

COMAH Competent Authority Inspection of Electrical, Control and Instrumentation Systems at COMAH Establishments

(Operational Delivery Guide)

the Competent Authority



Introduction

- 1 This Delivery Guide (DG) describes how the COMAH Competent Authority (CA) inspects Electrical, Control and Instrumentation (EC&I) aspects of control of major hazards at COMAH sites. Its purpose is to ensure consistency within the regulation of COMAH and to provide transparency to Operators about what is expected and the way inspector resource is targeted.
- 2 The guide includes the benchmark standards that are used to assess the way Operators manage risk. They represent a consensus between regulators, technical experts, duty holders and other stakeholders on what constitutes proportionate action to control a given hazard. Electrical, Control and Instrumentation engineering is supported by comprehensive established standards that should not require further interpretation.
- 3 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.
- 4 In particular, for aspects of nuclear facilities and installations that may be subject to COMAH, the benchmark standards specified in Annex 2 may not be applicable where other nuclear sector standards have been used in their design, construction, installation, operation, use and maintenance. In such cases, information on relevant nuclear sector standards that may form a benchmark for EC&I inspections by the CA can be provided by the Office for Nuclear Regulation.
- 5 There is a comprehensive range of guidance documents available from professional institutions and trade associations which can be helpful to Operators in meeting the benchmark standards in this delivery guide. This delivery guide does not list these guidance documents specifically as there are many such documents from different organisations, often addressing the same subject-matter.
- 6 Whilst primarily aimed at HSE EC&I inspectors, this guide will be useful to Operators in managing risk in relation to major accident hazards and preparing for CA inspections.

Justification

- 7 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.
- 8 In many processes and activities undertaken at COMAH establishments, EC&I equipment and systems provide important prevention and mitigation measures against major accidents. Examples include:
 - instrumented process safety measures such as trips, alarms and interlocks (including safety instrumented systems);
 - protection against electrical sources of ignition;
 - protection against large releases of electrical energy, and;
 - reliability and availability of utilities.

Scope

9 The EC&I specialist discipline covers three priority topics:

- functional safety;
- explosive atmospheres, and;
- electrical power systems.

Functional Safety

10 Functional Safety is concerned with the management, design, installation, operation and maintenance of instrumented process safety systems that reduce the risk of a major accident. Such systems include:

- process control systems;
- safety instrumented systems;
- alarm systems.

Explosive Atmospheres

11 In the context of the EC&I inspection, explosive atmospheres is concerned with the management, design, installation, operation and maintenance of systems that reduce the risk of electrical sources of ignition arising from:

- electrical and instrumentation equipment;
- lightning;
- static;
- radio frequency radiation;
- cathodic protection;

and the mitigation of releases using:

- flammable and toxic gas detection;
- fire detection.

Electrical Power Systems

12 In the context of major accident hazards, electrical power systems are concerned with:

- the initiation of major accidents by electrical equipment through fire and explosion;
- the management, design, installation, operation and maintenance of electrical power systems so that they provide the necessary reliability and availability to prevent or mitigate major accidents and so that they prevent danger to personnel.

EC&I Inspection Process

13 An EC&I inspection should address one or more of the following elements of one or more of the EC&I priority topics in order to assess Operator risk management performance against relevant good practice:

- hazard and risk assessment;
- specification, design and engineering;
- operation and maintenance;

underpinned by:

- competent people;
- an effective Safety Management System.

There may be circumstances where the inspector may decide to inspect areas other than in this guide, because of specific known issues or issues identified at site during the inspection.

Targeting

- 14 The CA will prioritise which sites to inspect and the order of inspection based on inherent hazards, duty holder performance on a range of topics and other intelligence in accordance with the COMAH Competent Authority Site prioritisation methodology (ref 3), HID Targeting & Prioritisation methodology (ref. 1), and other relevant CA procedures. EC&I inspectors will follow the principles set out in the HID Regulatory Model (ref. 2).
- 15 Regardless of their performance, COMAH Operators will be subject to a degree of periodic inspection to provide public reassurance that major accident hazards continue to be managed appropriately.

Sampling

- 16 An EC&I inspection should address one or more of the priority topics in sufficient detail to determine performance against relevant good practice. The topics selected should examine and test the effectiveness of critical EC&I control measures relating to the major hazard scenarios relevant for the establishment. Inspectors will focus on and test in detail the most important layers of protection and accident prevention barriers and the systems which support them. They will use their professional judgement to decide how deeply to probe Operator performance and the underlying causes of failure before they make a regulatory decision.
- 17 The standards and good practice relevant to the technical benchmarks that apply to Electrical and Instrumentation Engineering on major hazard sites are set out in Annex 2. An overview of the inspection process is shown in Figure 1.

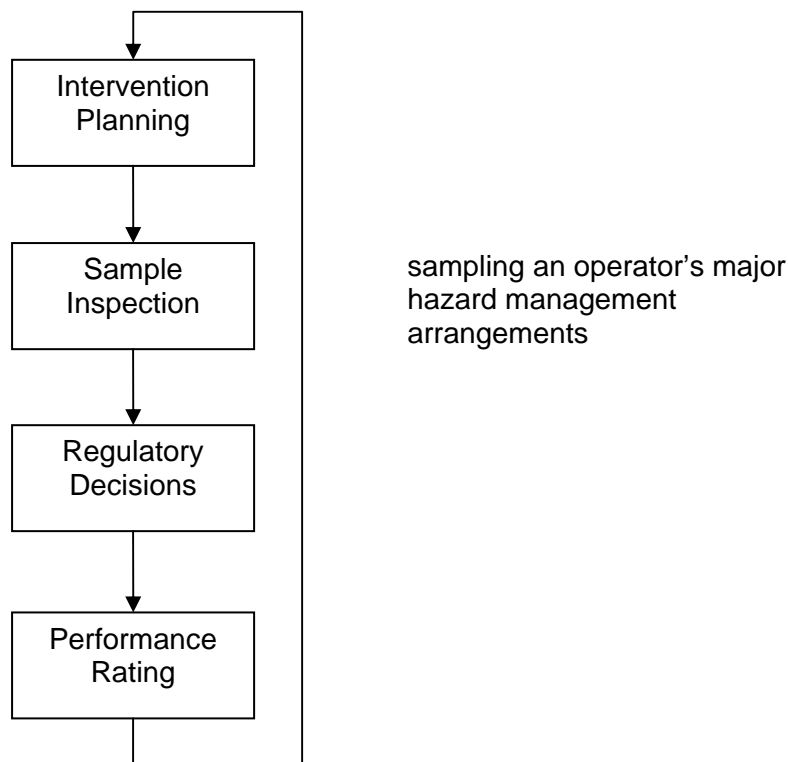


Figure 1: Overview of the EC&I inspection process

18 Annex 3 of this guide also provides inspection templates that can be used to record the performance rating arising from inspections.

Making Regulatory Decisions

19 Evidence gathered during inspection should be used to derive enforcement decisions in accordance with the CA Enforcement Management Model. EC&I sources of evidence could include:

- risk assessment studies;
- specifications;
- design documents;
- calculations;
- equipment certificates and manuals;
- maintenance procedures;
- maintenance records;
- test and inspection records;
- competence records;
- compliance against safety management system procedures;
- field observations, including information provided verbally by the Company.

Evidence of compliance may be gathered on site or may be received after the site inspection if further information was requested. If further information was requested, the inspection will not be complete until that information is assessed.

Evidence gathered during inspection should be used to derive enforcement decisions in line with the use of the Enforcement Management Model by the Competent Authority. It should also be used to ensure that the information contained in the safety report adequately reflects the conditions in the establishment.

Performance Rating

20 An Operator shall be given a performance rating using the criteria set out in the Table 1 for each of the EC&I priority topics based on the outcome of that inspection and relevant evidence from previous inspections where available. These include:

- functional safety;
- explosive atmospheres, and;
- electrical power systems.

The performance score should be communicated to the Operator as soon as the topic inspection is complete, or as soon as possible thereafter, and recorded in the inspection report.

Performance Assessment					
Each risk control topic should be assessed against the following performance criteria, a score of 20 or 10 must satisfy all specified criteria.					
60	50	40	30	20	10
Unacceptable	Very Poor	Poor	Broadly Compliant	Fully Compliant / Good	Exemplary
Performance standards are defined by the HID Targeting & Prioritisation methodology (ref. 1) and the COMAH Competent Authority Site prioritisation methodology (ref. 3)					

Table 1: performance standards

Annex 1: References and Supporting Information

References

- 1 [HID Targeting & Prioritisation - HID Principles for Prioritising Major Hazard Inspections](#)
- 2 [The HID Regulatory Model](#)
- 3 [COMAH Competent Authority Site prioritisation methodology Intrinsic Hazard \(Safety and Environment\) and Performance](#)
- 4 [COMAH Competent Authority Ageing Plant Operational Delivery Guide, Appendix 5, Ageing plant inspection topics](#)

Supporting Information

[Enforcement Policy Statement;](#)

[Enforcement Management Model \(EMM\);](#)

[Use of The Enforcement Management Model by the COMAH Competent Authority](#)

[The Safety Report Assessment Manual \(SRAM\);](#)

[Competent Authority procedures and delivery guides;](#)

[Use of the enforcement management model by the COMAH competent authority \(EMM-C\),.](#)

Annex 2: Benchmarks

Functional Safety

The following benchmark standards, or equivalent, should be applied:

- in full to installations built since the establishment of the benchmarks;
- as far as reasonably practicable to installations that pre-date their publication, recognising that compliance with previous revisions of the benchmark standards might be adequate;

The benchmarks quoted are applicable at the time of publication of this guide. Where the benchmark has been updated, the equivalent clause of the updated benchmark should be applied subject to the reasonable practicability clause above.

Key Benchmark Standards

Subject	Benchmark Standard
Functional safety - Safety instrumented systems	BS EN 61511
EC&I aspects of Alarm Systems	EEMUA Publication No. 191
Management of instrumented systems providing safety functions of low / undefined safety integrity	HSE Operational Guidance

Benchmark Standards for Inspection

Hazard & Risk Assessment

Subject	Benchmark Standard
Hazard and risk assessment at COMAH sites is led by the Process Safety Discipline, and Environmental Officers for environmental risk. Environmental expertise will be required where risk to the environment dominates.	

Engineering and Design

Subject	Benchmark Standard
Allocation of safety functions to protection layers.	BS EN 61511-1:2004, Clause 9
Safety requirements specification for the safety instrumented system	BS EN 61511-1:2004, Clause 10
Design and engineering of safety instrumented system	BS EN 61511-1:2004, Clause 11
Requirements for application software	BS EN 61511-1:2004, Clause 12
EC&I aspects of Alarm Systems	EEMUA Publication No. 191: Edition 3
Low integrity systems	HSE Operational Guidance

Operation and Maintenance

Subject	Benchmark Standard
Installation, commissioning and validation	BS EN 61511-1:2004, Clauses 14 and 15
Operation and maintenance	BS EN 61511-1:2004, Clause 16
Modification	BS EN 61511-1:2004, Clause 17

Subject	Benchmark Standard
Decommissioning	BS EN 61511-1:2004, Clause 18
Proof Testing of Safety Instrumented Systems	HSE Operational Guidance
Operator Response within Safety Instrumented Systems	HSE Operational Guidance
Low integrity systems	HSE Operational Guidance
Maintaining integrity	EC&I aspects of COMAH CA Ageing Plant operational Delivery Guide (ref. 4)

Competence

Subject	Benchmark Standard
Organization and resources	BS EN 61511-1:2004, Clause 5.2.2
Competence management	Managing competence for safety-related systems, HSE http://www.hse.gov.uk/humanfactors/topics/mancomppt1.pdf http://www.hse.gov.uk/humanfactors/topics/mancomppt2.pdf

Safety Management

Subject	Benchmark Standard
Management of functional safety and functional safety assessment and auditing	BS EN 61511-1:2004, Clause 5
Safety life-cycle structure and planning	BS EN 61511-1:2004, Clause 6.2
Verification	BS EN 61511-1:2004, Clauses 7, 12.4, and 12.7
Information and documentation requirements	BS EN 61511-1:2004, Clause 19

Explosive Atmospheres

The following benchmark standards, or equivalent, should be applied:

- in full to installations built since the establishment of the benchmarks;
- as far as reasonably practicable to installations that pre-date their publication, recognising that compliance with previous revisions of the benchmark standards might be adequate.

The benchmarks quoted are applicable at the time of publication of this guide. Where the benchmark has been updated, the equivalent clause of the updated benchmark should be applied subject to the reasonable practicability clause above.

Key Benchmark Standards

Subject	Benchmark Standard
Explosive atmospheres	BS EN 60079
Protection against lightning	BS EN 62305 CBI / HSE Guidance – Explosives Manufacturing & Storage Facilities HSE Operational Guidance
Hazards due to static electricity	PD IEC/TS 60079-32-1
Ignition of flammable atmospheres by radio-frequency radiation	PD CLC/TR 50427 HSE Operational Guidance
Cathodic protection	BS EN 13636 / BS EN 15257
Detection of flammable gases and oxygen	BS EN 60079-29
Detection of toxic gases and vapours	BS EN 45544
Fire detection and fire alarm systems	BS 5839

Benchmark Standards for Inspection

Hazard & Risk Assessment

Subject	Benchmark Standard
DSEAR risk assessment	Led by the Process Safety discipline
Area classification	Led by the Process Safety discipline
Lightning	BS EN 62305-2 HSE Operational Guidance
Radio frequency radiation	PD CLC/TR 50427:2004, Clause 10 HSE Operational Guidance

Engineering and Design

Subject	Benchmark Standard
Electrical installations design, selection and erection	BS EN 60079-14 BS7671:2008 Chapter 44 / BS7430 / BS EN 50522
Lightning protection systems	BS EN 62305-3 BS EN 62305-4 CBI / HSE Guidance – Explosives Manufacturing & Storage Facilities

Subject	Benchmark Standard
Static control measures	PD IEC/TS 60079-32-1
Cathodic protection	BS EN 13636:2004 clause 7.3.3, 8.3.3
Detectors for flammable gases and oxygen	BS EN 60079-29-2:2007, Clause 8
Detectors for toxic gasses and vapours	BS EN 45544-4:2000, Clause 5
Fire detection and fire alarm systems	BS 5839-1:2013, Section 2 & 5

Operation and Maintenance

Subject	Benchmark Standard
Electrical installations inspection and maintenance	BS EN 60079-17 BS7671 GN3 / BS7430
Moveable equipment	BS EN 60079-17:2014, Clause 4.4.3
Equipment repair, overhaul and reclamation	BS EN 60079-19
Lightning protection systems	BS EN 62305-3:2011, Clause 7 BS EN 62305-3:2011, Annex E, Clause E.7 BS EN 62305-4:2011, Clause 9 Guidance For Electrical Installation And Equipment Within Explosives Manufacturing And Storage Facilities Including Fireworks (November 2009), CBI / HSE, Clause 9.10 and 16.3
Static earthing	PD IEC/TS 60079-32-1:2013, Clause 13
Detectors for flammable gases and oxygen	BS EN 60079-29-2:2007, Clause 11
Detectors for toxic gasses and vapours	BS EN 45544-4:2000, Clauses 7, 8 & 9
Fire detection and fire alarm systems	BS 5839-1:2013, Sections 6 & 7
Maintaining integrity	EC&I aspects of COMAH CA Ageing Plant operational Delivery Guide (ref. 4)

Competence

Subject	Benchmark Standard
Electrical installations	BS EN 60079-14:2008, Annex F BS EN 60079-17:2014, Clause 4.2 & Annex B
Cathodic protection	BS EN 15257
Competence Management	Human factors: Training & Competence

Safety Management

Subject	Benchmark Standard
Electrical installations	BS EN 60079-17:2014, Clause 4
Lightning protection	BS EN 62305-3:2011, Annex E, Clause E.7

Electrical Power Systems

The following benchmark standards, or equivalent, should be applied:

- in full to installations built since the establishment of the benchmarks;
- as far as reasonably practicable to installations that pre-date their publication, recognising that compliance with previous revisions of the benchmark standards might be adequate.

The benchmarks quoted are applicable at the time of publication of this guide. Where the benchmark has been updated, the equivalent clause of the updated benchmark should be applied subject to the reasonable practicability clause above.

Key Benchmark Standards

Subject	Benchmark Standard
Electrical installations - HV	BS EN 61936-1
Electrical installations - LV	BS7671
Electrical power system earthing	BS EN 50522 / BS 7430
Safe operation / safe systems of work	BS 6867 / BS 6626 / HSG85
Inspection, maintenance & testing	BS 6867 / BS 6626 / BS 6423 / BS 7671 / BS 7430

Benchmark Standards for Inspection

Hazard & Risk Assessment

Subject	Benchmark Standard
Impact of catastrophic failure of electrical equipment	Management of Health and Safety at Work Regulations 1999 BS EN 61936-1:2010 Clause 8
Impact of electrical power failure on other utilities & systems	Management of Health and Safety at Work Regulations 1999

Engineering and Design

Subject	Benchmark Standard
Earthing arrangements	BS EN 61936-1:2010, clause 4 and 10 BS EN 50522 BS 7430 BS 7671
Equipment selection & erection	BS EN 61936-1:2010, clause 5, 6, 7 and 8 BS EN 62271 series BS EN 61439 series IEC 60076 HSG 230 - Selection of new, replacement or refurbished switchgear
Equipment strength & capability	BS EN 61936-1:2010, clause 4 IEC / BS EN 60909 HSG 230 (2002) – para 33 HSG 230 (2002) – para 44

Subject	Benchmark Standard
Protection arrangements	BS EN 61936-1:2010, clause 9 HSG 230 (2002) – Operational Issues, para 44 ENA G59 or G75
Equipment layout / segregation	BS EN 61936-1:2010, clause 8

Operation and Maintenance

Subject	Benchmark Standard
Safe Operation / Safe Systems of Work	BS 6626:2010, Clause 9 BS 6867:2013, Clause 4 BS 6423:1983, Appendix A HSG 230 – Operational Safety Documents HSG 85
Inspection, Testing and Maintenance (HV & LV)	
HV systems	BS 6867 BS 6626 [ANSI/IEEE 62/1995 Part 1] BS EN 60422 (Insulating Oil) HSG 230 – Care and maintenance HSG 230 – Protection HSG 230 - Batteries and chargers
LV systems	BS 6423 BS 7671:2008, part 6, chapter 61 & 63 IET BS 7671 GN 3 HSG 230 – Care and maintenance HSG 230 – Protection HSG 230 - Batteries and chargers
Emergency back-up systems	ISO 8528-12:1997, clause 11
Electrical power system earthing	BS 7430:2011, clause 10
Maintaining integrity	HSG230 – Assessment of aged switchgear EC&I aspects of COMAH CA Ageing Plant operational Delivery Guide (ref. 4)

Competence

Subject	Benchmark Standard
Competence – Safe operation / Safe systems of work	BS 6423:1983, Appendix A HSG 230 – Training HSG 85:2013, para 44

Subject	Benchmark Standard
Competence – Inspection, Maintenance & Testing	BS 6626:2010, clause 6 BS 7430:2011, clause 10 BS 7671:2008, part 6, clause 610.5 & clause 621.5 IET BS 7671 GN 3 (6 th edition), section 1.2 HSG 230 – Training

Safety Management

Subject	Benchmark Standard
Competence Management System	Human factors: Training & Competence
Information and documentation requirements	BS EN 61936-1:2010, clause 7.1.2 and 9 BS 6626:2010, clause 4 and 5 BS 6423:1983, Appendix D BS 7671:2008, Part 6 HSG 230 - Records

Annex 3: Performance Assessment Records

Performance Assessment Record: Functional Safety

Operator:

Site:

Current topic assessment score:

Hazard and Risk Assessment	
Coverage to Date:	Hazard and risk assessment at COMAH sites is led by the Process Safety Discipline, and Environmental Officers for environmental risk. Environmental expertise will be required where risk to the environment dominates.
Current Opinion:	n/a
Assessment Score	n/a

Specification, Design and Engineering	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Operation and Maintenance	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Competence	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Functional Safety Management System	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Performance Assessment Record: Explosive Atmospheres

Operator:

Site:

Current topic assessment score:

Hazard and Risk Assessment			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Specification, Design and Engineering			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Operation and Maintenance	
Coverage to Date:	

Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Competence			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Management System	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History

Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Performance Assessment Record: Electrical Power Systems

Operator:

Site:

Current topic assessment score:

Hazard and Risk Assessment			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Specification, Design and Engineering			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Operation and Maintenance	
Coverage to Date:	

Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Competence			
Coverage to Date:			
Current Opinion:			
Assessment Score			
Relevant Inspections, Reviews and Performance History			
Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Management System	
Coverage to Date:	
Current Opinion:	
Assessment Score	

Relevant Inspections, Reviews and Performance History

Rev	Date	Inspection Ref. / Details of Review	Assessment Score
D			
C			
B			
A			

Notes for Completion of Performance Assessment Records

Performance Assessment

The purpose of performance assessment is to assess performance in the topic for the site concerned, so that future interventions can be appropriately prioritised. Where there is a history of intervention at a site over many years a nominal limit of 5 years should be placed on the consideration of historical information.

The performance assessment should be reviewed and updated so that it remains sufficiently current to prevent annual intervention planning from prioritising issues that have already been addressed.

Realistically, performance assessment can only ever be based on a sample inspection of site installations and this is recognised by the HID Regulatory Model (ref. 2).

Coverage to Date

The inspection report provides the evidence on which the performance score is based. In scoring a particular topic at a site, previous inspections will be used where relevant, to make up the score together with what was inspected. Reference may be made to relevant sections of inspection reports that address the topic concerned.

The benchmark standards define the coverage for each of the topics and are listed in Annex 2.

Current Opinion

A brief summary of the current view of the site's performance against the topic will be based on the performance assessment word models of Table 1.

In practice, it might not be possible to fully cover an inspection topic during one or more inspections. In this case, Inspectors should make a judgement as to whether an opinion can be formed on the achieved coverage or whether further inspection is required. For example, it would be reasonable to form an opinion when most of a topic has been covered AND adequate engineering and operational management systems have been demonstrated.

Current Assessment Score

A performance score will be assigned based on the performance scoring model of Table 1. If sufficient information upon which to base a judgement is not available then a score will not be recorded.

Current Topic Assessment Score

The weakest score within a particular topic should be used to give the overall score for the topic.

Performance Assessment Record

Performance assessment records will be living documents that will be updated after each relevant inspection. Each site will, therefore, have up to three performance assessment records, one for each topic.

In order to retain the history of assessment scores, the superseded scores will be retained in the performance assessment records. They should be **greyed** out to avoid confusion.

Recording of Performance Assessments

The completed, or partially completed, performance assessment records shall be filed in the relevant COIN case.

The current topic assessment score shall be entered into the IRF/Ratings tab of the relevant COIN service order.