



ENGINEERING SAFETY CONSULTANTS
The Global Provider of Functional Safety Expertise and Technical Consultancy

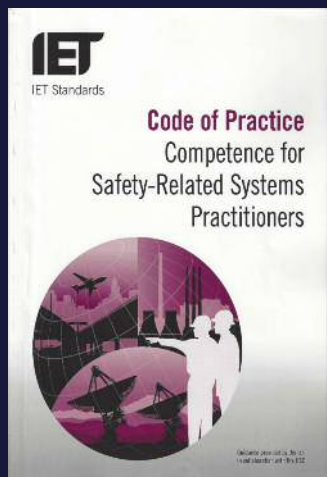
IET Code of Practice: Competence for Safety Related Systems Practitioners

Ron Bell
Engineering Safety Consultants Ltd

ron.bell@esc.uk.net
www.esc.uk.net



IET Code of Practice



- **Guidance provided by the IET in collaboration with HSE (Both logos on back cover)**
- **Published in December 2016**
- **www.theiet.org/standards**

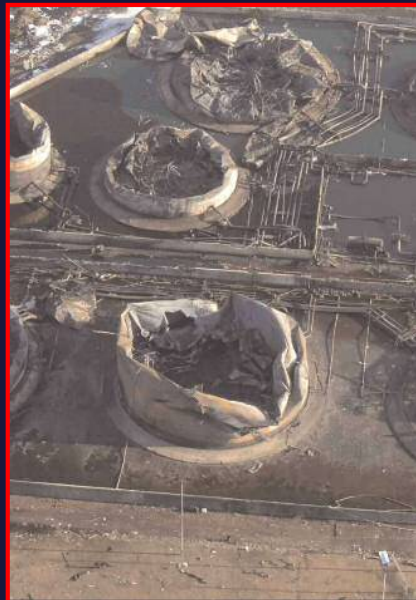
- **Market environment**
- **HSE Delivery Guides**
- **Competence requirements in standards**
- **IET Code of Practice: Competence for Safety Related Systems Practitioners**
- **Questions and discussion**



- **Market environment**
- **HSE Delivery Guides**
- **Competence requirements in standards**
- **IET Code of Practice: Competence for Safety Related Systems Practitioners**
- **Questions and discussion**



Incident at Buncefield fuel depot, UK, Sunday 11 December 2005





Buncefield: Economic impact

Overall quantifiable costsby sector

- Aviation: = £245,000,000
- Site operators(compensation claims): = £625,000,000
- Comp Authority & Gov interventions = £15,000,000
- Environmental impact on water supplies = £2,000,000
- Emergency response = £7,000,000

Total = £894,000,000

Buncefield explosion: Initial Report findings

- Improvements to maintaining the primary containment include:
 - Electronic monitoring of tanksand associated alarms that warn of abnormal conditions;
 - The detection of flammable vapours.....
 - The response to the detection of abnormal conditions.....
 - The recording of monitoring, detection and alarm systemsand their availability

Active & managed safety measures



Functional safety!

Buncefield explosion:

Investigation Board recommendations on the design and operation of fuel storage sites....key groupings

1. Systematic safety integrity level requirements
2. Protecting against loss of primary containment using high integrity systems
3. Engineering against escalation of loss of primary containment
4. Engineering against escalation of loss of tertiary containment
5. Operating with high reliability organisations
6. Delivering high performance through culture and leadership



Market Environment: Summary

- Increasing dependence on safety critical systems to achieve Target Risk levels
- Increasing need to justify that you have achieved adequate levels of safetybasis
- Safety Regulators using international standards as of what is reasonable (“accepted good practice”)
- Increasing formality of safety culture, management of functional safety, competence of the organisation and personal competence
- Increasing interest in management of legacy systems
- Business reputation in relation to safety a key business driver

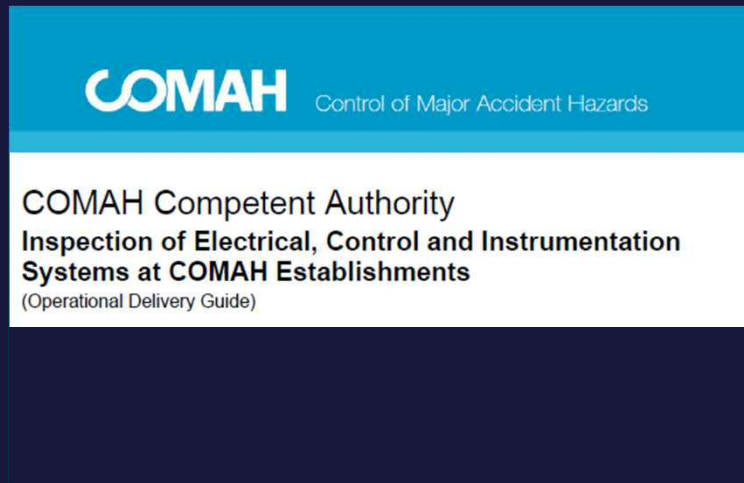
- **Market environment**
- **HSE Delivery Guides**
- **Competence requirements in standards**
- **IET Code of Practice: Competence for Safety Related Systems Practitioners**
- **Questions and discussion**

Legal Requirements

- **Health & Safety at Work etc. Act 1974**
- **The Management of Health & Safety at Work Regulations 1999**
- **Control of Major Accident Hazards (COMAH) Regulations 2015**
- **Dangerous Substances & Explosive Atmospheres (DSEAR)**
- **The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015**

COMAH Competent Authority Delivery Guides (Rolled out in 2015)

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments



Delivery Guide: Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

- The EC & I Delivery Guide:
 - Describes how the COMAH Competent Authority (CA) inspects Electrical, Control and Instrumentation (EC&I) aspects of control of major hazards at COMAH sites.
 - Includes the benchmark standards that are used to assess the way Operators manage risk
 - Whilst aimed at HSE EC&I inspectors, the guide will be useful to Operators in managing risk in relation to major accident hazards and preparing for Competent Authority inspections.
- Not all of the benchmark standards contained in the guide are necessarily applicable at every establishment. The Operator should already be aware of the hazards and risks at their establishment and hence which benchmark standards are applicable.

Justification for the EC&I Delivery Guide (Competent Authority Statement)

- Failure to control process conditions and the risks from electrical installations and equipment have been the main or underlying cause in many major accidents both in the UK and abroad including Buncefield and BP Texas City.
- HSE research into the causation of major accidents and incidents indicates that failure to adequately control process conditions, especially during normal operations, is responsible for the loss of containment of hazardous substances.

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

- EC&I Inspection process will address one or more of the following topics in order to assess Operator risk management performance against **relevant good practice**:
 - ✓ Hazard and risk assessment;
 - ✓ Specification, design and engineering;
 - ✓ Operator maintenance;
- Above topic areas will need to be underpinned by:
 - ✓ Competent people;
 - ✓ An effective Safety Management System

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

- Scope
 - ✓ **Functional safety;**
 - ✓ Explosive atmospheres, and;
 - ✓ Electrical power systems.

- **Functional Safety** is concerned with the management, design, installation, operation and maintenance instrumented process safety systems that reduce the risk of a major accident. Such systems include:
 - ✓ Process control system;
 - ✓ Safety instrumented systems (SISs);
 - ✓ Alarm systems.

HSE position on "good practice" & Functional Safety

- The general benchmark of good practice is BS EN 61508 - **"Functional safety of electrical, electronic and programmable electronic safety related systems"**.

- BS EN 61508 has been used as the basis for application-specific standards such as:
 - BS EN 61511: process industry
 - BS EN 62061: machinery
 - BS EN 61513: nuclear power plants
 - BS EN 61511, **"Functional safety - Safety instrumented systems for the process industry sector"**, is the benchmark standard for the management of functional safety in the process industries.

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

Operator Performance Rating:

HSE will assess duty holder performance on a range of factors these include:

- ✓ The degree of compliance inspection on topics covering technical standards, major hazard risk control systems and cross-cutting issues such as leadership, competence and workforce engagement;
- ✓ The extent of non-compliance issues raised;
- ✓ Enforcement history, including enforcement notices and prosecution; Incident data such as formal RIDDOR reports;
- ✓
- ✓

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

Performance Rating:

- ✓ **Operator** will be given a performance rating using the criteria set out in the Table below for each of the EC&I topic areas based on the outcome of the inspection and relevant evidence from previous inspections.
- ✓ The performance score will be communicated to the **Operator**.
- ✓ The performance score will be available under a Freedom Of Information request.

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

Performance Rating:

| Performance Assessment | | | | | |
|--|-----------|------|-------------------|------------------------|-----------|
| 60 | 50 | 40 | 30 | 20 | 10 |
| Unacceptable | Very Poor | Poor | Broadly Compliant | Fully Compliant / Good | Exemplary |
| Performance Standards defined by HSE and the COMAH Competent Authority | | | | | |

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

Operator Performance Rating:

- ✓ The performance score reflects the duty holders degree of compliance on the specific issue being inspected and is based on HSEs Enforcement Management Model's risk gap and expressed as a numerical value.
- ✓ Scores of 30, 40, 50 or 60 against individual inspection topics are evidence of a risk gap.
- ✓ HSE will consider the nature and extent of the risk gap, including the underlying causes, in judging the duty holders overall performance.

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

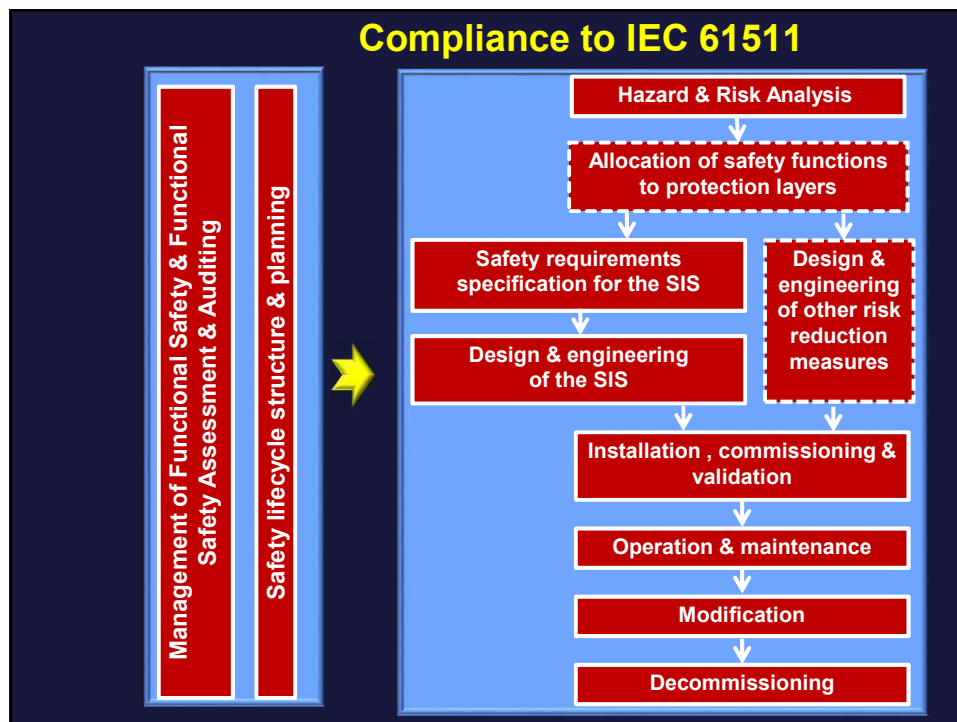
| Enforcement Management Model Risk Gap | | | | | |
|--|-------------|----------|-------------------|------------------------|-----------|
| Extreme | Substantial | Moderate | Nominal | None | None |
| Topic Performance Score | | | | | |
| 60 | 50 | 40 | 30 | 20 | 10 |
| Unacceptable | Very Poor | Poor | Broadly Compliant | Fully Compliant / Good | Exemplary |
| | | | | | |

Inspection of Electrical, Control and Instrumentation (EC&I) Systems at COMAH Establishments

| Enforcement Management Model Risk Gap | | | | | |
|---|-----------------------------|-----------------------------|-------------------------|------------------------|-----------|
| Extreme | Substantial | Moderate | Nominal | None | None |
| Topic Performance Score | | | | | |
| 60 | 50 | 40 | 30 | 20 | 10 |
| Unacceptable | Very Poor | Poor | Broadly Compliant | Fully Compliant / Good | Exemplary |
| Enforcement Management Initial Enforcement Expectation | | | | | |
| Prosecution / Enforcement Notice | Enforcement Notice / Letter | Enforcement Notice / Letter | Letter / Verbal Warning | None | None |
| | | | | | |

- Delivery Guides provide a basis for the Competence Authority to make objective judgements which is open to the Operator
- Operators should be aware of the proposed approach from the Competent Authority
- Key benchmark standard for functional safety in the process sector is IEC 61511 & IEC 61508
- Compliance with the benchmark standards is the basis good practice in the achievement of functional safety.
- Evidence of adequate Management of Functional Safety including competence of those having responsibilities for functional safety is high priority for Competent Authority inspections

- **Market environment**
- **HSE Delivery Guides**
- Competence requirements in standards
- **IET Code of Practice: Competence for Safety Related Systems Practitioners**
- **Questions and discussion**



IEC 615011-1

Persons, departments or organizations involved in SIS safety life-cycle activities shall be competent to carry out the activities for which they are accountable.

Requirements in IEC 61511-1

The following items **shall be addressed** and documented when considering the **competence of persons**, departments, organizations or other units involved in SIS safety life-cycle activities:

- engineering knowledge, training and experience appropriate to the process application;
- engineering knowledge, training and experience appropriate to the applicable technology used (e.g., electrical, electronic or programmable electronic);
- engineering knowledge, training and experience appropriate to the sensors and final elements;
- safety engineering knowledge (e.g., process safety analysis);
- knowledge of the legal and regulatory functional safety requirements;
- adequate management and leadership skills appropriate to their role in the SIS safety life-cycle activities;
- understanding of the potential consequence of an event;
- the SIL of the SIF;
- the novelty and complexity of the application and the technology.

Requirements in IEC 61508-1

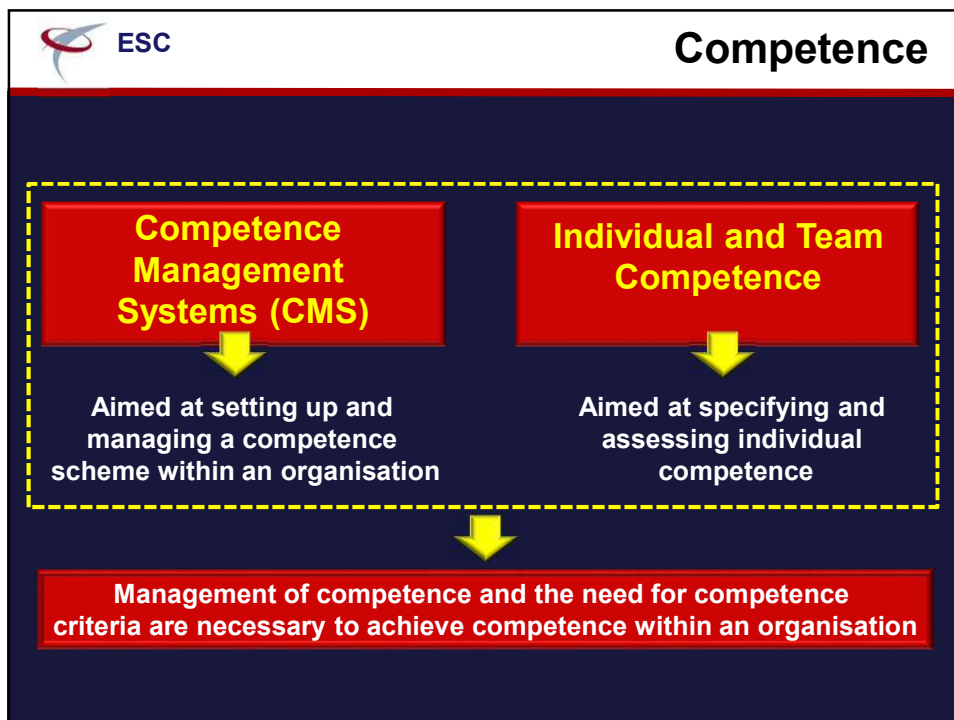
The **appropriateness of competence** shall be considered in relation to the particular application, taking into account all relevant factors including:

- the responsibilities of the person;
- the level of supervision required;
- the potential consequences in the event of failure;
- the safety integrity levels of the E/E/PE safety-related;
- the novelty of the design, design procedures or application;
- previous experience and its relevance to the specific duties to be performed and the technology being employed ;
- the type of competence appropriate to the circumstances (for example qualifications, experience, relevant training and subsequent practice, and leadership and decision-making abilities);
-etc

Requirements in IEC 61511-1

A procedure shall be in place to manage competence of all those involved in the SIS life cycle. **Periodic assessments shall be carried out to document the competence of individuals against the activities they are performing and on change of an individual within a role.**

Competence Management System (CMS) System



The achievement of competence should be addressed at:

1. **Organisation level: Effective Competence Management Systems (CMS)**

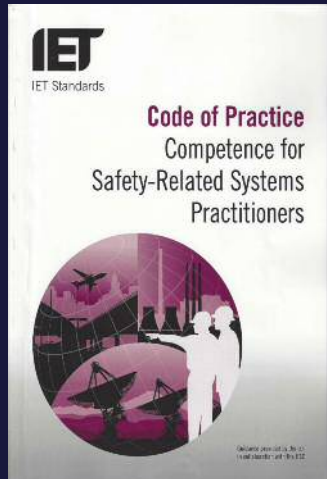
- ✓ Managing competence for safety-related systems- Part 1: Key Guidance. First published 2007.
- ✓ Managing competence for safety-related systems- Part 2: Supplementary Material. First published 2007.

2. **Personal & Team level: Individual and Team Competence to undertake the defined activities and tasks within those activities.**



IET Code of Practice: Competence for Safety Related Systems Practitioners

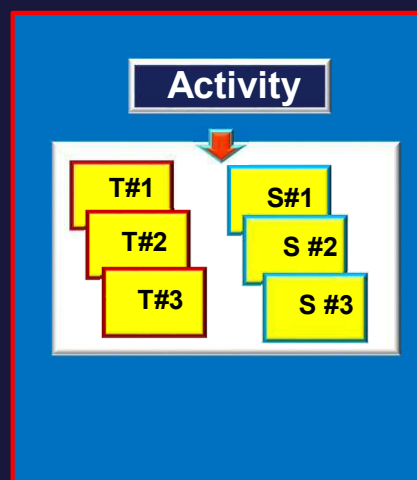
- **Market environment**
- **HSE Delivery Guides**
- **Competence requirements in standards**
- **IET Code of Practice: Competence for Safety Related Systems Practitioners**
- **Questions and discussion**



- Guidance provided by the IET in collaboration with HSE (Both logos on back cover)
- Published in December 2016
- www.theiet.org/standards

All the Tasks in an Activity require specific knowledge, understanding and skills, which are expressed as a set of **Task-based competencies**

An Activity may also require knowledge, skills and personal qualities that are not directly related to specific Tasks and these are expressed as **Supporting Competencies**.



- Competence comprises several generic components which are:
 1. Knowledge (Know what): *E.g. Sector knowledge*
 2. Understanding (Know why): *E.g. Principles of Safety and Risk*
 3. Personal Qualities (Attitudes & Behaviours): *E.g. Personal integrity; Team player*
 4. Skills (Know how); E.g. *Technical skills (Hazard Analysis, Report Writing);*
- The above four generic components should be addressed in defining the competencies within an **Activity**.
- Experience is fundamental in the gaining of competence with respect to the above generic competence components.

- All the Tasks in an Activity require specific knowledge, understanding and skills, which are expressed as a set of **Task-based competencies**.
- In addition, an Activity may also require knowledge, skills and personal qualities that are not directly related to specific Tasks and these are expressed as **Supporting Competencies**.
- **Supporting Competencies** such as “effective communication” may be required for multiple activities.

IET Code of Practice defines three levels of Competence

- **Level 1:** Someone with Level 1 competence in a defined task-based or supporting competency has sufficient knowledge and understanding of good practice to be able to apply those competencies without placing an excessive burden on the more competent safety practitioner who is responsible for supervising their work. *[Shortened version]*
- **Level 2:** Someone with Level 2 competence in a defined task-based or supporting competency has sufficient knowledge and understanding of good practice, and has the demonstrated experience, to be able to apply those competencies without the need for supervision. *[Shortened version]*
- **Level 3:** Someone with Level 3 competence in a defined task-based or supporting competency has sufficient understanding of why things are done in certain ways and has the sufficient managerial skills to be able to take overall responsibility for the performance of a task or activity. They will be familiar with the ways in which systems, and previous safety management systems, have failed in the past. *[Shortened version]*

An example of an Activity Competence profile when three Levels of competence have been defined

| Competence Level | T1 | T2 | T3 | SC1 | SC2 |
|------------------|----|----|----|-----|-----|
| Level 3 | | | | | |
| Level 2 | | | | | |
| Level 1 | | | | | |

Activity Competence Profile

| Competence Level | T1 | T2 | T3 | SC1 | SC2 |
|------------------|-----|------|------------|------|--------|
| Level 3 | Red | | | | |
| Level 2 | Red | Blue | Light Blue | Grey | Orange |
| Level 1 | Red | Blue | Dark Blue | Grey | Orange |

Two important statements from the Code of Practice

- Other competence management systems may define these competence levels differently. However, even if different definitions are used, the rest of the guidance contained within this Code of Practice remains relevant.
- It is even possible to specify task-based and supporting competencies for a given activity **without adopting the concept of competence levels**. Again, the guidance contained within the rest of this Code of Practice will still remain relevant.

Activity Competence Profile

| Competence Level | T1 | T2 | T3 | SC1 | SC2 |
|------------------|-----|------|------------|------|--------|
| Level 3 | Red | | | | |
| Level 2 | Red | Blue | Light Blue | Grey | Orange |
| Level 1 | Red | Blue | Dark Blue | Grey | Orange |

With respect to the adoption of three Competence Levels

- In the first instance focus on developing Competence Criteria for the specific Activity (No competence levels);
- The adoption of the three Levels of Competence may be advantageous when there are many identical Activities within the organisation. The key issue is whether they are identical!



ESC

Key steps in determining competence

Step 1: Define the Organisational roles and activities



Step 2: Specify the competencies required for each Task within the defined Activity (i.e. the Activity competence profile)



Step 3: Assess the competencies of the person relevant to each Task within the defined Activity



Step 4: Compare the specified competencies required for each Task within the Activity with the competencies of the person relevant to each Task within the Activity. This comparison will facilitate an objective judgement to be made as to whether the person is competent to undertake the defined Task within the Activity.



ESC

Activity Competence Profile

| Competence Level | T1 | T2 | T3 | SC1 | SC2 |
|------------------|-----|-------|------------|-------|--------|
| Level 3 | Red | White | White | White | White |
| Level 2 | Red | Blue | Light Blue | Grey | Orange |
| Level 1 | Red | Blue | Dark Blue | Grey | Orange |

Required Profile



Compare Activity Profiles



| Competence Level | T1 | T2 | T3 | SC1 | SC2 |
|------------------|-----|-------|-----------|-------|--------|
| Level 3 | Red | White | White | White | Orange |
| Level 2 | Red | Blue | Dark Blue | Grey | Orange |
| Level 1 | Red | Blue | Dark Blue | Grey | Orange |

Assessed Person's Profile





Competence criteria are provided for the following example safety-related activities:

- corporate functional safety management;
- project safety assurance management;
- safety-related system maintenance and modification;
- safety-related system or services procurement;
- independent safety assessment;
- safety hazard and risk analysis;
- safety requirements specification;
- safety validation;
- safety-related system architectural design;
- safety-related system hardware realisation;
- safety-related system software realisation;
- human factors safety engineering.



Tread with caution when using Annex D:

- Annex D sets out Task-based competencies and Supporting competencies....not intended to be a cookbook with ready-made recipes!
- Provides examples for developing your own competence criteria;
- Key issue is the competence criteria you develop is for the specific Activity;
- In the first instance focus on developing Competence Criteria for the specific activity (no competence level).
- The adoption of the three Levels of Competence may be advantageous when there are many identical Activities within an organisation.

- There is a drive towards more formal competence requirementstraceability is a key issue.
- There is no agreed international scheme for CMS or competence criteria for functional safety.
- Competence has to be addressed at organisational level and personal level.
- Supply chain issue very important and challenging!
- Subcontractor issue very important and challenging!
- The IET Code of Practice provides useful guidance **but don't use it as a cook book!**

- IET Code of Practice: Competence for Safety-Related System Practitioners
<https://www.theiet.org/resources/standards/competence-cop.cfm>
- Managing competence for safety related systems. Part 1: Key guidance
<https://www.theiet.org/factfiles/msc/man-comp1-page.cfm>
- Managing competence for safety related systems. Part 2: Supplementary material
<https://www.theiet.org/factfiles/msc/man-comp2-page.cfm>



ENGINEERING SAFETY CONSULTANTS
The Global Provider of Functional Safety Expertise and Technical Consultancy

Thank you

©

ron.bell@esc.uk.net
www.esc.uk.net