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Fixed equipment inspection programs: Moving beyond the basics

In years of assessing numerous mechanical integrity (MI) programs, we've discovered a common misconception that can lead companies to a false sense of security when it comes to their specific MI program. In many cases, MI programs are built based on historical practices rather than current best practices. On the surface, a program that includes external and internal visual inspections, identified condition monitoring locations and regular spot thickness readings for their fixed equipment (i.e., pressure vessels, process piping and storage tanks) appears to be an effective fixed equipment inspection program. However, to establish a truly effective and robust fixed equipment inspection program, consider integrating the following two important components.

Establish Integrity Operating Windows (IOWs)

Defined parameters within which fixed equipment can operate will help avoid degradation that can lead to a loss of containment. Most companies already have "not to exceed" parameters referenced in their safe operating limits (SOLs). SOLs include pressure, temperature, level limits and occasionally flow rates and concentrations. Other parameters to consider when establishing IOWs include pH, water content, acid gas loading, sulfur content, salt content, NH_4HS limits, NH_3 content, total acid number, acid strength, amine strength and inhibitor concentration. Additional parameters such as heating and cooling rates, delta pressure, flow rates, injection rates, inhibitor dosage, slurry contents and corrosion probe measurements can also provide important safeguards.

Once a detailed set of IOWs is identified, it's important to establish the specific response the operator must take in order to avoid unanticipated damage. It's also critical to establish a means for operations to communicate with fixed equipment inspection personnel when equipment is operated outside the established IOWs, even if only for a brief period. The API Committee for Refinery Equipment is currently finalizing API RP 584 Integrity Operating Windows, which will provide further guidance.

Establish a program that identifies potential damage mechanisms

A critical function of an effective fixed equipment inspection program is to detect deficiencies and prevent potential damage or disasters. Performing a damage assessment review is an invaluable exercise to determine what is currently and potentially could degrade equipment and cause a loss of containment. For instance, taking thickness readings at various points on vessels, tanks and piping may be satisfactory if the only damage mechanism is general corrosion; however, there are many other mechanisms that can degrade this type of equipment.

A damage mechanism review is one of the first steps for conducting a fitness-for-service assessment and establishing a risk-based inspection program. The damage mechanism assessment is a systematic review of process conditions, established IOWs, environmental conditions and equipment impacted by the conditions.

The key to a successful damage assessment review is the makeup of the review team. It's essential to have an experienced corrosion engineer and process engineer knowledgeable of the process. Operations, maintenance, inspection and engineering personnel are also crucial team members. API's recommended practice, API RP 571 Damage Mechanisms Affecting Fixed Equipment in the Refining Industry, is an excellent resource to help identify potential degradation mechanisms that could affect equipment.

While typical external and internal visual inspections and corrosion monitoring are important components of a basic fixed equipment inspection program, it's important to look beyond the check list. In order to check off the box indicating an effective MI program, consider identifying IOWs, monitoring process conditions, reacting to deviations from IOWs and establishing inspection activities based on damage mechanisms unique to each particular process. Only then can you be confident you've gone beyond the minimum and provided for that extra layer of protection.

For more information, visit www.abs-group.com, call (281) 673-2800 or email mi@absconsulting.com. ●