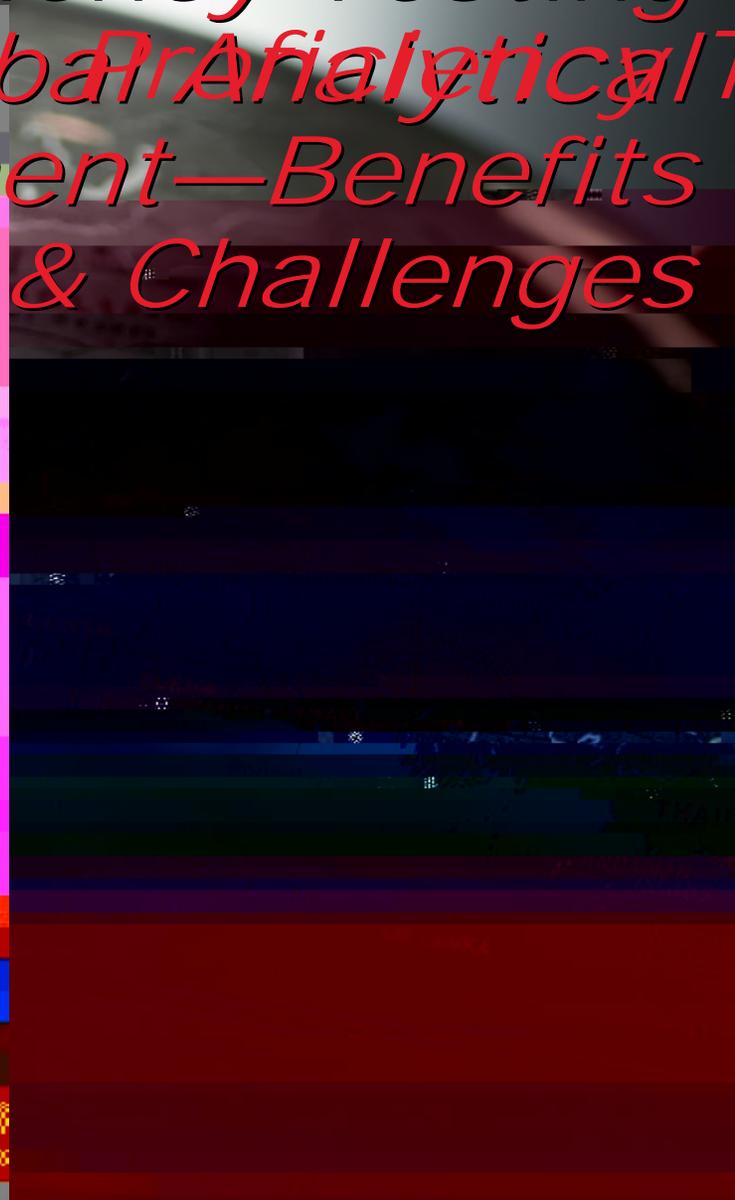
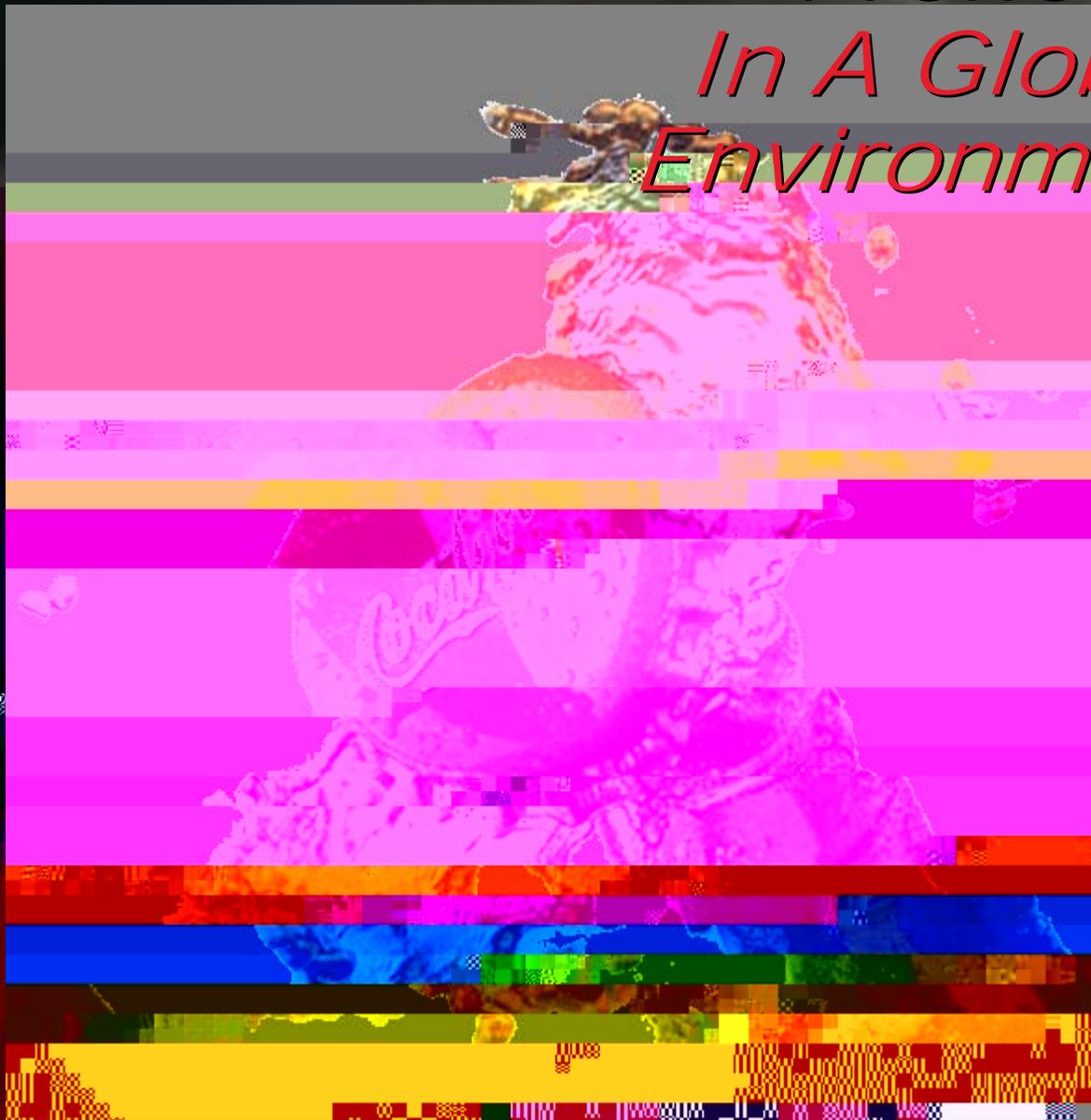
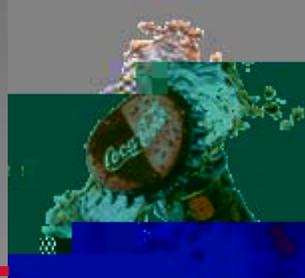
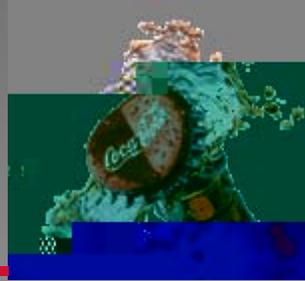


# *Proficiency Testing In A Global Analytical Environment—Benefits & Challenges*





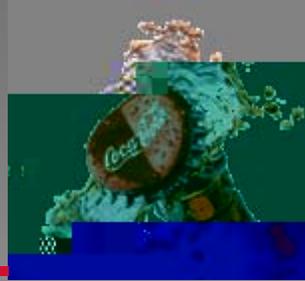
# ***Global Operating Segments***



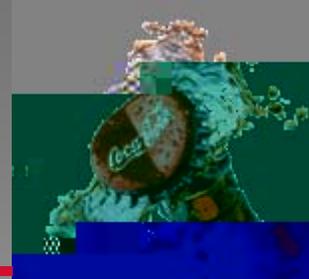
- Ø **The Coca-Cola Company has approximately 71,000 employees in the following operating segments**
  - ' **Africa**
  - ' **East, South Asia and Pacific Rim**
  - ' **European Union**
  - ' **Latin America**
  - ' **North America**
  - ' **North Asia, Eurasia and Middle East**
  - ' **Bottling Investments**
  - ' **Corporate**

# ***The Coca-Cola Company***

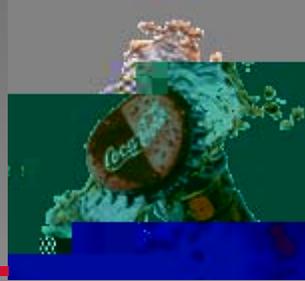
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# Complexity Of A Global Analytical Community

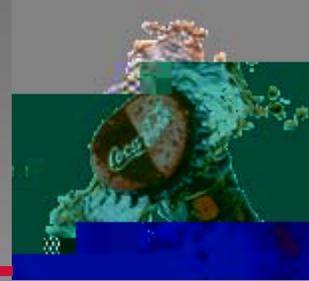


# ***Assurance Of Analytical Proficiency***



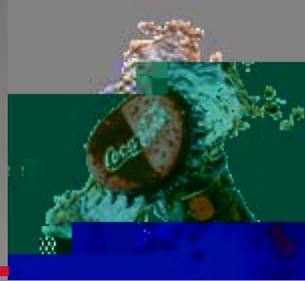
- ∅ Analyst Certification Program (analytical and microbiological)**
- ∅ ISO 17025 Accreditation**
- ∅ Internal Proficiency Testing Programs (ingredients, intermediates and finished goods)**
- ∅ Laboratory Audits (TCCQS ISO 2000 )**
- ∅ Adoption of industry standard methods (AOAC, USP, FDA, EPA...)**
- ∅ Formal Method Validation**
- ∅ External Laboratories Audit and Authorization Process**
- ∅ Check Sample Programs**
- ∅ Proficiency Testing, Inter-Laboratory Comparisons**

# ***Benefits and Uses of Proficiency Testing***



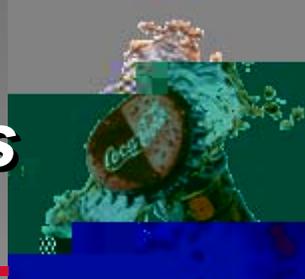
- Ø **Benchmark and Demonstrate Technical Capabilities**
  - ' Independent review of results
  - ' Document performance and capability
  - ' Improve laboratory skills
  - ' Training
  
- Ø **Identify analytical issues with sample matrix and analytes of interest**
  - ' To develop sampling and testing programs with scientific proof
  
- Ø **Identify best practices and best laboratories for specific fields of work**
  - ' The importance on method validation expertise cannot be underestimated even when using mandated methods
  
- Ø **Reduce cost by addressing logistic issues that could render the measurements unusable or scientifically flawed**

# ***Benefits and Uses of Proficiency Testing***

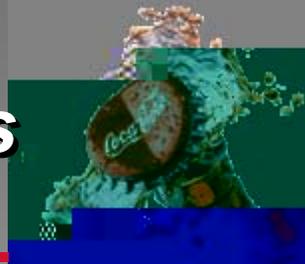


- ∅ **In many countries, commercial laboratories are required to participate in specific PT programs**
  - ' For each specific field of work (e.g., organics in water)
  - ' To obtain local/international recognition
  - ' To demonstrate Technical and Analytical Capabilities
  - ' To benchmark against best scientific practices
  
- ∅ **For example: water testing for environmental discharge or human consumption**
  - ' USA NELAC/ISO 17025 Standards
  - ' EU IUPAC/ISO/AOAC International Protocol for Proficiency Testing
  
- ∅ **To facilitate and promote Free Trade many countries are signatories of international agreements that require PT**
  - ' ILAC
  - ' APLAC
  - ' NELAP

# *Challenges Of Proficiency Testing Programs*

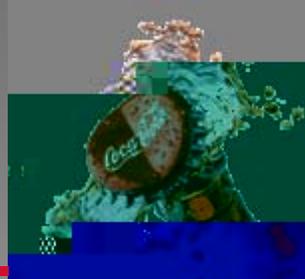


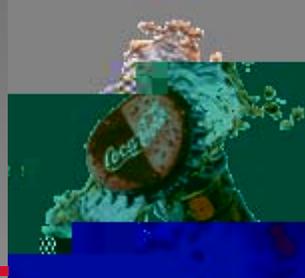
# Challenges Of Proficiency Testing Programs



## LOGISTICS

- Availability of a Commercial PT Program for the Specific Analyte of Interest
- Number of Laboratories Necessary to Conduct a Valid Inter-laboratory Comparison
- Shipping and Handling of Samples
  - Availability of Carriers
  - Spills in Traffic
- Classification of Shipments by Country
  - Corrosive
  - Toxic
- Sample Integrity
  - Customs Opens the Package
  - Repeatability
  - Sample Homogeneity
    - Solubility and Partition
  - Sample Stability
    - Preservation
      - £ Refrigeration
      - £ Acidification
      - £ Addition of Chemicals
- Cost
  - Cost to Prepare the Study
  - Cost to Run the Samples
  - Cost to Ship and Handle the Samples
  - Cost to Interpret and Report Results



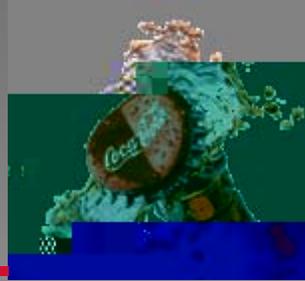


# ***Real Life Example*** ***Proficiency Testing in Water Analysis***



- Ø **As water is our highest volume ingredient, it is necessary to have state-of-the-art internal and external capabilities to assess and monitor safety and quality at all times**
  - ' **For all regulated compounds, we employ the best available technology**
  - ' **Mandated methods are adopted when available (i.e. EPA, FDA...)**
  - ' **Modifications are sometimes necessary to achieve lowest detection limits as per our global standards**
  - ' **We benchmark our laboratories against the best in class for each field of work**

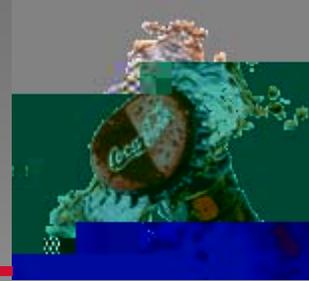
# ***Proficiency Testing to Determine Analytical Capabilities in Water Testing And Sample Preservation***



## **Study Overview**

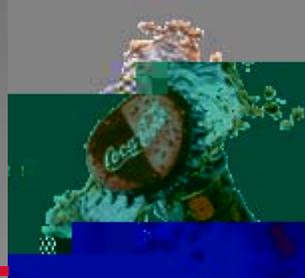
- Ø A major PT provider was contracted to conduct a complete assessment on the technical capabilities for water testing on reference laboratories
  - ' USA (2), India (1), Europe (2)
  - ' Each laboratory was required to analyze water samples spiked with known concentrations of the following target analytes
    - § Volatile Organics (6 analytes)
    - § Trihalomethanes (4)
    - § Pesticides/Semivolatiles (15)
    - § Carbamates (4)
    - § Herbicides (6)
    - § Metals (7)
    - § Inorganic Disinfection Byproducts (3)
    - § Nitrate (1)

# Proficiency Testing to Determine Analytical Capabilities in Water Testing

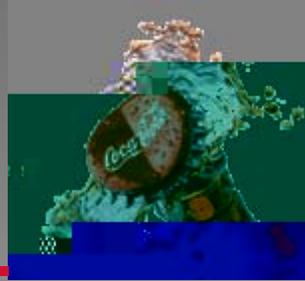


## Study Overview

- ∅ **Samples:**
  - ' Blank (1)
  - ' raw Water (4)
    - § 1 ppm Cl<sub>2</sub> residual
    - § Preserved and unpreserved
  - ' Treated water (2)
    - § Preserved
- ∅ **Analyze levels above and below RL's**
- ∅ **Testing Schedules**
  - ' Day 1, 3, 14, 21
- ∅ **Methods**
  - ' **VOAs & THMs**
    - § USA1, USA2, and India – 524.2 (Purge/Trap GC-MS)
    - § EU1 and EU 2 – Headspace-GC-MS
    - § EU2 – Headspace-GC/ECD for THMs
  - ' **Pesticides/Semivolatiles**
    - § USA1, USA2, India – 525.2 (Liquid/Solid Extraction-GC-MS)
    - § USA1 – 7 Pests. by 505 (Microextraction-GC)
    - § EU1 – SPE/GC-MS
    - § EU2 – SPE-GC-MS



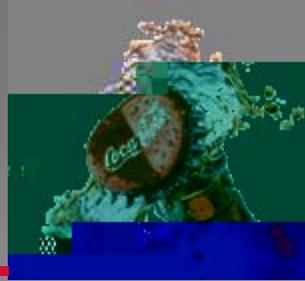
# ***Study Challenges Data Interpretation***



∅ GC-MS Residuals data are more accurate with lower RSDs than GC-MS

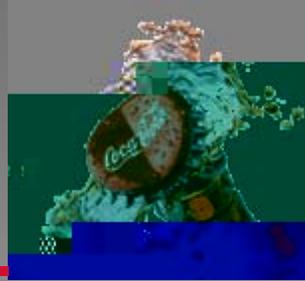
# ***Study Learnings***

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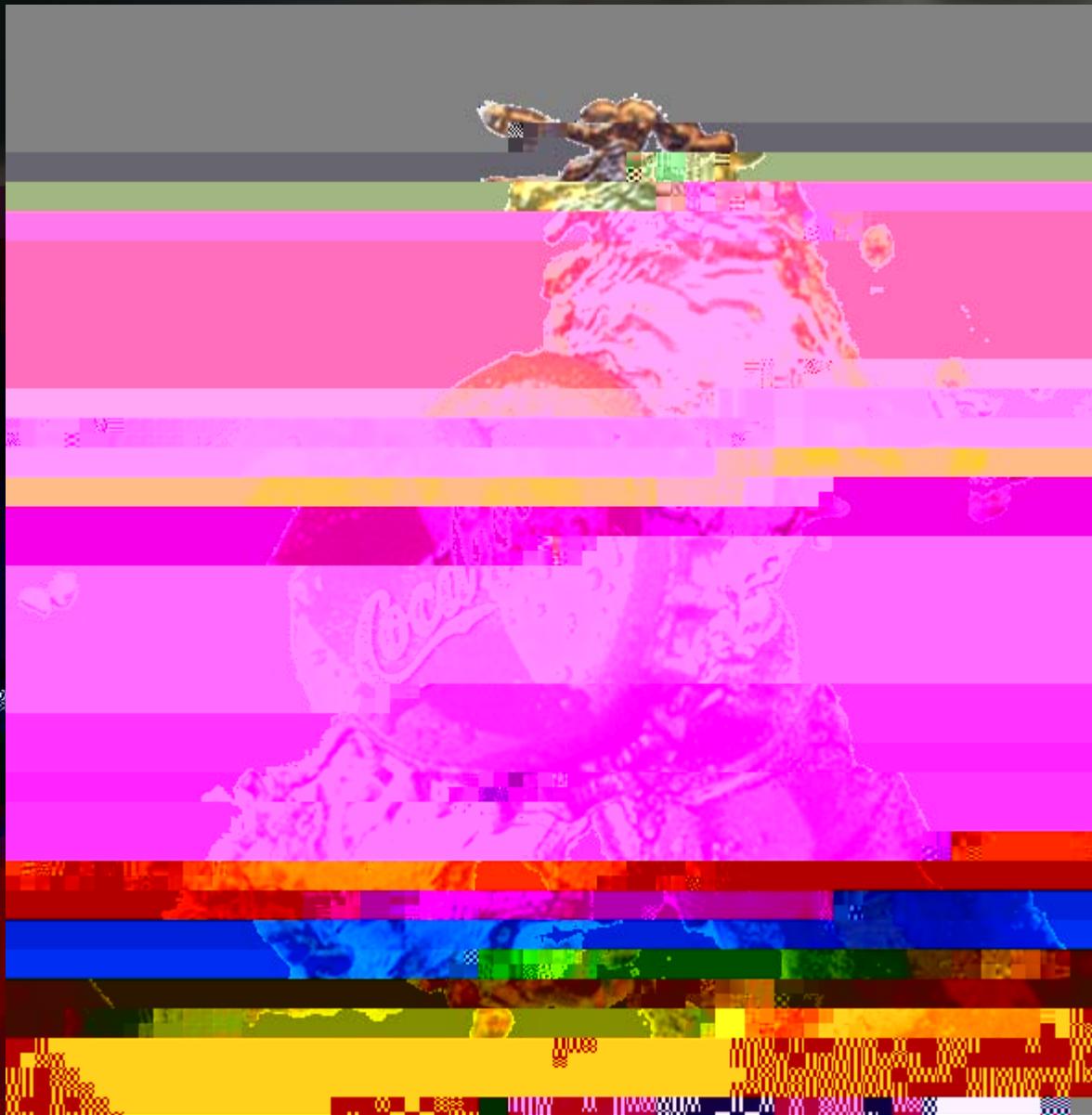


- Ø **Your results will only be as good as your sampling practices**
- Ø **Methodology differences may not be critical**
  - ' **Good data was obtained for all me**

# ***Additional Points To Consider***



- ∅ **In most situations, the laboratory knows the sample is artificial**
  - ' They are alerted of the upcoming test
- ∅ **The spikes are normally too high and do not challenge the DL's**
- ∅ **Analysts can repeat the test and provide averaged data**
- ∅ **Samples are clean and unnatural — artifacts such as other contaminants are not present to challenge the selectivity of the methods**
- ∅ **Recoveries are high due to the concentration**
- ∅ **Laboratories may assign the PT sample to their best analyst but your typical sample goes to the average analyst**



*Thank You*

# Effect of Sample Preservation Technique in Sample Stability

