Risk Based Inspection, an analytical process to work out an optimal plan for plant maintenance, has been gaining ground in recent years over the classic approach which relies on preventive maintenance on a fixed date. This overview from the Cortem Group provides an introduction to its application to electrical systems within plants.

This methodology, particularly of use in the petrochemical sector, is designed to define the optimal:

- frequency of inspection;
- methods of inspection;
- extent of inspections, depending on risk.

The process was developed to ensure the safety and reliability of systems using pressure equipment, scrutinising factors affecting the operation of the equipment and ensuring the integrity of the components so as to avoid the risk of accidents. It can be effectively applied for the periodic testing of electrical equipment used in areas where there is a danger of explosion.

Risk Based Inspection analysis evaluates the process variability, the characteristics of the materials used and the hostility of the environment, amongst much else, to identify weaknesses that might cause a failure.

Full details for the management of plant inspections using the process are available in American Petroleum Institute documents (API-580 and API-581).

www.hazardexonthenet.net
Inspection and maintenance of electrical systems

The electrical system in a hazardous area has different characteristics depending on the variables needed to make it secure against the probability of ignition of the explosive atmosphere. These variables are:
- type of explosive atmosphere;
- classified area;
- level of security required by the system;
- type of protection;
- construction features and equipment specifications.

Although we know that the equipment is built, tested and certified to ensure safe operation even in the event of failure, we must ensure that the characteristics of the type of protection are maintained over time.

For example, an Ex “tb” certified item is suitable for installation in Zone 21. This equipment provides protection against the ingress of dust thanks to a gasket that gives protection at least equal to IP6X. The tests performed to certify the equipment, ensure that the gasket has been subjected to artificial ageing, in order to verify it over time. The real operating conditions, however, may affect over time the elastic quality of the gasket and adversely influence the degree of protection IP6X, on which the safety of the system depends.

The periodic checking of the enclosure, therefore, assumes vital importance for the safety of the equipment and, consequently, of the plant.

From this example we can understand how necessary it is to ensure, for the whole life of electrical installations in hazardous areas, the integrity of electrical equipment and features which are critical for the safe operation of the equipment.

The EN 60079-17 standard stipulates that both an initial inspection and regular periodic checks are required, with ongoing supervision by trained personnel.

Risk Based Inspection methodology can be useful to keep inspection and maintenance costs as low as possible, maintaining, and sometimes improving, the equipment’s safety. The methodology is based on the assessment of the probability that a failure may affect the safety protection systems.

Each industrial plant has, at any specified moment, a level of risk which is called the residual risk, relevant to the probability of damage and the consequences in case of damage. An optimised inspection and control regime allows this risk to be evaluated and mitigated, i.e. to be brought within acceptable values.

An optimised inspection plan must be developed by answering the following questions:
- What kind of damage am I looking for?
- Where do I look for it?
- How do I look for it?
- When should I look for it?

The answer to these questions can be facilitated by systematic procedures to gather data from previous inspections. API 580 and API 581 can be used here as the basis for the preparation of appropriate plans.

The methodology was initially developed principally for pressure equipment, but can also be used in the development of inspection plans for electrical equipment installed in explosive areas.

The advantages

The RBI study must begin with the careful collection of information, both on the equipment and on the possible mechanisms of damage, principally by using data previously collected, information on the status of the equipment in time, levels of degradation etc...

Close attention should be paid to equipment maintenance guides, even if inspection dates are given based on fixed frequencies over time. Once the level of risk is defined, you can plan inspections based on the analysis carried out. The goal is to minimise the possible risk by identifying the damage mechanisms for each device.

The RBI study will take into consideration several factors:
- the most appropriate inspection intervals;
- the purpose of the inspection;
- the methods and data of previous evaluations;
- inspection and maintenance.

An essential element is a cost/benefit analysis of a particular intervention, while a probability/impact matrix will provide the level of risk and show whether to reduce or increase the frequency of inspections and maintenance.

The output of the plan will be:
- probability/impact matrix;
- time schedule (Gantt chart) of the interventions;
- check list;
- inspection reports.

Through these tools, interventions can be scheduled based on the results of inspections, with monitoring frequencies regularly re-evaluated to optimise safety and cost-control.