CONDITIONS' MONITORING FOR SUCCESSFUL MAINTENANCE STRATEGY AT INEOS PLANT IN ROSIGNANO

Giuseppe P. Adriani, Andrea Giannoni, Manrico Grassi

Giuseppe P. Adriani – Mecoil Diagnosi Meccaniche / p.g.adriani@mecoil.net
Andrea Giannoni – Ineos Rosignano / andrea.giannoni@ineos.com
Manrico Grassi – Ineos Rosignano / manrico.grassi@ineos.com

ABSTRACT

The research of instruments for Predictive maintenance has been the primary goal for the management of the INEOS (former PE plant) in Rosignano, since the years '90, looking after services & systems able to reduce downtime and correcting potential failures of the process, trough conditions' monitoring efforts.

The skill ness of field technicians, under the supervision of an evoluted plant Engineering, has addressed them toward reliable and affordable tools for onsite and offsite diagnostic experiences, aiming for an effective TPM.

Among them was initially selected Vibrations and Shock Pulse Monitoring to detect unbalancing and misalignment of rotating devices, together with Termography and Oil Analysis to control early stages of wear modes and contamination control of lubricants.

Keywords: Reliability centred maintenance, T.P.M., Wear control, trough Conditions' monitoring.

INTRODUCTION

The Ineos plant in Rosignano is part of the original industrial settling in the Solvay area; mostly dedicated to High density Polyethylene processing, starting from gas storage, unloaded by tankers mooring at the terminal dock, all the way to polymerization and extrusion of PEHD pellets. The total area of 260.000 m2, of which 28.000 m2 are covered by the installation. The plant was built in '60 starting with a production of 45000 ton/year of HDPE, until the actual production of 200kt and 185 employees. The range of products is represented by 45 different resins grades for caps, pipes, textile, cartridges applications on 4 polymerization and 4 extrusion lines. A research plant is also part of the site, one of the most important of the group.

TOWARD AN INTEGRATED SYSTEM FOR OIL MONITORING

In the beginning of the program (with former Solvay-PE plant) the oil samples were collected and delivered to the laboratory (located in Firenze) and the analytical results (feed-back) was initially sent trough regular mail (hard copies) with a certain delay on follow-up.

After the introduction of e-mail, the certificates, on a custom made excel file were addressed to the supervisor, to be transferred in the internal data base for trending capabilities.

With this step, a lot of time was saved and the speeding up of process was considered very cost effective, in the optic of reducing potential damages.

The third stage (year 2002) was the introduction of a web based platform capable to manage the samples' flow and the results, as well as corrective actions to be taken.

www.permantenere.net became a web shared data management system, holding technical information from the field, feedbacks & lab's results.

Different levels of reliability team technicians were able to update or simply control the infos.

Oil analysis results

The F881/5 is the main extruder of the site produced by W&P ZSK177 and equipped with a FLENDER gearbox. This equipment has a reduction rate of 1:3.4 and is connected to a 2.8 MW variable speed motor drive. The gearbox is composed by 10 wheels and 8 shafts, supported by 25 ball and roller bearings.

This item is considered one of the bottleneck systems in all the plant; an eventual sudden failure of the machine may create a severe damage to all the process and activities related.

The introduction of online reporting (through Permantenere) has given the opportunity to better evaluate the dynamics of wear and the graphics gave an immediate sight of what was not totally under control.

That means that with proper lubrication and load applied there were no signs of impending failures or consistent wear. Around the end of 2007 we assisted to the very first glimpse of accelerated wear, with both parameters steadily increasing toward 100 ppm for Iron and 20 ppm for copper; these values are not abnormal in itself, but by comparison with previous results, something is coming to the surface, in terms of “weak signals”. Immediately after (no more than 3 months) the pick increased in a very impressive way. Nevertheless other dynamic parameters (SPM or Vibrations) did not report any alarm.

By analyzing the new samples with LaserNet Fines (a new technology of particle counting, with a special device to recognize shapes and sizes of contaminants) we have been able to confirm the impending failure in a bearing or bushing component.

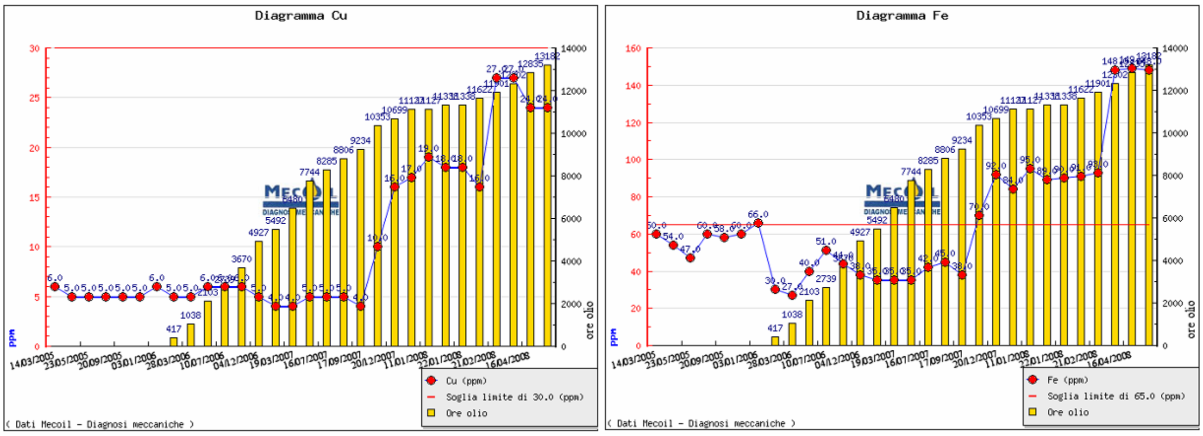

Fig. 1: Trend of Iron and Cuprum;

As we may notice in the image the trend for Iron (steel) in the plot shows a steady increase, since the end of year 2007. Again notice how constant and consistent is the behaviour in the past two years, never exceeding the 50/60 ppm (g/Ton). Same pattern can be noticed in the plot of Copper (and Zinc or Tin) trend. The small percentage of these soft metals reveals the presence of an alloy, Brass mostly, involved in the wear process.

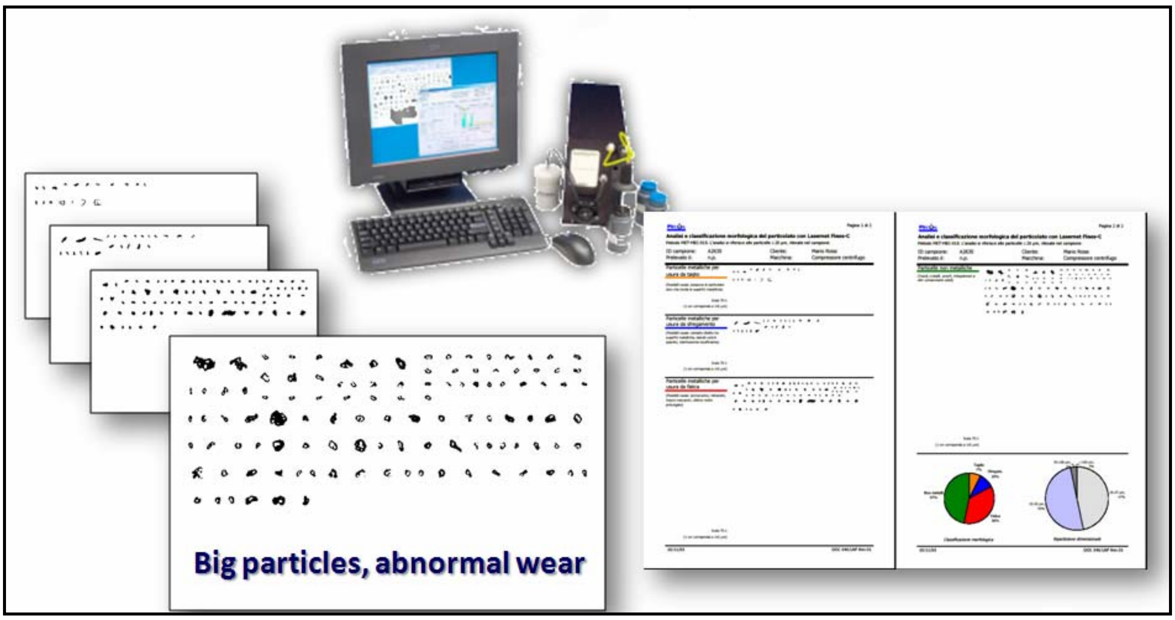

Fig. 2: LaserNet Fines;

As already mentioned the other “Predictive” parameters related with Vibrations did not show any abnormal behaviour, but the Direction decided anyhow to take the advantage of a routine stop to deeper investigate with an endoscope probe, to reveal eventual inner wear signs, of the roller bearings in the slow & high speed shafts.
At this point the necessity for a more radical intervention was addressed to the production management, in order to program a stop, for the necessary corrective actions to be taken.

Overhaul

The decision was made to start the planned intervention by May 19, having already in stock all the required materials for this scheduled, forecasted replacements.
Among them the following items/spare parts:

N° SK		PC
95002939	BEARING QJ 230 N2 C3	1
95002936	BEARING NU 2230 C3	1
95002938	BEARING NU 2236 EMC1	1
70132025	BEARING SL 185040 C2	1
70132028	BEARING SL 182236 C3	1
71032005	BEARING 89456	1
70172007	BEARING NU 234 EC3	1
70132006	BEARING 81122	1
95002937	BEARING 29412E	1
70132031	KIT GASKET 1° STADIO	1
95009383	MOBIL XP 320 900 LT	900 LT

Tab. 1: LaserNet Fines;

After several levels of dismantling shields, components and gears/bearings, as well detailed in the pictures taken (image 1 through 4), there was the evidence of several major signs of wear related with pitting, fretting and in site spinning of few roller bearings.

Fig. 3 - Crankcase after removal of top cover; *Fig. 4 - High speed shaft removal;*

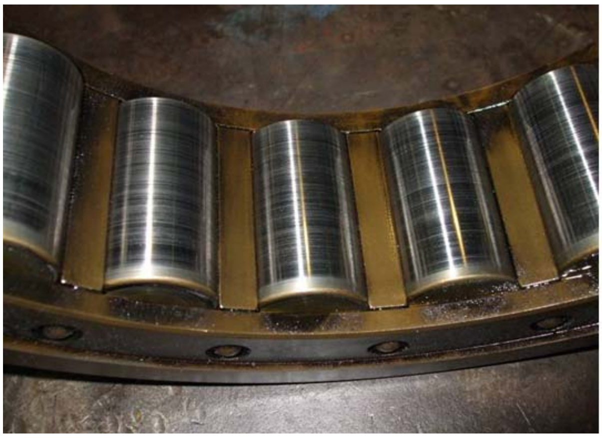

Fig. 4 - 152 Bearing with deep scoring; *Fig. 5 - 151 Bearing with circular wear signs;*

The work with final tests came to conclusion by May 23rd, and since that moment, the machine is running fine.

No more maintenance works have been requested since that moment. Oil Analysis and all the other controls (extended conditions' monitoring) revealed that trends became normal.

Conclusions

The above presentation of a real case history in a critical component of process industry, shows how different approaches are sometimes required, in order to “pick” the actual problem, since the very beginning of the latter.

In the actual situation, given the thickness/size of some components/shields, not all the vibrations and dynamic pulses could be detected in the due time. Probably the very slow rotation of some gears and the related dull signs, with interferences caused by not uniform load, are responsible of such lack of early detection.

Used oil analysis has been very helpful to supply this tribological support to detect early stages of wear for the management, in order to strategically schedule the required corrective actions.

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