Appendix 5

Ageing plant inspection topics

1. This Appendix defines the topics to be addressed at sites identified for ageing plant inspection, aiming to do so in a way that allows a gap analysis to be carried out against information obtained during previous interventions at the site.

2. Where there is a history of previous intervention on some or all of the topics (likely to have been carried out by, or with the support of, Mechanical Engineering or C&I Discipline Specialists) the Inspection Team should assess the current knowledge on the site in a gap analysis against the topics identified in this appendix. The results of this gap analysis should be used to define the detail of future interventions such that all topics are addressed and an overall view of the performance of the site can be taken.

3. Initial inspections should be aimed at providing sufficient knowledge of systems, and their operation, at the site to enable Field Teams to gauge the extent to which the arrangements are suitable, and to identify issues requiring further intervention. For more complex sites it is expected that further Discipline Specialist interventions will be required to follow up specifically identified issues in more detail.
### Ageing Plant: Key Inspection Topics

<table>
<thead>
<tr>
<th>Topic 1. Leadership</th>
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<tbody>
<tr>
<td>To what extent are the site senior managers aware of the performance of the systems designed to maintain the integrity of safety-critical assets, and what is their commitment to ensuring that such assets remain fit for service at all times?</td>
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</table>

**Rationale:** It is important that the site leadership team have clear visibility of the performance of the various systems that deliver continuing asset integrity in order that they have confidence that the site remains in a fit state to operate. In addition it is important that those in ultimate authority demonstrate a commitment to asset integrity by providing independence to those who are charged with making key decisions regarding fitness for service and supporting the decisions they make.

<table>
<thead>
<tr>
<th>Benchmark</th>
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<tbody>
<tr>
<td>There should be a clear set of Key Performance Indicators that provide the leadership team with information on the performance of the various systems delivering asset integrity. These should be reviewed on a regular basis, with evidence that poor performance is subject to challenge. Where ageing has progressed to the extent that equipment is nearing the end of its useful life there should be evidence that the leadership team are aware of this and supporting plans to provide replacement equipment when necessary. For example, where significant repair work or fitness for service assessments are required to enable equipment to return to service this should be clearly visible to the leadership team. Where difficult integrity decisions have been necessary, there should be evidence that the leadership team have supported the independence of those charged with making such decisions.</td>
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### Ageing Plant: Key Inspection Topics

<table>
<thead>
<tr>
<th><strong>Underlying Key Issues</strong></th>
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<tbody>
<tr>
<td>Do the leadership team regularly review KPIs relevant to asset integrity?</td>
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<td>Is poor performance indicated by KPIs subject to challenge?</td>
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<tr>
<td>Where ageing issues have progressed to the point where equipment is nearing the end of its life, are the leadership team aware of this and supporting plans to replace the equipment?</td>
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<tr>
<td>How are lessons learned from incidents/accidents and near miss reports used to improve integrity management?</td>
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<tr>
<td>Are there safety suggestion schemes, plant defect reporting schemes etc to encourage personnel to report problems or observations or suggest ways to improve the systems and arrangements?</td>
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<tr>
<td>Is there evidence of the leadership team supporting the independence of those charged with making key decisions on asset integrity?</td>
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<tr>
<td>How does leadership know if sufficient resources are assigned to this effort on an ongoing basis?</td>
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<tr>
<td>How does leadership establish the resource requirements to ensure an effective integrity/maintenance system?</td>
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<tr>
<td>How does leadership know that the people involved in this effort are competent to perform the duties that leadership expect them to perform?</td>
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<tr>
<td>In addition to changes to process technology and equipment, does leadership recognise that subtle changes to people and management processes can affect the integrity/maintenance performance, and how do they manage these changes?</td>
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<tr>
<td>How does leadership reconcile potential conflicts between releasing equipment for integrity management/maintenance needs versus production needs?</td>
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<tr>
<td>How does leadership ensure that process safety-critical equipment inspection/examination deferrals are technically sound and approved by appropriately qualified and sufficiently independent persons?</td>
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</tbody>
</table>
### Ageing Plant: Key Inspection Topics

#### Topic 2. Plant and equipment on site – the Asset Register

Does the site have a comprehensive Asset Register that contains all its equipment? If so, does it identify and differentiate its process safety critical equipment, so that appropriate operating, maintenance and integrity management strategies can be applied? Does this register include mechanical, electrical, control and instrumentation and structural equipment?

**Rationale:** Sites may already have asset registers that include both equipment that is not process safety-critical and that which is. However, their resources will invariably be limited, so it is important to know not only what plant and equipment is present on site, but also how important it is to safety. This will allow maintenance and integrity management systems and processes to prioritise and focus on effectively controlling major accident hazards.

#### Benchmark

There should be an Asset Register that lists equipment, where it is, and indicates its safety significance. It is imperative that process safety-critical equipment is/has been identified by a multi-disciplinary team, which should include, but not be limited to, a professional process engineer with intimate knowledge of the process under discussion, an experienced operator, and suitably experienced and qualified maintenance/integrity engineers or control and instrumentation engineers as appropriate. Note: Field Teams may choose to explore this aspect of the asset register during separate inspections involving Mechanical and C&I Specialists.

There should also be information on the hazardous ‘fluids’ along with their hazardous properties i.e. Material Safety Data Sheets (MSDSs) as a minimum.

Most sites will have both computer and hard copy records with this information but often in different formats, some collected together others not. Format is not an issue as long as the information about the ‘hazardous fluids’ and the ‘hazardous fluids’ envelope is easy to access and use.

It is also important that the asset register is kept-up-to-date and mirrored by accurate up to date P&IDs and other plant or process documentation. The importance of these information system updates should be recognised in a documented management of change of system for the site.

The asset register should clearly identify all primary containment safety-critical mechanical equipment (tanks, vessels, pumps, piping etc) which, if they fail, could give rise to a MAH. There should also be a register of safety-related electrical, control and instrumentation and prevention/control/mitigation safeguards equipment for major hazard plant.

There should be some form of prioritisation or risk ranking system within the asset register or maintenance management system to highlight safety-critical plant and equipment associated with major hazard plant.

There should be some mechanism for identifying and highlighting equipment found to be subject to significant ageing, either through the inspection reports, written schemes of examination or integrity reviews, so these can be monitored and managed effectively – the existence and operation of these systems will be tested by later questions in this Appendix.
### Ageing Plant: Key Inspection Topics

**Underlying Key Issues**

- Is there an Asset Register in place?
- How is the Asset Register kept up-to-date?
- Does it include EC&I, prevention, control and mitigation safeguards, and structures (this can be particularly important where the safety of the plant relies on instrumented protective systems e.g. Safety Integrity Level (SIL) 1 or higher rated systems)?
- Have safety-critical items been identified by an appropriately qualified team?
- Are safety-critical items highlighted together with all the relevant assets that comprise this, support it, or are necessary for it to function?
Ageing Plant: Key Inspection Topics

**Topic 3. Assuring the integrity of the primary containment boundary**

Are arrangements in place to identify and assess the condition of the primary containment boundary that may be showing signs of ageing, or which may be approaching or beyond its original design life or calculated remnant life, and to justify, continued operation or down-rate/decommission this? In this context the primary containment boundary should be taken to include all vessels and pipework (rigid and flexible elements), mechanical protective devices such as bursting discs and pressure relief valves and structural items (e.g. support structures, pipe hangers) which if they were to fail or not function correctly, could cause failure of the primary containment boundary.

Rationale: Degradation of the primary containment boundary through mechanisms such as corrosion, erosion, fatigue, creep etc needs to be identified so that it can be monitored and assessed to check whether it is still fit for purpose. If the deterioration is significant, then the equipment may have to be down-rated, removed from service, or other measures introduced so it can safely continue in operation. For items that are required to function (e.g. PRVs, BDs) to prevent a loss of containment there should be arrangements in place to provide assurance that this functionality is present at all times.

**Benchmark**

All sites should have a management system designed to ensure that plant and equipment forming the primary containment boundary remains fit for service at all times. In the vast majority of cases this will lead to periodic examination of equipment to a scheme of examination. This will be designed to monitor the degradation mechanisms that have been assessed as being a credible threat to the integrity of each specific item forming the primary containment boundary.

The management system will define the following key processes:

- **Roles and responsibilities** – at its most basic level this will be a declaration as to whether the integrity management function will be provided by in-house personnel (a second party arrangement) or by an external body (a third party arrangement). It should be clear what the responsibilities of each party involved in delivery of the system are, in particular it should be clear who is ultimately responsible for certifying that an item of plant or equipment is fit to return to service following examination. Where third parties are involved, both the dutyholder and the third party should be clear as to what the roles and responsibility of each are. It should be clear that there is independence of the integrity management function from day-to-day operational management of the site; where a second party arrangement is in place this would be supported by UKAS Accreditation to ISO 17020.

- **Scope of equipment covered** – there should be integrity management arrangements in place to cover all equipment where the failure of the primary containment boundary could result in a hazard, or where failure of the item could lead to subsequent failure of the primary containment boundary. In the main this hazard will result from the release of stored energy (pressure) or the hazardous nature of the released fluid, but in some cases may be due to the dynamic effects of an otherwise benign fluid (e.g. a large water storage vessel).
Definition of inspection scope and periodicity – a fundamental requirement of a system design to provide assurance of the integrity of the primary containment boundary is that it is able to identify the degradation mechanisms which may threaten the integrity of each element forming that boundary. It must then define the examination technique to be adopted to monitor these mechanisms, together with the periodicity with which they should be applied. This may range from the application of industry standard procedures at simple sites (e.g. LPG storage) to the use of Risk-Based Inspection (RBI) techniques at more complex installations. Whatever approach is adopted, it must be appropriate to the situation. Where RBI is used, it is likely that a more detailed inspection by a Mechanical Engineering Specialist will be appropriate at a later stage but the key features that should be evident at this initial stage are:

- A team-based approach utilising members with expertise in the process technology under consideration, inspection, operations and materials/corrosion as a minimum.
- Appropriate levels of expertise – for example many smaller sites would not have materials/corrosion expertise within their own resources so would have to seek external support in this area.
- A process that reviews examination results to both confirm that the equipment remains fit for service and assess the potential implications of adverse finding on other areas of the plant. Where equipment has a specific design life, this review process should ensure that action to validate continued operation is taken as equipment approaches this life.

Delivery of the examination process – it should be clear how the examination schemes developed for each item of equipment will be implemented, and by whom. Where external resource is utilised, as will often be the case for the delivery of non-destructive testing, it should be clear what their role is. In all cases level of detail required in reporting of examination results should be clear.

Dealing with adverse findings – there should be clear arrangements for assessing examination reports to confirm whether or not the equipment concerned remains fit for service. As a minimum, it should be clear that reports are checked against original design requirements (e.g. where corrosion has been found) to confirm that the design minima have not been breached. Where degradation is a significant issue it is likely that the site will, at times, need to carry out fitness for service assessments to support continued service. Where evidence of such practices are found, these are likely to warrant follow-up inspection by a Mechanical Engineering Specialist.

Postponement of examinations – there should be a clear process in place for the approval of postponement of examinations. This should ensure that approval is obtained before the examination becomes overdue and include assessment to confirm that the delay in examination will not result in a significant increase in likelihood of failure of the containment boundary. This process should consider the need (where appropriate) for partial or supplementary inspections in lieu of the documented requirements, before the actual inspection due date. This will allow a more quantitative assessment of the contemporary equipment condition and help provide a more detailed technical basis to support deferment.
Ageing Plant: Key Inspection Topics

- Repairs – there should be arrangements in place to control the specification and implementation of repairs, both permanent and temporary. Key features are that repairs are not permitted to be implemented unless a system of quality control of maintenance materials is applied, the repairs have been shown to be like for like and fit for purpose. Where they are temporary or not like for like, they should be subject to a documented management of change procedure that makes a technical assessment and defines the justified lifespan of each repair.

- Performance monitoring – there should be performance measures in place to monitor the operation of the system, these are likely to include regular monitoring to confirm that equipment is not allowed to go overdue without prior approval and monitoring of ‘procedural’ near misses. Loss of containment incidents, temporary repairs still in place within or out of their agreed lifespan, inspections awaiting final reports etc.

- Interface with operations – the work of the Integrity Management team needs to interface effectively with the Operations and Maintenance departments to ensure that equipment is released for examination as required, and that it is not returned to operation until the Integrity Department have confirmed in writing that it is fit for continued service. In addition, there should be arrangements in place to ensure that changes to operating parameters are advised to the Inspection Department.

It is expected that an initial inspection will establish how the system is structured and whether key elements are absent, providing information around which to structure further detailed intervention as necessary. The inspection should not be restricted to discussion of the systems in place but should test practical delivery by detailed assessment of the examination schemes, reports etc of sample vessels and pipework systems. The level of sampling should be sufficient to enable intervention topics requiring more detailed scrutiny (or confirmation that no further intervention is required at this stage) to be identified. These may include, for example, issues such as, operation of the RBI system, strategy for dealing with Corrosion Under Insulation (CU), the use of non-invasive techniques, fitness for service assessment procedures.
### Ageing Plant: Key Inspection Topics

<table>
<thead>
<tr>
<th>Underlying Key Issues</th>
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<tbody>
<tr>
<td>■ Is there a clear structure to the integrity management system?</td>
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<td>■ Are roles and responsibilities, including those of third parties clearly defined?</td>
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<td>■ Is the system able to effectively identify degradation mechanisms that will credibly threaten the</td>
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<tr>
<td>integrity of the containment boundary?</td>
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<td>■ Does the system ensure that inspection schemes effectively monitor the credible degradation mechanisms?</td>
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<td>■ Is it clear who is responsible for confirming that equipment remains fit for service?</td>
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<td>■ Are fitness for service assessments carried out?</td>
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<tr>
<td>■ Are arrangements in place to approve the postponement of examinations when necessary?</td>
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<tr>
<td>■ Are performance measures in place to monitor the effective performance of the system?</td>
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<tr>
<td>■ How are repairs managed to ensure they are fit for purpose and meet the original design intent?</td>
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<tr>
<td>If they don’t meet the original design intent, have management of change procedures been applied?</td>
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<td>■ Is there a process to control the quality of key process safety-critical maintenance materials and</td>
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<tr>
<td>spare parts?</td>
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<td>■ Is there a process that provides assurance of the continued functionality of safety devices such as</td>
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<td>PRVs and BDs?</td>
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<tr>
<td>■ Is there a process that manages the condition of support structures that could affect the</td>
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<tr>
<td>integrity of the primary containment boundary?</td>
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<tr>
<td>■ Are effective interface arrangements in place that ensure that equipment is released for</td>
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<td>examination when required and not allowed to return to service until approved by a designated</td>
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<tr>
<td>person?</td>
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<tr>
<td>■ Are there features of the system that warrant further, deeper, intervention activities?</td>
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### Topic 4. Assuring the integrity of safety-critical mechanical equipment

Does the mechanical maintenance system effectively identify and manage the maintenance of equipment that, if it were to fail, could initiate, fail to mitigate or cause escalation of a major accident?

**Rationale:** On most sites there will be equipment of which failure could initiate a major accident or contribute to the escalation of such an accident. This equipment will not normally be covered by the management system dealing with the primary containment boundary, yet could lead to a hazard from failures resulting in a loss of containment and/or loss of functionality.

#### Benchmark

The site maintenance management system will normally cover a vast array of equipment, much of which will either not be of interest from a mechanical engineering perspective and/or will not have safety significance. The objective of this question is to confirm that mechanical equipment of safety significance is properly identified and flagged in the Asset Register (generally referred to as safety-critical equipment) and then that its maintenance is managed such that the potential for failure in service is kept to an acceptably low level.

The following key processes should be explored:

- Identification of safety-critical equipment (SCE) – there should be a process in place to enable individual items of equipment to be assessed to establish whether or not they should be classified as safety critical. This process should consider both the potential for failure to lead to a loss of containment (e.g. as a result of a bearing/seal failure) and the impact of a loss of function (e.g. the loss of a critical pump might lead to an inability to control an exotherm – hence, potentially, lead to a major accident). The system (normally a computer-based database system such as SAP) should flag those items of equipment identified as safety critical in such a way that information about them can be extracted from the database. The process adopted for identification of SCE should be appropriate to the site concerned, but would normally be expected to involve a multi-disciplinary team. Other than for very simple sites, it is unlikely that one person alone could effectively carry out this process. This process is also addressed in Topic 2 as, at some sites, Field Teams may wish to address the issue of identification of safety-critical equipment across all disciplines in a single intervention.

- Maintenance of safety-critical equipment – the system should ensure that SCE is maintained in such a way as to minimise the potential for failure in service. Inspection of the system should establish how the scope and periodicity of maintenance for particular equipment is defined (this might range from simply applying manufacturer’s recommendations through to the use of Reliability Centred Maintenance (RCM) or Risk-Based Maintenance (RBM) systems) and what the arrangements are for approving this and subsequent changes to it. Where an RCM system is in operation it may be appropriate to carry out a separate follow-up inspection on the operation of the system. A key feature of an effective maintenance system will be a review and feedback process, similar to that expected in the management arrangements for the primary containment boundary. This is to ensure that where degradation of the equipment has been greater than expected, action is taken to address the problem, whether that be by reducing the maintenance interval or other means.
Ageing Plant: Key Inspection Topics

- Performance monitoring – there should be measures in place to monitor the delivery of the maintenance programme overall (large backlogs will be an indicator of resourcing issues that may ultimately lead to an inability to complete safety-critical maintenance on time) and, specifically, delivery of the maintenance of SCE. There should also be a means of monitoring reactive maintenance activities on SCE as this may indicate problems with the scope or periodicity of planned maintenance activities. It is important that the KPIs adopted allow the management team to differentiate between SCE and ‘other’ equipment.

- Postponement of SCE maintenance – in much the same way as for equipment forming the primary containment boundary, there should be a system in place to ensure that where SCE maintenance is necessarily delayed, an assessment of the potential safety impact is carried out. The proposed delay should be approved in advance by a designated person, who should have a demonstrable level of independence from the operations function.

- Spares holding policy – what arrangements are in place for the provision of spares for SCE, what provision is made for older potentially obsolete equipment? Whilst not of direct interest from a process safety management point of view, poor or inadequate arrangements in this area could lead to pressure to keep equipment in service which should be subject to repair, or to reverse engineer spare parts, and may indicate a need to look more closely at the independence of the process for SCE maintenance deferment and/or the application of the management of change process.

- Spares quality assurance - Making sure that the specified maintenance materials and spares are used, by the application of an effective quality control of maintenance materials process. This should include ensuring that maintenance technicians are able to identify that the correct materials have been supplied to them and aware of what action is required if this is not the case.

Underlying Key Issues

- Is there an effective process in place to identify safety-critical equipment?
- Does the Asset Register (or other database used as part of the MMS) clearly identify equipment that has been classified as safety-critical?
- Is the execution of maintenance on SCE effective?
- Are maintenance backlogs being managed to an acceptable level?
- Are the performance indicators in place to monitor the timely completion of SCE maintenance?
- Is there a process to approve delays to SCE maintenance in advance and is there an appropriate degree of independence in this process?
### Ageing Plant: Key Inspection Topics

#### Topic 5. EC&I Inspection and Test

Are the instrumentation systems tested and calibrated regularly? Are the constituent parts inspected regularly?

**Rationale:** The instrument systems tell you what is happening on the plant. If they are faulty or out of calibration, you may lose control of the plant. Also, the instrumentation may be used to provide a historical record of the state of the plant. If that historical record is wrong or incomplete, you may not pick up a trend that indicates deterioration of the plant.

#### Benchmark

The Asset Register and linked documentation should list the equipment, and relevant information about the state of that equipment. Most sites will have both computer and hard copy records with this information but often in different formats, some collected together others not. Format is not an issue as long as the information is easy to access and use.

It is also important that this information is kept up-to-date and mirrored by accurate up-to-date P&IDs and other plant or process documentation namely operating manuals, loop drawings, maintenance manuals and test procedures etc.

The information held should clearly identify all safety-related electrical, control and instrumentation and prevention/control/mitigation safeguards equipment for major hazard plant. For each instrument and actuator in this category, the defined test interval should be recorded, along with the date of test, measurement results, resulting action and confirmation that the resulting measurement is then within tolerance.

There should be some audit mechanism for identifying and highlighting equipment found to be subject to significant ageing or failing, either than expected, so the situation can be monitored and managed effectively.

There should be some audit mechanism in place to report to a responsible person whenever safety-related items are not tested in accordance with the defined test intervals.
## Ageing Plant: Key Inspection Topics

### Underlying Key Issues

- Does the asset register and supporting documentation include EC&I, prevention, control and mitigation safeguards? This can be particularly important where the safety of the plant relies on instrumented protective systems e.g. Safety Integrity Level (SIL) 1 or higher rated systems.

- Where safety related systems have been identified, does the test regime identify how the system can be tested, from end to end? Partial testing or component testing may not show some faults, and the disturbance of the system to allow partial testing may of itself cause problems.

- Does the documentation record the actual condition of the equipment when tested, or just confirm that the equipment was working by the end of the test?

- How are the requirements for maintenance, testing and inspection set?
  - Are leading and/or lagging indicators used to indicate whether inspections/tests are being carried out on schedule, what proportion of the items inspected/tested are passing the test etc?
  - Is there a process in place to assess how quickly the instrumentation is deteriorating e.g. by sample inspections to define the appropriate time between inspections of different types of instrumentation?

Are items found to be suffering from ageing, identified and brought to the attention of the responsible member of the management team?
### Ageing Plant: Key Inspection Topics

#### Topic 6. EC&I management of Out-of-date or Obsolescent Equipment

How is out-of-date or obsolescent EC&I equipment, identified and managed to ensure their integrity and performance (including equipment that may no longer be supported by the supplier or manufacturer)?

**Rationale:** Some of the assets onsite, including electrical, instrument and control systems may be very old, or essentially obsolete, or no longer supported by the manufacturer or supplier. This may not necessarily mean that they are no longer fit for purpose, but it could affect the ability to maintain, test and repair these items.

### Benchmark

The company should have a list of equipment that is obsolete or no longer supported by the manufacturer/supplier. This may be indicated in the Asset Register and maintenance procedures.

The company should have a process in place for repairing, maintaining or replacing such equipment, including for example identifying sources of parts or software programmes with the right experience.

The company should have a defined member of the management team who has responsibility for deciding whether to continue to use equipment as it becomes obsolete, or whether to phase in its replacement.

Replacing obsolete instrumentation should be subject to formal change management procedures to ensure that all implications are identified, assessed and approved at the relevant level.

Where safety-instrumented systems with SIL 1 or higher is to be replaced with modern digital equipment, this will need to be carried out in accordance with the requirements of IEC 61508/IEC 61511 (including change management). If the company does not have its own specialist resources and competency in these key areas, then there should be evidence of, or the intention to, bring in specialist contractors etc to advise and assist.

### Underlying Key Issues

- How are out-of-date or obsolescent equipment or systems identified?
- How is equipment maintained, repaired and tested where there is:
  - difficulty in accessing detailed information on its design and maintenance requirements;
  - difficulty in obtaining spares; or
  - a lack of expertise/skills or knowledge, for example, to maintain, change/debug software etc?
- How does the company access specialist skills or knowledge needed about these items?
- What is the replacement strategy for such plant and equipment?
- Where safety-instrumented systems with SIL 1 or higher equipment is to be replaced with modern digital equipment, is the company aware of the requirements of IEC 61508/IEC 61511 and the implications of these, particularly regarding specialist resources and competency to deal with these?
Ageing Plant: Key Inspection Topics

Topic 7. Resources

Are the resources available for the management of mechanical integrity, maintenance and C&I system inspection and test of suitable competence and available at a sufficient level to enable effective delivery?

Rationale: Asset integrity management is a significant task that needs to be properly managed and resourced. Over the years sites may have changed, organisation and management reorganised, personnel changed and duties reallocated. There has also been an increase in the use of independent bodies for the management of integrity. It is important to establish that those with responsibility for managing the assets and undertaking the maintenance, testing, inspection etc are suitably competent and that the overall allocation of resources is adequate to maintain the integrity, functionality and safety of the plant and equipment.

Benchmark

The inspections carried out in order to address the structure and operation of the systems delivering plant and C&I equipment integrity and maintenance (Topics 3 – 6 above) will identify major issues with resource competence or availability, and address many of the issue covered by this question. The information obtained by inspecting against Topics 3 – 6 should be considered by the Field Team in deciding the priority and coverage of a specific inspection against this question.

Those responsible for managing and undertaking maintenance, testing and inspection should be competent for this. Someone with an engineering qualification would be expected to manage the maintenance, inspection and testing systems and arrangements. Technicians should also have suitable NVQ, SVQ or similar qualifications or experience or specific training to meet the company requirements. Supervision should be in place for those not yet assessed as fully competent, newcomers, or those in training. The better companies will have recruitment, training and development competence assessment in place. Particular interest should be taken if the company has recently appointed a new inspection body or contractor for maintenance, or is about to lose or has recently lost experienced staff due to retirement, organisational changes etc. Where key people are about to leave, some evidence of activity to retain or plug gaps in skills and knowledge should be evident.

Do staff involved in activities associated with the management of ageing have an appropriate level of knowledge of the relevant company/site procedures and processes, such as management of change, materials quality assurance, pre-operational testing etc?

The company should have checks in place to confirm the competency of third parties involved in asset integrity management. These should include competence checks as part of the selection and monitoring processes for contractors.

Inspection bodies should be registered and certificated as such, e.g. to BS EN ISO/IEC 17020:2004 and UKAS accreditation.

The level of backlogs in the maintenance management systems may give an indication as to whether the overall levels of resources are suitable. This can be a particular issue if there has been recent downsizing of maintenance staff and managers in the company.

Changes to resources or responsibilities should be identified, assessed, managed and approved through the change management systems.
### Underlying Key Issues

- Who is responsible for monitoring and maintaining the maintenance, inspection and testing programme and ensuring this is delivering the required performance?
- Are those responsible suitably qualified in terms of professional qualifications, experience and skills?
- What are the key integrity/maintenance/engineering roles that can influence process safety?
- What are the key competencies required for each role (other than professional/vocational qualifications)?
- How do you know these competencies are available and maintained?
- How are contractors or other bodies involved in asset integrity management or inspection and testing activities selected, and how are they assessed for competency and managed/monitored to check they are working to the required scope and standards?
- How do you ensure you retain the skills and experience to maintain, test (re-program?) and repair unusual, novel, old or obsolete plant and equipment (include EC&I systems and equipment) still in use on site?
- How are Maintenance Management System (MMS) backlogs monitored, priorities assigned and addressed?
- Is job/skills continuity addressed when changing personnel or plant and equipment?
- How is the adequacy of overall resource levels assessed? Is the completion and close out of tasks and actions and MMS backlogs used as KPIs?
- Is leadership supportive?