

How Majis Industrial Services Company managed to recover the integrity of a Reverse Osmosis “RO desalination” plant

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MAJIS Industrial Services Company

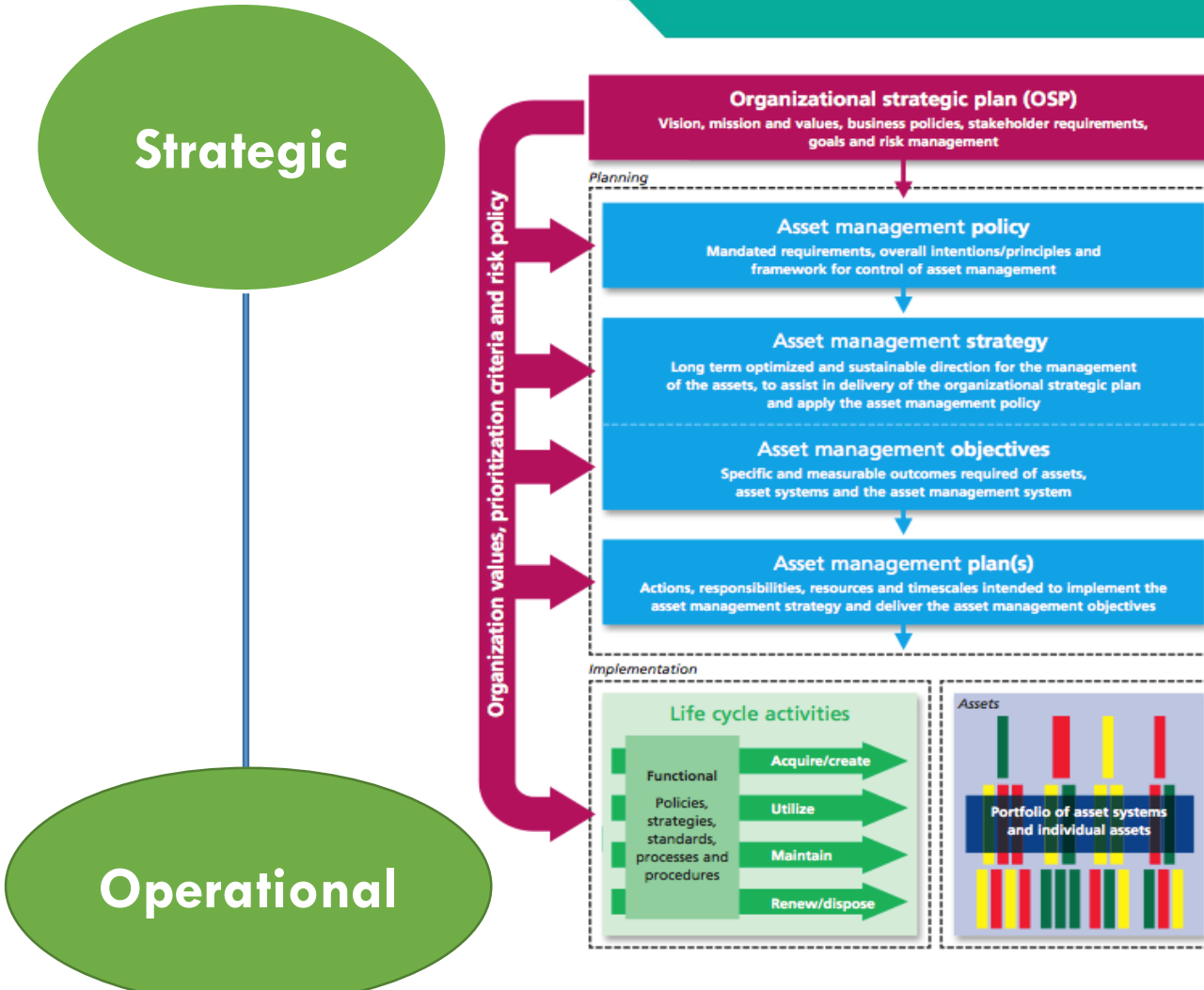
MAJIS Industrial Services Company established in 2006 to supply water solutions to Oman's growing industrial port and other special economic areas in Sohar and globally. MAJIS started its operations by providing seawater for cooling purposes to the tenants of Sohar Industrial Port Area (SIPA) and has since grown to become a one-stop water solutions provider. With the Government of Oman as the sole shareholder Majis play a unique role by providing wide spectrum, sustainable and ecofriendly water solutions.



*We
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Why Asset Management



- Organizations are usually strong at operational area if asset Management implemented
- Improving asset management usually requires enabling the organization to work more strategically
- Working operationally keeps the water tap on
- Working strategically keeps the water tap on more effectively and efficiently
- Operational activates are more short term, responsive and asset specific
- Strategic activities are longer term, planned and holistic
- Asset management is a journey and ISO55001 can be measure of where you are on the journey
- ISO 55001 is generic for all asset –centric organization. It has to be made specific to an organization to be of use

Plant Recovery

Two Major contributors to recover the integrity of Reverse Osmosis “RO desalination” plant :

- 1. Computerized systematic Preventive and Predictive maintenance**
- 2. Well calculated chemical dosing**

Computerized Maintenance Management System

CMMS and
Maintenance



What is CMMS

A CMMS is computer software designed to simplify maintenance management. CMMS stands for **Computerized Maintenance Management System**

❖ What is CMMS used for ?

CMMS is a software package that maintains a computer database of information about an organization's maintenance operations & simplify maintenance management

❖ What is CMMS do ?

A computerized maintenance management system software that helps maintenance teams keep a record of all assets they are responsible for, schedule and track maintenance tasks, and keep a historical record of work they perform. CMMS packages can produce status reports and documents giving details or summaries of maintenance activities

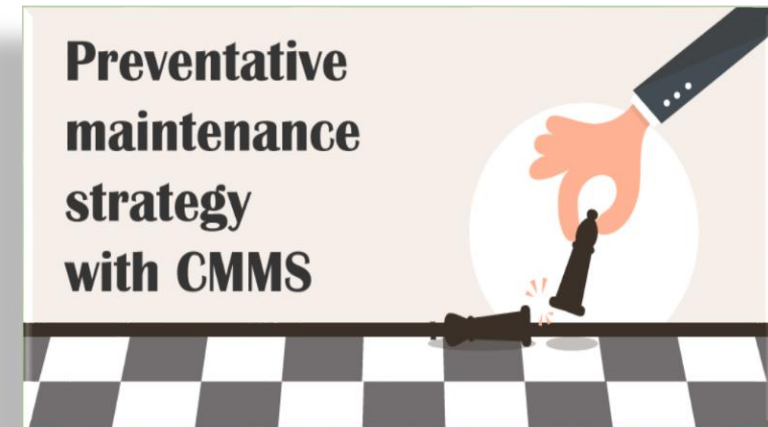
Classification of work in CMMS

1. Preventive maintenance
2. Predictive maintenance
3. Corrective maintenance

1. Preventive maintenance

The main goal behind PM is for the equipment to make it from one planned service to the planned service without any failures. This may be by preventing the failure before it actually occurs .

In CMMS first we need to create & update all the instruments & equipment's with a proper OBJECT ID. Then it should be migrated to the CMMS software as per the time frequency of the maintenance. Normally time frequency of maintenance classified as "Monthly, Quarterly & Yearly".



Creating Object ID For Asset

Below shows the example of creating tag number for **71FIT002**

RO1-PST-PW	FIT
RO1-PST-PW-FIT	Flow indicating transmitter
RO1-PST-PW-FIT-71FIT002	Process water header (near RO-5)

RO1 - Reverse osmosis - Plant
PST - Post treatment - Process
PW - Process water - Sub process
FIT - Flow indicating transmitter - Asset

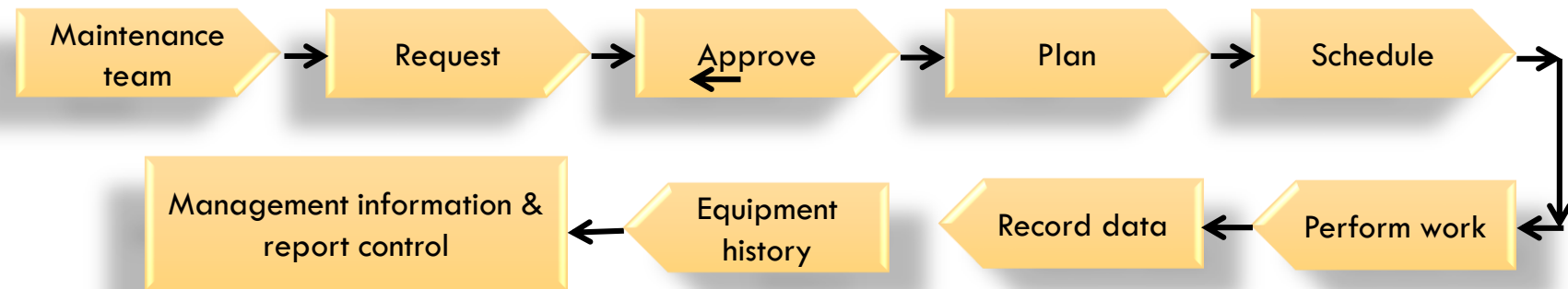
Object ID Created as per the process wise mentioned above. Now we can create ID for all asset and it should be migrated to the system by the administrator. Once all data's migrated to system we can preview the details as we migrated.

CMMS generated page view of assets

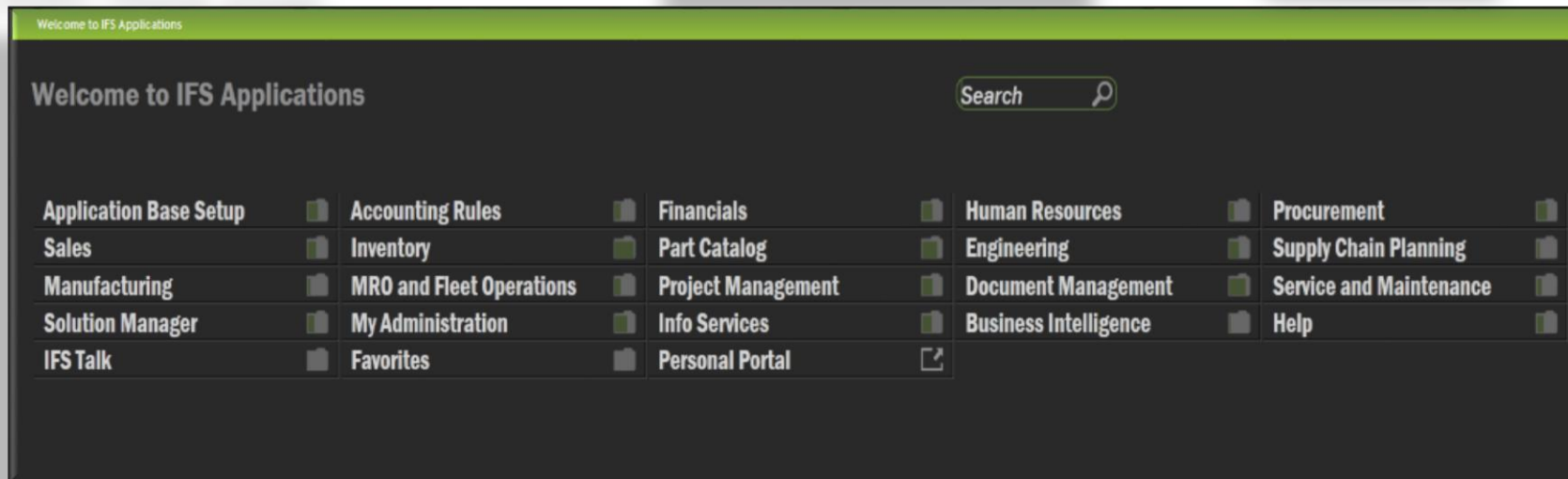
Active Work Orders							
WO No	WO Site	WO Site Desc.	Connection Type	Object Site	Object Site Desc.	Object ID	Object Description
646414	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-RO4-SKID-4-SWRO6104	Sea water reverse osmosis skid-4
646539	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-RO4-SKID-4-SWRO6104	Discharge Line of RO CIP Pump P - 1101
646540	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-SWRO1-FIT-61FIT023	SWRO Train - 02
646541	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BWRO1-QIT-62QIT001	Permeate Header of BWRO Train-01
646542	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BCST-LG-34LG001	Bulk Caustic Storage Tank BCST - 34 01
646543	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BCST-LG-34LG003	Caustic Dosing Tank DT - 34 02
646544	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BCST-LG-34LG005	Caustic Dilution Tank DT - 3403
646545	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-PT-SCF-VALVE-BV001	Scf 1 Blow Down Valve
646546	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-PT-MF-MF1-MF5201	MF Skid 1
646549	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-PT-MF-MF1-MF5201	MF Efm/Cip Pump 2
646550	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-SMBS-DT2-AGR-AG3202	Agitator For Smbs Dosing Tank2
646551	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-POTTRNFR-PUMP2-P8102	Potable Water Transfer Pump 2
646664	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-20MVA-TR1-TR 001	33KV/6.6KV 20MVA TRANSFORMER-1
646655	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-SMBS-PG-32PG001	Discharge Line of SMBS Dosing Pump DP-3201
646656	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-SMBS-PG-32PG002	Discharge Line of SMBS Dosing Pump DP-3202
646657	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PW-QIT-71QIT002	Product Water Header
646658	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-FIRE-PS-75PS001	Common discharge of fire hydrant system 1
646659	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-CD RO-MT1-DP 3407	CAUSTIC DOSING COMMON RO FEED MOTOR - 1
646660	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-CAUSTIC-D PUMP2-OP3407	Caustic Dosing Pump-2 N/Pit & Efm Cip Cleaning
646661	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-POT-NPIT-PUMP-P-4201	N/Pit Chemical Transfer Pump 1
646662	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PROWTR-DEW P-DW-01	Process Water Dewatering Pump
646663	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PRO J-K-MT1-JOPU 1	PROCESS WATER JOCKEY MOTOR-1
646554	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-EOT-W5-EOT 07	EOT FOR WORKSHOP 5T
646665	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BWRO4-PIT-61PIT015	Suction of Booster Pump P - 6108
646293	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-HP-MT1-P 6101	RO HIGH PRESSURE MOTOR-1
646295	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO2-RO-HP-MT2-P 6202	RO HIGH PRESSURE MOTOR-2
646296	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BP-MT1-P 6102	RO BOOSTER MOTOR-1
646298	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-RO1-PUMP4-HP6101	Swro Skid 1 High Pressure Pump
646556	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-CF-PG-11PG003	Inlet Line to Micron Cartridge Filter E - 1101
646559	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BCST-LG-34LG004	Process Water Caustic Dosing Tank DT - 3401
646560	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-PT-MF-MF1-MF5201	Common Dis of MF Backwash Pumps -01/02
646561	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-MF-SHD-MT1-DP 3301	MF CLEANING SODIUM HYPO DOSING MOTOR-1
646562	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-SODIUM-D PUMP1-DP3301	Sodium Hypo Dosing Pump-1 Mf Cleaning
646563	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-SMBS-P1-DP3201	Smbs Dosing Pump- 1
646564	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-POTTRNFR-PUMP3-P8103	Potable Water Transfer Pump 3
646565	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-SMBS-MT2-DP 3202	SMBS DOSING MOTOR-2
646566	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PORT W TR5-MT1-P 8101	PORTABLE WATER TRANSFER MOTOR -1
646567	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-EOT-POWH-EOT 09	EOT FOR PORTABLE WATER PUMP HOUSE 3.2T
646568	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-UPS-CR-UPS 03	390V DC BATTERY BANK WITH UPS
646666	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-HYPO-PG-33PG001	Discharge Line of Sodium Hypo DP - 3301
646667	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-SWRO3-TT-P6105PDE	SWRO Train - 03 HP pump drive end temperature
646668	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PW-QIT-71QIT004	Potable Water Header
646669	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-FIRE-PS-75PS002	Common discharge of fire hydrant system 1
646670	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-CS-CD RO-MT2-DP 3408	CAUSTIC DOSING COMMON RO FEED MOTOR-2
646671	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-POT-NPIT-PUMP-P-4202	N/Pit Chemical Transfer Pump 3
646672	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-FIRE-P1-DGP4101	Fire Water Pump-1Diesel
646673	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-PT-SCF-BDP-P-5201	Scf Blow Down Pump 1
646674	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-NPIT-CHA-MT1-P 4201	N-PIT 1st CHAMBER MOTOR-1
646675	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-PRO J-K-MT2-JOPU 2	PROCESS WATER JOCKEY MOTOR-2
646676	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-SWRO3-TT-P6105PDE	SWRO-3 HP pump Non-drive end temperature
646677	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-20MVA-TR2-TR 002	33KV/6.6KV 20MVA TRANSFORMER-2
646677	102	Reverse Osmosis	EQUIPMENT	102	Reverse Osmosis	RO1-RO-BWRO4-PIT-61PIT016	SWRO Train - 04 Feed Inlet Line

From single page we can retrieve all the details of equipment's & instruments

Creating Work Order



CMMC Home page.



By selecting **service & maintenance** we can navigate to various maintenance activities

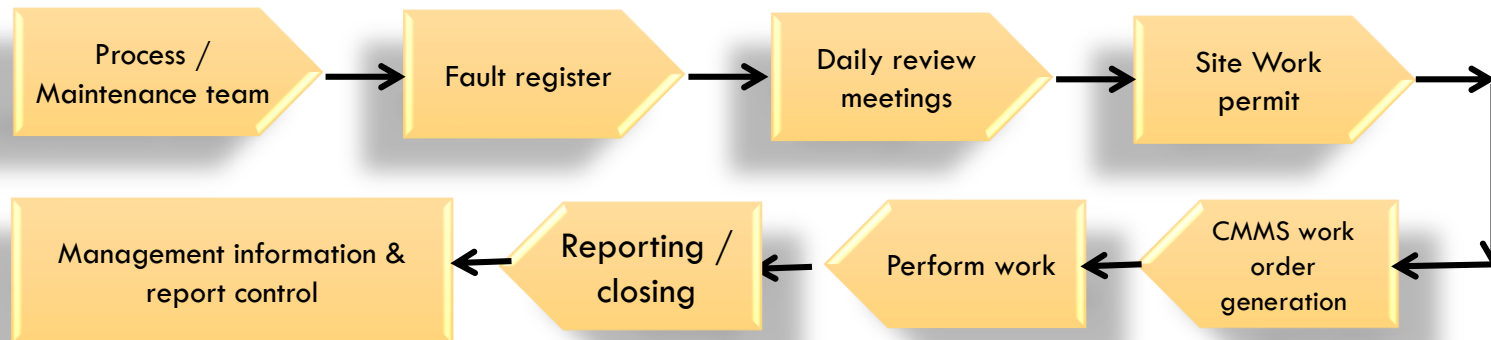


Predictive Maintenance



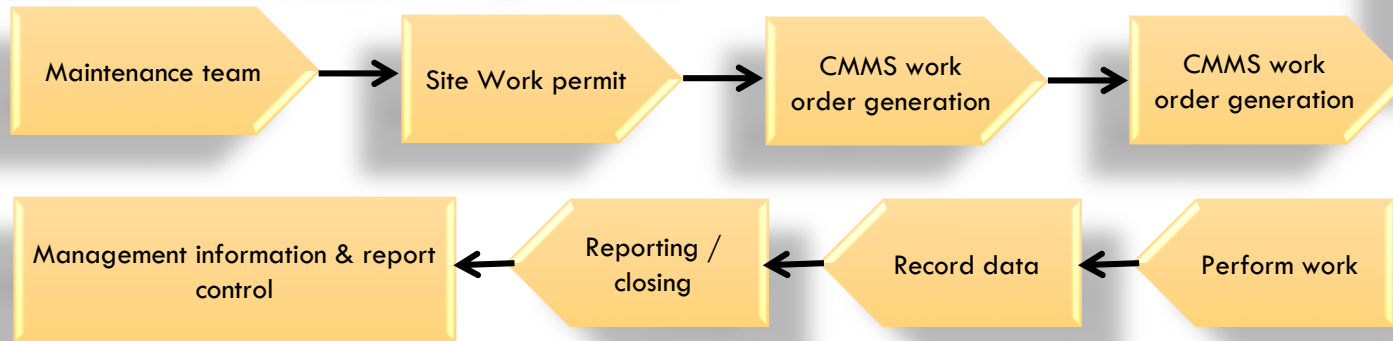
The main promise of predictive maintenance is to prevent unexpected equipment failures. The key is "the right information in the right time". By knowing which equipment needs maintenance, maintenance work can be better planned (spare parts, people, etc.) and what would have been "unplanned stops" are transformed to shorter and fewer "planned stops", thus increasing plant availability. Other potential advantages include increased equipment lifetime, increased plant safety, fewer accidents with negative impact on environment, and optimized spare parts handling.

- **How predictive maintenance carried out**



Corrective Maintenance

Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations



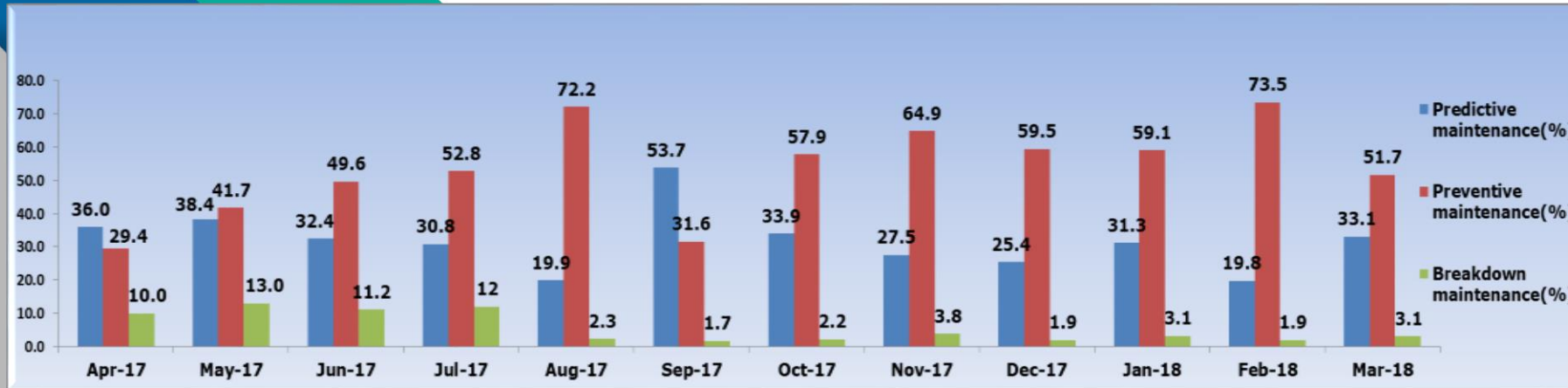
- ✓ Whenever site team perform a maintenance task (PM,PDM,CM) through CMMS everyone can access the data related to the maintenance like startup time, man hours, spares & consumables etc.

Advantages of CMMS Software

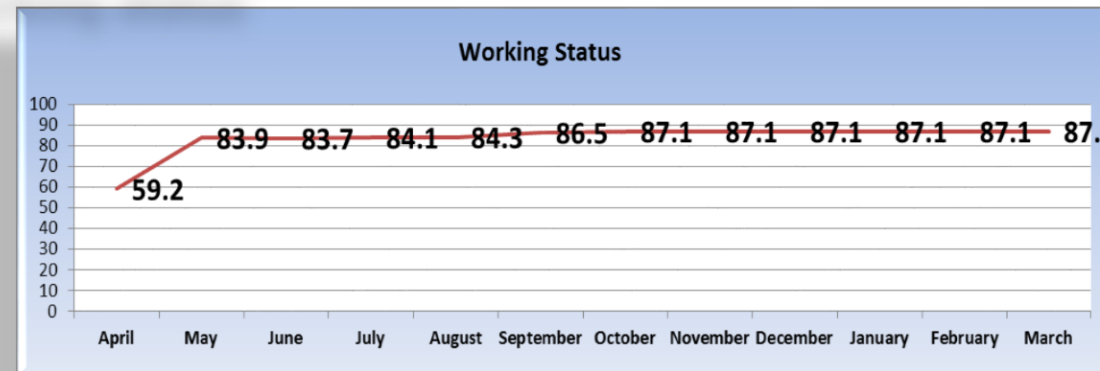
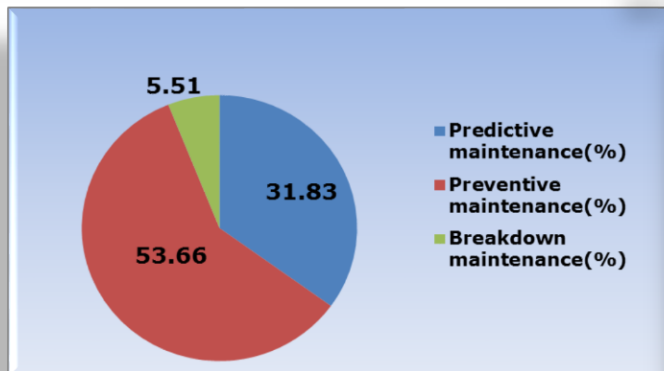
- Increase plant availability
- Plan and schedule preventative maintenance.
- Manage work orders efficiently.
- Manage spare parts inventory
- Enhance productivity.
- Reduce downtime and repair costs.
- Proper documentation/reports.
- Reduce overtime.



Yearly Maintenance Activity After CMMS Implementation

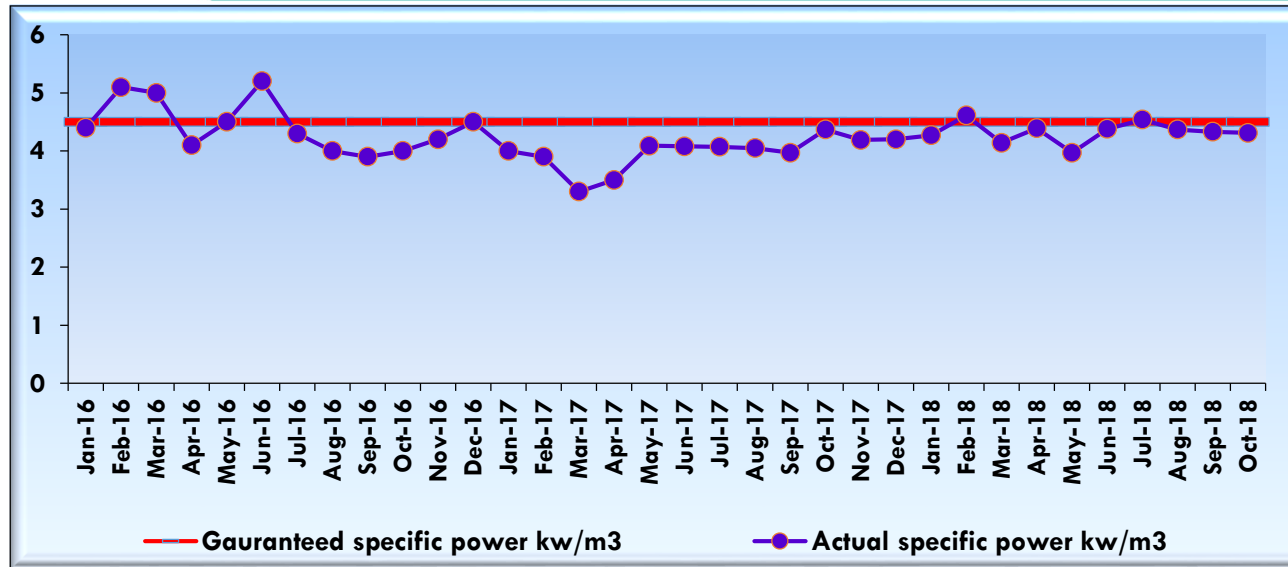


Working status



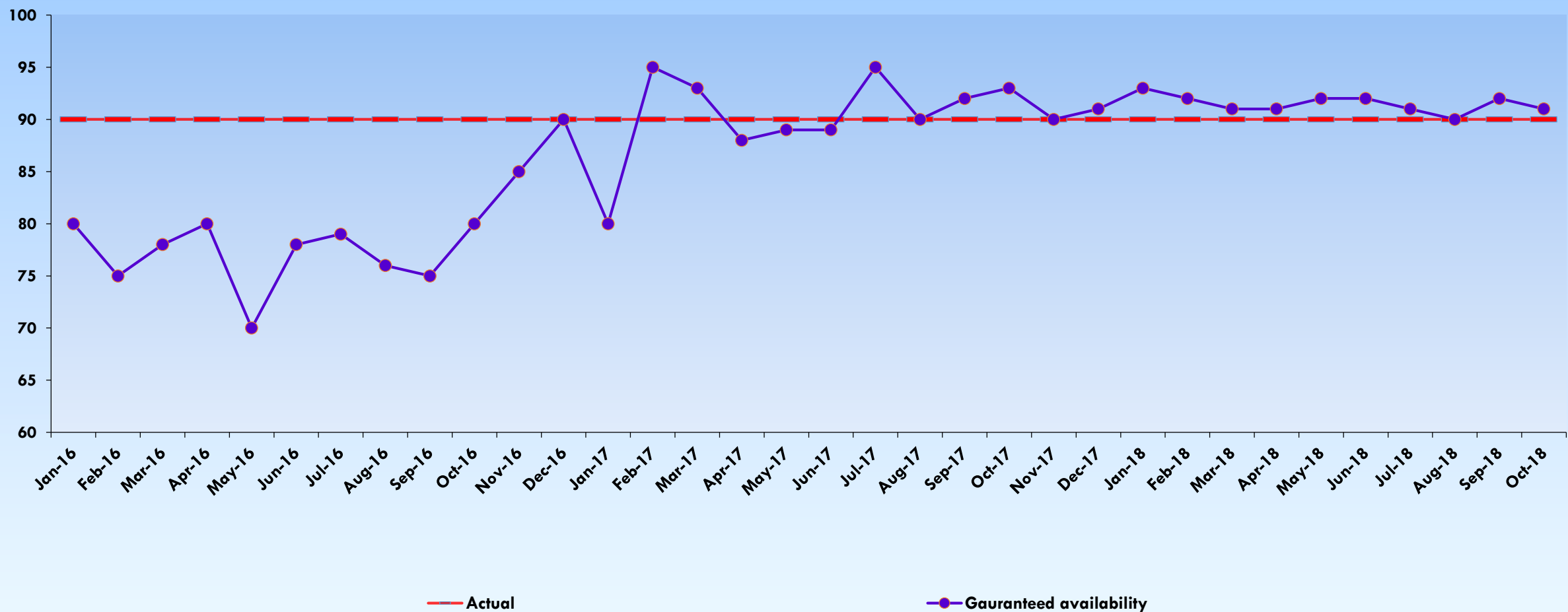
Month of May 2017 CMMS implemented and all maintenance activities was start tracking.
From graph we can analyses the details after implementation.

SPECIFIC POWER CONSUMPTION KW/M3



1. Average Specific power consumption for the period 2017-2018 is 4.0 kw/m³ against guaranteed 4.5 kw/m³
2. Due to effective operation of plant achieved power savings-1784887 kW per year.

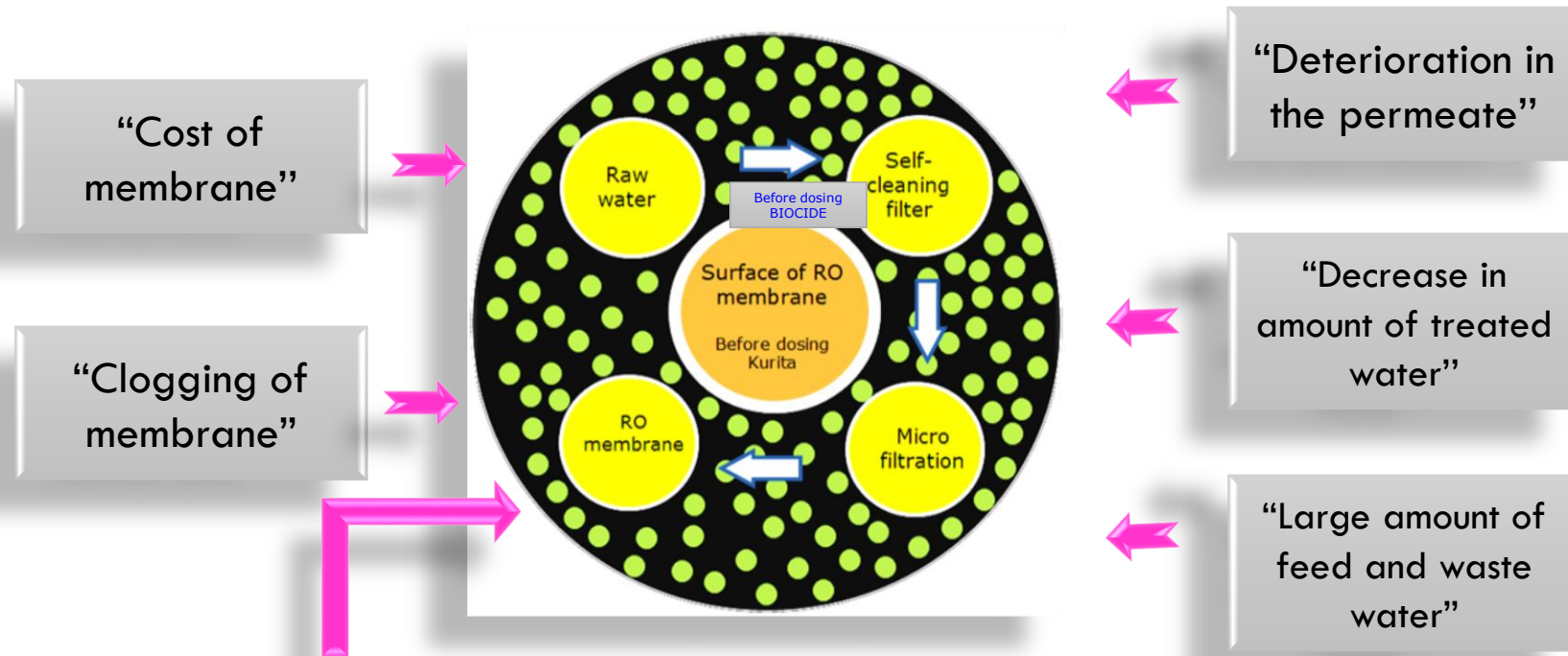
PLANT AVAILABILITY



Biocide biofilm control agent for membrane systems: biocide

- Biofouling is one of the most critical issues Reverse Osmosis (RO) systems are facing, especially in systems with high organic load like waste water recovery plants, sea water desalination plants, pharmaceutical industry or food industry among others.
- Biocide developed, a biofilm control agent, which protects plants from biological impact on pre-treatment systems and the membranes it serves. Biocide is added to the raw water tank in order to protect the whole RO system against biofouling with only one product. The concept of water treatment becomes simple and it has a direct impact on the reduction of cleaning process and related costs for manpower, chemicals and standby times, leading to a reduction of the Total Cost of Operation.
- When applying Biocide the differential pressure decreases, the loss of flux is reduced, and salt rejection improves. The excellent results are proven by RO membrane autopsies confirming a significant decrease of biofouling on the RO membrane by the use of the new biofilm control agent.

BEFORE DOSING BIOCIDES



1. decrease of permeate water amount
2. deterioration of permeate water quality
3. deterioration of RO membrane
4. high frequency of CIP cleaning
5. high frequency of membrane replacement
6. increase of pressure and electricity consumption
7. increase of discharge (concentrate) amount

TOTAL OPERATION COST DOWN

Reduction in electricity consumption of high pressure pump, frequency of cleaning & replacement of RO membrane and reduction in feed water consumption and waste water generation. BIOCIDES can provide a

Electricity cost of pump → 40% cut

Frequency of cleaning → 80% cut

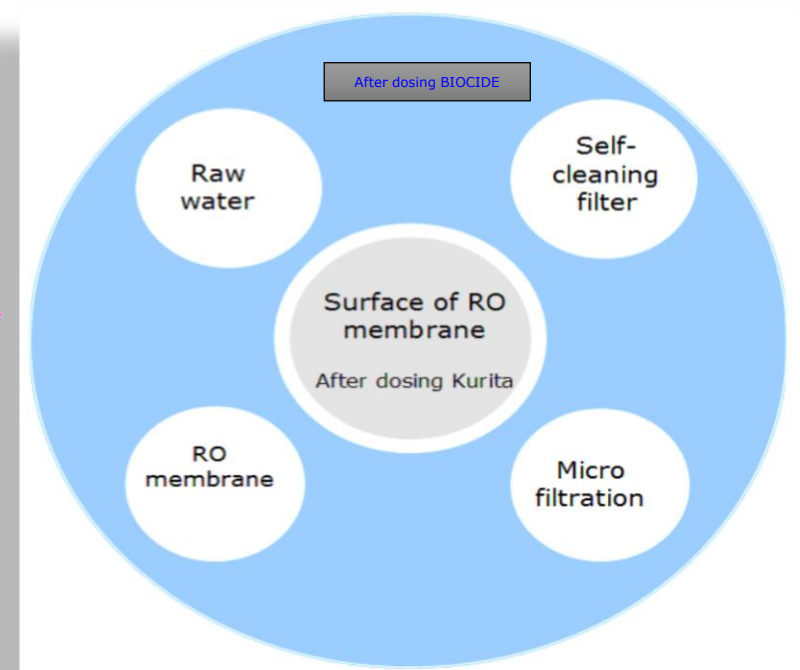
Frequency of replacement → 50% cut

Cost for feed and discharge water → 33% cut

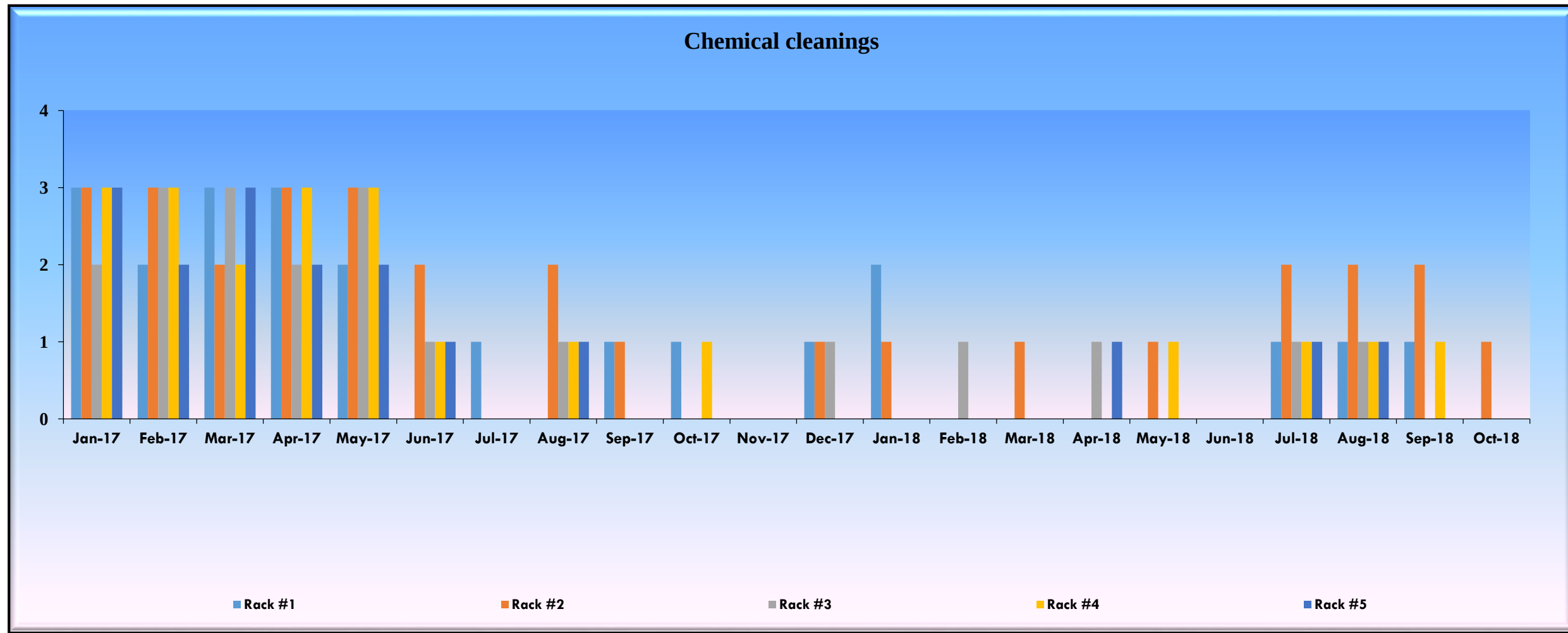
AFTER DOSING BIOCIDES



1. Prevent the fouling caused by slime and scale
2. Keep the treated water amount and quality
3. Prevent the clogging of RO membrane
4. Improve the frequency of membrane cleaning and replacement
5. Prevent pressure increasing and cut electricity consumption of pressure pump
6. Reduce the deterioration of RO membrane
7. Decrease the amount of discharge (concentrate)



CHEMICAL CLEANINGS





THANK YOU

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