OCEMS

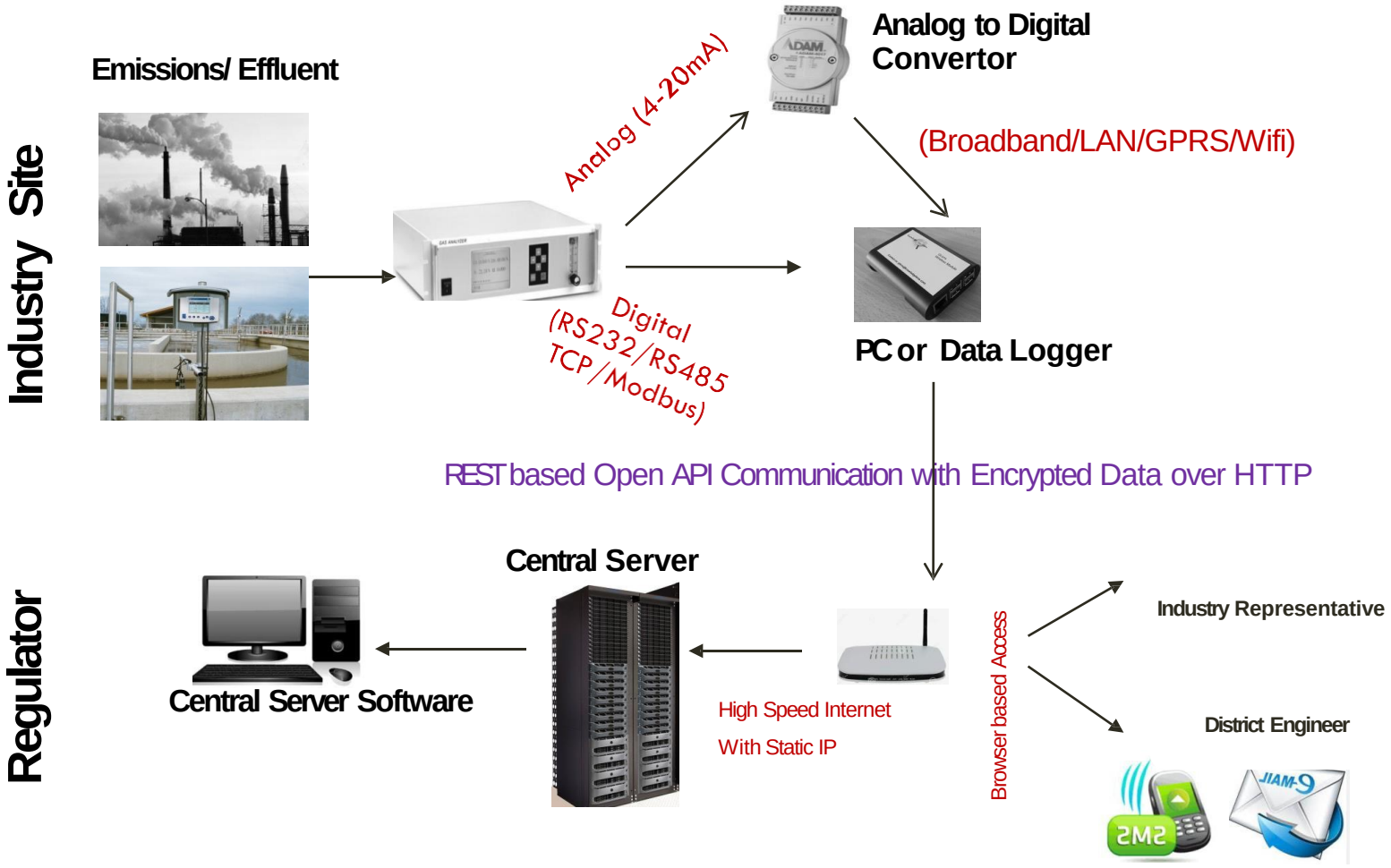
REQUIREMENTS & REGULATORY

GUIDELINES

J. S. Kamyotra

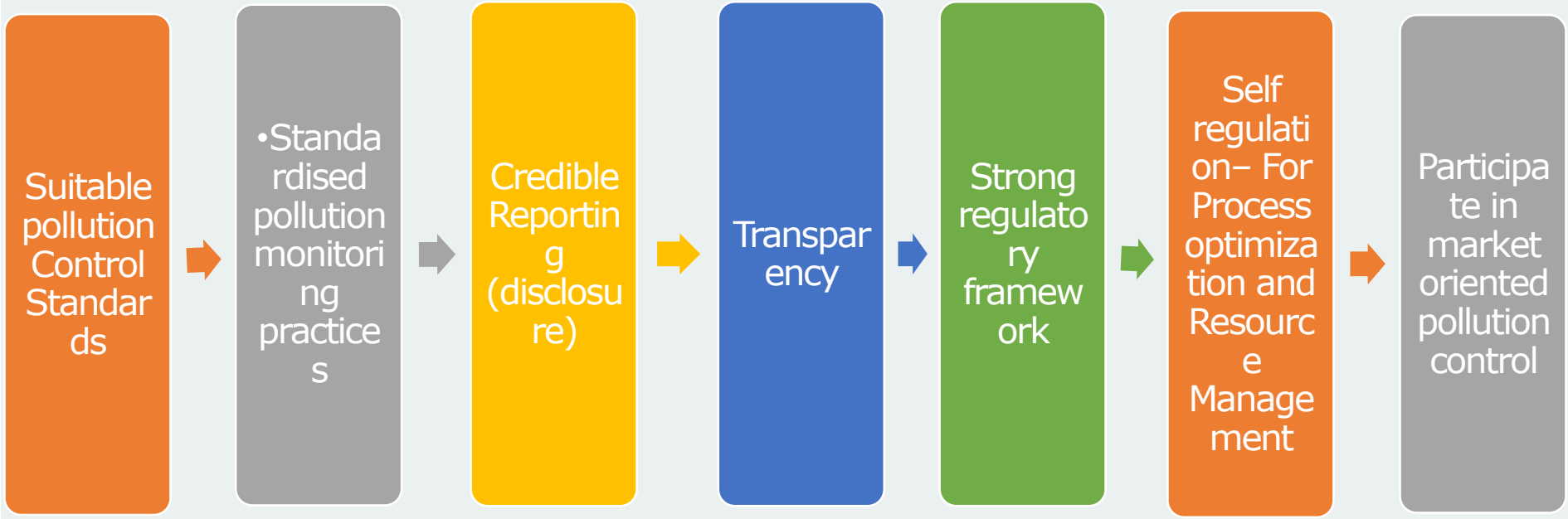
kamyotra@yahoo.co.in

Best Practices and Handling of CEMS in Emission Monitoring



Conceptual view of online monitoring

A good environmental governance regime paves the path for sustainable growth of a nation- assures quality environment, equitable growth, health & safety for its people while promoting growth.



HOW CEMS STARTED

CPCB direction issued in Feb 2014

-17 categories of industries, CETPs, common bio- medical treatment facility, Common hazardous waste treatment facilities, municipal solid waste treatment

CPCB direction under National Ganga River Basin Authority Mission (NGRBA), March 2014

- For installation of real time effluent quality monitoring- nearly 800 industries

CPCB Guidelines for CEMS- August 2017; Guidelines Revised in Aug 2018-

Mandated for RED category industries in revised guidelines.

OCEMS (Online CONTINUOUS EMISSIONS / EFFLUENT MONITORING SYSTEM)

The system composed of Equipment, Instrument to draw, condition, analyze the Effluent or Emission sample and provide permanent record of emissions or process control parameters continuously at real time basis is called Continuous Emissions Monitoring System (CEMS)

COMPONENTS OF A CEMS

- Sample Collection — sampling device
- Interface – Sample conditioning & transportation wherever required
- Analyzer — Specific to pollutants, generates an output signal proportional to the concentration
- Calibration devices – Analyzer control system,
- calibration gases, recording etc.
- Data Acquisition – Data logging system record electrical signals in defined number of channels
- Data Handling System— Pick, calculate, record, transfer
- the data in report form to desired destination
- Additional Devices: Flow Rate (Velocity Monitor, Temperature sensor, Moisture monitoring device, Diluent Gas monitoring Devices

Benefits of OCEMS

Provides real time data.

Time series analysis possible with continuous data.

Reduction in regulatory cost as well as long term monitoring cost.

Helps optimization in process control

Continuous performance check of Air Pollution Control Devices and optimization of resources used.

Expected better compliance through self regulation by industry hence lower emission.

Remotely accessible to operator/regulator.

Greater transparency in monitoring of performance. Develop confidence in Market

Can open market driven pollution control venture (ETS)

17 CATEGORIES OF INDUSTRY, THEIR EMISSION STANDARDS AND PROBABLE OPTIONS FOR CEMS

SN	Industries	Pollutants Emission Limits	Recommended CEMS Options
1	Aluminium Smelting		
	Raw Material Handling	PM – 150	In situ PM CEMS NDIR for CO FTIR for CO and F DOAS for all
	Calcinations	PM – 250 CO – 1% (Max)	
	Green Anode Shop	PM – 150	
	Anode Bake Oven	PM – 50 Total Fluoride – 0.3 Kg/MT of Al	
	Pot room	PM – 150 Total Fluoride – 2.8 Kg/MT of Al for Soderberg Technology Total Fluoride – 0.8 kg/t for Pre-baked Technology	
2	Basic Drugs & Pharmaceuticals	For incinerator PM – 50 HCI-50 SO2 – 200 CO – 100 TOC – 20 PCDDs /F – 0.2ng TEQ/NM^3 (existing) PCDDs /F – 0.1ng TEQ/Nm^3 (New commissioned after July 2009) Metals – 1.5	Preferably Extractive PM CEMS NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis FID for HC (TOC) PCDDs , Metals not possible by CEMS Chemiluminescence UV-Fluorescence

SN	Industries	Pollutants Emission Limits	Recommended CEMS Options
3	**Chlor Alkali (Hg Cell)** (H_2 Gas stream) (Hypo- tower) (HC Plant)	Hg – 0.2 mg/Nm^3 Cl_2 – 15 mg/Nm^3 HCl vapour and Mists – 35 mg/Nm^3	FTIR for multi-gas
4	**Cement Plant**		
	Rotary Kiln-without co-processing	PM-30 mg/Nm^3 SO2- 100,700,1000 mg/Nm^3 (Pyrite Sulphure 0.25%, 0.5 %, 1.0 %) NOx – 600 (New), 800 (Existing)	Preferably Extractive PM CEMS NDIR for CO IR GFC, FTIR, DOAS for multi-gas analysis FID for HC (TOC) PCDDs , Metals not possible by CEMS
	Rotary Kiln with co-processing	PM-30 mg/Nm^3 SO2- 100,700,1000 mg/Nm^3 (Pyrite Sulphure 0.25%, 0.5 %, 1.0 %) NOx – 600 (New), 800 (Existing)	
	Rotary Kiln with co-processing	HCl- 10 mg/Nm^3 HF – 1 mg/Nm^3 TOC – 10 mg/Nm^3 Hg and its compounds – 0.05 mg/Nm^3 Cd+Tl and their compounds – 0.05 mg/Nm^3 Sb+As+Pb+Co+Cr+Cu+Mn+Ni+V and their compounds – 0.5 mg/Nm^3 Dioxins and Furans – 0.1 ngTEQ/Nm^3	Chemiluminescence UV-Fluorescence
	Vertical Shift Kiln	PM – 50 mg/Nm^3 (New) CPA/Urban Centre – 75 mg/Nm^3 (old) Others – 150mg/Nm^3 (old)	

SN	Industries	Pollutants Emission Limits	Recommended CEMS Options
5	**Copper Smelting**		
	Copper Smelting (Old Units) Copper Smelting (New Units)	PM—100 mg/Nm^3 PM – 75 mg/Nm^3	In-situ PM CEMS
	SO2 recovery units above 300 T	SO2 – 1370 mg/Nm^3 (Existing);1250 mg/Nm^3 (New) Acid Mist and Sulphur Trioxide – 90 mg/Nm^3 (Existing); 70 mg/Nm^3 (New)	UV Fluorescence, FTIR, DOAS
	SO2 recovery units above 300 T	SO2 – 1250 mg/Nm^3 (Existing) ;950 mg/Nm^3 (New) Acid Mist and Sulphur Trioxide – 70 mg/Nm^3 (Existing); 50 mg/Nm^3 (New)	
6	**Dyes and Dye Intermediate**		
	Captive Incinerator	PM – 50 mg/Nm^3 SO2 – 200 mg/Nm^3 HCl (Mist) – 50 mg/Nm^3 CO – 100 mg/Nm^3 TOC – 20 mg/Nm^3 PCDDs /F – 0.1ng TEQ/NM^3 Metals – 1.5 mg/Nm^3	In situ PM CEMS IR GFC, FTIR, DOAS TLD, PAS for multi-gas analysis FID for TOC PCDDs, Metal not possible by CEMS
7	Fermentation (Distillery)	Boiler Standard	In situ System for PM
8	Fertiliser (Phosphate)	PM – 150 Total Fluoride – 25	In situ System for PM FTIR, DOAS TLD, PAS for F
	Fertiliser (Urea) Old plants	PM – 150 or 2Kg/MT product	Velocity monitor

SN	Industries	Pollutants Emission Limits	Recommended CEMS Options
9	**Integrated Iron & Steel**		In situ System for PM, IR GFC ,FTIR, TLD, DOAS, Chemiluminescence UV-Fluorescence NDIR for CO Velocity monitor
	Sintering plant	PM – 150	
	Steel making	PM – 150 (Normal Operation); PM – 300 (Oxygen Lancing)	
	Rolling Mill	PM – 150	
	Coke Oven	PM – 50	
		SO2 – 800	
		NOx - 500	
		CO – 3 Kg/T coke	
	Refractory Material Plant	PM – 150	

SN	Industries	Pollutants Emission Limits			Recommended CEMS Options
10	Leather Processing Tanneries	Boilers Standard			In situ PM CEMS
11	Oil Refinery				
	Furnace, Boiler and captive power plant Gas based	Polutants	Before 2008	After 2008	
		SO2	50	50	BAM for PM IR GFC, FTIR, DOAS TLD, PAS
		NOX	350	250	
		PM	10	5	
		CO	150	100	
		Ni + V	5	5	
		H_2S	150	150	
	Furnace, Boiler and captive power plant Liquid Fuel based	SO2	1700	850	In situ PM CEMS IR GFC, FTIR, DOAS TLD, PAS for multi-gas analysis or individual technology specific to pollutants
		NOX	450	350	
		PM	100	50	
		CO	200	150	
		Ni + V	5	5	
		H_2S	150	150	
	FCC Regenerator		Hydro	Others	
		SO2	500	1700	
		NOX	400	450	
		PM	100	350 (N) 100	
		CO	400	50 (N) 400	
		Ni + V	5	300 (N) 2 (N) 2	CEMS Not Applicable for Metals Opacity
		% Opac.	30	30	
	SRU	H_2S	15	10 (N)	IR GFC

	Industries	Pollutants Emission Limits			Recommended CEMS Options
12	Pesticide	HCl – 20 CL2 – 5 H2S – 5 P2O5 (as H3PO4) - 10 NH3 – 30 PM with Pesticide – 20 CH3Cl – 20 HBr – 5			IR GFC, FTIR, DOAS TLD, PAS P2O5, PM with Pesticide and CH3Cl are not conventional CEMS parameter
13	Pulp & Paper	PM – 250 H_2S – 10			In situ System for PM IR GFC for H2S
14	Petrochemical	Polutants	Existing	New	In situ PM CEMS IR GFC, FTIR, DOAS TLD, PAS for multi-gas analysis or individual technology specific to pollutants
		SO2 (Gas) (Liquid) NOX (Gas) (Liquid) PM (Gas) (Liquid) CO (Gas) (Liquid)	50 1700 350 450 10 100 150 200	50 850 250 350 05 50 100 150	
15	Sugar	Boiler Standard			In situ PM CEMS

	Industries	Pollutants Emission Limits	Recommended CEMS Options
16	Thermal Power Plants	**TPP before 31.12.2003** PM-100 mg/Nm^3 SO_2- 600 mg/Nm^3 (<500 MW) -200 mg/Nm^3 (>500 MW) NOx - 600 mg/Nm^3 Hg – 0.03 mg/Nm^3 (>500 MW) **TPP between 01.012004 & 31.12.2016** PM- 50 mg/Nm^3 SO_2- 600 mg/Nm^3 (<500 MW) -200 mg/Nm^3 (>500 MW) NOx - 450 mg/Nm^3 Hg – 0.03 mg/Nm^3 **TPPs after 01.01.2017** PM- 30 mg/Nm^3 SO_2- 100 mg/Nm^3 NOx -100 mg/Nm^3 Hg – 0.03 mg/Nm^3	Insitu system for CEMS, IR-GFC, FTIR, DOAS, TLD Chemilumescemce, fluorescence

	Zinc Smelting (New Units)	PM – 75	
	SO2 recovery units upto 300 T	SO2 – 1370 mg/Nm^3 (Existing);1250 mg/Nm^3 (New) Acid Mist and Sulphur Trioxide – 90 mg/Nm^3 (Existing); 70 mg/Nm^3 (New)	FTIR, DOAS
	SO2 recovery units above 300 T	SO2 – 1250 mg/Nm^3 (Existing) ;950 mg/Nm^3 (New) Acid Mist and Sulphur Trioxide – 70 mg/Nm^3 (Existing); 50 mg/Nm^3 (New)	
	Boilers (According to capacity)		In situ PM CEMS
		Particulate Matter	IRGFC, Chemilumisance UV – fluorescence Concentration corrected to 12 % CO_2 concentration
	Less than 2 T/ hr	1600 mg/Nm^3	
	2 – 15 T/hr	1200 mg/Nm^3	
	Above 15 T/hr.	150 mg/Nm^3	
	Steam Generation		
	less than 2 TPH 2 to less than 10 TPH 10 to less than 15 TPH 15 to above	(Particulate Matter) Revision proposed* 1200 mg/Nm^3 500 mg/Nm^3 800 mg/Nm^3 150 mg/Nm^3 150 mg/Nm^3 50 mg/Nm^3	Measured values for PM, SO_2 and NOx to be normalised at 6 % O_2 for solid fuels and 3% O_2 for liquid fuels on dry basis • For Coal /lignite based boiler TPP standards applicable • 10 TPH and above boiler to install CEMS for PM & SO_2

Notes:

Wherever load based standards are notified Flow/Velocity Monitor is mandatory

O2, CO2 monitoring is essential where the standards are to be corrected for.

CO2 monitoring is a complementary part of monitoring if extractive dilution system is selected.

COMMON HAZARDOUS WASTE INCINERATOR

	A. Emission		
	Limiting concentration in mg/Nm³ unless stated	Sampling Duration in (minutes) unless stated	Recommended CEMS
Particulate Matter	50	30	
HCL	50	30	Preferably Extractive
SO_2	200	30	PM CEMS
CO	100	30	NDIR for CO
	50	24 hours	IR GFC, FTIR, DOAS for multi-gas analysis
Total Organic Carbon	20	30	
HF	4	30	FID for HC (TOC)
NO_x (NO and NO_2, expressed as NO_2	400	30	PCDDs , Metals not possible by CEMS
Total dioxins and Furans	0.1 ngETQ/Nm³	8 hours	
Cd+Th+their Compounds	0.05	2 hours	
Hg and its Compounds	0.05		
Sb+As+Pb+Co+Cr+Cu+Mn+Ni+ V+ their Compounds	0.50		

Notes:

i. All monitored values shall be corrected to 11 % oxygen on dry basis.

ii. The CO_2 concentration in tail gas shall not be less than 7%.

iii. In case, halogenated organic waste is less than 1% by weight in input waste, all the facilities in twin chamber incinerators shall be designed to achieve a minimum temperature of 950°C in secondary combustion chamber and with a gas residence time in secondary combustion chamber not less than 2 (two) seconds.

iv. In case halogenated organic waste is more than 1% by weight in input waste, waste shall be incinerated only in twin chamber incinerators and all the facilities shall be designed to achieve a minimum temperature of 1100°C in secondary combustion chamber with a gas residence time in secondary combustion chamber not less than 2 (two seconds).

v. Incineration plants shall be operated (combustion chambers) with such temperature, retention time and turbulence, as to achieve Total Organic Carbon (TOC) content in the slag and bottom ashes less than 3%, or their loss on ignition is less than 5% of the dry weight].

ISSUES WITH CEMS IMPLEMENTATION

Technology Selection:
-Suitability / Fitness to specific emission
-Quality Certification (COP)

Installation

Calibration

Field Performance testing

Data Acquisition

Data Handling System

Data Robustness

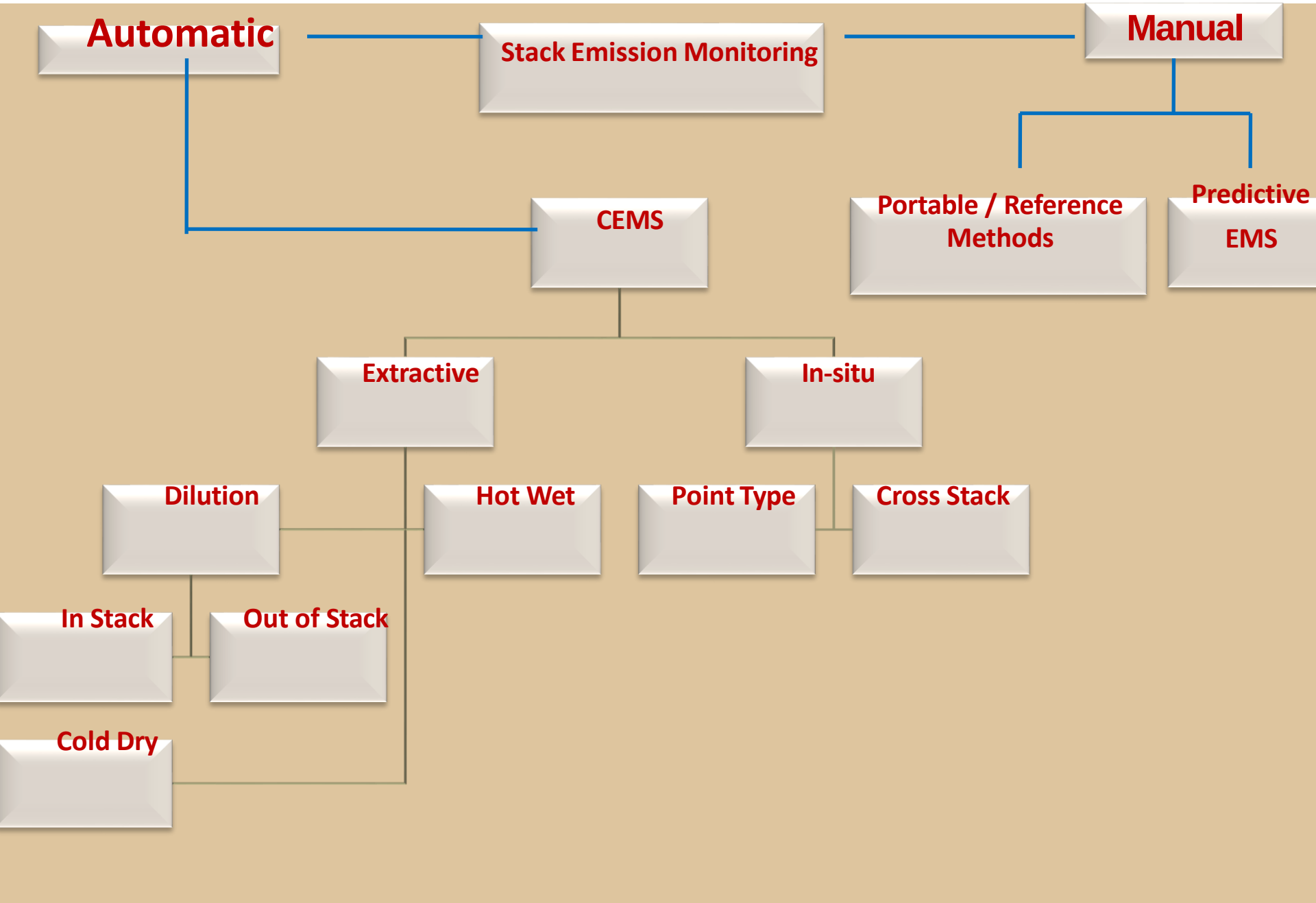
Data Exceedance / Violation

Compliance

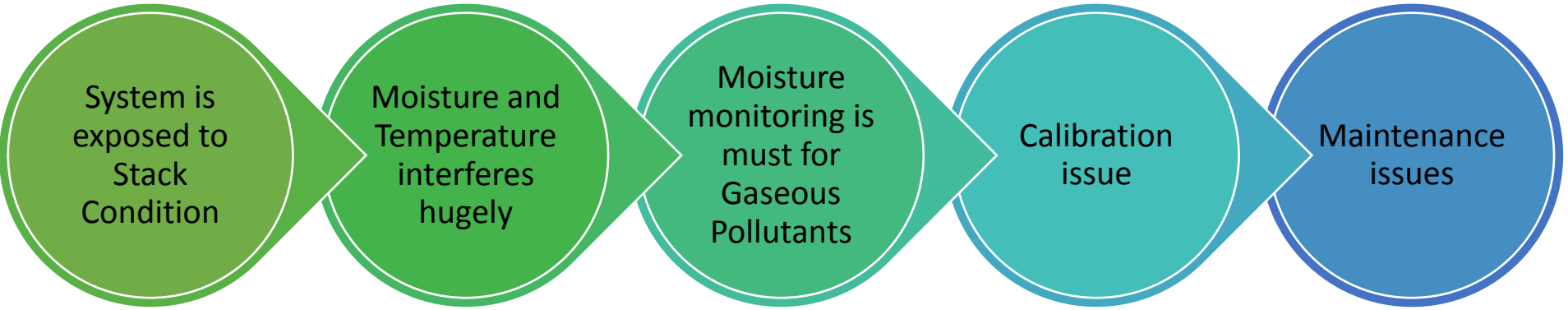
Parameter to be monitored (Online)

Category	Effluent Parameters(13)	Emission Parameters(7)
Aluminium	pH, BOD, COD, TSS, Flow	PM, Fluoride
Cement	-	PM,NOx,SO_2
Distillery	pH, BOD,COD,TSS, Flow	PM
Dye and dye	pH, BOD,COD, TSS, Cr, Flow	-
Chlor Alkali	pH, TSS, Flow	Cl_2,HCl
Fertilizers	pH, flow, Ammonical Nitrogen, F	PM, Fluoride, NH3
Iron & steel	pH, Phenol, cyanide, flow	PM,SO_2
Oil refinery	pH, BOD,COD,TSS, flow	PM,CO,NOx,SO_2
Petrochemical	pH, BOD,COD,TSS, flow	PM,CO,NOx,SO_2,
Pesticides	pH, BOD, COD, TSS, Cr, As , flow	-
Pharmaceutical	pH, BOD, COD, TSS ,Cr ,As, flow	-
Power Plants	pH, TSS, Temperature	PM,NOx,SO_2
Pulp & paper	pH, BOD, COD, TSS ,AOx, flow	-
Sugar	pH, BOD,COD,TSS, flow	-
Tannery	pH, BOD, COD, TSS, Cr, flow	-
Zinc	pH, TSS, flow	PM SO_2
Copper	pH, TSS, flow	PM SO_2

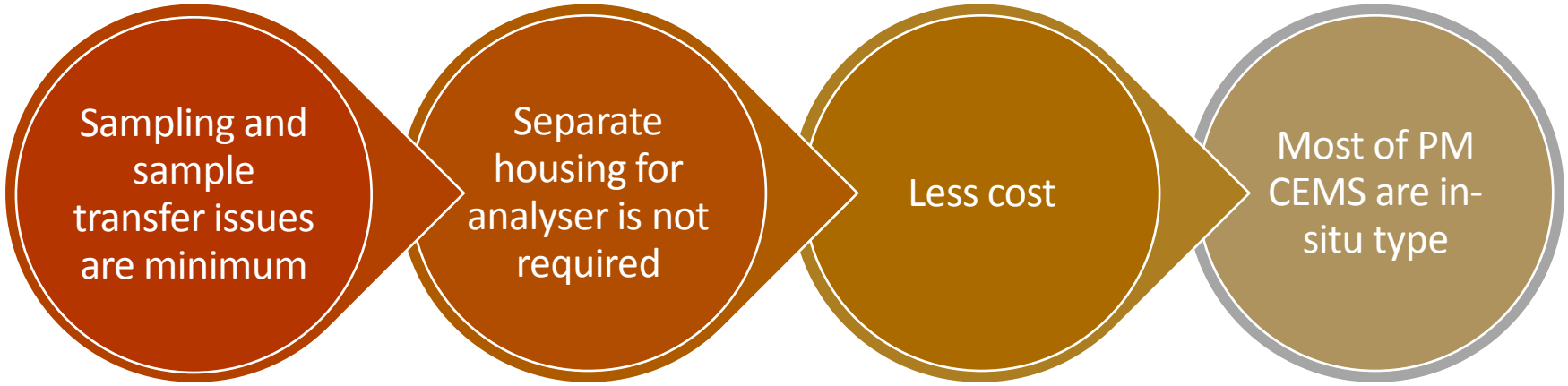
Methods & Options for Source Emission Monitoring



Challenges in In-situ CEMS



Advantages in In-situ CEMS



Challenges for Extractive CEMS

- PM Sample has to be drawn from Stack iso- kinetically
- Distance from source and analyser
- Positive Bias of Secondary PM

Advantages of Extractive CEMS

- Wet Stack emission can be monitored
- Measurement ranges of analyser may be maximized
- Size fractionation is possible
- Maintenance is less compared to in-situ system

PM CEMS TECHNOLOGY SELECTION – STACK CHARACTERISTICS MATRIX

Parameter	DC Tribo	AC Tribo	Light Scatter	Opacity	Light Scintillation	Extractive	
						Light Scatter	BAM
Units of Measured Value	**g/s, kg/hr**	**mg/m3, g/s, kg/hr**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**	**mg/m3**
Velocity Monitor Required	X	✓	✓	✓	✓	✓	✓
Duct <1m Diameter	✓	✓	✓	X	X	✓*	✓*
Duct >1m to 4m Diameter	✓	✓	✓	✓	✓	✓*	✓*
Duct >4m Diameter	X	X	X	✓	✓	✓*	✓*
Electrostatic Precipitator	X	✓***	✓	✓	✓	✓	✓
Stack Gas Temperature > 500^{0}C	X	✓***	✓	✓	✓	✓	✓
Wet Scrubber or Water Droplet <70^{0}C	X	✓***	X	X	X	✓	✓
Large particles >20um	✓	✓	X	✓	✓	X	✓
Dust> 100 mg/m3	✓	✓	✓****	✓	✓	X	✓
Varying gas velocity	✓	✓***	✓	✓	✓	✓**	✓

* Primary Wet Stack, ** Worked on slowly varying velocity, *** ESP/Wet scrubber, *** Meas.upto 300 mg/m^3

Summary of Technology Options for Gaseous CEMS

Technique	Type	Gases Measured	Comments
Chemiluminescence	Extractive	NO, NO_X, NO_2 *	*NO_2 calculated (NO_X – NO)
UV Fluorescence	Extractive	SO_2 (H_2S, TRS)	Gases in brackets can also be measured but not simultaneously
IR Gas Filter Correlation (GFC)	Extractive	CO, CO_2, NO_X, SO_2, N_2O	Multiple gases can be monitored, generally no more than 2-5.
Fourier Transform Infra-red (FTIR)	Extractive / Path	CO, CO_2, SO_2, NO_X, HCl, HF etc.	Multiple gases can be monitored, typically 5+
Differential optical absorption spectroscopy (DOAS)	Path	CO, CO_2, SO_2, HCl, HF, NO, NO_2, NH_3, VOCs, H_2O	Multiple gases can be monitored, typically 5+ NO_2 measured directly. Additional gases can be added at relatively low cost.
Flame Ionization Detector (FID)	Extractive	Total HC	Requires hydrogen carrier gas.
Tunable Laser Diode (TLD)	Path	HCl, HF, NH_3, CH_4, CO, CO_2, H_2O	Cost effective for single component applications.
Zirconia oxide cell	In-situ	O_2	Widely used, maximum temperature generally 500°C
Paramagnetic	Extractive	O_2	
Photo acoustic spectroscopy (PAS)	Extractive	CO, CO_2, SO_2, HCl, HF, NO, NO_2, NH_3, VOCs, H_2O	Can measure virtually any gas that absorbs IR. Detailed analysis of other compounds that may be present other than target gases required.
Transmissometry (Laser Optical Backscatter)	In-situ	Opacity (smoke), & Total PM (dust)	2400Hz intensity controlled LED & Solid State Diode Laser

FEW MANDATORY ADDITIONAL REQUIREMENTS FOR FULL PROOF SYSTEM

- Flow Monitor / Velocity Monitor (Mandatory Wherever Load based Standards are Given
- Stack Temperature Monitoring (Mandatory)
- Moisture Monitoring Device (Mandatory in system with large fluctuation in % Moisture)
- O_2 /CO_2 /CO monitoring as per regulatory requirement
- Extractive dilution system should have Cal gas injection facility at sampling point to Calibrate the system not only analyser

REGULAR PERFORMANCE EVALUATION PROCESS

- Instrument health checking: fixed time (10.00 a.m.) using standard methods and standard reference materials.
- The health of the instruments/analyzers shall be assessed on daily basis at fixed time (10.00 a.m.) by checking the zero drift.
- Calibration verification shall be done on quarterly basis by empaneled laboratories.
- The instruments/analyzers shall be rechecked for zero and span drift every Friday . In case the daily zero drift is more than the acceptable limit as specified in the catalogue/brochure of the instrument/analyser manufacturer and persists continuously for five days, the instrument / analyser shall be recalibrated following procedure laid down at point (ii) above.
- In case the weekly span drift is more than the acceptable limit as specified in the catalogue brochure of the instrument/analyser manufacturer and persists continuously in the succeeding week the instrument/analyser shall be recalibrated following procedure laid down .
- Data capture rate of more than 85% shall be ensured.
- The comparison/ verification of data/ calibration shall be done by empaneled laboratory once in 6 months.

ASKED QUESTIONS

- **How many stacks should be monitored?**

All consented stacks and effluent outlets

- **What are the parameters**

Please follow the list of parameters as given in Guideline

- **Whether Flow Monitor / Velocity Monitor is necessary at all stacks**

No. Only at those stacks wherever load based standards are prescribed. In case of DC Tribo PM CEMS Flow monitor is mandatory.

- **Whether Stack Temperature sensor is necessary at all stacks**

Yes

- **Moisture Monitoring Device is necessary at all stacks**

No. It is mandatory for waste incinerator. Moisture monitoring is required where In situ gaseous monitoring systems are installed. It is also mandatory for Hot Wet Extractive system

FREQUENT INDUSTRY ENQUIRIES

- **Which parameter is mandatory regulatory requirement O2 /CO2**

Diluents like O2 or CO2 are selectively required as specified in prescribed standards

- **How to report the emission (in ppm or in mg/NM3)**

All the pollutants shall be reported in mg/NM^3

- **Why Temperature, Diluents (O2/CO2) etc are required to be monitored**

As the prescribed standards are in dry and normalized condition the temperature and pressures are important. To ensure do excess air is present in emission diluents monitoring is required

FREQUENT ENQUIRIES OF THE INDUSTRIES

- **What should exactly be position of installation of sampling probe / device**
- **Ideal requirement is a laminar flow for emission monitoring. There should not be any control/dilution system beyond that point**
- **For water the point of sampling should be well mixed and there should not be any control/dilution system beyond that point**

- **Ideally both PM and Gaseous CEMS location of sampling plane is 8D downstream and 2D upstream from last disturbance point.**

- **If there is any Relaxation?**
- **Other locations for installation is allowed only after ensuring that there is no stratification**

FREQUENT ENQUIRIES OF THE INDUSTRIES

- **How to Calibrate PM CEMS**

It is the only comparison against Isokinetic sampling

- **Is it required to do at different load conditions?**

Yes ideally it should be done atleast at three operational loads

- **How to Vary Load conditions?**

It is really difficult for a running industry to vary operational load, however; calibration at different load is recommended for atleast once

- **How many samples are required for PM CEMS calibration**

Ideally it should be Nine at three load conditions. Minimum Six samples to calculate DUST FACTOR

- **What is the frequency of calibration needed?**

The validity of DUST FACTOR shall be Checked fortnightly with single monitoring. If it is not varying more than 20% the same Factor can continue. Otherwise normal frequency of calibration is six monthly

FREQUENT ENQUIRIES OF THE INDUSTRIES

- **Who will Calibrate PM CEMS**

Till Date any NABL accreditated and EP approved laboratory can be engaged for calibration. Intermediate checks can be performed by industry itself.

- **What is Zero Calibration?**

Normally the instrument is operated in establishing two point's linearity, one zero and one span. Instrument's zero should be checked regularly with zero/inert gases. We should not call it zero calibration it is zero check only. Here adjustment is not allowed.

- **What is the frequency of zero check?**
  - **Daily**
  - **What is Span Calibration?**
  - **Span is the extreme point of the system calibration concentration.**
  - **What is the frequency of span check?**
  - **Once in a week**

FREQUENT ENQUIRIES OF THE INDUSTRIES

- **What is Instrumental Range?**

Instrumental range is the declared certified range of the instrument for respective parameters

- **What should be the range of selected instrument?**

Basic for Instrumental range selection ELV * 2.5 to 3.0

- **What should be the span gas concentration?**
- **The span gas concentration should be 75 – 80% of selected instrumental range.**
- **Does any multipoint calibration necessary?**

Yes; test of linearity shall be established with multipoint calibration at a frequency of once in a year

Is it require to calibrate the whole system including conditioning

Yes it is always preferred to perform system calibration. Extractive dilution system should have Cal gas injection facility at

sampling point to Calibrate the system not only analyser


DATA ACQUISITION
AND
HANDLING

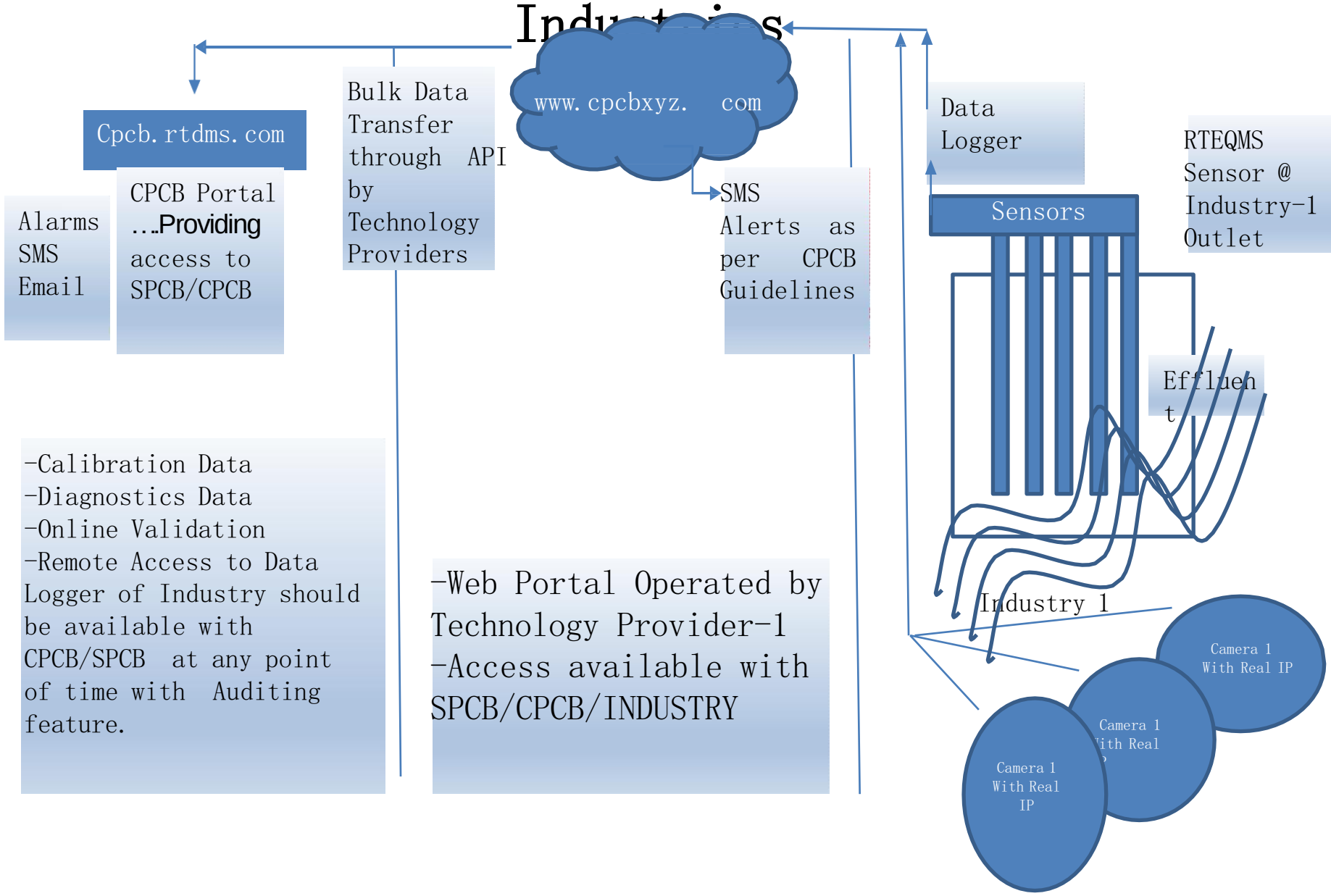
Requirements of System

- Accommodating any new requirements
- •Data collection on Real Time basis without human intervention.
- •Data Collection from any REAL TIME SYSTEM.
- Generating ALERTS in case of violation of stipulated standards
- •Providing. data to all stake holders without delay
- Having Dashboards for facilitating SPCBs/PCCs/CPCB intelligent surveillance display for meaningful application of data.
- Collection of Performance criteria parameters & Health status of instruments
- Providing a system of change request management with recording mechanism for data validation purpose.
- Providing facility for online calibration check of systems.
- Providing tamper proof mechanism

Requirements of System Contd..

- •Continuous Transfer of Real Time data for display on industry website & Industry main gate.
- •Data storage effortlessly without data loss.
- •Easily Deployable.
- Creating a National Database for Policy & Decision Makers at a single GIS map.

Schematic of Data Management from Industries



Real Time Data Acquisition → Conceptual View

Industry Side

Emission
Ambient
Effluent

RS232/RS485

Analyser

Analog Output
(4-20mA/0 to 10 V et

Analog to Digital Converter

Site Data Acquisition and Management Software

RS232/RS485

Local DB Storage

Internet

Regulator Side

Real Time Data Acquisition Platform

Alerts and Alarm Module

Data Validation Analysis and Reporting

SMS/Emails

Headquarters Regulator

View/Analyse Data
Create Reports
Monitor Site Connectivity

Highly Scalable Time-Series Database

Monitor Site

View Site Data and Receive SMS/Emails

Site Operators

View Data/Reports and Receive SMS/Emails

District Office - Regulator

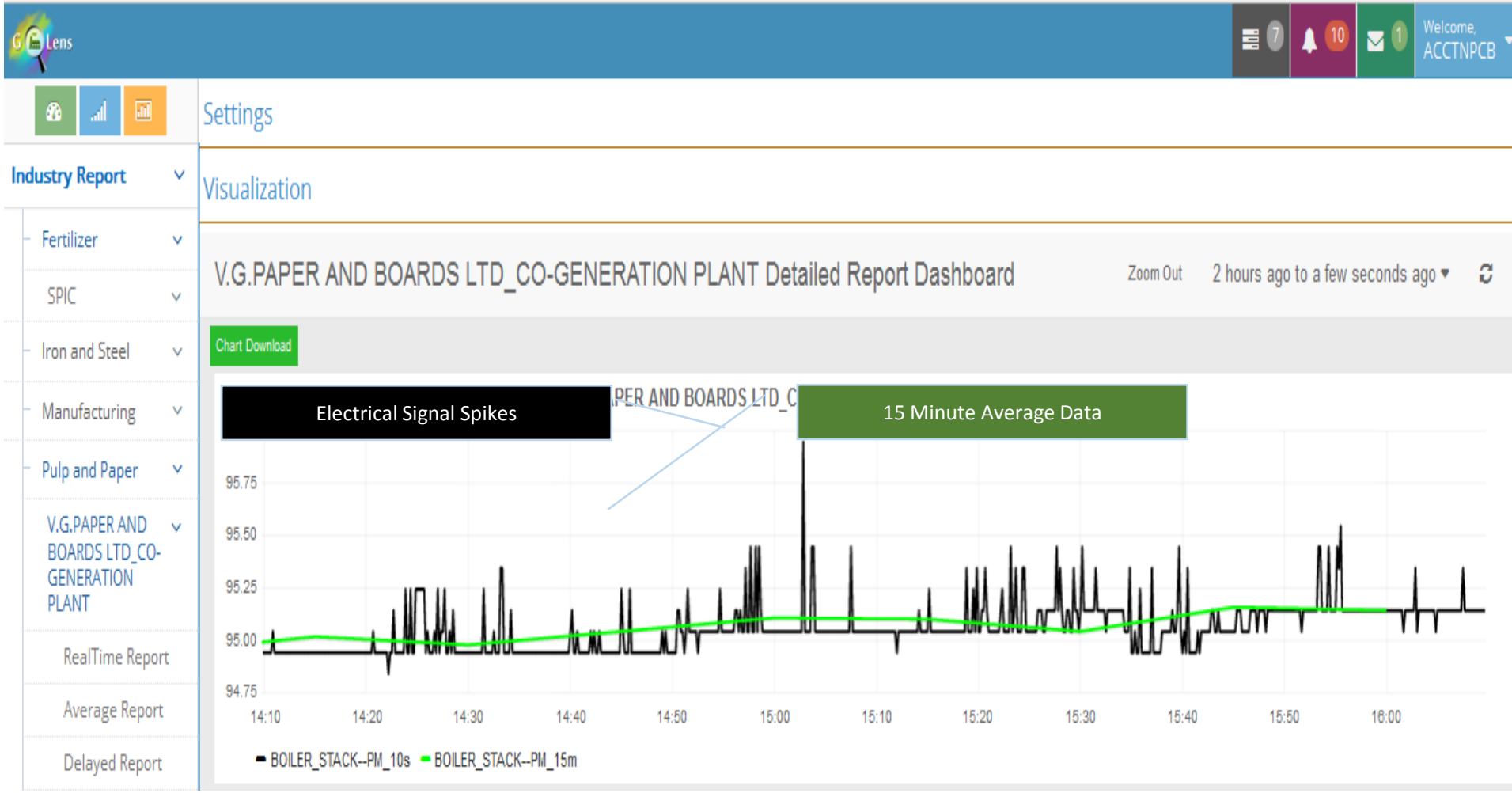
Challenges

- What Parameters to Monitor?
- Which Analyser Principles are approved?
- What should be the analyser range of measurement?
- Which Software is accepted? Does it support all analyser make and model?
- Does the software support bi-directional communication?
- What technology is Software based on?
- Whether Physical Server or Cloud Server?
- Which Communication Medium is accepted?
- How much of data representativeness?
- What should be the frequency of data acquisition?
- What about Security of Data and Software?

Data Visualization Examples of Good Data

- (at least the OCEMS is responding)
- Calibration Verification required before validation and acceptance

Differentiating Signal Spikes from True Exceedances



Super imposing 10 Second data with 15 Minute Average

An Effective way to differentiate signal noise or spikes from true parameter exceedance

Data Validation and Annotation of the Data

Data Validation

SiteName: LAKSHMI MACHINE ...

Monitoring Type: Emission

Monitoring Unit: STACK_IF

Analyser: MIP_LM3188

Parameter: PM

Data Quality Code: Raw

From: 30-11-2015 00:00:00

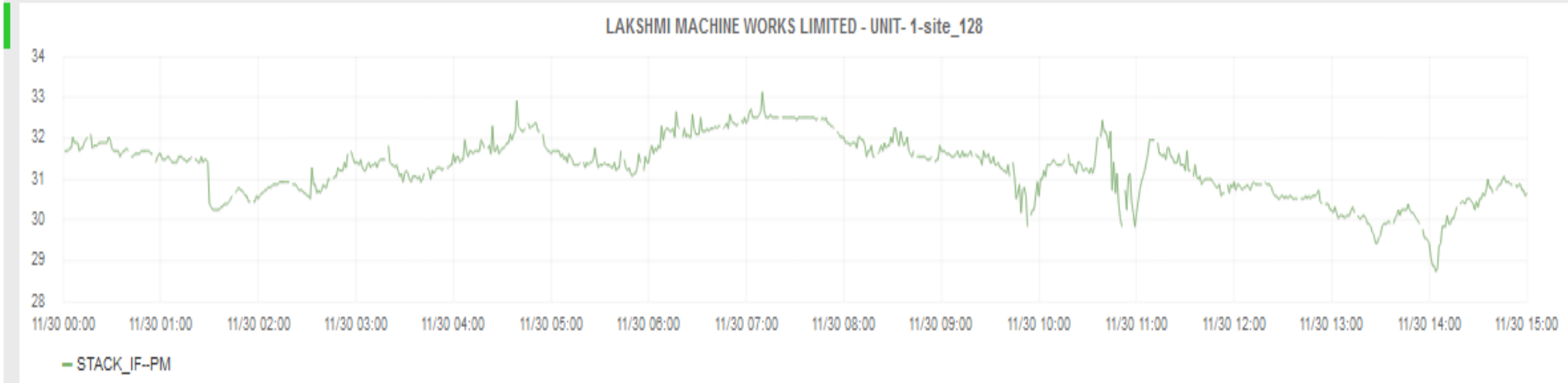
To: 30-11-2015 15:00:00

Fetch

Validated Data

LAKSHMI MACHINE WORKS LIMITED - UNIT- 1-site_128

Zoom Out | Nov 30, 2015 00:00:00 to Nov 30, 2015 15:00:00



From: Mon Nov 30 2015 00:00:00 GMT+(

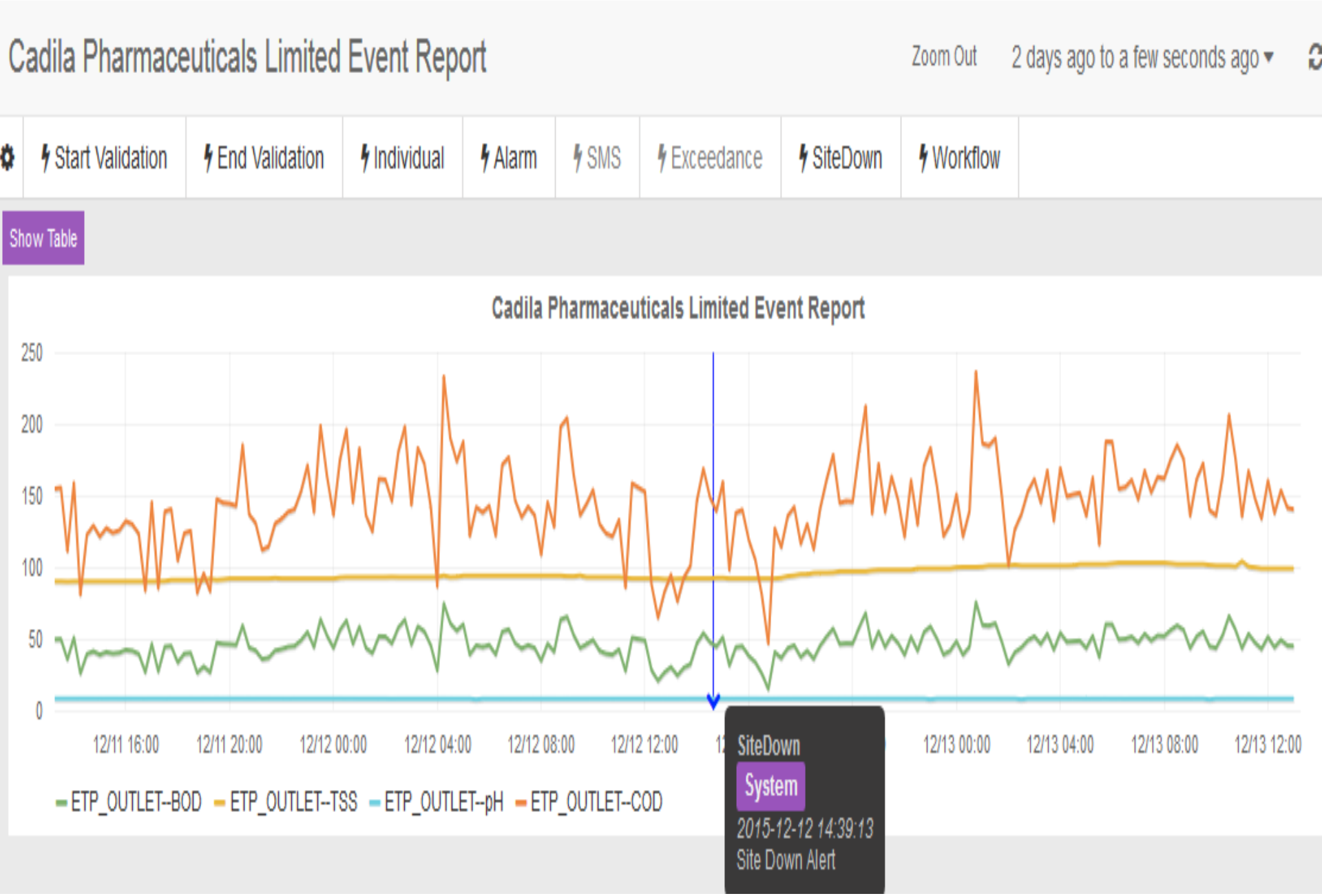
To: Mon Nov 30 2015 15:00:00 GMT+(

DataQuality Code: Validated

Comments: Data Validated

Update

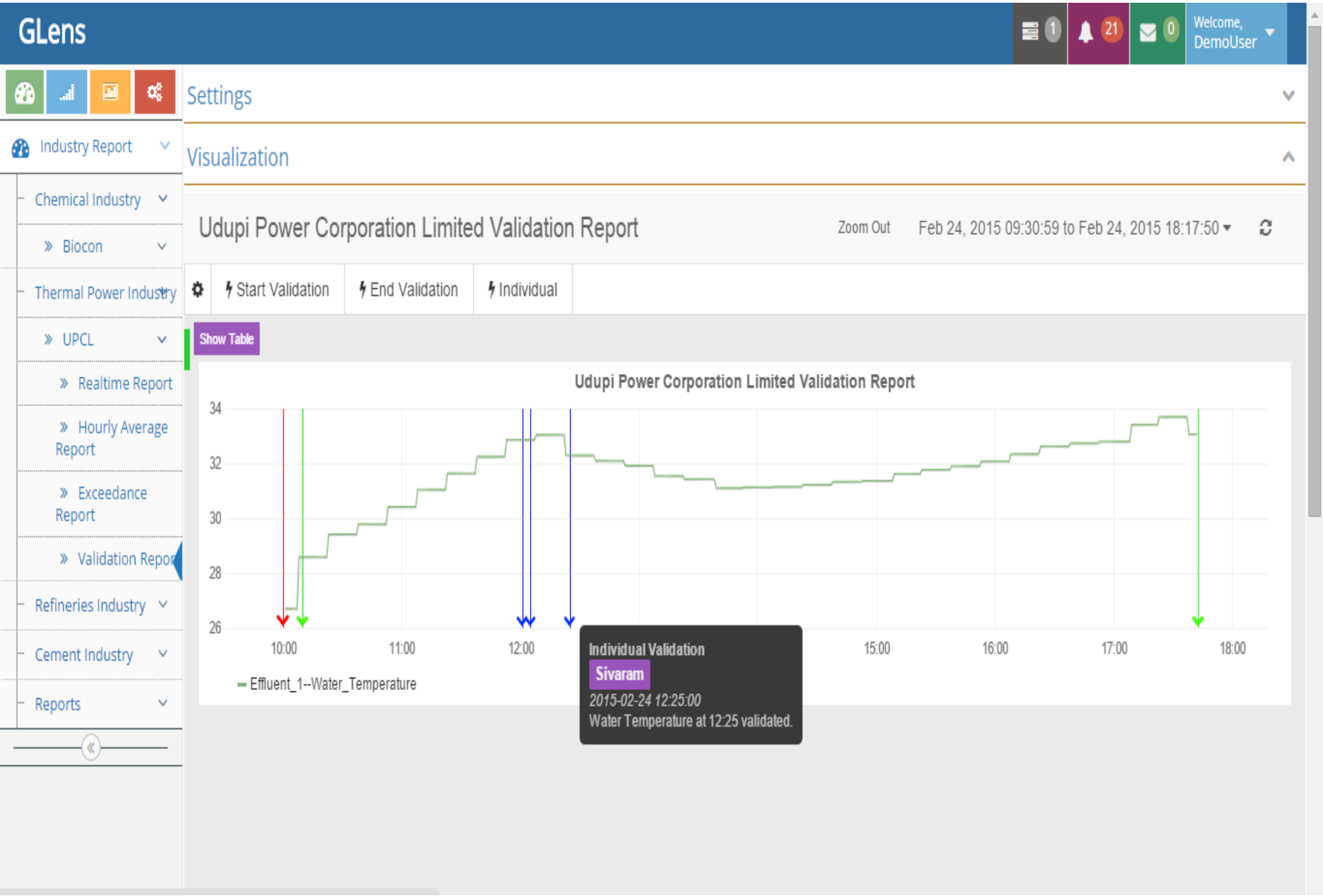
Event and Annotation Report



Data Visualization Examples of Bad and Doubtful Data

- (OCEMS is either not responding or perhaps tampered or being adjusted illegally)
- Immediate intimation is required
- Field visit is necessary to investigate the issue

Validation Report -- Annotations



GLens – CPCB Consolidated Dashboard

Central Pollution Control Board

Welcome, CPCB

AP Paper Mills ETP_OUTLET Mohali , Punjab PULP and PAPER

BOD

15 minutes Average

27.8 mg/l

Standard: 30 mg/l

Data fetched at 13-Dec-2015 18:31 Hrs

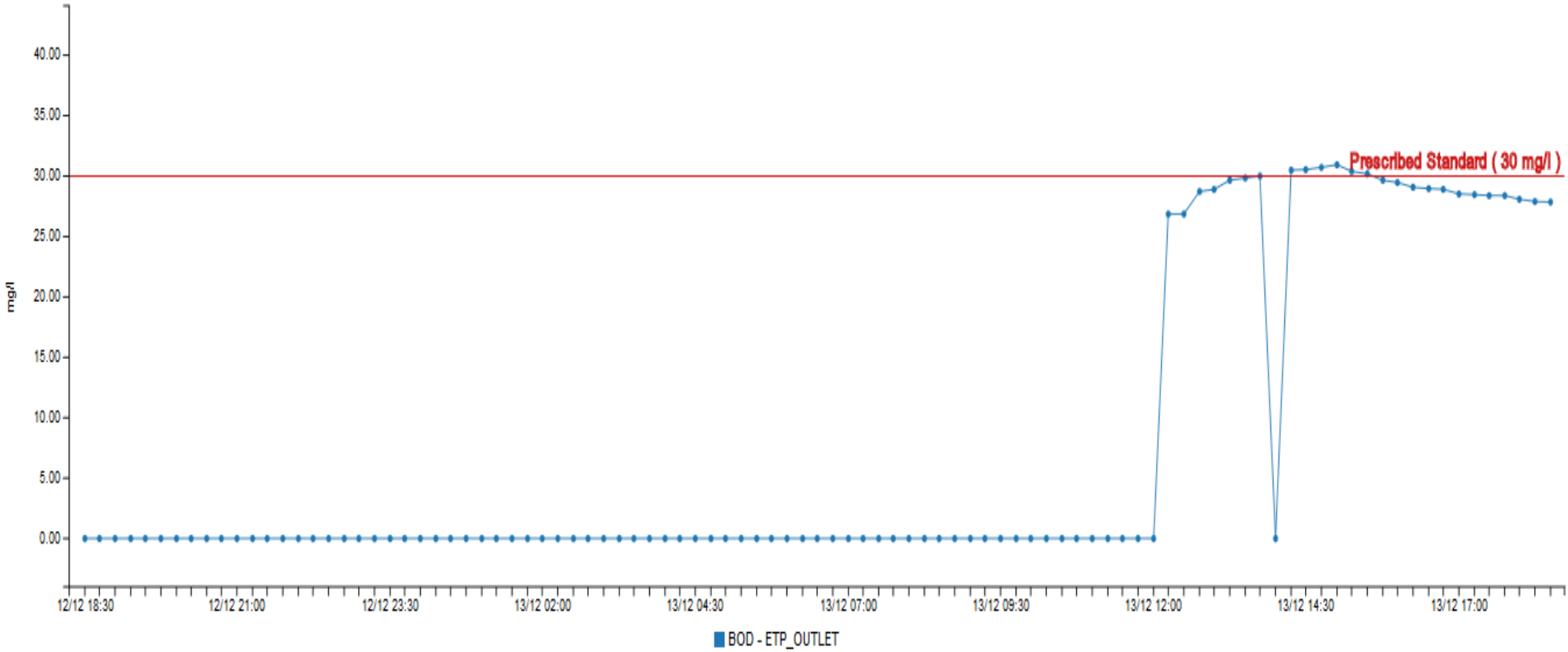
14	1	4	1
Total Exceedances (in a Week)	Monitoring Stations	Parameters Monitored	Exceeding Parameters

Parameters List

BOD - ETP_OUTLET - 27.8 mg/l
Standard - 30 mg/l

COD - ETP_OUTLET - 138.2 mg/l
Standard - 150 mg/l

TSS - ETP_OUTLET - 45.2 mg/l
Standard - 30 mg/l



CENTRAL POLLUTION CONTROL BOARD

Online Effluent and Emission Monitoring System

A.V. International Tannery Bhadurgarh,Haryana

Data last received on: 2017-06-07 18:15:00:000

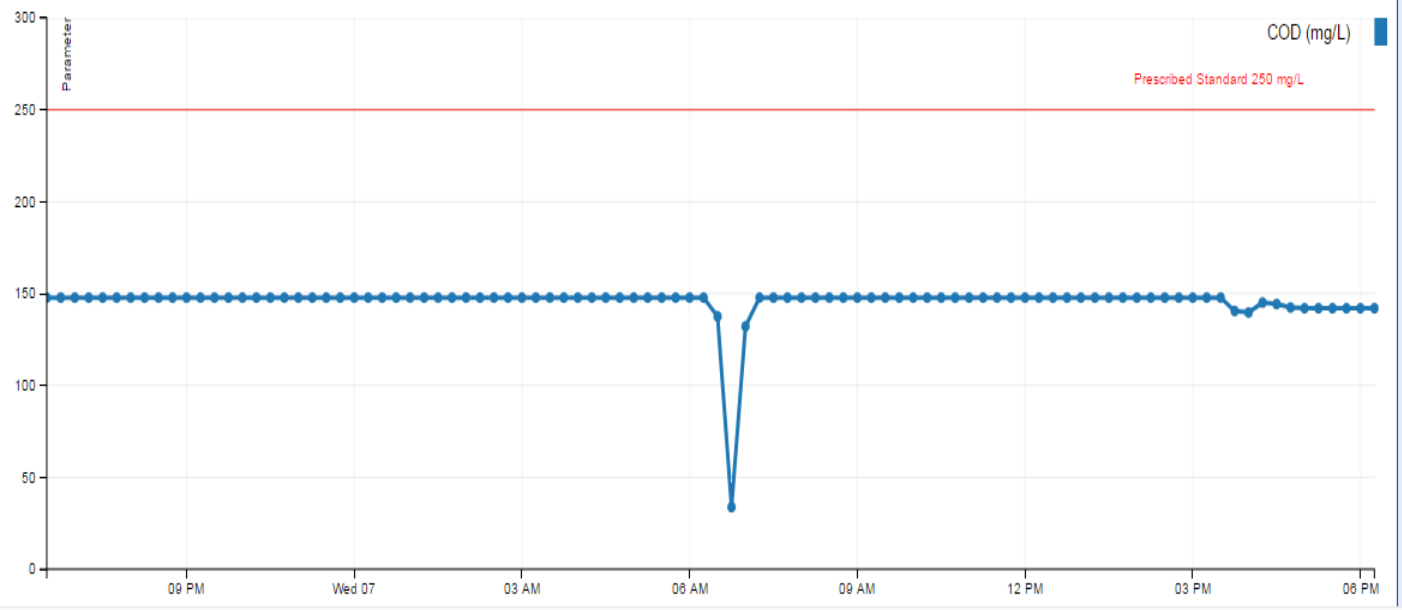
Stations	Parameters	Parameters exceeded (24 hrs)	SMS generated in last 7 days
1	4	1	6

ETP_1_OUTLET

COD 142 mg/L

BOD	20.8 mg/L
TSS	28.9 mg/L
pH	7.9
COD	142 mg/L

ETP_1_OUTLET COD (24 hour trend - 15 min average)



Exceedance in Emission

✓Any exceedance of values over the prescribed standards or norms shall be considered as violation.

✓Any exceedance of values over the prescribed standards or norms shall be considered as violation.

✓Continuous exceedance of values upto 10% over the standards/norms for more than half an hour, shall require preventive action from the industry.

✓Frequent exceedance of the values i.e. more than 5% of the total data capture in a day of the prescribed standards/norms shall invite action from SPCBs/PCCs

✓Any exceedance of the monitored values as against the standards shall invite SMS & email to the industry from SPCBs/PCCs requiring immediate feedback on the corrective action initiated/taken.

✓In case the emission exceeds continuously the prescribed norms by 10% over the standards and for a duration of one hour or more, the industry shall inform the SPCBs/PCCs of the action initiated to control the emission

Exceedance in Emission

In case the industry fails to control the emissions/discharges within the norms it shall move towards closure of its operation following the laid down standard operating practices.

10% of the norms for period exceeding one hour the industry shall immediately move towards closure of its operation under intimation to SPCBs/PCCs. (viii) The values recorded during calibration or during preventive maintenance shall not be considered for exceedance and assessing the data capture rate. (ix) Plant start-up or batch process starting emissions shall not be considered for averaging for the initial 30 minutes period in case of batch processes or small

Plant shut down period shall be excluded while calculating data capture rate.

THANK YOU

Technologies	Parameters	Applicability
UV Spectrophotometry (Single/two/four wavelengths)	COD, BOD	Fresh Water & Waste Water analysis with constant matrix in water source
UV-Vis Spectrophotometry 40 wavelength	COD, BOD, TSS	Fresh Water & Waste Water analysis with Constant matrix in water source
UV-Visible Spectrophotometry (Single Beam)	COD, BOD, TSS	Fresh Water & Waste Water analysis without interference check and compensation
UV-Vis Spectrophotometry (Double beam with entire spectrum scanning)	COD, BOD, TSS	Fresh water to Waste water analysis Interference check for color and turbidity and compensation.
Combines Combustion Catalytic Oxidation at 680°C and NDIR Method	TOC (Co-relation with BOD & COD)	Fresh Water and Waste Water analysis
UV Persulfate NDIR Detector	TOC (Co-relation with BOD & COD)	Fresh Water & Waste Water analysis
Persulfate Oxidation at 116-130degC NDIR Detector	TOC (Co-relation with BOD & COD)	Fresh Water & Waste Water analysis
Measuring COD using Potassium dichromate($K_2Cr_2O_7$) + Calorimetric	COD	Fresh Water & Waste Water analysis
Electrode /Electrochemical method	pH	Fresh water & Waste Water analysis
Scattered Light Method (IR)	TSS	Fresh water & Waste Water analysis
Nephelometry Method	TSS	Fresh Water & Less turbid water analysis
Colorimetric (645-655nm)	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome
Ion Selective Electrode method With temp correction	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome.
UV Absorbance or Multiple Wavelength UV Absorbance Spectrophotometers (200-450nm)	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome.
Colorimetric method Reaction of Cr-VI with diphenyl carbazide in acid solution	Chromium	Fresh Water & Waste Water analysis.
Voltammetry (Anodic Stripping Voltammetry)	Chromium	Fresh Water analysis.
Dual Beam UV-Visible Spectrophotometry	Chromium Hexavalent and Trivalent	Fresh water & waste water analysis.
Voltammetry (Anodic Stripping Voltammetry)	Arsenic	Fresh Water analysis.