Chartered Technician Wind Turbine Safety Rules guidelines
WTSR v3 & SCADA cyber security

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1 Guideline for the Chartered WTSR v3 Certification of Wind Turbine Service Technicians (Edition 2015)

Michael Mattocks, City & Guilds Examiner and Microsoft HQ User Groups mentor, explained the relevance of the new guidelines:
“It is important for owners and manufacturers of wind turbines as well as banks and insurers involved to know the different certification processes and guidelines for Wind Turbine Service Technicians.
The updates incorporate the new releases from RenewableUK Wind Turbine Safety Rules version 3 (WTSRv3) including the High Voltage boundaries for WTG internal transformers. Currently there are Operational Safety Rules Group discussions whether Technicians should attain the HV Certification as well.
It has been developed primarily to enable those Engineers who have not attained funding for an Apprenticeship to complete the first week of learning and attain the Chartered status to progress to be an Authorised Engineer”

This Guideline was compiled by WindHSE.org in cooperation with the Health & Safety Executive, Lloyd’s Underwriters representative of the European Wind Turbine Committee and RenewableUK steering committee members including Siemens , Repower, Vestas and utilities such as RWE.

City & Guilds WTSR v3 Certification has been successfully piloted by DNV-GL the certification body for Wind Turbines.

This Guideline comes into force on 1st July 2015

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City & Guilds Qualification Level 3 Electrical Power Engineering-Wind Turbine Maintenance
2339 79 Unit 750 Health and Safety in the power industry

Demonstrate an understanding of Health and Safety

1.1 Identify statutory regulations and organisational requirements for Health and Safety

It is paramount for Wind Turbine Service Technicians to understand that they have a partnership arrangement with their Operational Controllers when controlling the supply of Wind generated electricity. There are important control panel security protocols that they must be aware of as Ethernet Technicians.

Cyber Security of industrial processes is now so pertinent that inter/national government departments are forming partnerships to raise employee awareness of these threats.

http://www.hse.gov.uk/horizons/current-issues/science-and-technology/cybersecurity.htm

'Implications:

> Accidental failure or malicious attack on process control systems could result in loss of system-critical safety functions such as interlocking and emergency shutdown systems and disruption of control of the process, potentially resulting in serious risks to operators and possibly the public. Whilst it is good practice to isolate safety-critical control or protection systems from any connectivity to the 'outside world' this approach is being challenged by the changing nature of plant electronic control and management systems. This is leading to increased vulnerability of plant to electronic attack, whilst at the same time the threat level is increasing. The possibility of such electronic attack of control systems is recognised as a threat to the Critical National Infrastructure . Understanding electronic attacks .'

http://www.automation.siemens.com/mcms/topics/en/wind-automation/pages/default.aspx

http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=43876783&caller=view%20%20

Updated	Current status of infected computers
11.03.2011	To date a total of 24 Siemens customers in the industrial sector worldwide have reported being infected with the Trojan horse. The malware was able to be removed in all cases. In none of these cases did the infection have an adverse impact on the automation solution.

Recommended procedure to identify and remove a Stuxnet infection
We recommend examining the following types of computers: 1. Embedded systems (e.g. Microbox) 2. Other computers Infrastructure computers (file servers, domain controllers, other servers...) Computers with and without WinCC installation

The following safety precautions also apply:

- All connections with the outside world must be checked and cleaned (customer data, USB devices, others).
- If possible, do not use any third-party USB sticks and/or mobile data carriers.
- Always check the safety concepts. For example, disable/uninstall services that are not needed.
- Installation of the Microsoft Patch is recommended for the operating systems listed by Microsoft

http://www.us-cert.gov/control_systems/pdf/ICSA-12-158-01.pdf

These vulnerabilities may be remotely exploited.

AFFECTED PRODUCTS

Siemens WinCC 7.0 SP3 web server and web applications are affected. These vulnerabilities may allow an attacker to gain unauthorized access, read from, or write to files and settings on the target system.

BACKGROUND

Siemens SIMATIC HMI is a software package used as an interface between the operator and the programmable logic controllers (PLCs) controlling the process. SIMATIC HMI performs the following tasks: process visualization, operator control of the process, alarm display, process value and alarm archiving, and machine parameter management. This software is used in many industries, including food and beverage, water and wastewater, oil and gas, and chemical.

WinCC web applications are susceptible to reflected cross-site scripting because they do not filter out characters when parsing URL parameters. Exploitation of this vulnerability may give an attacker authenticated access to WinCC web applications.

The object-oriented SCADA system Simatic WinCC Open Architecture allows you to implement integration of a wide variety of components

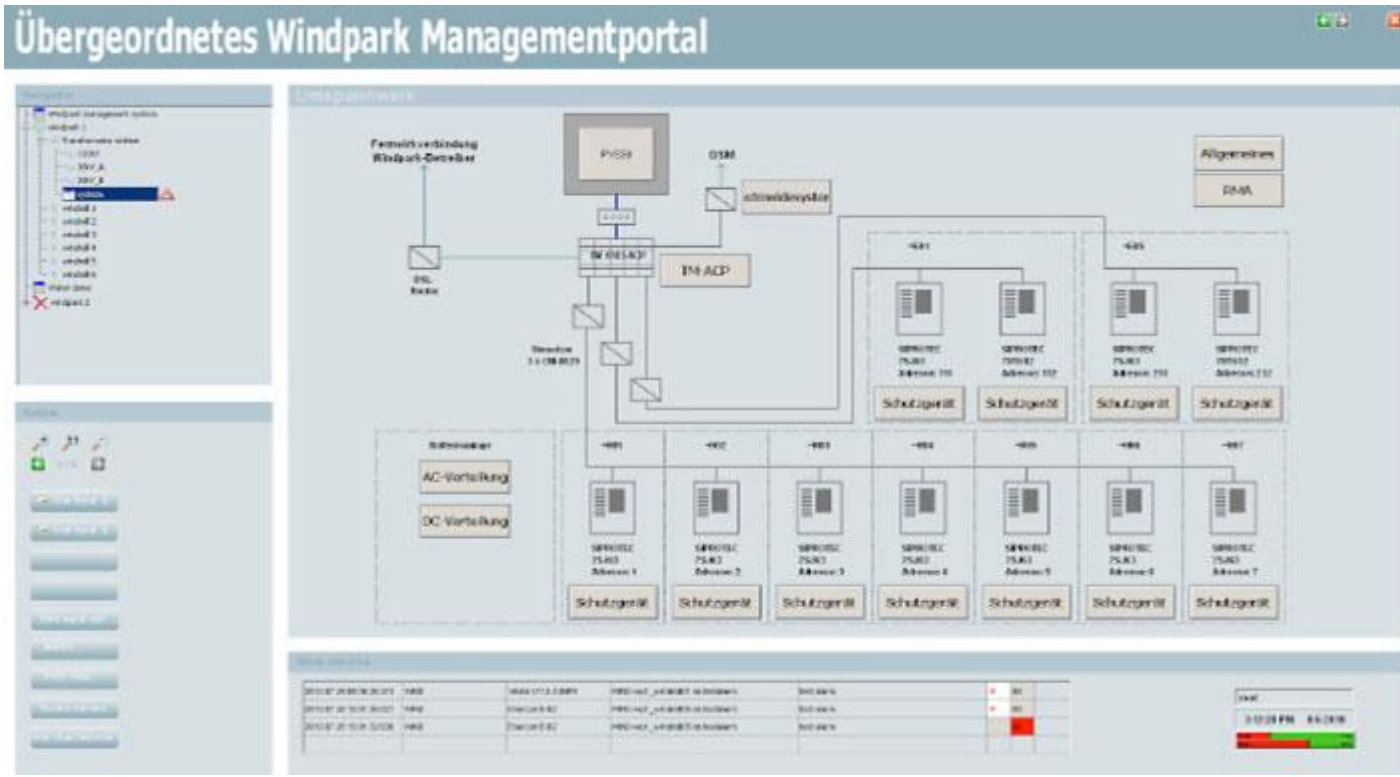
However this comes at a cost of potential intrusion & technicians need to be mindful of this during their operations:

http://www.industry.siemens.com/verticals/global/en/wind-turbine/wincc/pages/default.aspx

Efficient Wind Farm Management

Central Control Desk with SIMATIC WinCC Open Architecture

SIMATIC WinCC Open Architecture from Siemens is a SCADA system that can be flexibly adapted to your specific requirements. This system is ideally suited as a central control desk for high-availability wind power plants. If personnel are distributed over a large geographical area or if a large number of wind farms have to be managed, the scalability of our SCADA system across several spatially distributed servers is a distinct advantage. Your benefit: From a central control desk, you have full access to all measured data, alarms, histories, and configurations of your wind turbines



WinCC and PCS 7 are the first SCADA systems to be specifically targeted by malware. The Stuxnet worm can spy on and even reprogram infected systems.It can cause Blades to overspin in replay control instructions where Blades can cause physical damage to a tower. Stuxnet can provide false feedback to controllers 'ensuring that they will not know is going wrong till it's too late to do anything about it' (IEEE.org)

1.2 List the roles and responsibilities of relevant Health and Safety organisations (Wind Turbine Safety Rules version 3 WTSRv3)

The national Wind Energy Association comprising all major Wind Energy Corporation members works in partnership with the national Health & Safety regulator to implement evolving standards

Renewable UK (formerly the British Wind Energy Association) is responsible for the Wind Turbine Safety Rules or 'hierarchy of controls'

These are increasingly being adopted by Wind Energy Companies worldwide as far away as New Zealand

Wind Turbine Safety Rules

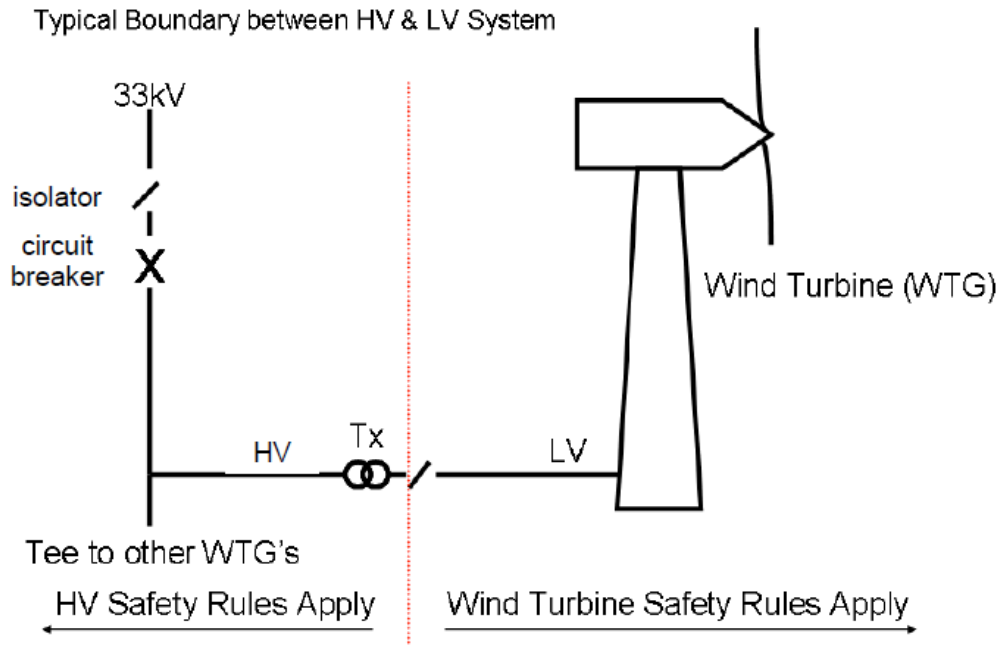
The RenewableUK (formerly known as BWEA) Wind Turbine Safety Rules (WTSR) have been developed by wind farm owners and operators for the purpose of formalising a safe system of work for operational wind turbines (onshore and offshore).

" The WTSR have been operational since late 2005 and they have been used at over 100 wind farms in the UK and Ireland. There is wide-scale buy-in, including positive feedback from site technicians. In June 2009 they were revised to include minor improvements identified by operators based on experiences gained from their use.

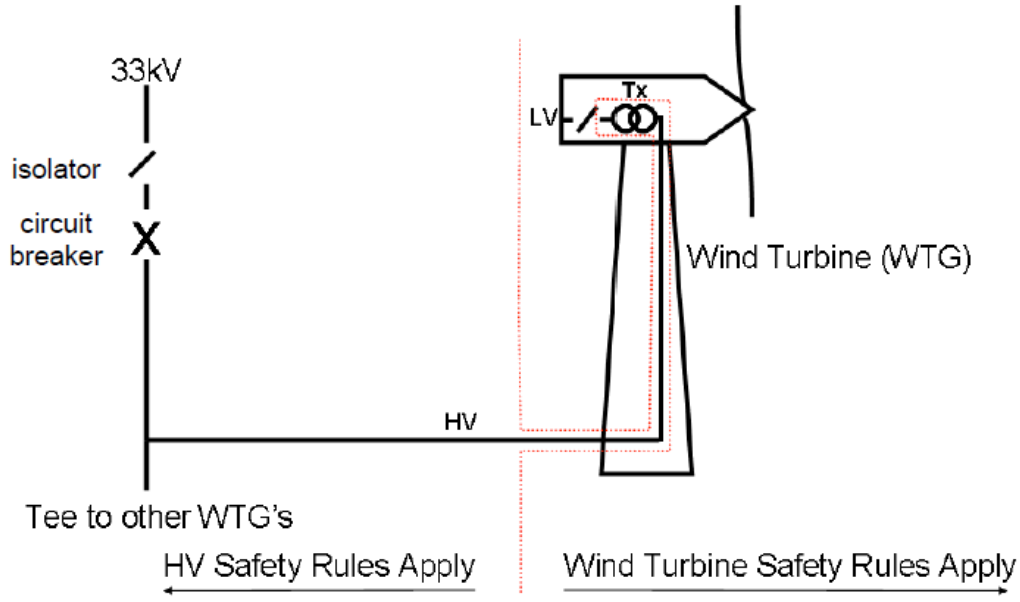
The WTSR set down the procedures to be followed when undertaking work or testing on plant and low-voltage (LV) apparatus associated with a wind turbine generator (WTG). Any work or testing on the high-voltage (HV) infrastructure that forms part of the wind farm or WTG should only be permitted under a set of approved HV safety rules

The Wind Turbine, its plant with their associated (LV) infrastructure (WTSR apply)

The boundary between these two systems needs to be clearly defined - a typical example is shown below:



EXAMPLE OF BOUNDARY WHERE TRANSFORMER IS LOCATED EXTERNAL TO THE WIND TURBINE GENERATOR



EXAMPLE OF BOUNDARY WHERE TRANSFORMER IS LOCATED INTERNAL TO THE WIND TURBINE GENERATOR

To carry out work on equipment in a wind turbine, the WTSR require Approved Written Procedures (AWP's) to be put in place for each work package significant enough to warrant it. An AWP is a procedure which specifies how work on plant & apparatus below 1000V AC or 1500V DC, will be carried out safely - it is similar to a method statement and it includes checkpoint signatures as auditable proof that safety precautions were applied for the duration of the work. The WTSR's also give guidance on when AWP's are required and when they are not necessary

RenewableUK HSE Guidelines

10.3 Operation 10.3.1 *Operational instructions*

Under the requirements of CDM, the EU Machinery Directive and CE Marking process, and the WTG Certification programme specified in IEC WT01, manufacturers of the wind farm hardware (including electrical infrastructure equipment and WTG) are required to supply to the owners/operators with an operations and maintenance manual. This manual is required to explain how the equipment is to be safely operated, maintained and inspected. The manual should also detail the frequency of maintenance checks and appropriate maintenance activities (including recommendations for component replacements) to be performed to maintain the integrity and the ongoing safety of the device.

Philosophy of the WTSRs : Wind Farms consists of two distinct systems:

A) The High Voltage Infrastructure (>1,000V AC/1500V DC)

B) The Wind Turbine Plant & associated Low Voltage infrastructure

Boundary between the two Systems must be clearly defined and understood - historically recognised within the industry as the switchgear associated with the LV side of the WTG transformer

AWP are required for each work package with Checkpoint Signatures and as these will become electronically recorded we will see the use of Digital Checkpoint Signatures (eg for recording IP Sensors & Actuators)

WTSR 'hierarchy of controls' stipulate handover from the 'control centre' to the Authorised Technician/Engineer

You as a WTG will receive WTSR similar to that provided by your Association

COMPANY ‘A’

WIND TURBINE SAFETY RULES

Third Edition

Operative from (DAY) (MONTH) (YEAR)

Issued by COMPANY ‘A’

Issued to:

..... (Signed)

..... (Print Name)

..... Date

10.9.3 The RenewableUK OSR sub-group has identified a need to examine how the rules could be developed to encompass the HV equipment that provides the connection to the grid, and which is now becoming increasingly present inside wind turbines. The result of this work is a new set of rules that can be applied to the turbines alone, or to the whole wind farm. The progress and results of a set of new rules, currently under operational trials, are available on the RenewableUK website (www.renewable-uk.com).

10.9.4 In order to establish a safe system of work, consider: • the need to establish safe working methods and written procedures; • the need to establish permit-to-work procedures; • any requirements for isolation, locking-off or tagging; • cross boundary/interface safety, e.g. with Distribution Network Operators;

1.3 State accident and emergency procedures

Emergency Response Procedures are essential to the WTG Technician and for this reason the Guidelines are updated by the Professional Association

http://www.renewableuk.com/download.cfm?docid=EBE2B090-0537-4315-BCFF2826FA5D96FC

9.10 Emergency arrangements

9.10.1 A site Emergency Response Plan (Project ERP) must be in place during the construction phase, with appropriate additions or adjustments for specific or 'one-off' operations.

When developing the ERP, consideration should be given to the remoteness of the site location and response times of emergency services, and appropriate arrangements provided, i.e. equipment and trained personnel (e.g. first aid / rescue training), to ensure self sufficiency and preservation of life until emergency services are in attendance.

Emergency Response Plans must include (as a minimum):

• the roles and responsibilities of all key personnel appointed to effectively manage the organisation's emergency response arrangements, including those in overall control and those appointed to control each site;

• contact details for organisation's legal advisers to be used in the event of serious incidents;

• emergency contact details for all internal and external parties involved in the works;

• vessel contact details (note: vessels >300 tonnes will be ISO-registered with a certified ISM system);

• third-party emergency service contact details;

• the location of all site access points and site plans;

• details of potential hazards and emergency situations that the emergency services may encounter;

• details and locations of significant hazards, e.g. high-voltage equipment;

• details and locations of nearby installations that may provide assistance in an emergency;

• emergency communications procedures;

• emergency response procedures for initial actions in emergencies that could be anticipated, including:

- evacuation of nacelle and WTG,

- emergency shutdown of energised equipment,

- failed lifting operations,

- fire,

- sickness,

- injury,

- pollution,

- bomb threat / sabotage,

- extreme weather,

- man overboard,

- vessel collision / grounding / punch-through,

• emergency response arrangements, including the provision of first aid equipment, rations and equipment in the event of stranding.

9.10.2 The following procedures should be established in line with the ERP, based on suitable and sufficient risk assessments and following consultation with local emergency services:

• all foreseeable emergency situations relevant to both onshore and offshore sites, including evacuation and escape;

• safe transportation and storage of hazardous materials, e.g. flammable substances;

• hazardous activities, such as hot work (the application of heat, including welding, burning or grinding on plant containing flammable materials), potentially including cable jointing/terminating;

• abnormal weather conditions, e.g. extreme cold, floods and lightning; and

• abnormal sea states, high winds and poor visibility.

9.10.3 Based on a suitable and sufficient fire risk assessment, working areas should be provided with:

• means of raising the alarm;

• clear and accessible evacuation instructions;

• suitable means of escape, including signage, emergency lighting and designated assembly areas;

• portable fire-fighting equipment;

• means of disposing of scrap and waste materials safely;

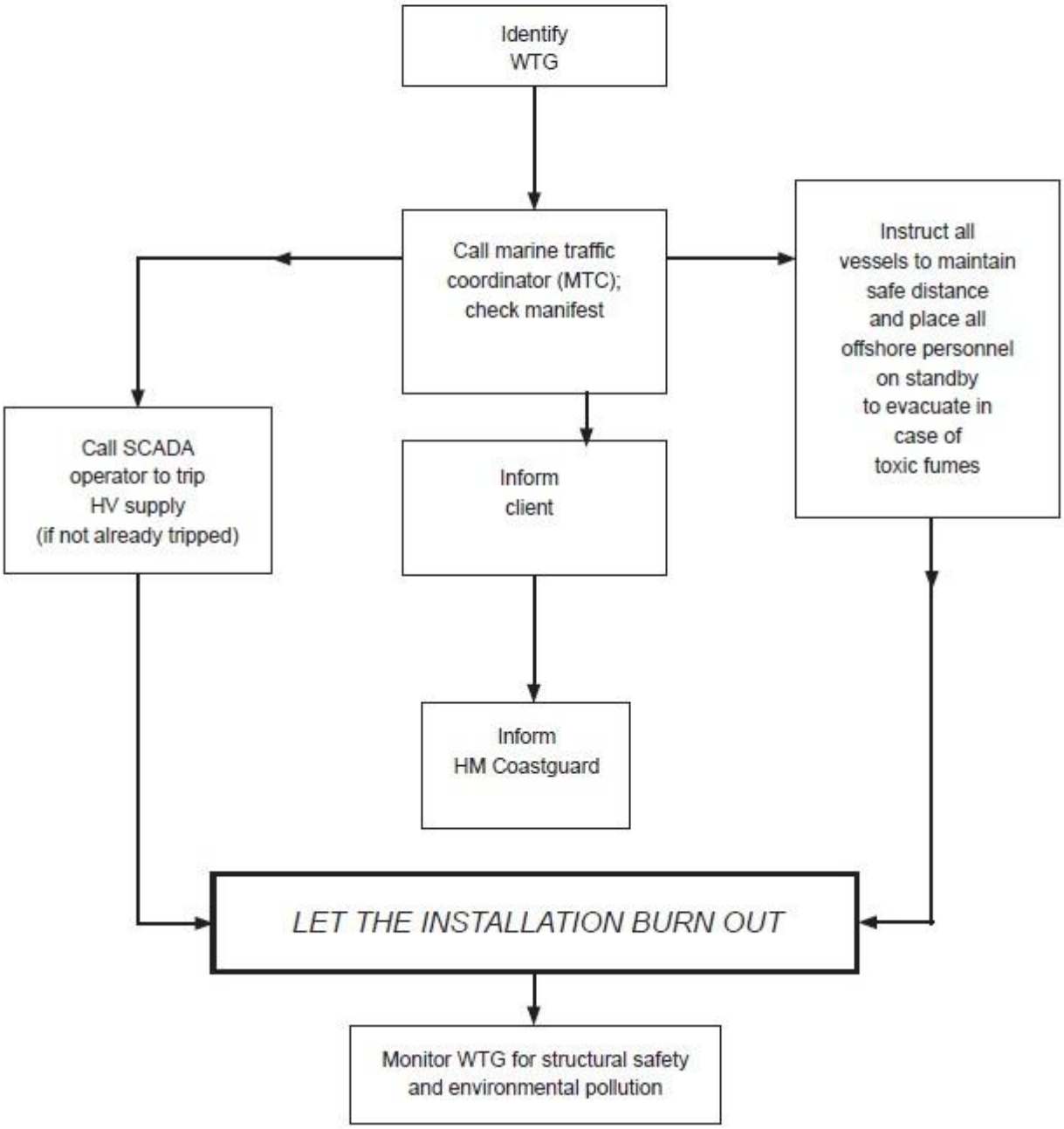
• fixed fire detection and extinguishing systems, where appropriate;

• additional precautions/devices as recommended by the fire risk assessment (e.g. smoke hoods, places of safety, refuges etc.); and

• provision for disabled egress (in case of injury and for Disability Discrimination Act compliance).

When all of these are in place WTG Technicians will be well placed for any Emergency Procedures such as

Emergency procedure: fire in WTG



1.4 Demonstrate and implement safe working practices with respect to safe working areas.

Control system involves three basic elements: sensors to measure process variables, actuators to manipulate energy capture and component loading, and control algorithms to coordinate the actuators based on information gathered by the sensors.[1]

As explained earlier WTG Technician understanding of the Wind Turbine Safety Rules (WTSR) as provided by your Professional Association are paramount in work involving electrical isolation before ANY maintenance is undertaken

In addition WTG Technician familiarity of WTG Security should become *second nature*

Refer to your downloaded Professional Association guidelines in the first instance

(cite http://www.renewableuk.com/download.cfm?docid=EBE2B090-0537-4315-BCFF2826FA5D96FC)

9.15 Security

The Occupier's Liability Act 1957 and 1984 requires employers to make provision for both lawful and unlawful visitors. Security measures should be sufficient to prevent access by any unlawful visitors without causing them harm.

All security measures should be put into effect prior to construction work starting and should be updated as necessary throughout occupation of the site. The measures should:

• ensure provision to prevent unauthorised access to the site;

• ensure materials are stored without risk to Health and Safety;

• ensure construction plant is secured against unauthorised operation;

• establish procedures for control of visitors;

• establish procedures for visiting workers; and

• ensure provision to monitor the effectiveness of the security arrangements.

Additional measures will be required when reviewing security arrangements during the construction and operational phases offshore'

These Additional measures whether for offshore or onshore wind farms increasingly include measues to prevent unauthorised Electronic access of the PLC

Before any operations or maintenance the WTG should remember the advice of their association you have downloaded with regards to

10.16 Safety equipment

10.16.1 The requirement for safety equipment should be identified within risk assessments. This may typically include:

• cable detectors;

• high-voltage measuring devices;

• portable earthing devices;

• temporary barriers, screens and notices;

• isolation devices for installed equipment, e.g. locks, chains, mechanical clamps; and

• survival/immersion suits, lifejackets, buoyancy aids, throwing lines and personal location beacons.

10.16.2 Ensure that when safety equipment is used:

• it is recorded on a register;

• persons are trained and competent in its use;

• it is properly stored, cleaned and maintained;

• it is periodically checked to ensure it remains in good working order and is safe to use; and

• all inspections and examinations are recorded, and records are retained.'

WTSR should also become second nature for WTG Technicians globally as they set the precedent for the HV/LV demarcation & thus the hierachy of controls

Scenario WTSR

The hierarchy of control (safety rules) under normal maintenance conditions as applied in a wind turbine

- Confirmation and identification of the turbine to be worked on, Authorised Technician liaises with the control centre
- Depending on the design of turbine, the remote control centre will stop operation of the turbine directly or hand over control of the turbine to the technician
- The turbine is put into 'service' mode by the Authorised Technician
- Manual brake is applied to the rotor
- Only competent technicians to work on the turbine, one of whom must be an Authorised Technician
- Once the maintenance is complete and all technicians have left the turbine, the Authorised Technician removes the manual brake and returns the turbine from 'service' mode to operational mode and control of the turbine is handed back to the remote centre

1.5 Identify relevant safety and hazard warning signs.

According to Wind Farm operators association safety & hazard signs are paramount to visualise potential dangers to WTG technicians

Refer to the British Wind Energy Association guidelines:

HEALTH AND SAFETY (SAFETY SIGNS AND SIGNALS) REGULATIONS

Safety signs must be provided where the risk assessment indicates that risks cannot be avoided or adequately controlled in other ways.

9.10.3 Based on a suitable and sufficient fire risk assessment, working a

• suitable means of escape, including signage, emergency lighting and designated assembly areas

9.14 Site access

• should be marked with warning signs and notices

Danger areas

All work areas that present a risk of falling or being struck by a falling object must be fitted with equipment and signage that prevents unauthorised access.

9.19 Electrical Safety

Signage should be installed on all electrical generating equipment, junction boxes, switchgear panels and doors to identify the Health and Safety risks that personnel may be exposed to should they open covers, doors or panels. All covers, doors and panels should be locked, or otherwise prevented from being opened without a mechanical device/tool, to restrict access and prevent exposure to live electrical components and systems.'

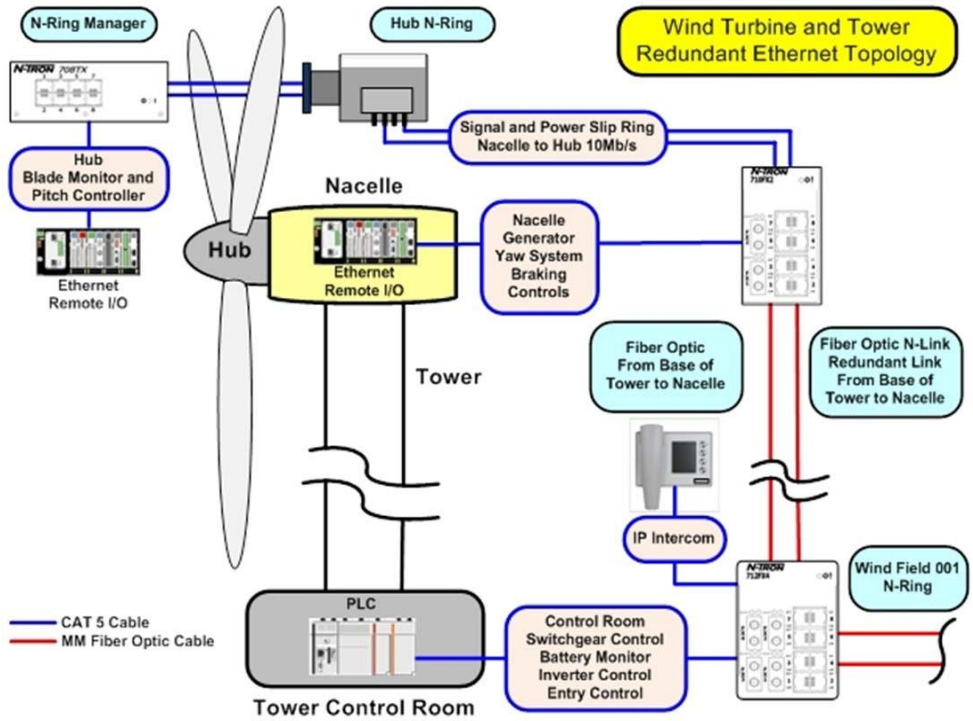
The Lock Out Tag Out scenario is probably the most important for the WTG Technician as before they consider maintenace the Turbine has to be isolated electrically

The sign is usually red to increase visibility and allow workers to readily see if a device is isolated.

1.6 Identify the reasons for accidents happening and the importance of putting in place preventative measures

Control intelligence may be distributed around the turbine, including in the hub. Control panels contain controller PLCs plus standard panel hardware to interface with sensors and auxiliary systems and combined may weigh up to 500kg. In some cases, CANbus or similar systems are used for interfacing between controller hardware and sensors, including via fibre-optic cables.

In parallel to the control system, a safety system protects the turbine from control system or operator error. Key sensors for this overriding safety system include speed and vibration sensors. This make up is illustrated here



As IEEE.org paper

"Cyber Intrusion of Wind Farm SCADA System and Its Impact Analysis"

indicates there is a Technician responsibility to maintain PIN and ethernet security with regards to Control Panel control of components

This can be done through avoid leaving chemical based fingerprints on pin pads. Thus wiping clean pin pads should become second nature.

Best practice would also mean avoid using USB sticks collected at conferences or 'on the ground' that could be infiltrated with malware such as Stuxnet or Flame.

Encryption and anti-virus checks of all files on PDAs would become common practice to avoid malware that could be used for espionage and direct 'replay attacks'. These attacks could lead to distorted PLC instructions and direct physical damage as oversped blades that may crash into the Towers or cause short circuit generator fires.

System logs (syslogs) on the Control software should be checked and any anomalies should be immediately elevated to the Computer Incident Response Team

1.7 Identify First Aiders, as well as situations where First Aid should be administered.

When it comes to the Power Sector because of the risk of severe electric shock or electrocution all Technicians should be trained in the use of First Aid to assist their buddies & team

http://en.wikipedia.org/wiki/Electric_shock

'Assuming a steady current flow (as opposed to a shock from a capacitor or from static electricity), shocks above 2,700 volts are often fatal, with those above 11,000 volts being usually fatal'

Remember according to the WTSR you are authorised to work with 1000V AC or 1500V DC

This professionalism is covered by your Association HSE Guidelines eg RenewableUK

Under the Health and Safety (First Aid) Regulations all workplaces should have first aid material in a clearly identified box and an appointed person(s) to ensure the proper management of injuries or illnesses at work. The first aid provision will depend on a variety of factors including: the nature and degree of the hazards at work, whether there is shift-work, what medical services are available, and the number of employees.

(The Government HSE regulator publications will describe further eg 'HSE booklet First Aid at Work' explains the requirements and provides guidance to help employers meet their obligations')

9.9 First Aid

Suitable risk assessments should be conducted to ensure that adequate and appropriate equipment, facilities and personnel are provided to ensure employees receive immediate attention if they are injured or taken ill at work. This should conform to the duties set out in the Health and Safety (First-Aid) Regulations

Specific examples that may require further attention for wind related projects include consideration of:

• Adequate eye wash, defibrillators, emergency showers, stretchers and other specific items of equipment relevant to the project

• Suitable measures to ensure first aid provisions are properly maintained;

• Additional training with respect to electric shock/burns, hypothermia, suspension syncope. (Note: Only following advice from a suitable competent person)

• The need to communicate to everyone on site what first aid provisions there are and where to find/summon them including the equipment and first-aiders

• Recording of first aid treatment in accordance with the statutory and company specific requirements'

1.8 State how to isolate an electrical source safely in an emergency and non-emergency situation

Define how to isolate an electrical source safely in a non-emergency:

The Wind Turbine Safety Rules (WTSR) has been developed by wind farm owners and operators for the purpose of formalising a safe system of work for operational wind turbines (onshore and offshore).

The WTSR set down the procedures to be followed when undertaking work or testing on plant and low-voltage (LV) apparatus associated with a wind turbine generator (WTG). Any work or testing on the high-voltage (HV) infrastructure that forms part of the wind farm or WTG should only be permitted under a set of approved HV safety rules

The Wind Turbine, its plant with their associated (LV) infrastructure (WTSR apply)

The Authorised Technician is responsible for:

•Transfer of Control of the WTG
•Establishing safe conditions for work as demonstrated by this educational video putting the WTG into service mode
•Checking safe conditions have been established or implementing specialist procedures that apply if equipment is still energised
•Confirming in writing that it is safe to commence work
•Supervising safety during the course of the work
•Confirming that the procedure is complete, return the WTG to an operational state and transfer operational control (Transfer Of Control)
This is achieved by following written procedures with signature checkpoints

LV Apparatus -
A voltage not exceeding 1000 volts alternating current or 1500V direct current.

- isolation where practicable
- Plant - isolation followed by draining and venting (unless the work requires the Plant to remain energised)

A2.3 Requirements for work under Approved Written Procedure

• Plant shall be clearly defined
• Plant shall be isolated, locked where practicable & Caution Notices shall be attached
• Contents adjusted (drained)
• De-pressurisation, if necessary (vented)
• For internal access, purge if residue of contents could cause Danger
• Stored Energy - contain or dissipate

A3.11 Only fused leads for portable test instruments should be used to safeguard persons from Danger

• Isolation by fuses, links isolators or other isolating devices Only
The use of time or float switches, thermostats, Emergency Stop Buttons etc.is not acceptable
• Where reasonably practicable immobilise and lock isolations
• Hand-held Apparatus - Remove plug and ensure that it is not replaced during work or testing (i.e. controller)
• Safety Keys and removable isolating devices retained by AT in safe custody (must be readily identifiable)
• Management Instruction states how AT retains items taken into safe custody
•For ongoing work transfer process as per Rule B2.3
Precautions for adjacent Live conductors (e.g. specifically appointed AT; screen off adjacent hazards; use insulated tools; mats; PPE remove metal jewellery; consider accompaniment etc.)
• Always prove 'dead' with Approved tester (at start and resumption of work and following any interruption)

Transfer of Control Process

The Transfer Of Control process must take place between an Operational Controller and an Authorised Technician before the work or testing can start under an Approved Written Procedure.

Authorised Technician reports to Operational Controller when on-site and ready to start work
Transfer Of Control of specific WTG from Operational Controller to Authorised Technician (details logged in accordance with a Management Instruction)
Authorised Technician retains responsibility of that WTG until control is transferred back to the Operational Controller

B2.3 Transfer

B2.3.1 Each AWP includes a Transfer Record to be used when work transfers from one AT to another or to record the progress of work beyond one working day

Rule C2: Authorised Technicians

(ii) following instructions on AWP and signing Signature Checkpoints'

The WTG Technician should follow the instructions on the signage

and proceed to apply red tickets around the Control Panel and Generator to warn other technicians and everyone

Non Emergency scenario:

Sometimes in extreme cases such as severe weather or Cyber Attacks we need to Isolate WTG electrical source safely in an Emergency

However the Wind Technician Must be sure it is an Emergency as shut down can cause damage to the machine due to the sudden shock

The Technician should activate the emergency stop button in the nacelle or bottom of the tower which will trip the main breakers and set off alarms

1.9 Outline safety procedures when manually handling a range of products of different size, shape and weight

Mechanical apparatus must be islolated in accordance with the Wind Turbine Safety Rules before any manual handling is undertaken

Reference to RenewableUK HSE Guidelines

MANUAL HANDLING OPERATIONS REGULATIONS

The Manual Handling Operations Regulations require employers to take reasonably practicable steps to avoid manual handling activities where there is a risk of injury. Where such manual handling cannot be avoided, the employer should make an assessment and take appropriate measures to reduce the risk of injury to the lowest level reasonably practicable.

The assessment will form part of the overall risk assessment required by the Management of Health and Safety at Work Regulations

Further guidance on the Regulations is given in the HSE booklet - Manual Handling.

10.17.4 Lifting and handling

This includes daily manual handling activities and lifting operations on site, both routine and major lifts.

When establishing the procedures required for manual handling, and to control the use of mechanical lifting equipment and devices, consider the following issues:

• identification and risk assessment of manual handling operations;

• the provision and use of equipment that reduces the need for manual handling;

• the provision of information, instruction and training to increase awareness and improve techniques;

• the need for health surveillance'

1.10 Outline safety procedures associated with mechanical and non-mechanical access equipment

Accessing the nacelle from the base of a tower may be achieved using either a fixed ladder or a lift.

A Tower Ladder is regarded as non-mechanical access equipment and the pre-requisite training to use a tower ladder is:

- Working at height training according to current wind turbine access standards
- Current certification (less than 12 months old)

The Personal Protective Equipment includes:

- Full body harness
- Lanyard
- Fall arrester
- Climbing helmet (must have chinstrap)
- Safety boots
- Gloves

Ideally the training should incorporate Save and Rescue of a buddy.

Your professional association has a special focus on Working at Height for obvious reasons as the size of Turbine are now over 100m in height

RenewableUK HSEGuidelines

WORK AT HEIGHT REGULATIONS

These Regulations have been made to prevent the deaths and injuries caused each year by falls at work. They replace all the earlier regulations about working at height. The Work at Height Regulations consolidate previous legislation on working at height and implement European Council Directive 2001/45/EC concerning minimum Health and Safety requirements for the use of equipment for work at height (the Temporary Work at Height Directive).

The regulations apply to all work at height where there is a risk of a fall liable to cause personal injury.

Working at height must be avoided if possible. If this is not possible then all working at height should be properly planned, organised, risk-assessed, controlled, appropriately supervised and carried out in accordance with a safe system of work.

The safe system of work and selection of equipment for working at height must give priority to the provision of fall prevention methods (e.g. barriers or guardrails) over personal fall protection measures (e.g. fall arrest or work restraint).

1.11 Outline safety procedures associated with mechanical lifting equipment

The WTG Technician is well advised to consider the guidelines defined by their association when considering lifting operations. Ideally a physiotherapist would design each task analysis with the association members

RenewableUK HSE Guidelines

LIFTING OPERATIONS AND LIFTING EQUIPMENT REGULATIONS

In the main, the Lifting Operations and Lifting Equipment Regulations (LOLER) replace existing legal requirements relating to the use of lifting equipment. They aim to reduce risks to people's Health and Safety from lifting equipment provided for use at work. In addition to the requirements of LOLER, lifting equipment is also subject to the requirements of the Provision and Use of Work Equipment Regulations

10.15 Site services

Due account must be taken of:

• overhead power lines and suitable safety clearances;

• underground services, e.g. gas, electricity, telephone, water;

• the need to inform landowners, mariners and fishermen;

• the location and depth of underground services and accuracy of installation drawings;

• the need to provide detection equipment, e.g. cable-location devices;

• the owners of the services;

• electrical hand tools: power supply is to be 110V centre tapped earth, and a favourable risk assessment is to be provided for other voltages; and

• subsea pipelines, export power cabling and telecommunication cables, during work activities and when travelling over them.

10.17.4 Lifting and handling

• the periodic testing and thorough examination of lifting equipment and accessories;

• risk assessment for lifting operations;

• preparation of safe systems of work and use of competent personnel for lifting operations, especially offshore where an Offshore Lift Supervisor must control lifting operations'

1.12 Define safe working procedures whilst operating in confined spaces

There is an emphasis on a requirement for a specific Work permit when working in confined spaces by your professional association. The Work Permit should outline the steps to be taken to make the space safe for entry and egress. The work location is not designed for continuous worker occupancy.

RenewableUK HSE Guidelines :

CONFINED SPACES REGULATION

The key duties are:

• to avoid entry to confined spaces, e.g. by doing the work from outside;

• if entry to a confined space is unavoidable, to identify the hazards and follow a safe system of work- normally using a permit to work; and

• to put in place adequate emergency arrangements before the work starts.

FACTORIES ACT

Still needed to cover particular industries and workplaces that have specific hazards and associated risks that need to be regulated and controlled. These regulations include The Breathing Apparatus.'

There are many locations of Confined Spaces in a WTG including nacelle, tower, hub and blade.

Low levels of oxygen and relevant breathing apparatus is a must consideration

1.13 Identify hazards associated with fire

There are many possible sources for fire hazards in a WTG as there alot of flammable liquids and gases. It is important that the WTG Technician uses all sensors and actuators to diagnose and minimise any risk of fire

Lets re-examine the cause of a fires described in recent popular industry online publications:

Two dead after Dutch turbine Fire

30/10/2013

Two service technicians have died following a turbine fire at Deltawind's 21MW Piet de Wit wind farm near Ooltgensplaat in the Netherlands.

The mechanics, aged 19 and 21, were working on one of 12 Vestas V66-1.75MW units at the site when the fire broke out yesterday afternoon.

Deltawind said it is possible that a short circuit on the unit caused the fire but warned it is awaiting the result of a police report into the incident.

The company said that the team had been on the site to perform scheduled maintenance

Whilst the incident is under investigation LinkedIn professional discussion have placed emphasis on Evacuation devices

In the USA OSHA have now introduced the 4 MINUTE RESCUE regulation in the light of the tragic incident and insurance companies such as Chubb Security will be checking for appropriate Certification of Wind Turbine Service Technicians….