Development & Perception of Continuous Protocol for installation and performance checks of Emission Monitoring System (CEMS) & CWQMS in India

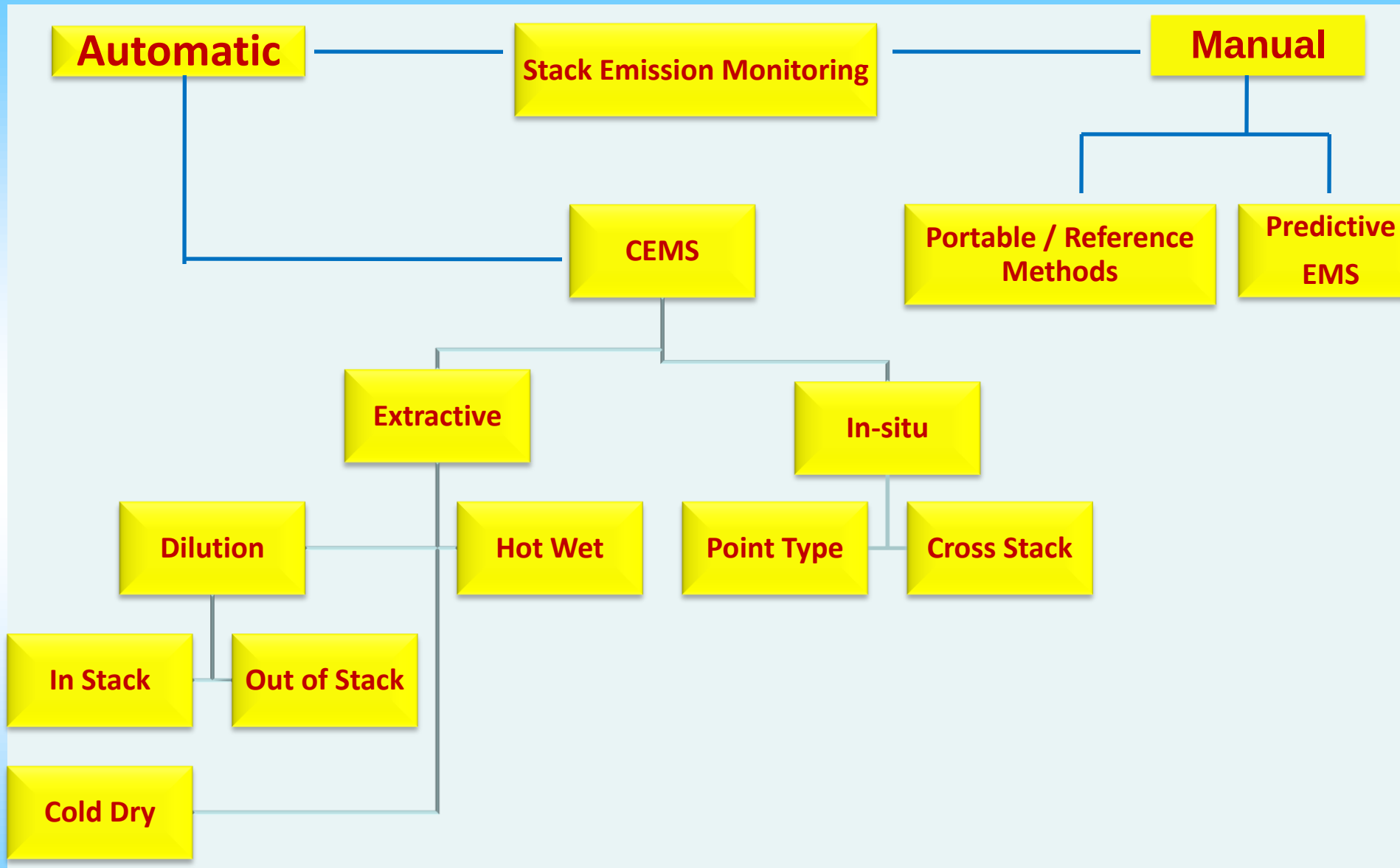
REVISED EMISSION PARAMETERS for 17 Cat

PM, NO_X, SO_2, CO, HCl. Cl_2, NH_3 and F

EFFLUENT PARAMETERS

Flow, pH, Conductivity, TSS, COD, BOD and Others

Methods & Options for Source Emission Monitoring



Issues in Implementation of CEMS in India

- **Issues among the industries regarding CEMS selection**
  - ✓ **Hyperactive business strategy of Vendors**
  - ✓ **Knowledge gaps among Industries and even regulators**
  - ✓ **Number of Stacks to be covered**
- **Presently Industries are interested to just comply with the direction by installing CEMS irrespective of fitness and performance of devices, investment is the only driving factor**
- **SPCBs are putting CEMS installations in Consent conditions in addition to the directed industries**
- **Most of the systems already installed are either not calibrated or wrongly calibrated**
- **In absence of any guidelines and limited clarity in issued direction the selection of components for a CEMS are not holistic to satisfy the requirement of regulation**
- **Competence of Vendors, laboratories, industries have not developed for**

Technical issues require immediate attention

- **Number of Stacks to be covered under notification immediately**
- **CEMS Selection Guideline**
- **CEMS Installation Guideline**
- **Range Selection for operation**
- **Calibration Protocol**
- **CEMS initial performance evaluation Protocol**
- **Intermittent performance verification protocol**
- **Excess Emission issues**
- **Empanelment of Laboratories for CEMS**
- **CEMS Audit Protocol**
- **Regulatory framework**

Any Other? : Feed back from stakeholders

International Practices for CEMS Implementation

European Union	USA
QAL I - Quality assurance level I (Certification of Product, COP) **QAL II -** Quality assurance level II (Performance evaluation at site) **QAL III -** Quality assurance level III (Audit verification and validation)	US has no certification process at product quality level for sampler/analyser (USEPA) has parameter wise performance standards (PS I to PS XI), which is equivalent to QAL II and QAL III
TÜV (Germany) (Technical watch-over Association) – a Product standard	**MACT** (Maximum Achievable Control Technology); this is an objective oriented quality certification applicable to US only
MCERTS (UK) (Monitoring Certification Schemes) – a Product standard	

Fitness of India for CEMS with international criteria

European Union / USEPA	Indian Scenario
QAL I - Quality assurance level I (Certification of Product, COP) MCerts (UK) for emission only	Does not exist as there is no certifying agency Indian agency should come up in near future
QAL II - Quality assurance level II (Performance evaluation at site)	Possible through performance evaluation; however criteria may be little relaxed
QAL III - Quality assurance level III (Audit verification and validation)	Possible but SPCBs/CPCB and empanelled Laboratories must be trained Provision for ILC shall be developed for QC requirement Availability of certified standard gases should be ensured
Performance standards (PS I to PS XI), which is equivalent to QAL II and QAL III equivalent RATA, RAA, CGA	Implementation Possible; however criteria may be little relaxed

Where to Install CEMS ?

Firstly The location satisfies the minimum siting criteria of Emission Regulation Part III (i.e., the location is greater than or equal to eight stack duct diameters downstream and two diameters upstream from a flow disturbance

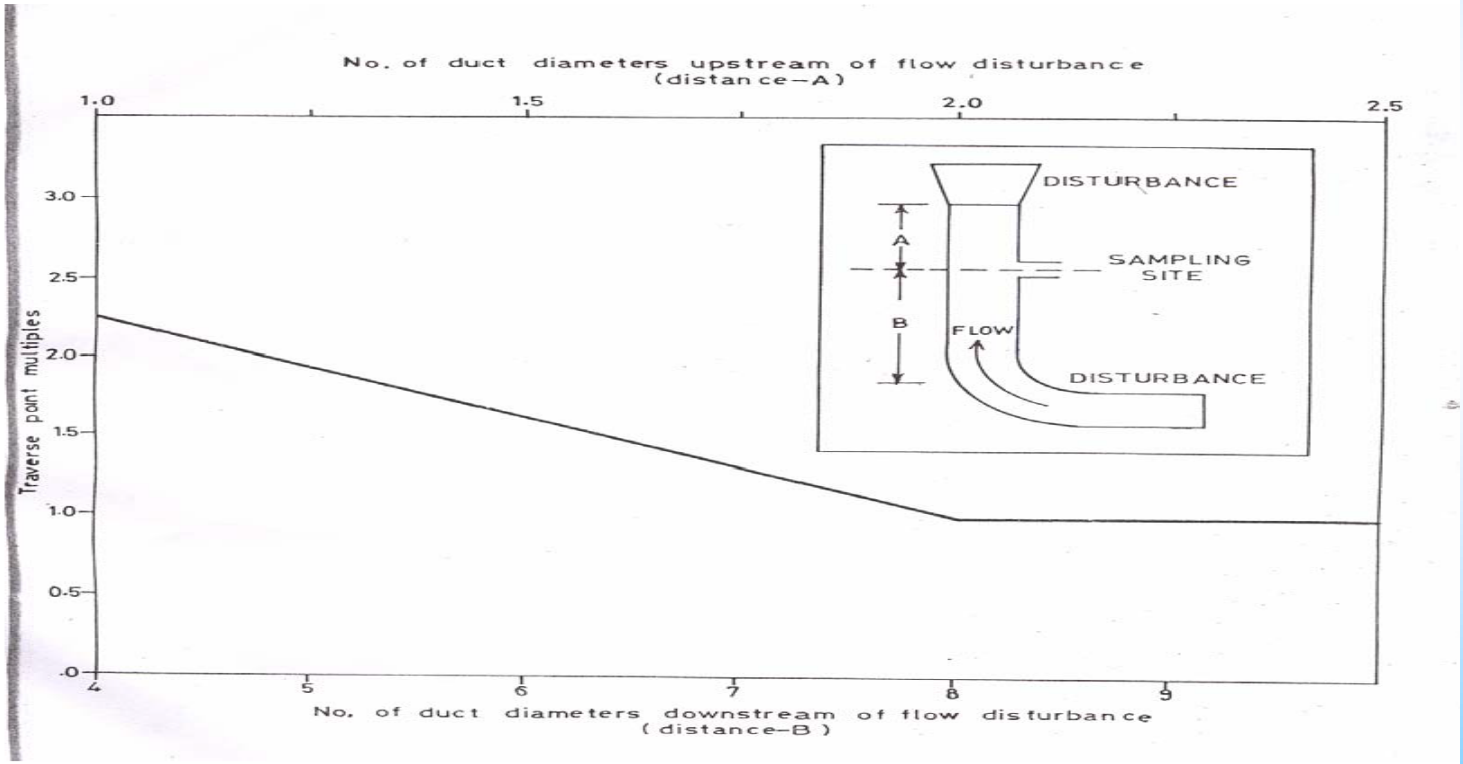
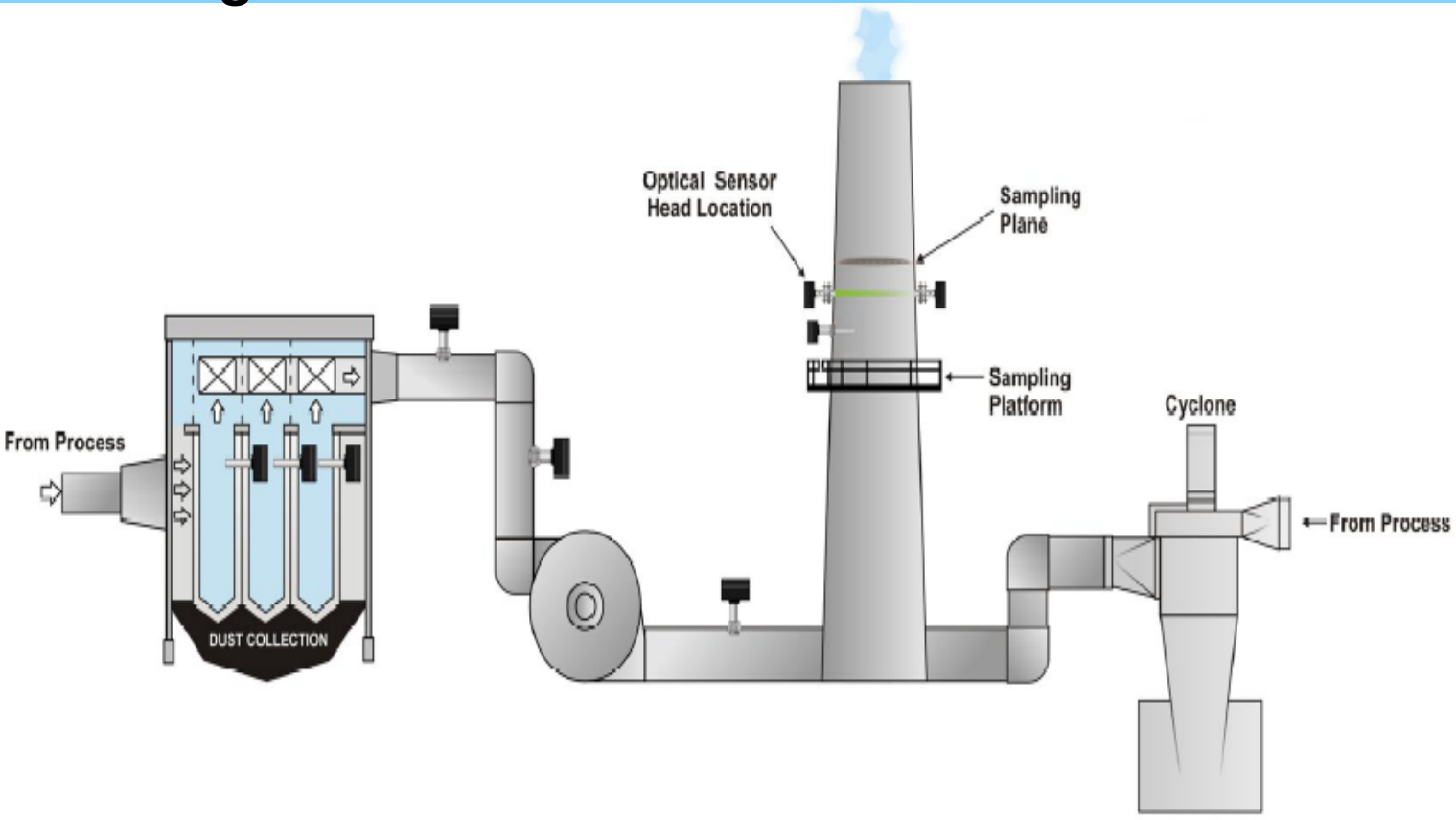


FIGURE 1.3 Travers point multiples to determine minimum number of traverse points requirement when a < 2 dia or b < 8 dia

Secondly It should be at the plane 500 mm above the Isokinetic testing Port



Positions to be considered for installation of Particulate Monitors

The installation should have logistic support like easy approach for calibration, Audit and maintenance etc.

CEMS Specific Location as per CFR Part 60 and Part 75

- ✓CEMS must be accessible, representative, and capable of passing a Relative Accuracy Test
- ✓At least 2 duct/stack diameters downstream of any “disturbance”
- ✓At least 1/2 diameter upstream of any “disturbance”
- ✓Any other location demonstrated to be acceptable if stratification correction is made
- ✓PM CEMS has no relaxation from 8D and 2D at laminar flow zone

India may also adopt the same criteria in extreme cases

CEMS Span and Range Part 60 vs Part 75

Span is a subset of Range (range is always ≥ Span)

Part 60 Sources – Usually Specified Span by the Subpart

Part 75, Appendix A, Section 2, gives Span Calculations

EPA's Objective to set range such that majority of measurement reading are in 20% to 30% range

So, Optimization of System after initial calibration and Performance test is required. Final Range of Measurement and Range of Span should be decided only after acquiring some monitoring data and estimation of actual spread of emission data

Steps for Calibration of PM CEMS

- Perform repeated isokinetic sampling (minimum 6 points) for PM
- Convert the manual reference method test data into measurement units (e.g., mg or mg/sec) consistent with the measurement conditions of your PM CEMS.
- Calculate the correlation equation(s) by drawing Regression curve (Linear)
- Do the variability test (statistical accuracy test)

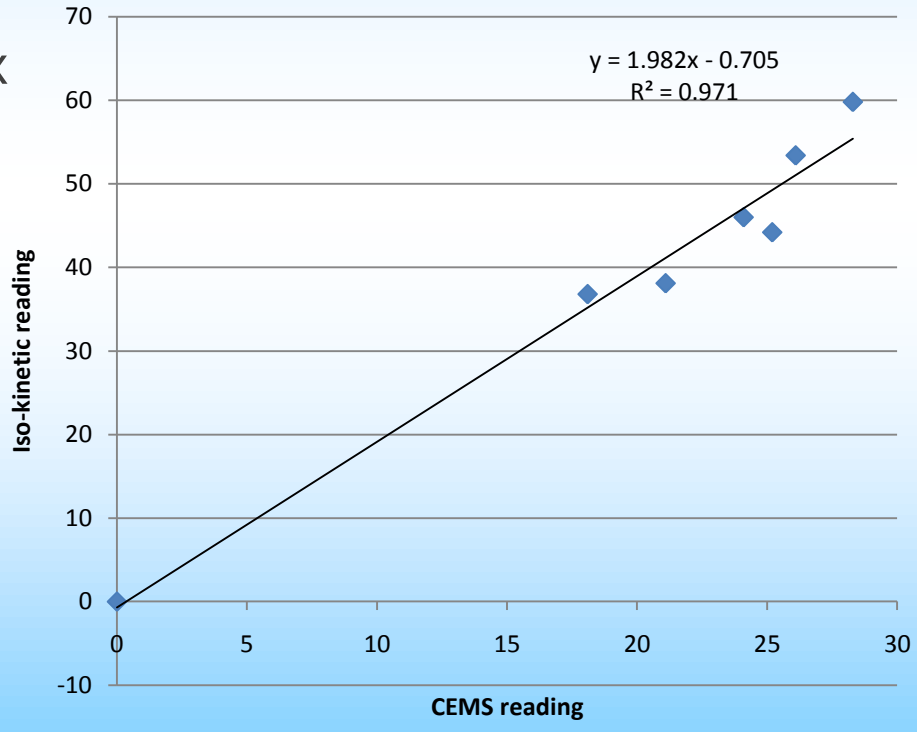
PM CEMS Calibration Procedure

Draw the scatter plot and fit the regression line

- In the scatter plot, CEMS reading should be on X-axis and Iso-kinetic reading on Y-axis.
- Find out the equation : y = a + bx

i.e: New CEMS reading = a + b*
(Old CEMS un-calibrated reading)

Sr. No.	CEMS reading	Iso-kinetic reading
	0	0
1	25.2	44.2
2	26.1	53.4
3	24.1	46
4	28.3	59.8
5	21.1	38.1
6	18.1	36.8



Steps for Calibration of Gaseous CEMS

- Perform repeated injection of Standard Known Concentration at the range actual emission is expected (minimum 3 levels in between Zero and Span)
- Span should be at 80% of the preferred range selected for the instrument to operate. As a thumb rule the range of operation is generally selected at 1.5 to 2.0 times of Emission Limit (EL)
- Calculate the correlation equation(s) by drawing Regression curve (Linear)

Requirement of Calibration gas levels and acceptance Criteria

40 CFR 60	40 CFR 75
2 calibration gases: 20-30% and 50-60% of monitor span Criteria ± 15% or ± 5 ppm	3 calibration gases: 20-30%, 50-60%, & 80-100% of monitor span Criteria ± 5% or ± 5 ppm

- When Daily Calibration Error or Linearity Check is Found Out-of-Control, The Emissions Data is Invalid.
- Invalid Data Starts At The Time That Calibration Error or Linearity Showed Out-of-Control Status, And Remains Invalid Until Corrective Action Shows No Out-of-Control Status
- Missing Data Substitution Must Be Used

We may set different approach

Performance Specification for SO_2, NO_X and CO

S.No.	Specification	Tolerance ranges/values
01	Zero Drift 24 hr.	≤ ± 2 % of Span
02	Span Drift 24 hr.	≤ ± 4 % of Span
03	Analyzer's Linearity	≤ ± 2 % of Span from calibration curve
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement

Performance Specification for O_2, and CO_2

S.No.	Specification	Tolerance ranges/values
01	Zero Drift 24 hr.	≤ ± 0.5 % of O_2
02	Span Drift 24 hr.	≤ ± 0.5 % of O_2
03	Analyzer's Linearity	≤ ± 0.5 % of O_2
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement or within 1% of O_2

Performance Specification for PM CEMS

S.No.	Specification	Tolerance ranges/values
01	Zero Drift between two servicing intervals	≤ ± 2 % of Full Scale range
02	Reference point Drift between two servicing intervals	≤ ± 2 % of Reference value range
03	Analyzer's Linearity	The difference between the actual value and the reference value must not exceed ±2 percent of full scale (for a 5 point check).
04	Performance Accuracy	≤ ± 10 % of compared Reference measurement

Installation of AWQMS

- Representativeness
- Well Mixed Zone without Turbulences
- Transfer line if it is extractive system
- Sample condition
- Installation Plane

Performance Check Evaluation

- Correctness of Installation
- Calibration (Internal Electronic Calibration)
- External Calibration and Verification
- Comparison against Reference Methods in same matrix
- Analytical Range Selection (Minimum and Maximum)
- Thorough data base introspection with conventional methods to optimize selected range covering all operational events in Industry
- Drift checks
- Audit (Composite sample monitoring)

Maintenance and Checking of Log Book

- Frequent changes of calibration Factor for indirect method may attract attention
- For photometric methods source lamp intensity, Wavelength calibration, stray light, linearity etc. are governing factors for instrument performance
- Filtration of Sample may be required to accurately eliminate the interferences; which invite clogging

Certification and approval

CWQMS Certification and approval is a big issue (Very few organization available worldwide)

The inspection protocol, check list, Formats etc. are major issues for regulators

Will be covered in session assigned for regulatory Framework and standard Methods

THANK YOU

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