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Improving Process Reliability in a Fertilizer Complex

presented by

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FERTILIZER FEEDS THE WORLD

About the IFA Technical Committee

The IFA Technical Committee encourages the development and adoption of technology improvements that can lead to greater production efficiencies and reduced emissions, as well as better health and safety standards throughout the fertilizer industry. Our mission is to actively promote the sustainable development of efficient and responsible production, storage and transportation of all plant nutrients. The Technical Committee accomplishes these objectives through a variety of channels, including:

- Technical and policy-oriented information materials. The committee regularly conducts surveys and produces reports on key industry metrics, including the IFA Energy Efficiency and CO_2 Emissions Report, the IFA Safety Report, and the IFA Emissions Report. This work enables member companies to assess their operations over time, make comparisons with similar facilities on an established level of performance, determine the need for technology improvements and identify good industrial and management practices.
- Regular exchange of information on technology developments and industrial practices. A key role of the IFA Technical Committee is to encourage ongoing technical innovation in the fertilizer industry through the development, compilation and exchange of technical information between members, researchers, engineers, equipment suppliers and other industry associations. To this end, the committee organizes a Technical Symposium every other year to examine progress in the production technology of fertilizers. Each Symposium traditionally features the presentation of 30-40 new technical papers from member companies worldwide, providing members with information on the latest technological developments. In the intervening years, the committee holds a variety of meetings to assess current industrial practices and standards, with an eye toward identifying key developments of interest to members.
- Technical and educational workshops and special events. The IFA Technical Committee provides workshops designed for engineers working in the fertilizer industry, particularly those who have recently assumed new responsibilities, and for new engineers to increase their technical knowledge. These workshops (e.g. concentrating on nitrogen and/or phosphate fertilizer production) are designed to improve the participants' skills and broaden their vision and understanding of the entire industry, including technology, economics, energy use, safety and environmental stewardship. Workshops also provide engineers with an opportunity to exchange ideas, solve specific problems and improve plant operations and profitability.
- Education and advocacy. The IFA Technical Committee recognizes that customers, markets and regulatory environments are best served by clear and concise information on the fertilizer industry and its practices and products. Because the knowledge and expertise found within the fertilizer industry is the best source for this information, the Technical Committee endeavours to educate policymakers, standardization bodies, customers and the public on industry achievements, technological advances, voluntary initiatives and best practices. The committee also encourages universities and development centres to conduct research on fertilizer product development and production processes.

(as provided by the author for distribution in Alexandria)

Improving Process Reliability in a Fertilizer Complex

Abstract

Avoiding Unplanned Machinery Stoppage is a very old commitment for any maintenance organization. There have been many tools developed for achieving this goal. However, Zero Unplanned Machinery Stoppages is not a simple goal. Avoiding surprises, in other words, is an exciting and hard to achieve objective.

Back in Dec-2002, Venezuelan national oil company and its affiliates were into strike for political reasons. At that time, Pequiven (Moron Complex) was in its third consecutive year with no earnings. The company was about to be sold. This is the only facility producing Nitrogen, Phosphate and Potassium based fertilizers, both simple (Urea, DAP, imported KCL) and complex (NPK in several compositions).

An strategy to improve the performance of the complex was necessary: Improve the process reliability was a must. The main objective for this paper is to share the success of this effort, using PAS-55 (standard used today to implement Asset Management) as a guide.

The job performed started with the selection of the appropriated methodologies and, therefore, the major "partners" in this effort. The starting methodologies selected are PROACT for the Root Cause Analysis (RCA - tool selected for investigating undesired events) and RCM+ for the Reliability Centered Maintenance (RCM – tool selected to establish new maintenance strategies). This means that the technology partners were also selected: Reliability Inc. for RCA and The Woodhouse Partnership Ltd. (TWPL) for RCM.

The risk calculation is also a dilemma very frequently. To go over this problem, it was decided to "calculate" the risk as money. This way, it is very simple to compare "risks" between plants and different installations, providing a very useful tool to select where it was better to start.

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All papers and presentations prepared for the IFA Technical Committee Meeting in Alexandria will be compiled on a cd-rom to be released in May 2005.

IMPROVING PROCESS RELIABILITY IN A FERTILIZER COMPLEX

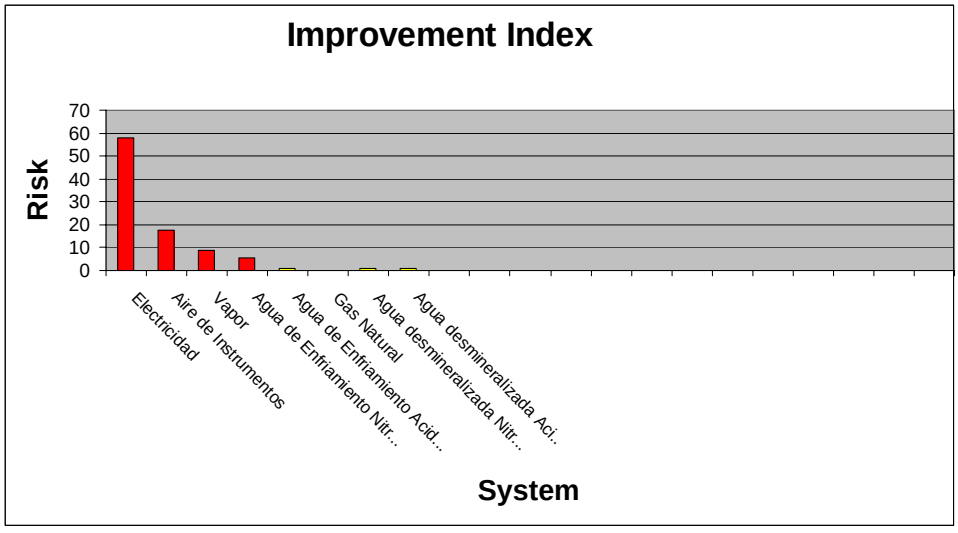
Avoiding Unplanned Machinery Stoppage: zero surprises. This is the main objective of any medium to big size maintenance and/or reliability organization. This involves the rupture of a paradigm: “there is no way to avoid failures. By nature, they will ALWAYS occur”.

A little history: Back in Dec-2002, Venezuelan national oil company and its affiliates were into strike for political reasons. At that time, Pequiven (Moron Complex) was in its third consecutive year with no earnings. The company was about to be sold. This is the only facility producing Nitrogen, Phosphate and Potassium based fertilizers, both simple (Urea, DAP, KCl) and complex (NPK in several compositions).

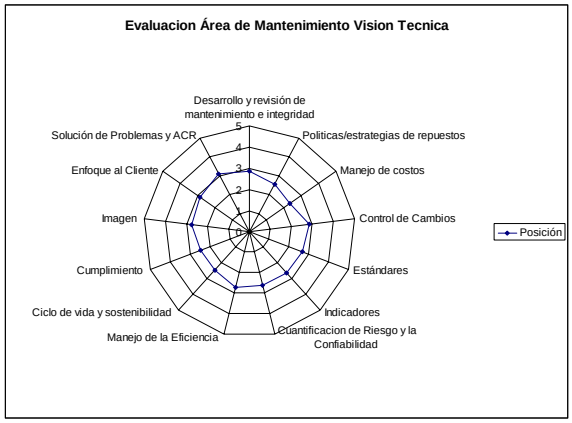
In addition to the above, it is well known that Pequiven, as a Venezuelan State Company, is responsible for the supply of all the fertilizers needed for making possible one of the most important goals of the Government: the Agricultural Independence.

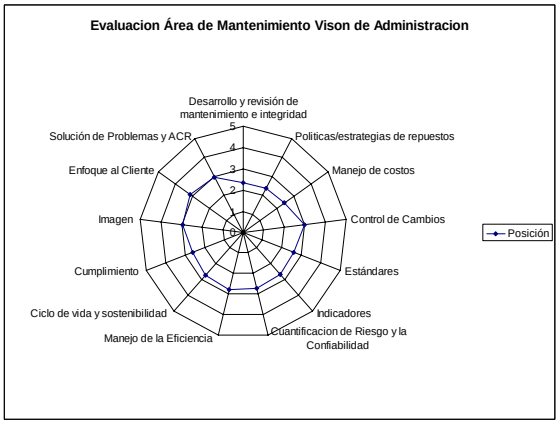
Having all situations above mentioned mixed together, Pequiven started efforts to increase the reliability of the production processes, back in July 2003. It was decided to use PAS-55 as an implementation guideline, since this standard regulates the asset management discipline. For having success, also, it is necessary to have a “mother source” for reliability. This is done by having a department that gives support to the people. An additional “must” in the road to success, is having support from the top and strong leadership in operations personnel to conduct the reliability tools.

Phase one: create a financial case. The first step of any reliability improvement strategy must be financial. It is necessary to demonstrate where money is not being productive. In Pequiven, there were many issues undergoing, which made the financial case a very simple job. In this part of the job, it was necessary to change the risk and criticality concept, which was (as usually) defined only in safety terms (risk) and operational feeling for a piece of equipment (criticality). However, it was demonstrated that measuring risk and criticality in terms of money, made simpler to compare risk and criticality among different installations; this provided an easy to see first shot scenario, where return of investment (ROI) can be very fast and to a very high rate. To establish this common measurement, it was stated that risk was now calculated as Risk=Frequency*Consequences, where frequency is the number of times that an undesired event occur (in the quantitative case) or can occur (in the probabilistic or qualitative case). Consequences are the amount of money the company does not earn because of this event. The numbers obtained are so dramatic, that the initial implementation means savings above 12 MM US$ for the first year only.



Phase two: establish your working scenario. Once having defined your financial case, with the "mother source" in place and the operations personnel trained and with strong leadership, a diagnostic phase was conducted. If we define Reliability as the ideal state, it is easily deducted that for achieving reliability as an excellence phase, the participation of all departments is necessary. It is not possible to get reliability if, for example, purchasing department is unconscious of its paper in the operational reliability performance.





The diagnostic phase was, therefore, composed by basically three tools: a test to determine the perception of persons in general in terms of reliability and maintenance, a test to determine the perception of persons in general about the organization (the company) and a general "request for improvements coming from people", which we called "the speaking wall". This communication tool, in terms of suggestions to improve, threw on the table almost 2,500 suggestion for improvements.

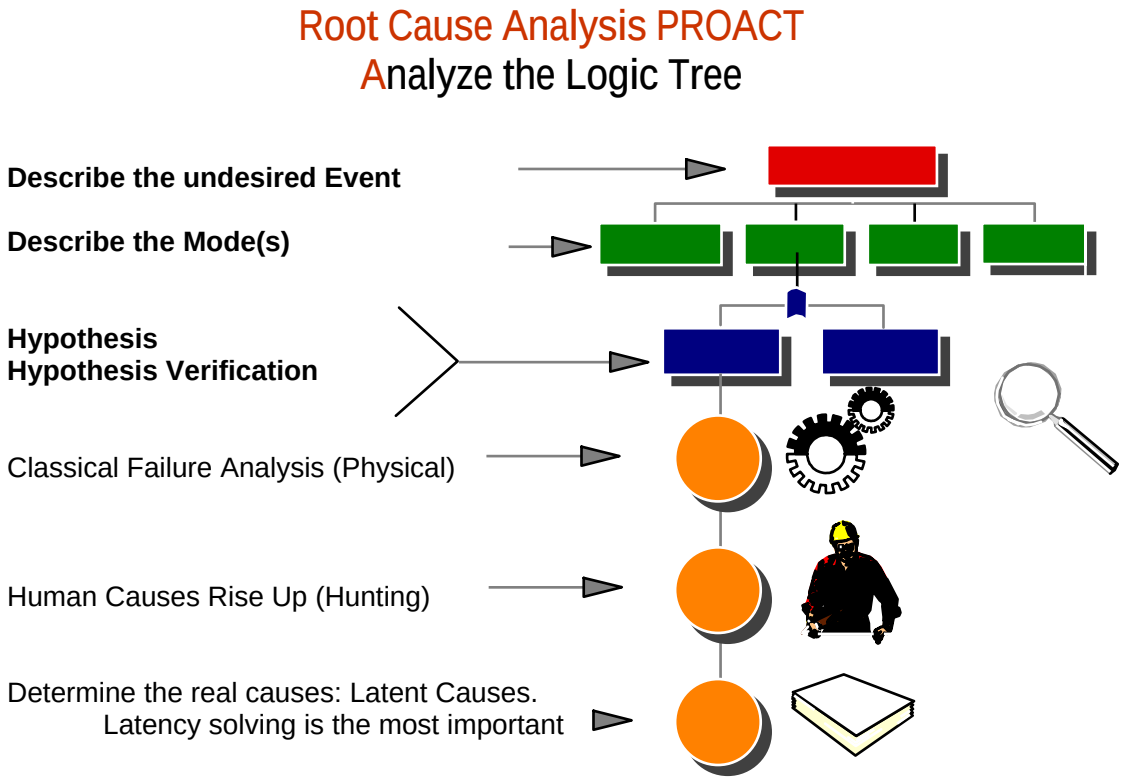
"The Speaking Wall"

Phase three: controlling the current situation. This phase is critical, because is the state where results start to be measured. In this stage starts the application of special tools; in Pequiven the tools selected are Root Cause Analysis (RCA) using PROACT and Reliability Centered Maintenance using RCM+.

This implies the need to start a technology transfer from the methodologies owners, Reliability Inc. (for RCA) and The Woodhouse Partnership Ltd., TWPL (for RCM+).

The technology transfer started with the training of 120 people from different department in basic RCA and 40 people in advanced RCA. There are basically three different cases of RCA: the Maxi's, the Midi's and the Mini's. For hitting the maxi's, the investigation team is basically conducted by external support. The Midi's are solved by a team conducted by a Principal Analyst (from the advanced training). The Mini's, which are basically the most frequents, are solved by the persons that were trained in basic RCA.

RCA was selected to attack problems of basically two types: Deductive and inductive. Deductive cases are those events that have occurred at least once. Inductive cases are those events that haven't occurred, but the consequence of the event is too high and should be solved before the first event. An example of inductive events is a plane crash. The typical steps to perform RCA PROACT are shown bellow.

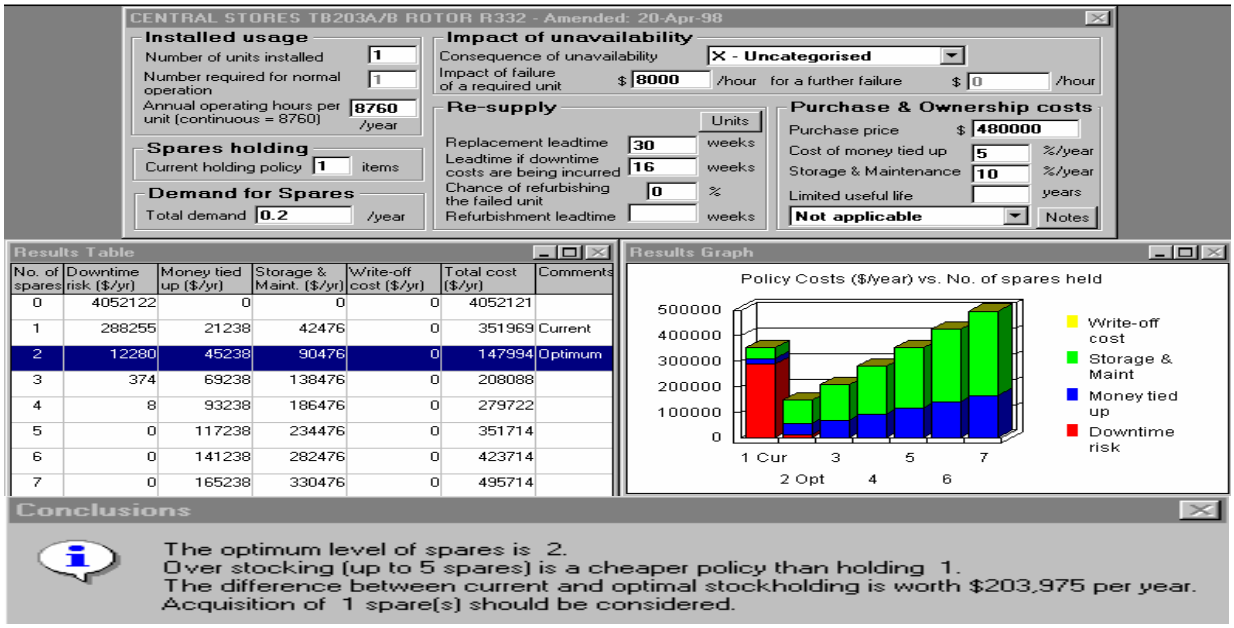


Applying RCA PROACT systematically, has recovered for Pequiven more than 6 MM US$ in only six months. And, who are the stars of these recoveries? The people!!

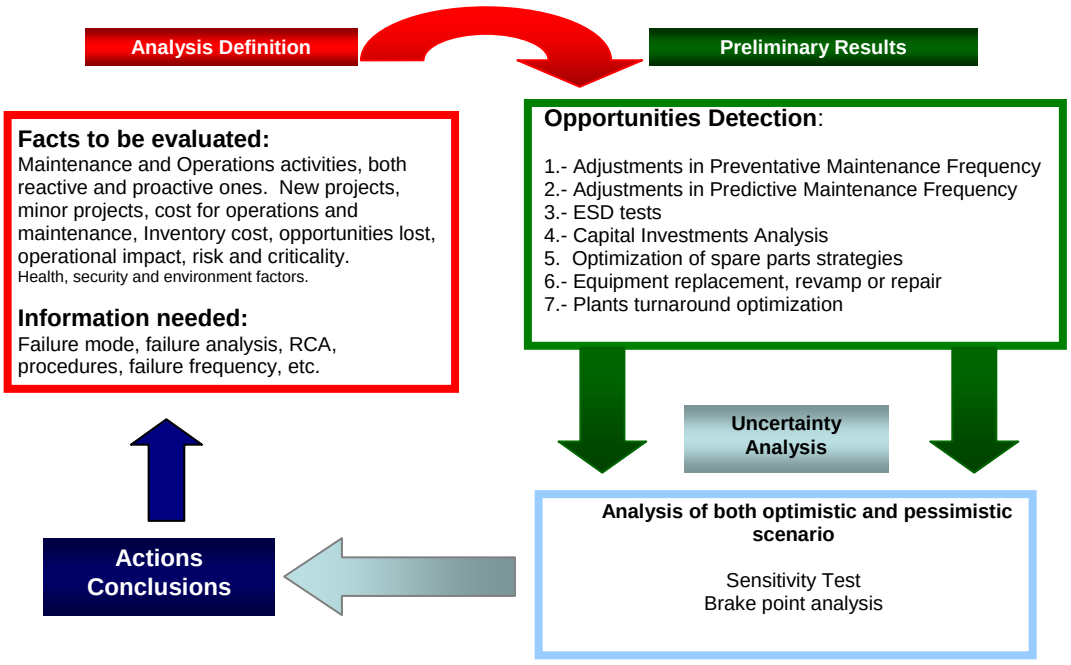
As stated above, in parallel, application of RCM+ was started. More than 160 persons have been trained in the tool; most of them are part of the normal maintenance team (preventive, predictive and corrective).

Phase Four: optimization. This stage implies the final improvement: the plan is sustainable in time. For this stage to be successful, it is necessary have fully completed stage three. **THERE ARE NO SHORTCUTS**. The main activities to be performed in this stage are:

Spare parts optimization: This is a lot more than only personal criteria. It is necessary to establish real strategies, based upon risk and criticality (within the new context). For this, it is necessary to obtain special software, with the adequate features and capabilities. A short analysis is shown bellow, as an example of what can be gotten.



Optimal Decision Making: the optimal decision making is a key factor in the road to the sustainability of the reliability improvement. It is also a closed circuit process, that auto feedback continuously. Basically, every activity that deals with operations and/or maintenance is monitored and tested continuously. These tests reveal the opportunities for improvement. Every opportunity, therefore, must be analyzed to the determine the certainty of the data, producing later the actions and or conclusions that, when properly applied, start by the modification of the facts to be evaluated.



Predictive Activities: Predictive activities are not related only to maintenance. This is the error found more frequently. Predictive activities are also related to disciplines like Process, Process Control, Plant Engineering, Interlock Functional Tests and Inspection. The uncertainty level should be precisely determined: as precise as possible. All the data collected with these activities should be used to model aspects like: corrosion rates, deterioration rate, etc.