

# Cyanide Analysis with the CNSolution 3100



# The CNSolution is your solution to cyanide analysis

- **Gas diffusion amperometry methods:**
  - Save time
  - Save money
  - Are more accurate
  - Have fewer interferences
  - Are “green”
- **The CNSolution = the FS3100**
  - Change to a photometric detector and run any colorimetric chemistry

CN

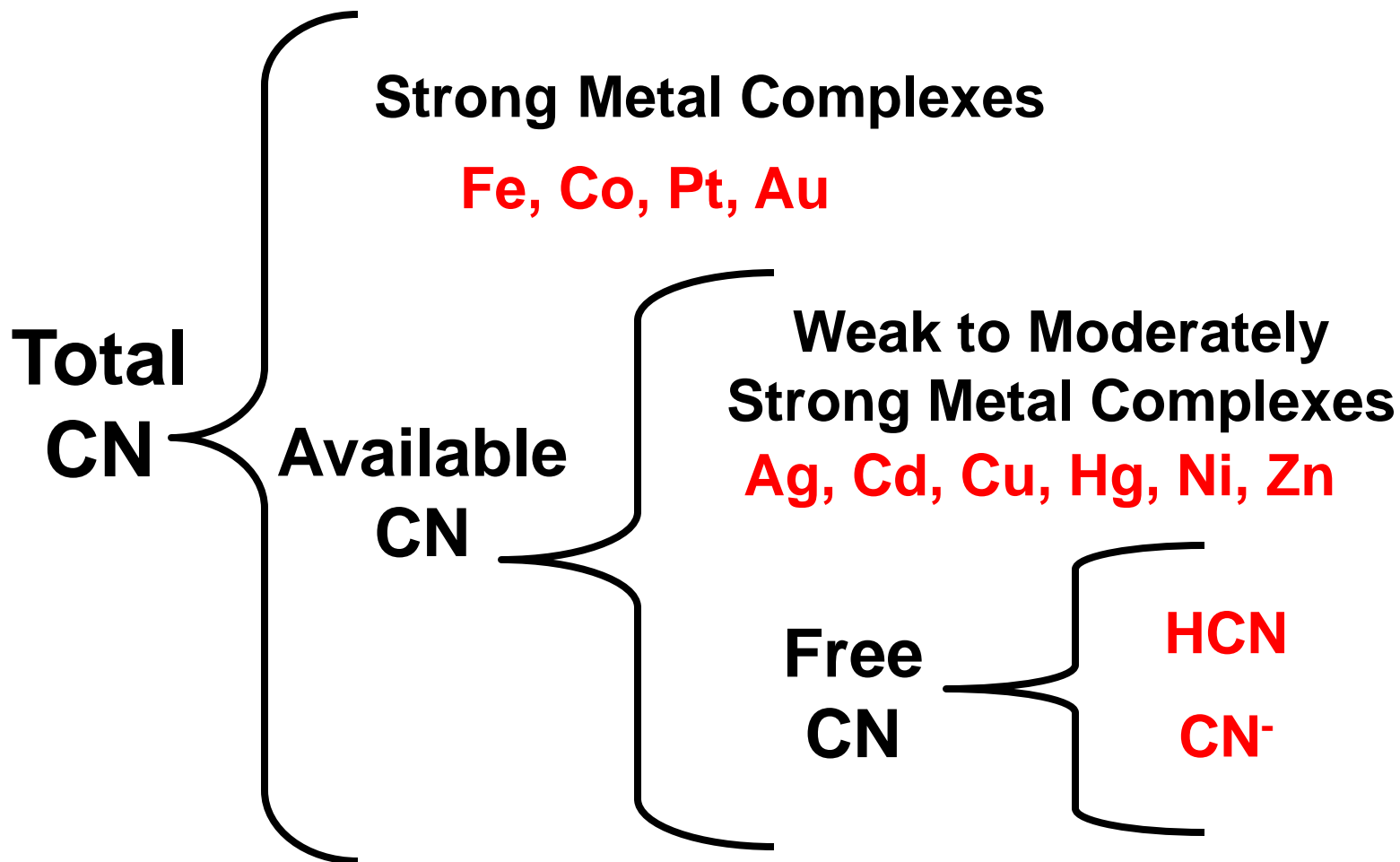
NH<sub>3</sub>

PO<sub>4</sub>

NO<sub>3</sub>

# Cyanide Methods

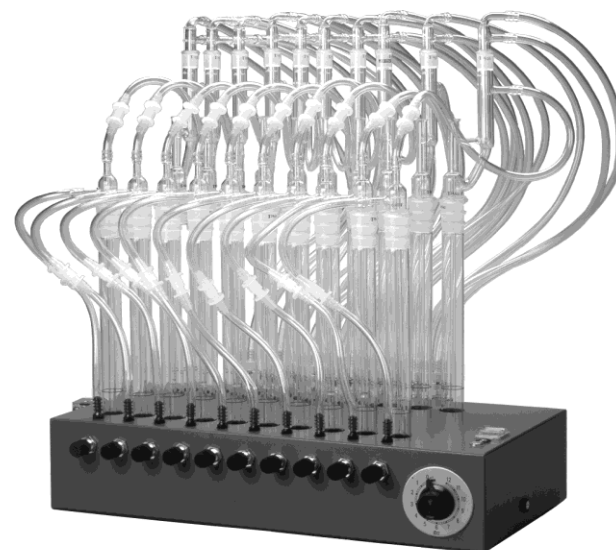
# Cyanide methods measure the various cyanide “species”



# Manual “distillation” is used to dissociate as HCN



**Macro Distillation**

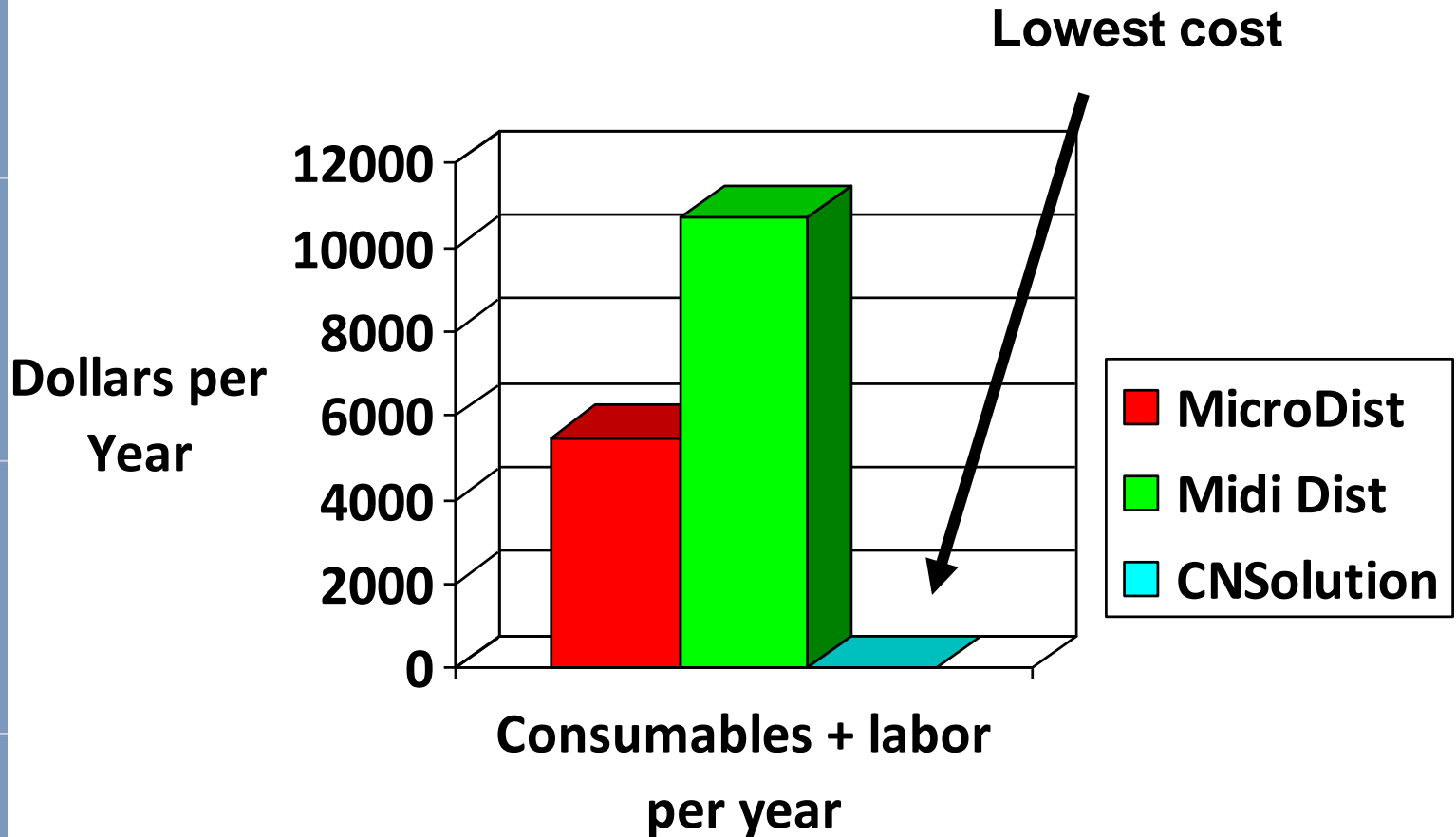


**MIDI  
Distillations**

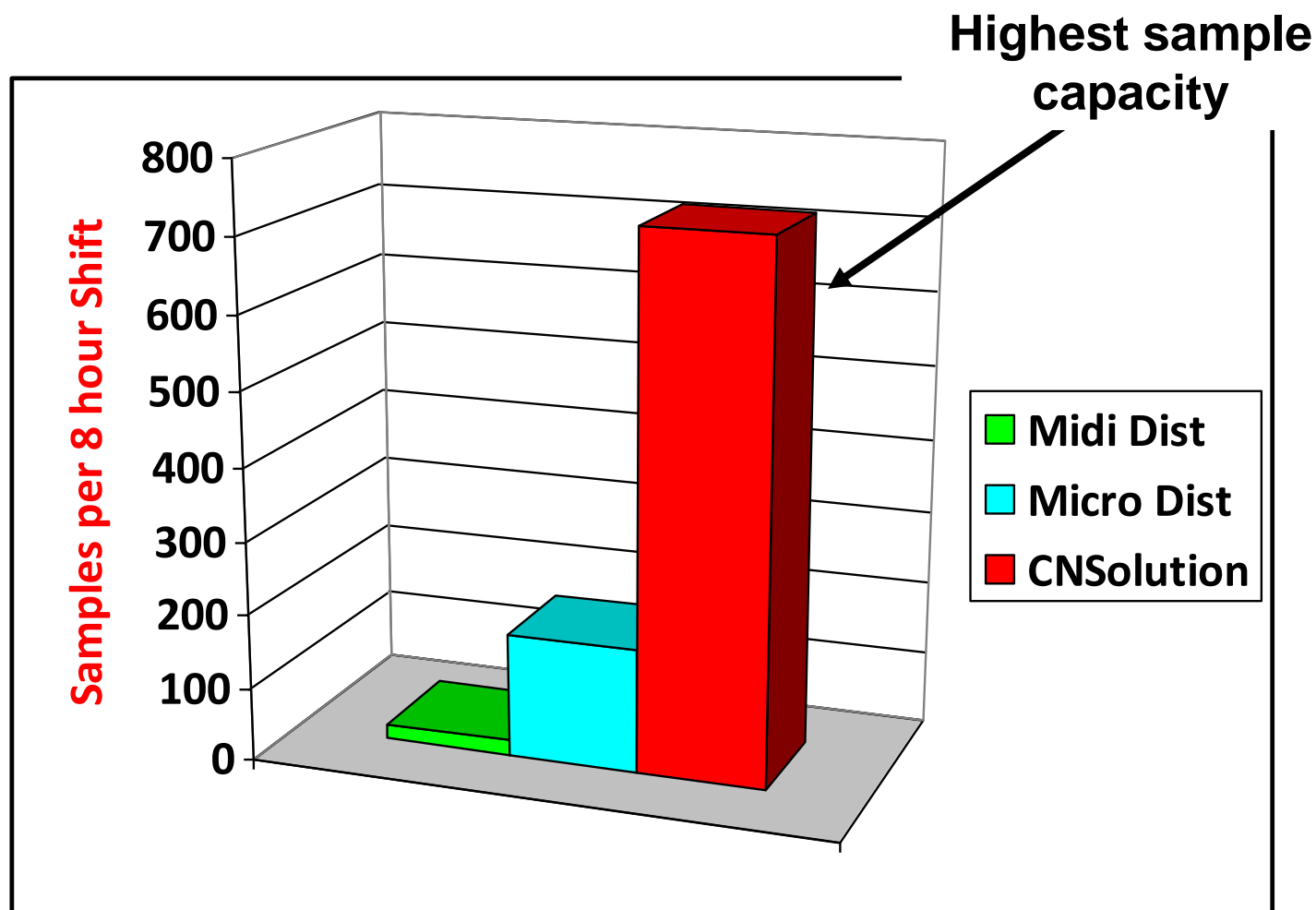
# Cyanide methods that utilize distillation have significant disadvantages

- **Time Consuming**
  - One hour long distillation (does not take into account setup and teardown)
  - CATC requires two, one hour distillations
- **Bulky and Relatively Expensive Glassware**
- **Operator-dependent results (technique)**
- **Multiple Interferences**

# Gas diffusion eliminates distillation and associated cost



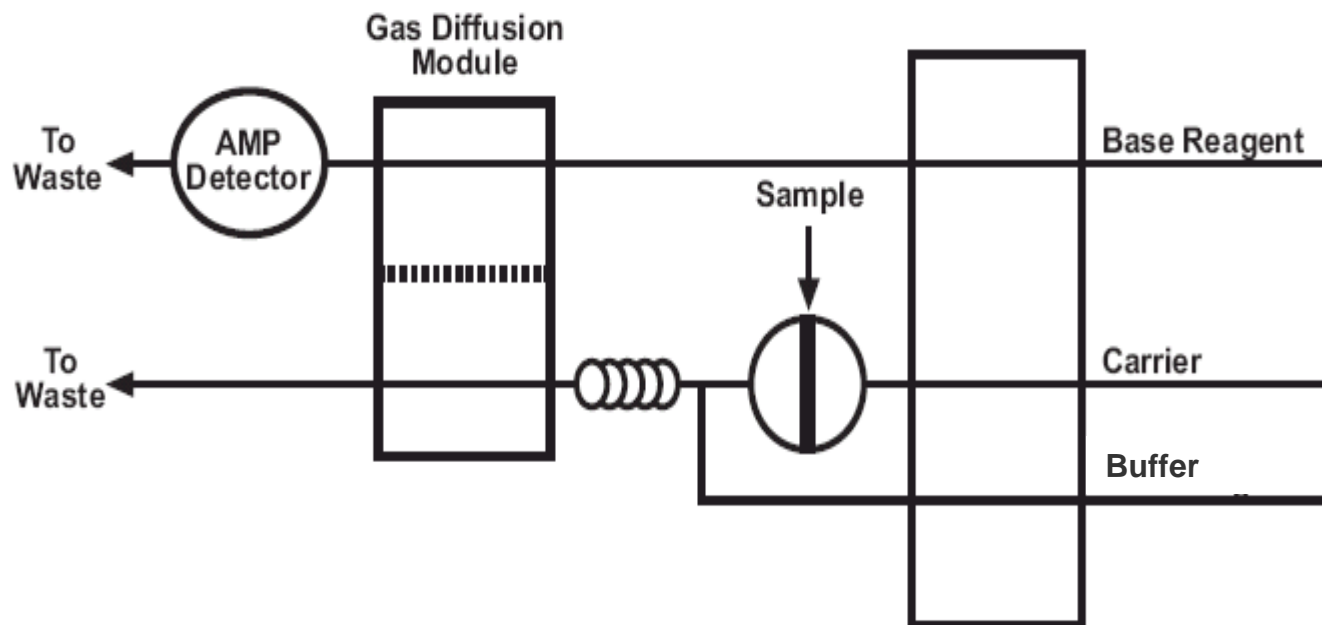
# Eliminating distillation increases laboratory capacity





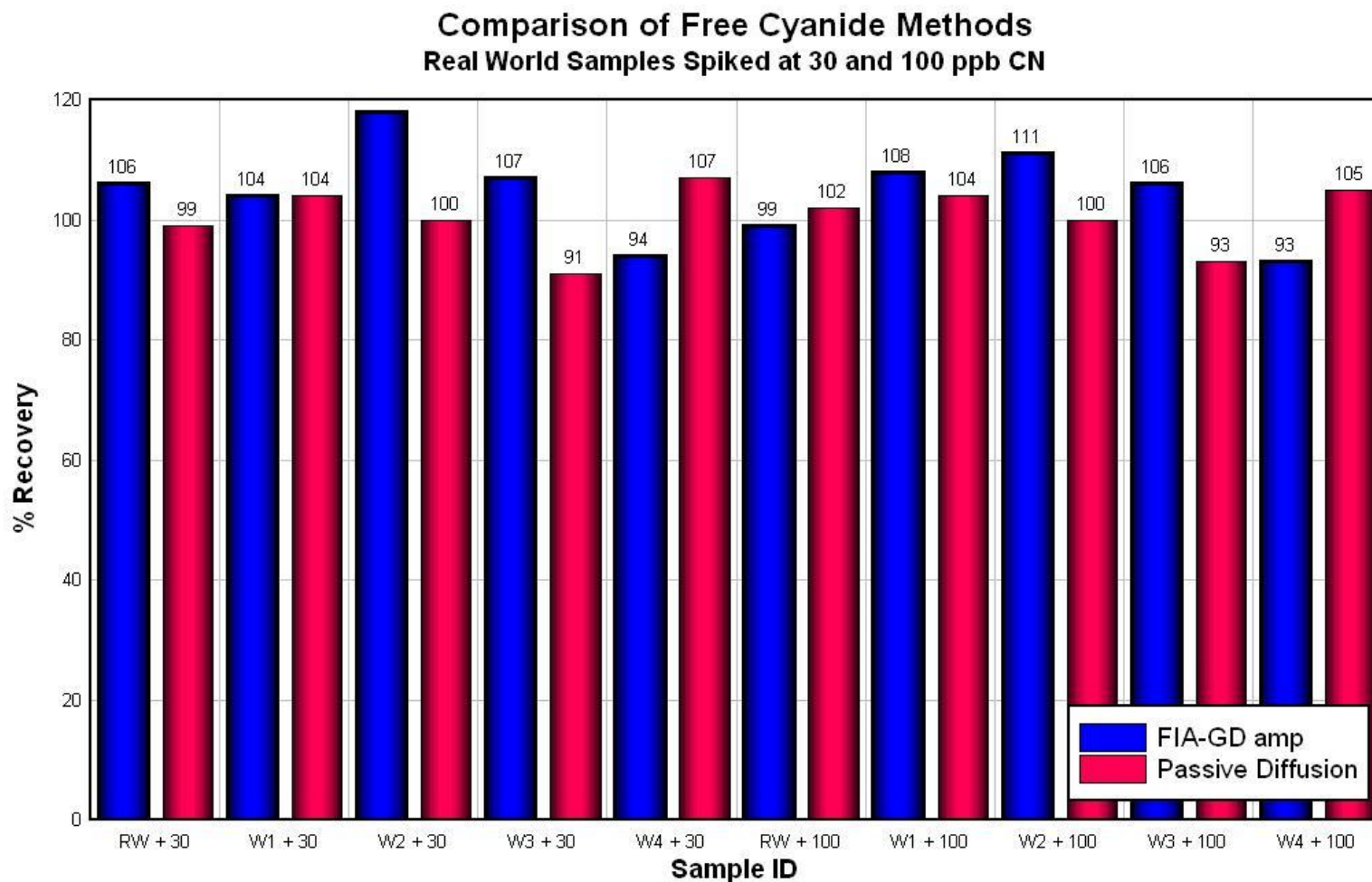
# Aquatic Free Cyanide Analysis

# ASTM D7237-06 can be run on a OIA1677 CNSolution analyzer



**Same Cartridge as OIA 1677**

# Obtain accurate, cost effective free cyanide results in minutes, not hours



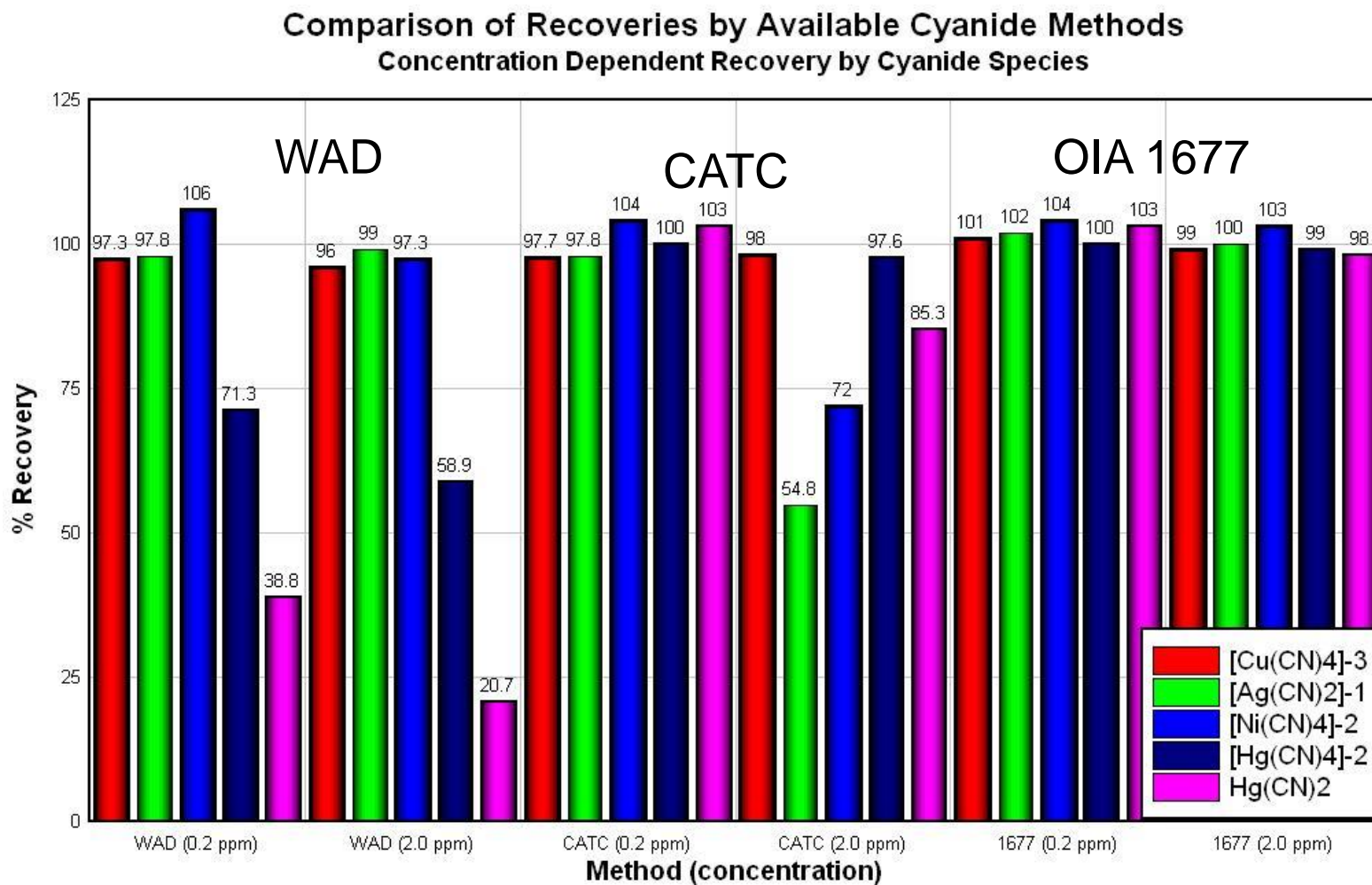
# Available Cyanide Analysis

# Ligand Exchange methods measure available cyanide

Method Number	Description	Measurement
OIA 1677	Ligand Exchange / Flow Injection Analysis	Gas Diffusion - Amperometry
ASTM D 6888	Ligand Exchange / Flow Injection Analysis	Gas Diffusion - Amperometry

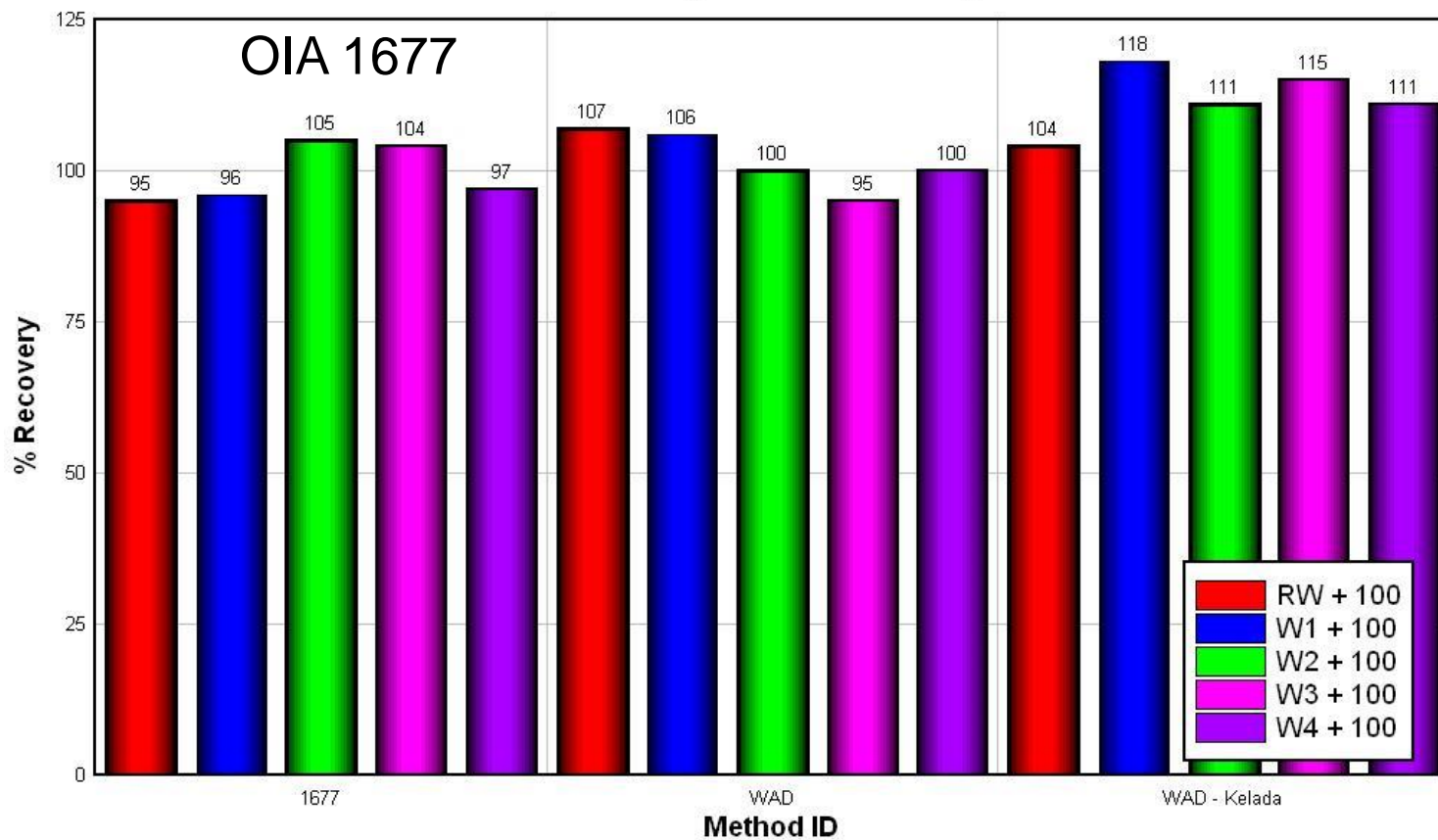
**GD-amperometry methods do not require distillation**

# Ligand Exchange GD-amperometry methods get better recovery

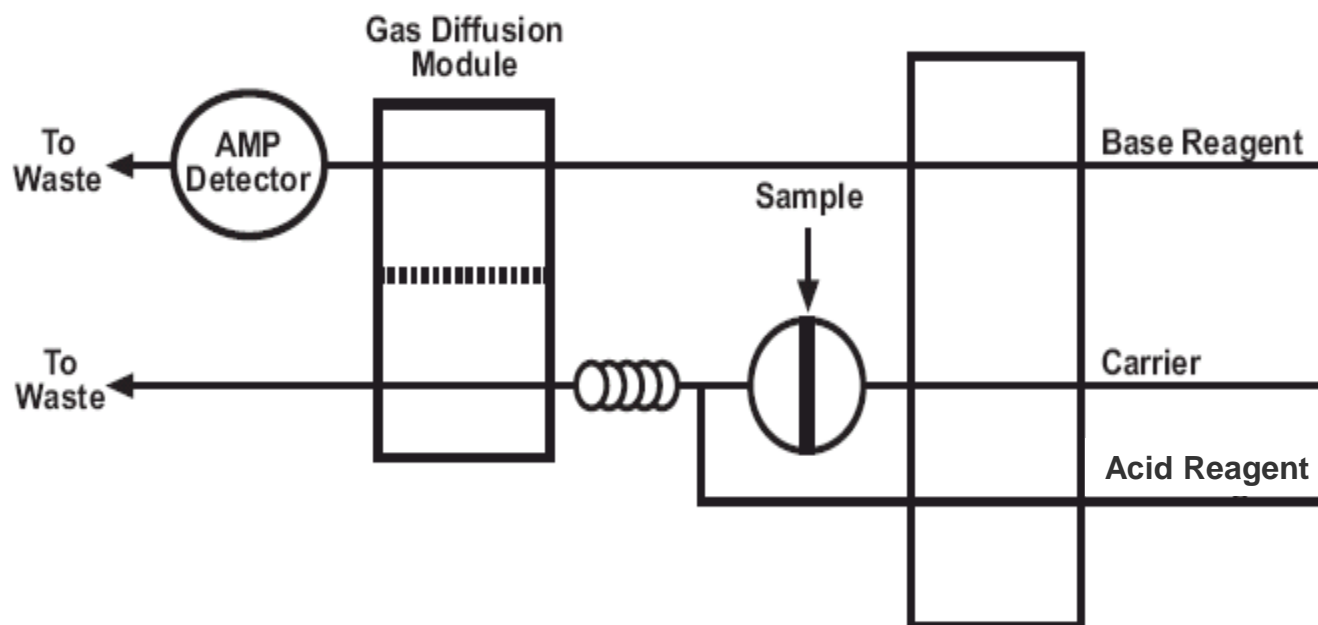


# Ligand Exchange GD-amperometry methods are more precise

Comparison OIA 1677 vs WAD and WAD-Kelada Distillations  
Real World Samples Fortified at 100 ppb CN



# OIA 1677 or ASTM D6888 flow diagram





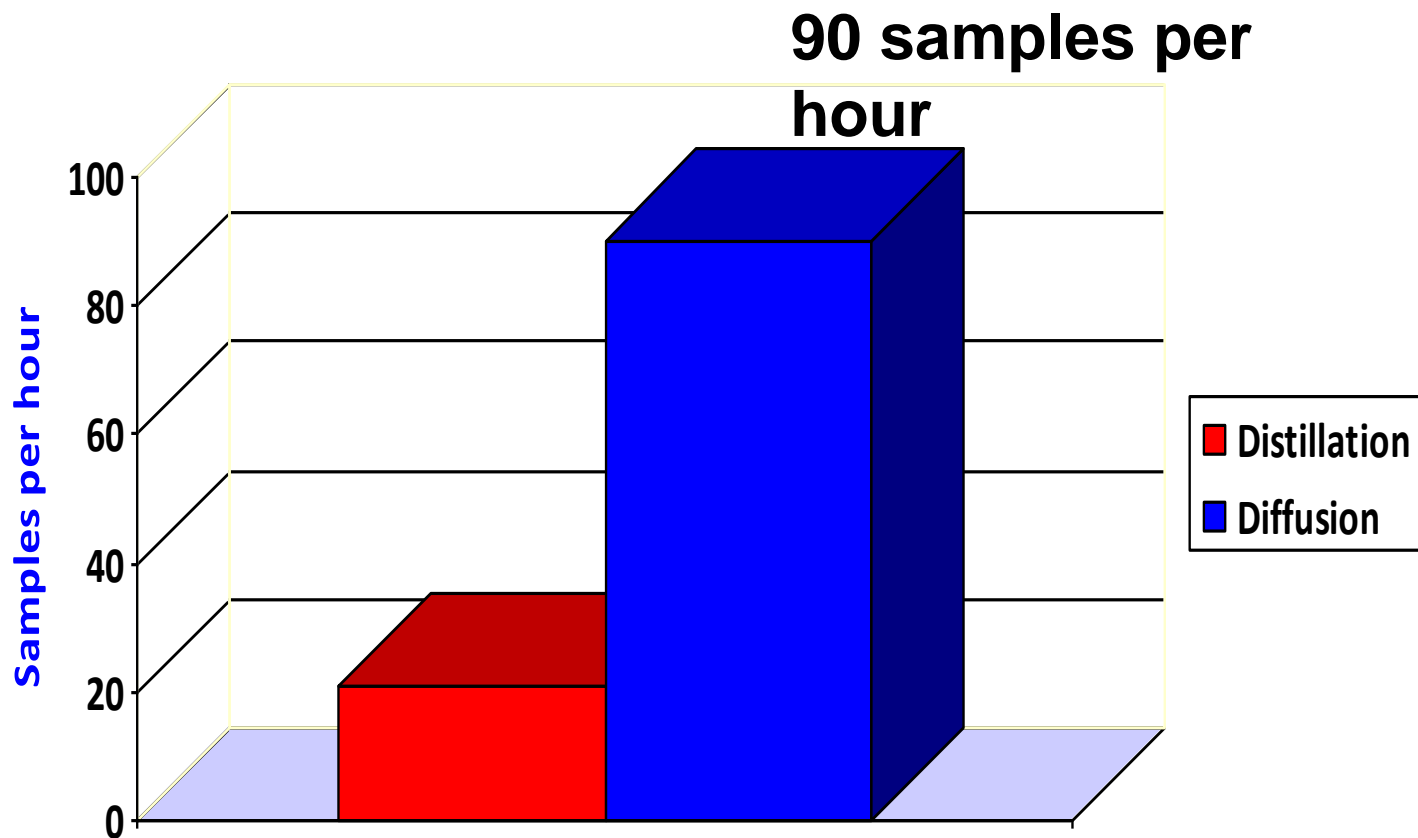
# Ligand Exchange GD-amperometry methods have fewer interferences

CATC	WAD	OIA 1677
N-organics	Excessive Iron Cyanide	None
SCN, NH <sub>3</sub> , NO <sub>2</sub>	Concentration Dependent	—
S <sub>2</sub> O <sub>3</sub> , H <sub>2</sub> O <sub>2</sub>	—	—
Concentration Dependent	—	—

# Ligand Exchange GD-amperometry methods give you results in minutes

	CATC	WAD	OIA 1677
Sample Preparation	2 distillations 2 – 3 hours	1 distillation 2 – 3 hours	No distillation
Analysis	1 – 2 minutes	1 – 2 minutes	1 – 2 minutes
Total Time	3 – 4 hours	3 – 4 hours	1 – 2 minutes

# Ligand Exchange GD-amperometry methods means more samples





# Ligand Exchange GD-amperometry methods provide the best benefits

- No distillation (eliminates 1 – 4 hours preliminary sample treatment)
- Low MDL (0.5 ppb)
- No Interferences
- High Throughput (up to 90 samples per hour)
- Ease of Operation, very simple chemistry.

CN

NH<sub>3</sub>

PO<sub>4</sub>

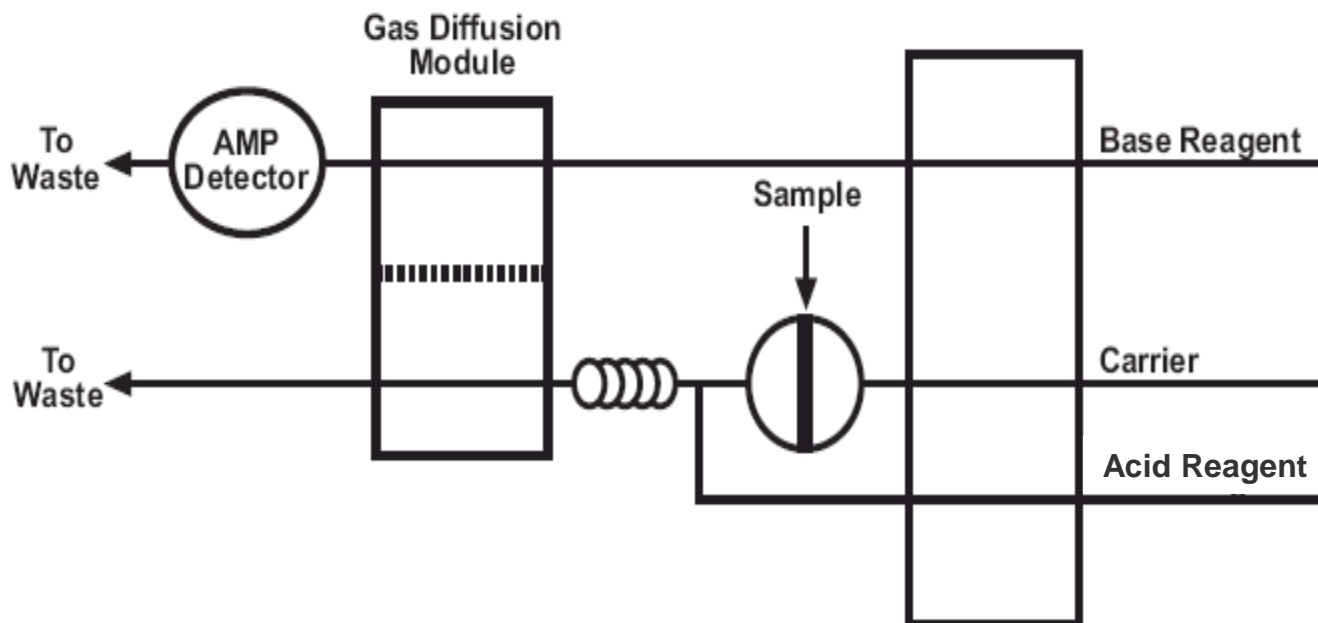
NO<sub>3</sub>

# Total Cyanide Methods

**Automated gas diffusion distillation and non-distillation methods**

# GD-amperometry provides the safest, easiest, and most accurate technique

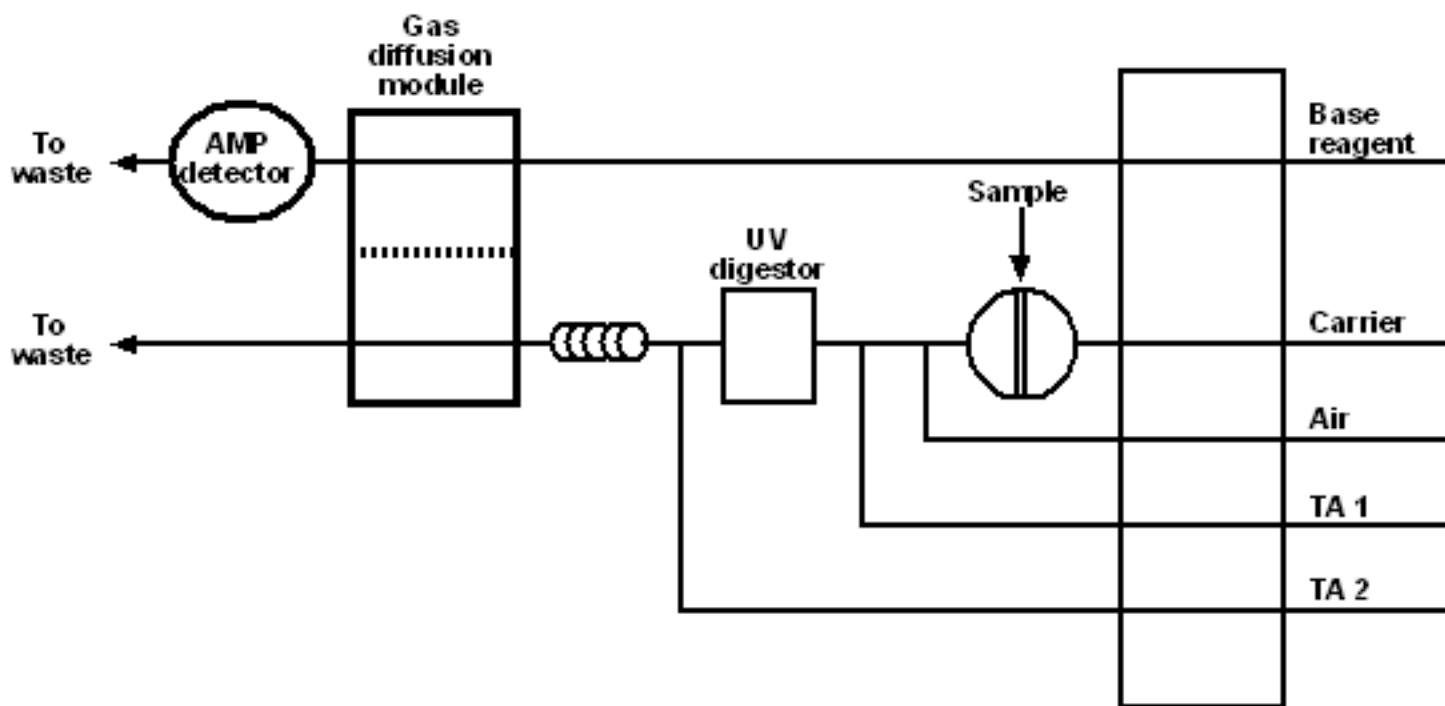
No pyridine



ASTM D7284-08 is a “green” chemistry

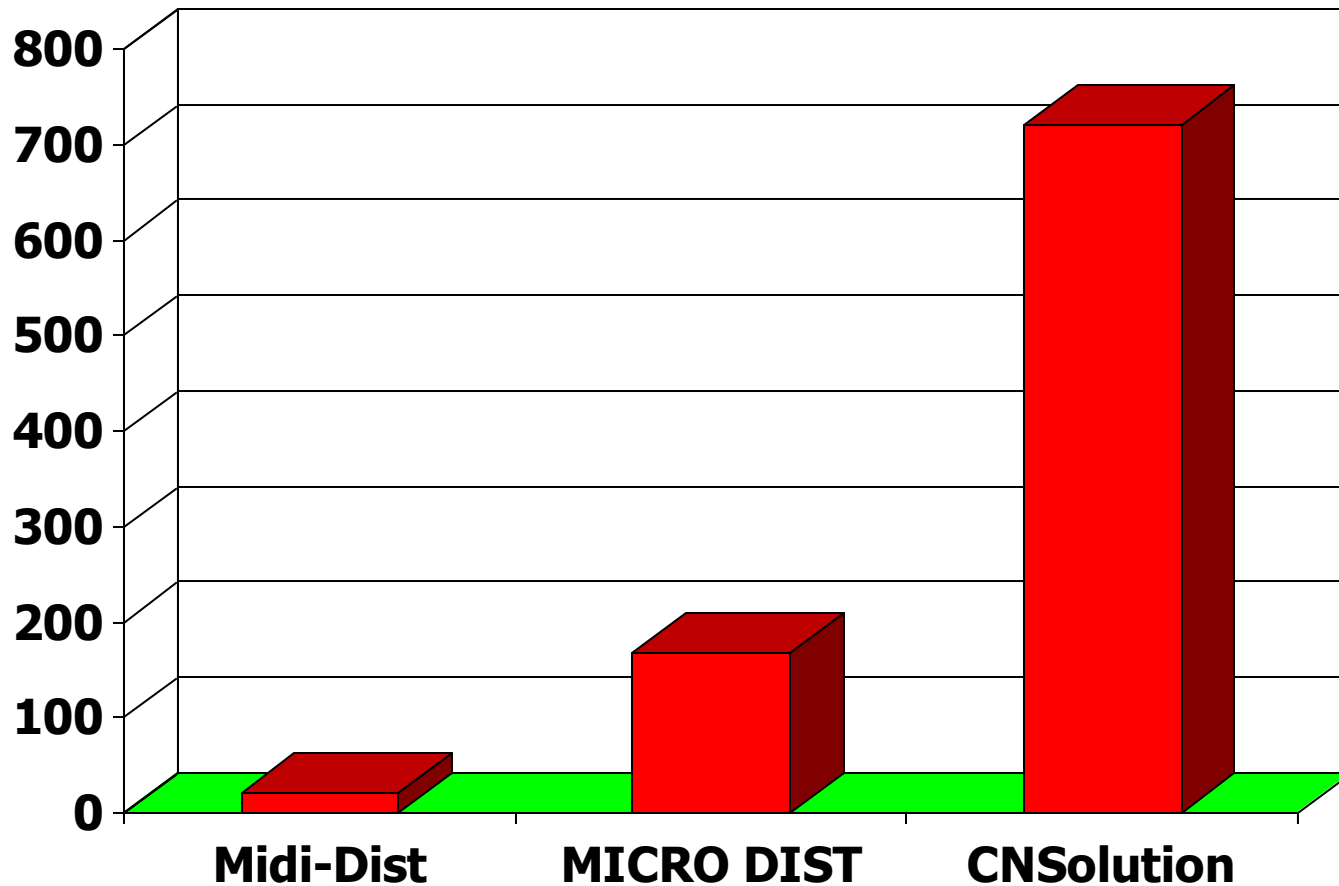
# ASTM D7511 is easy to understand and operate and does not distill.

No pyridine



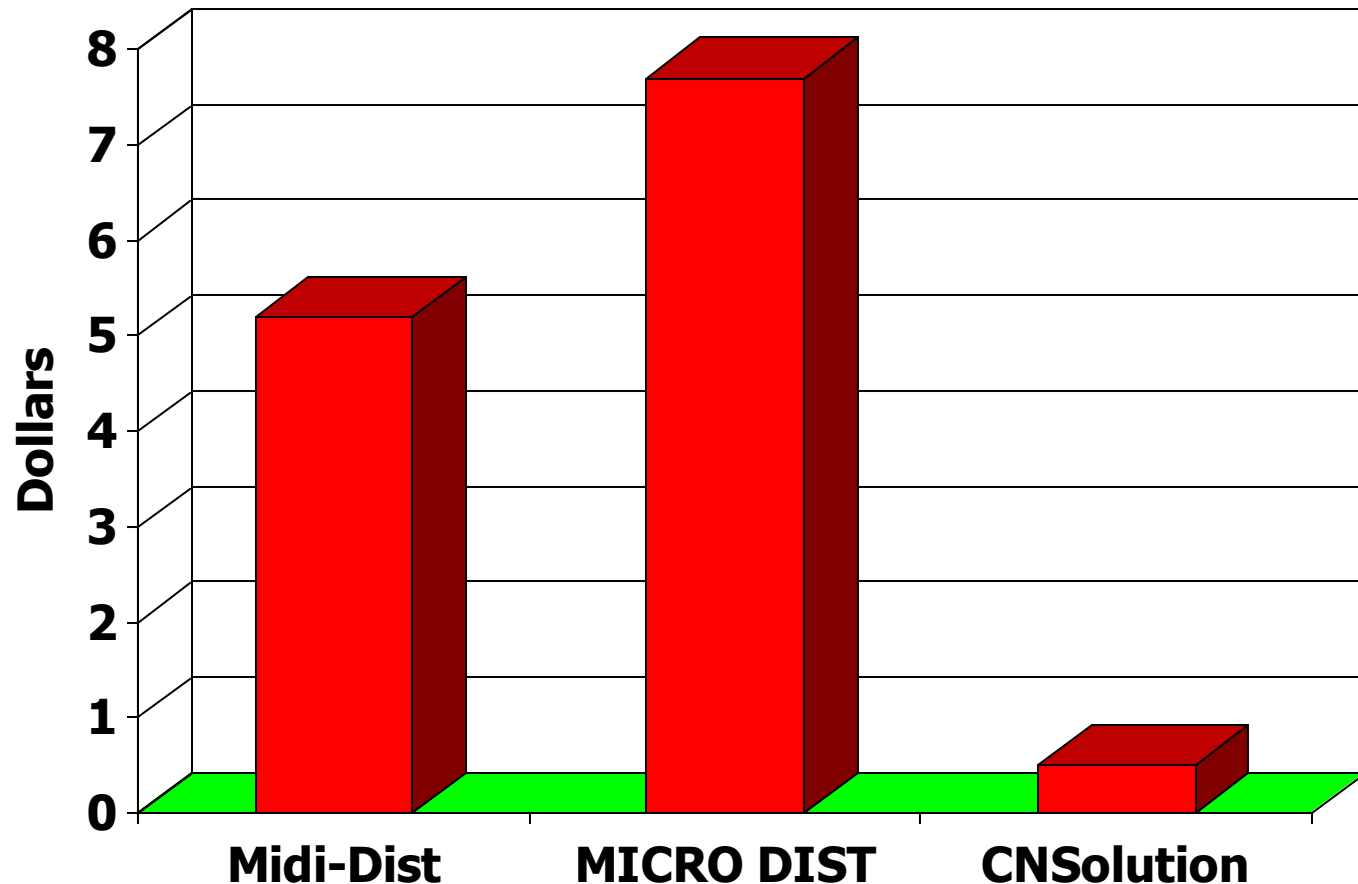
“Green” Chemistry

# Analytical Throughput per 8 Hour Shift

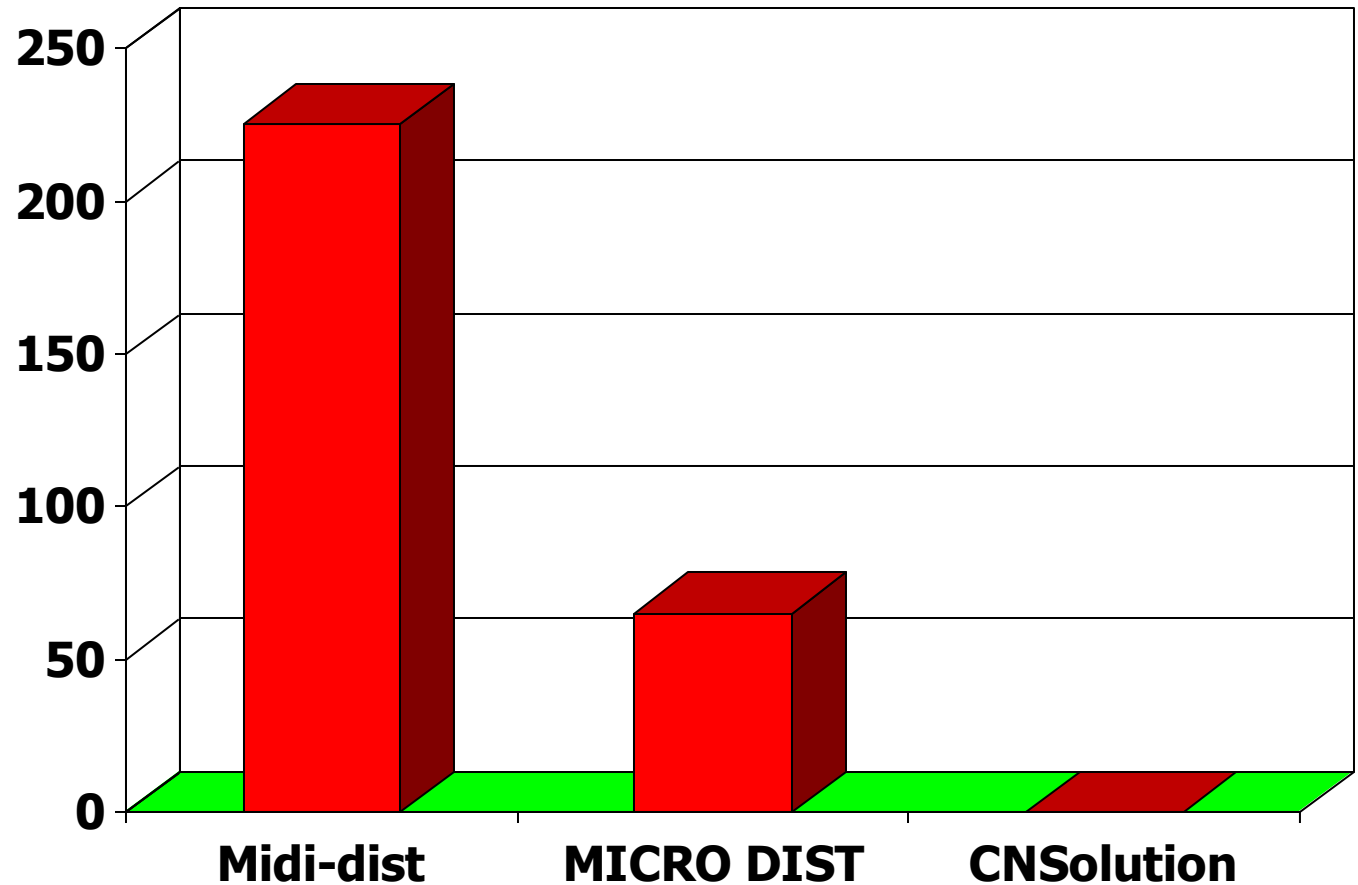




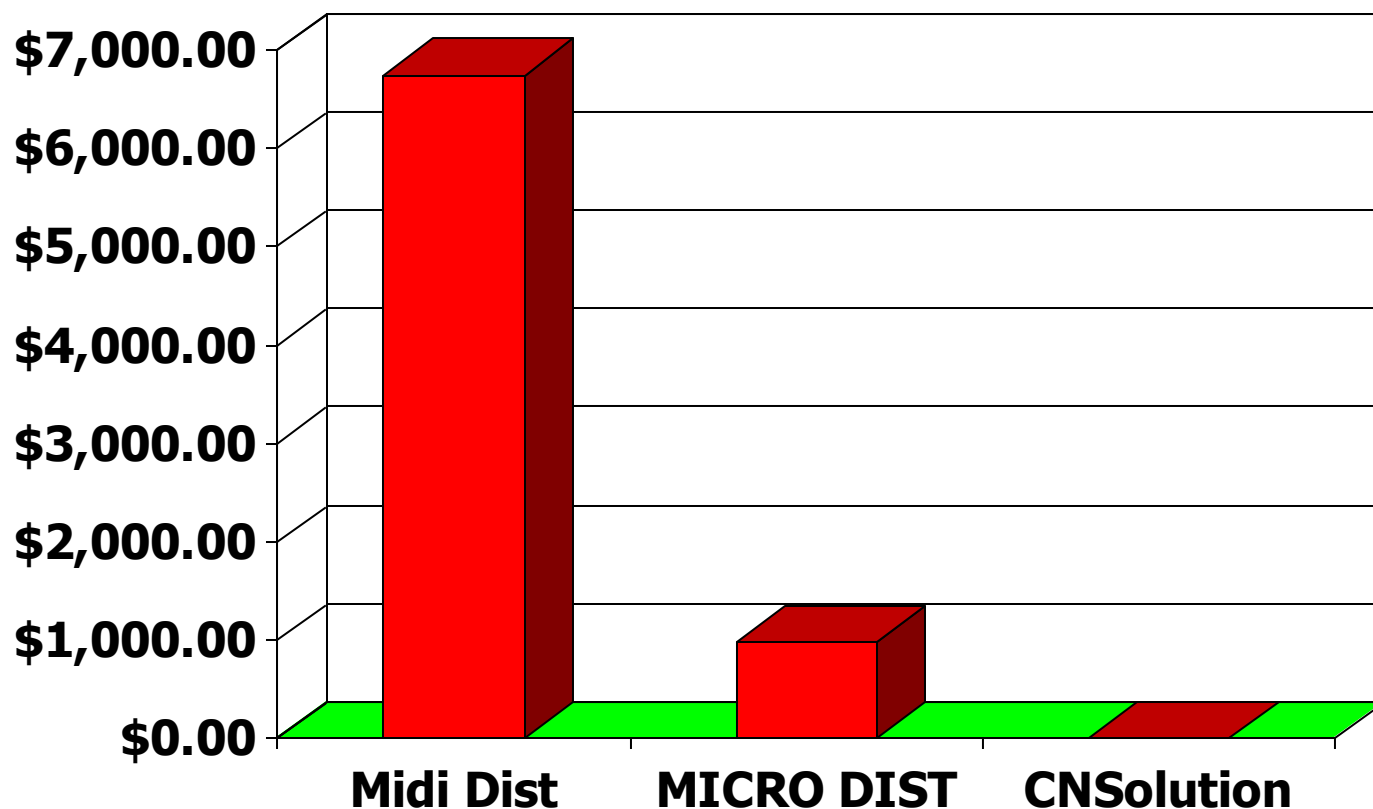
# Estimated Reagent and Consumable Cost per Analysis for Distillation (US Dollars)



# Estimated Labor (in minutes) Required to Distill 20 Samples for Analysis

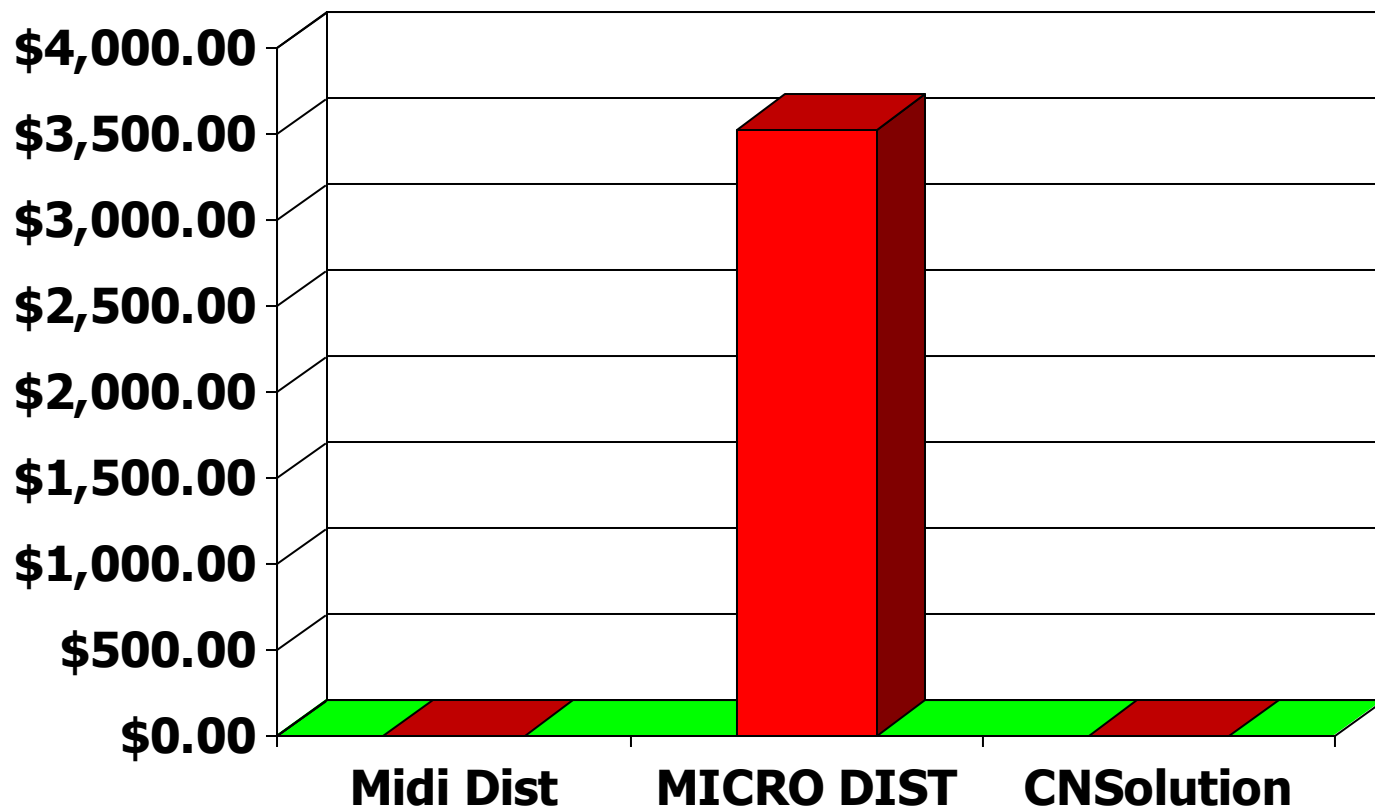


# Estimated Annual Labor Cost to Distill and Analyze 40 Samples per Month (Including Overhead)

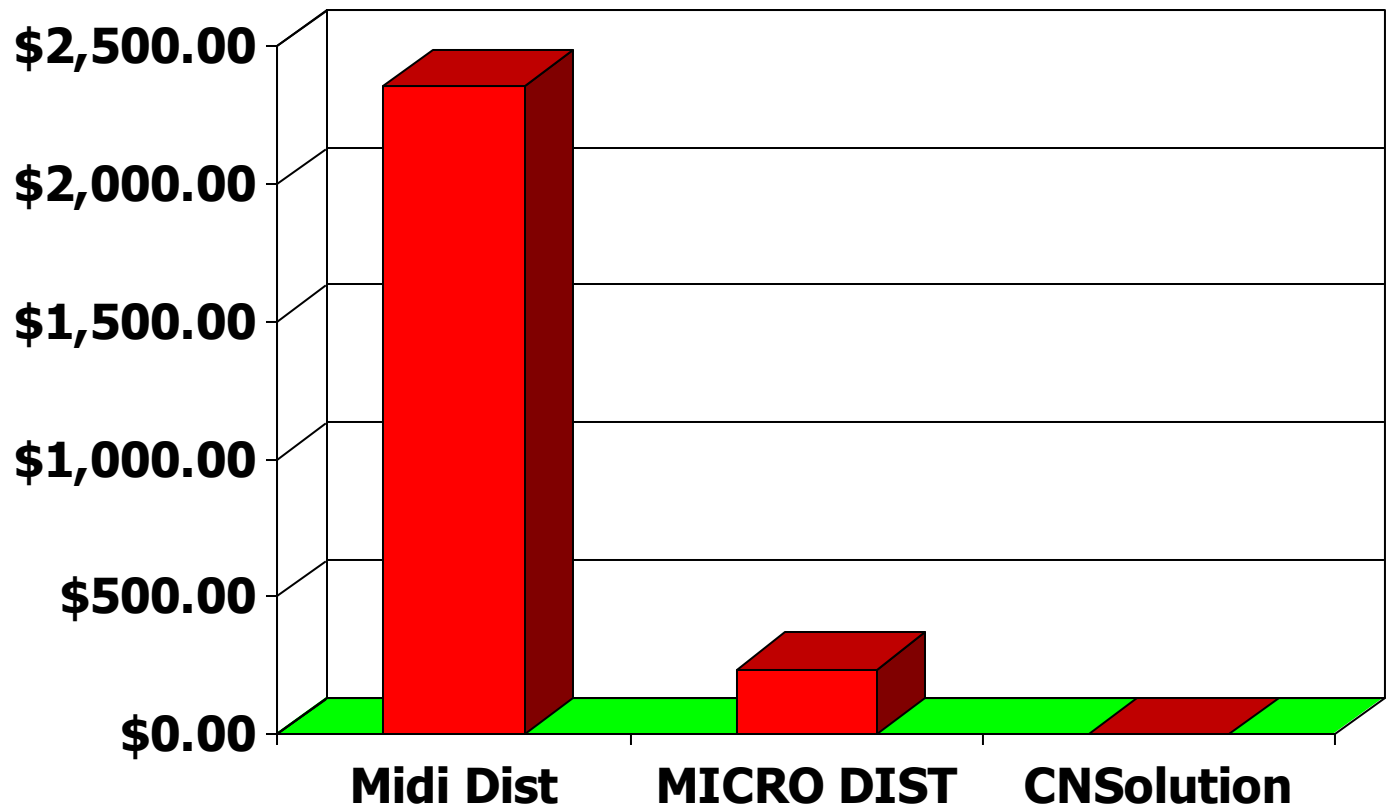


Assume tech pay at  
\$15/hour

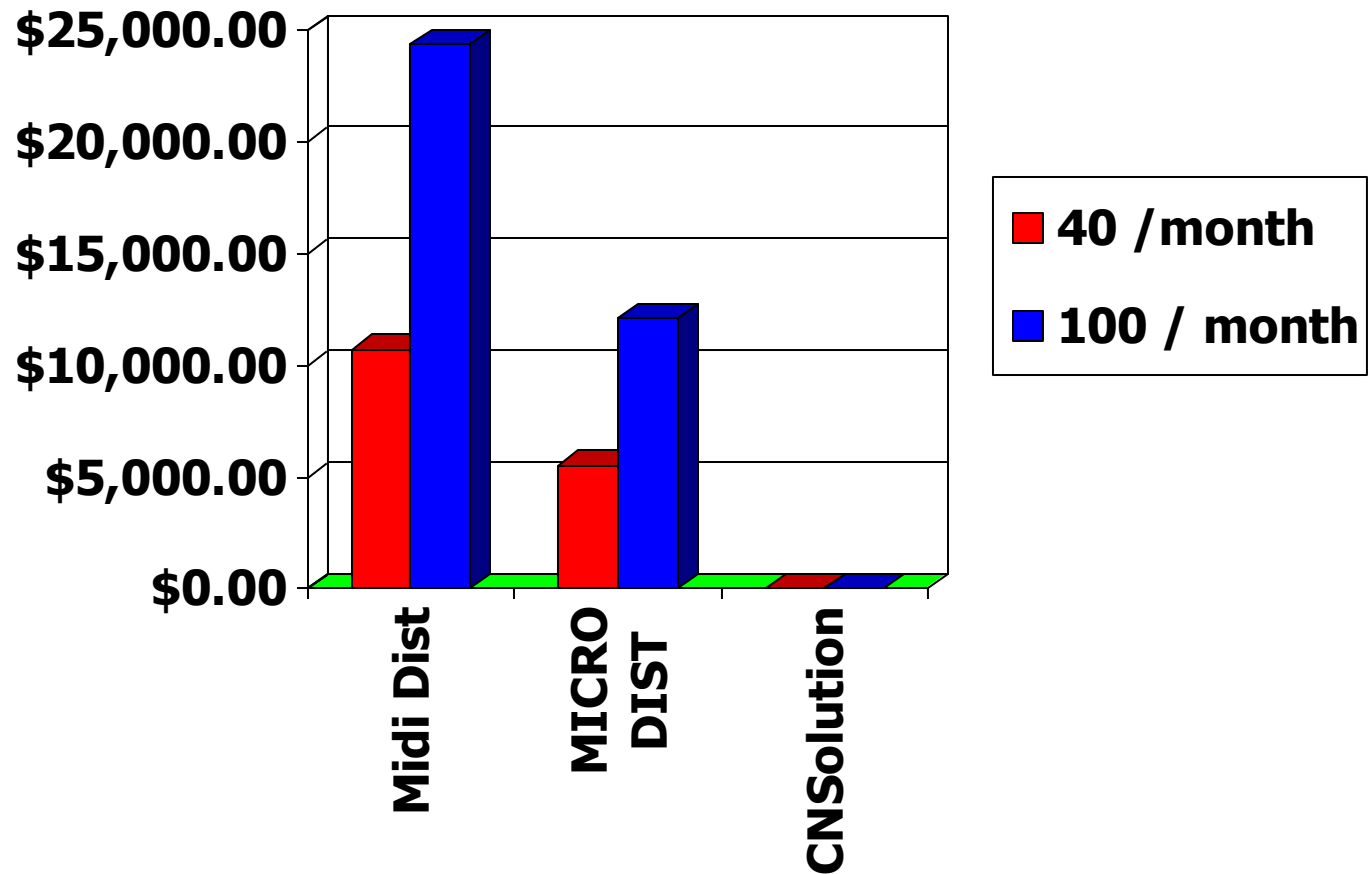
# Estimated Annual Cost for Consumables to Distill and Analyze 40 Samples per Month



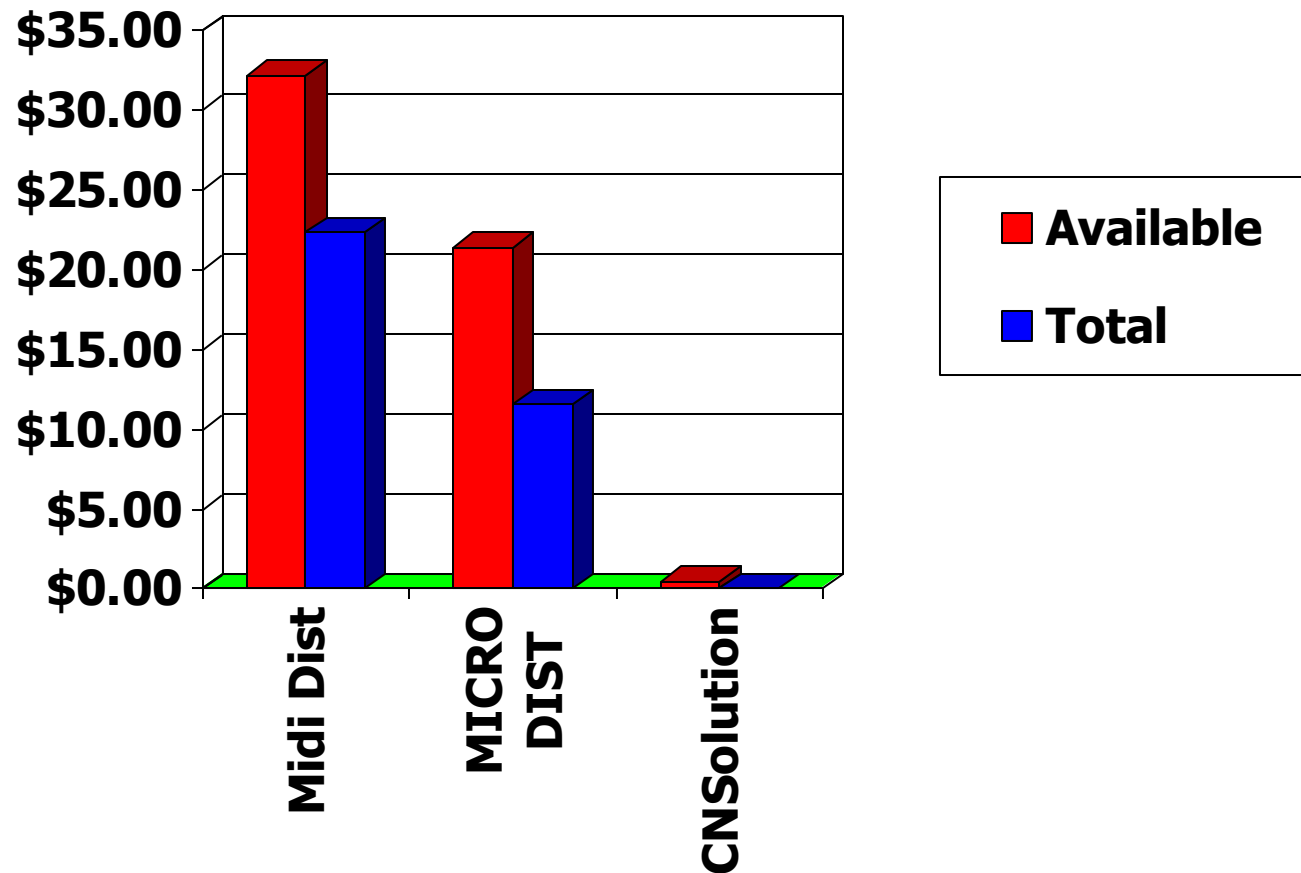
# Estimated Annual Cost for Reagents to Distill and Analyze 40 Samples per Month



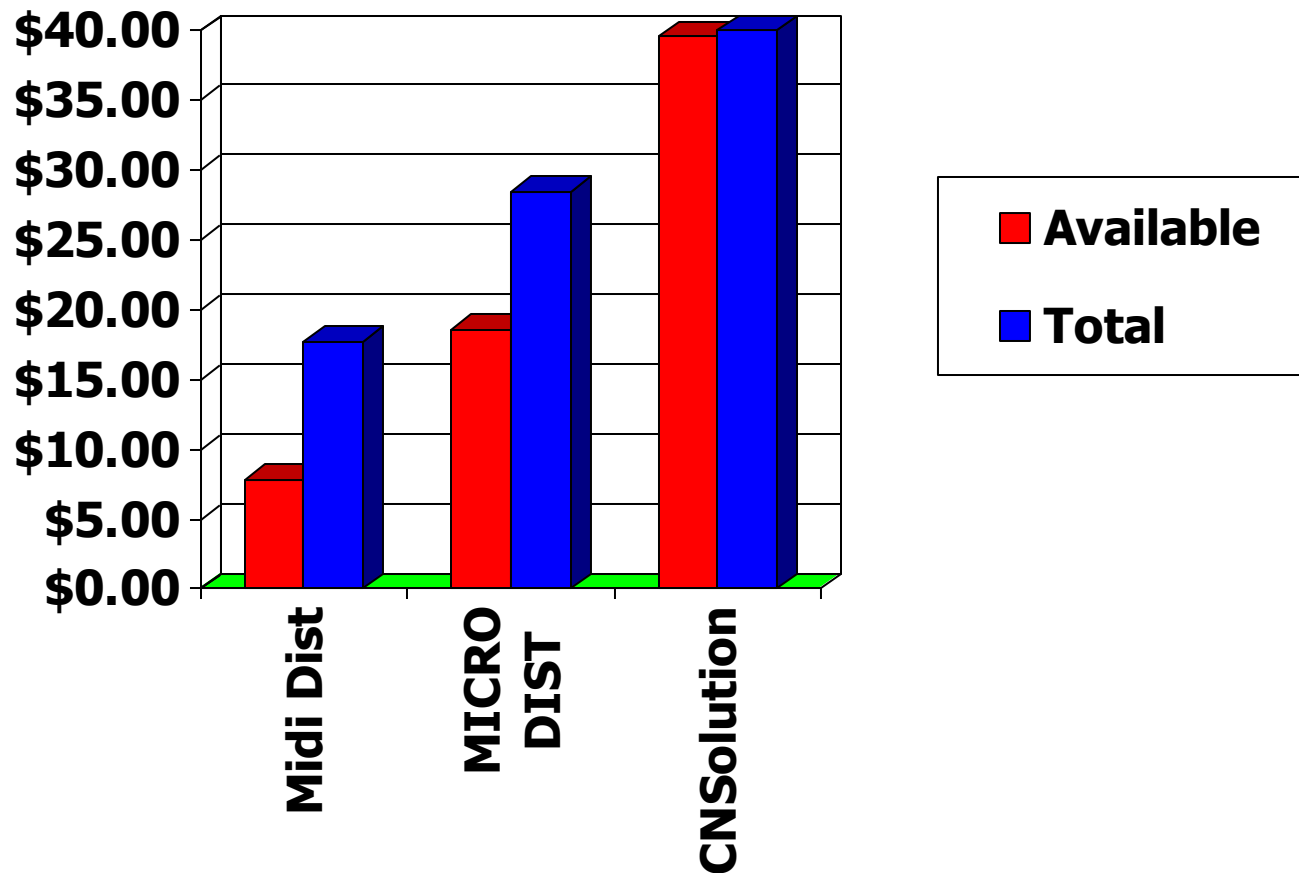
# Annual Cost for Distillation vs. Non-Distillation Techniques



# Comparison of Cost per Sample by Cyanide Species and Method

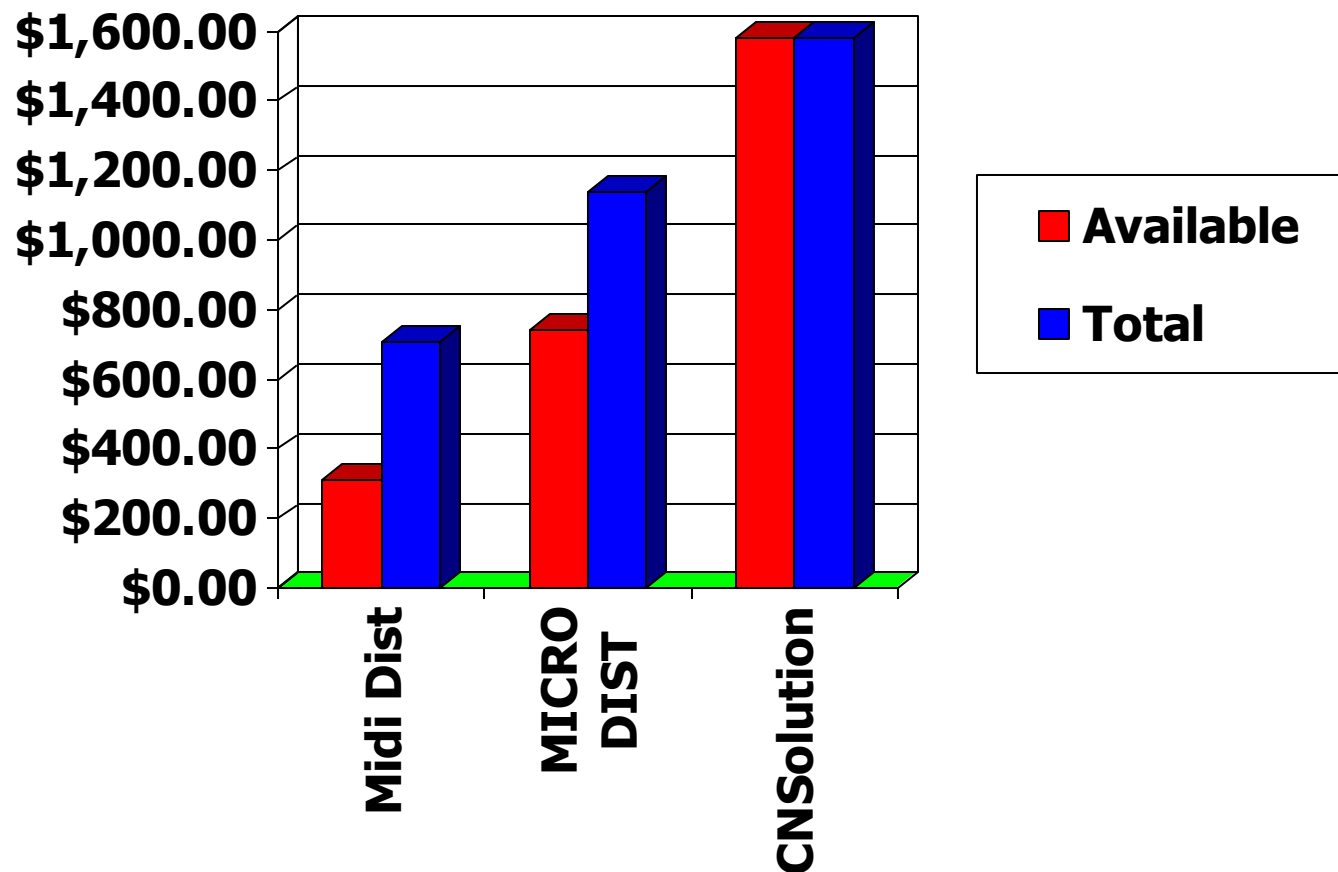


# Profit per Sample by Cyanide Species at \$40 per Test

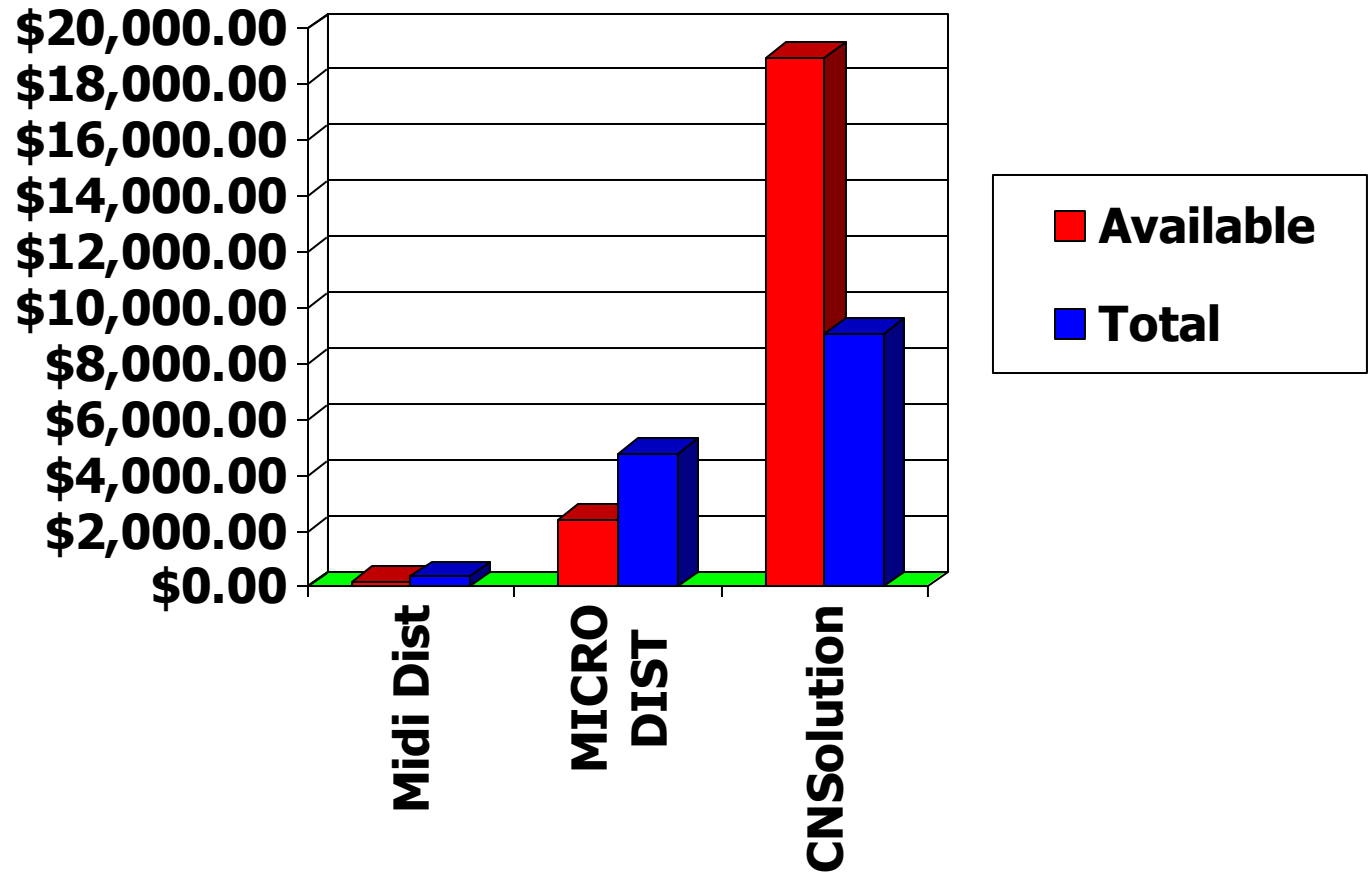




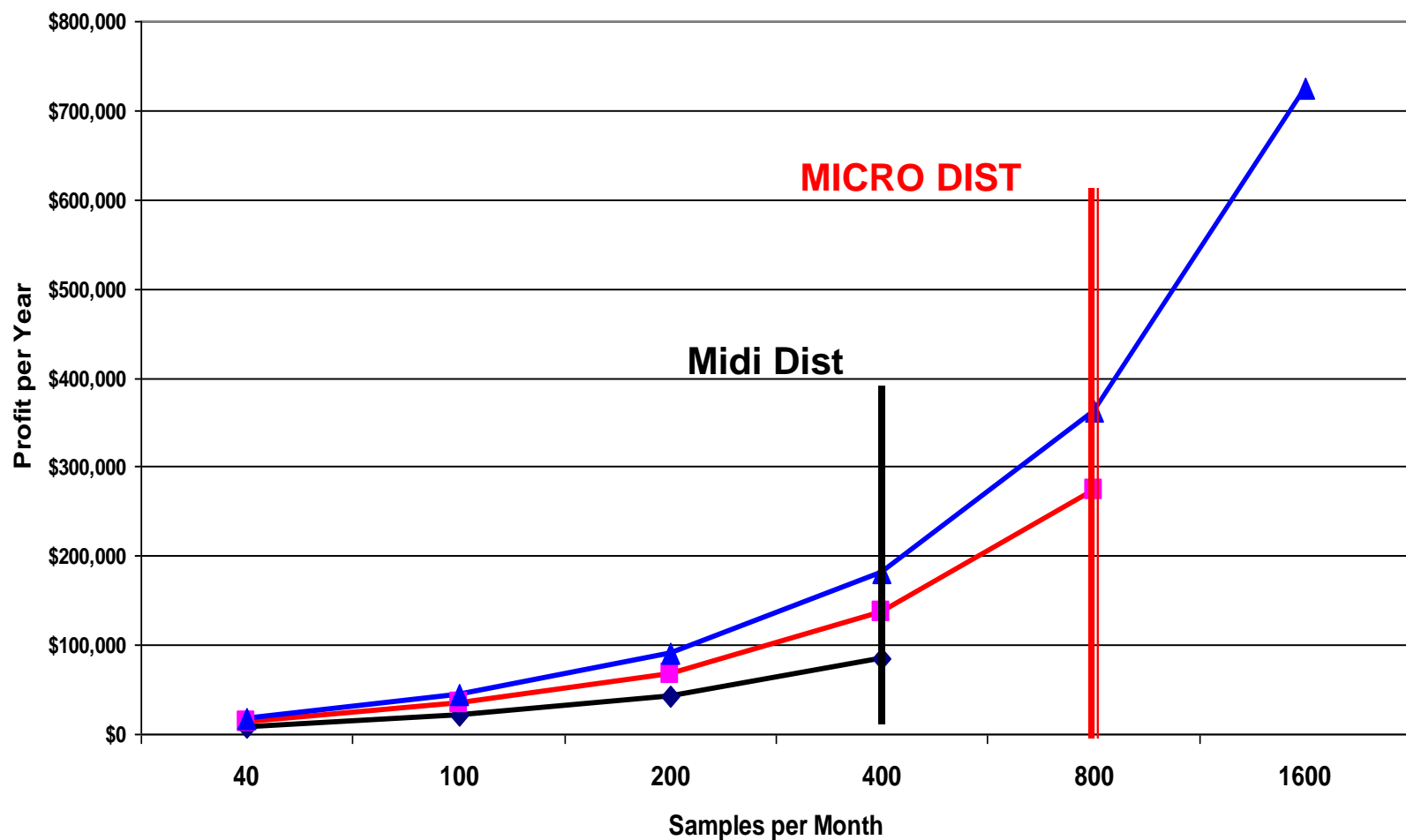
# Profit per Month by Cyanide Species at \$40 per Test and 40 Samples per Month



# Profit per Shift by Cyanide Species at \$40 per Test Based on Maximum Capacity



# Estimated Profit by Number of Samples Analyzed at Maximum Capacity



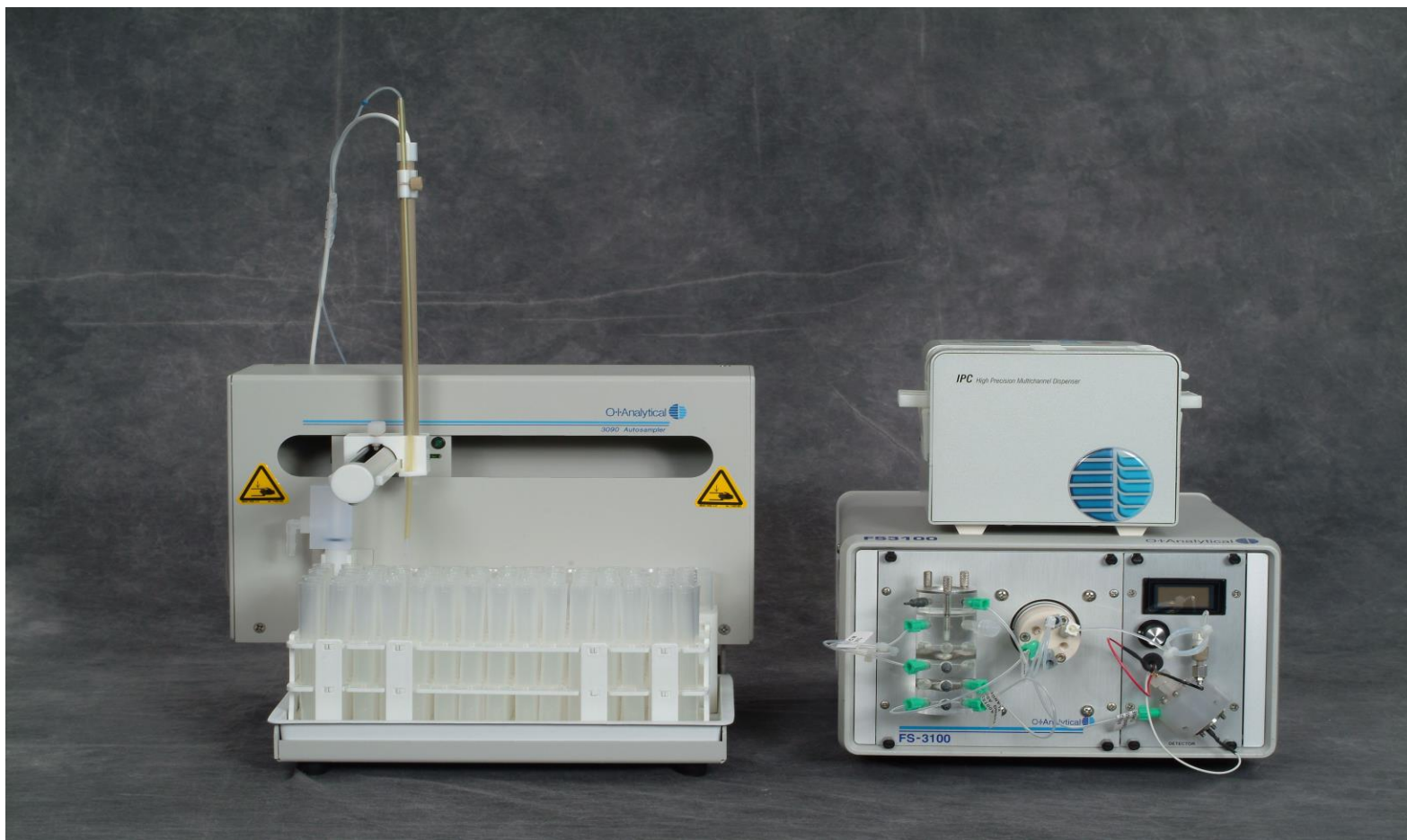
The left side of the slide features a vertical blue bar with a white chromatogram line. Along this line are four boxes containing chemical symbols: CN, NH<sub>3</sub>, PO<sub>4</sub>, and NO<sub>3</sub>.

# Thoughts Regarding “Break Even” Analysis

- **Manual distillation and manual spectrometer versus CNSolution**
  - Manual equipment costs 3 x less
  - CNSolution profit 3 x higher per test
- **Break Even = 1000 samples for both!**
- **That's 20 samples per week regardless**

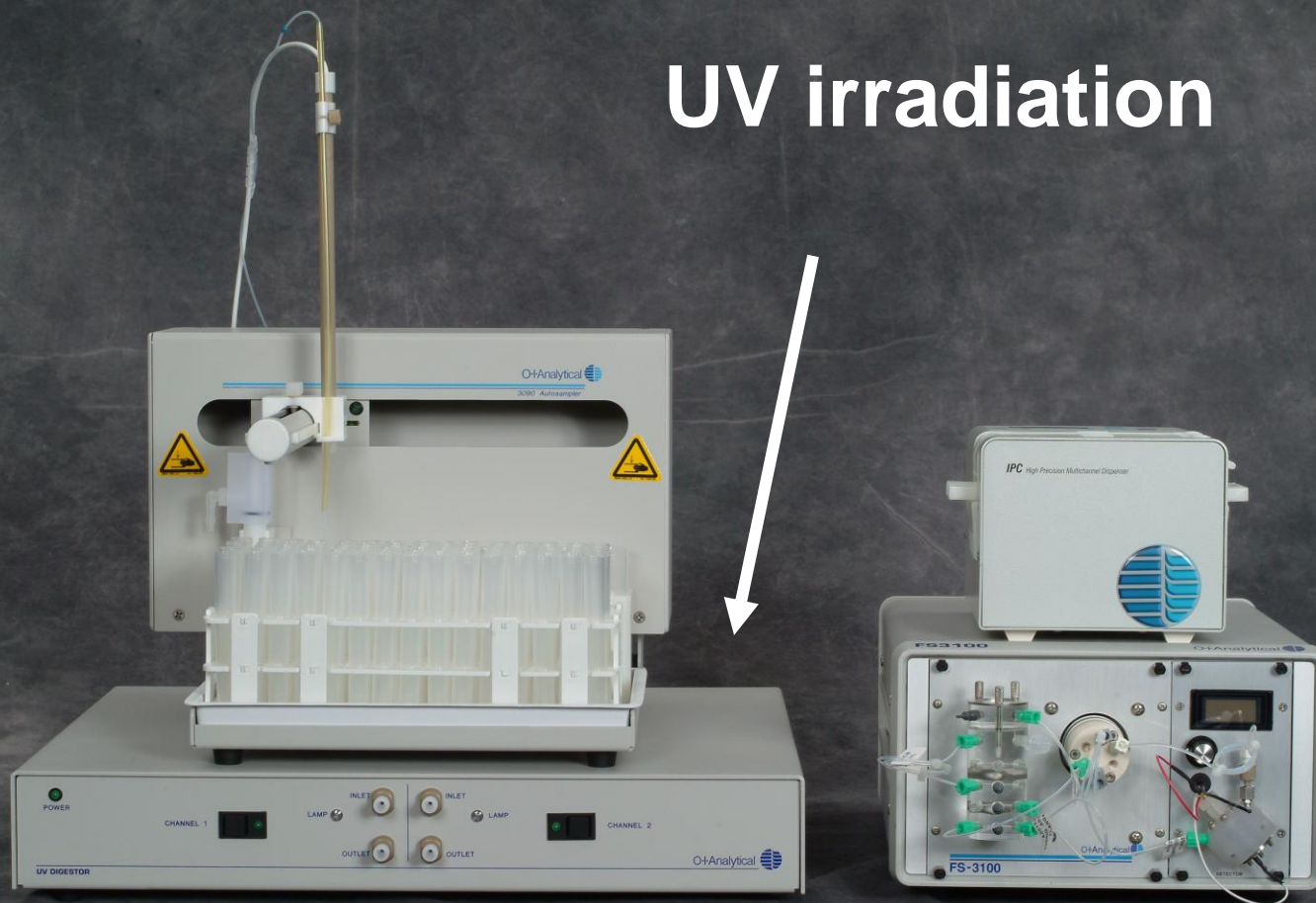
# Description of the Analyzer

# The CNSolution 3100 available cyanide system



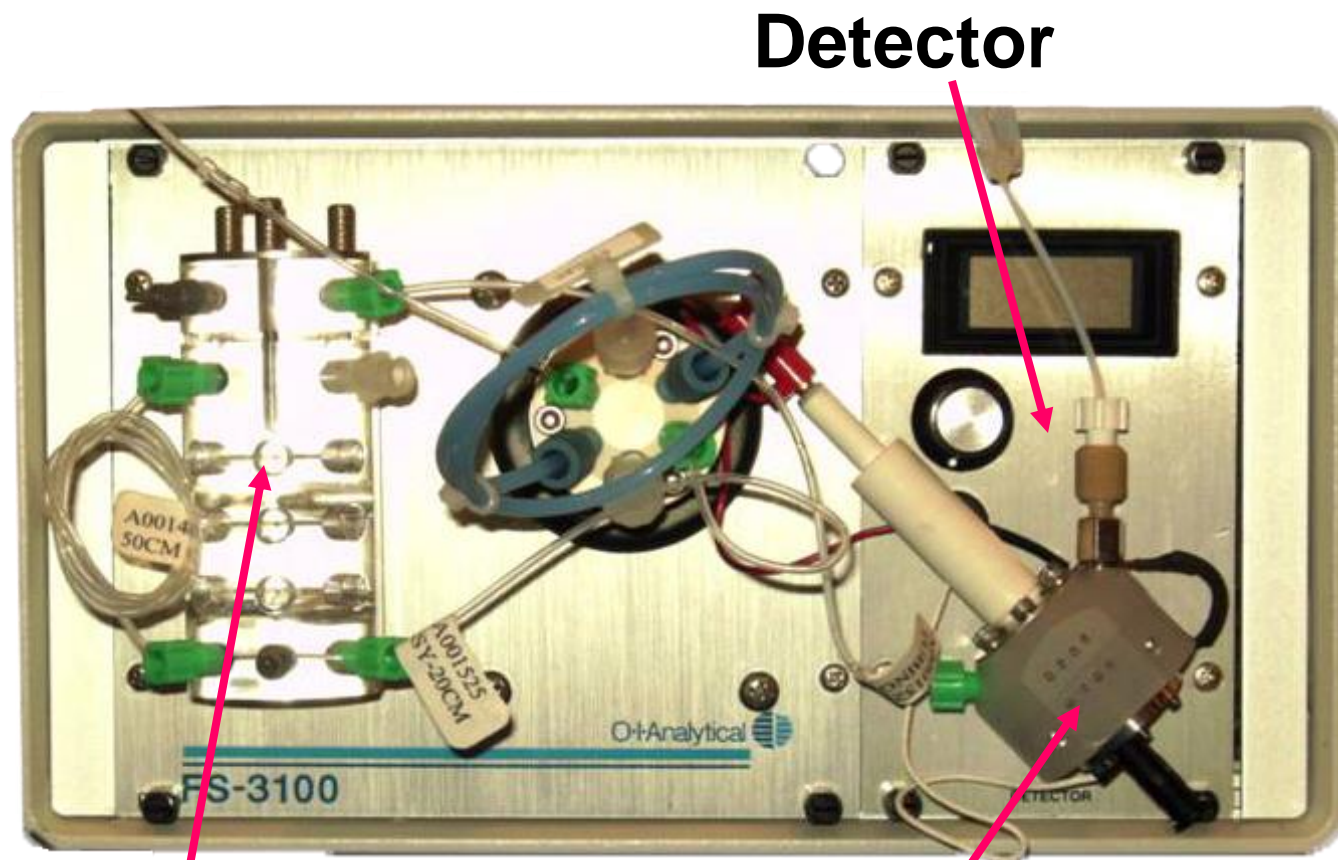
# The CNSolution 3100 total cyanide system

UV irradiation





# A close up of the analytical module





# A high quality peristaltic pump



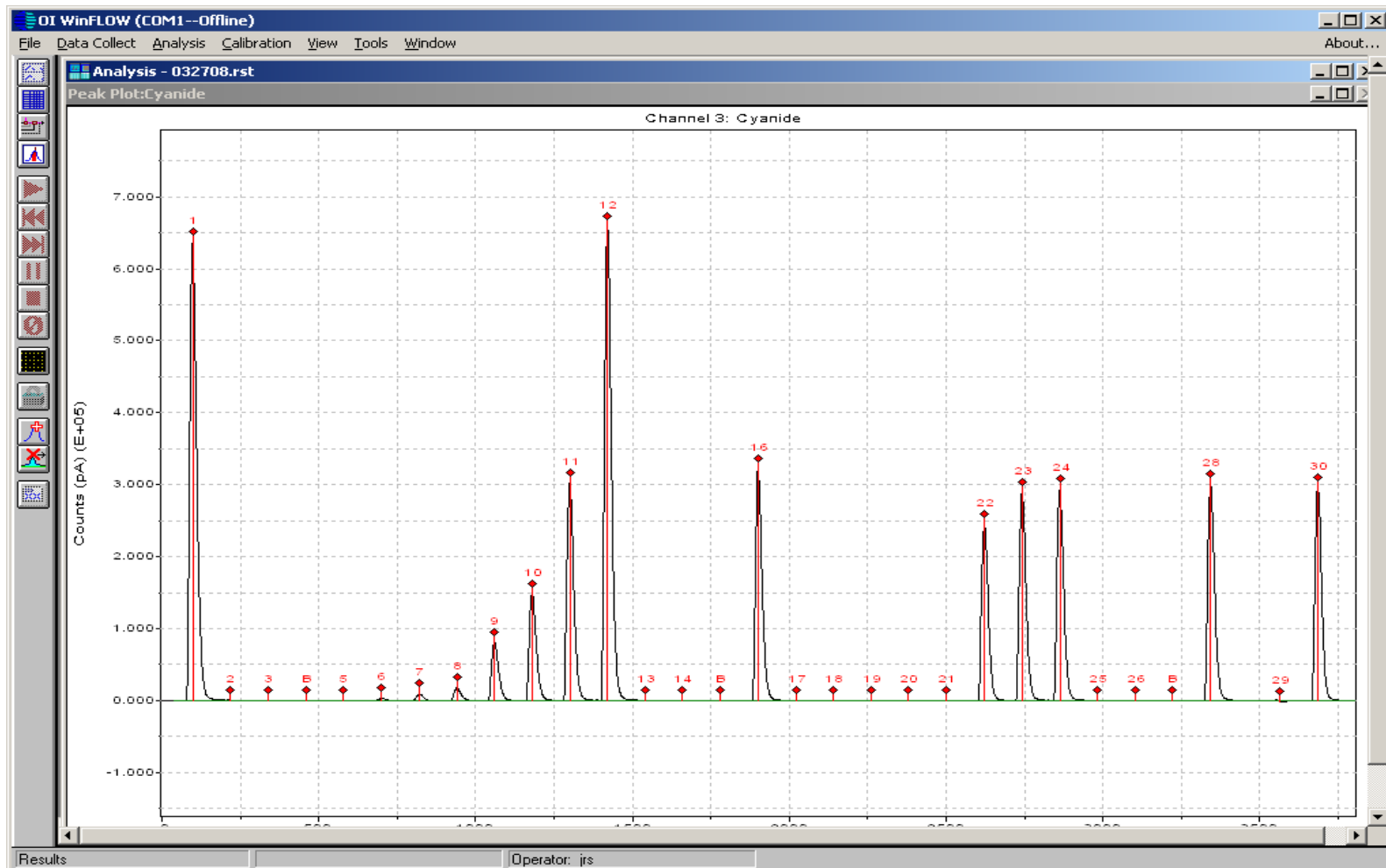
**Separate module, individual channels, long pump tube life.**

# A random access xyz sampler



- Integrated circulating wash station
- 90 or 360 positions
- Separate standard and QC vials

# Winflow software provide accurate quantitation of CN results





# The CNSolution 3100 is accurate, and cost effective

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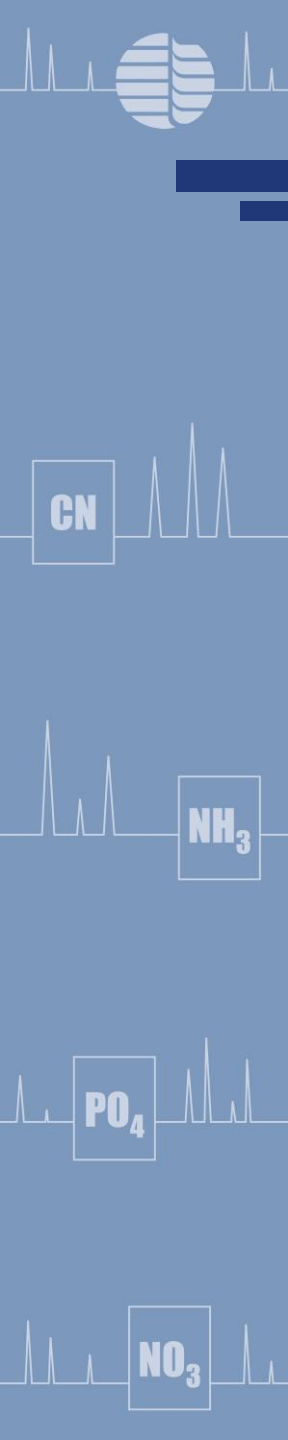
- **Rapidly analyze cyanide**
- **Eliminate time consuming error causing distillations**
- **Expand capability to colorimetric FIA and SFA**

CN

NH<sub>3</sub>

PO<sub>4</sub>

NO<sub>3</sub>



# Thank You

## Questions?

[www.oico.com](http://www.oico.com)