Environmental Proficiency Testing, Certified Reference Materials, and Quality Control Standards for Analytical Laboratories

Marelize Ferreira
Microsep (Pty) Ltd
Waters Division
Background and History of ERA
History

- Founded in 1977
- 70 full-time employees
- 60,000 square-foot lab/production/office facility in Golden, Colorado
- Acquired by Waters in 2008
Globalization

- ERA manages >80% market share of the environmental PT segment in the United States.

- ERA manages studies for two governments internationally

- Our products are used in nearly 80 countries

- By participating in ERA PT schemes, your results will be compared to laboratories throughout the world
Commitment to Quality

- Full range of accreditations
- Dedicated QA staff
- In-house accredited laboratory

<table>
<thead>
<tr>
<th>Area</th>
<th>Accreditation</th>
<th>When ERA was First Accredited</th>
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<tbody>
<tr>
<td>Quality System</td>
<td>ISO 9001</td>
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<td>PT Provider</td>
<td>NIST NVLAP</td>
<td>1999</td>
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<td>ISO Guide 43/17043</td>
<td>2002</td>
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<td></td>
<td>ISO 17025</td>
<td>2008</td>
</tr>
</tbody>
</table>
Acceptability

ilac

AZLA

SANAS

ERA

A Waters Company
Basics of Quality Control
Terminology

- CRM
  - Assigned value
  - Known homogeneity, uncertainty and stability
  - Traceable
  - CoA

- Proficiency testing
  - Single blind sample
  - Interlaboratory comparison
Basics of quality control

- Corrective Action
- Method Development
- Ongoing Performance
- Staff Training
Method Development

- Precision
- Accuracy
- Detection Limit
- Reporting Limit
- Linear range
- Ruggedness
  - What if something changes?
Method Development - CRMs

- **Precision**
  - Run CRM 10 times with the same conditions
  - Run CRM over 10 days

- **Accuracy**
  - Run a CRM or blind PT sample

- **Detection Limit**
  - Blank runs

- **Reporting Limit**
  - Dilute CRMs

- **Linear range**
  - Run a high and low CRM

- **Ruggedness**
  - Run CRM under controlled conditions
  - Change the conditions
  - Record variation
Basics of quality control
Staff Training

- New staff / new method

- Was the training effective? How do we prove competence?

- The best way to do both of these is to use CRMs as hands-on training samples and to document the analyst’s performance versus the assigned value of the CRMs

- Continuous assessment of competency
Basics of quality control

Corrective Action

Method Development

Ongoing Performance

Staff Training
Once a method is established in your laboratory, there are still many variables that can affect its performance:

- Analysts
- Instruments
- Standards and reagents
- Laboratory environment
- Sample matrix
- Random errors
Ongoing Performance

- **Routine QC**
  - **Calibration**
    - Fresh
    - Trusted source
    - Traceable
  
  - **CCV: continuing calibration verification**
    - Same source as calibration
    - Checking for short-term drift
  
  - **ICV: independent calibration verification**
    - Independent source
      - Certified reference material
    - Generally mid-calibration range
    - Control chart the results of ICV analysis
Ongoing Performance

- Control charting is the process of plotting the percent recovery of a certified reference material, each time it is analyzed.

- Ideally, the CRM is analyzed with each analytical batch, or at least once each day that the analysis is performed.

- When possible, use the same lot number of CRM for your control charting for as long as possible.
  - This ensures that any potential variations between CRMs are not affecting your control charts.
  - If you consistently use CRMs from the same, accredited provider, you should not experience lot-to-lot variations.
Control Chart Example

- **Out of control limits** indicated by a significant drop in the graph, suggesting a possible problem in the process.

- **Warning limits** are shown as a horizontal line, indicating a range where the process is still considered in control.

- **Trend** is a general direction in the data, which in this case appears to be decreasing.

- The graph uses different colors to represent different data sets:
  - **Result**
  - **LCL**
  - **LWL**
  - **UWL**
  - **UCL**
Ongoing Performance

Control charting

- When you begin to notice a **trend** in your control chart, you can implement **preventive action** to ensure that your data do not drift out of control.

- If your data do become **out of control**, you should stop the analysis, implement **corrective action**, and then document that the corrective action was successful before resuming analysis.
Ongoing Performance

- Proficiency testing
  - Periodically
  - How do we measure up?
Basics of quality control

Corrective Action

Method Development

Ongoing Performance

Staff Training
Corrective Action

- **When?**
  - Failed PT sample
  - Calibration linear regression does not fit
  - Outside of quality control limits
    - Control chart

- **Corrective action:**
  - Root cause analysis
  - Implement corrections
  - Test that corrections are appropriate
  - Monitor to ensure that corrections are effective
Corrective Action

- CRMs are effective when conducting root cause analysis:
  - Run using same conditions as when problem identified
  - Make minor adjustments if necessary
  - Use to identify the source of the error (Man, Machine, Materials, Methods)
    - Analyst
    - Instrument
    - Standards
    - Procedure
Corrective Action

Once the problem is identified and a change has been implemented, CRMs are helpful to ensure effectiveness:
- Was change appropriate
- Is the change effective long term

Proficiency testing
- Are we back on track?
Overview of ERA Environmental Products
Environmental Product Line

- Over 1500 analyte/matrix combinations
  - Proficiency Testing (PT), and
  - Certified reference material (CRM)
- Over 250 calibration standards
  - Metals, Anions, pH, Inorganic analytes
Environmental Products

- Our products cover all major environmental analyses
  - Organics
  - Inorganics
  - Metals
  - Physical parameters
  - Microbiology
  - Radiochemistry
  - Whole effluent toxicity
Matrices

- ERA stock PT and CRM standards are offered in 5 different matrices
  - Drinking Water
  - Waste Water
  - Air and Emissions
  - Soil and Solid materials
  - Multi-media
Drinking Water

- Concentrations are based on US EPA drinking water maximum contamination limits (MCLs)

- Matrix is deionized water
  - Whole volume samples are made in deionized water
  - For concentrates, labs are directed to dilute into deionized water
Water Pollution

- Concentrations are based on US EPA clean water act requirements

- Matrix is deionized water
  - Whole volume samples are made in deionized water
  - For concentrates, labs are directed to dilute into deionized water
Air and Emissions

- Air and Emissions (AE) PT and CRM standards are designed to fulfill global requirements for emissions and ambient air.
- Concentrations are based on typical regulatory levels.
- Matrices are common air sampling media:
  - Impinger solutions
  - Filter papers
  - Sorbents
  - PUF
  - Compressed gas cylinders
Soil and Solid Matrices

- Soil PT and CRM standards are designed to fulfill global requirements for monitoring in soil and solid matrices

- Concentrations are based on typical regulatory levels

- Matrix are real solid matrices
  - Dried and homogenized
  - Soil, sewage sludge, vegetation
Multi-media

- Multi-media Radiochemistry (MRAD) PT and CRM standards are designed to fulfill global requirements for monitoring of radiochemicals.

- Concentrations are based on typical levels of these radionuclides in environmental samples.

- Available matrices for MRAD PT and CRMs are:
  - Soil
  - Vegetation
  - Air Filters
  - Water
Certified Reference Materials
Certified Reference Materials

- Known value

- Accredited to ISO Guide 34

- Multiple lots available

- **Accurate, stable** and are **fully documented**

- Samples are prepared to be **traceable to NIST** materials when available.
Certified Reference Materials

Inorganics

<table>
<thead>
<tr>
<th>CRM</th>
<th>PT M</th>
<th>QR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. #698</td>
<td>Cat. #591</td>
<td>Cat. #698QR</td>
</tr>
</tbody>
</table>

One 500 mL whole-volume bottle is ready to analyze. The CRM is also certified for Sodium. For a Sodium PT, order Hardness, Cat. #555.

- Alkalinity as CaCO₃: 25-200 mg/L
- Chloride: 20-160 mg/L
- Fluoride: 1-8 mg/L
- Nitrate as N: 3-10 mg/L
- Nitrate plus Nitrite as N: 3-10 mg/L
- Potassium: 10-40 mg/L
- Specific Conductance at 25 °C: 130-1,300 µmhos/cm
- Sulfate: 25-250 mg/L
- Total filterable residue (TDS) at 180 °C: 100-1,000 mg/L

Each analyte will have a certified value within these concentration ranges.
Certified Reference Materials

### Low-Level Nitroaromatics & Nitramines

<table>
<thead>
<tr>
<th>CRM</th>
<th>PT</th>
<th>QR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. #677</td>
<td>Cat. #932</td>
<td>Cat. #677QR</td>
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</tbody>
</table>

One 2 mL flame-sealed ampule yields up to 2 liters of sample after dilution. Use with EPA methods 8330 and 8091 for explosive and explosive residue analytes. Contains at least 80% of the analytes randomly selected from the list below at 1-20 µg/L.

- 4-Amino-2,6-dinitrotoluene
- 2-Amino-4,6-dinitrotoluene
- 1,3-Dinitrobenzene
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- HMX
- Nitrobenzene
- 2-Nitrotoluene
- 3-Nitrotoluene
- 4-Nitrotoluene
- RDX
- Tetral
- 1,3,5-Trinitrobenzene
- 2,4,6-Trinitrotoluene

Some analytes will be unspiked and will have an assigned value of <1 µg/L.
## Certified Reference Materials

### Certificate of Analysis

**Certificate No. 5146-697**

**Issue Date:** November 22, 2008  
**Revised Date:** Original

### PotableWatR Metals

**Catalog No. 690**

### Certification

<table>
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<tr>
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<th>PT PAU**</th>
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<td></td>
<td>(µg/l)</td>
<td></td>
<td>(µg/l)</td>
<td>(µg/l)</td>
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<tr>
<td>aluminum</td>
<td>28.03</td>
<td>2.0%</td>
<td>1749 - 2250</td>
<td>1740 - 2250</td>
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<tr>
<td>arsenic</td>
<td>26.4</td>
<td>3.1%</td>
<td>207 - 453</td>
<td>215 - 447</td>
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<tr>
<td>copper</td>
<td>43.0</td>
<td>1.0%</td>
<td>37.4 - 48.2</td>
<td>30.5 - 59.3</td>
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<tr>
<td>lead</td>
<td>224</td>
<td>2.2%</td>
<td>2030 - 2405</td>
<td>1900 - 2500</td>
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<tr>
<td>manganese</td>
<td>11.2</td>
<td>1.2%</td>
<td>10.9 - 11.6</td>
<td>11.0 - 11.6</td>
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<tr>
<td>molybdenum</td>
<td>1520</td>
<td>3.0%</td>
<td>1416 - 1629</td>
<td>1310 - 1700</td>
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<tr>
<td>nickel</td>
<td>46.0</td>
<td>1.5%</td>
<td>39.6 - 54.2</td>
<td>34.5 - 51.7</td>
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<tr>
<td>phosphorus</td>
<td>73.3</td>
<td>1.3%</td>
<td>64.8 - 81.6</td>
<td>63.7 - 84.3</td>
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<tr>
<td>potassium</td>
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<td>2.0%</td>
<td>85.5 - 96.6</td>
<td>82.6 - 97.5</td>
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<tr>
<td>selenium</td>
<td>57.4</td>
<td>3.5%</td>
<td>50.1 - 63.7</td>
<td>49.3 - 64.2</td>
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<tr>
<td>silver</td>
<td>87.4</td>
<td>1.2%</td>
<td>77.1 - 95.9</td>
<td>76.2 - 97.6</td>
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<td>thorium</td>
<td>7.00</td>
<td>2.2%</td>
<td>6.72 - 8.40</td>
<td>5.78 - 10.0</td>
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<td>vanadium</td>
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<td>1.4%</td>
<td>7.10 - 12.90</td>
<td>7.15 - 18.90</td>
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<td>zinc</td>
<td>1750</td>
<td>1.4%</td>
<td>1595 - 1930</td>
<td>1590 - 1940</td>
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### Analytical Verification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean (µg/l)</th>
<th>NIST Traceability Recovery (%)</th>
<th>n</th>
<th>NIST Traceability Recovery (%)</th>
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<td>aluminum</td>
<td>19.70</td>
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<tr>
<td>arsenic</td>
<td>25.1</td>
<td>97%</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>copper</td>
<td>27.4</td>
<td>96%</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>iron</td>
<td>32.0</td>
<td>93%</td>
<td>45</td>
<td></td>
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<tr>
<td>lead</td>
<td>27.6</td>
<td>95%</td>
<td>44</td>
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<tr>
<td>molybdenum</td>
<td>33.7</td>
<td>94%</td>
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<td>molybdenum</td>
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<td>42</td>
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<td>39.4</td>
<td>91%</td>
<td>41</td>
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<tr>
<td>nickel</td>
<td>86.8</td>
<td>90%</td>
<td>40</td>
<td></td>
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<tr>
<td>phosphorus</td>
<td>99.1</td>
<td>90%</td>
<td>39</td>
<td></td>
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<tr>
<td>phosphorus</td>
<td>98.3</td>
<td>90%</td>
<td>38</td>
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<tr>
<td>silicon</td>
<td>7.96</td>
<td>89%</td>
<td>37</td>
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<tr>
<td>silicon</td>
<td>1260</td>
<td>89%</td>
<td>36</td>
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<tr>
<td>silicon</td>
<td>1780</td>
<td>88%</td>
<td>35</td>
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*Please see footnotes on back*
## Certified Reference Materials

**Certificate of Analysis**
Lot No. S146-697

### Certification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Certified Value (µg/l)</th>
<th>Uncertainty (%)</th>
<th>QC PALs (µg/l)</th>
<th>PT PALs (µg/l)</th>
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<tr>
<td>aluminum</td>
<td>2020</td>
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<td>1740 - 2200</td>
<td>1740 - 2230</td>
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<td>antimony</td>
<td>36.4</td>
<td>3.1%</td>
<td>30.7 - 43.6</td>
<td>25.5 - 47.3</td>
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<tr>
<td>arsenic</td>
<td>43.0</td>
<td>1.8%</td>
<td>37.4 - 48.6</td>
<td>30.1 - 55.9</td>
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<tr>
<td>barium</td>
<td>2240</td>
<td>2.2%</td>
<td>2020 - 2460</td>
<td>1900 - 2580</td>
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<tr>
<td>beryllium</td>
<td>9.62</td>
<td>2.3%</td>
<td>8.31 - 10.7</td>
<td>8.18 - 11.1</td>
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<tr>
<td>boron</td>
<td>1500</td>
<td>2.3%</td>
<td>1410 - 1620</td>
<td>1310 - 1660</td>
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<tr>
<td>cadmium</td>
<td>45.6</td>
<td>1.8%</td>
<td>39.0 - 48.7</td>
<td>36.5 - 54.7</td>
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<tr>
<td>chromium</td>
<td>73.3</td>
<td>1.3%</td>
<td>64.8 - 81.8</td>
<td>62.3 - 84.3</td>
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<tr>
<td>copper</td>
<td>881</td>
<td>1.4%</td>
<td>795 - 967</td>
<td>793 - 969</td>
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<tr>
<td>iron</td>
<td>507</td>
<td>2.3%</td>
<td>450 - 564</td>
<td>443 - 563</td>
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<tr>
<td>lead</td>
<td>75.1</td>
<td>1.4%</td>
<td>65.6 - 84.6</td>
<td>52.6 - 97.6</td>
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<tr>
<td>manganese</td>
<td>86.8</td>
<td>0%</td>
<td>78.6 - 95.0</td>
<td>77.3 - 97.0</td>
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<tr>
<td>molybdenum</td>
<td>68.9</td>
<td>2%</td>
<td>59.6 - 77.5</td>
<td>59.5 - 76.6</td>
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<tr>
<td>nickel</td>
<td>394</td>
<td>0.0%</td>
<td>360 - 428</td>
<td>236 - 462</td>
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<td>selenium</td>
<td>57.4</td>
<td>0.0%</td>
<td>48.1 - 70.1</td>
<td>48.1 - 70.1</td>
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**PotableWatR Metals**
Catalog No. 697
Issue Date: November 29, 2008
Revision Date: Original

**QC Acceptance Limits**

**PT Acceptance Limits**

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# Certified Reference Materials

## Analytical Verification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean (µg/l)</th>
<th>NIST SRM and Traceability %</th>
<th>Number of data points</th>
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<tbody>
<tr>
<td>aluminum</td>
<td>1970</td>
<td>SRM 3101a 102%</td>
<td>49</td>
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<tr>
<td>antimony</td>
<td>37.1</td>
<td>SRM 3102a 98.4%</td>
<td>47</td>
</tr>
<tr>
<td>arsenic</td>
<td>43.0</td>
<td>SRM 3103a 99.4%</td>
<td>56</td>
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<tr>
<td>barium</td>
<td>2230</td>
<td>SRM 3104a 104%</td>
<td>54</td>
</tr>
<tr>
<td>beryllium</td>
<td>9.50</td>
<td>SRM 3105a 100%</td>
<td>58</td>
</tr>
<tr>
<td>boron</td>
<td>1520</td>
<td>SRM 3107 104%</td>
<td>29</td>
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<td>cadmium</td>
<td>43.9</td>
<td>SRM 3108 98.0%</td>
<td>61</td>
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<tr>
<td>chromium</td>
<td>72.6</td>
<td>SRM 3112a 99.2%</td>
<td>59</td>
</tr>
<tr>
<td>copper</td>
<td>881</td>
<td>SRM 3114 100%</td>
<td>77</td>
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<tr>
<td>iron</td>
<td>507</td>
<td>SRM 3126a 100%</td>
<td>55</td>
</tr>
<tr>
<td>lead</td>
<td>75.1</td>
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<tr>
<td>manganese</td>
<td>87.7</td>
<td>SRM 3132 101%</td>
<td>54</td>
</tr>
<tr>
<td>molybdenum</td>
<td>68.6</td>
<td>SRM 3134 99.2%</td>
<td>37</td>
</tr>
<tr>
<td>nickel</td>
<td>394</td>
<td>SRM 3136 98.6%</td>
<td>50</td>
</tr>
<tr>
<td>selenium</td>
<td>59.1</td>
<td>SRM 3149 96.1%</td>
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<tr>
<td>silver</td>
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<tr>
<td>thallium</td>
<td>7.56</td>
<td>SRM 3158 98.5%</td>
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</tbody>
</table>

## Study Mean (units and %)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean (µg/l)</th>
<th>Recovery (%)</th>
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<td>37.1</td>
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<tr>
<td>arsenic</td>
<td>43.0</td>
<td>100%</td>
</tr>
<tr>
<td>barium</td>
<td>2230</td>
<td>99.7%</td>
</tr>
<tr>
<td>beryllium</td>
<td>9.50</td>
<td>98.8%</td>
</tr>
<tr>
<td>boron</td>
<td>1520</td>
<td>101%</td>
</tr>
<tr>
<td>cadmium</td>
<td>43.9</td>
<td>96.2%</td>
</tr>
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<td>chromium</td>
<td>72.6</td>
<td>99.1%</td>
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<tr>
<td>copper</td>
<td>881</td>
<td>100%</td>
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<tr>
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<td>507</td>
<td>100%</td>
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<tr>
<td>lead</td>
<td>75.1</td>
<td>100%</td>
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<tr>
<td>manganese</td>
<td>87.7</td>
<td>101%</td>
</tr>
<tr>
<td>molybdenum</td>
<td>68.6</td>
<td>99.5%</td>
</tr>
<tr>
<td>nickel</td>
<td>394</td>
<td>100%</td>
</tr>
<tr>
<td>selenium</td>
<td>59.1</td>
<td>103%</td>
</tr>
<tr>
<td>silver</td>
<td>86.3</td>
<td>98.7%</td>
</tr>
<tr>
<td>thallium</td>
<td>7.56</td>
<td>98.2%</td>
</tr>
</tbody>
</table>
ERA CRM Advantages

- ERA provides multiple lots each year
  - Each lot has unique analyte/concentration combinations

- A customer can get a different CRM each time or they can order multiple of one lot to use over the course of several years
  - Different lots provide a unique challenge each time
    - Use for training
    - Match different “real” samples
  - Using a single lot over time allows for control charting
Calibration and Laboratory Reagents

- Calibration standards are used to define the relationship between Instrument Response and Concentration.

- Reagents are chemical used in processing or manufacturing facility.

- Consistency is key!
Proficiency Testing
### Inorganics

<table>
<thead>
<tr>
<th>CRM</th>
<th>PT M</th>
<th>QR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. #698</td>
<td>Cat. #591</td>
<td>Cat. #698QR</td>
</tr>
<tr>
<td>$89</td>
<td>$93</td>
<td></td>
</tr>
</tbody>
</table>

One 500 mL whole-volume bottle is ready to analyze. The CRM is also certified for Sodium. For a Sodium PT, order Hardness, Cat. #555.

- Alkalinity as CaCO₃: 25-200 mg/L
- Chloride: 20-160 mg/L
- Fluoride: 1-8 mg/L
- Nitrate as N: 3-10 mg/L
- Nitrate plus Nitrite as N: 3-10 mg/L
- Potassium: 10-40 mg/L
- Specific Conductance at 25 °C: 130-1,300 μmhos/cm
- Sulfate: 25-250 mg/L
- Total filterable residue (TDS) at 180 °C: 100-1,000 mg/L
Proficiency Testing

- ERA’s PT studies are accredited to ISO 17043

- Over **8000 labs participated** in ERA’s PT studies in 2014

- ERA is a **global** PT provider with participants from over 80 countries

- ERA allows **online data entry** as well as online tools to help you compare your data and improve your performance
Proficiency Testing

- Samples are supplied to labs as single blind
- Laboratory analyzes like a real sample, then returns results to ERA
- We evaluate all study participants and provide an evaluation report
- PT is used for fulfilling accreditation requirements and for internal quality control
PT Flexibility

- ERA has 42 PT studies scheduled for 2017
  - Many analytes available 12 times per year
  - Most other analytes are available at least 4 times per year
- Allows labs to participate in PT when it meets their schedules the best
- Other providers generally offer a test only once or twice per year
PT calendars

**2017 PROFICIENCY TESTING SCHEME SCHEDULE**

<table>
<thead>
<tr>
<th>Scheme #</th>
<th>Opens</th>
<th>Closes</th>
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<tbody>
<tr>
<td>AE 030</td>
<td>Jan 30</td>
<td>Mar 16</td>
</tr>
<tr>
<td>AE 040</td>
<td>Apr 28</td>
<td>Jun 12</td>
</tr>
<tr>
<td>AE 041</td>
<td>Jul 31</td>
<td>Sep 14</td>
</tr>
<tr>
<td>AE 042</td>
<td>Oct 23</td>
<td>Dec 7</td>
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**MRAD**

<table>
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<th>Closes</th>
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<tbody>
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<td>Mar 20</td>
<td>May 10</td>
</tr>
<tr>
<td>MRAD 027</td>
<td>Sep 16</td>
<td>Nov 17</td>
</tr>
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</table>

- 2 schemes per year - open for 60 days

**Radiochemistry**

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<tr>
<td>RAD 106</td>
<td>Apr 10</td>
<td>May 25</td>
</tr>
<tr>
<td>RAD 110</td>
<td>Jul 10</td>
<td>Aug 24</td>
</tr>
<tr>
<td>RAD 111</td>
<td>Oct 8</td>
<td>Nov 20</td>
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**Soil (including UST in Soil)**

<table>
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</thead>
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<td>Mar 9</td>
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<tr>
<td>SOIL 98</td>
<td>Apr 24</td>
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<tr>
<td>SOIL 99</td>
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<td>Sep 7</td>
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<tr>
<td>SOIL 100</td>
<td>Oct 16</td>
<td>Nov 30</td>
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**Water Pollution (including UST in Water)**

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**DMR-QA**

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<td>TDD</td>
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*These products are specifically targeted for U.S. customers holding NPDES permits.

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COMPANY CONFIDENTIAL
Proficiency Testing Process

1. Order PT samples
   - What tests are needed
   - What schedule works best for your laboratory

2. Receive PT samples
   - Samples are shipped on study opening date
   - Should arrive within 2 weeks

3. Analyze by your normal methods
   - Same instruments, calibration standards, analysts, etc.

4. Report your results
   - Use eDATA™ website

5. Receive and review final report
   - Available in about 3 weeks
   - Look at evaluations and compare performance to other labs
**eDATA™**

- **eDATA™** access is automatic when signing up for a PT study
  - Revised and improved over past 15 years
  - Accessible through ERA’s website for all study participants
  - Makes PT participation easier
  - Gives labs tools to realize additional value of PT

- Easy data reporting options
  - Direct entry into our website

- Summary report
  - Review before study closes
  - Make sure all data was entered correctly
  - Reduces data entry errors, saving time and money
eDATA™ Tools

- Preliminary results
  - Available shortly after studies close
  - Fast feedback identifies potential problems

- Online reports
  - Easy access whenever needed
  - Archived for future use

- Statistics
  - Compare methods
  - Ability to see performance relative to other participants
  - No hidden data
Inorganics

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QuiK™ Response

- A faster, customized form of proficiency testing
- Used when a lab wants a PT result very quickly
  - Prefers a faster turn around
  - Problem solving
  - Corrective action for a previously failed PT
  - Adding to scope of accreditation
  - To submit with a quote or bid

1. Customer orders today
2. We ship in one to two days
3. They analyze and report back to us
4. Evaluation is available immediately after they report results online through eDATA™
Summary
Summary

- ERA is largest manufacturer of Certified Reference Materials and Proficiency Testing Studies worldwide
- Over 37 years experience
- Large Product Range Environmental and Life Science CRMs
- Demonstrated quality - Accreditation
- PT Study participant size provides confidence and ensures robust statistics
- PT Schedules and product designs provide flexibility
- Data can be used to evaluate, document and improve your overall data quality
Waters
THE SCIENCE OF WHAT’S POSSIBLE.