

Improving Productivity and Profitability in the Environmental Lab

BSK Associates' Laboratory Service Division



Established in 1967, BSK Labs operates multiple laboratories and service centers along the US west coast. Their team of 70 employees includes microbiologists, chemists, technicians and support staff. BSK specializes in potable water quality chemistry, wastewater discharge compliance, storm water runoff, groundwater monitoring and solid waste characterization. They also offer a range of support services, from project consultation to sample collection to small public water system operation and management.

Brad Meadows, Vice President & Lab Director at BSK Labs, kindly agreed to tell us about his experience with Metrohm Environmental IC Analyzers. As an analytical chemist with 15 years of experience in management at analytical labs, Brad understands the interplay between instrument capabilities, total cost of operation, and throughput.

Typical Environmental Test Lab Challenges

BSK Labs processes between 200 and 350 samples per week, depending on the time of the year, and like any other laboratory measuring samples using EPA 300 Part A methods, they have numerous challenges that need to be managed. This case study details the productivity and profitability benefits of a Metrohm IC environmental analyzer system. We will describe the specific productivity and consumable savings that BSK Labs obtained from our accessories such as ultrafiltration and automatic in-vial dilution. We demonstrate how each step of the work flow impacts productivity and profitability, from sample preparation to data analysis.

Sample preparation is very expensive for BSK Labs, particularly given the volume they service. A considerable amount of labor is involved in handling and processing samples: all of which require filtration and many require dilution. Instrument consumables are particularly expensive, and need to be replaced routinely. Daily instrument setup and recalibration was causing delays in actual sample testing forcing samples with short hold times to be prioritized in the queue ahead of existing samples to ensure proper processing.

Moving to Metrohm IC

BSK Labs needed an alternative IC solution capable of overcoming these operational challenges. Metrohm recommended a system configuration with ultrafiltration and automatic in-vial dilution, and BSK Labs agreed to bring a system to the lab for evaluation. Over the next 30 days, they put the system through testing, doing their very best to challenge its capabilities as it went head to head in parallel testing of real world samples, side-by-side with their other competitive IC instruments.

Filtration showed the most benefits including improving the chromatography and increasing the system ROI. Despite injecting some of the most turbid samples they receive, the filter continued to perform with no evidence of clogging. This meant a possible savings of \$1 per syringe filter and roughly an hour in labor. Coupling this benefit with no evidence of carryover, BSK Labs saw cost and savings benefits compared to their existing IC systems.

BSK Labs used automated in-vial dilution to increase the number of billable samples at the end of a sequence, and to avoid exceeding the hold time for nitrite and nitrate. With intelligent dilution they estimated to save an hour a day of operator time by not having them dilute and reanalyze the samples.

During their evaluation BSK Labs observed that the Metrohm suppressor was rugged and well-suited to the environmental sample matrices they analyze. For a lab that frequently changes a suppressor, this drove significant cost savings.

Decision Criteria for Purchase

For BSK, the cost of operation and system reliability were the two most important factors in considering Metrohm. A new system needs to provide a return on investment in about a year; anything higher is hard to justify. They needed a system that would pay for itself as quickly as possible. Reliability of the instrument is also mission critical for BSK Labs due to the significant number of samples they process and the short hold time for several anions.

Filtration ROI*		
	Ultrafiltration	Syringe Filter
Filter cost per sample	\$ 0.11	\$ 1.00
Labor cost per sample	None	3 min
Total	\$ 1,586	\$ 27,170
Savings	\$ 25,584 per year	

Filtration Material and Labor Savings

BSK Labs filters all their samples prior to analysis. Their high volume drove material cost down to \$1 per sample, but at 14,300 samples per year, that's still \$14,300 per year just to filter samples. Metrohm's IC system with ultrafiltration provides a large cost reduction. By changing filters once per day versus once per sample BSK Labs saves \$13,000 annually on the cost of filters alone.

Labor savings are also significant. At three minutes per sample filtration, and a labor charge of \$18 per hour, BSK Labs has about \$13,000 in labor costs just for sample filtration on top of the material cost. Looking at the benefits of Metrohm ultrafiltration alone, our total savings are more than \$25,000 per year.

Suppressor ROI		
	Metrohm	ERS
Replacement cost	\$ 0	\$ 1,200
Replacements per year	0	4
Regeneration	\$ 52 after 1,000 samples	\$ 0
Total	\$ 750	\$ 4,800
Suppressor Savings	\$ 4,050 per year	

Less Suppressor Changes Save Time and Cost

BSK Labs, replaces their membrane-based suppressors about once every three months, at a cost of \$1,200 each. In contrast, the cost of reagents to regenerate the Metrohm suppressor is only \$750 for the year, yielding about \$4,000 in yearly savings. In addition to the savings benefit, the Metrohm suppressor provides faster start up time, better sensitivity and greater overall productivity.

Better Separation and Longer Column Life

BSK Labs' spending on IC columns was very high, making it one of the biggest motivations in testing the Metrohm IC system as an alternative to their existing systems. They were particularly interested to know how well Metrohm columns would perform compared to what they had been using. BSK Labs estimates that they will be able to reduce column expenses from \$20,000 per year to less than \$3,000 by switching to Metrohm columns.

Metrohm columns offer better separation, better linearity and substantial longevity improvements. BSK Labs found that a Metrohm column gives an average of 7,000 injections compared to the 1,200 injections possible with other columns. They believe that extended column life is a combined effect of smaller sample injection volume and better filtration down to 0.2 micron as compared to the 0.45 syringe filters used previously.

"Coupling this benefit with no observance of carryover, BSK Labs started to see tremendous benefits compared to existing IC systems."

Columns ROI		
	A Supp 5	AS4A
Injections	7,000	1,200
Column cost	\$ 1,420	\$ 1,751
Total	\$ 2,900	\$ 20,866
Savings	\$ 17,966 per year	

Using a Metrohm suppressor they also saw a signal enhancement of 4-5 times compared to other IC systems. This enhanced detection limit allowed them to reduce the injection volume to one fifth of that required on the previous instruments.

Automatic Dilution Increases Throughput and Eliminates Holding Time Violations

At BSK Labs, about 30% of samples need at least one dilution, requiring at least three minutes of operator time. Based on an \$18/hour labor cost, about \$3,800 per year of the chemists' time is spent diluting samples that have already been run. The Metrohm automatic in-vial dilution eliminates this hands-on operator time, allowing chemists to improve their efficiency. BSK Labs is able to measure more billable samples every day. Short hold time samples are no longer an issue, as the system will go back and dilute the over range samples that may not otherwise pass the hold times.

Dilution ROI		
	Metrohm	Competitive System
Samples	4,290	4,290
Labor	None	3 min/sample
Total	\$ 0	\$ 3,861
Savings	\$ 3,861 per year	

Better Overall Performance

Beyond reduced operating costs, BSK Labs uncovered additional benefits during their evaluation. They found Metrohm instruments to be very rugged and able to handle the wide range of samples tested. They also found calibrations from Metrohm ICs to be very stable, allowing them to calibrate every 2-3 weeks compared to every 2-3 days on their competitive IC systems. Auto-dilution is more accurate than manual dilution and minimizes missed hold times.

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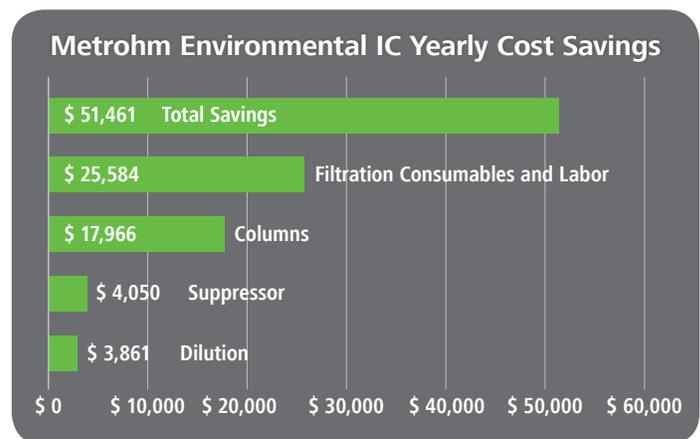
What BSK Labs found most impressive was the linear dynamic range and the sensitivity of the Metrohm system. The sensitivity enhancement allowed them to reduce the injection volume to one fifth of the previous system and increase the upper calibration range. The reduced injection volume enhances column life and the wider linear range reduced the dilution rate down to 2%.

Summary

After a 30-day trial, BSK Labs found that a Metrohm environmental IC analyzer offered them considerable material and labor savings, combined with several performance improvements. Ultrafiltration and improved column performance have translated into significantly lower consumable costs, as column life is longer and filters need to be changed much less frequently. A suppressor change may never be required. In-vial dilution and ultrafiltration have drastically reduced their manual dilution and filtering labor costs. Less frequent changes of consumables will also translate into less labor for BSK Labs in the long term, as well as increased system uptime and sample throughput, demonstrating the extended benefits to be gained from a high-performance Metrohm IC system tailored specifically to a lab's unique needs.

Total Savings and ROI

When BSK Labs tallied the overall cost savings realized in a year, they found that ultrafiltration, consumables and labor costs provide the most significant cost savings, followed by column replacement cost.



* All savings examples in this case study reflect BSK Labs average sample volume of 14,300 samples per year. The per hour labor rate was assumed to be \$18.