

## COMMON TOPICS

### Common topic 2: Maintenance error

#### Introduction

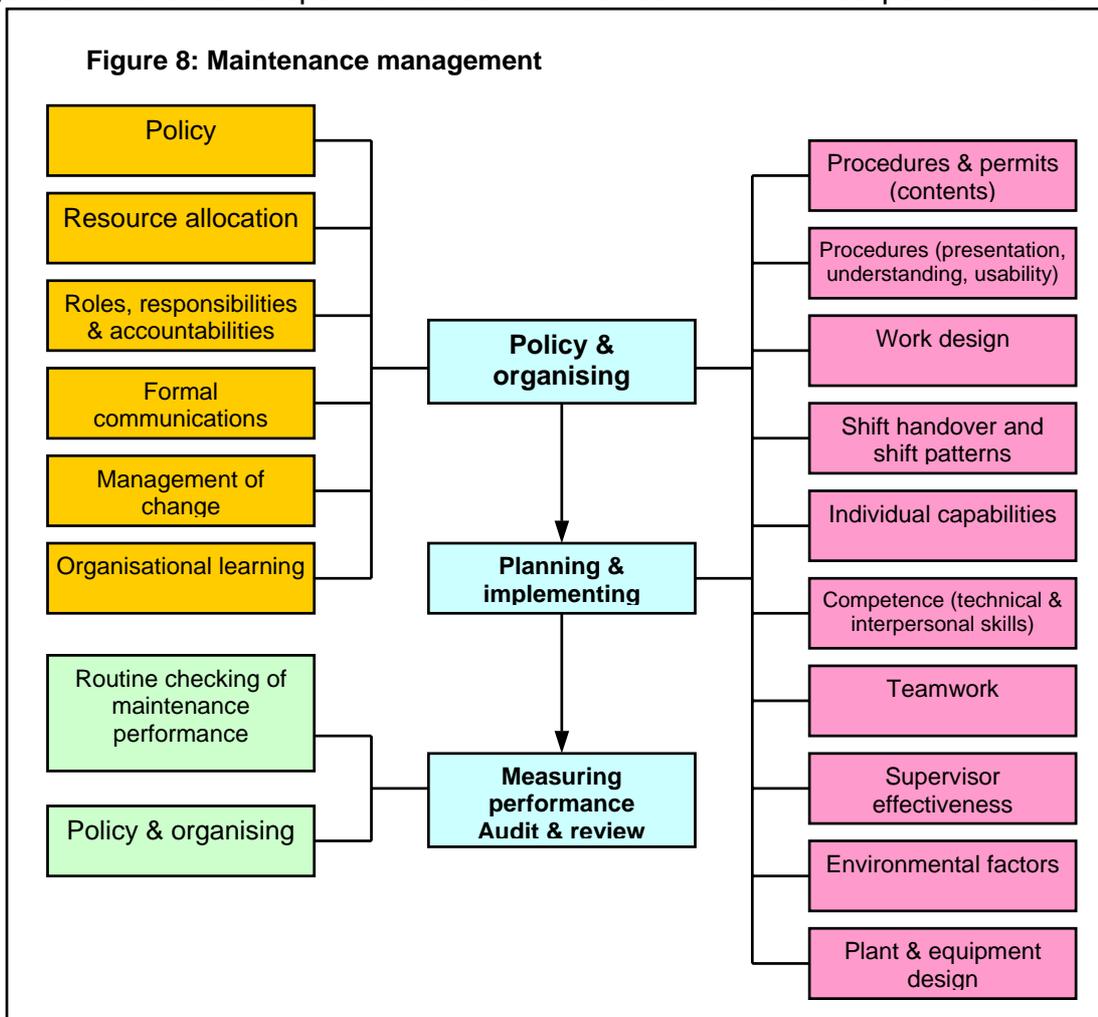
The key is assuring the adequate performance of routine or breakdown maintenance activity either on, or potentially affecting, control of MAHs i.e. work on safety critical plant and equipment or processes.

It is important to be clear what is being examined here, that is, the risk of maintenance error leading to a major accident, and not the personal risk to the maintenance staff (although good control of the former will often greatly improve the latter).

Although many maintenance systems and databases do distinguish critical equipment this is often not linked to the MAH analysis and main scenarios, and criticality may not be defined adequately for this.

Sites should have reliably identified such activities, plant, instrumentation and equipment and have arrangements in place to assure their maintenance e.g. via task analysis, supporting job aids (including procedures, checklists, diagnostic tools, up-to-date diagrams/P&IDs etc), competency of personnel involved, and communication of key major accident hazard information.

Figure 8 illustrates 18 specific issues which affect maintenance performance linked to elements of



health and safety management. These issues need to be controlled in order to ensure optimal maintenance performance. An understanding of these issues will help to identify the likelihood of human failure.

#### Common failures found at major hazard sites:

- Major accidents and near misses resulting from maintenance errors are often not separately identified and addressed;
- Risk assessments, training and procedures do not usually assure adequately against error;
- Many sites don't do even simple assurance against error;
- Safety critical maintenance tasks and procedures are often not identified;
- Sites don't make the link between maintenance error and their risk assessments;
- Statistics and investigations show this is a continuing serious issue.

### **Specific documents**

In addition to the general documents that should be requested prior to the visit (see chapter 'Aim of the Guidance') it is recommended that the following documents, which are specific to this topic, should also be requested:

- Any evidence of reviews of human performance in maintenance activities.
- Lists of safety critical equipment, plant and processes.

### **Enforcement and advice**

Enforcement should be considered following an incident or near miss where a maintenance error or failure was a significant cause. HF and mechanical engineering support is likely to be needed for this initially. A review or assessment of maintenance activity re MAHs would be appropriate, following the questionnaire approach in the guidance and considering the consequences of human failure and error.

No enforcement yet but advice given as part of several field interventions and guidance increasingly being used by individual inspectors to support routine COMAH inspection and audit, and to get operators to start looking at this issue in a structured way.

A more detailed question set than the one below is available if needed. Please contact the Human Factors Team for a copy.

### **Guidance**

- **Improving Maintenance – A Guide to Reducing Human Error**
- **Managing Maintenance Error – Reason & Hobbs**, Ashgate, 2003, ISBN 0-7546-1591-X

**Question set: Maintenance error**

	<b>Question</b>	<b>Site response</b>	<b>Inspectors view</b>	<b>Improvements needed</b>
1	<p>Is there evidence that maintenance is firmly based on a robust understanding of, and linked to, an analysis of the site's major accident hazards?</p> <ul style="list-style-type: none"> <li>• Are safety-related &amp; safety-critical maintenance items and activities reliably identified?</li> <li>• Are associated job aids and procedures developed for these priority items?</li> <li>• Is human failure, including violations and error, understood and addressed / managed?</li> </ul>			
2	<p><b>Policy:</b> Is there a clear strategy on maintenance?</p> <ul style="list-style-type: none"> <li>• Does it consider the role of human error?</li> <li>• Does it recognise that some maintenance is of higher priority than others?</li> <li>• Are safety critical equipment / tasks / activities identified?</li> <li>• Is there a link between preventing loss of containment and general plant / equipment reliability?</li> </ul>			
3	<p><b>Resource allocation:</b> Is there an adequate system for maintenance resourcing, planning and prioritisation?</p>			
4	<p><b>Roles, responsibilities and accountabilities:</b> Are responsibilities defined and made clear to staff?</p>			
5	<p><b>Formal communication:</b> Are major accident hazard safety requirements and priorities communicated regularly and reliably to key staff?</p>			
6	<p><b>Management of change:</b> Are maintenance requirements adequately assessed for new projects or modifications?</p> <ul style="list-style-type: none"> <li>• Does this include <b>organisational</b> change (e.g. moving to team working)?</li> <li>• Are procedures and training reviewed and revised?</li> </ul>			
7	<p><b>Organisational learning:</b> Is there evidence of visible commitment to continuous improvement and is this resourced?</p>			

	Question	Site response	Inspectors view	Improvements needed
8	<p><b>Procedures and permits:</b> Are procedures clear? Is the permit system designed to an accepted standard (e.g. OIAC guidance). Are adequate job aids provided, based on e.g. task analysis or risk assessments, for critical tasks (job aids include procedures, checklists, diagnostic tools)?</p> <ul style="list-style-type: none"> <li>• Do staff find procedures useful and accurate?</li> <li>• Do they <b>use</b> them? <ul style="list-style-type: none"> <li>○ Is compliance checked and monitored?</li> <li>○ Are they reviewed regularly?</li> </ul> </li> </ul>			
9	<p><b>Work design:</b> Is attention paid to design of maintenance tasks?</p> <ul style="list-style-type: none"> <li>• How is critical work scheduled (e.g. shouldn't be planned for the end of long shifts / cross-shift)?</li> <li>• Is fatigue managed e.g. is overtime monitored individually; are clear limits set on hours?</li> </ul>			
10	<p><b>Communication issues:</b> Are critical communications assured?</p> <ul style="list-style-type: none"> <li>• Is there a shift handover procedure and log?</li> <li>• Is there adequate co-ordination and tracking of maintenance work?</li> </ul>			
11	<p><b>Competence:</b> Is there a competence assurance system linked to the analysis of major accident hazards on site, and the safety-related / critical tasks?</p>			
12	<p><b>Teamwork:</b> Are there formal or informal teams and are these recognised and managed?</p> <ul style="list-style-type: none"> <li>• How are temporary teams managed e.g. for shutdown, major breakdowns?</li> </ul>			
13	<p><b>Supervisor effectiveness:</b> Do supervisors or team leaders monitor key work practices?</p>			
14	<p><b>Environmental factors:</b> Are the conditions in which tasks are carried out (e.g. lighting, access) likely to lead to poor work, errors and mistakes, and incomplete work?</p>			
15	<p><b>Plant and equipment design:</b> Is there evidence that design or modification for maintainability is considered?</p>			

	Question	Site response	Inspectors view	Improvements needed
16	<p><b>Monitoring and review:</b> Are key performance indicators for safety and reliability set and monitored with maintenance, inspection and test performance included?</p> <p>Is performance reviewed via the results of an adequate inspection and audit programme?</p> <ul style="list-style-type: none"> <li>• Are maintenance accidents / incidents / near-misses (or those with maintenance root causes) adequately investigated and the results and actions communicated appropriately?</li> <li>• Are the MA aspects reliably captured and prioritised?</li> </ul>			