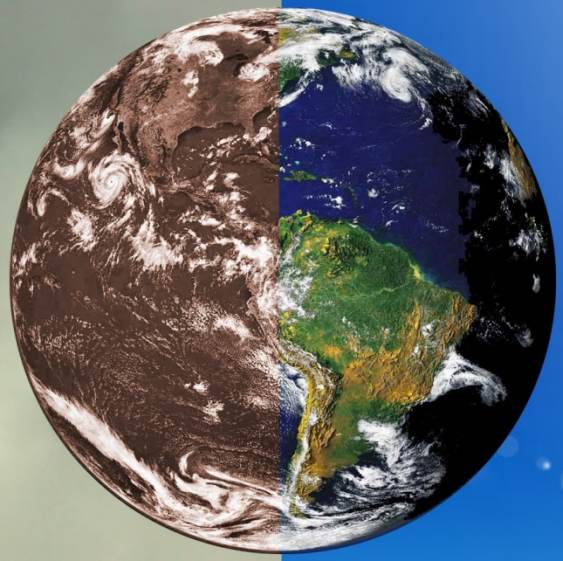


SOLUTION TO POLLUTION

A brief about online monitoring system

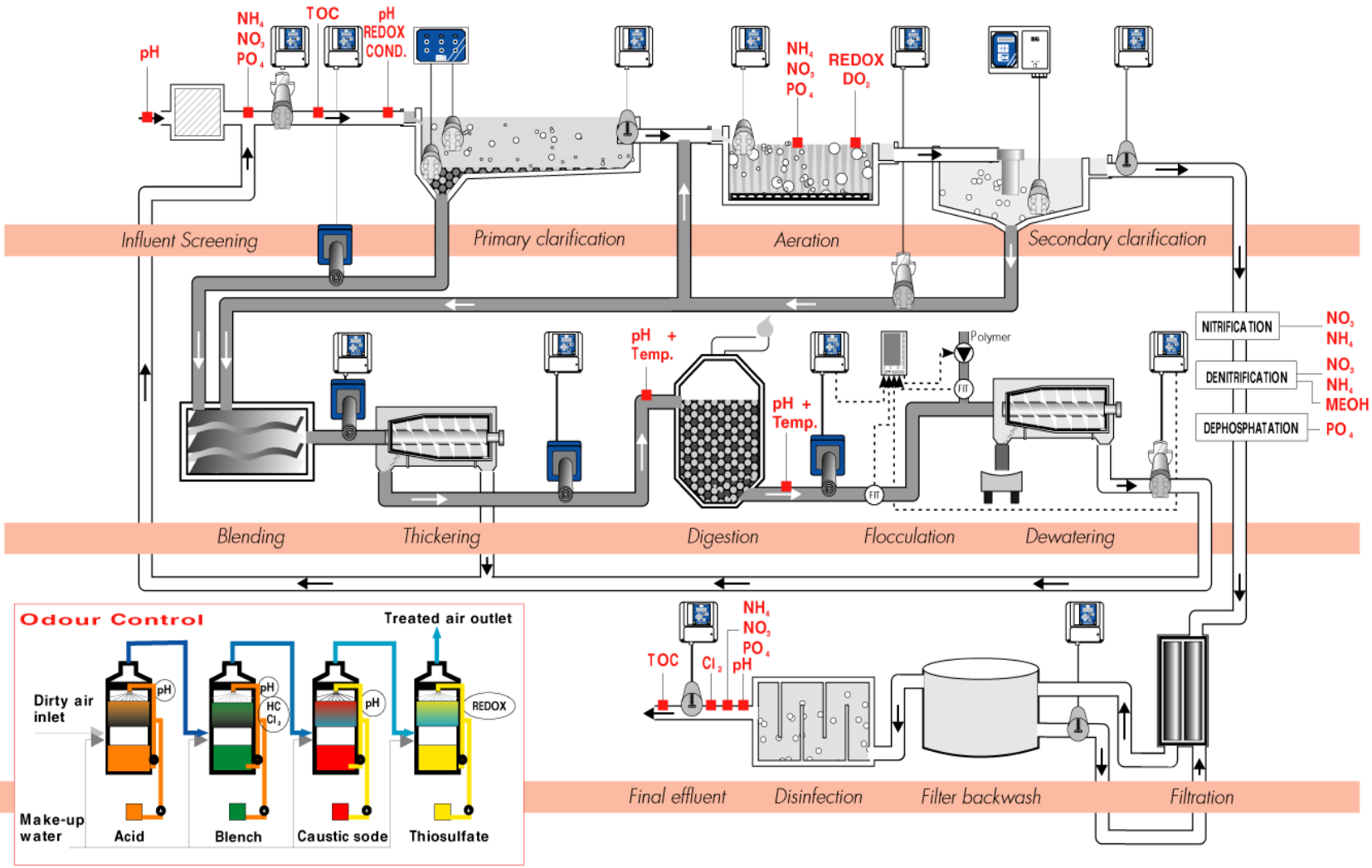
By Ajit Joshi & Amol Malode

Regulatory Regime

WHY IS REAL TIME MONITORING SYSTEM REQUIRED?

- Self Monitoring mechanism within the industries
- Increased management responsibility for regulatory compliance
- Increased cost-effectiveness
- Fast corrective action
- Improved control over impacts on the environment
- Higher environmental awareness
- Increased public access to information (public

Understanding a Typical waste water plant



PCB Guidelines

- First CPCB directives released on Feb, 214 with 31st March 2015 target date.
- Pollution control in 17 types of highly polluting industries and sugar is one of them.
- Self monitoring of compliance.
- Need to inculcate habit of self monitoring mechanism within the industries for complying the prescribed standards.
- The ground trothing of the values indicated by the online devices need to be done before bringing them in public domain for proper interpretation.
- To connect and upload the online emission and effluent monitoring data at SPCBs/PCCs and CPCB server in a time bound manner.
- Temper proof mechanism having facilities for online calibration.
- Detailed guidelines for ETP & RMS provided on 7th Nov, 2014.
- Specified suitable Techniques & Technologies for ETP monitoring.

PCB Guidelines

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Monitoring Systems operated by Industries

Air Pollution Monitoring System

- Emission Monitoring Systems

- Ambient Air Quality Monitoring Systems

Ambient Air Quality Monitoring Station

Water Pollution Monitoring System

- Effluent Monitoring Systems

List of Parameters for in line monitoring

Sr. No.	Category	ETP Parameters	Emission Parameters
1	Aluminium	COD, BOD, TSS, pH	PM, Fluoride
2	Cement	-	PM, NOx, SO2
3	**Distillery**	**COD, BOD, TSS, pH**	**PM**
4	Dye & Dye intermediate	COD, BOD, TSS, pH	-
5	Chlor Alkali	COD, BOD, TSS, pH	Cl2, HCL
6	Fertilizers	COD, BOD, TSS, pH	PM, Fluoride, Ammonia
7	Iron & Steel	COD, BOD, TSS, pH	PM, SO2
8	Oil & Refinery	COD, BOD, TSS, pH	PM, CO, NOx, SO2
9	Petrochemical	COD, BOD, TSS, pH	PM, CO, NOx, SO3
10	Pesticides	COD, BOD, TSS, pH	-
11	Pharmaceuticals	COD, BOD, TSS, pH	-
12	Power Plants	pH, TSS	PM, NOx, SO2
13	Pulp & Paper	COD, BOD, TSS, pH	-
14	**Sugar**	**COD, BOD, TSS, pH**	**-**
15	Tannery	pH, TSS	-
16	Zinc	COD, BOD, TSS, pH	PM, SO2
17	Copper	COD, BOD, TSS, pH	PM, SO2

General Pollution Norms*

- pH : 6.5 ~ 8.5
- COD : < 250 ppm
- BOD : < 30 ppm
- TSS : < 100 ppm

Measurement Technologies specified by CPCB

- UV VIS Absorption Spectroscopy,
  - Based on Beer-Lambert Law which states about linear relationship between absorbance and concentration of absorbing species.

- TOC Based Methodology
  - Based on combustion, oxidation and IR measurement.

Measurement technologies specified by CPCB

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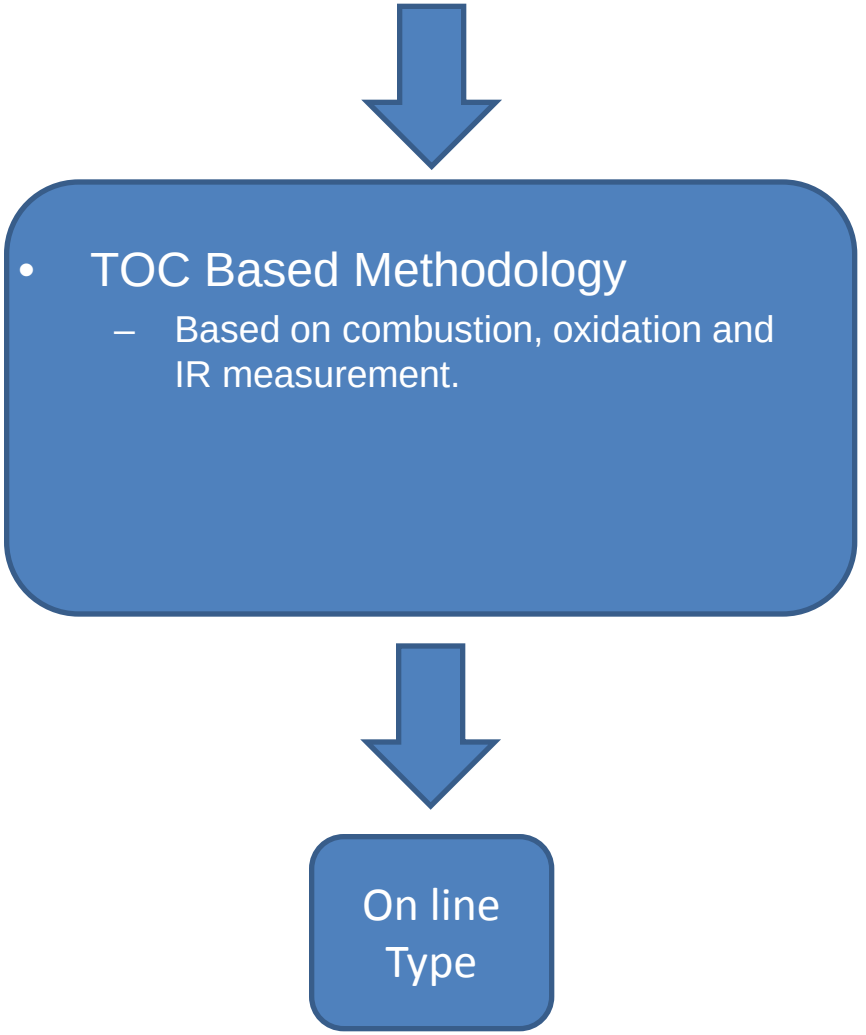
- TOC Based Methodology
  - Based on combustion, oxidation and IR measurement.

On line Type

In line Type

On line Type

Measurement technologies specified by CPCB



TOC Based COD/BOD Analysis

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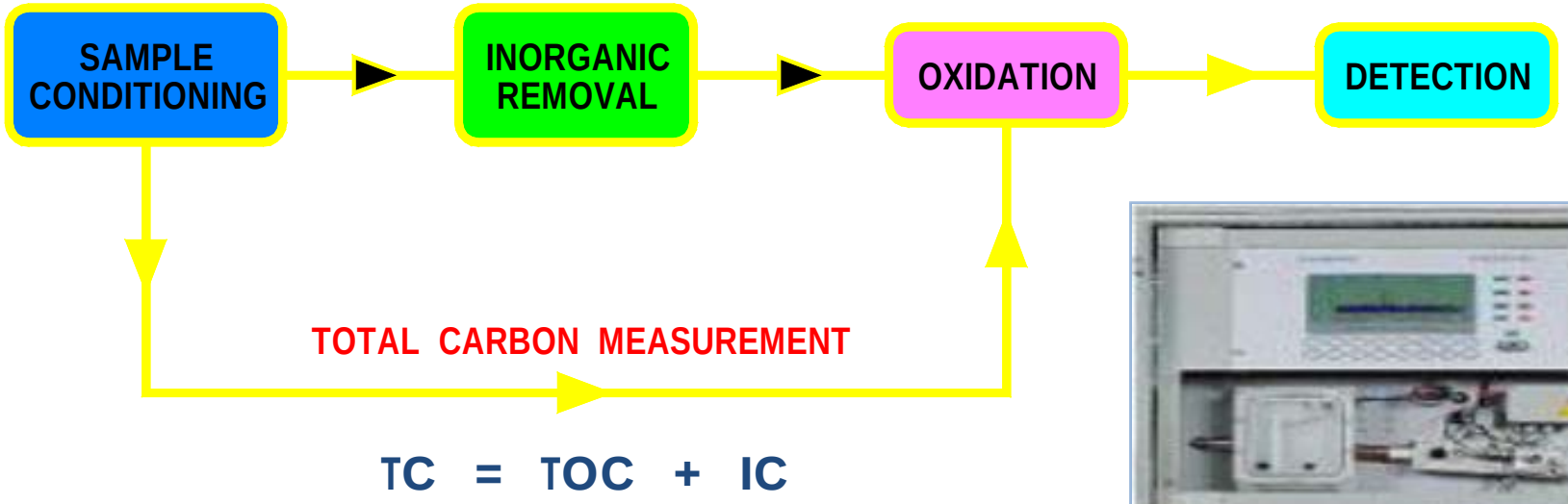
TOC measurement technology



TC = TOC + IC

TOC Based COD/BOD Analysis

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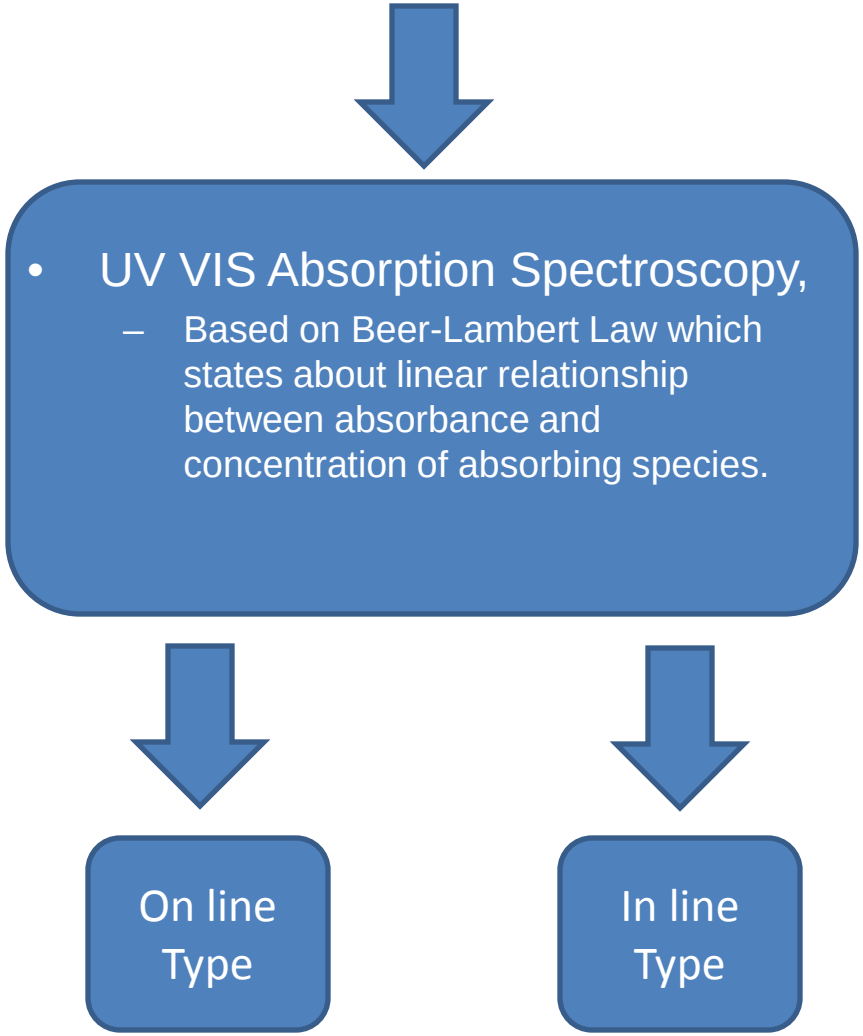
Features:

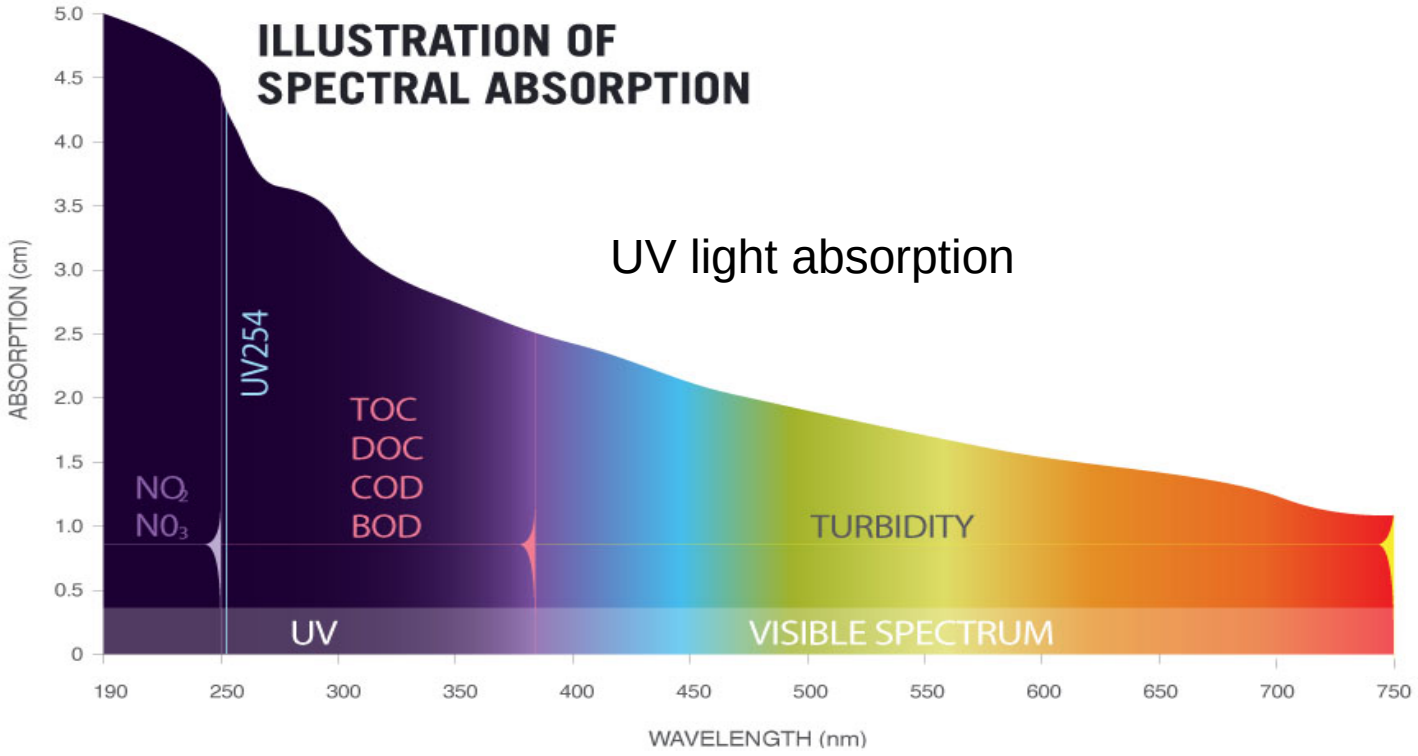
- The TOC measurement is a Global parameter, measuring all organic species.
- True online Analysis of TOC; COD & BOD are co-related/ derived from TOC.
- Cycle time is 5~7min or more
- Utilities: Two to three reagent & carrier gas (instrument Air/Nitrogen) required.
- Frequent calibration may be required
- Micron level filtration is required.
- TSS and pH has to be separately measured

Measurement technologies specified by CPCB



COD/BOD/TSS/pH Analysis

In accordance with DIN38404-C3 standard and can be considerate as an alternative method referring to *AFNOR XPT90-210* standard.



Measurement technologies specified by CPCB

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- UV VIS Absorption Spectroscopy,
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On line Type

COD/BOD/TSS/pH Analysis

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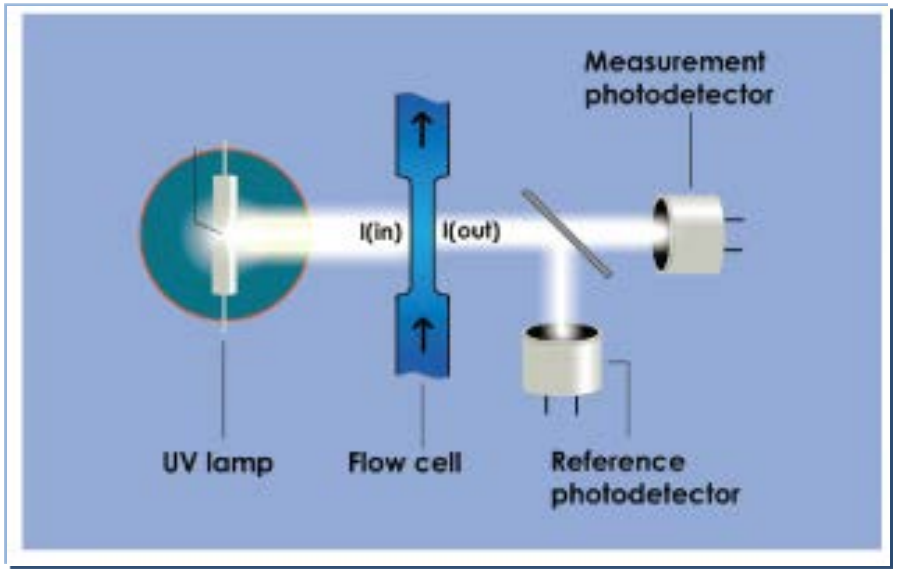
Principle: UV-Vis Absorption Spectroscopy – On line type

The measuring principle is based on the UV VIS Absorption Spectroscopy.

[C] = k log (Iin/Iout) With [C]: sample concentration
k : absorption coefficient (specific to each molecule)
Iin : light intensity at the input of the sample
Iout : light intensity at the output of the sample

Turbidity, suspended solids or dirt on the flow cell is automatically compensated by a differential measurement with a second detector at a reference wavelength.



- **COD measurement**: UV Vis Absorption Spectrophotometry type.
- **TSS measurement**: UV Vis Absorption Spectrophotometry type.
- **BOD measurement** Correlation type
- **pH measurement** using combination type pH sensor.

COD/BOD/TSS/pH Analysis

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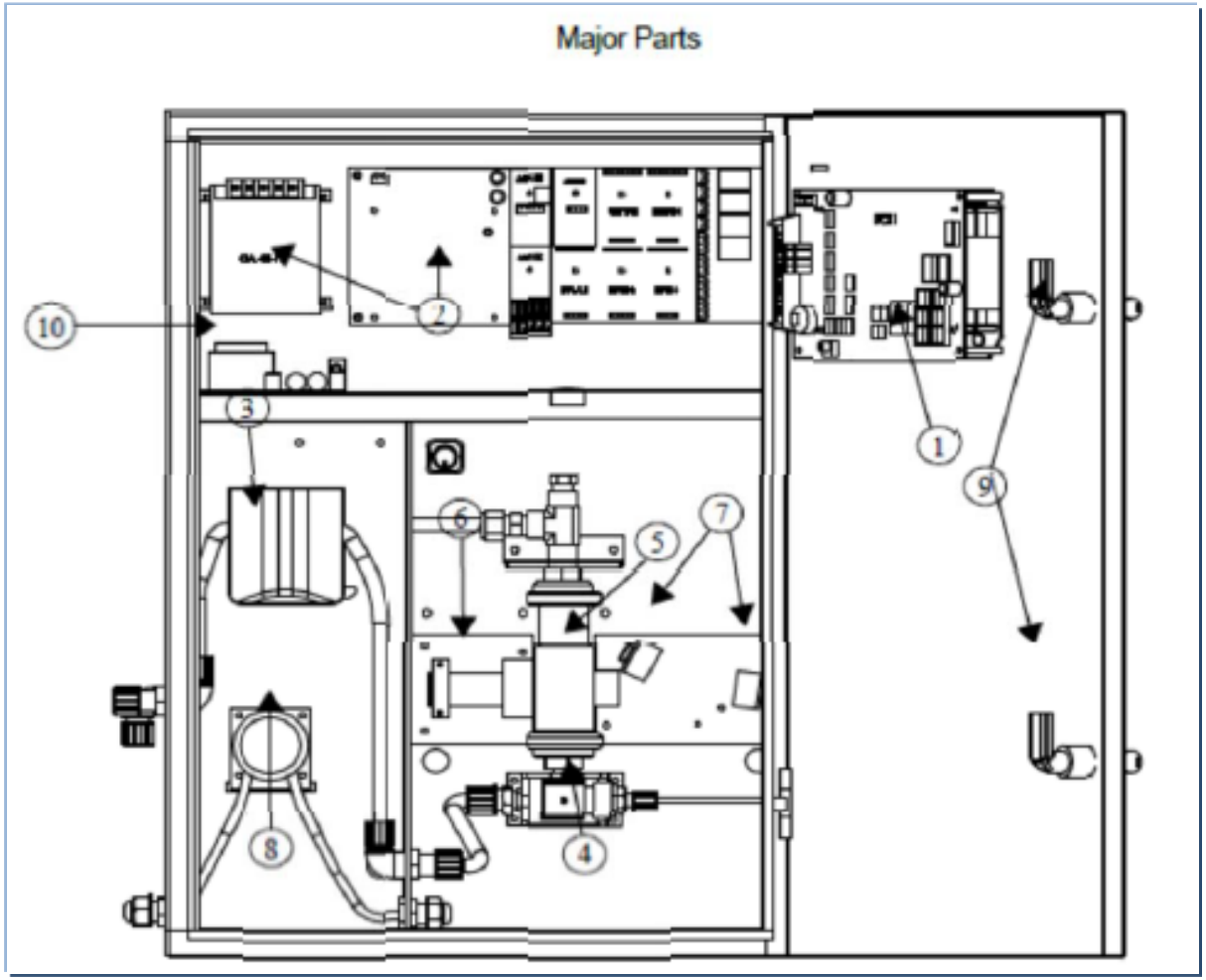
Principle: UV-Vis Absorption Spectroscopy – On line type



No	Description	Ref
1	Screen Board	PCX1
2	Power Supply Board	PCX2
3	Peristaltic Pump Head	
4	3-Way Electric Valve	
5	Flow Cell	
6	Xenon Lamp	
7	Photo Detector	
8	Cleaning Pump	
9	Locks	
10	0701 Board	

On Line Measurement technology

On Line Measurement technology

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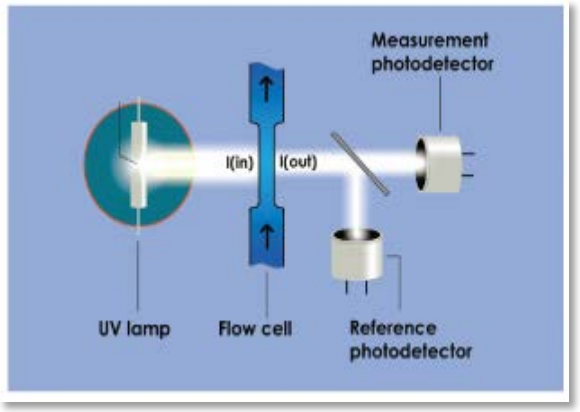
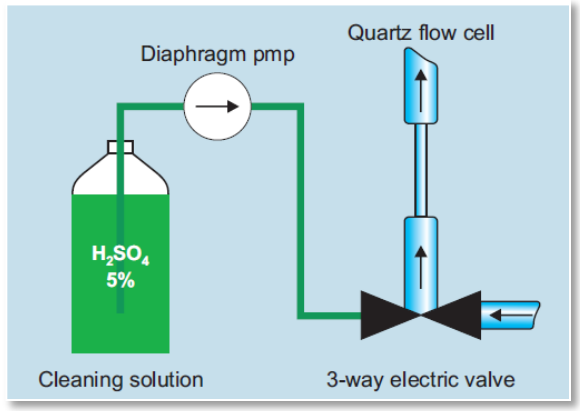
Features of online type analyzer

- No reagents or consumables.
- Auto Zero during cleaning cycle.
- Quick Response time.
- No Air supply.
- No filtering required.
- Non-Contact type optical system.
- Non metallic wetted parts.
- Compensation for Turbidity and colored samples.
- 10-years lamp life.
- Built-in peristaltic pump.
- Automatic Cleaning facility with freely programmable time period with DM water for cleaning.





Measurement technologies specified by CPCB

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In line Type

COD/BOD/TSS/pH Analysis

FORBES MARSHALL

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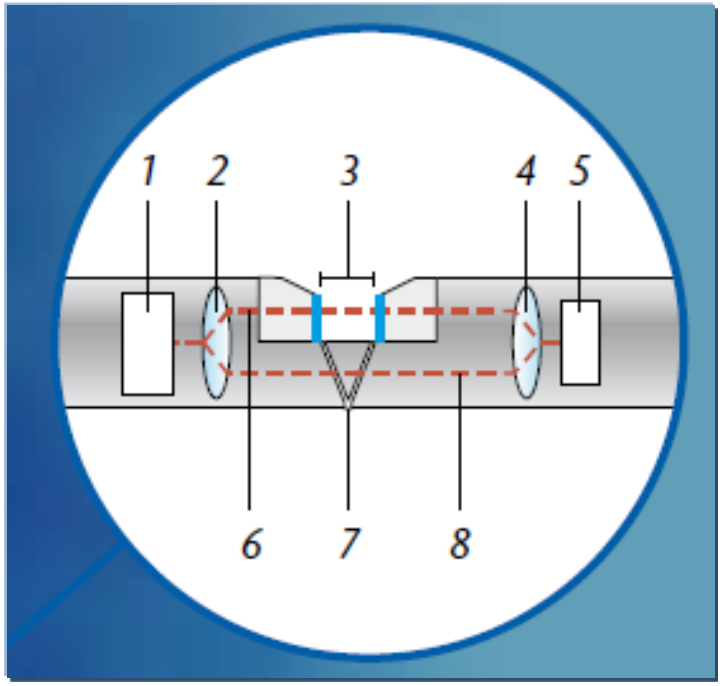

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- **TSS measurement**: UV Vis Absorption Spectrophotometry type.
- **BOD measurement** Correlation type
- **pH measurement** using combination type pH sensor.

In Line Measurement technology (Probe Type)

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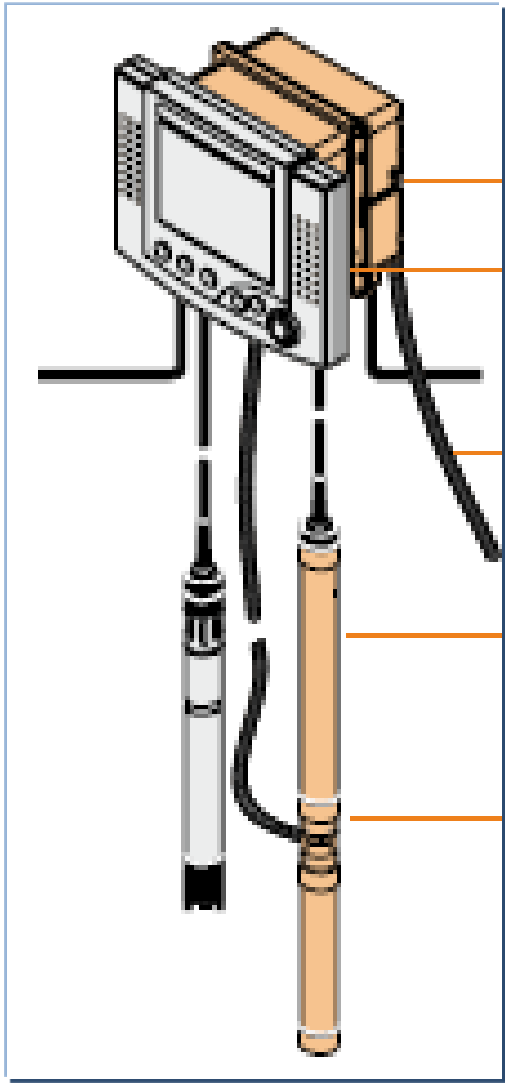
In-situ measurement

using a spectrometer sensor

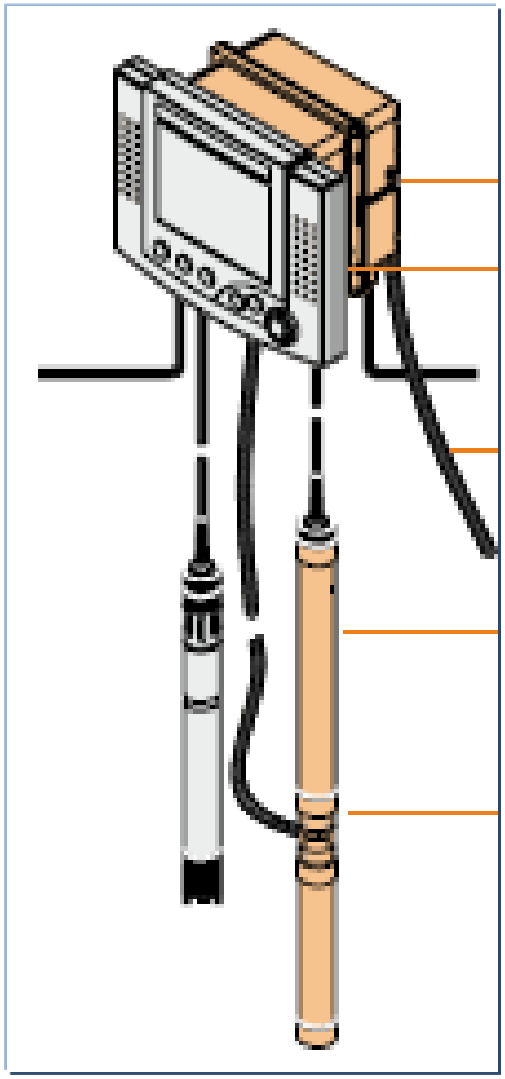
Continuous measurement

=> fast response time,
suitable for control strategies



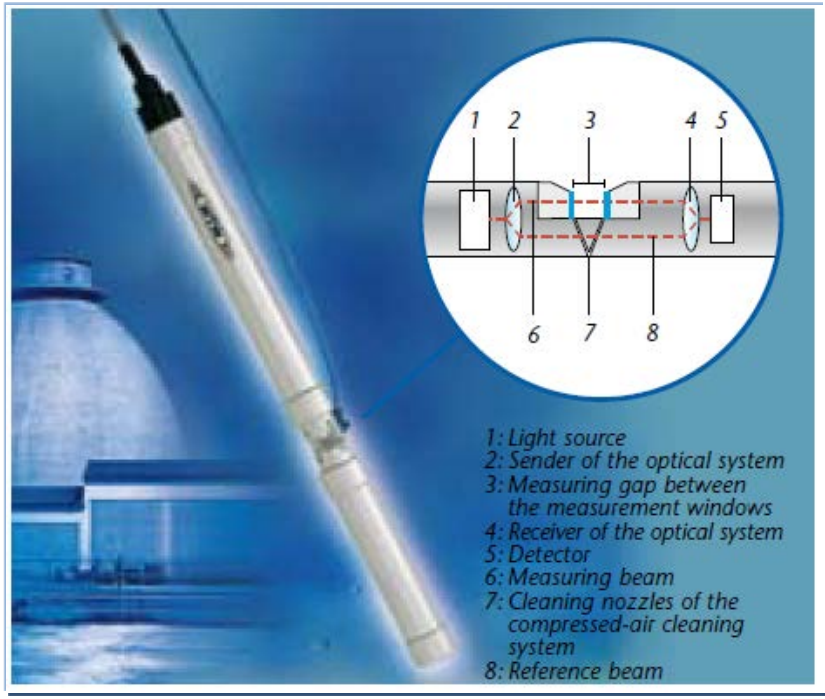
In Line Measurement technology (Probe Type)

FORBES MARSHALL



Features of In line type analyzer

- The sensor measures directly in the process medium.
- No sample transport, no sample preparation necessary.
- No lag-time between sampling and result of the measurement.
- Current values immediately available.
- Compensation of interferences and turbidity based on the spectral information
- Long operation periods by automatic air cleaning or ultrasonic cleaning for almost maintenance-free.
- Optical system works without consumables with low costs of ownership.



UV VIS vs TOC based analysis

UV VIS Absorbance type

- No reagents/ Chemicals.
- Response time : < 1 mins
- No regular maintenance.
- No air supply/ Nitrogen Supply.
- Can handle all type of samples. Non metallic MOC for harsh chemicals & applications
- Effective cleaning of flow cell being Non-contact type sensor
- No filtration.
- Maintenance free analysis

TOC based COD/BOD

- Costly, hazardous & difficult to handle chemicals.
- Response time : 6 -10 mins.
- Regular replacement of parts such as tubes & pumps.
- Air or Nitrogen as carrier gas.
- Pre-treatment of sample with high chloride values.
- Difficult to achieve appropriate cleaning.
- Needs primary filtration
- Would require AMC to achieve max. uptime.
- It uses sample quantity of less than 1cc
- Separate sensor for TSS.

ON line vs In line type measurement

On-line Type

- Non Contact type design
- Automatic zero offset correction
- Effective cleaning of flow cell via DM water solution (+5% H2SO4)
- Can handle all type of samples. Non metallic MOC for harsh chemicals & applications
- Turbidity & color compensation to achieve accurate measurement.
- In place calibration facility
- Better cleanability
- Sample need to be fetched to the analyzer
- Time required for the sample to reach the analyzer depending upon the distance of the sampling point and its pressure.

In-line Type

- Contact type
- OFF line Zero calibration.
- Cleaning type -Air-Jet/ Ultrasonic
- Difficult to handle dirty and corrosive samples.
- Has aging effect of sensor (light source), cable etc.
- Suitable sensor MOC to be selected
- Flow sensitivity
- Sample temperature limitation
- Direct Measurement via probe
- Additional time not required for sample to travel till the analyzer.

Components of monitoring system

- **Recommended Instrumentation/Monitoring Methodology**
- **Calibration**
- **Sampling Location**
- **Empanelment Of Laboratories**
- **Data Acquisition System**

Recommended Instrumentation/Monitoring Methodology

- All the measurement technologies mentioned in the presentation are equally acceptable as per CPCB guidelines.

- The user has to select the best applicable technology as per their own application and needs based on the merits of the proposed system and supplier.

- The user may also verify for the number of satisfactorily working installations of the supplier and the number of year of their experience.

CALIBRATION

To ensure proper functioning of the instrument/ analyser system for generating reliable and accurate data, the specified protocol shall be adopted by the Industry/Instrument Manufacturer/ Supplier:

- Effluent Quality Monitoring

PCB Guidelines

EFFLUENT QUALITY MONITORING

FREQUENCY OF CALIBRATION FOR:

pH, COD, BOD, TSS, TOC – Weekly Basis
Temperature – Monthly Basis

TARGET ACCURACY:

COD, BOD, TSS : ± 10 %
pH : ± 0.2 } against the standard

VALIDATION OF DATA:

Parameters validated against standard reference laboratory methods engaging recognize laboratories

DATA CAPTURE RATE: More Than 90%

CALIBRATION FREQUENCY :

Based on the performance of CEMS / CWMS dat quality, and Water suggested frequency of calibration for both A monitoring systems will be reviewe after six months

CALIBRATION

Calibration & Validation of COD:

➢Against authorized Lab reading of the sample as per the approved Lab technologies.

➢Using Potassium hydrogen Phthalate/KHP (CAS 877-24-7) 851mg to 1L of DI water for 1000ppm COD . You can dilute the same to prepare any standard of lower value (as per APHA standards).

Calibration & Validation of TSS:

➢Against Lab reading of the sample as per the approved Lab technologies.

➢Kaolin power can be used to prepare a standard solution for calibration and verification of total suspended solids. This solution gives better results when kept overnight and stirred continuously. (as per APHA standards).

Calibration & Verification of pH:

➢Using standard buffer solution of 4.01/7.00/9,21 pH

SAMPLING

The analysers/ instruments/ sensors have to be installed as per the specified sampling criteria so as to have representative sampling of the treated effluent discharges. While collecting samples for verification and comparison of the values recorded by real time monitoring systems i.e. analysers/ instruments/ sensors, representative sampling shall be ensured by the empanelled laboratories.

Important check points for regulators

- To ensure a representative sample of the all plant effluent is captured at the analyzer inlet or at the probe installation.
- All the sensors/ analyzers for real time monitoring shall be installed in a defined channel, without any turbulence or eddy current.
- In case more than one channel joins the common discharge channel, the sampling system shall be installed after proper mixing of the 0ne (or more) streams.

Important check points for regulators

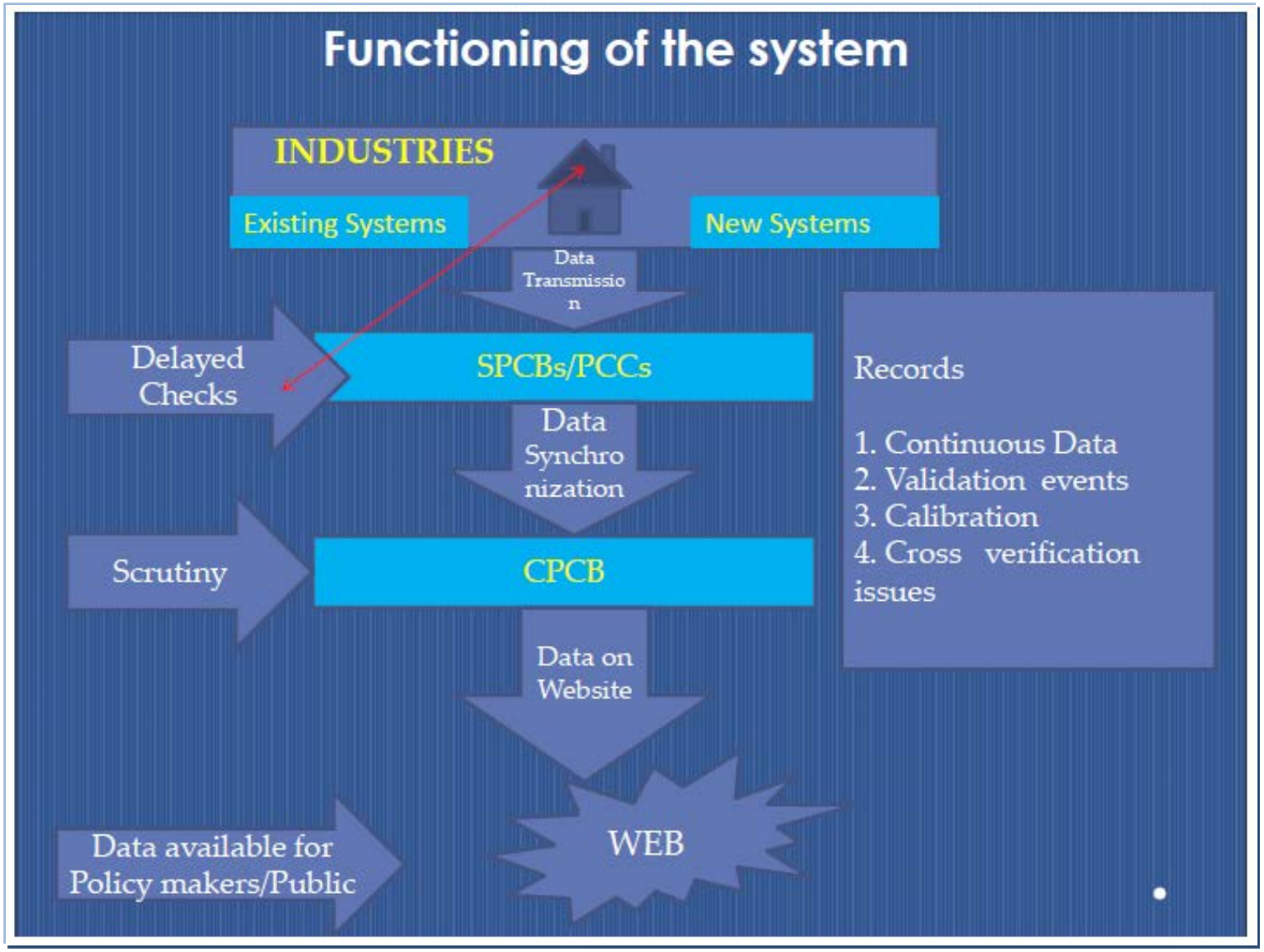
- All optical sensors require frequent cleaning in waste monitoring applications.

- There are several types of cleaning systems commonly used for UV-VIS analyzers:
  - Automatic cleaning
  - Compressed air cleaning
  - Automatic wiper cleaning
  - Automatic brush cleaning
  - Ultrasonic cleaning
- To ensure proper sampling point for Lab/Local analysis and compatible Lab measurement technologies for comparison.
- *Installation of analyzer/ indicator should preferably under a shade for efficient operation of the system.*

Key points to note for regulators

- Regulator during the visit should validate the sample pickup point or sensor installation location to ensure representative sample.
- Repeatability should be considered apart from the accuracy of the system.

Components of monitoring system

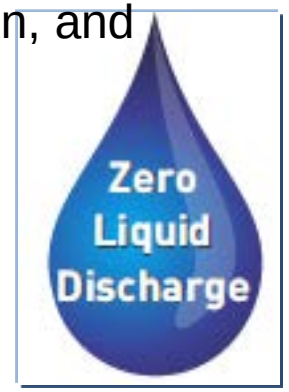


Solution for ZERO LIQUID DISCHARGE Plants

Zero Liquid Discharge systems employ the most advanced wastewater treatment technologies to purify and recycle virtually all of the wastewater produced, leaving zero discharge at the end of the treatment cycle. The ZLD process involves an advanced wastewater treatment method that includes ultrafiltration, reverse osmosis, evaporation/crystallization, and fractional electrode ionization.

Need for Metering and Monitoring in ZLD Plants

Every industry claiming zero discharge has to follow strict norms and is prohibited from discharging any liquid waste originating from its facilities. To meet the necessary regulations, for difficult to treat wastewaters, or in situations where scarcity of water demands water recovery (recycle/reuse) – KROHNE MARHALL offers the ideal solution for metering and monitoring in ZLD plants, helping you achieve norm compliance, reduce your carbon footprint, create positive public perception, and avoid environmental pollution.



Solution for ZERO LIQUID DISCHARGE Plants

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IP Camera: Network Video Recorder

1.3Mp HD Cost-effective Network IR PTZ Dome Camera

- 20x optical zoom
- H.264 & MJPEG dual-stream encoding
- Max 240°/s pan speed, 360° endless pan rotation
- Up to 255 presets, 5 auto scan, 8 tour, 5 pattern
- Micro SD memory, IP66
- IR Distance up to 100m
- DVR for data recording

SITE VISIT


Thank You
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