ELAN DRC-e at Washington Suburban Sanitary Commission Helps to Resolve a Lead-Contaminated Drinking Water Crisis

(Left to right) Lou Buckley, Phil Reed and Rafiq Qayami of WSSC stand proudly in front of their ELAN DRC-e ICP-MS and ASX-520HS autosampler.

Imagine this scenario: You are a manager in a large suburban water municipality. You literally have thousands of drinking water samples coming into your lab to be analyzed for lead (Pb)... You have two school superintendents in charge of almost 400 public schools in your area, worried about a potential Pb contamination problem in their drinking water supply... You have thousands of parents extremely concerned about the health and well-being of their children... You have a Lab Director who wants the problem to go away, and you are just about to be interviewed by the local TV station about how you are going to make that happen... If that isn't enough to stress you out, you know you don't have a suitable instrument to carry out the investigation.

Well, this is exactly what confronted Sam Richardson, the Laboratory Support Unit Coordinator at Washington Suburban Sanitary Commission (WSSC), in Silver Spring, MD, back in March of 2004. A recent study had been carried out by the District of Columbia Water and Sewer Authority (DCWASA), which found elevated levels of Pb in the drinking water supply of many of the schools in the District. Although this was not totally unexpected considering the age of the schools and the plumbing systems, it set off alarm bells at the Public Health Departments in nearby Montgomery and Prince Georges Counties in Maryland.

But Sam could not have envisaged the magnitude of the problem when it was first encountered. *"We were expecting to get 20-30 drinking*

water samples per school but the problem turned out to be far bigger than we ever imagined", was how he first described the situation.

The magnitude of the problem soon became evident when initial samples uncovered some abnormally high Pb levels of up to 40,000 ppb in some of the schools. As a result, it was clear that the frequency and number of samples tested was going to dramatically increase. In fact, in some of the larger schools, the water supply needed to be sampled at over 500 different locations to fully understand the severity of the problem.

When Sam was about to go in front of the cameras back in March, he knew his current ICP-MS, purchased in 1997, just couldn't handle the expected workload of over 500 samples a day. He knew that the only way his lab was going to analyze this number of samples was to invest in a new instrument. But it was also clear that a typical instrument delivery time of 8-10 weeks was unacceptable, because over 25,000 samples could be generated in that time frame. It was at this point that Sam decided to contact PerkinElmer and another vendor with the objective of getting a new instrument installed as fast as possible.

Fortunately, the urgency of their problem proved to be advantageous to PerkinElmer. Timothy Williams, the local Sales Engineer, was able to respond to the request, get samples run, organize a demo and deliver the instrument... all in less than 2 weeks from the time PerkinElmer was first contacted. In the words of Rafiq Qayumi, Senior Chemist in the WSSC Metals' Section, and one of the main operators of the instrument:

"Under normal circumstances, we would have carried out a comparative evaluation, but we just didn't have the time. We were fortunate that PerkinElmer's response and their understanding of the urgency of our application problem made the decision easy to choose the ELAN® DRC-e."

They were further convinced the right decision had been made, because just one week after installation of the system by Leo Mecler, the local Service Engineer, they were fully operational and making a dent into the huge backlog of drinking waters, which were coming in at a rate of 500 samples per day. They initially set up the instrument to run around the clock, seven days a week using the 500-sample capacity CETAC ASX-500. They recently switched to the new ASX-520HS, which has a 720-sample capacity – an increase of almost 50% in their lab productivity. In a typical day, they fill the autosampler and run a QC standard spike sample and blank every 10 samples. If the QC standard falls outside the U.S. Environmental Protection Agency (EPA) drift specifications of +/- 15%, recalibration automatically takes place. However, this does not happen very often, because the ELAN is extremely stable... as discussed by Rafiq:

"The stability of the Pb calibration on the ELAN DRC-e using bismuth as an internal standard is very impressive. I cannot recollect the QC standard or the spiked sample falling outside the U.S. EPA limits in the 6 months we have had the instrument."

By taking advantage of the instrument's ability to run unattended overnight, they quickly got through the backlog of samples and resamples and to date have analyzed over 60,000 drinking water samples in less than 6 months. Unfortunately, the data generated from the investigation have posed almost as many questions as answers to the problem. It looks like the solution will focus mainly on a combination of water treatment and replacing the copper and brass pipes/fittings used in the plumbing system. Evidently, when the drinking water lies stagnant in the pipes for a period of time, it leaches out Pb from the pipes, fittings or the Pb-based solders and, in extreme cases, can show levels as high as 40,000 ppb of Pb. However, when the water system is flushed for a few minutes, the Pb levels are dramatically reduced and resampling has shown that they quickly fall below the U.S. EPA "action level" of 15 ppb.

The CETAC ASX-520HS autosampler provided a 50% increase in lab productivity.

I think it's fair to say that the performance and workload capability of the ELAN DRC-e has exceeded WSSC's expectations. They never imagined they would have gotten through this huge backlog of samples in such a short period of time. With over 60,000 Pb results reported to date, the investigation is slowly coming to an end.

We are happy to say that the ELAN DRC-e has come through with flying colors. We'll leave the final words to Phillip Reed, the Senior Lab Analyst and one of the ELAN's operators:

"You cannot imagine the pressure we were under to get this Pb problem solved. Because of the health threat to every child in our public school system, everybody involved in this investigation was acutely aware of the need to resolve it quickly. There is no question that the response of PerkinElmer and the performance of the ELAN DRC-e have played a vital role in ensuring that this potential crisis was brought to a rapid conclusion."

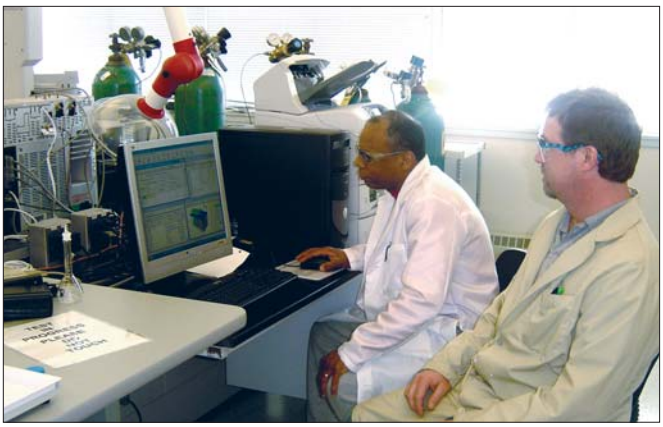
Further Reading

For more information about this story, please visit the following websites:

Montgomery County Public Schools:
http://www.mcps.k12.md.us/info/emergency/lead/

Washington Suburban Sanitary Commission:
http://www.wsscwater.com/info/leadInformation/LeadInformation.html

U.S. Environmental Protection Agency:
http://www.epa.gov/safewater/lead/schoolanddccs.htm



Automated quality-control checks verify method requirements are met.

The speed of the ELAN DRC-e helped WSSC clear up their backlog and keep up with the large number of samples required to better understand the Pb problem.

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