

Applications of Ion Chromatography Technology in the Beverage Industry



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PepsiCo Analytical Water Laboratories Vision



**Our Vision: To provide Analytical and
Technical support in Water Quality
Applications across PepsiCo, in which
the Safety & Quality of our products to
our consumer are prioritised**



PepsiCo Analytical Water Laboratory

Products Analysed in the PepsiCo Analytical Water Lab

- PepsiCo Bottled Water Brands
- Ingredient Water from PepsiCo Bottling facilities
- Raw Water & Hypochlorite solutions

Analysis carried out in the PepsiCo Analytical Water Lab

- Wet Chemistry
- Volatile Organic Compounds & Trihalomethanes
- Metals
- Cations
- Oxyhalides & Anions



Dionex Ion Chromatography Instrumentation

○ ICS2500

○ DX320

○ ICS3000

WHO Guidelines for Drinking Water Quality

Analyte	WHO Guideline
Fluoride	1.5 mg/l
Chlorite	0.7 mg/l
Chloride	No Limit
Chlorate	0.7mg/l
Nitrate	50 mg/l
Nitrite	0.2 mg/l
Bromide	No Limit
Bromate	0.01 mg/l
Sulphate	No Limit
Phosphate	No Limit



ICS2500



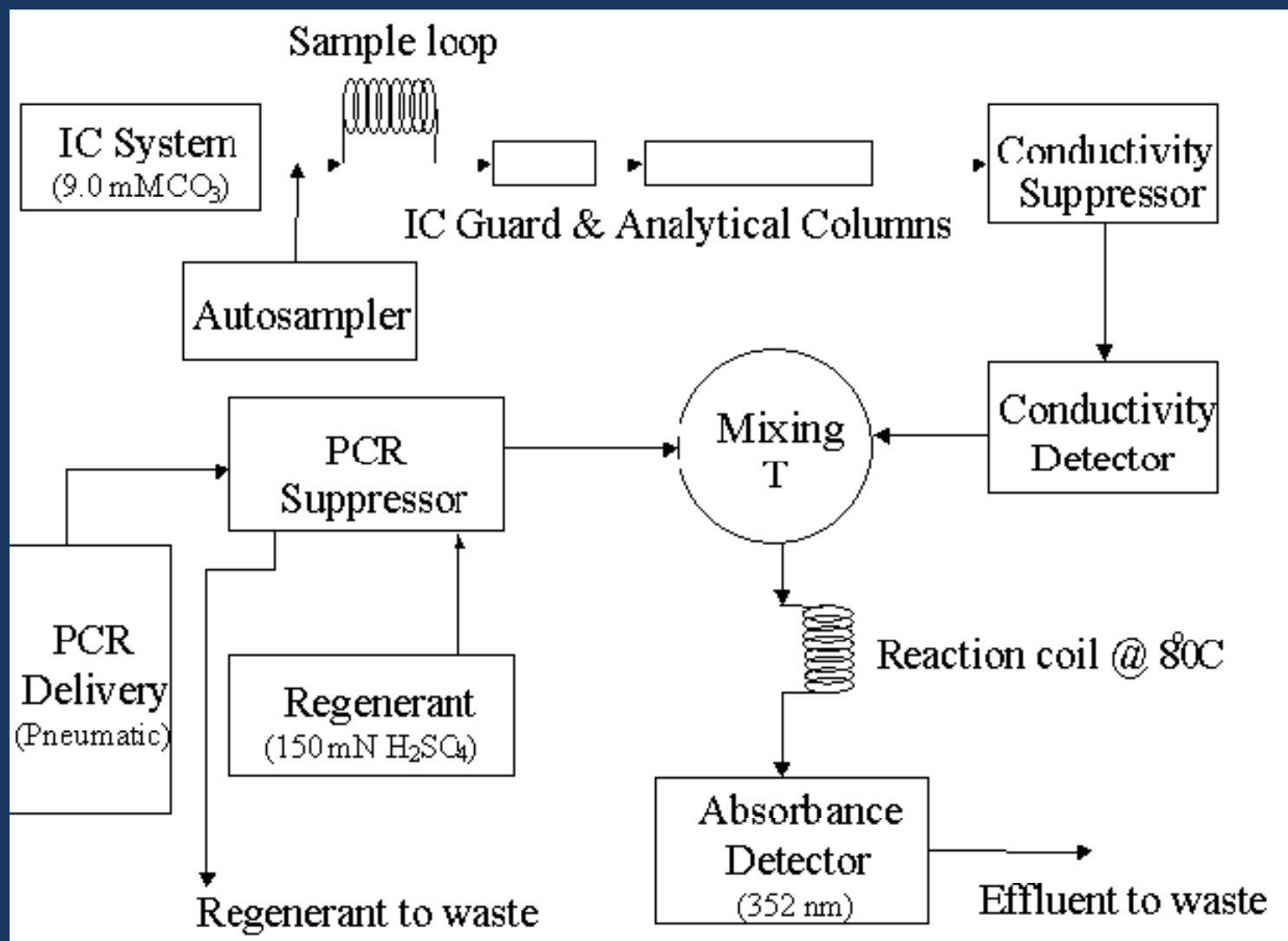
ICS2500 – Bromate/Bromide Application

Dionex application note 149 & EPA 326.0 method

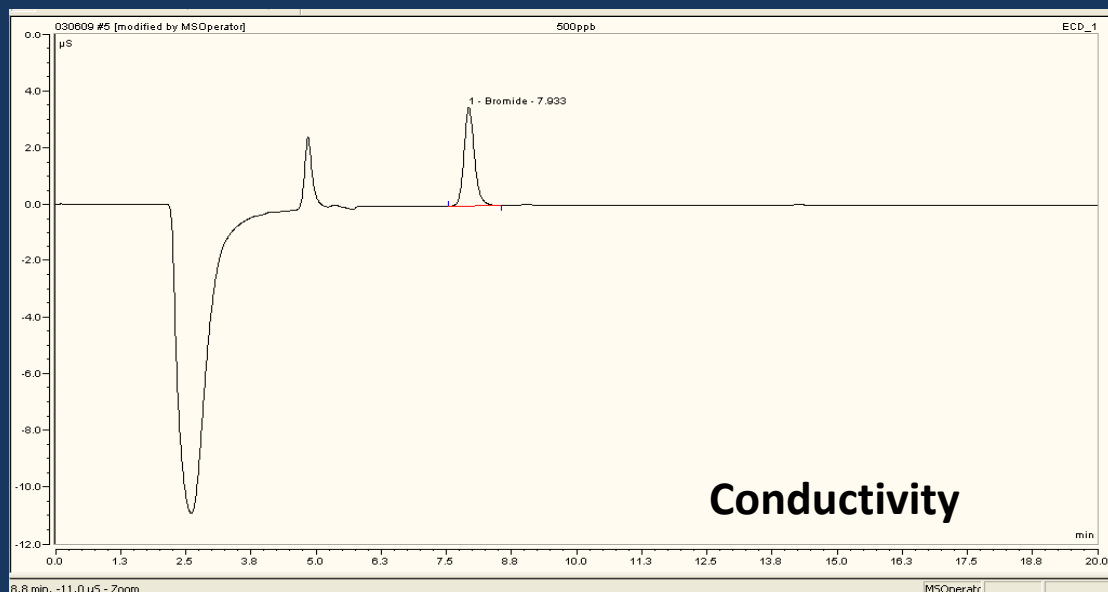
- Columns: IonPac NG1, AG9, AS9 HC
- Flow Rate: 1.3 ml/min
- Temp: 30°C
- Eluent: 9mM Sodium Carbonate
- Suppressors: ASRS 4mm, AMMS
- Volume: 700 µl
- Post Column Reagent: Acidified KI
- PCR Flow Rate: 0.4ml/min
- Post Column Heater: 80°C
- Detectors: Conductivity & UV



ICS2500 Br/BrO₃

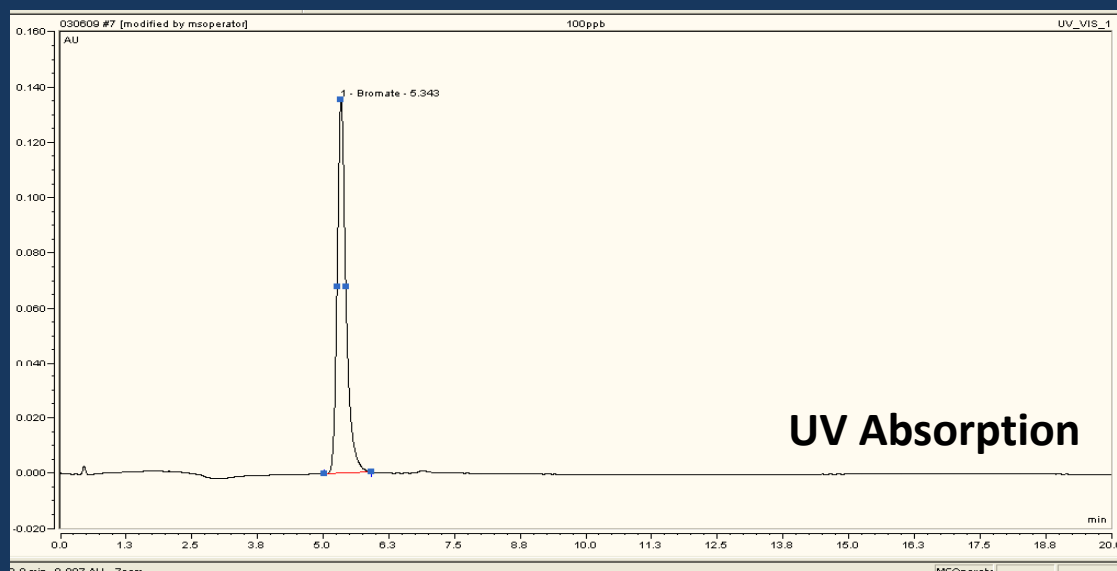


ICS2500 – Br/BrO₃ Analysis



After separation and suppression of the eluent, the oxyhalide bromate >15.0 ppb and bromide are measured using conductivity detection.

To facilitate low-level detection of bromate, the suppressed effluent from the conductivity detector is combined with an acidic solution of potassium iodide containing a catalytic amount of molybdenum VI. The mixture is heated at 80deg C where the bromate reacts with iodide to form the tri-iodide ion which is measured by its UV absorption at 352 nm.



ICS2500

Reasons for this analysis

- Bromide is naturally occurring ion and readily forms bromate through the **treatment/ozonation process**
- Bromate is an inorganic oxyhalide disinfection by-product which is classified as **carcinogenic** to humans
- WHO guideline limit for bromate is **10ppb** in drinking water
- No WHO limit set for Bromide
- Bromide level multiplied by 1.6 equals the formation of bromate via the ozonation process of water



PepsiCo have categorised **Bromate** as a **health risk** to the consumer.

ICS 2500

Benefits of using the ICS2500 for Br/BrO3 analysis

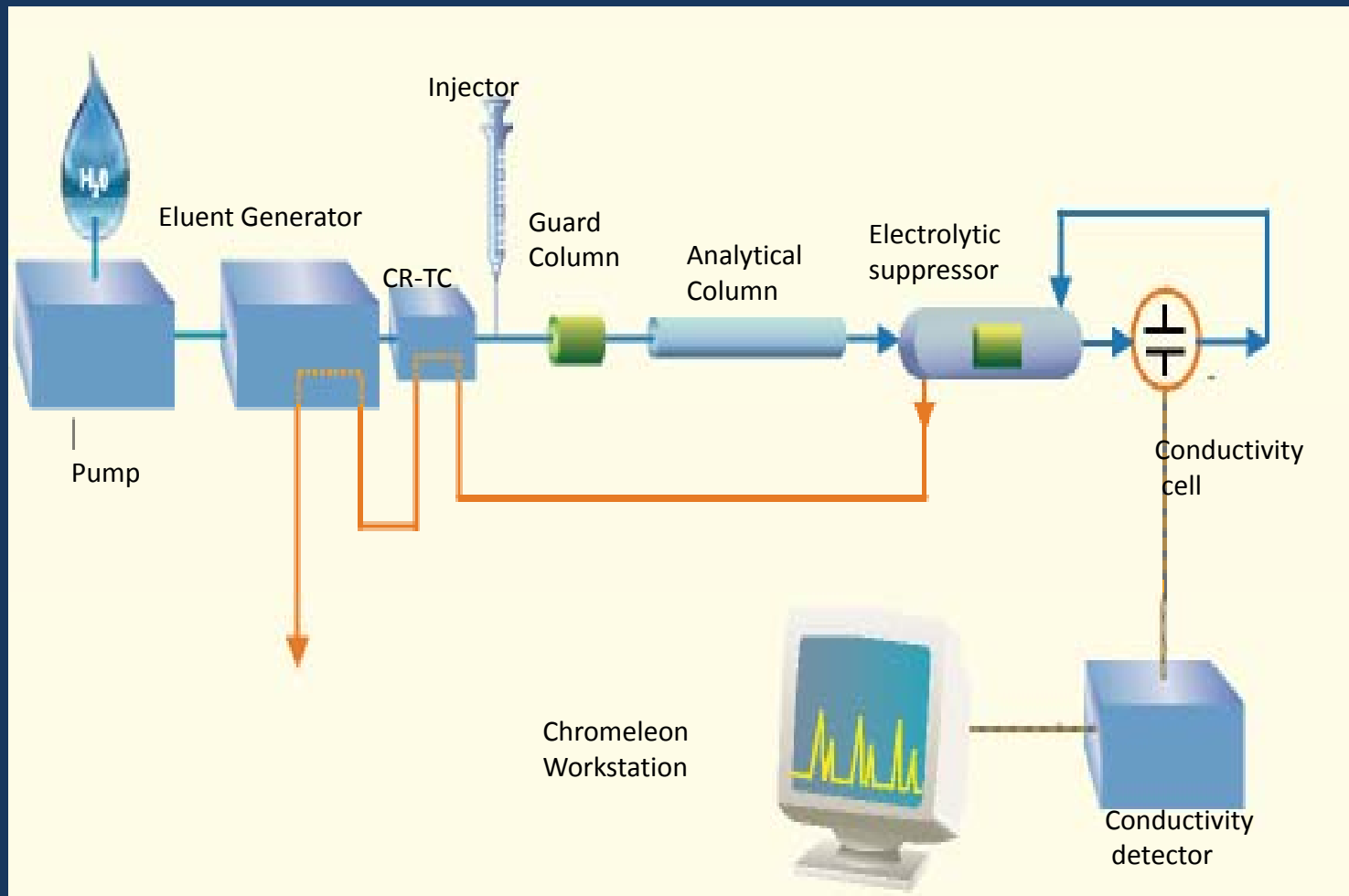
- ✓ EPA approved method
- ✓ Trace analysis
 - ✓ Bromate LDL 1ppb
 - ✓ Bromide LDL 5ppb
- ✓ Large calibration ranges
 - ✓ Bromate: 1ppb to 100ppb.
 - ✓ Bromide: 5ppb to 500ppb
- ✓ Range of sample types
 - ✓ Source (municipal, ground water)
 - ✓ treated
 - ✓ hypochlorite solutions
 - ✓ bottled water



DX320 with RFIC -EG



DX320 with RFIC -EG



RFIC –EG – Anion & Oxyhalide Application

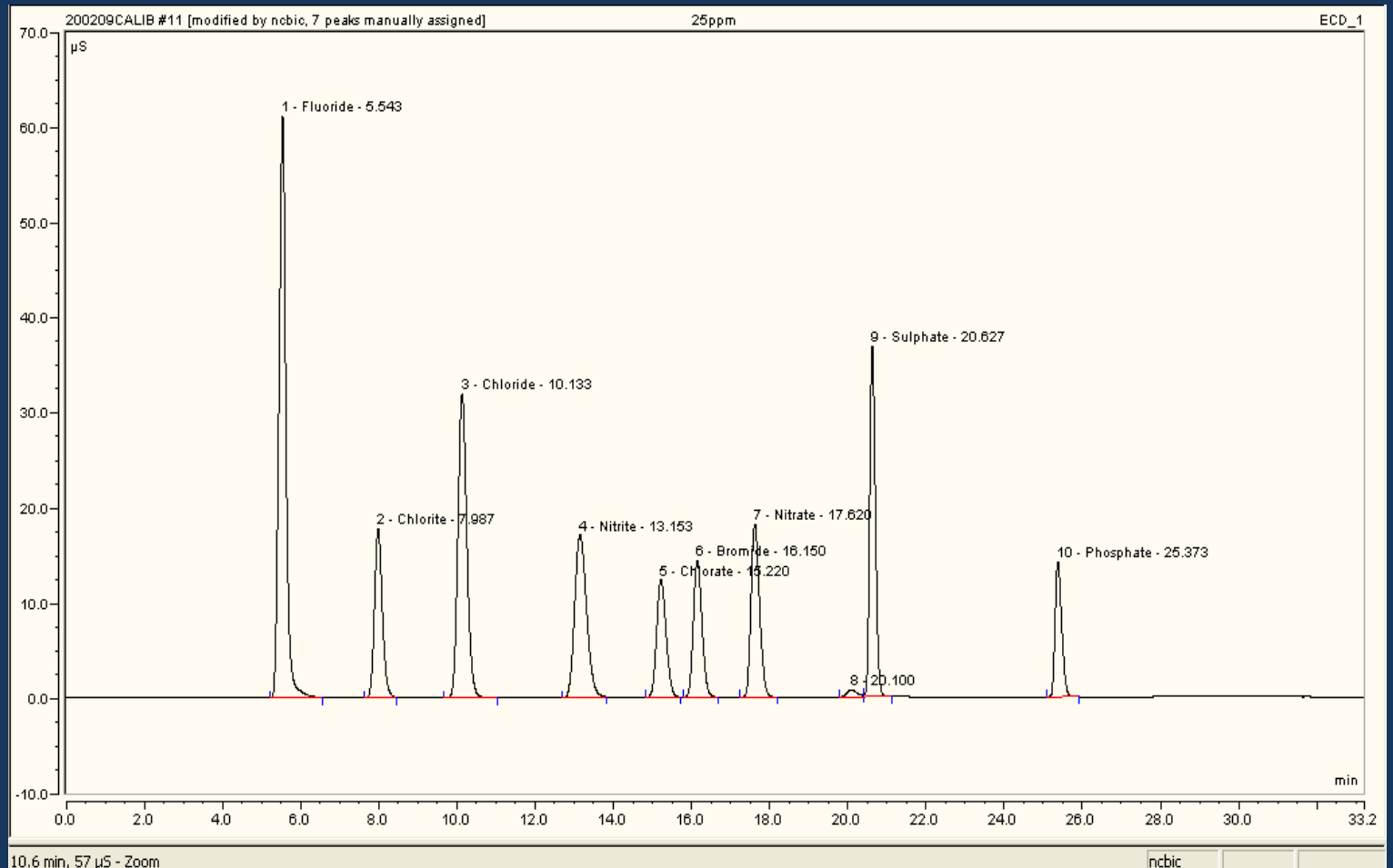
Based on EPA 300.1 method

- Columns: IonPac NG1, AG19, AS19
- Flow Rate: 1ml/min
- Temp: 30°C
- Suppressor: ASRS Ultra 4mm
- Volume: 20ul
- Eluent: EG gradient with 55mM KOH with CR-ATC

Time(Min)	Conc (KOH mM)
0	10
10	10
25	55
28	55



DX320 with RFIC -EG



DX320 with RFIC -EG

Reasons for analysis

- Chlorate & Chlorite
 - Formed through the disinfection/treatment process
 - Causes oxidative stress to red blood cells in humans
 - 0.7ppm WHO Limit
- Fluoride
 - Naturally occurring
 - Causes dental, skeletal fluorosis & thyroid/endocrine problems
 - 1.5ppm WHO Limit
- Nitrate & Nitrite
 - Nitrate reduced to nitrite in stomach of infants
 - Nitrite is able to oxidize haemoglobin (Hb) to met haemoglobin (metHb), preventing transport of oxygen around the body.
 - Nitrate 50ppm WHO limit
 - Nitrite 0.2ppm WHO Limit



PepsiCo categorise **Fluoride, Chlorite, Nitrite, Chlorate & Nitrate** as **Health Risks** to our **Consumer**

DX320 with RFIC -EG

Benefits of using RFIC –EG for Anion analysis

- ✓ EPA approved method
- ✓ Detection Limits below the WHO limits
- ✓ Wide calibration range from 0.1ppm to 500ppm
- ✓ No eluent preparation - **just add water!**
- ✓ No reagent preparation
- ✓ Minimum baseline drift
- ✓ System continuously running – **saves time!**
- ✓ Water only through pump - **increases pumps life span!**
- ✓ Range of sample types
 - ✓ Source (municipal, ground water)
 - ✓ treated
 - ✓ hypochlorite solutions
 - ✓ bottled water

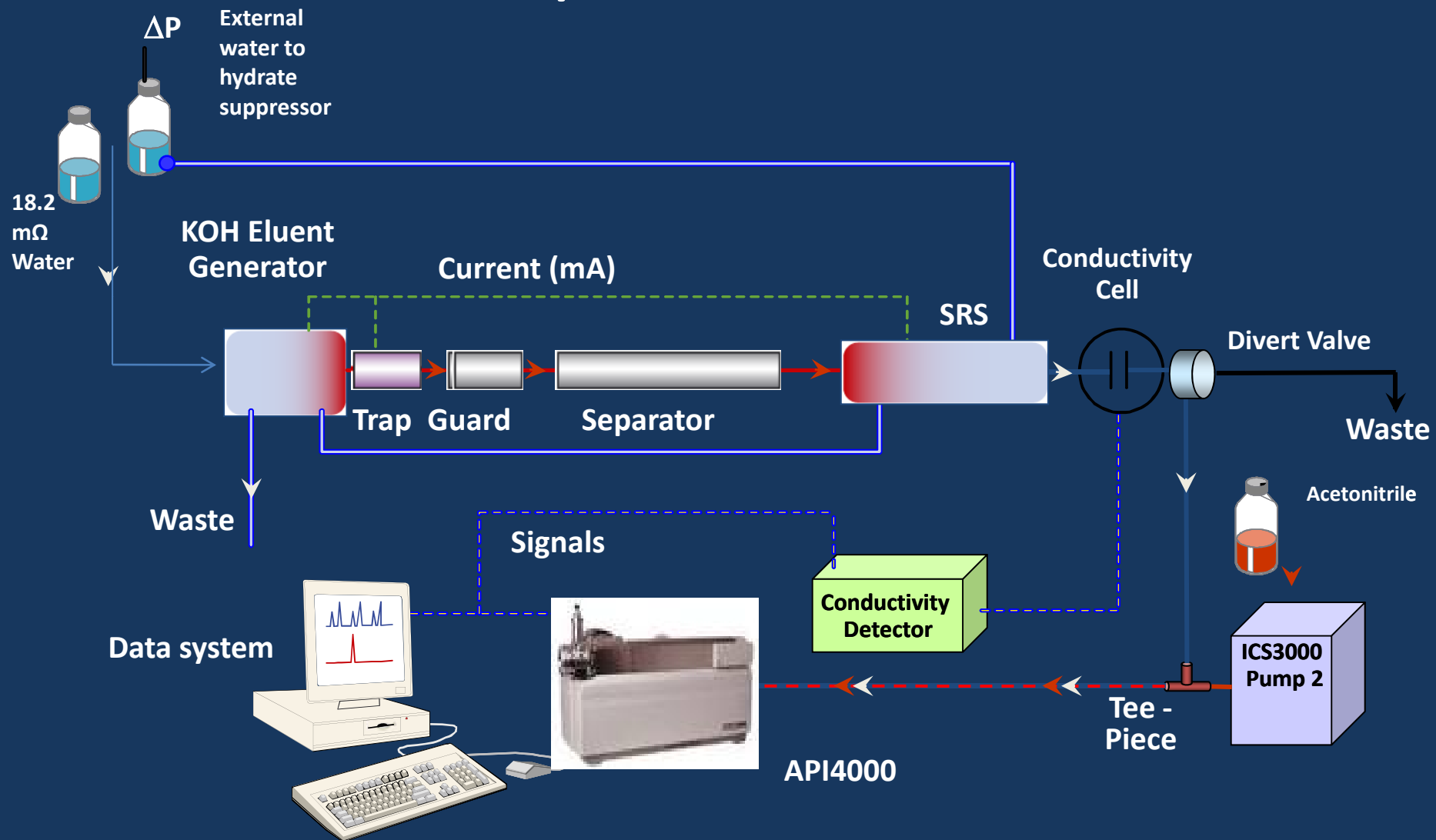


IC-MS/MS

ICS3000 linked to API4000



IC-MS/MS Schematic



IC-MS/MS Application

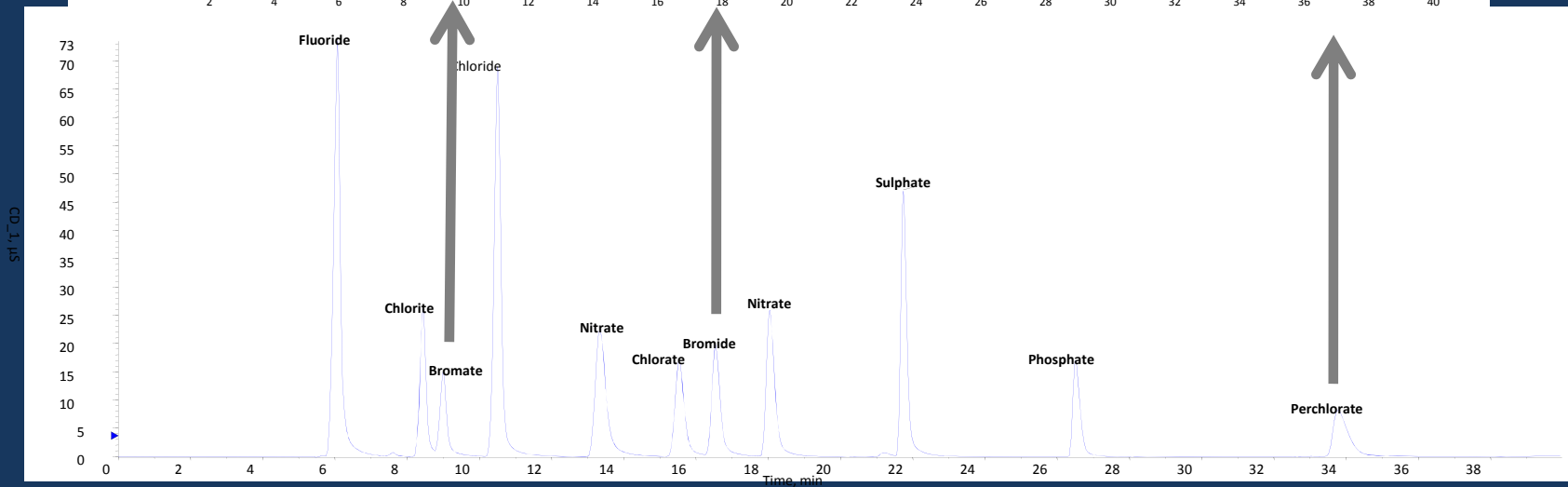
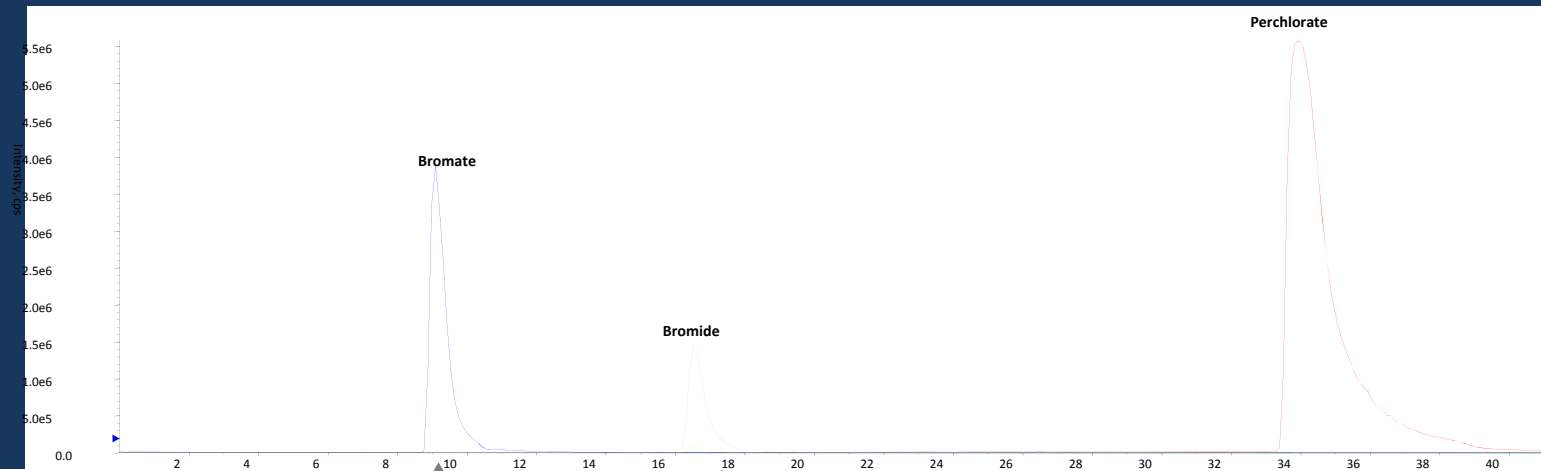
- Columns: AG19, AS19 2 mm
- Flow Rate: 0.25ml/min
- Temp: 30°C
- Suppressor: ASRS Ultra 2mm
- Volume: 20ul
- Eluent: EG gradient with 55mM KOH with CR-ATC

Time(Min)	Conc (KOH mM)
0	10
10	10
25	55
40	55



IC-MS/MS

10ppm standard solution



Benefits of IC-MS/MS

- ✓ Combining two current methods within PepsiCo
- ✓ 2mm chemistry – **very little eluent consumption!**
- ✓ 2mm chemistry – **sharper peaks!**
- ✓ Ability to test to ppt levels
- ✓ EPA approved method
- ✓ Detection Limits below the WHO limits
- ✓ No eluent preparation - **just add water!**
- ✓ No reagent preparation
- ✓ Minimum baseline drift
- ✓ System continuously running – **saves time!**
- ✓ Water only through pump - **increases pumps life span!**
- ✓ Range of sample types
- ✓ Capability to test emerging contaminants



**Thank you for
Listening**

