Data Review, Validation and Verification

“All data should be considered VALID unless otherwise proven invalid”

- Reggie Smith, California Air Resources Board
- PQAO Training 2017


FRIDAY, 4.59PM

Training Objectives

- Define **data review**, **verification, and validation**
- Discuss **QA handbook critical, operational and systematic criteria**
- Describe general task performed for a multi-level **data review**
- Review **basic AQS upload process** and common **upload issues**

Define Terms

- Data review – Day to day actions used to **accept, reject or qualify data** in an **objective** and **consistent manner**
- Data validation - evidence that the particular **requirements for a specific intended use** are fulfilled
- Data verification - evidence that **specified requirements** have been fulfilled

Data Validation Criteria

- Code of Federal Regulations
- QA HB Vol II (Appendix D)
- SOP & QAPP's
- Instrument Operating Manuals
- Quality Assurance Bulletins

- Critical Data Validation Criteria (red)

Ozone Validation Template

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
One Point QC Check Single analyzer	*1/ 2 weeks*	≤ ±7% (percent difference)	1 and 2) 40 CFR Part 58 App A Sec 3.2 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec 2.3.1.2. QC Check Conc range 0.01 - 0.10 ppm, relative to routine concentrations
Zero/span check	1/ 2 weeks	Zero drift ≤ ± 1.5 ppb Span drift ≤ ± 7 %	1 and 2) QA Handbook Volume 2 Section 12.3 3) Recommendation and related to DQO

- Operational Criteria (yellow)

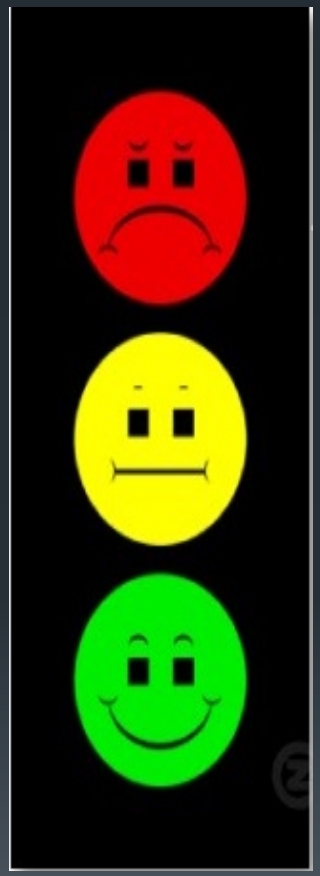
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration of standard of higher level 1/6 months if manual zero/span performed biweekly 1/year if continuous zero/span performed daily	All points within ± 2 % of calibration range of best-fit straight line Linearity error <5%	1) 40 CFR Part 50 App D 2) Recommendation 3) Recommendation- Linearity error 40 CFR Part 50 App D Multi-point calibration (0 and 4 upscale points) 40 CFR Part 50 App D sec 5.2.3

- Systematic Criteria (green)

Sample Residence Time Verification	1/year	*< 20 seconds*	1) 40 CFR Part 58 App E, section 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, section 9 (c)

QA Handbook Validation Criteria

- **Critical – Observations not meeting each and every criterion should be invalidated unless there is a compelling reason**
- **Operational – A violation of these may be a cause of invalidation**
- **Systematic – Important for interpretation of data but usually do not impact data valid**ity



Critical Criteria for Continuous $PM_{2.5}$

1) Criteria (PM2.5 Cont)	2) Frequency	3) Acceptable Range
CRITICAL CRITERIA- $PM_{2.5}$ Continuous, Local Conditions		
Sampling Period 24 hour estimate	***every sample period***	***≥ 75% (18) of hourly averages***
Hourly estimates	Every hour	Instrument dependent
Sampling Instrument		
Average Flow Rate	***every 24 hours of op***	***average within 5% of 16.67 liters/minute***
Variability in Flow Rate	***every 24 hours of op***	***CV ≤ 2%***
One-point Flow Rate Verification	***1/mo***	***± 4% of transfer standard*** ± 5% of flow rate design value
BAM Specific Critical Criteria		
Reference Membrane Span Foil Verification (BAM)	Hourly	± 4% of ABS Value

Best practices or rule of “thumb”

- Standard procedures/QAPP
- Review data frequently (recommended daily)
- Clear concise notes and logs
- Timely reviews/reporting (data review schedule)
- Document retention
- Flag missing or invalid data (reason???)

AQS Data Codes and Flags

- Referred to as Qualifier Codes in AQS
- 4 Types
  - ✓Quality Assurance (code)
  - ✓Null (code)
  - ✓Informational (flag)
  - ✓Request for Exceptional Event (flag)

- Typically can be applied at any review level
- Be consistent
- Most data systems can auto apply codes/flags

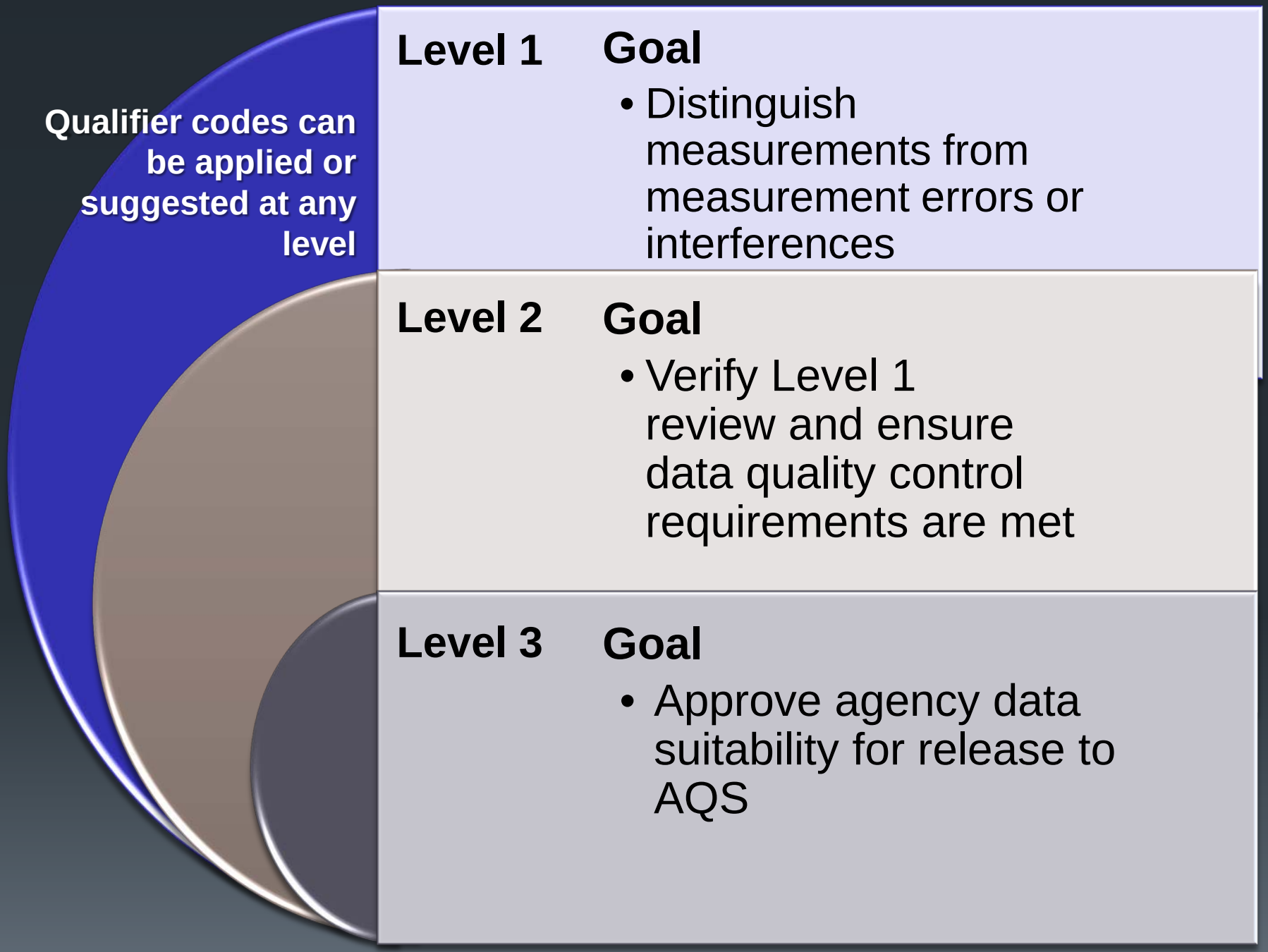
Automated QC Checks

- Done by most Data Management Systems
- Typical screening criteria
  - ✓ *Min/Max values*
  - ✓ *Rate of change (hourly)*
  - ✓ *Sticking or repeating values*
  - ✓ *Excessive negative values*
- May not work at every site
- Not take place of manual reviews

Multi-Level Data Review Process

- *General multi-level review process*
  - ✓ *Station Operator (1st Level)*
  - ✓ *AM Specialist (2nd Level)*
  - ✓ *AM Lead /AM Supervisor (3rd Level)*

- *Same person may accomplish two levels at small agencies*


Qualifier codes can be applied or suggested at any level
Level 1
Goal
• Distinguish measurements from measurement errors or interferences
Level 2
Goal
• Verify Level 1 review and ensure data quality control requirements are met
Level 3
Goal
• Approve agency data suitability for release to AQS

1st Level Reviewer Tasks

- Most important step in the review process
- Documentation
  - ✓QC forms
  - ✓Station logs
  - ✓Control charts
- Missing data or downtime
- Instrument operation
- Flag suspect data for further review

2nd Level General Tasks

- Data Verification
- Review site operator edits/notes
- Quality Control review
  - ✓1-point QC checks
  - ✓Flow rate verification
  - ✓Preventative maintenance
- Mins, Maxs, NAAQS, SAAQS
- Site Buddy Checks

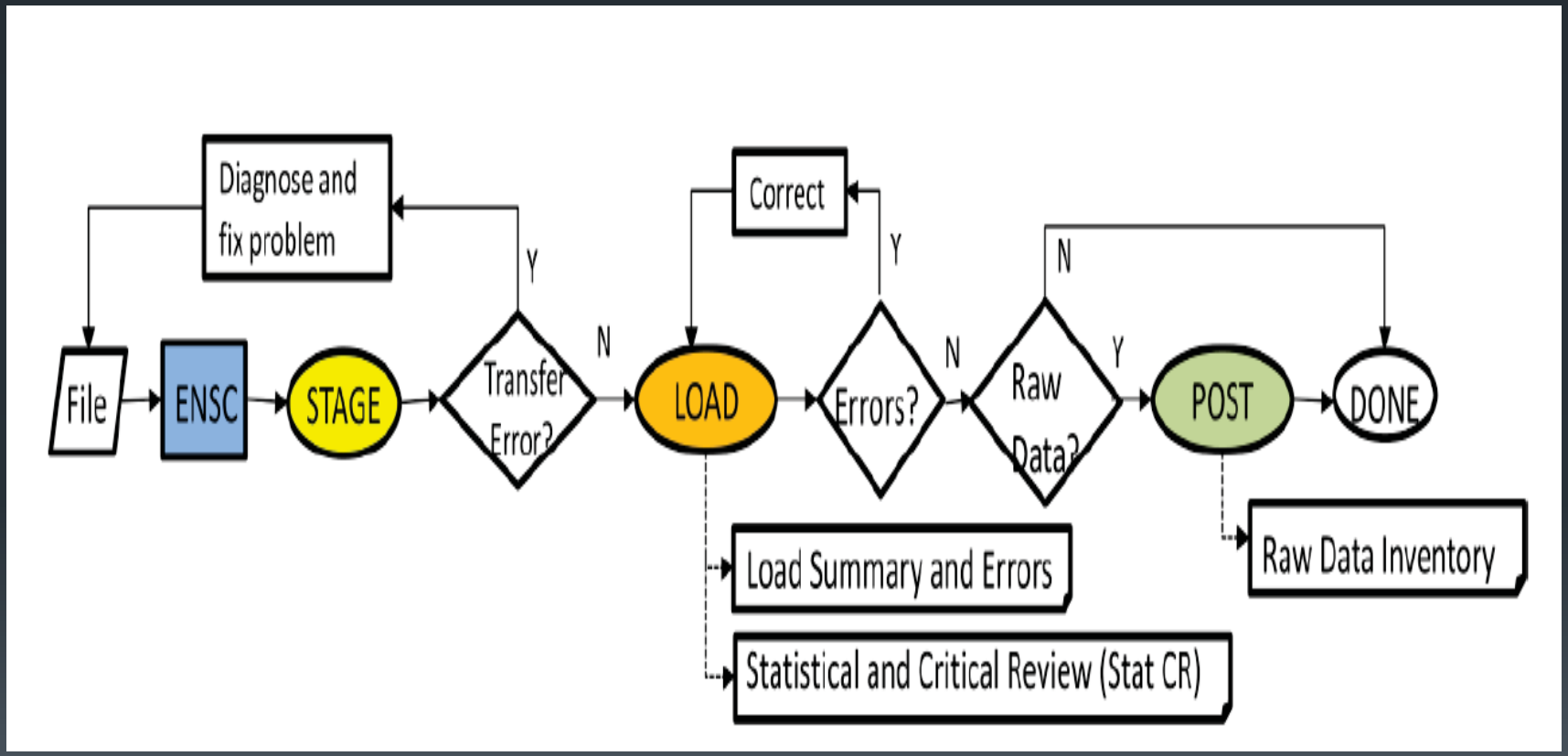
3nd Level General Tasks

- Review data capture rates and completeness
- Request for exceptional events
- Sign data validation letter/memo
- Approve data for upload to AQS

AQS Upload

- *Basic AQS upload process*
  - ✓*Stage, Load, Post*
- *Direct submitters v ARB reporting agencies*
- *Common AQS Upload issues*
  - ✓*No monitor available in AQS*
  - ✓*Uploading over existing data*
  - ✓*Inconsistent POC*

AQS Upload Process



Post AQS Data Confirmation

- *QA Bulletin 005*
- *Ensures AQS uploads are accurate and complete*
- *Quarterly Reviews*
  - ✓*AMP256 – Data Quality Indicator*
  - ✓*AMP350 – Raw Data*
  - ✓*AMP430 – Data Completeness*
- *Annual Reviews*
  - ✓*AMP600- Certification Evaluation*

Summary

- Define Terms
- Data Validation Criteria
- General multi-level review process
- AQS submittal process

REMEMBER!!

“All data should be considered VALID unless otherwise proven invalid”

Break Out Sessions

Data Validation/Certification

- Room - Mountain Vista 1
- 1:45 – 3:15 pm (session 1)
- 3:30 – 5:00 pm (session 2)

- Janice Lam Snyder (Sac Metro)
- Nathan Trevino (San Joaquin)

AQS

- Room - Auditorium
- 1:45 – 2:25 pm (session 1)
- 3:30 – 4: 10 pm (session 2)

- Jennifer Williams (US EPA)