

The Historical Changes and Quality Improvements of EPA's Discharge Monitoring Report - Quality Assurance (DMR- QA) Program

Jeff Lowry
Director of Technology
Environmental Resource Associates

Introduction

- EPA Office of Compliance
 - DMR-QA Program
- Clean Water Act
 - Section 308(a)
 - National Pollutant Discharge Elimination System (NPDES)
- Purpose
 - Evaluate the analytical and reporting abilities of the laboratories routinely performing analyses required in NPDES permits
 - Chemistry
 - Whole-effluent toxicity
 - Microbiology

Presentation Overview

- EPA Performance Evaluation Studies (PES)
- EPA DMR-QA Program
 - Analytes/Parameters
- History of DMR-QA Program Changes
- Quality Performance of DMR-QA Programs
 - Study Failure Rates
 - Study Acceptance Limits
 - Study Relative Standard Deviations

EPA Performance Evaluation Studies



- Started in the late 1970's
 - Water Supply (WS) – Safe Drinking Water Act
 - Water Pollution (WP) – Clean Water Act
 - Discharge Monitoring Report - Quality Assurance (DMR-QA) – Clean Water Act for NPDES Permits
- Administered by the EPA
 - Sample Production
 - Sample Distribution
 - Collection of Study Data
 - Statistical Analysis
 - Distribution of Final Reports

DMR-QA Program



- Historical Analytes/Parameters
 - Thirty-nine Whole Effluent Toxicity Tests
 - Seven Organisms
 - Acute and Chronic Test Conditions
 - Twenty-nine Chemistry
 - Fourteen Trace Metals
 - Four Demand
 - Five Nutrient
 - Six Miscellaneous Analytes

DMR-QA Program

— Historical EPA DMR-QA Chemistry Parameters

Trace Metals	Demand cont'
Aluminum	Carbonaceous Biochemical Oxygen Demand (CBOD)
Arsenic	Chemical Oxygen Demand (COD)
Cadmium	Total Organic Carbon (TOC)
Chromium	Nutrients
Cobalt	Ammonia as N
Copper	Nitrate as N
Iron	Ortho-phosphate as P
Lead	Total Kjeldahl Nitrogen
Manganese	Total phosphorus as P
Mercury	Miscellaneous Analytes
Nickel	Total Residual Chlorine
Selenium	Cyanide, total
Vanadium	pH
Zinc	Phenolics, total
Demand	Non-Filterable Residue (TSS)
Biochemical Oxygen Demand (BOD)	Grease & Oil

DMR-QA Program



- Laboratories Reported PES Results to Permit Holders
- Permit Holders Report Laboratory Data and Laboratory information to PT Provider
- Final Report – PES Evaluation to Permit Holder and EPA DMR-QA Coordinators
- Any “Not Acceptable” Results require corrective action from permit holder to DMR-QA Coordinator
 - Permit Holder has ultimate responsibility for laboratory data reported under their NPDES permit

History DMR-QA Program Changes



- 1995 – Decision by EPA to Privatize PES
- 1995 – 1998 Cooperative Privatization
 - EPA, National Institute of Standards (NIST) and National Environmental Laboratory Accreditation Conference (NELAC)
- 1998 – EPA Publication of National Standards for Water Proficiency Testing Studies Criteria Document
 - NELAC adopt EPA Criteria Document
- 1999 – PT Providers Accreditation from NIST
- 2000 – First Privatized DMR-QA Study Implemented
- 2001 – EPA Final Publication of National Standards for Water Proficiency Testing Studies Criteria Document
 - WETT Guidance Added to 1998 EPA Criteria Document

History DMR-QA Program Changes

- 2005 – NELAC revises Field of Proficiency Testing (FoPT) for Non-Potable Water
 - FoPT Contains
 - Analytes/Parameters
 - PT Concentration Range
 - Acceptance Criteria
 - PT Sample Design Criteria
- 2006/2007 – EPA Adds Nineteen Analytes/Parameters to DMR-QA Studies
 - Seven Trace Metals
 - Seven Mineral
 - One Nutrient
 - Three Microbiology

History DMR-QA Program Changes



- Additional DMR-QA Parameters

Trace Metals	Minerals
Antimony	Alkalinity as CaCO ₃
Barium	Calcium Hardness as CaCO ₃
Beryllium	Chloride
Hexavalent Chromium	Conductivity at 25°C
Molybdenum	Fluoride
Silver	Total Hardness as CaCO ₃
Thallium	Sulfate
Nutrients	Microbiology
Nitrite as N	E.coli
Miscellaneous Analytes	Fecal Coliform
Settleable Solids	Total Coliform
Turbidity	

History DMR-QA Program Changes



- 2009 – EPA Streamlines Data Reporting
 - Laboratories to report PT Data to Providers
 - Laboratory to provide Final Report to Permit Holders
 - Permit Holders report simple checklist of laboratory PT results to EPA Coordinators

- Elimination of Duplicate Data Reporting
 - Permit holder reporting laboratory PT Data to Provider
 - PT Provider reporting Laboratory Final Report to Permit Holder

- Focus on Laboratory Performance

Quality Performance of DMR-QA



- Data Gathering
 - EPA PES DMR-QA Studies 1995 – 1999
 - NERL website
 - Environmental Resource Associates (ERA)
 - DMRQA Studies 2000 - 2008

- DMR-QA Studies in support major and selected minor NPDES permits
 - EPA Data approximately 7500 permits
 - ERA Data approximately 4500 permits

Quality Performance of DMR-QA



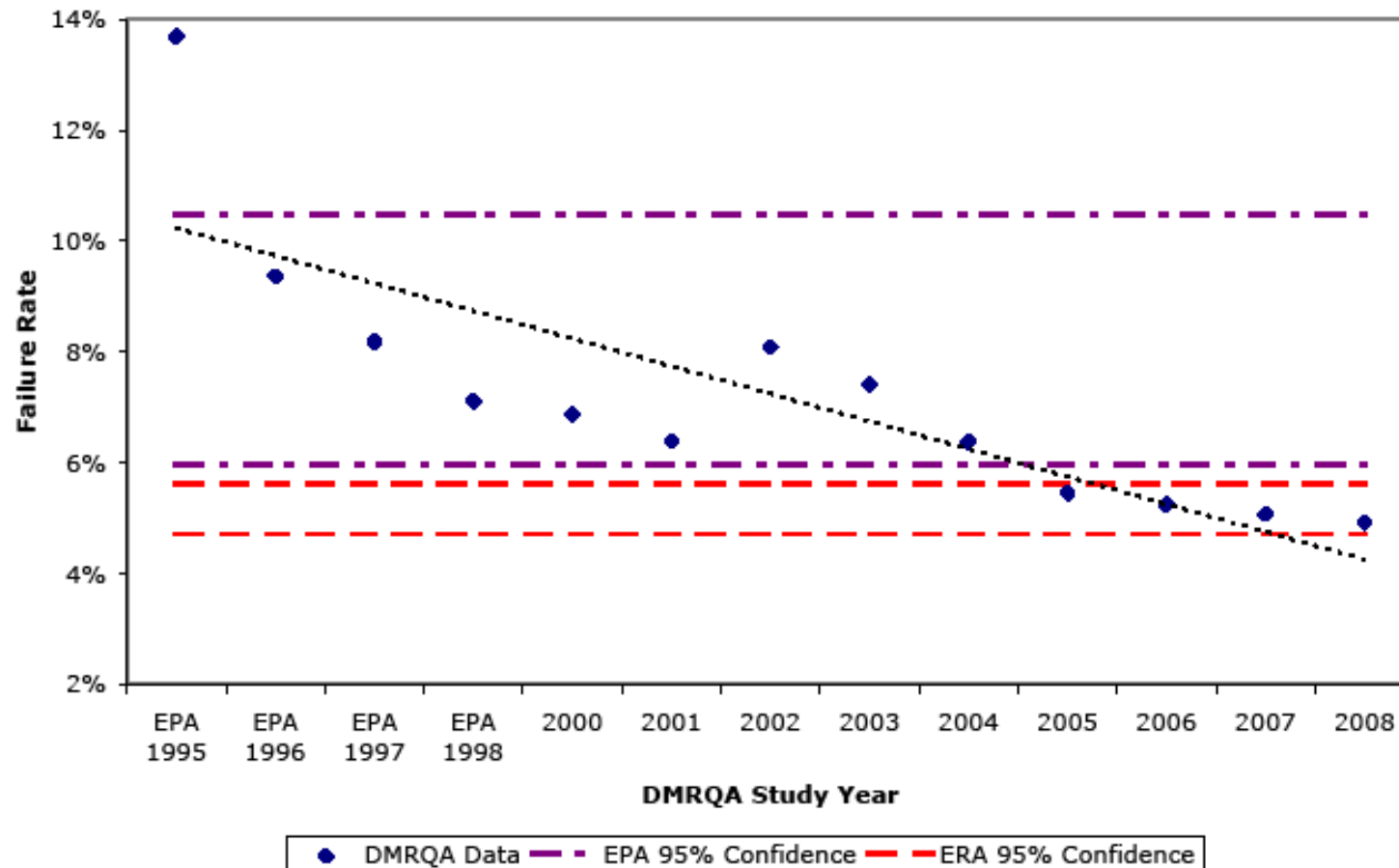
- Procedure
 - Common analytes/parameters 1995 - 2008
 - Twenty-nine chemistry consistently reported

- Laboratory Failure Rates
 - Number of Not Acceptable Data divided by the Total Reported Data Points
 - Compared EPA vs. ERA Failure Rates

Quality Performance of DMR-QA

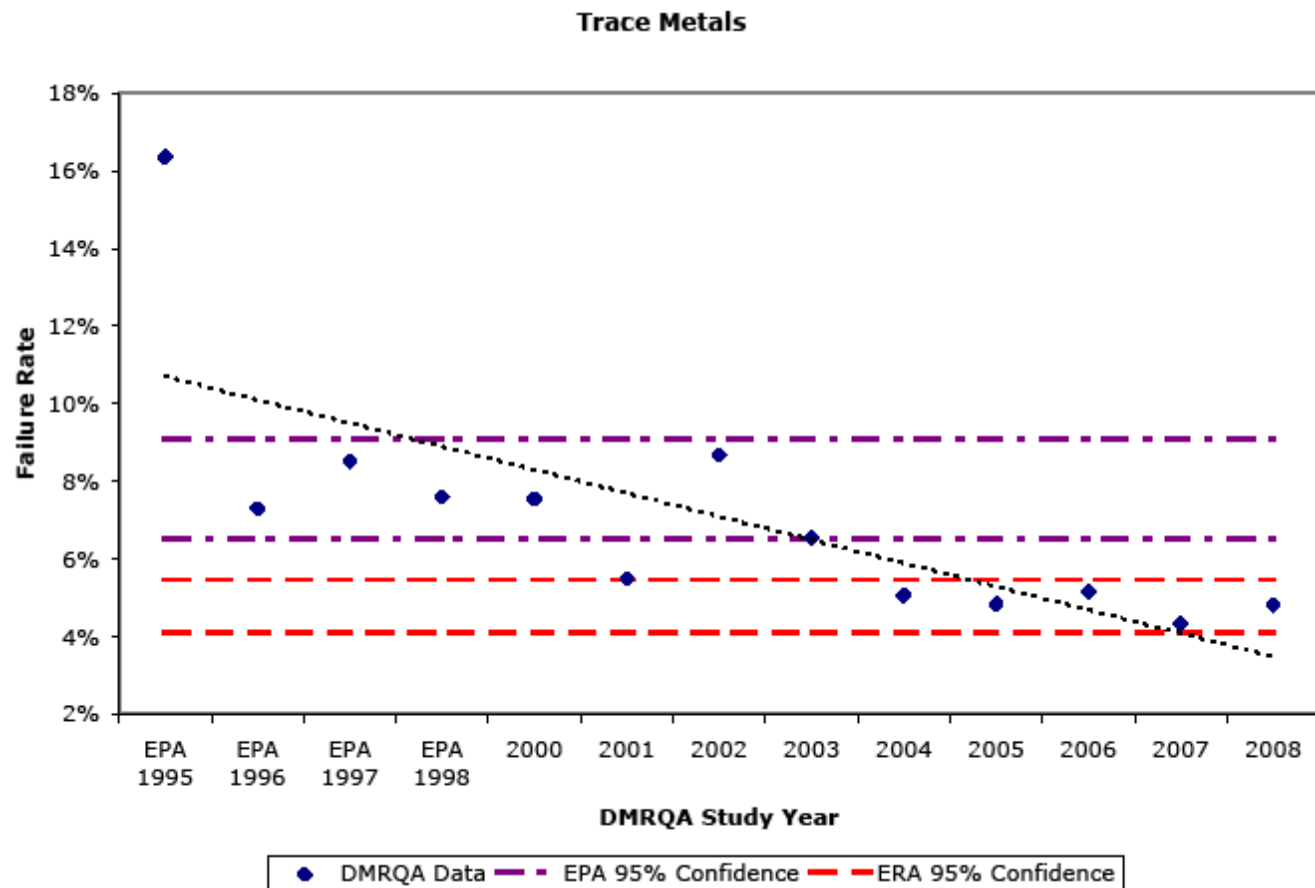
- DMR-QA Failure Rates Comparison – Twenty-nine Parameters

Inorganic Parameters



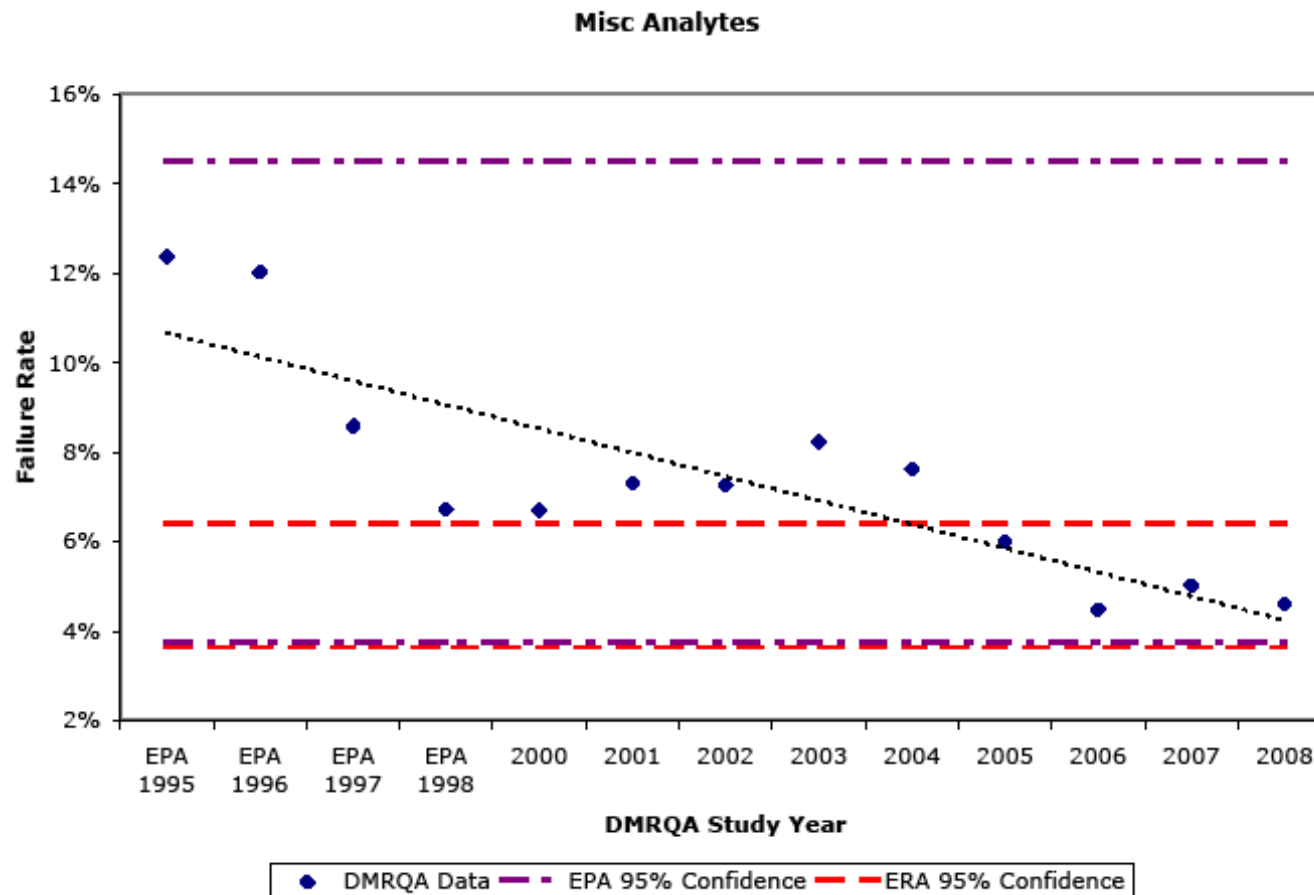
Quality Performance of DMR-QA

- DMR-QA Failure Rate Comparison – Fourteen Trace Metals
 - 35% of Total Data



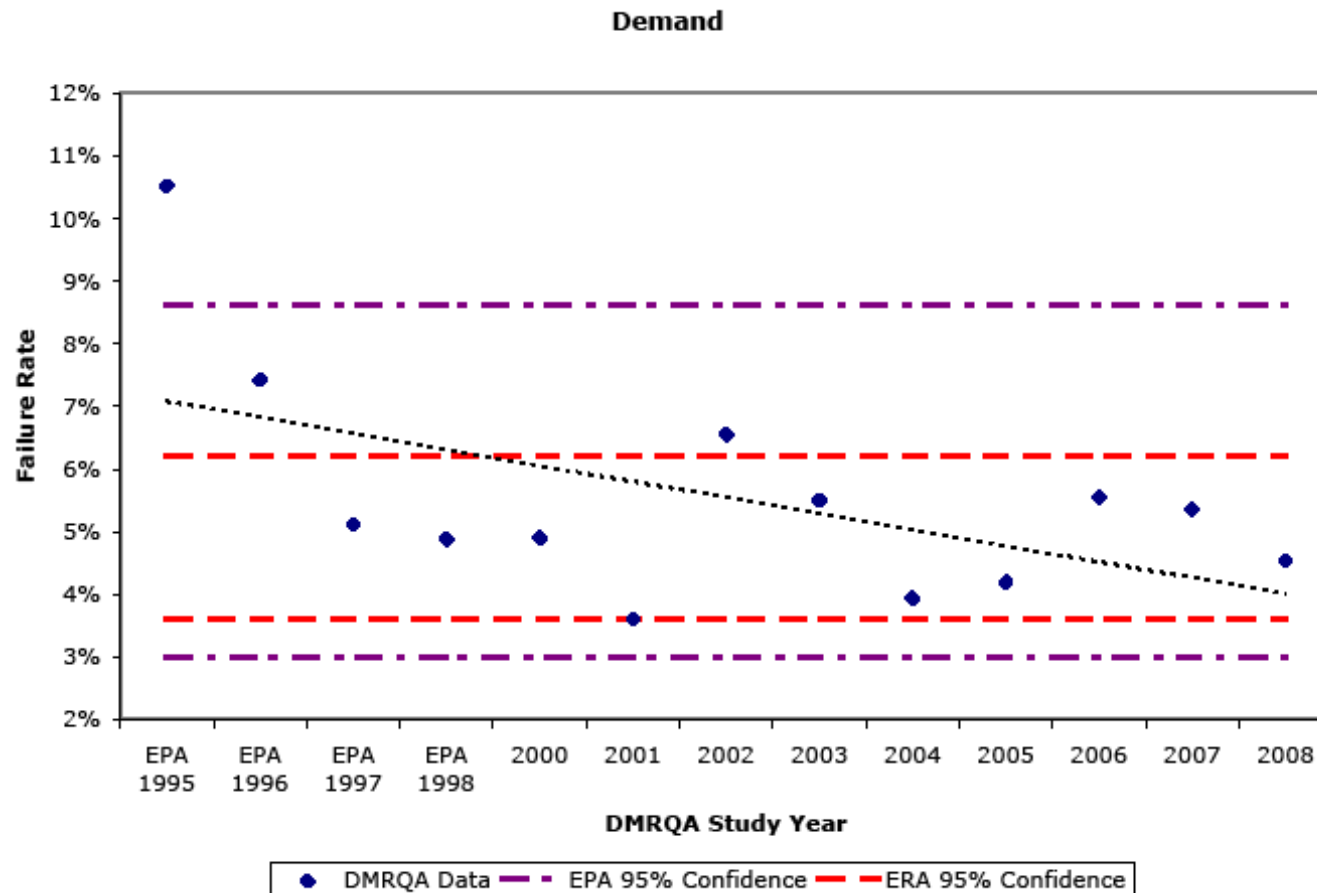
Quality Performance of DMR-QA

- DMR-QA Failure Rate Comparison – Six Misc Parameters
 - 35% of Total Data



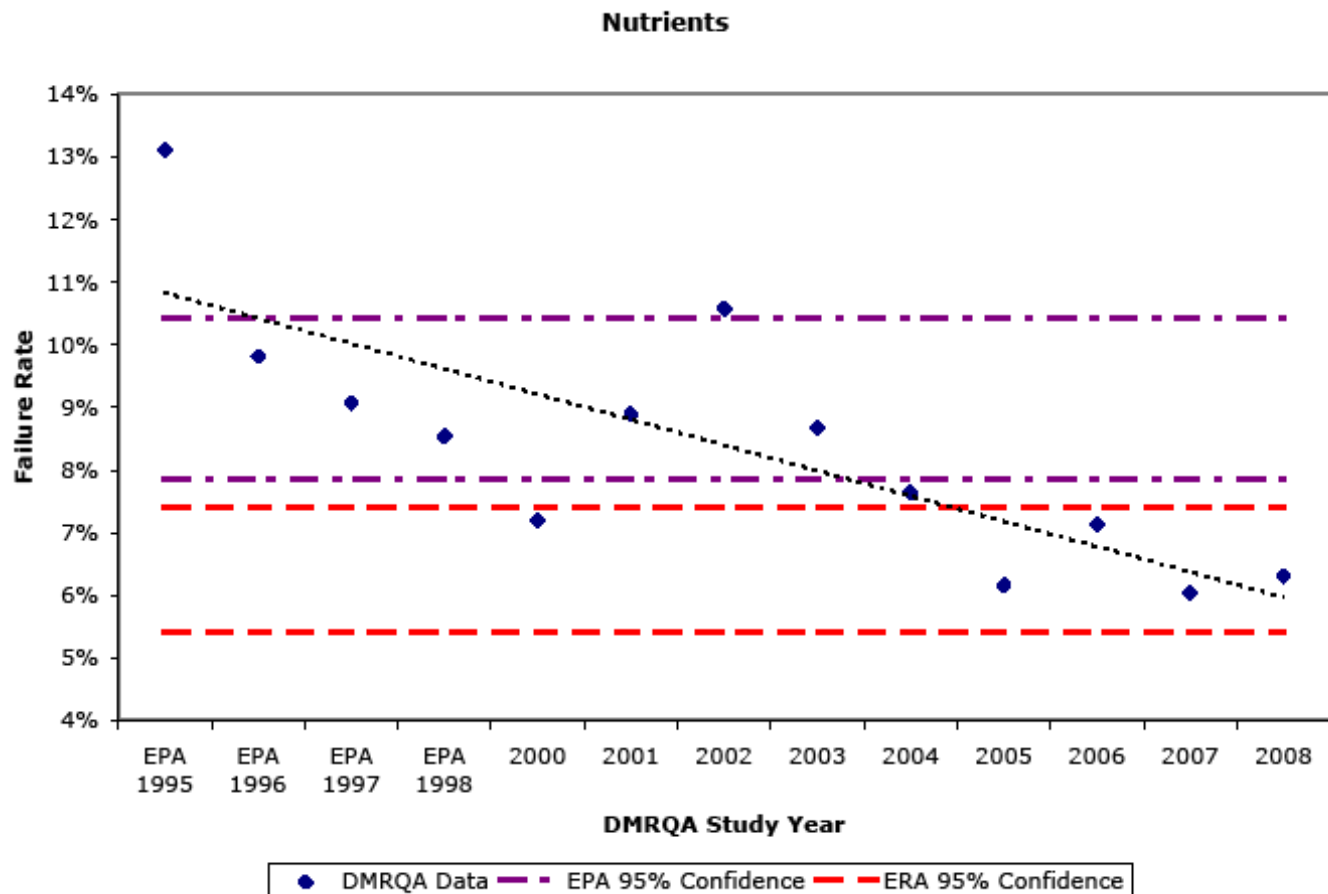
Quality Performance of DMR-QA

- DMR-QA Failure Rate Comparison – Four Demand Parameters
- 14% of Total Data



Quality Performance of DMR-QA

- DMR-QA Failure Rate Comparison – Five Nutrient Parameters
- 16% of Total Data



- Failure Rate Comparison
 - Not all twenty-nine analytes individually show the trend of decreasing failure rates over time
 - Several groups of analytes do show the same decreasing failure rate trend
 - Overall the trend of decreasing failure rates is apparent

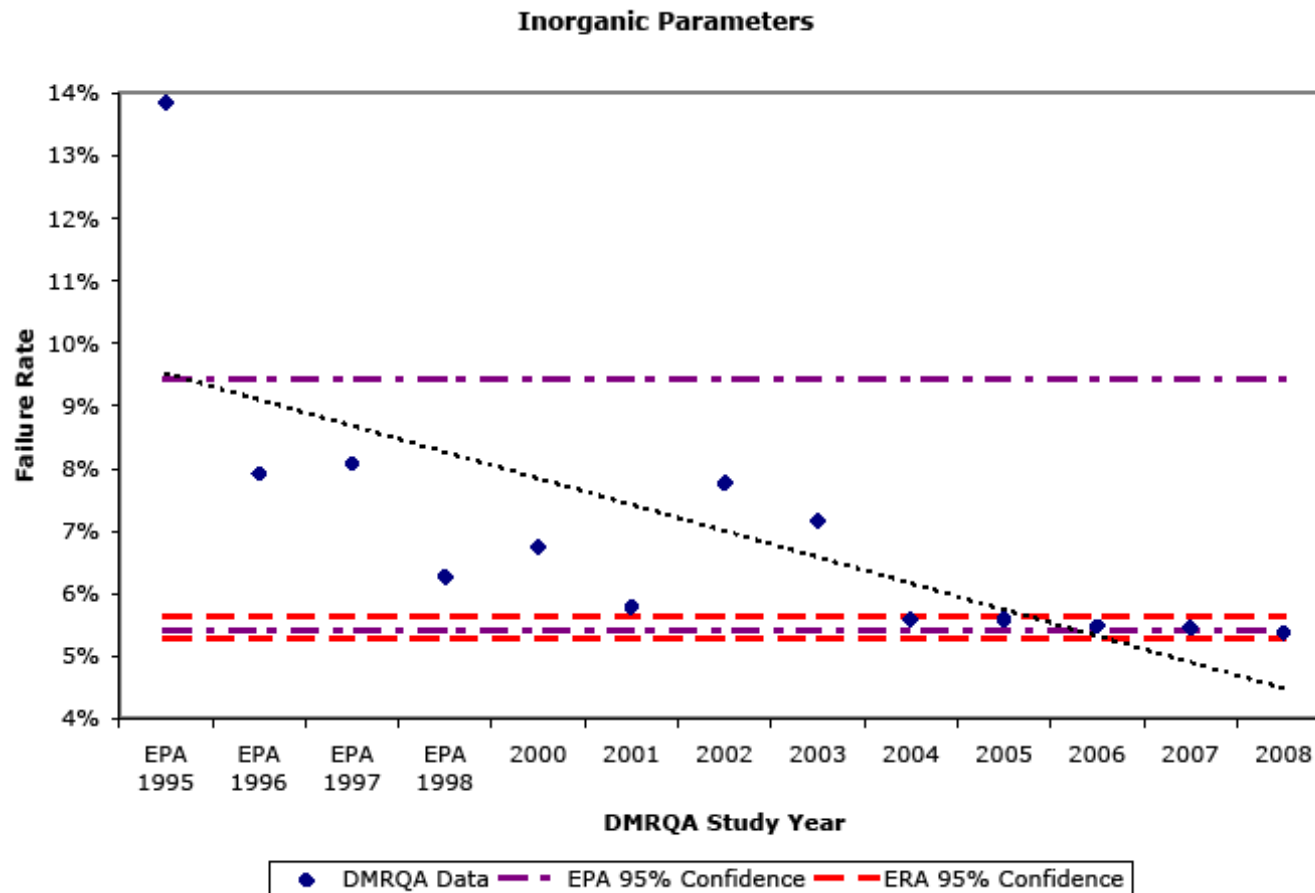
Quality Performance of DMR-QA

- Failure Rate influenced by PT Acceptance Limits
- EPA Criteria Document 1998
- Criteria changed in 2005
- EPA Studies Acceptance Limits
 - EPA established using EPA and State Laboratories
 - Examination of 1995 – 1999 PES Data reveals the possible use of linear regression equations
 - EPA Criteria Document Linear Regression Equations established from EPA PES historical data
 - Best representation of PES
- NELAC Linear Regression Equations from FoPT tables

- Comparison of NELAC FoPT Table vs. EPA Criteria Document
 - Acceptance Limits
 - Calculating the delta between the lower and upper acceptance limits across the PT concentration range
 - Results NELAC FoPT Table
 - 15 analytes same acceptance limits
 - 7 analytes tighter acceptance limits
 - 7 analytes wider acceptance limits

Quality Performance of DMR-QA

- DMR-QA Failure Rate Comparison – Twenty-two Inorganic Parameters with the Same or Tighter Acceptance Limits



- Acceptance Limits influence on Failure Rates
 - 22 analytes with the same or tighter acceptance limits
 - Failure Rate Comparison shows same decreasing failure rate trend as all twenty-nine analytes
 - Overall the change in acceptance limits has no significant influence on failure rates for the DMR-QA studies

Quality Performance of DMR-QA

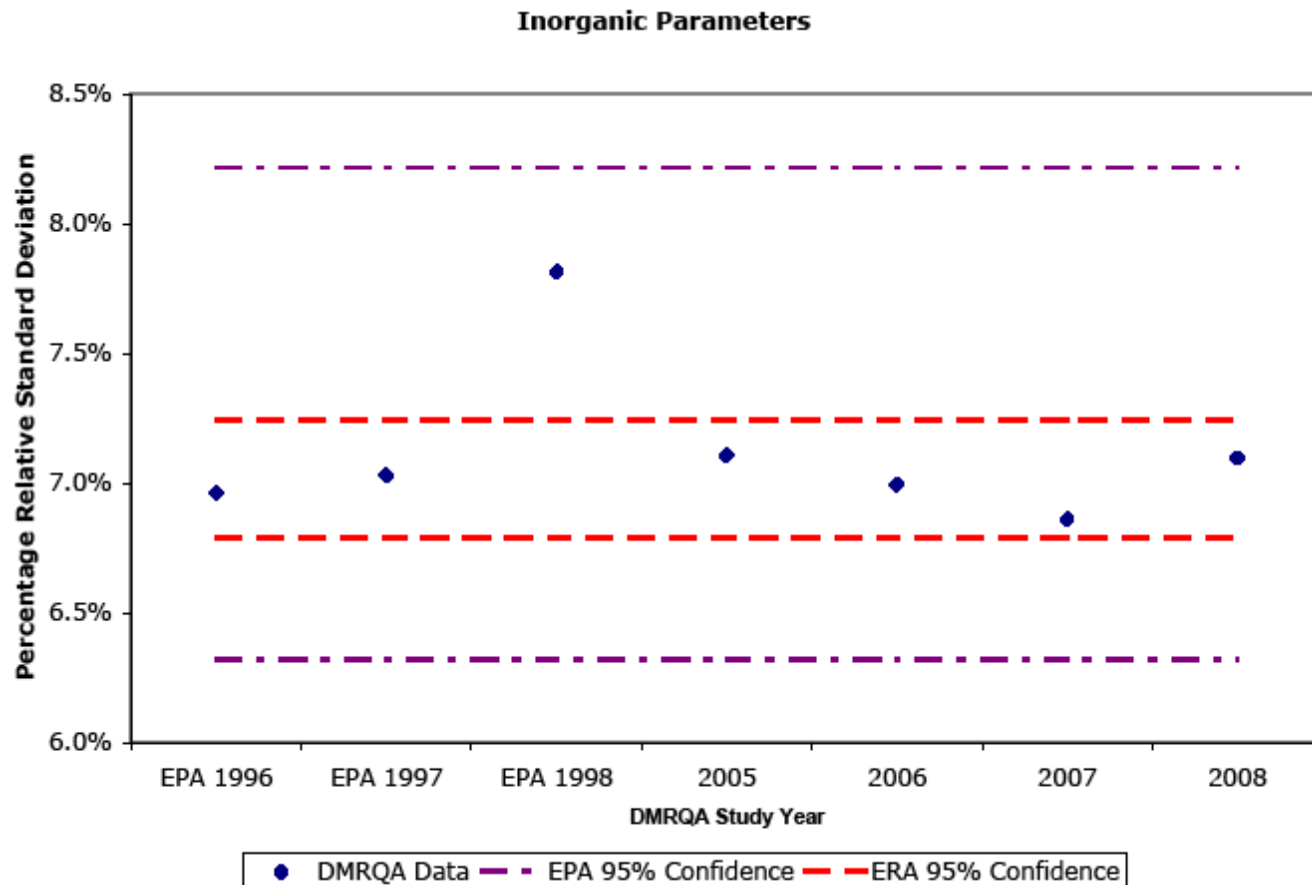
- Measurement of Relative Standard Deviation (RSD) can be used as an indicator of laboratory performance over time
 - $RSD = \text{Study Standard Deviation} / \text{Study Mean}$

- A decrease in relative standard deviation would show laboratory quality improvement

- Comparison of the twenty-nine parameters shows not significant decrease in relative standard deviation
 - Averaged the RSD for all parameters

Quality Performance of DMR-QA

- DMR-QA Relative Standard Deviation Comparison - Twenty-nine Parameters



Quality Performance of DMR-QA



- Relative Standard Deviation Performance
- The EPA Study Years 1996 to 1998 contained a subset of the whole dataset
 - Study Mean and Standard Deviation calculated from EPA and State Laboratories
- The ERA Study Years 2004 to 2008 contained the whole dataset
- In the last four years the permit holder laboratories, both in-house and contract, performed as well as the EPA and State Laboratories

Conclusion on DMR-QA Performance

- In the early 1990's the EPA Office of Water published a report on the EPA Performance Evaluation (PES)
 - Increase the cost-effectiveness of the DMR-QA Program
 - Throughout privatization reporting WP study data to fulfill DMR-QA requirement has been strongly suggested
 - ERA Study Data
 - 2000 approximately 18% from WP Studies
 - 2008 over 60% from WP Studies
 - The shift from technology-based to quality-based effluent limits necessitated the need for lower level concentrations of analytes in the DMR-QA
 - EPA Criteria Document combined the DMR-QA and WP studies into one concentration range

Conclusion on DMR-QA Performance



- EPA Office of Water PES report Cont'
 - Regulations moving toward microbiology indicators expand the parameter list to include microbiology
 - In 2006/2007 the three major micro indicators were added
 - Technical assistance to laboratories is significant
 - Privatization has distributed this technical assistance over several PT Providers
 - Unnecessary distribution of final reports
 - In 2009 the EPA has streamlined the DMR-QA reporting

Conclusion on DMR-QA Performance



- One of the most important purposes of DMR-QA Program
- Improve Laboratory Performance
 - Evidence of quality improvement exists
- Privatization has allowed EPA to concentrate on larger issue within the program

Thank You

Jeff Lowry

Contact email: jlowry@eraqc.com
Environmental Resource Associates