MARSH JLT SPECIALTY

ENERGY & POWER

Inspection Deferrals in the Downstream Energy Industry

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MARSH

The energy industry is experiencing record low oil prices and an unprecedented downturn in output, partly due to oversupply, and partly due to decreased demand as a result of COVID-19-related lockdowns. For many companies this may result in financial distress.

In a recent survey of the energy and power industry, Marsh JLT Specialty found that all respondents were considering cost control measures. Most companies protected critical maintenance, but non-essential maintenance was often reduced or delayed. More than a quarter (28%) of respondents had already reduced or delayed non-essential maintenance. Another 50% were considering or planning to do so. For those with turnarounds to consider, almost 40% of respondents were either considering postponing turnarounds, or had already done so.

We explore some of the key factors when considering deferring inspection dates, and highlight some of the questions businesses need to answer beforehand.

This guidance assumes that the site has well-established management systems that set the foundations for managing inherent process safety risks, including process safety, operational, inspection, maintenance, and emergency response management systems. On that basis, the site is expected to have set inspection dates and established inspection strategies for all fixed equipment.

Inspection Postponement Process

Owners can improve their confidence when inspection postponements are required by following the below process.

Early stakeholder engagement

A multidisciplinary assessment team should ideally meet before carrying out technical reviews. The team will help troubleshoot potential issues, such as equipment integrity and capability of releasing equipment from service (that is, difficult versus impossible). They will also help identify quick wins and maintain team ethos with a common direction — sharing individual concerns or opinions earlier in the process helps to identify and proactively address potential challenges or conflicts.

Inspection deferrals can cause emotive responses across the workforce, as the scope will have been pre-agreed and signed at the previous inspection. A strong technical explanation for the postponement removes subjectivism and ensures transparency, and also provides well-documented and auditable records.

Standard deferral process

Although inspection deferrals are relatively common in the industry, companies should have a documented standard that defines the deferral process. The decision to defer an inspection should always be made from a process-safety and asset-integrity perspective, and not driven solely by cost.

The standard that defines the deferral process should be approved and owned by the inspection manager. Stakeholders that should be engaged to support the process's development, and for routine reviews, include: inspection, operations, mechanical engineering, process engineering, and process safety.

Detailed documentation for mass deferrals

Turnaround or process unit(s) deferrals can be complicated and require extensive reviews from a range of disciplines. These deferrals should list and assess each individual piece of equipment regardless of fluid categorization, regulatory requirements, or risk of a loss of containment. A master repository or database should be used to capture all deferrals by unique equipment number.

Additional information that should be included to justify the deferral from a technical perspective includes:

- **Applicable regulatory requirements:** Deferrals of inspections required by local law require both technical assessments and endorsement by the local regulator before deferring. Any deferral must comply with local regulations.
- **Prioritizing by risk:** This is relevant for sites already using American Petroleum Institute (API) 580 for risk-based inspection (RBI), or those that quantify the probability of equipment failure consequences (across environmental, process safety, personnel health and safety, and financial impact — such as property damage, business interruption, and company brand impact). The risk level of each unique equipment type should be categorized, capturing any increased level of risk due to the proposed deferral. Each individual equipment item is likely to have several degradation mechanisms, all with a range of potential failure mechanisms and rate of deterioration. Assessing each degradation mechanism is required, and the deferral basis should consider all residual risks that will not be mitigated by the inspection (or maintenance) activity. Higher-risk items may require senior leadership approval, while medium- and lower-risk items could be approved by asset owners and inspection managers.
- **Release options:** Ensure operations have reviewed both master process and instrumentation diagrams and isolations/layouts in the field of each unit equipment number. The options for release of each must be documented to confirm whether an entire process unit outage is necessary to release the equipment for inspection. Plant modifications since the last inspection may have facilitated alternative release options (new isolation valves, pipe runs, or commissioning of spared equipment). Alternative options will have inherent risks that may require approval by the permit signatory — in this instance, their input is recommended to ensure alternative concepts would be endorsed, for example, is single valve isolation suitable based on the service, or is double-block and bleed required? If no existing options are available, can a plant modification be installed, for example, hot-tap and stopple to install isolation valve(s)?
- **Implementing new inspection techniques:** As technology develops, data required from an inspection can be gathered via alternative methods, including non-intrusive methods. For example, inspection for high-temperature hydrogen attack, in accordance with API 941, can be done by a range of non-destructive testing (NDT) techniques. Some techniques can be carried out without extensive process preparation and confined space entry, such as external time-of-flight diffraction (TOFD). Although most techniques require equipment downtime (due to inspection tool temperature limitations), external techniques can be useful alternatives. Drone inspections have been successful for flare, stack, and tank inspections, where personnel would otherwise not be permitted access. Phased array ultrasonic testing (PAUT), electromagnetic acoustic transducer (EMAT), and long-range ultrasonic testing (LRUT) are well-established methods of inspecting for degradation, all of which require a trained technician.
- **Proactive repair:** When an inspection required to assess the condition of equipment approaching the end of life cannot be conducted, one alternative is to install an engineered repair in preparation for the expected failure. For example, a piping system normally inspected during a turnaround is assessed by reviewing ultrasonic thickness (UT) testing at condition monitoring locations, based on API 570 and API 571. One piping elbow location is expected to reach or exceed the corrosion allowance within the proposed deferral duration. As a physical means of justifying the deferral, a temporary engineered repair could be installed over the elbow (see ASME PCC-2). However, this introduces additional considerations, including ongoing inspection options, requirement for end restraints, composite versus mechanical repair, thermal cycles impacting resin fill within an engineered box, and returning the pipe to original design. Another alternative could be to carry out a radiography survey to quantify the loss. This requires a bespoke management of change assessment.

Assembling a specialist assessment team

Approval of a deferral proposal should be documented using a preapproved standard form. The technical basis for deferral should be formally approved by at least the inspection manager and asset owner. Due to the level of technical assessment required, for most deferrals the following specialists should be engaged:

- **Inspection/corrosion engineer** to identify degradation mechanisms and their impact in the event of a deferral — for example, furnace tubes exceeding their creep life based on Omega calculations or Larson-Miller parameters; crude distillation piping expected to exceed its corrosion allowance due to naphthenic acid corrosion; or various types of acidic corrosion on chemicals units.

- **Operations shift leader** to determine possible alternatives to release the equipment for inspection without affecting the rest of the unit. Operations can often provide solutions to these challenges, and are very familiar with isolations and how to achieve what is required. Operations are also key to understanding the risk — for example, the potential scenario if equipment fails, how they would respond, and additional mitigating actions if the failed equipment cannot be isolated.

- **Mechanical engineering** to assist with determining the equipment's remaining life by reviewing in more detail the basis for the inspection due date. When the inspection date has been set due to specific degradation mechanisms, the mechanical engineer can work with the process technologist and inspection engineer to determine a calculation-based corrosion allowance, superseding the design corrosion allowance — for example, API 579 fitness-for-service assessment for general metal loss.

- **Process engineer** to assess the actual operating condition, and likely variance over the extended duration. Limitations due to ongoing fouling or catalyst reaching end-of-life, will need to be assessed, as well as anticipated feed diet — for example, total acid number specifications of import crude assays or hydrogen partial pressure on hydrotreating units. Limitations and assumptions regarding operating conditions, and integrity operating windows, will need to be agreed by the process engineer and relevant disciplines.

- **Process safety engineer** when reviewing equipment that could result in major accidents (for example, Control of Major Accident Hazards — COMAH — Regulations equipment). Input from the process safety engineer will allow appropriate risk assessment to be carried out as well as risk quantification, which determines the effectiveness of specific mitigations.

- **Maintenance** to confirm that the remit set by inspection and engineering is feasible and achievable in the timeline agreed. Maintenance input at the process' front end will allow new ideas to be suggested, and the logistics to be considered ahead of attempting fieldwork. Maintenance input ranges from labor resourcing availability, to access options (for example, rope access, scaffolding, drones, or mobile elevating work platforms — MEWPs), through to materials procurement (from bespoke gaskets to specialist engineered repairs). Planning without maintenance input could result in a great plan that the site cannot achieve in the timescale provided.

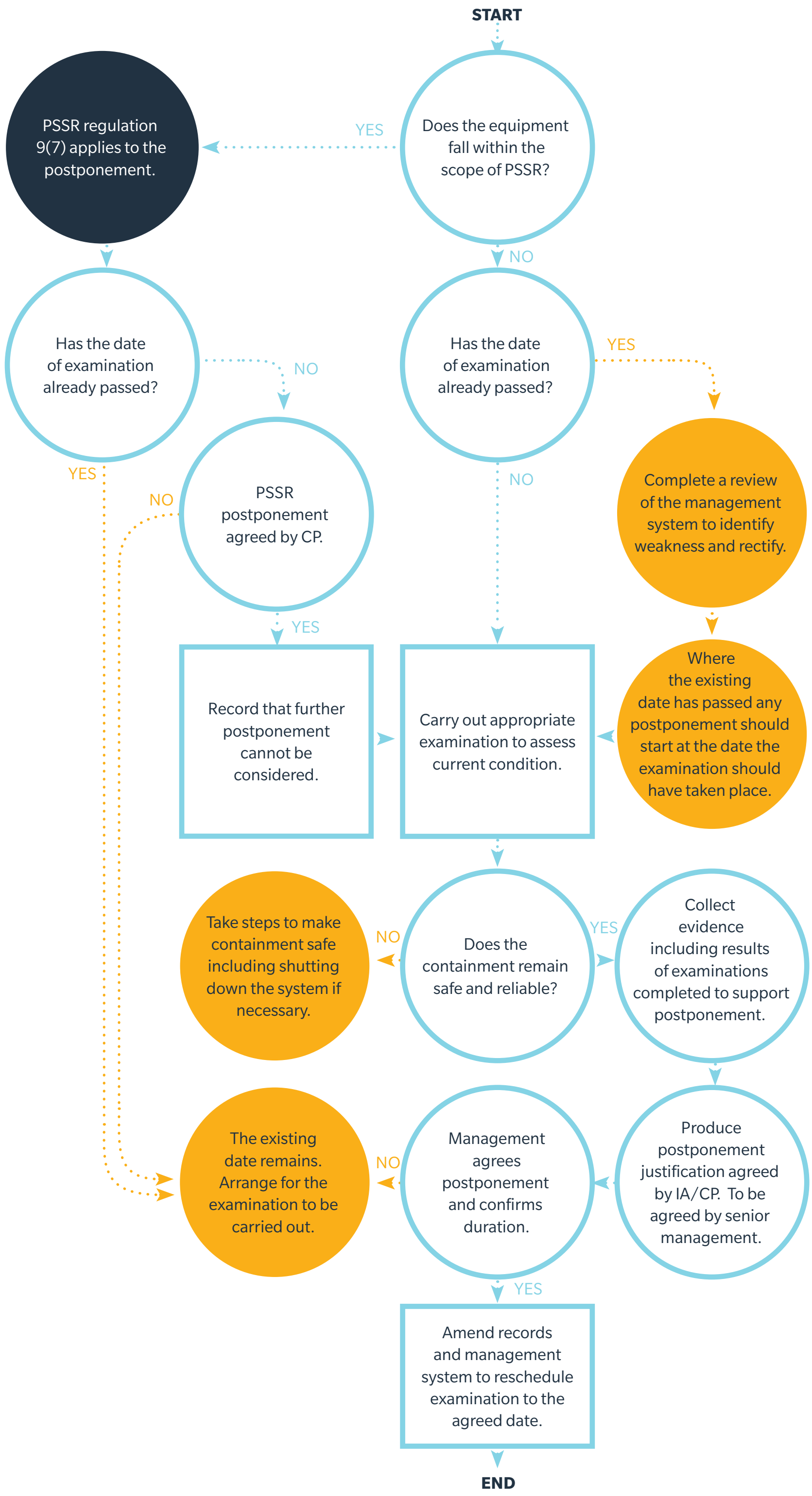
Additional Resources to Support Deferrals

- **Inspection personnel competency and certifications:** Competency of inspection personnel can be measured based on certifications such as API inspector certifications. Industry organizations provide exams for individuals to obtain formal accreditation for inspection of various equipment types, such as piping and pressure vessels. Qualifications, certifications, and accreditation by local inspection authorities provide a tangible method of signalling competency to local standards. The United Kingdom Accreditation Service (UKAS) takes this further, categorizing inspector competency in its publicly available *Accreditation for In-Service Inspection of Pressure Systems/ Equipment* publication.

- **Sources of information required for RBI assessments:** Defining what sources of information are required is a key starting point to ensure the assessment's foundations are sturdy. For example, API 580 paragraph 7.5 lists a range of reference materials that should be used.

- **Pressure relief valves (PRVs):** For guidance, Emerson has published the *Pressure Relief Valve Engineering Handbook*. In addition to original equipment manufacturer guidance on inspection and maintenance, third-party contractors that specialize in online trevi-testing may be an option to ensure online integrity without the requirement to shut down.

- **Free industry guidance documents:** Section 9 of EEMUA 231 *The mechanical integrity of plant containing hazardous substances* (free to download) covers inspection postponements. The EEMUA process flowchart (see right) captures key considerations.



- **Codes and standards:** The assessment method for fitness-for-service is likely to vary depending on the type of equipment and code of construction. The below table is an example of codes and standards by equipment type. Bear in mind that the degradation mechanism and mode of failure should be assessed using API 571.

Equipment Type	Construction Codes	Assessment Standards
• Pressure vessels	• ASME VIII Div. 1, PD5500	• API 579, ASME VIII Div. 2
• Piping	• B31 Series, B16 Series, ASME PCC-1, DIN, EN 10216, BS	• API 579
• Storage tanks	• API 620/650, BS 14015	• API 653, EEMUA 159
• Boilers and heaters	• API 560, B31.1	• API 573, API 579
• Heat exchangers	• TEMA, ASME VIII Div. 1, PD5500	• API 579
• Pressure relief devices	• APII 521, API 526, API 527, API 2000	• API 576

Case Studies

Furnace Deferral

CREEP LIFE

Deferral of a process unit turnaround (TAR) initially seemed to be limited by the ability to defer the furnace inspection due to its creep life. Specialist third-party assessment at the previous outage reported replication results;, the report highlighted that the condition was deteriorating and inspection was critical. Further, the integrity operating windows had, on occasions, been exceeded through the previous run. The specialist third party visited the site and reviewed the operating data available since the previous assessment. Based on the technical analysis, a six-month deferral was possible and the run length was extended. To better assess the furnace's remaining life, tube sections were removed for destructive testing in order to assess the actual metallurgical condition, including Omega parameters to assist with API 579 creep analysis.

FCCU Slide Valves

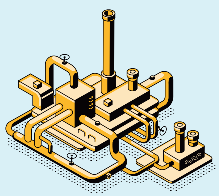
OVERHAUL DEFERRAL

The TAR date of a European refinery had been set at the previous site TAR. The date was pre-agreed by all disciplines based on the PSSR document. Towards the end of the run, management requested a technical review of the basis for the TAR date as they were looking to defer the TAR by four months. The fluid catalytic cracking unit (FCCU) slide valves were expected to be key limiting components in terms of justifying deferral of the unit, on the basis that COMAH scenarios apply to slide valve malfunction. Internal site standards defined the inspection and maintenance strategy for the slide valves, including maximum operational duration. Before a decision was made, the extension was reviewed by the lead inspector as well as the FCCU process, mechanical, and control engineers. Reports were reviewed with input from the TAR group that previously executed the overhaul, and a specialist third-party overhaul contractor (licensed to overhaul the valves by the OEM) provided invaluable experience due to its experience with equipment overhauls. Based on the known operating history of the slide valves and input from the specialist third party, an inspection deferral was approved under risk assessment and endorsed by the inspection manager.

Temporary Repairs

HOW TEMPORARY IS TEMPORARY?

Deferral of a process unit was being reviewed when a question arose relating to management of change deadlines to retire temporary repairs (engineered composite wraps, engineered box, welded patch repairs, and pipe clips). Technical review of the repair design, field inspection of the condition of the equipment, and OEM input resulted in the temporary repairs being considered suitable for an additional year of operation. Engineered repairs were in compliance with ASME PCC-2, "Repair of Pressure Equipment and Piping," which improved confidence in the deferral. All other repairs were captured by well-documented and reviewed management of change procedures with bespoke risk assessment.



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