



AirSentry II IMS Analyzer

Real-time, continuous, point-of-use AMC monitor

Presentation Agenda

- Historical Review
- AirSentry II Introduction
- AirSentry II Performance Data
- New AMC Monitoring Strategies
 - Critical Location Monitoring Examples
- Summary

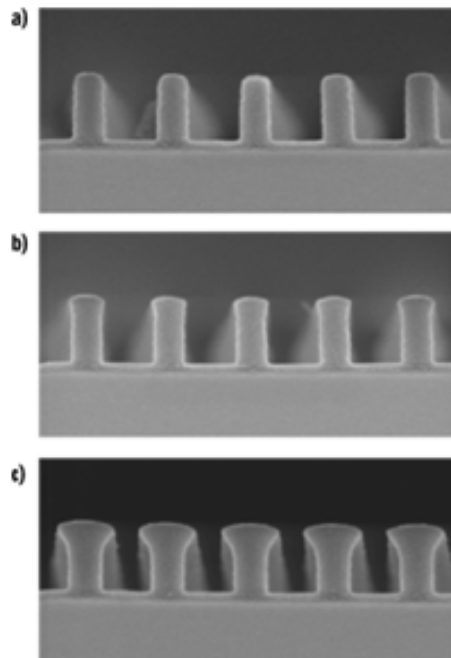
Historical Review

- Airborne Molecular Contamination (AMC)
Gas-phase contamination that reacts with or adsorbs onto critical surfaces
- Surface Molecular Contamination (SMC or NVR)
AMC that forms very thin chemical films on surfaces
- Sources:
 - Indoors – cross process, people, equipment, chemicals, materials
 - Outdoors – auto exhaust, agriculture, industrial emissions
- Effects:
 - Chemical – corrosion of Al and Cu lines, t-topping of resist
 - Electrical – unintentional doping
 - Optical – hazing of optics and reticles
 - Physical – adhesion

Historical Review – Effects of AMC

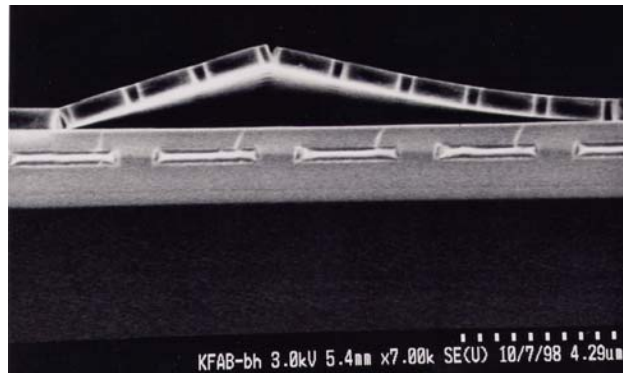
Resist T-Topping:

Ammonia & Amines neutralize the formed photo-acid molecules



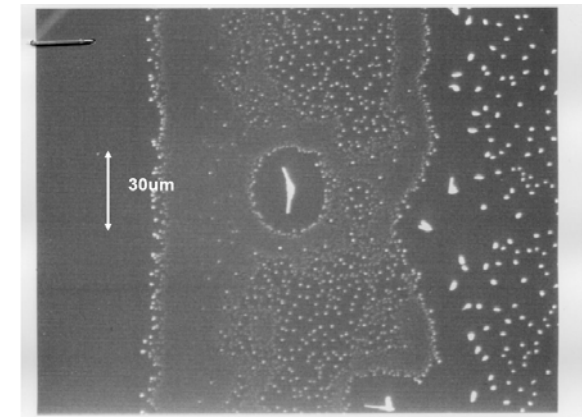
Adhesion:

Chemical film formation prevents adequate bonding of resists or thin-films



Reticle Haze

Ammonia reacts with acid contaminants in presence of 193nm radiation
Increased mask set costs, downtime for cleaning, decreased reticle lifetime, negative yield impacts, productivity losses



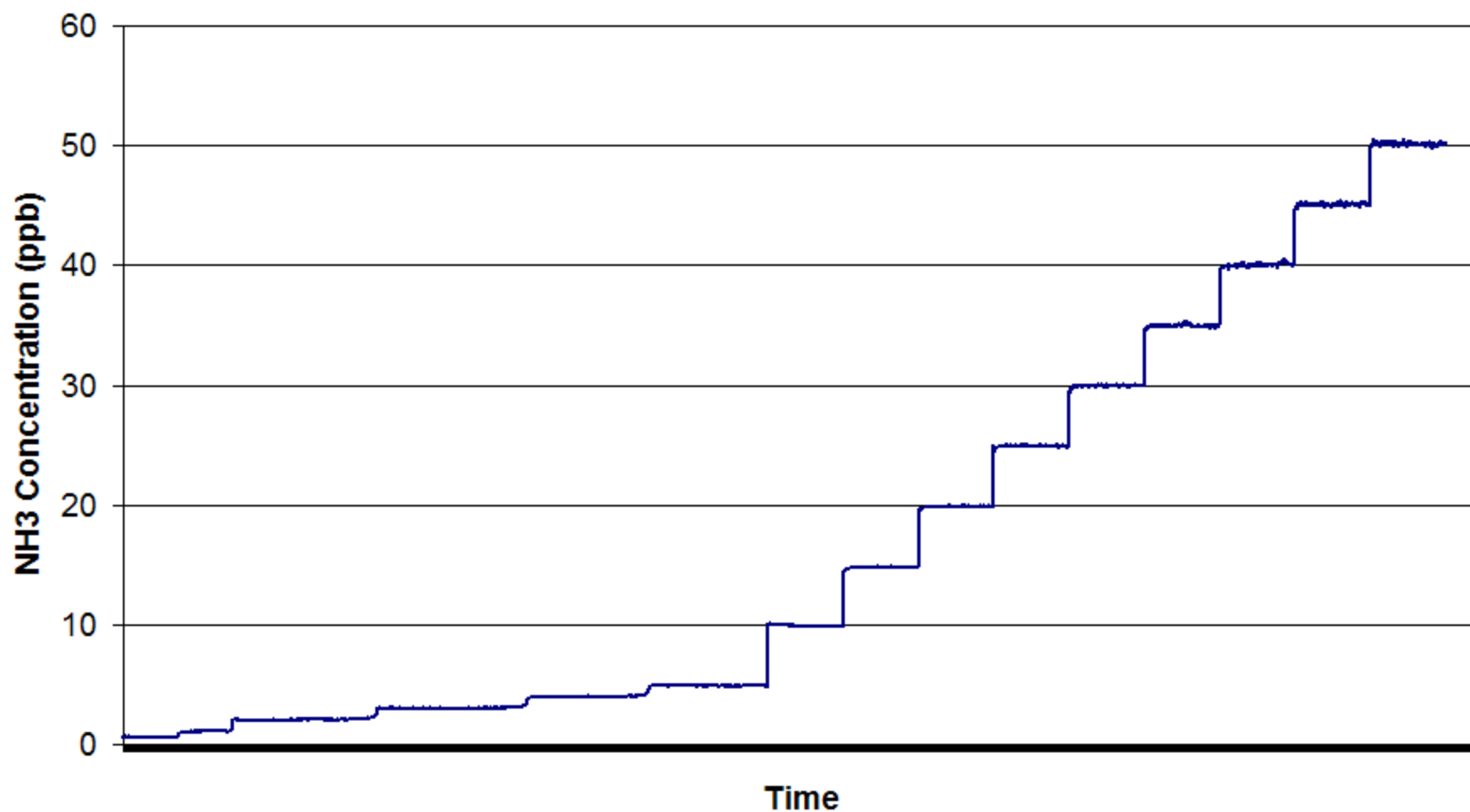
ArF lithography reticle crystal growth contributing factors, Eschbach, et al, Intel, 2004

Introduction to the AirSentry II

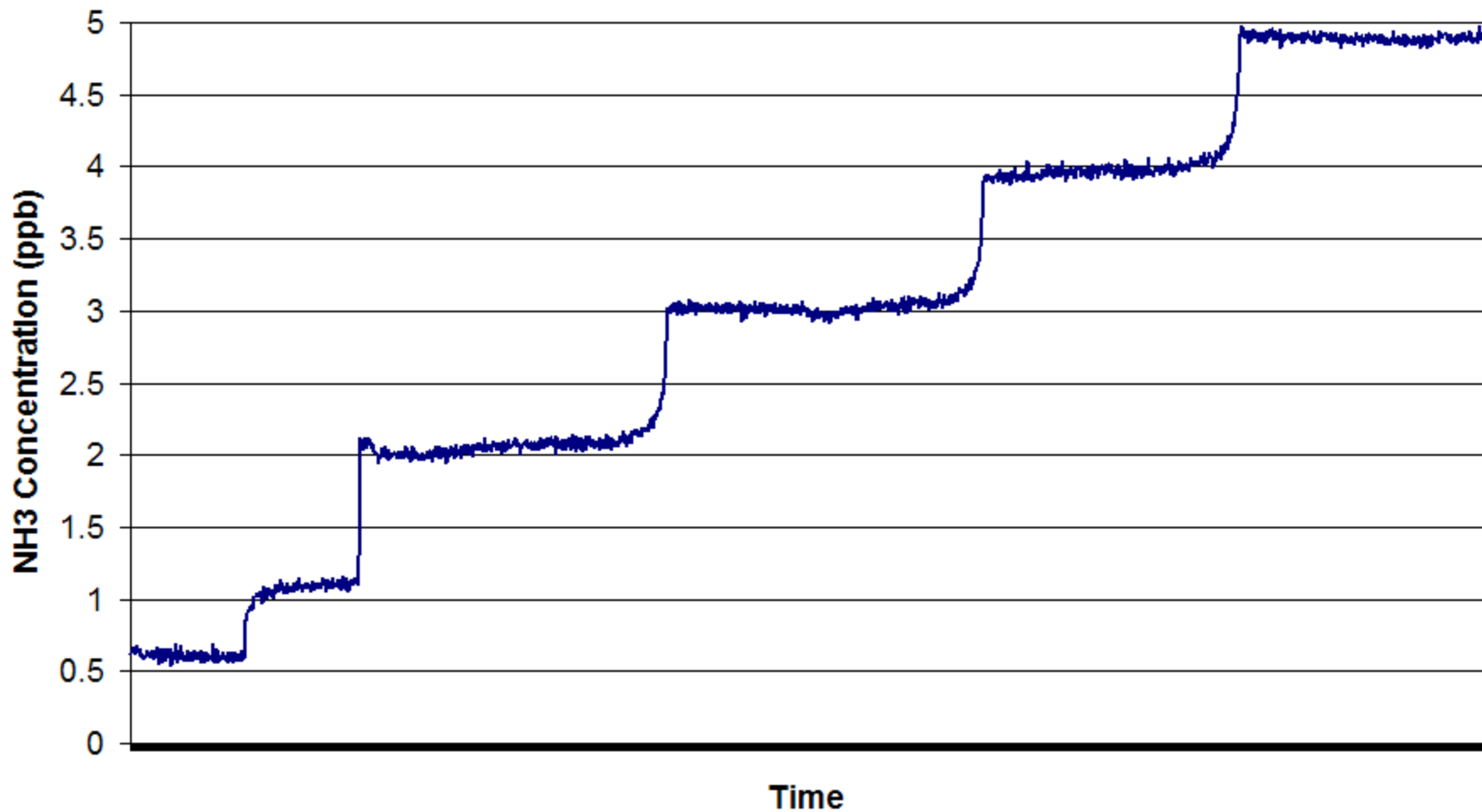
- Sensitivity: 70 ppt_v (part-per-trillion)
- Information: Continuous 24/7 monitoring
- Reliability: Simplified electronics & pneumatics
- Accuracy: Exceptional analyzer to analyzer matching



High Concentration Calibration of an AirSentry II Ion Mobility Spectrometer

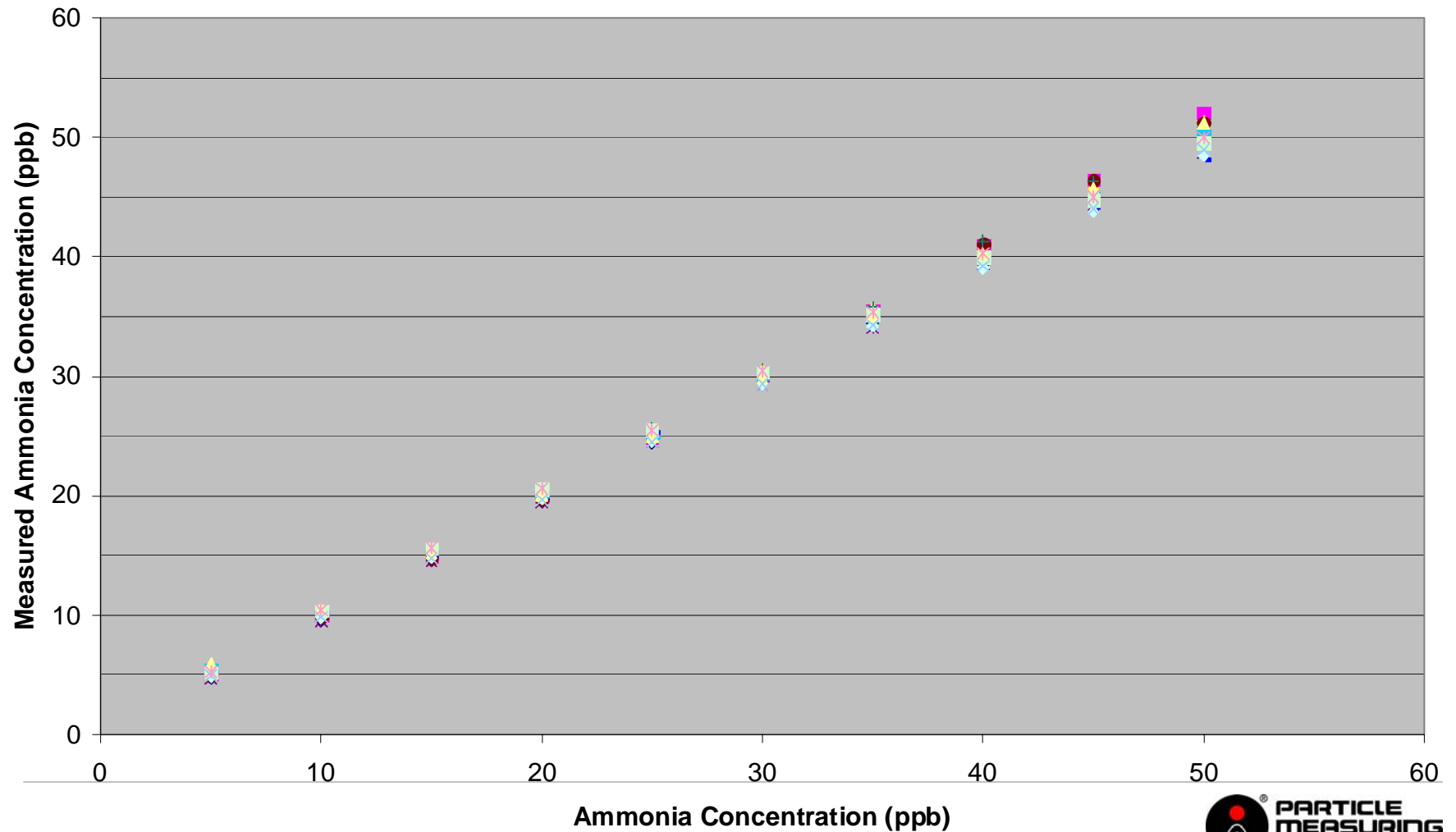


Low Concentration Calibration of an AirSentry II Ion Mobility Spectrometer

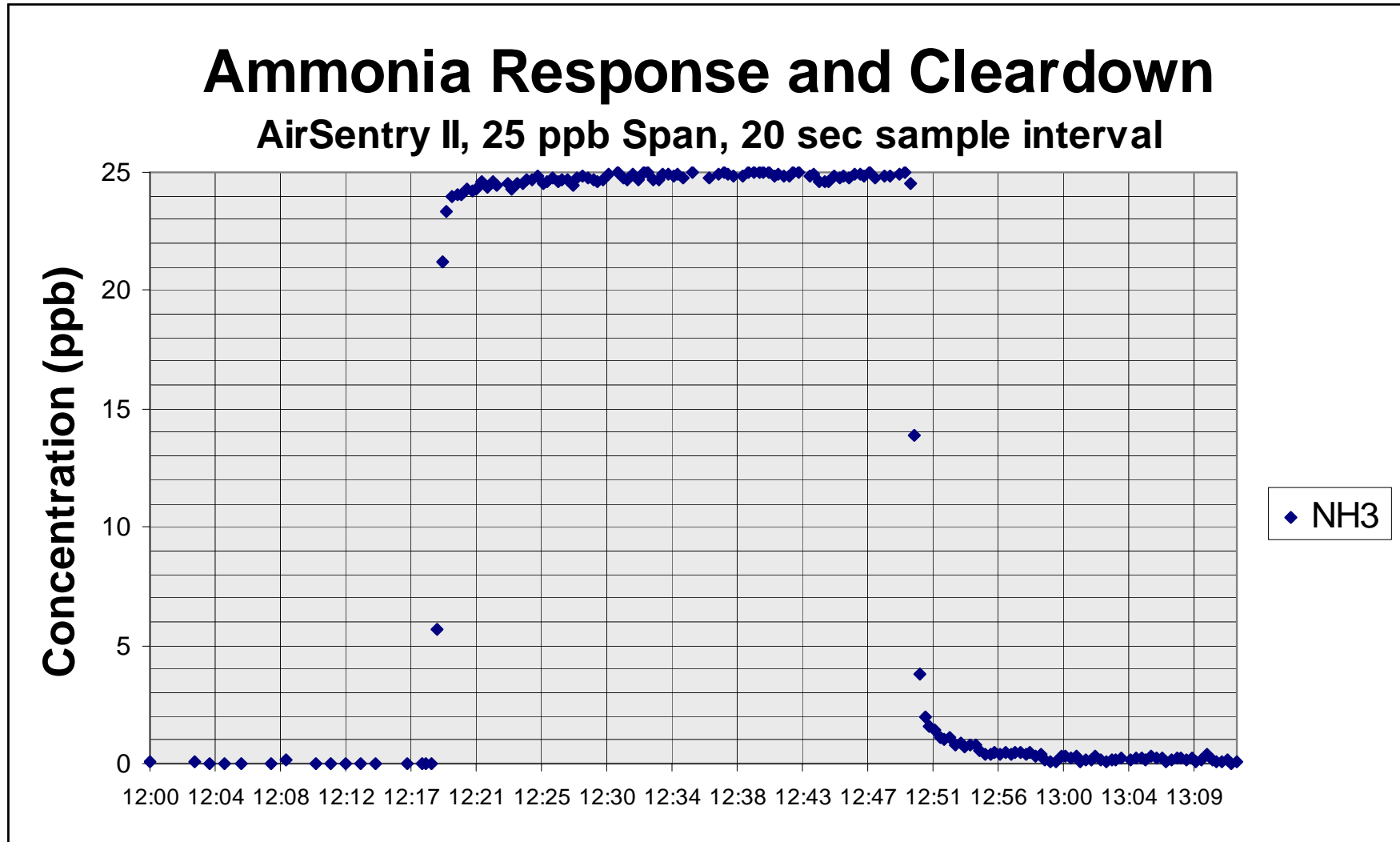


AirSentry II Analyzer Accuracy & Repeatability

Measured Ammonia Concentrations
14 Linearity Runs with 7 Analyzers



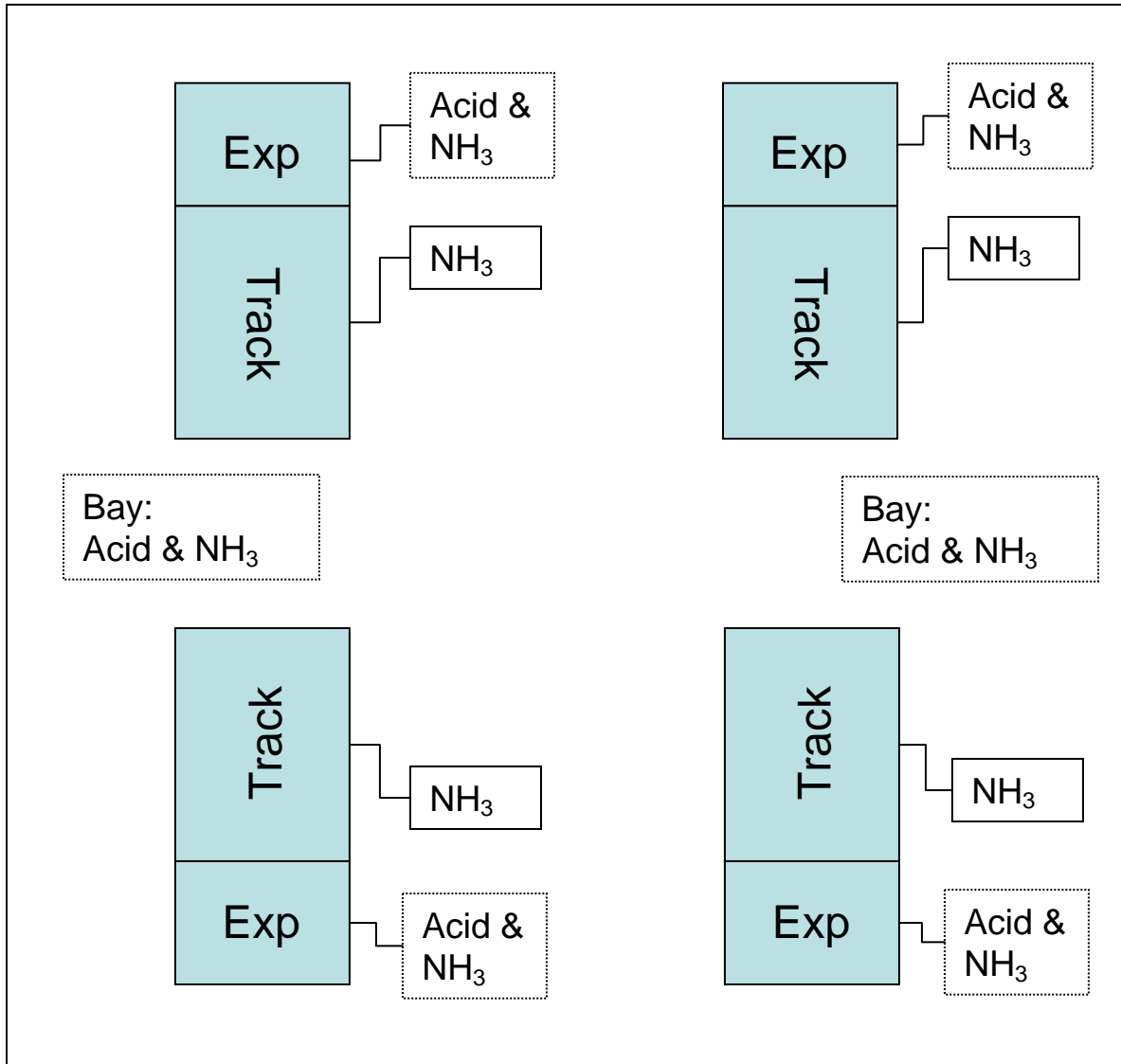
AirSentry II Analyzer Response & Cleardown



New AMC Monitoring Trends & Strategies

- Trends:
 - Classification of cleanroom, equipment, and process into critical and non-critical points for AMC monitoring
 - Critical locations have more stringent monitoring requirements
 - Non-critical locations have more relaxed monitoring requirements
- Critical Location Examples:
 - 193nm Photolithography
 - Reticle & Wafer Storage Systems
 - Make-up Air Handlers
 - Locations protected by chemical filtration
 - Locations protected by purge gases
- Non-Critical Locations Example:
 - Most process bays (other than photolithography, etch, wet-clean)

Critical Location Example: 193 nm Lithography Bay

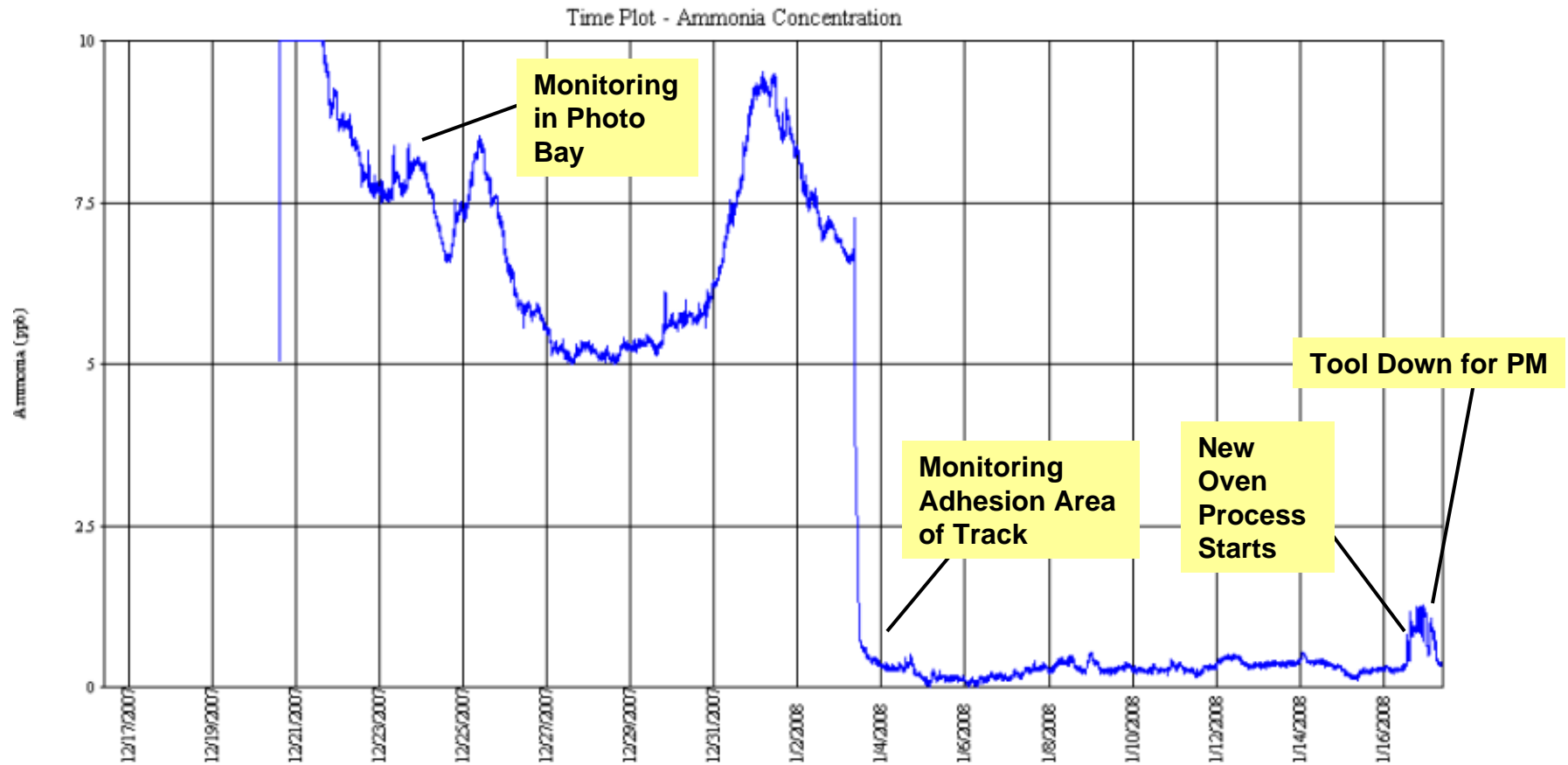


- Continuous monitoring of exposure chamber to:
 - Detect optical and reticle haze formation from acids/bases
- Continuous monitoring of track to:
 - Detect base interaction with chemically sensitive photoresists
- Continuous monitoring of process bay to:
 - Identify excursions from make-up and recirculation air handlers
 - Calculate chemical filter efficiency

Ammonia Data

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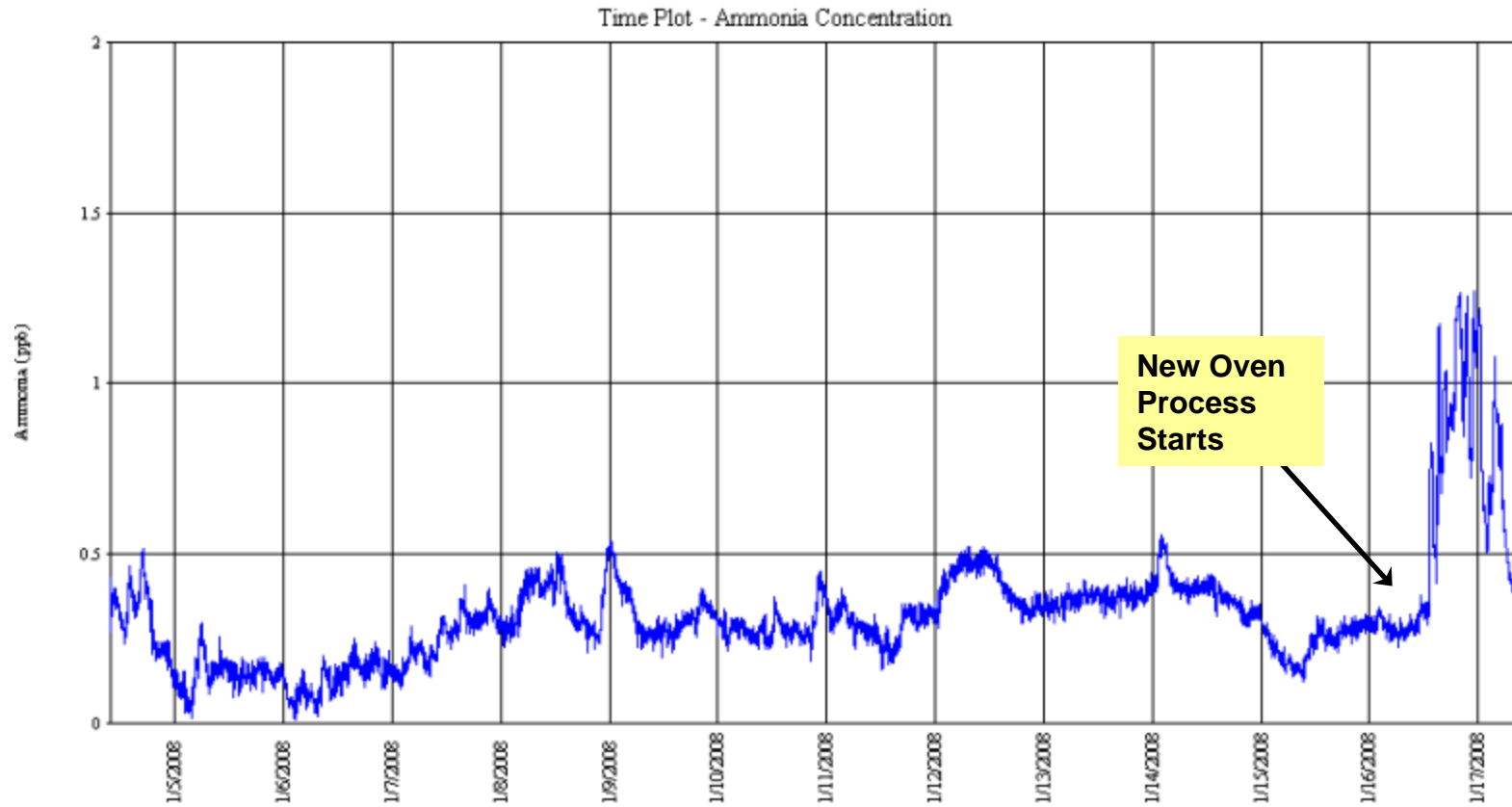


Item **Plot Data Type**
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Filter join: Off
Flyer filter: None

Ammonia Track Data

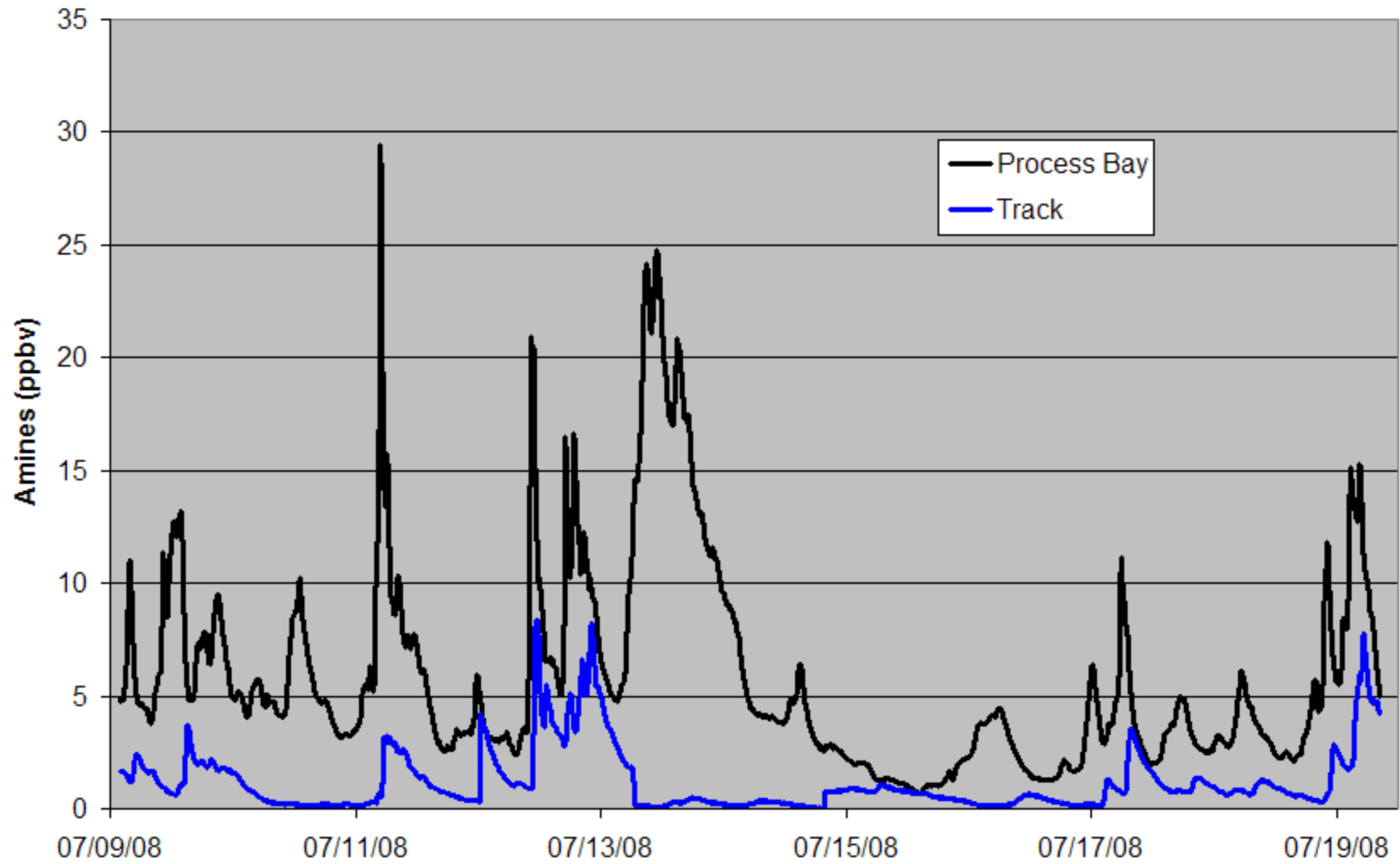
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AMC Monitoring - IMS (Amines) Lithography Process Bay & 193nm Track



Point-of-Use Monitoring Benefits

Accuracy, Information, Reliability and Sensitivity

▪ Accuracy

- Located at the process – Eliminate sample tube effects and response/cleardown issues
- Single calibration source - exceptional unit-to-unit matching and traceability

▪ Information

- Continuous monitoring 24/7
- No missed contamination events
- Immediate warning of a contamination event
- Better understanding of the process improves yield

▪ Reliability

- Inherent in simplicity of design is reliability
- Simplified pneumatics and state-of- the-art electronics ensure highest uptime
- Eliminates down time for service or calibration: swap analyzer with a spare **analyzer**

▪ Sensitivity

- High sensitivity design and averaging provides 5 -10x better detection limits
- Improved ability to distinguish small changes in concentration

Summary

- AirSentry II has specific advantages that provide enhanced value
 - Sensitivity
 - Information
 - Reliability
 - Accuracy
- New monitoring strategies are incorporating real-time continuous point-of-use analyzers in critical locations
- 3 critical locations exist in each 193nm lithography bay
 - Exposure – Amines & Acids
 - Track – Amines
 - Process Bay – Amines & Acids