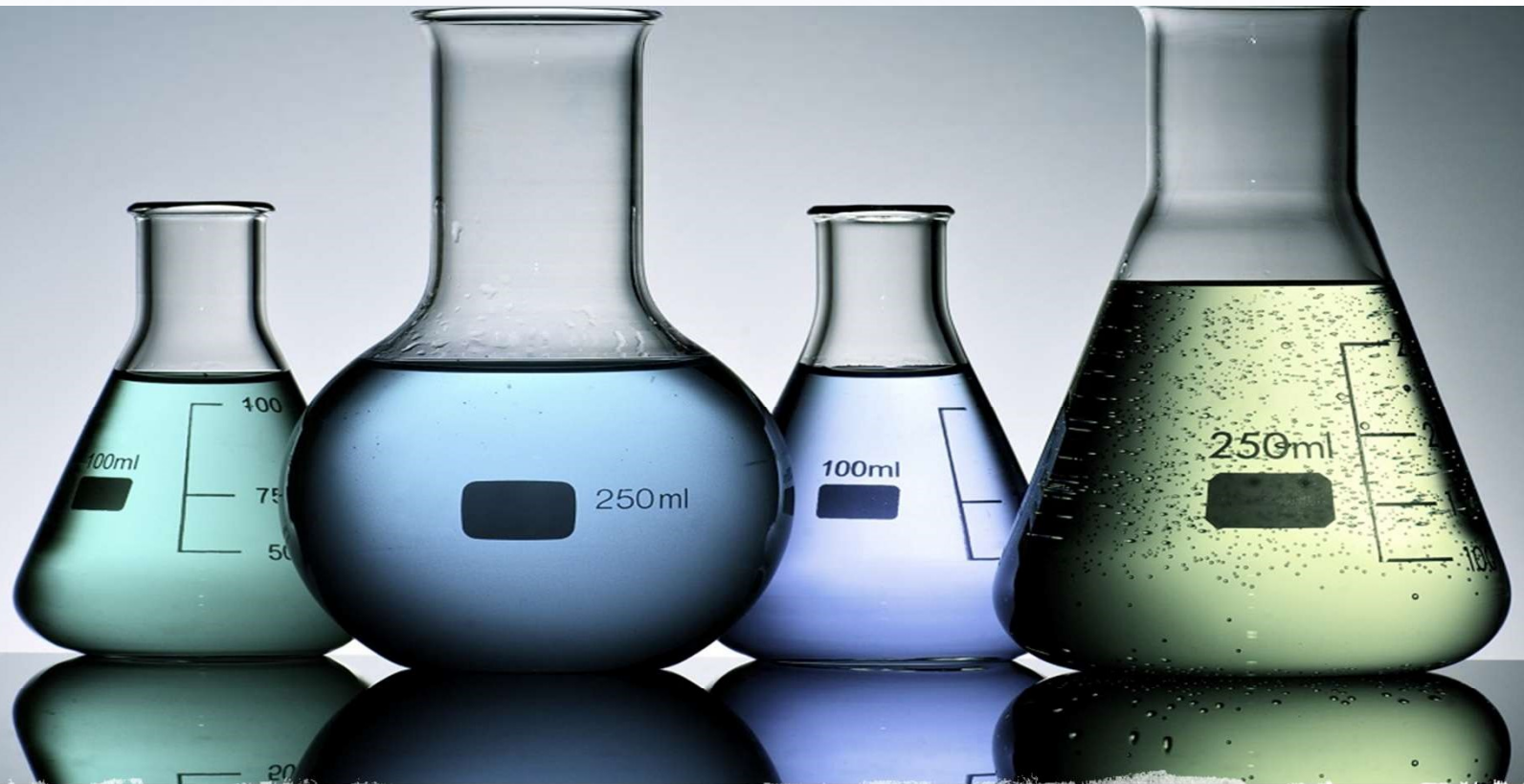


Assessment of Abqaiq Plant Water Treatment Program

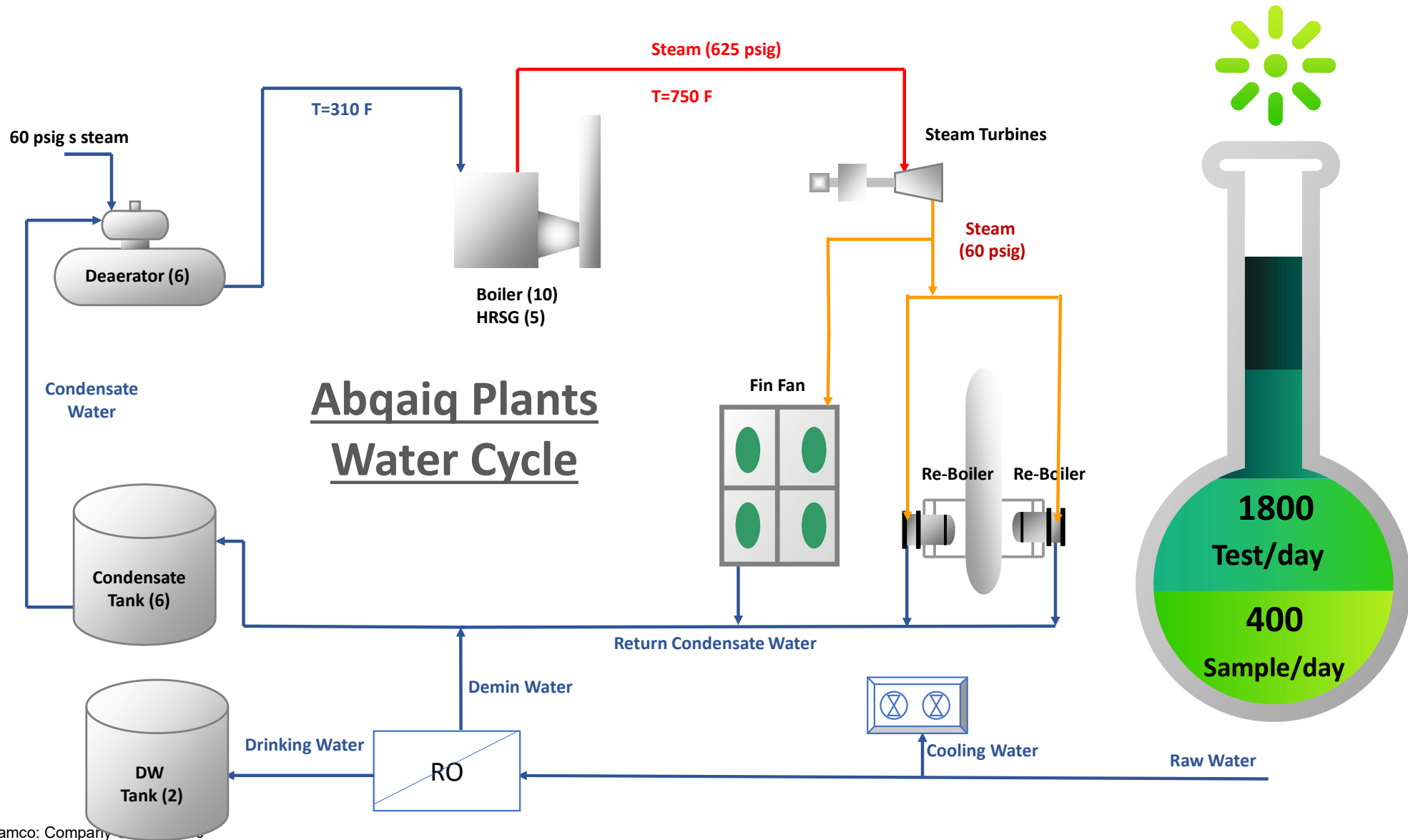


Mohammed A. Al-Mugahwi & Mohammed S. Alajaji
Abqaiq Plants, Saudi Aramco

A close-up photograph of a microscope's objective lens and eyepiece, set against a blue background. The lens is illuminated from below, creating a warm glow. A large white circle is overlaid on the right side of the image, containing the word "Overview" in a bold, blue, sans-serif font. Several smaller, semi-transparent blue circles are scattered in the background.

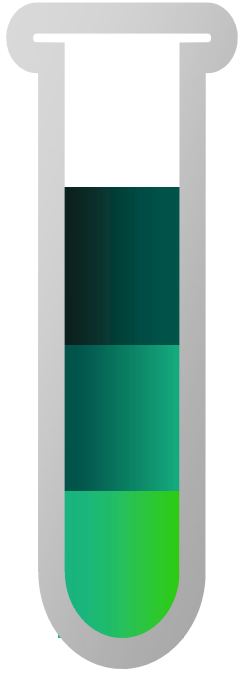
Overview





Objectives





Maintain Water / Steam Quality



Protect Assets Integrity



Avoid Waste Resources

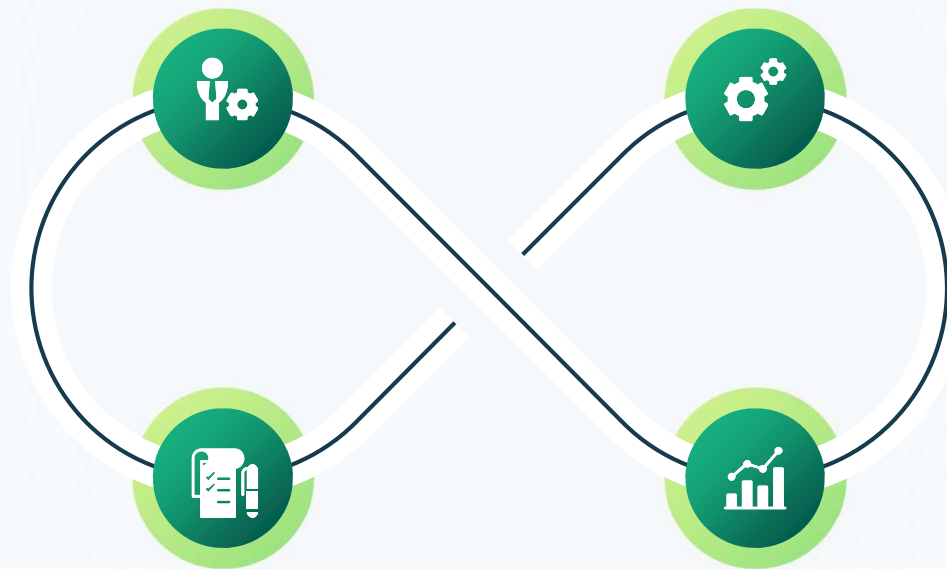
Methodology



**Established a team that consisted of
SALD, APOD/UOD , APOE/I&CU ,
Chemical Supplier led by APOE/UU**

Assessed the Water Treatment program

- Identified the Required Tests to be Conducted On Collected Samples.
- Evaluated the SALD capability to conduct the required test
- Reviewed all the chemical ranges/ limits
- Ensured all the chemicals ranges are consistent for all the reperting methods (OIMs,NALCO, Operation Log sheet)



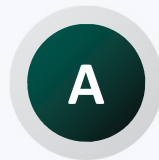
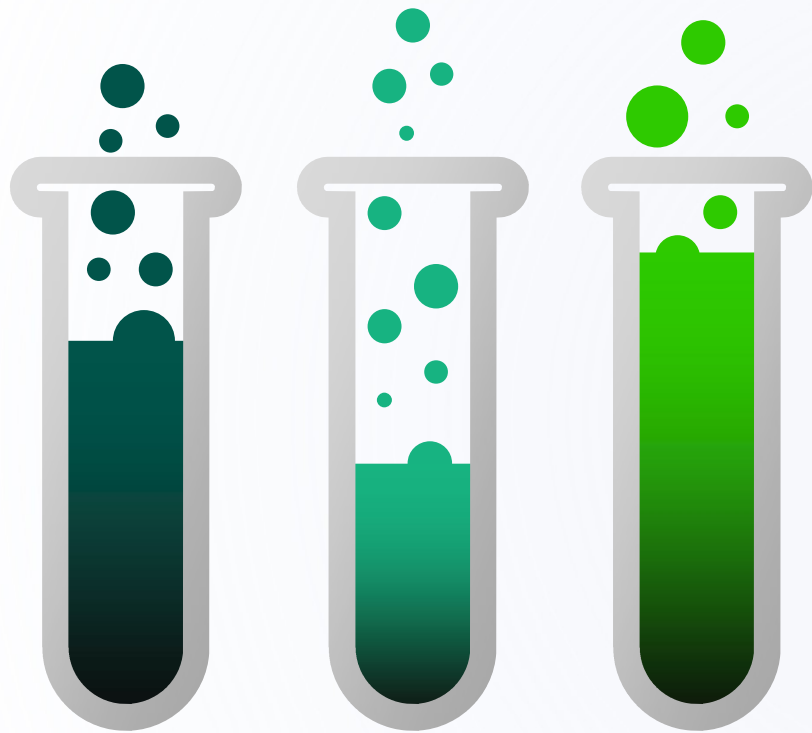
Identified the references (SA Standards and International Standards) :

- SABP-A-026,028,029
- Boiler Manufactures Association (BMA)
- National Electrical Manufacturers Association (NEMA.)
- American Society of Mechanical Engineers ,Ch-13 (ASME)

**Reviewed and Concurred the
Results by Central Engineering**



Results



**Revised Water Treatment Program
Control Ranges**



Optimized Number of Field Samples



Optimized Number of LAB Tests Analysis

A

Revised Water Treatment Program Control Ranges

MUGAHWI

Document Responsibility: Materials and Corrosion Control Standards Committee
Issue Date: 27 January 2010
Next Planned Update: TBD

SABP-A-029

Corrosion Control in Boilers

GAHWI

**Table 3 – Control Ranges for Boiler Feedwater
(400-750 psig Watertube Boilers)**

Parameter	Sample Frequency	Control Range
Conductivity ¹	Daily	<10 µs/cm
pH ²	Once per shift	8.5-9.5

Attachment # 3

MOHAMMED.MUGAHWI

2018 Sample Analysis Forecast for the Utilities plants

PRODUCT	UNIT CODE	PLANT	SAMPLING POINT	DESCRIPTION	ANALYSIS	FREQUENCY	MIN	MAX
Boiler Feed Water(BFW)	ABQ-430	South Steam 100	ABQ-430-005	South Boiler Feed	PH	Once / shift	8.80	9.20
Boiler Feed Water(BFW)	ABQ-430	South Steam 100	ABQ-430-005	South Boiler Feed	CONDUCTIVITY	Once / shift	0	10.00



Optimized Number of Field Samples

Annual Number of Field Samples: ~~150 M~~ 88 M

Document Responsibility: Materials and Corrosion Control Standards Committee
 Issue Date: 27 January 2010
 Next Planned Update: TBD

SABP-A-029

Corrosion Control in Boilers

Table 6 – Control Ranges for Condensate

Parameter	Sample Frequency	Control Range
Conductivity	Daily	<10 microsiemens/cm
pH	Daily	8.5-9.2
Iron	Daily	<2.0 ppm
Copper ¹	Daily	<1.5 ppm

Attachment # 3

2018 Sample Analysis Forecast for the Utilities plants

PRODUCT	UNIT CODE	PLANT	SAMPLING POINT	DESCRIPTION	ANALYSIS	FREQUENCY	MIN	MAX
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	PH	Once / shift	8.50	9.20
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	CONDUCTIVITY	Once / shift	0	10.00
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	Iron	Once / shift	0	0.02
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	COPPER	Once / shift	0	0.01



Optimized Number of LAB Test Analysis

Annual Number of LAB Test Analysis: ~~660 M~~ 230 M

Document Responsibility: Materials and Corrosion Control Standards Committee
Issue Date: 27 January 2010
Next Planned Update: TBD

SABP-A-029

Corrosion Control in Boilers

Table 6 – Control Ranges for Condensate

Parameter	Sample Frequency	Control Range
Conductivity	Daily	<10 microsiemens/cm
pH	Daily	8.5-9.2
Iron	Daily	<2.0 ppm
Copper ¹	Daily	<1.5 ppm

Attachment # 3

2018 Sample Analysis Forecast for the Utilities plants

PRODUCT	UNIT CODE	PLANT	SAMPLING POINT	DESCRIPTION	ANALYSIS	FREQUENCY	MIN	MAX
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	PH	Once / shift	8.50	9.20
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	CONDUCTIVITY	Once / shift	0	10.00
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	Iron	Once / shift	0	0.02
Condensate Water (CW)	ABQ-410	Air and Water 111	ABQ-410-019	Storage Tank D-35	COPPER	Once / shift	0	0.01

Financial Impacts



Operational Cost Optimization

2018

2019

Total Number of Field Samples Points /yr

150 M



88 M

Total Operator Labor Hour/ yr (10 min/Sample Point)

25 M



15 M

Cost of Operator Labor \$/ yr (Employee Labor Cost \$28 /hr)

0.63 MM



0.41 MM

Laboratory Cost Optimization

2018

2019

Total Number of LAB Tests Analysis /yr

660 M

230 M



Total Lab Scientist Labor Hour/ yr (5 min/Test)

55 M

20 M



Cost of Lab Scientist Labor \$/ yr (Employee Labor Cost \$28 /hr)

1.5 MM

0.5 MM



Material Cost Optimization

2018

2019

Cost of Chemicals Reagents \$/yr (\$1.25)

0.5 MM



0.13 MM

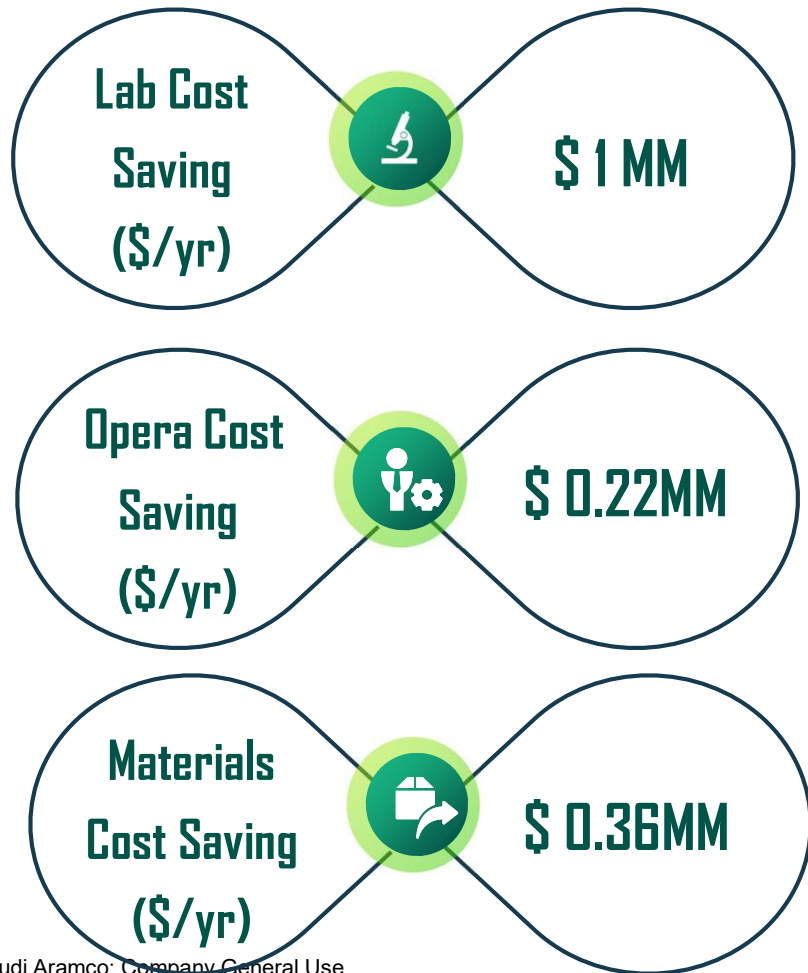
Cost of Water Bottles Samples \$/yr (sample point/ weekly change)

33 M



22 M

Total Cost Optimization



Path-Forward



01



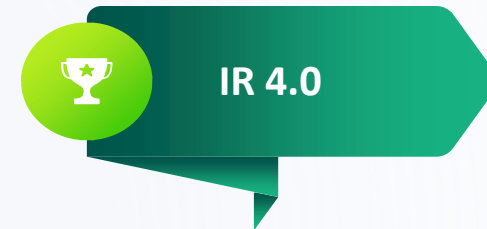
Monitor the assessment results and implement them in full scale by 2020.

02



Dashboard will enhance sample monitoring and timely corrective actions

03



Adapt IR 4.0 in order to enhance the water quality and looking for more enhancement such installing smart Analyzers.

Thank you!