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SAFETY

Long-term machinery and equipment safety upkeep: scheduled maintenance, routine checks, change management

As mentioned in other articles published on the pages of this magazine, today a company's ongoing safety issues are no longer related to obvious non-conformities of its machinery and equipment; they have to do instead with its organizational and operating issues. While in the world of tissue the existence of residual risks - even very serious ones - is still inevitable, even in the most attentive and investment-prone companies, we have to admit that such risks may be rather easily avoided if the work is well organized, if safety issues are taken into due account, and at the same time the staff are truly well trained.

Alessandro Mazzeranghi - MECQ S.r.l.

Obviously, to properly organize work in terms of safety, not only must instructions be provided for those operations that are exposed to specific residual risks, but monitoring processes, too, must be outlined so as to avoid accidents or industrial diseases.
If we mapped the critical processes of an industrial company - and hence pertinent to our field of work - we would discover that one of the most delicate issues is the "management" of its systems and equipment, i.e., that set of activities that aims to maintain in the long term the safety conditions that have been achieved through risk assessment and to prevent uncontrolled or potentially hazardous modifications being made.

A FEW EXAMPLES. Here is a brief summary of a case that occurred in the industry. At a machine operator's request, a mechanical maintenance operator and his supervisor decided to modify the opening/closing system of a safety guard by replacing a pneumatic cylinder with one having a larger diameter so that the safety guard could move more smoothly. But in doing so, they did not consider that the replacement of the cylinder would have caused greater stress on the safety guard upon closing, against any obstacle that hindered the closing operation. So they had created a hazardous situation that did not exist before and that turned out to be the source of a major accident later on.
A second, more banal, case: while repairing a failure on an accumulator, the safety enclosure nets of the accumulator were removed. When the machine was ready to be restarted, the nets were not completely fitted back in (presumably due to the haste of moving on to another operation) and so the machine remained accessible. This also turned out to be the source of an accident, luckily with negligible consequences.
A third case, not from the world of tissue: while a maintenance operator was reading a pressure gauge, a metal plate that protected a bundle of pressurized oil pipes came off and hit him in the shoulder. An inspection of the accident revealed that no one had ever checked the state of the plate. As a matter of fact, no one could even trace by whom and when that safety guard had been installed.
One last example, which unfortunately we could call a "classic": a maintenance operator was removing a valve from a pressure circuit without bleeding off the circuit first. Some parts of the valve were thrown around, luckily with no damage.
Every day, I see hazardous situations that are the result of an improper way of considering the aspect of maintenance, so I urge you not to underestimate these examples as remote events caused by mistakes that a normally competent operator would never commit. These accidents do happen, even if the staff has been trained and procedures are in place. Such accidents are even more frequent and often lethal on electric systems.

PROCESS CRITICALITIES.
One would suspect that corporate norms and regulations do not cover the real criticalities of the process. Let's take the last example that, as we said, is a classic. The LOTO (Lock Out Tag Out) procedure, i.e., locking out the isolator and putting a tag stating who is at work, is largely advocated by all the electrical industry norms, but, even when it is actually applied, often it is not supported by routine tests that operators regard as unnecessary: for example,

checking if power has actually been disconnected (which basically means that the right isolator has been opened). At any rate, even those who correctly implement the LOTO procedure, when working directly on electrical parts, often underestimate the possibility of the machine unexpectedly starting to run.
So, even in this case, the corporate maintenance organization needs to be carefully reviewed.
But the real problems come from elsewhere: routine checks, scheduled maintenance, change management. In this realm, there are often no norms on processes: people “play it by ear', using their commonsense or experience.
But we are not saying there are no norms that govern, for instance, routine checks on machinery: under the national laws, every company conducts or has experts conduct at least the compulsory checks. We are saying that, as far as checks are concerned, they are only conducted in 'reactive' form, based on binding prescriptions, without anyone examining the root of the problem and trying to establish what tests would actually be needed in his or her own production sites.
Let's go into detail: there are of course substantial differences between one company and the next, or between one corporation and the next. I have marginally experienced the huge attention that Procter & Gamble focused on the problem of electrical hazards, to such an extent that the corporation has enforced maintenance and test procedures that go far beyond the best European practices. Other companies have focused their attention on other problems: the Unilever Group, at least nationwide, has thoroughly explored the problem of Change Management, not least in connection with the application of TPM as a continuous improvement corporate philosophy.

ROUTINE CHECKS AND SCHEDULED MAINTENANCE. The processes we have briefly mentioned are different, and they are all very complex. So in this article we will begin to look into one of them, choosing the one that in our opinion is the most underestimated by the technical staff.
Let's start with the first process; the purpose is to ensure in the long term a safety level that is assigned to a point zero, defined as the moment when the machines, equipment etc. are considered to be adequate. Factors that may change this state are failures and deteriorations of such an extent as to cause hazardous situations. At first, let's consider those failures and deteriorations that may directly cause hazardous situations: let's take a worn casing of a Yankee cylinder which, unless kept under control, might cause the pressure system to explode, with obvious hazards for people.
We should ask ourselves: how many situations should be kept under control? And how should we keep them under control?
Let's start from the latter question: in this sphere, the concepts of routine checks and scheduled maintenance are not too different from each other. They both detect and resolve a potentially hazardous situation. In other words, an inspection is carried out when maintenance is not considered to be necessary, but it is still important to have objective evidence of the continuing upkeep of safety requisites. Scheduled maintenance is preferable when one can reasonably retain that an inspection might lead to the conclusion that maintenance interventions would be needed (e.g. some worn-out parts may be replaced at regular intervals, without this wasting a significant 'amount' of their residual life). Inspections are obviously a compulsory choice in all those cases in which a failure or deterioration might be the result of an accidental event. In short, such choice is only dictated by practical convenience in terms of costs/benefits.
Let's go back to the first question, which requires instead a more complex answer that will certainly not be completely exhaustive. The answer is not: all that is expressly mentioned by the industry laws and norms that apply to my company. The one we just mentioned is a minimum requirement! The immediate answer should be: all those elements that, by deteriorating or breaking, may cause a hazard to people's health or safety. This statement is warranted by a recent Italian legal provision, and in our opinion this is a natural extension of the fact that a company must protect its staff's health and safety. But this statement is not easy to work out in technical terms.
Let's try to make some considerations: whenever we have a use-and-maintenance manual - for instance the manual of a recently manufactured machine - we will certainly find some sort of guidelines regarding its maintenance. But often these are just bare indications that list the ordinary interventions needed to keep the machine running. At the same time, at least for PLC-controlled machines, diagnostics and troubleshooting guidelines are also provided. Safety-related routine inspections or maintenance are rarely included. This makes us suspect (?!) that manuals do not provide all the instructions we would need, or that safety inspections are 'hidden' behind operational and performance inspections.

SO TO CONCRETELY ENSURE STAFF SAFETY, a company that uses a machine or equipment must analyze the predictable failures and deteriorations that may impact on safety. Obviously for such analysis a company may use norms or guidelines (there are for example lots of guidelines on the maintenance of forklift trucks), or it may use its own expertise and experience.
But make no mistake: such an analysis is a sort of risk assessment, the only difference being that, unlike a usual

risk assessment conducted by a company that uses machinery and equipment, this refers to failures and deteriorations. In order to decide what should be regularly inspected or maintained, the usual parameters must be considered:
- Gravity of potential damage;
- Likelihood for a hazardous failure or deterioration to occur (or for a failure or deterioration to be capable of posing a hazard to people);
- Frequency and length of people's exposure to a potentially hazardous area;
- Likelihood for a person to be exposed to a risk of damage.

OBVIOUSLY, THE RISK ESTIMATE MUST BE SUPPORTED BY AN ASSESSMENT CRITERION WHICH SETS A RISK LEVEL BEYOND WHICH A MAINTENANCE AND INSPECTION PLAN MUST BE DEFINED. The complexity of such a job, which is now usually carried out only on equipment exposed to major accident hazards, is already apparent. As to our industry, instead, we need to make some further considerations. We spoke of deteriorations (which in principle are events related to the features of a machine or equipment and hence derive from technical sources only), but we also mentioned predictable failures. They depend on the features of a machine as well as on the way it is used and on the operators' safety awareness. The idea is to inspect hazardous situations to promptly restore conditions of safety and give objective evidence that the safety conditions are under control. Someone might rightly object that failures must be notified by the machine and equipment operators (obviously if they are easily detectable), but in several industries of many European countries (here I would not like to make too many distinctions between countries, at least in my experience) this mechanism does not work to perfection. So a routine inspection should be conducted and documented, and at this point such inspection might be helpfully extended, in addition to predictable failures, also to the predictable tampering of the safety systems, guards, etc. which often are a consequence of an attempt at simplifying the operation of the machine, under the delusion that the operators can still steer clear of damage.
This approach, the natural development of the European Industrial Safety Directives (since 89/391/EEC) and the safety management systems requirements (OHSAS 1800: 2007), is already implemented in places with a high risk of accidents, but it is certainly new and complicated for the tissue industry. Yet we think it cannot be neglected, not least because of the increasing attention that is being placed on safety by customers and by the community at large. However we must be careful and do what is necessary, without any excess that would be just a cost, with no real benefits.
So, to sum up, a standard process might be as follows:
1. Beforehand, define a risk estimate and assessment criterion, setting the hazard level beyond which we want to perform scheduled maintenance or inspections;
2. Analyze the machinery and equipment to detect any potential failures or deteriorations;
3. Select the failures or deteriorations that might impact on safety;
4. Conduct a risk assessment to detect any actually hazardous failures or deteriorations (beyond the hazard level we have set as acceptable);
5. Describe maintenance or inspections methods and intervals.
This is the logical sequence that should be followed; the critical choice of course concerns that of setting an acceptable hazard level (which may make the number of inspections and maintenance interventions increase or decrease), but the criticality that makes this job complex is the one of step 2 (detecting failures or deteriorations) which is time- and resource-consuming and requires lots of specific technical expertise.
However this regular work is effective, in that it objectively improves a company's safety conditions, as well as showing that the company has a systematic, rational approach to the problem; all this will benefit the company itself in the unfortunate event an accident should happen.