examples in Table 2 are not exhaustive and there will be times when tower sites under review do not fit comfortably into any of the categories detailed within Table 2. In such cases, a local site visit and assessment should be undertaken and relevant detail recorded on Form 1 and returned to the Scheme Development Engineer so that, if necessary a local site risk assessment can be carried out.

Often Frequented Towers	Non Often Frequented Towers
Tower in school playground/playing field or children's play area	Tower adjacent footpath
Tower in formal or informal play area / sports ground, picnic or other recreational area.	Tower adjacent road
Tower in domestic garden (including holiday accommodation) or where free access to the tower legs within 3m of property or holiday accommodation is possible (i.e where access is not restricted by a physical barrier	Tower adjacent bridleway
Tower in industrial or commercial environment where there is significant activity around the tower legs e.g. builder's merchants storage yard, plant nursery etc	Tower in golf course
Tower legs in field that are freely accessible and where large numbers of people congregate (e.g music concert, agricultural show, car boot sale etc	Tower in car park
Tower close to point of normal access/egress to premises where people may linger (e.g a designated fire meeting point or smoking area)	Tower in farmland
Tower in caravan site or where site is used as a permanent encampment by travellers	Tower in wood or forest
A tower where there is evidence of public activity (i.e children's local meeting/gathering point	Risks to Mobile Phone Base Station operators are managed through owner company specific working procedures.

Table 2 – Often Frequented Tower Examples

1.5 Determination of ROEP

- 1.5.1 The methodology for determining the maximum ROEP, the distance over which step potentials are exceeded and the potential gradient at a particular tower is detailed in Appendix A. Where a particular tower type is not included in Appendix A, the nearest equivalent should be chosen.

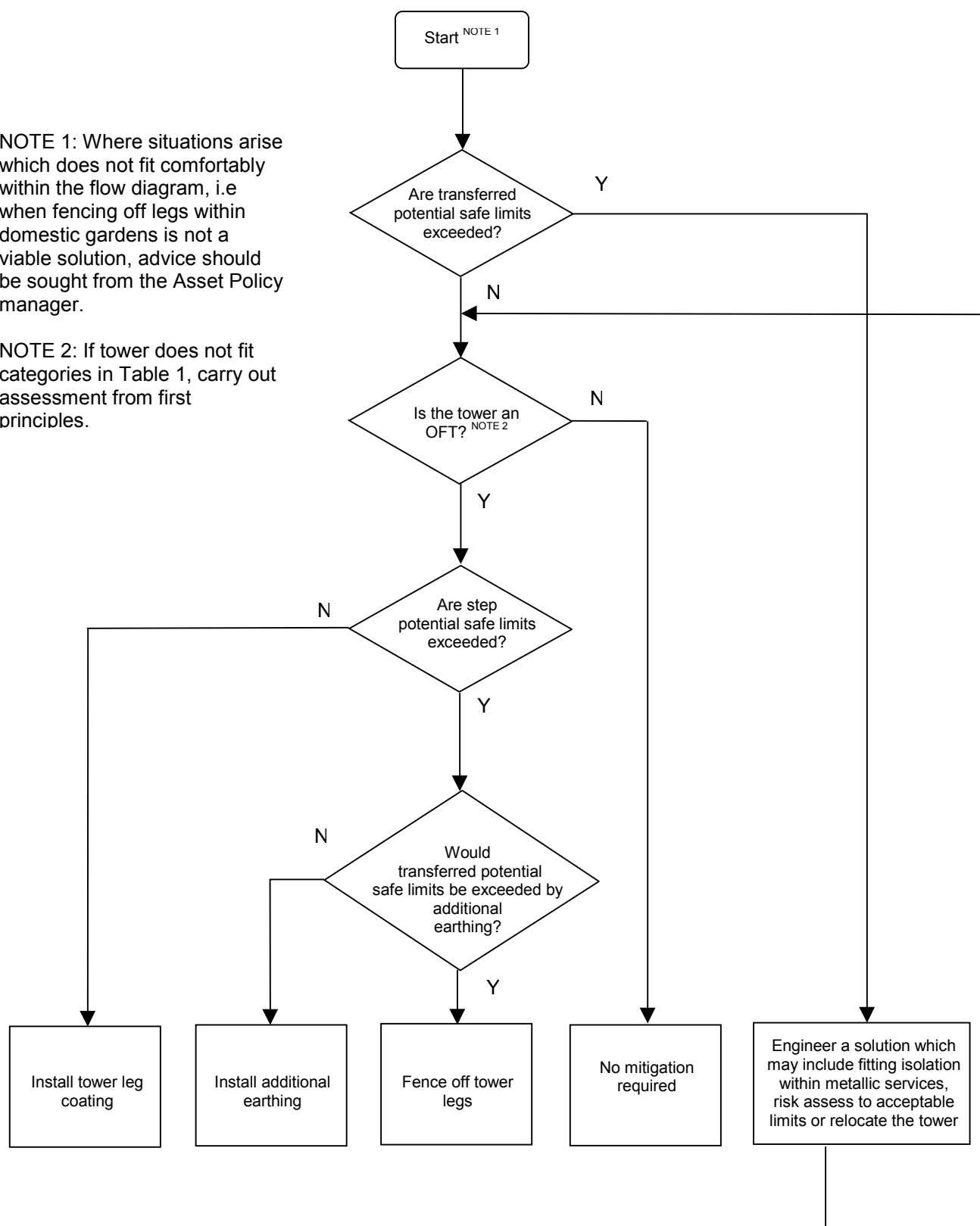
1.6 Mitigation

- 1.6.1 The choice of appropriate mitigation measures should be made in accordance with the flow diagram in Figure 1. Additional earthing would involve a buried electrode system connected to the tower legs designed to control touch and step potentials.
- 1.6.2 The tower insulating coating shall have a withstand voltage rating of 50kV and shall comply with NGTS 3.1.2 [5]

FIG 1 – Mitigation Measures Flow Diagram

NOTE 1: Where situations arise which does not fit comfortably within the flow diagram, i.e when fencing off legs within domestic gardens is not a viable solution, advice should be sought from the Asset Policy manager.

NOTE 2: If tower does not fit categories in Table 1, carry out assessment from first principles.



2 FORMS AND RECORDS

Form 1 - Tick sheet to record local assessment of tower against OFT status

Often Frequented Towers – Record			
Name of Assessor		Company Name of Assessor	
Date of Assessment			
Tower route and tower number identification marker (e.g. 2KN082)			
Description and distances of properties close to tower (e.g. Domestic, Industrial or Commercial buildings)	House/s	(describe)	(metres)
	Industrial		
	Commercial		
	Other		
Often Frequented Tower - Reason			
Tower in school playground/playing field or children's play area		(tick)	
Tower in formal or informal play area / sports ground, picnic or other recreational area.			
Tower in domestic garden (including holiday accommodation) or where free access to the tower legs within 3m of property or holiday accommodation is possible (i.e. where access is not restricted by a physical barrier)			
Tower in industrial or commercial environment where there is significant activity around the tower legs e.g. builder's merchants storage yard, plant nursery etc			
Tower legs in field that are freely accessible and where large numbers of people congregate (e.g music concert, agricultural show, car boot sale etc			
Tower close to point of normal access/egress to premises where people may linger (e.g a designated fire meeting point or smoking area)			
Tower in caravan site or where site is used as a permanent encampment by travellers			
A tower where there is evidence of public activity (i.e children's local meeting/gathering point			
Other reason not identified above		(describe fully)	