

Reconditioning of EH oil

A power plant in Western India using Chinese technology turbine EHC system saved 3.01 Cr approx. with MLC LVDH TRIX-20 EH Oil Filtration

PROBLEMS

Failure of Servo valve, Hunting and Sluggish behavior of the turbine, Unplanned Shutdown, Presence of varnish & Silt in the clearance of the spool, High TAN value leading to electro kinetic erosion of line and accessories of EHC system, Ingression of particle & moisture contamination.....

Ultimately all resulting to

GENERATION LOSS & REVENUE LOSS

SOLUTIONS

Installation of Minimac's EH oil reconditioning system "**MLC LVDH TRIX 20**" comprehensively designed with 4 major technologies to:

- Remove solid contamination in oil by **superfine filtration**.
- Remove moisture in oil by vacuum **dehydration technology**.
- Remove Total Acid Number (TAN) by **ion exchange technique**.
- EHC system tank moisture removal and ingress prevention by **Inert Gas blanketing technique**.

Along with equipment installation, our service engineer has trained the customer's team on the function of EH oil Re-Conditioner, FRF maintenance and contamination control, Importance of Oil Analysis Program.



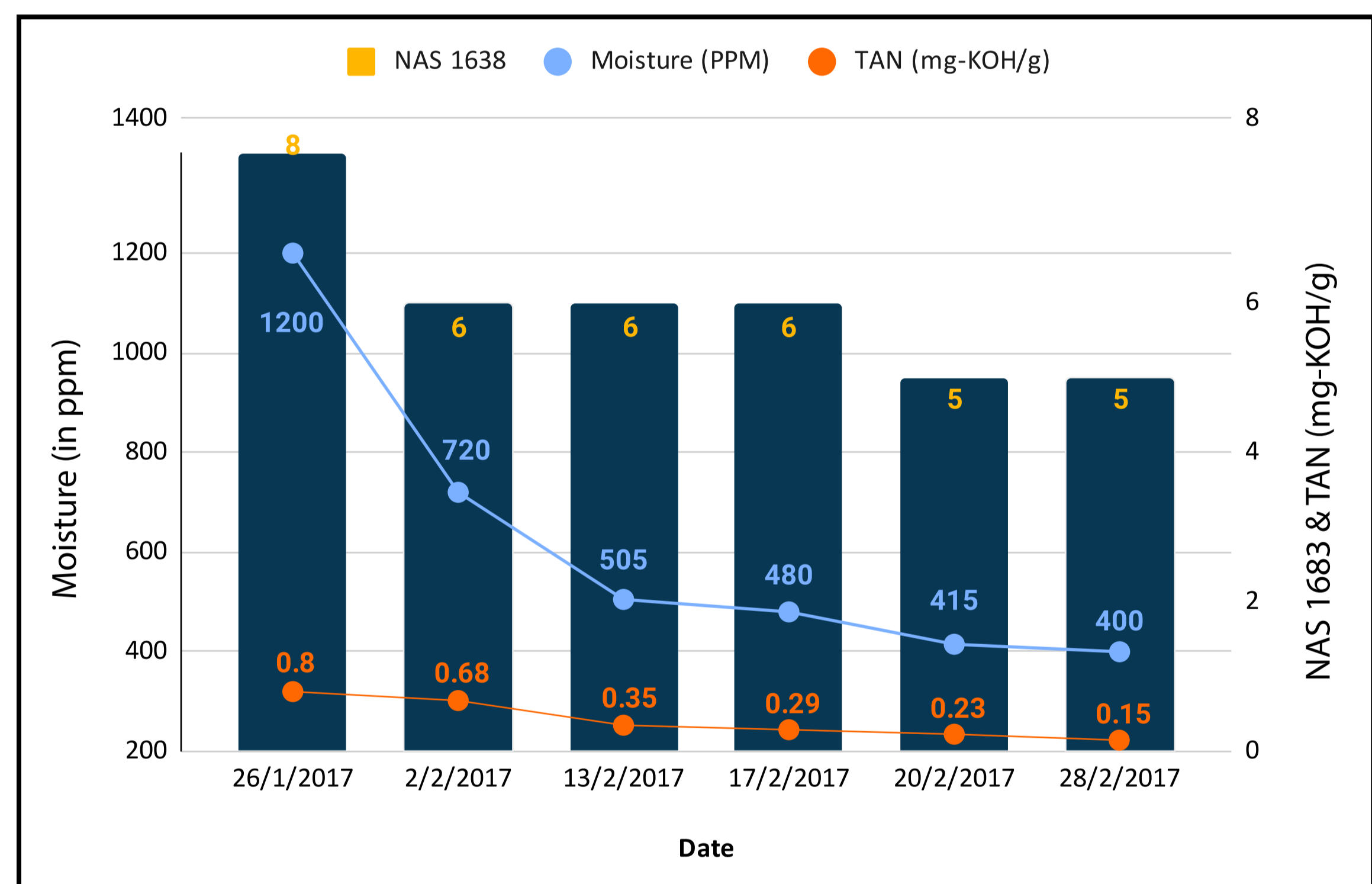
MLC-TRIX Series works on TAN reduction by ion exchange and nitrogen blanketing technologies.

SYNOPSIS

A Power plant (2 x 600 MW) in Western region of India was struggling with the rapid increase in TAN values in the EH oil of the governing system of the turbine and moisture content was also more than permissible limits. Degradation of the oil was due to contamination ingress into the system and resulting into formation of by-products.

Minimac's EH oil Reconditioning system "MLC LVDH TRIX 20" act as saviour for the plant which has escaped the unexpected shutdown of the turbine worth 2.8 Cr (approx. 48 hours downtime) and cost & effort for Replacement of oil worth 21 lakhs.

In total, the company has saved around 3.01 Crore by installing external Reconditioning system at their Site.



Above graph shows the trend analysis of NAS 1638, Moisture and TAN value around one-month installation of the reconditioning of EH oil at customer site.

Consumable required to finish this reconditioning of EH oil having quantity of 1200 liters are:

01 quantity of 10 micron and 03-micron filter element. Total consumption of resin was 36 liters

Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹21 Lakh approx.
- Cost of Downtime: ₹2.8 Cr approx.

BENEFITS:

- 1) Extending oil life
- 2) Reduced TAN value
- 3) Eliminate oil Replacement cost
- 4) Protect Turbine against hunting
- 5) Increased Turbine availability & reliability

Reconditioning of EH oil

A power plant in Northern India using Indo- Japanese technology turbine EHC system saved 1.5 Cr approx. with MLC LVDH TRIX-20 EH Oil Filtration

SYNOPSIS

A Power plant (2 x 600 MW) in the Northern region of India was struggling with the rapid increase in TAN values in the EH oil of the governing system of the turbine and moisture content was also more than permissible limits. Degradation of the oil was due to contamination ingress into the system and resulting in the formation of by-products.

Minimac's EH oil Reconditioning system "MLC LVDH TRIX 20" acted as a savior for the plant which has escaped the unexpected shutdown of the turbine worth 1.05 Cr per day (approx. 15 hours downtime) and cost & effort for Replacement of oil worth 44 lakhs.

In total, the company has saved around 1.5 Crore by installing external Reconditioning system at their site.

PROBLEMS

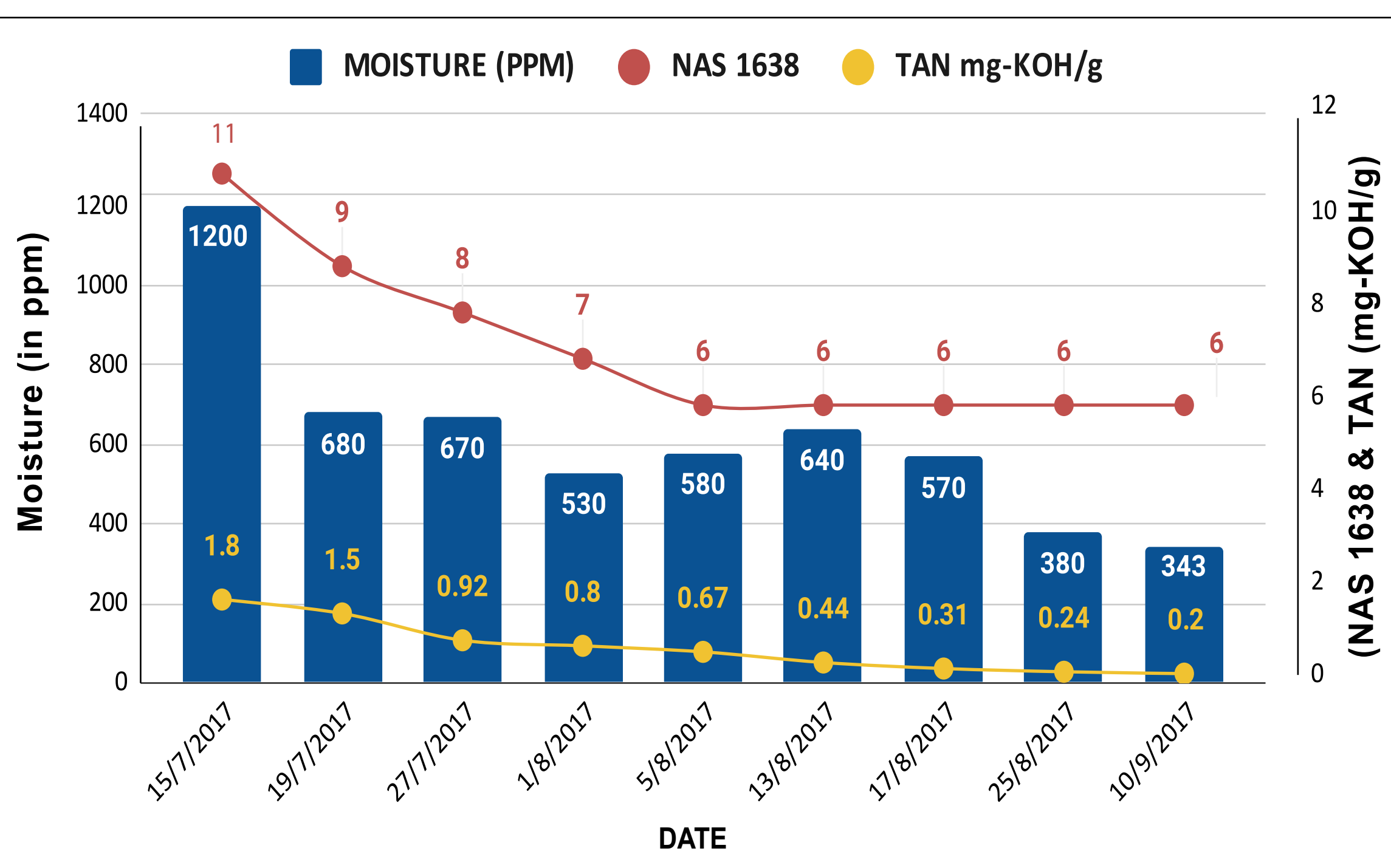
Failure of Servo valve, Hunting and Sluggish behavior of the turbine, Unplanned Shutdown, Presence of varnish & Silt in the clearance of the spool, High TAN value leading to electrokinetic erosion of line and accessories of EHC system, Ingression of particle & moisture contamination.....Ultimately all resulting to **GENERATION LOSS & REVENUE LOSS**

SOLUTIONS

Installation of Minimac's EH oil reconditioning system "**MLC LVDH TRIX 20**" comprehensively designed with 4 major technologies to:

- Remove solid contamination from oil by **Superfine filtration**.
- Remove moisture from oil by vacuum **Dehydration technology**.
- Remove Total Acid Number (TAN) by **Ion exchange technique**.
- EHC system tank moisture removal and ingress prevention by **Inert Gas blanketing technique**.

Along with equipment installation, our service engineer has trained the customer's team on the function of the EH oil Re-Conditioner, FRF maintenance and contamination control, Importance of Oil Analysis Program.



The above graph shows the trend analysis of NAS 1638, Moisture and TAN value during one-month installation of the reconditioning of EH oil at customer site.

Consumable required to complete the reconditioning of EH oil having quantity of 1200 liters are:

01 quantity of 10 microns and 03-micron filter element Total consumption of resin was 36 liters

Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹44 Lakh approx.
- Cost of Downtime: ₹1.05 Cr approx.

BENEFITS:

- 1) Extending oil life
- 2) Reduced TAN value
- 3) Eliminate oil Replacement cost
- 4) Protect Turbine against hunting
- 5) Increased Turbine availability & reliability



PE Fluid Reconditioning in Turbine EHC System

A 1,320 MW (2 x 660 MW), one of the first and largest supercritical coal-fired power plants using Indo-Chinese Turbine EHC System in Northern India.

SYNOPSIS

The plant was struggling with the rapid increase in TAN values in the EH oil of the governing system of the turbine. Moisture content was also more than permissible limits. Degradation of the oil was due to contamination ingress into the system resulting in by-product formation.

Minimac's EH Oil Reconditioning System "MLC LVDH TRIX 20" acted as a savior for the plant and as a result the unexpected shutdown of the turbine worth ₹1.4 Cr per day was saved.

PROBLEMS

- Degradation of EH oil properties at both the units of the plant.
- The installed regeneration system for each EHGC tank of unit #1 and #2 was failing to control neutralization number (TAN value) and showing a rapid increase in the same.
- The company was unaware of the consequences of increased TAN values like possibilities of failure of servo valve, hunting, power generation loss, unplanned shutdown, etc.



SOLUTIONS

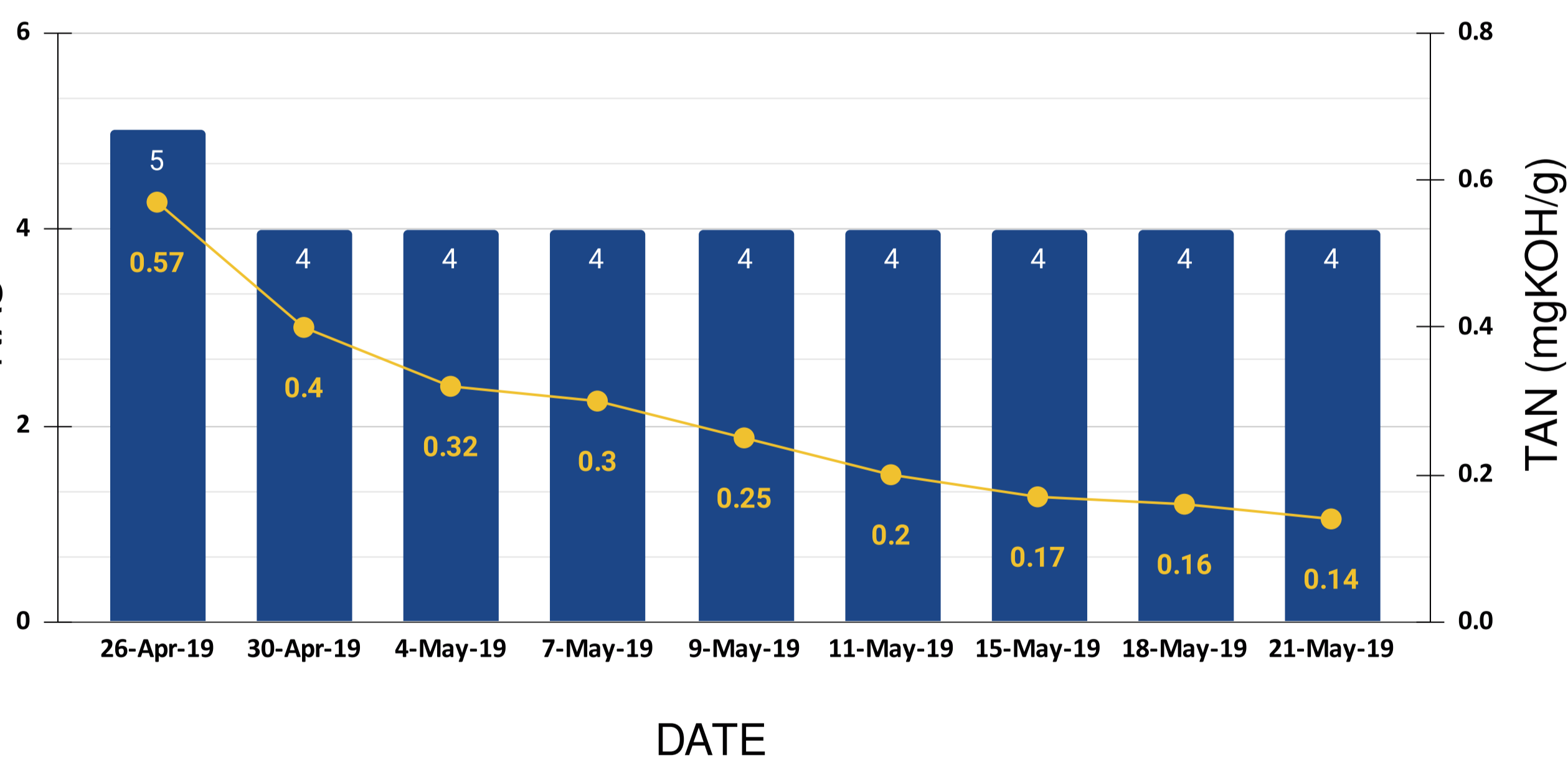
Installation of Minimac's EH Oil Reconditioning System "MLC LVDH TRIX 20" comprehensively designed with 4 major technologies to:

- Remove solid contamination from oil by **Superfine Filtration Technology**.
- Remove moisture from oil by **Vacuum Dehydration Technology**.
- Reduce Total Acid Number (TAN) by **Ion Exchange Technique**.
- EHC system tank moisture removal and ingress prevention by **Inert Gas Blanketing Technique**.

Along with equipment installation, our Service Engineer trained the customer's team on the functions of the EH Oil Re-Conditioner, FRF Maintenance, Contamination Control, and Importance of the Oil Analysis Program.

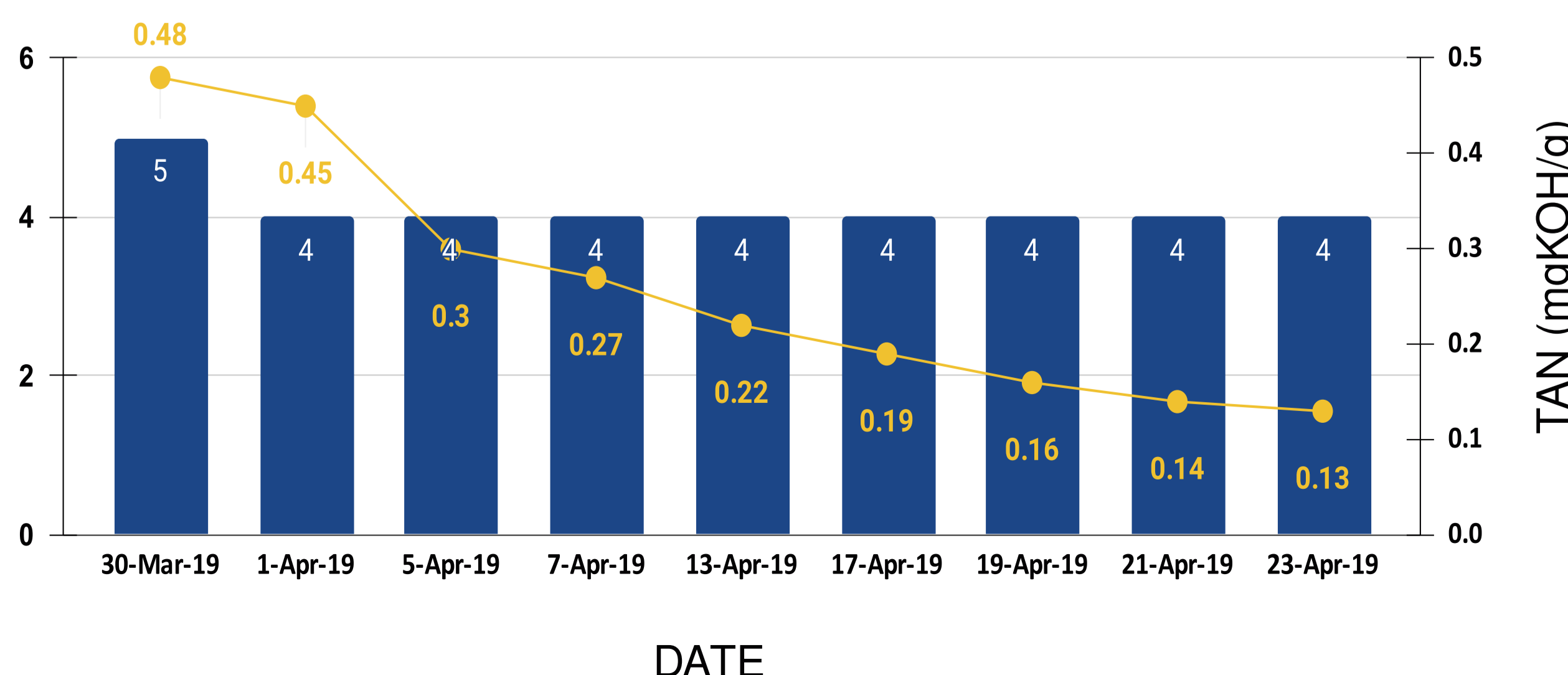
Unit #1: Trend Analysis

■ NAS ● TAN (mgKOH/g)



Unit #2: Trend Analysis

■ NAS ● TAN (mgKOH/g)



Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹78 Lakh approx.
- Cost of Downtime: ₹5.6 Cr approx.

BENEFITS:

- 1) Extended oil life
- 2) Elimination of oil replacement cost
- 3) Protection of turbine against hunting
- 4) Increased turbine reliability

CASE SHOT 4

Reconditioning of EH Oil

A 1200 MW coal-fired thermal power plant using Indo-Chinese Turbine EHC System in Southern India.

SYNOPSIS

The Plant was struggling with the rapid increase in TAN values in the EH oil of the governing system of the turbine. Also, the moisture content was more than permissible limits. Degradation of the oil was due to contamination ingress into the system resulting in by-product formation.

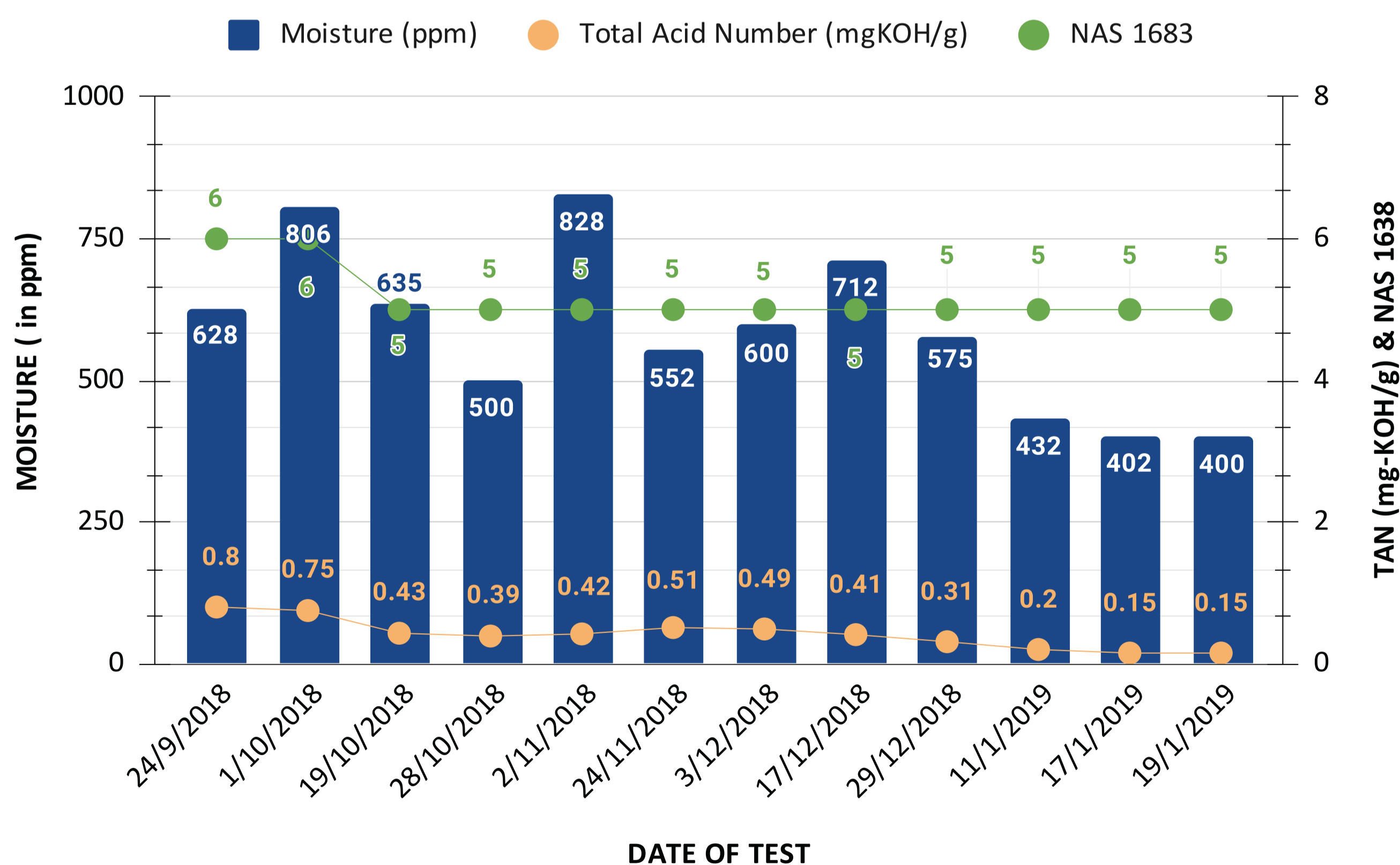
Minimac's EH oil reconditioning system "MLC LVDH TRIX 20" proved to be the savior and an unexpected shutdown of the turbine worth ₹1.05 Cr per day was saved.

PROBLEMS

A rapid increase in the Total Acid Number (TAN) could degrade the EH oil and lead to the possibilities of failure of servo valve, hunting, power generation loss, unplanned shutdown, etc.

Oil Analysis was done to check the properties of EH oil like Moisture, NAS value, Total Acid Number.

The below graph shows the trend analysis of tracked values during the reconditioning of EH Oil at Unit #2:



Total Consumable Details:

- Filter - 01 qty of 10 - microns
- Filter - 01 qty of 3 - microns to achieve NAS 5 cleanliness
- Total Resin - 60 liters.

SOLUTIONS

Installation of Minimac's EH Oil Reconditioning System "MLC LVDH TRIX 20" comprehensively designed with 4 major technologies to:

- Remove solid contamination from oil by **Superfine Filtration Technology**.
- Remove moisture from oil by **Vacuum Dehydration Technology**.
- Reduce Total Acid Number (TAN) by **Ion Exchange Technique**.
- EHC system tank moisture removal and ingress prevention by **Inert Gas Blanketing Technique**.

Along with equipment installation, our Service Engineer trained the customer's team on the functions of the EH Oil Re-Conditioner, FRF Maintenance, Contamination Control, and the Importance of the Oil Analysis Program.



Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹60 Lakh approx.
- Cost of Downtime: ₹4.2 Cr approx.

BENEFITS:

- 1) Extended oil life
- 2) Elimination of oil replacement cost
- 3) Protection of turbine against hunting
- 4) Increased turbine reliability.

Reclamation of FRF

A 1200 MW coal-fired thermal power plant using Indo-Chinese Turbine EHC System in Southern India.

SYNOPSIS

The power plant was suffering from loss in electricity generation for a few days as per the desired target. The O&M team identified that the turbine command was not functioning properly and was tripping frequently. On further investigation, it was found that the Servo Valve (Moog Valve) had failed and showed hunting or sluggish behavior.

Minimac's EH Oil Reconditioning System "MLC LVDH TRIX 20" acted as a rescuer and saved the plant from an unexpected shutdown. If this system would have been implemented earlier, a loss of **more than ₹5 Cr could have been saved.**

PROBLEMS

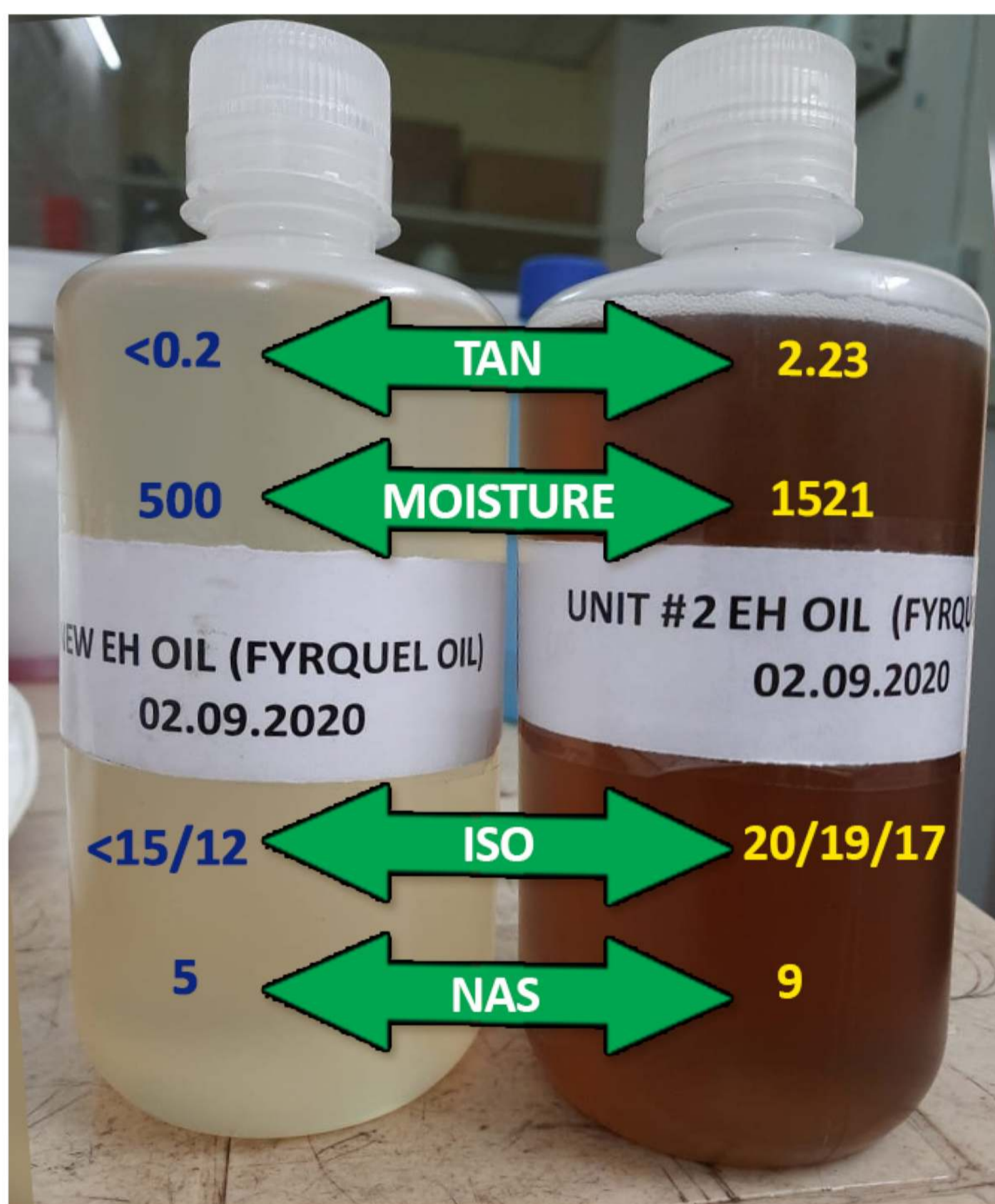
- **Failure of Moog Valve:** This was the main reason for the turbine trip and breakdown in the power plant.
- **Poor Oil Analysis Program:** Oil analysis should be done monthly for Particle Count & TAN (weekly if the trend is negative). For moisture contamination, weekly test is suggested but the customer failed to perform the tests as per the schedule.
- **Inadequate Operation Practices:** The solenoid valve of the LVDH (oil purification machine) vacuum line was only 20% closed which failed to generate vacuum.

SOLUTIONS

Installation of Minimac's EH Oil Reconditioning System "MLC LVDH TRIX 20" comprehensively designed with 4 major technologies to:

- Remove solid contamination from oil by **Superfine Filtration Technology.**
- Remove moisture from oil by **Vacuum Dehydration Technology.**
- Reduce Total Acid Number (TAN) by **Ion Exchange Technique.**
- EHC system tank moisture removal and ingress prevention by **Inert Gas Blanketing Technique.**

Along with equipment installation, our Service Engineer trained the customer's team on the functions of the EH Oil Re-Conditioner, FRF Maintenance, Contamination Control, and Importance of the Oil Analysis Program.



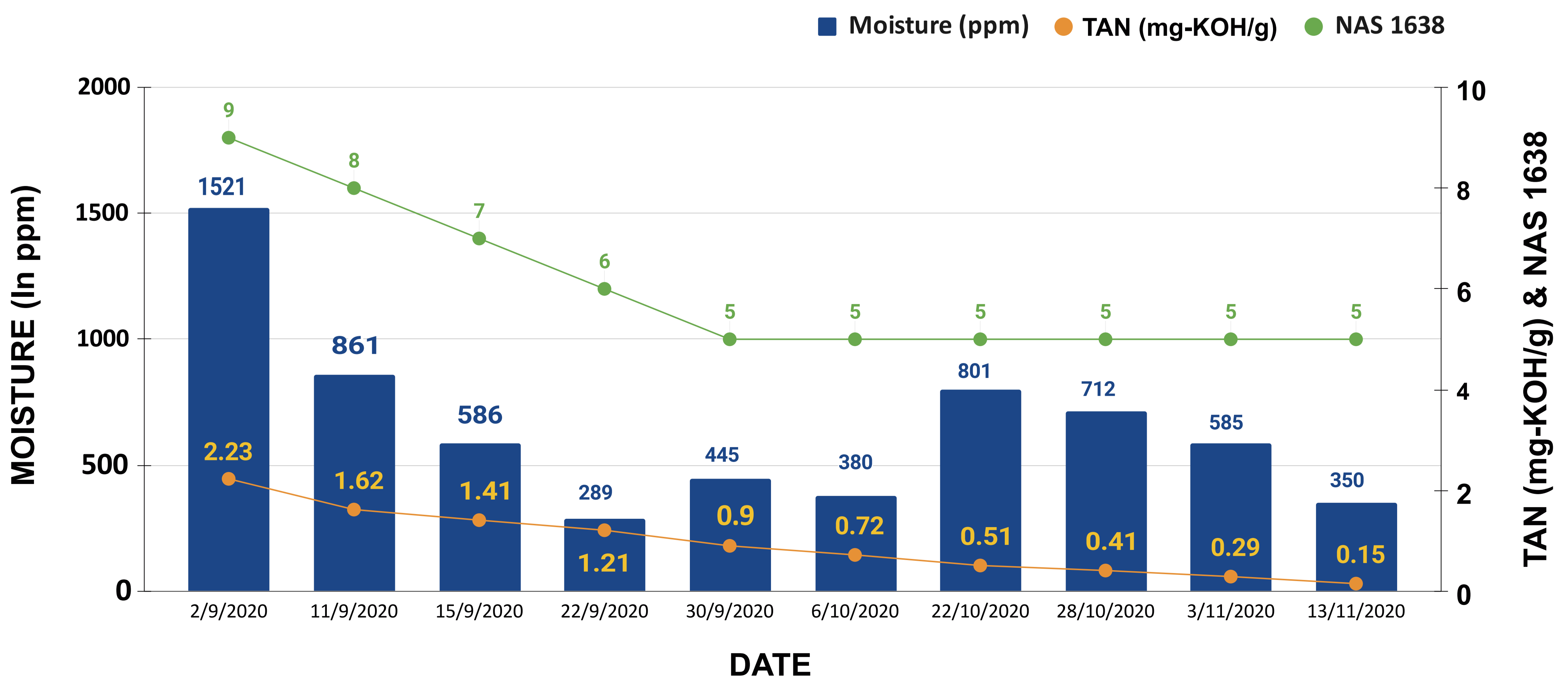
EH Oil (FYRQUEL): New Oil (LHS) Vs Used Oil (RHS) both on the same date



Total Consumable Details:

- Filter - 01 qty of 10 - microns
- Filter - 01 qty of 3 - microns to achieve NAS 5 cleanliness
- Total Resin - 36 liters.

The below graph is showing the trend of decrease in the values with continuous cycling of EH Oil and total running hours of equipment being 698 hrs.



Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹60 Lakh approx.
- Cost of Downtime: ₹4.2 Cr approx.

BENEFITS:

- 1) Extended oil life
- 2) Elimination of oil replacement cost
- 3) Protection of turbine against hunting
- 4) Increased turbine reliability

CASE SHOT 6

Lube Oil Reclamation from NAS 12 to NAS 3

Critical project successfully executed for ISO 9001 Certified - Millenium's shipbuilding yard under the Ministry of Ports, Shipping, and Waterways (Defence Sector).

SYNOPSIS

The maritime-related facilities in the port city, the first enormous greenfield shipbuilding yard located in the state of Kerala, faced significant oil degradation issues affecting the overall functioning of the India's first Indigenous Aircraft Carrier (IAC), which led to the abrasion of the machines. 49k liters of oil were required to be purified and stored in two different tanks; the leading service tank had 22k liters of oil, followed by 27k liters of oil in another.

Due to the contamination and degradation of the oil, the plant faced issues in wear and tearing of the machines that would lead them to machine breakdowns.

Minimac provided FS225 and FS150 Oil Filtration Systems, which helped infiltrate the gearbox lubeoil. Also, testing the oil transparency was equally crucial so that no particles left could harm the mechanism.

PROBLEMS

Due to high NAS level, the oil had degraded, resulting in increased friction and wear. There was frictional power loss aggravating the surface roughness. The **NAS value 12** indicated the contamination of the oil, stating the risk factor the plant was having. They were facing frequent breakdowns and massive losses. The oil had solid contamination.

Client's Requirement -

- To achieve NAS level < 5.
- To filter the gearbox lube oil.
- To test the transparency of oil.
- To perform flushing activities.
- Smooth and timely execution of the tasks.
- No spillage.

SOLUTIONS

- Oil was present in separate tanks of stages 1 and 2, where 27k liters of oil were bifurcated again into reserved and storage tanks.
- Filtering the oil and balancing the NAS level simultaneously was an arduous task. While performing tasks, continuous obstructions occurred due to various naval activities, engineers faced language issues, and the negative pressure created on the machines was quite challenging. Minimac provided FS225 and FS150 LPM Oil Filtration Machines, Trained Manpower and other consumables under the **MOMS (Minimac Operations and Maintenance Service) offering.**
- The filtration process helped the oil to reach its standard value considering the contamination and transparency.
- Our team achieved ISO19994460 18,15,12 standards. Before filtration, the initial NAS value was 12; after filtration, **NAS 3** in tank 1 and **NAS 5** in tank 2 was achieved successfully.
- The team achieved this goal by disassembling the pieces of equipment, fabricating them, and re-assembling the equipment in the time and space given. No spillage occurred during the service job.



BENEFITS

- 1) Extended oil life.
- 2) Smooth functioning of the machines.
- 3) Elimination of oil replacement costs.
- 4) Improved machine's life.
- 5) Successful on time commissioning of the first IAC.

CASE SHOT 7

Reduction of the TAN value of the control fluid from 0.23 to 0.08 mgKOH/gm

Team Minimac successfully executed a critical project to re-condition the control fluid (tank capacity 16 KL) for a 2*600 MW coal-based thermal power plant in Chhattisgarh.

SYNOPSIS

The plant establishes, operates, and maintains a thermal power generating station in Chhattisgarh. There was a problem with higher **Total Acid Numbers (TAN)**, observed typically when moisture content exceeds the permissible range. They were facing difficulties in stable unit operation because of the sluggish and erratic behavior of the turbine governing system. It was a significant threat to generation loss and unit outage. The situation was examined by Minimac Operations and Maintenance Service (MOMS). Three machines - **Nitrogen Blanketing TMR unit** (100 LPM), Oil purification **MLC-LVDH-TRIX** (50 LPM), and TAN reduction— **Resin filter** modified in cartilage format were deployed to address the issue.

Oil Purification	TAN Value	NAS Value	Moisture
Before Oil Purification	0.23 mg KOH/gm	10	678 PPM
After Oil Purification	0.07 mg KOH/gm	6	250 PPM

The major challenge faced during the execution was if we charged resin, TAN will reduce, but moisture would increase. So, an analysis was done and implemented to control the moisture first, then charged the second resin cycle. Minimac gave a 100% customized solution within time.

PROBLEMS

The tank capacity was 16k liters, which was huge. The biggest challenge was to execute the project during **running operations**. Because for moisture control, it was necessary to turn off the system. Water bubbles were forming, leading to the fluctuation in NAS. Resin charge means moisture increase, and our motto was to bring moisture below 500 ppm so we can plan for the next cycle of resin charge.

Client's Requirement -

- To purify the control fluid.
- To reduce the TAN value from 0.23 to 0.08 mgKOH/gm.
- To reduce the moisture levels.
- To achieve NAS 6.
- Smooth and timely execution without any downtime.
- Customized solution.
- No spillage.

BENEFITS

- 1) Extended in-service oil life.
- 2) The smooth functioning of the machines.
- 3) Elimination of new oil replacement cost.
- 4) Avoiding the risk of fire and explosion.
- 5) Reduction in the possibility of product degradation due to blanketing.

SOLUTIONS

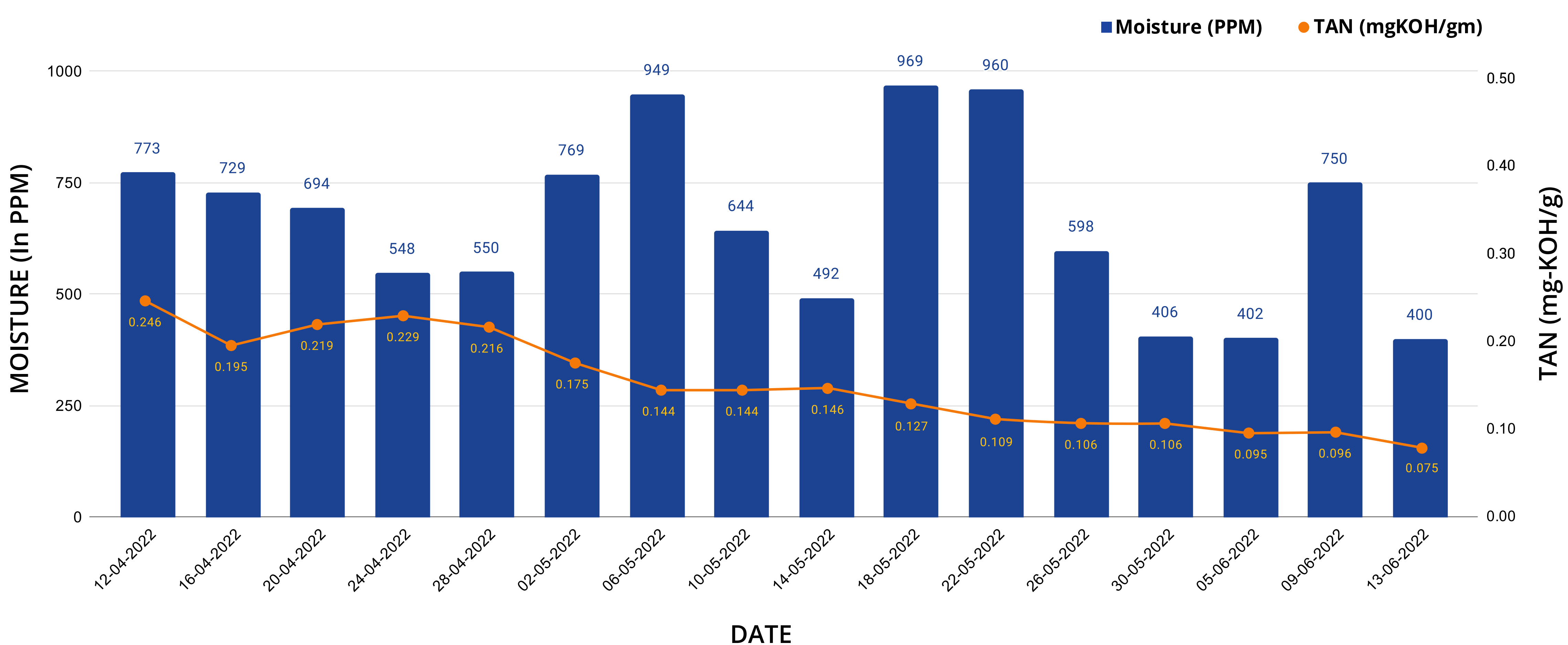
- The **Nitrogen Generation Unit (TMR)** was deployed and installed at the client's site. The salient features of the TMR unit are - 99.9% pure nitrogen, a dew point less than -15 degree celsius, and a dedicated moisture condensing unit.
- For Nitrogen Blanketing, TMR – 100 LPM had a flow regulator of 0-150 LPM.
- Oil purification machine **MLC-LVDH-TRIX-50** for NAS & moisture reduction was installed.
- Installed 12 new resin filters for TAN reduction in existing recirculation units.
- **Before** the oil conditioning process, the **TAN** \geq **0.210** mg KOH/gm (Electronic method) and **0.246** mg KOH/gm (manual titration), which was reduced **after** oil purification to **TAN** \leq **0.097** mg KOH/gm (Electronic method) and **0.124** mg KOH/gm (manual titration).
- For further improvement in TAN, **the oil vapor extraction fan(OVEF)** was throttled in the range of 50-55%, with the support of the user.
- They had an LVDH machine, and the NAS standard to be maintained as per the PO was 10+. We gave a better result without the replacement of the NAS filter.
- Minimac provided Trained Manpower and other consumables under the **MOMS (Minimac Operations and Maintenance Service)** offering. Minimac has charged resin in an 8-cycle with 3 hrs intervals. 24hrs resin charge KPI was 0.074 mgKOH/gm.

Cost Saving -

This Plant managed to save:

- Cost of Oil Replacement: ₹3.2 Cr approx.
- Cost of Downtime: ₹3.15 Cr approx.

By investing ₹9 lakh only.



CASE SHOT 8

Saved the plant from a major breakdown

The Minimac team successfully completed a critical flushing project in a Big Fertilizer company with a capacity of 4000 tonnes in Jharkhand.

SYNOPSIS

An installation project was ongoing at the fertilizer plant's premises. Newly built lube pipelines and tanks were to be flushed to remove the welding debris and other components left inside while fabricating the pipelines. The entire project was delayed due to a very slow flushing process. **Minimac Operations and Maintenance Service (MOMS)** Team evaluated the situation and came out with a solution to expedite the flushing process. The project required flushing their two main compressors, i.e., PSE processed air compressor and Carbon Dioxide compressor.

PROBLEMS

Proper flushing had to be done as the pipeline was newly fabricated; otherwise, it would have led to a major breakdown of the compressor, as the impurities would choke the blades and erode/damage the compressor. Other issues were to ensure proper calculation for variable pipe diameters, and if the oil goes to the rundown tank and overflows, 60-65 degree oil will fall, causing a huge mishap.

Client's Requirement -

- Fast completion of the job to meet the project timeline.

BENEFITS

- 1) The reliable operation of the system and trouble-free operation of machines.
- 2) Sustainable performance of manufacturing process.
- 3) Elimination of new compressor cost.
- 4) Avoiding the risk of fire and explosion.
- 5) Reduction in the possibility of product degradation due to lack of proper flushing.
- 6) Timely Execution.

Feedback -

OEM's request for no debris in the mesh was successfully fulfilled. As a result of Minimac's excellent work, another assignment of a similar nature was assigned to them.

SOLUTIONS

- Minimac Systems examined the pipeline, which consisted of a low-pressure pipeline, high-pressure pipeline, and run-down tank.
- A proper calculation was done as the work was a bit critical; any negligence could become a mishap.
- All parameters must be considered, including segment-wise flushing, hammering, thermal showering, etc.
- At the end of the flushing, a mesh was installed to check if any impurities were present.
- Completing the flushing project was ensured as per ISO 18/15/12.

Cost Saving -

This Plant managed to save:

- Cost of Import caused due to deficit of fertilizer.

