RC 502683

Risk Based Inspection:

A wider perspective on establishing an Inspection strategy based on Risk Assessment.

The steps outlined in this document are especially targeted towards the hydrocarbon industry, specific adjustments may be made to tailor them to chemical and process industries as applicable.

INTRODUCTION: A brief background.

In process plants, inspection and testing programs are put in place to evaluate deterioration rate, prevent loss of containment and ascertain quality of equipment due to Inservice operation. Inspection plans require modification periodically and a risk-based inspection is effective to establish procedures to be carried out to upgrade an existing inspection plan. In earlier times a qualitative approach had been employed to establish inspection plans for the hydrocarbon industry, however with the rise of digitalization in recent times asset integrity software such as Web based Integrity Management System (W.ims) and more importantly Synergi Plant RBI Software develop and maintain a typical integrity management cycle for either an existing equipment or a plant in line with the **Plan – Do – Check – Act (PDCA)** Cycle through a quantitative and semi qualitative approach all within the boundary of Quality Management System (QMS).

Risk based Inspection is a systematic process that begins with the identification of equipment, collation of data and highlights the probability of failure (P.O.F) and Consequence of failure (C.O.F) resulting from a failure of process, equipment or plant. The process culminates with the creation of a risk-based Inspection plan based on the credible damage mechanism and risk of failure. A number of methodologies could be employed to manage risk once the risk is known and the magnitude of the risk is established.

“Mitigation efforts can reduce risk by changing the variables used to evaluate the risk” (API RP 580., 2023, P42)
This could be in the form of construction material changes, fabrication design, inspecting for credible damage mechanisms and process control all of which reduce the probability of failure.

To conceptualize the process of risk-based analysis, two ideologies will be used to determine the risk and in turn set up or update an existing inspection plan.

1. **Consequence of Failure:** This is an adverse effect resulting from a loss of containment or failure of component at any given time. Feasibility studies show this could be in form of environmental pollution, safety and health issues or even economic issues given the cost of repatriation. The unit of measurement for this adverse effect is in area per event.

2. **Risk Matrix:** In lieu of the previously highlighted C.O.F the Probability of failure has to be taken into consideration as the likelihood, the risk matrix thus shall be used to determine the risk level of a given situation thus; **Risk = (C.O.F x P.O.F)**

aryslimited@gmail.com +2347043821355

The corresponding value on the risk matrix will determine the commensurate action to be taken.

Risk Assessment carried out after an RBI is conducted shall birth an inspection strategy that mitigates or confirms the 'fit for purpose' status of the equipment. ''The inspection strategy shall be designed in conjunction with a monitoring or mitigation program so that all equipment will have resultant risks that are acceptable'' (API RP 580., 2023, P73).
Certain factors shall be considered to establish an inspection strategy, a qualitative approach shall require less factors which may but are not limited to;
Data Acquisition, Previous Inspection plans, Maintenance records, risk criteria and ranking.

Moreover, a wider perspective on an inspection strategy to be generated shall require a more quantitative approach. Data acquisition shall be done with both precision and accuracy as the system of measurement on data acquisition devices should be calibrated adequately. The composition of the fluid such as density, viscosity, flow rate shall be accounted for. The grade of material for construction, Damage mechanisms, time in service, half life calculations, adjustment factors of which- Online monitoring, Injection points, Dead Legs, Settlement, shall all be accounted for. This gives precision and accuracy to the Inspection strategy to be established. An inspection strategy is only as effective to the extent at which it determines damage mechanisms.

In practice the RBI Implementation is part of the integrity management of a plant. Figure 1 highlights the steps involved to carry out the Plan-Do-Check-Act (PDCA) Cycle in line with Quality Management System (QMS) of an established organization and this is the cycle facilitated by the Synergi plant software. Quantitative data in addition to C.O.F and P.O.F provides precise risk assessment or evaluation, this in turn is used to establish or update an inspection strategy.

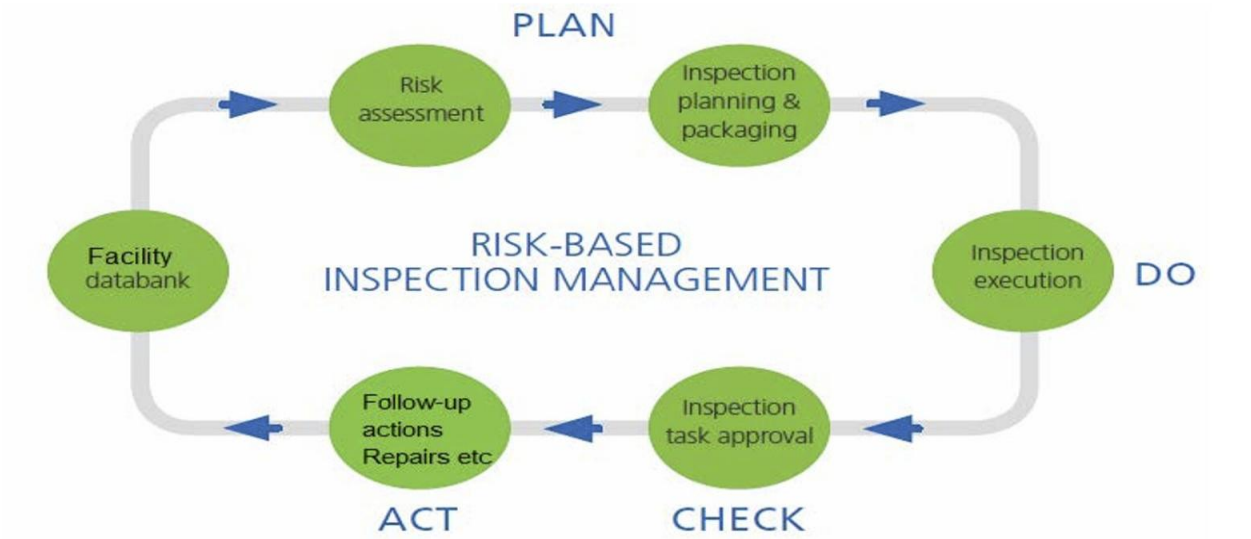

Fig 1: Plan – Do – Check – Act Cycle in Integrity Management