Electrical Strategy

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Why?

To Manage Appropriately;

- Patient Risk
- Business Risk
- Legal Risk
Why?

Patient Risk [including visitors, staff and volunteers]

• Loss of electrical supplies making it dangerous to escape

• Loss of electrical supplies preventing treatment

• Electrocution causing injury or death including “micro shock”
Why?

Business Risk

- Missed appointments and treatments
- Cancelled operations
- Over time waits
- Closure of wards and departments
- Closure of support departments e.g. Path Lab, Boiler House, Operating Theatres, etc.
Why?

Legal Risk

This includes

• Health and Safety at Work Act 1974
• Electricity at Work Regulations 1989
Guidance

• HSR 25 Memorandum of guidance on the Electricity at Work Regulations 1989:2007

• HSG 85 Electricity at work safe working practices 2nd edition 2003

• BS EN 61xxx Series covering Electro Magnetic Compatibility and many other electrical issues

• HTM 06-01, -02, -03:2006/7

• HTM 07-05 WEEE Regulations:2007
Guidance

• MEIGaN : 2007
  Medical Electrical Installation Guidance Notes

• Annex to MEIGaN
  Healthcare interpretation of IEE Guidance Note 7
  (Chapter 10) and IEC 60364-7-710 : 2005

• HTM 00 Policy and Principles : 2006

• HBN 00-07
What Are The Requirements?

• To cover Legal, Patient and Business risk

• For the Trust Chief Executive Officer to be able to demonstrate

The systems to be:
  Reliable
  Available
  Maintainable
  Alterable
  Economic, in terms of energy, revenue and capital
Some Common Problems

- Discrimination
- Under capacity cables
- Undersized generators
- Inappropriately tested generators
- Complex control systems e.g. generators
- Power factor, equipment harmonic issues
- Single points of failure!
What Should The Trust Do?

- Set the brief, get advice if it helps
- Gather the installed information
- Gather the EIC and PIR
- Gather together brief histories of incidents
- Gather together brief outline of maintenance carried out
- Enclose a copy of the operational log book
- Enclose an outline (with plans) of the trusts strategic development plan and estates strategy
## Monitoring Record

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## Conditional formatting

The screenshot shows a spreadsheet with various conditional formatting applied. The spreadsheet contains data with dates and numerical values in different columns. Conditional formatting highlights specific data cells based on certain criteria, making it easier to identify important information at a glance. The screenshot also includes a toolbar with various formatting options, indicating the capabilities of the spreadsheet software for customizing the display of data.
• There has to be a sufficient number of samples to ensure there is confidence in the conclusions

• See various statistical text books and BS documents for guidance on statistical certainty
What Specific Guidance Do We Have?

HTM 06-01 Electrical services supply and distribution
Part A: Design considerations:2007
Part B: Operational management:2007

HTM 06-02
Electrical safety guidance for LV systems:2006
Electrical safety handbook:2006

HTM 06-03
Electrical safety guidance for HV systems:2006
Electrical safety guidance for HV systems: Sanction-for-test:2006
Authorised person’s logbook:2006

MEIGaN:2007
Annex to MEIGaN Healthcare interpretation of IEE GN7 (Chapter 10) and IEC 60364-7-710 : 2005
What HTM 06 Has To Say
This chapter deals with the assessment of risk and the need to ensure that the design of the primary electrical infrastructure (PEI) adequately protects the end-user, and in particular patients, from electrical failures.

It promotes multidisciplinary design-team and stakeholder involvement throughout the design process (4.1)
This should identify any “residual risks” from the design.

The identification of the residual risks will enable the healthcare organisation to manage their collective ownership of risk management and hence make appropriate non-electrical and/or fixed wiring operational and emergency contingency plans in accordance with DH Emergency Planning Guidance. (4.1)
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<th>Risk by clinical category (refer to Chapter 4 under 'Clinical risk')</th>
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**RISK OF ELECTRICAL FAILURE BY INFRASTRUCTURE**

Distribution strategy (refer to Chapter 6)
The Discovery and Optimisation Process

• An iterative design process will help stakeholders to assess the distribution strategy (4.40)

• “Designers and stakeholders should consider” the holistic risk strategy for options and design solutions when adopted (8.3 etc, etc.)
Operational & Maintenance Strategy

• Maintenance strategies should be evaluated with the distribution strategy and clinical risks.

• The electrical plant and electrical distribution infrastructure might **will and does** degrade to a point of failure unless suitable maintenance regimes exist. (B4.4)
More Practical Matters

• Does the location of the generator, large motors, switch gear, oil storage, cause a risk to patients or other medical equipment etc?
  
  e.g. MRI see HTM 05 and HBN 6 volume 3 : 2003

• Does the location of any other equipment, services including radiation hazard give rise to a risk to the electrical installation
Can the new or refurbished electrical plant and cable be accommodated as outlined in the option?

Is there sufficient capacity (all components) for organic growth and site development?

In the NHS electrical consumption is growing by 4%-6% per annum - in five years this will result in 17% increase.
More Practical Matters

• In addition to future load growth, can the installation carry the extra load imposed if the PF equipment fails? This could easily be an additional 15%.

• Transformers should be in separate enclosures (7.40).

• Switch panels should be in separate enclosures (7.64).
More Practical Matters

• If there are single points of potential failure can separation control the risk?

• Are there other potential single points of failure can these risks be managed out? E.g. Control systems

• Develop a strategic risk plan / register
Emergency Planning
Emergency Preparedness and Contingency Planning

• Requires trust to meet the requirements of Civil Contingencies Act 2004

and

• NHS Emergency Planning Guidance 2005

Also applicable to PFI, PPP and LIFT projects (6.13)
Emergency Planning

Healthcare organisations may encounter such scenarios as:

- Unplanned interruption to a utility supply (gas, water, electricity etc);
- Unexpected equipment and service distribution failures (telephones, water pipework, medical gases etc);
- A civil incident (act of terrorism, civil disturbance etc);
- An environmental incident (floods, transport incident, storm damage etc).
HBN 00-07 - Resilience Planning For The Healthcare Estate (May 07)

- Replaces in part HTM 2050

- Replaces other NHS Estates and DoH guidance

- To be read with all other HTMs and HBNs

- Has many relevant sections for the construction of Healthcare Buildings

- Has many relevant sections for the Engineering Services in Healthcare Buildings
Section 3
Procuring Resilient Facilities

Action Points:

• Understand the principles
• Analyse the threats and hazards (Risk Register)
• List the risks to be mitigated
• Identify the resilience requirements
• Incorporate the resilience requirements into the project brief
• Review the design proposal to ensure that the requirements have been met
• Control delivery
Resilience is the ability of the building and engineering infrastructure to continue operating in extraordinary circumstances.

Resilient facilities are those that have the following features:

Robustness – the system or facility should be able to absorb the effects of an event and continue to operate at the required level;

Redundancy – where robustness cannot be absolutely guaranteed, it is essential to provide more than one of a key facility or sub-system;

Re-configurability – the unanticipated risk is often the most devastating. To be truly resilient, a system or facility should be adaptable to cope with the effects of an unexpected event.

Responsibility of All including the Client and Designers (3.3)
Resilient Facilities

What Might This Mean For Engineering Systems?

Box 10: Hypothetical examples of resilience requirements

These are examples of resilience requirements developed from a risk assessment:

1. “The completed facility incorporates the means to control the approach of vehicles so that a potential vehicle bomb cannot approach within 25 m of an occupied area.”

2. “Provision for at least two entrances to the facility that will have sufficient space to assemble and operate a casualty decontamination facility capable of processing 10 casualties per hour – four to be on stretchers.”

3. “Provision for an electricity supply system that is capable, in the absence of mains electricity, of sustaining the essential load of the facility for a period of not less than 200 hours.”
An Example of Electrical Resilience

“Provision for an electricity supply system that is capable, in the absence of mains electricity, of sustaining the essential load of the facility for a period of not less than 200 hours.” (was 192 hours in HTM 2011)
Is It Resilient?

Could this be replaced in five years time?

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Diagram:

- Essential Load
- Generator
- Incomer
- Non Essential Load
What about cast resin transformers and transformers incorporated into switch panels?
Is It Resilient?
Is It Resilient?
Is It Resilient?

- Central battery systems
- Emergency light installation
- Operating light installations consider separating operating and satellite
Is It Resilient?

Are there spare fuses, are they the right pattern, how many sets, where are they?
Importance of Commissioning

Even when developing the strategy the importance of commissioning and validation should be emphasised.
Estates Resources

• These continue to reduce

• Few estates departments have sufficient HV switching knowledge

• Estates management staff have many non electrical responsibilities

• Estates staff are mainly managers

• Maintenance electricians do not normally switch or maintain large circuits or electrical equipment
• All estates managers are expected to be able to manage the electrical system in all emergencies!!

• So this means there must be at least three people working on site that are fully conversant with operating the system in all eventualities!!

• There are NO exceptions to the above
The strategy, must evaluate and take account of these issues.

Each viable option must take into account all aspects of the estate resource.

The estate resource must be evaluated for the short, medium and long term (the person undertaking this must be competent to do so).
Manufacturer Quoted figures
> 150amps
Maintenance of Infrastructure

• Can the, switch gear, generator, transformer be replaced without affecting the operation of any other department (including other services)

• Is there a spare? Can it be fitted, tested and re-commissioned during an emergency with the resources available,

• Could all the plant, be safely accessed and maintained at all times, e.g. snow, cold, rain, height, excellent emergency lighting see BS 5266 pt 7:1999 etc. All required by work place regulations:1992

• if not, it shouldn't be proposed or installed
Cost and Revenue Plans

• Energy cost

• Installation of low loss transformers

• Economic sizing of cables

• Setting the transformer taping (monitoring voltage before and after)

• Installation of PF equipment

• Correct installation of surge arresters

• Correct control of Harmonics
Post Occupancy Evaluation

Was it commissioned?
Were They Installed In Separate Rooms?
Did That Cable Need To Be Changed?
Questions

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Thank You
The End