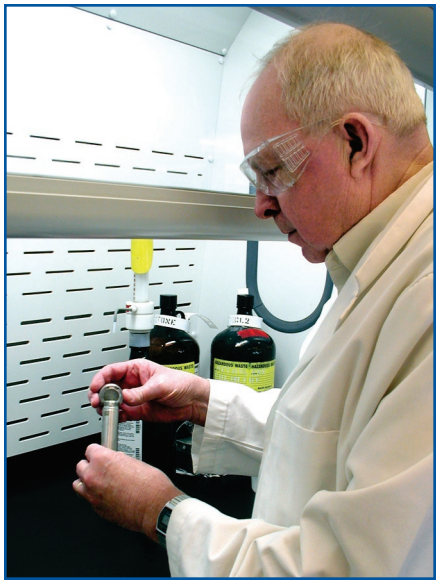
Northwest Fisheries Science Center

THE EDGE

Out with the Old, In with the New:
Scientists Improve a Critical Analysis Process

Good business analysts are sought out like firecrackers on the 4th of July: they can help companies save millions of dollars by making the same or better product at less cost. While the Northwest Fisheries Science Center isn't a fortune 500 company, it does perform many different studies and analyses that produce data critical to understanding our oceans and the health and status of important living marine resources, including salmon, groundfish, and killer whales. One Center process was recently revamped by a team of the Center's very own "business analysts" and the outcome is better, faster, and less expensive data.



Don Brown, the Environmental Chemistry Team Leader, preparing a sample for analysis. Other team members include Richard Boyer, David Herman, Ronald Pearce, and Catherine Sloan.

Every year Center scientists analyze hundreds of samples from fish and marine mammals for contaminants, including pesticides and polychlorinated biphenyls or PCBs. This is a complicated process—involving two primary instruments and many different steps—and, like a temperamental car, there are always ways to fine-tune the process to increase efficiency. Recently, when one of the primary pieces of analysis equipment started to wear out, the Center's environmental chemistry (EC) team decided to not only replace this piece of equipment, but to give the whole process a tune-up by creatively examining every step of the analysis process for possible improvements.

EC team scientists are veterans of the contaminant analysis process and collectively had the skills and creativity necessary to take on the challenge of revamping this complicated procedure. Like meticulous detectives with a flair for bargain hunting, they researched equipment, carefully examined instruments and different parts that were available, and talked with product vendors. When the EC team found something that they thought might work, they set it up and tried it out. Like all great inventors, not everything panned out, but even small successes sometimes resulted in tremendous improvements. For example, to prevent contamination during the analysis process, all glassware must be new and rinsed with solvents to ensure that it is clean. The rinsing process takes staff time and produces hazardous materials. Through their investigations, the EC team found sources of less expensive glassware—from one half to one tenth the previous cost. They also modified an existing furnace to heat the glassware to temperatures high enough to clean it, eliminating the need for solvent rinsing. This revised step in the process has saved costs and staff time and has reduced exposure to and production of hazardous materials.

The furnace now used to clean glassware.

Not only did EC team scientists investigate a wide range of available equipment, they also created their own. While almost all of us would be reluctant or downright scared to take parts of old equipment and create something new that involves electricity and chemicals, the EC team did so with great success.

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Center scientists conduct state-of-the-art research. The Edge is a monthly article that reveals some of the techniques being developed and applied at the Center and some of the facinating discoveries that are made.

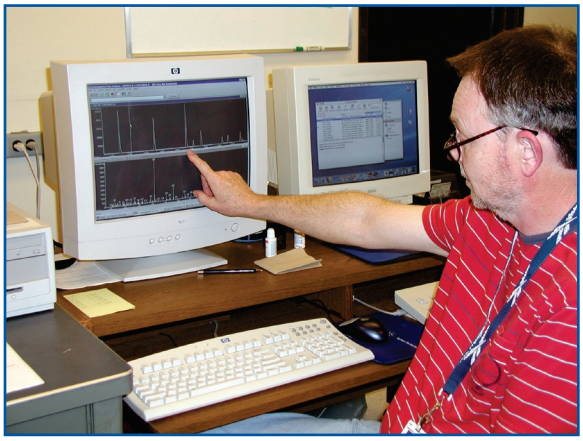
THE DGE

Thanks to the environmental chemistry team's efforts, the Center is saving about $20,000 a year on its contaminant analyses!

As part of the analysis process, staff concentrate each sample twice to ensure there is an appropriate volume to feed into each of the two analytical instruments. First, staff concentrate a sample from about 60 milliliters (ml) to 1ml and then later from 1ml to 100 microliters (ul—a thousandth part of a milliliter). To improve these steps in the process, EC team scientists built a piece of equipment—a block evaporator—to help concentrate the samples and ensure that 1ml and 1ul remains. Before this piece of equipment existed, staff visually gauged when the sample level reached 1ml and 100ul—a somewhat tricky, and at times, nerve-wracking task that sometimes could result in lost samples.

One of the biggest challenges the EC team faced, however, was not from creating new equipment from old parts, but from a new piece of equipment—the gas chromatography/mass spectrometry instrument or GC/MS—that was purchased to replace the one that was wearing out. This instrument separates chemical mixtures and has a very sensitive detector that sends signals about each compound to a computer. These signals help scientists identify the different compounds in a sample because every compound, like a fingerprint, has a unique pattern or signal.

The GC/MS is critical to the Center's contaminant analyses, but the new instrument did not work properly. Through much experimentation and patience, EC team scientists worked with the GC/MS manufacturer to explore and eventually fix the problems. For example, scientists installed a different filament so that they could increase the source temperature from 235° to 300°. They also installed a different mechanism for injecting a sample into the GC/MS column for analysis. Ultimately, the GC/MS produced results that all scientists dream of—accurate and reliable. Moreover, these fixes eliminated one of the problems with the previous GC/MS: the need to re-run samples, which is costly and time-consuming.



EC Team scientist, Ronald Pearce, examining data from the GC/MS.

With these improvements and more, EC team scientists revamped an important analysis process that saves time and costs, improves safety, and increases the quality of our data. Scientists can analyze 30% more samples in the same amount of time and save about $400 or 43% of the costs per sample—that means hundreds of more samples can be run and thousands of dollars are saved each year. In addition, with the revamped process the Center has reduced exposure to and production of hazardous materials by 40% and dramatically improved the accuracy and precision of the data—an impressive and critical improvement.

While the details of the process are impressive, it is important to remember that the data produced helps scientists understand what contaminants, and how much of each contaminant, are present in different marine mammal and fish samples. This information is key to deciphering the multiple risks that marine mammals and fish face in their environments, as well as to help ensure seafood safety. For example, results from fish tissue samples run through this process have helped scientists understand the impacts that certain restoration activities at hazardous waste sites have had on contaminant levels in Puget Sound bottom fish.

Given the application of the Center's contaminant analyses, it is evident why the EC team's dedicated work to revamp this process will have many immediate and long-lasting benefits. The EC team represents some of the talented individuals that work at the Center and reminds us that there is always room for invention and creativity in our work.

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