

# Presentation

## "Managing Electrical Risk

by Andy Chappell. Secretary, BHSEA

Although the topic was unchanged this month, the speaker came from closer to home, as the publicised speaker had to stand down due to ill health. This came as almost as big a surprise to the speaker, as to the audience!

Although Electricity is wonderful servant, we all know it is an unforgiving master, as these most recent HSE statistics show.

Electrical Accidents 2003/04				
Agent of Accident	Fatal	Major	Over-3-day	Total
Domestic type equipment (including crockery/glassware, kettles, microwaves)	-	6	41	47
Overhead lines	1	6	4	11
Underground electricity cables	-	24	16	40
Other electricity cables including trailing, buried in walls	4	44	120	168
Other	7	75	194	276
Total	12	155	375	542
1998/99 Total	14	192	320	526

Since 1999 these figures have not changed significantly but, very often, there is only such a very thin dividing line between a Major Injury and Fatality that we can never allow ourselves to become complacent about keeping on top of safe working principles! The best framework for managing electrical risk is given to us by the **Electricity at Work Regulations 1989 (EAW)** and its associated **Memorandum of Guidance (HSR25)**. This was made deliberately quite different to the traditional formats of Approved Codes of Practice, however, because of the breadth of work and complexity of designs encountered in electrical systems!

The Regulations, which came into force in 1990, started life in 1976 and progressed through the various professional and public consultation stages for the next 14 years! Prior to the EAW, there were the Electricity (Factories Act) Special Regulations 1904 and 1944, which only covered Factories, so the new law brought another **16 million** workers under the protection more specific legislation,

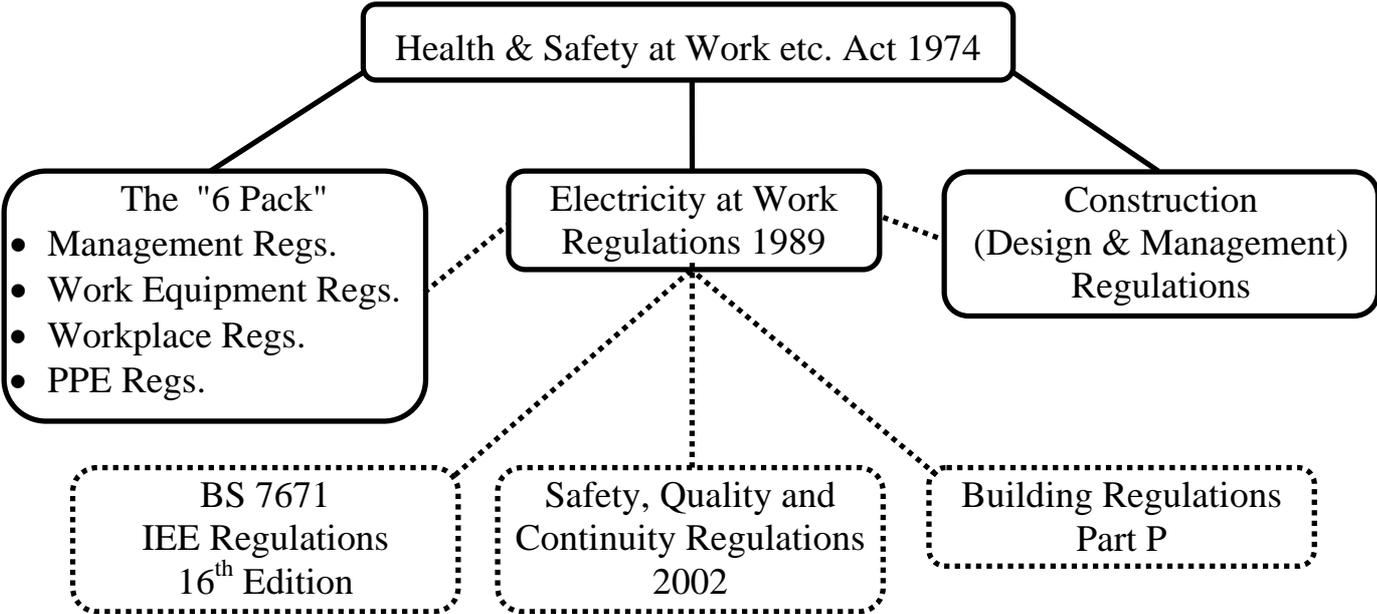
in Offices, Shops, Hospitals, Universities, Laboratories, Farms and Domestic Premises.

The main objectives of the EAW are to **Prevent Death, or Personal Injury to any person, in connection with work activities, from the following Electrical causes:** -

- **Electric Shock**
- **Electric Burns**
- **Fires of an Electrical origin**
- **Electric Arcing**
- **Explosions, initiated or caused by electricity**

Although they predated the Six-pack Regulations, the EAW Regulations are an essential part of the support infrastructure for the subsequent legislation and are very compatible with their risk-based approach. The EAW principles are also very much in line with the philosophy of the Construction (Design and Management) Regulations, which play such a vital role in the total life of any structures. An important standard that is an essential part of the EAW, and which predated them by many years, is the Wiring Regulations for Buildings, published by the **Institution of Electrical Engineers (IEE)**. A few years after EAW came into force, the Wiring Regulations became **British Standard 7671**, which significantly raised its legal standing in any court actions as an example of acceptable design and training standards. More recently we have seen the enactment of the **Safety, Quality and Continuity Regulations 2002** and the brand new **Building Regulations Part P**, aimed at safety in Residential Properties.

This diagram shows the main relationships associated with electrical safety, both for Occupational Safety and Public Safety.



It is helpful to look at EAW as vehicle to manage electrical risk in the following two, important ways: -

**System Design Standards, covering**

Installations, Equipment and their Environment (including distribution systems AND connected machines/appliances), regardless of voltage.

**System Operation Procedures, covering**

Safe systems of Work  
Competence and Training.

The responsibility for complying with the Regulations is, naturally, placed on **Employers and Self-employed Persons**, in a similar way to other legislation. Understandably, **Employees** are also required to co-operate with the other Dutyholders in complying with the Regulations. Significantly, though, there is special requirement for employees

**“to comply with the provisions of these regulations so far as they relate to the matters which are within his control”**

The crucial aspect of this wording is that it is specifically intended to reflect the unusual responsibility that Electricians bear, in designing certain features of electrical systems and installing them competently, without **direct** sanction or approval of a supervisor. For instance, terminations must be made-off with care so that they do not deteriorate and create a hazard. Similarly, circuit components must be positioned, so that they can be operated and maintained safely.

These are very important, **Absolute** requirements, which **“must be met, regardless of cost or any other consideration”**. Having imposed this Absolute requirement, however, EAW sensibly acknowledges the variety in performance and design complexity of electrical systems and the environments, in which they are installed and operated by providing **Regulation 29, Defence**. This defence permits **“...any person to prove that he took all reasonable steps and exercised all due diligence to avoid the commission of that Offence”**. This Regulation, again, underlines the reliance on employees’ training skills and continuing competence!

Regarding design, EAW demands the overriding requirement that All Systems, **at all times** shall be of such construction as to prevent danger. This is extended to include a requirement for **“..all systems shall be maintained to prevent, so far as is reasonably practicable, danger”**. This is very similar to the philosophy behind PUWER and the CDM Regulations. A crucial element of design is the quality of system components, which must **“...have the Strength and Capability to withstand thermal, electro-magnetic, electro-chemical or other effects of the electric currents which might be expected to flow when it is part of a system”**. These may be called the “danger from within”, because they are caused by the very nature of electricity. Equally, electrical systems can be installed in very hostile environments (the danger from without) and so **“Construction must prevent danger from foreseeable exposure to Mechanical damage, Weather, dirt, dust, corrosives, flammable or explosive substances”**.

Certain design requirements are a very significant element in system safety, such as that to earth metal casings on electrical equipment. Closely related to earthing systems is the **“Referenced conductor”**, which must not be broken because it links crucial points on a system or adjacent systems. Naturally, it follows on logically from all of this that every joint and connection in a system shall be mechanically and electrically suitable for use!

Finally, other design features that are required concern the safe operation of electrical systems and these are: -

- **Efficient means shall be provided for protecting every part of a system from excess current in order to prevent danger.** *This usually means fuses, switch-fuses, or protective circuit-breakers that stop excessive system currents from damaging components. The guidance is not specific, but just identifies the general principle to be followed.*
- **Means shall be provided for cutting off supply and isolation of equipment.** *This provides for safe working on whole/part systems and must be supported by clear marking of system circuits and safe, secure isolation points to maintain isolation during work activities.*

Finally, EAW requires **“Adequate working space, means of access and lighting shall be provided at all electrical equipment on which, or near which, work is being done”** This is an Absolute requirement, which has since been reinforced by the CDM Regulations.

Coming on to the System Operation features of EAW, dutyholders have to comply with requirements on Working Practices, Competence and Training in Regulation 4(3), which says: -

**“Every work activity, including operation, use and maintenance of a system and work near a system, shall be carried out in such a manner as not to give rise....to danger”**. Additionally, Regulation 4(4) states that: -

**“Any equipment.....for the purpose of protecting persons at work on or near electrical equipment shall be suitable for the use for which it is provided, be maintained in a condition suitable for that use, and be properly used.”** *This covers tools, equipment, PPE and even fixed barriers for segregating live conductors. So, in this single regulation dutyholders could be required to comply, not only with EAW, but also with the Management Regulations, PUWER, PPE Regulations and even the CDM Regulations, as well! This is not an overwhelming burden as many of these will have to be in place for other activities, in any case, and it does show the value of a co-ordinated approach through the risk assessment process!*

Turning, now, to the system operation aspects of EAW, there are basically two types of **Safe Working Methods** required to be followed under these regulations, namely **Dead Working (Regulation 13) and Live Working (Regulation 14)**

The preferred method is obviously Dead Working and Regulation 13 says: -

“Adequate precautions shall be taken to prevent *electrical equipment*, which has been made dead in order to prevent danger while work is being carried out on or near that equipment, from becoming electrically charged during that work if danger may thereby arise.”

In other words, **Make sure it's dead and Make sure it stays that way!**

The other rather subtle requirement of this seemingly simple principle is that it applies, crucially, to work of even a non-electrical nature, adjacent to any electrical system! This often applies to workers next to electrical equipment who, because they have absolutely no intention of working on it, give no thought whatsoever to electrical hazards or risk! Damage to Underground Cables and contact with Overhead Lines are two examples that spring all too easily to mind! Another treacherous pitfall in Dead Working control measures is that they fail, very often, because carefully planned work is changed halfway through and the initial safety precautions are left in place. Some important precautions to be observed are: -

- Isolate from all Points of Supply
- Secure each Point of Isolation from interference
- Earth where appropriate
- Securely apply warning notices on the boundaries of the safe zone of work
- Fix shrouds and/or barriers around adjacent live conductors
- Release circuits for work under a Permit to Work system

AND ALWAYS

***Prove Dead at the Point of Work – BEFORE starting!***

Although Working Live is an obviously more dangerous option, there are valid reasons why it is sometimes necessary and EAW, quite sensibly tries to regularise this in a safe way. Regulation 14 lays down these *very stringent* requirements: -  
“No person shall be engaged in any work activity on or so near to any live conductor (other than one suitably covered in 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 him 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.”

The important feature to note here is that the paragraphs **a, b and c** are linked with the word **AND**, so they are not just **alternative** measures!

Examples of justifications for Live Working are: -

- Impracticality of carrying out work with the conductors dead, e.g. live testing or maintenance work under railway traction conductors.
- Creation of other hazards to, say, other users, by making the conductors dead, e.g. supplies to lifts or ventilators.
- The need to comply with other statutory requirements.
- Level of Risk and effectiveness of precautions set against economic need.

Working Live calls for a special approach to the task, reinforced by a robust, formal procedure, based on specific risk assessment of each job. Here are a few key issues that need to be addressed for live working procedures: -

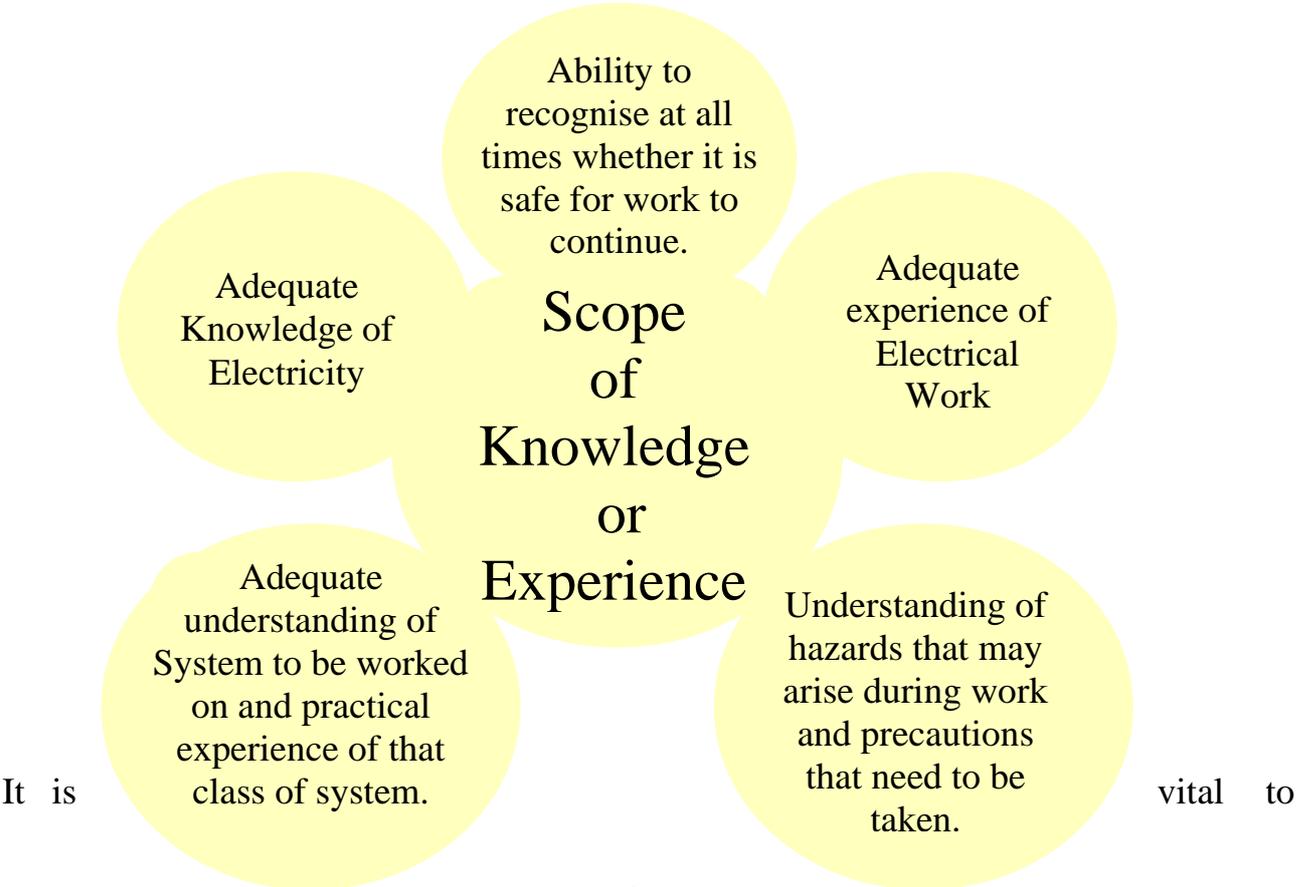
1. **Staff must be well trained and competent.** This is best recognised within the procedure by having specific categories for individual ranges of specialised work.
2. **Provide adequate information in a Permit-to-Work system**
3. **Use suitable insulated tools and PPE**
4. **Use suitable barriers or screens**
5. **Use appropriate test instruments or probes**
6. **Consider the need for accompaniment.** The justification of Additional persons should be based on the need for them to assist with the application of risk control measures. They should not be there just to pick up the pieces after an accident!
7. **Maintain rigorous control of the working area.** Consider that an individual electrical circuit may have remote, multiple working areas!

The importance of training and competence is emphasised throughout these Regulations as well as in the Guidance. Regulation 16 says: -

“No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent danger or, where appropriate, **injury** unless

- He possesses such knowledge or experience,
- OR
- Is under such degree of supervision as may be appropriate having regard to the nature of the work”

This diagram sums up the main aspects of competence



appreciate that academic training courses can only take a person so far along the competence trail and that is why proof of practical experience and skills are so important. It also demonstrates the crucial need for employers to monitor performance in a supportive way, so that competence levels do not deteriorate and are developed to meet new challenges. Probably the most intuitive of the above elements is the

**“Ability to recognise at all times whether it is safe for work to continue.”**

All of the following hazards could be an alarm to save workers from making a terrible mistake in either operating defective equipment or working on it! Cut or abraded cable sheaths or taped joints

- Cable sheaths pulled out of plugs (probably together with a hidden, disconnected Earth conductor, inside?)
- Cracked, burnt or discoloured plugs
- Damaged casings, Rusty Trunking, or Conduit
- Accumulations of Dust/Grime and/or Fluids
- Smell of overheating or burning
- No labels on Switchgear or Machines (Tolerated in normal conditions, but menacing in emergency situations)
- No schematic drawings
- No Manufacturers’ manuals

Individually, some of them seem innocent enough, but a combination of them in unforeseen conditioned might prove lethal! In the workplace a combination of electricity and hand tools has been hazardous and considerable effort has been made to reduce the inherent risks with the use of: -

- Battery/Air powered tools
- 110V – Centre-tapped Earth Systems
- Class II (‘Double’) insulation
- Residual Current Devices

Underlying all of these systems is the essential need for effective testing and maintenance, which is more frequent in the Construction Industry, for example, where the operating conditions are harsher than in an office. Although this is required by EAW, there is a similar duty under PUWER.

In 2003 the Electricity Safety, Quality and Continuity Regulations 2002 came into force, to replace the Electricity Supply Regulations 1988. These Regulations govern the installation and use of electrical networks owned or operated by generators, distributors and are enforced by the Department of Trade and Industry. It includes provision of an Inspection regime, as well as requirements for protection of the public and others conducting work activities which may be affected by the network.

Detailed requirements are imposed on specific dutyholders with regard to System protection and Earthing, Substations, underground cables overhead lines and the provision of maps of underground networks. These Regulations are intended to provide protection to third parties working near any part of the network by providing

network records and other assistance with protective measures. The dutyholders have a strong duty of care to third parties working near their systems and are obliged to provide information about underground plant and safe clearance from overhead lines.

Another change, which is being introduced at the moment, will be finalised in 2006 is the changeover to harmonised insulation colour codes for cables. The details are given below: -

### New Colour-coding for Fixed Wiring

Old 3ph Fixed		New 3ph Fixed		Appliances (240 V)
	L <sub>1</sub>		L <sub>1</sub>	
	L <sub>2</sub>		L <sub>2</sub>	
	L <sub>3</sub>		L <sub>3</sub>	
	N		N	
	E		E	

Bi-colour Green-and-yellow

The latest change in Electrical Safety involves the residential wiring and is aimed at reducing the number of deaths, injury and property damage caused by house fires. It is being introduced as Part P of the Building Regulations and will be enforced by Local Authorities' Building Control Offices. Under these Regulations, only registered electricians will be allowed to carry out specified wiring installations in residential properties.

- It applies to Residential properties, common access and external areas
- Covers - Adding a new circuit to a dwelling, notified to building control, which will then inspect the work, or carried out by a competent person who is registered with a Part P Self-Certification Scheme.
- It is not applicable to small jobs such as replacing a socket-outlet or a light switch on an existing circuit (although there will be some exceptions for high risk areas such as kitchens and bathrooms).

•Persons registered with Part P Self-Certification Schemes will be fully qualified electrical contractors with the ability to thoroughly check a circuit for safety. They will be able to issue Building Regulations certificates of compliance.

Further Information may be obtained by visiting: -

- The Institution of Electrical Engineers  
[www.iee.org.uk/Publish/WireRegs/BR-PartP-dwellings-cfm](http://www.iee.org.uk/Publish/WireRegs/BR-PartP-dwellings-cfm)
- National Inspection Council for Electrical Installation Contracting  
[www.niceic.org.uk](http://www.niceic.org.uk)

AND

[www.odpm.gov.uk/stellent/groups/odpm\\_buildreg/documents/divisionhomepage/br0054.hcsp](http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/divisionhomepage/br0054.hcsp)

## *Members' Questions*

**Bob Jones of Birmingham City Council** asked where Permits to Work should be used and I commented that they were an important part of the risk assessment and were particularly crucial in conveying essential information to the operatives.

**David Hughes** asked what provision was there to supervise the new requirements and I referred back to the Local Authority role, particularly for new build housing and extensions.

**Chris Peck of the University of Central England** asked a rhetorical question about whether insurance companies will take note. I think that it is almost a racing certainty that if they smell the slightest chance of throwing their risk back to a client who has contravened Part P, then they will jump at the opportunity!

**Peter Evans** commented that the safety risk assessment might indicate that a second qualified person is needed under **Regulation 16, Persons to be competent to prevent danger and injury**. I agree totally with that, as electricians very often work independently of **direct** management control and, as Regulation 4 implies, the former need to exercise a high degree of initiative. Thus, if management are to ensure that they control effectively, at a distance, their risk assessment must take account of the competence factor well in advance.

**David Smith** made the very valid point that, as there were six organisations awarded the task of registering electricians to do this work, how was the ordinary householder to know where to contact these little-known bodies? It wasn't as though there was a single entity like CORGI for the Gas Industry! Added to which, the 'Ordinary Householder' had not been alerted to Part P and most were so unaware that they might be an easy target for the rogue electrician, or even the well-meaning tradesman who might decide to do the customer a favour by completing a bit of wiring! There was also another problem that the building Inspectors may not cope with the extra workload. These remarks, understandably, provoked a vigorous debate! It will

undoubtedly take some time for the new systems to settle down; even now, the CORGI scheme is by-passed by many people who want to cut corners. On the positive side, the bulk of relevant installations will come to the attention of Building Inspectors because they are associated with planning approval. No doubt the building Societies will add their voice when mortgage surveys are done, as will the insurance companies when setting premiums – or refusing claims!

At this point, the questions drew to a close and, as I was dying of thirst, Warwick thankfully closed the meeting!