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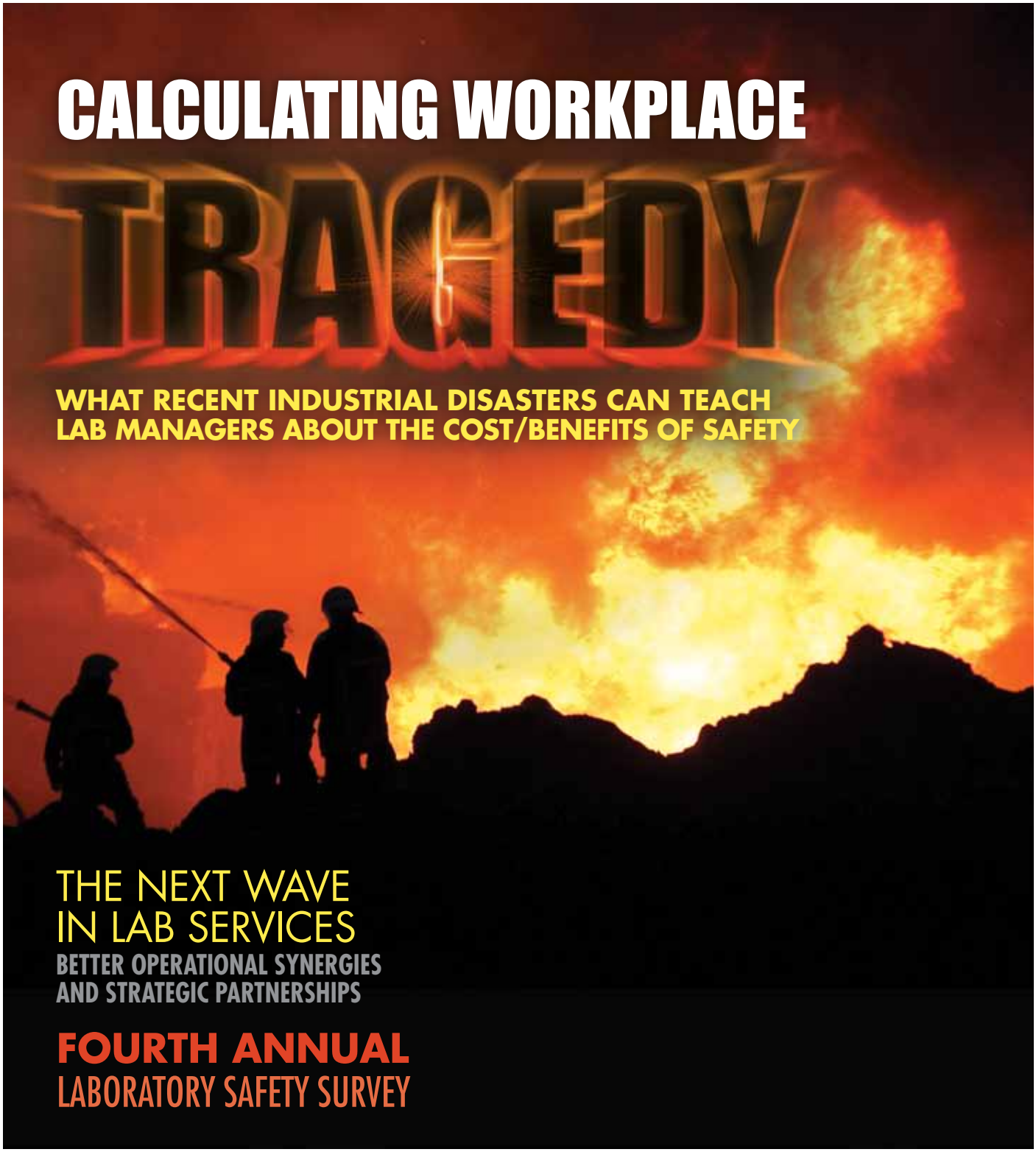

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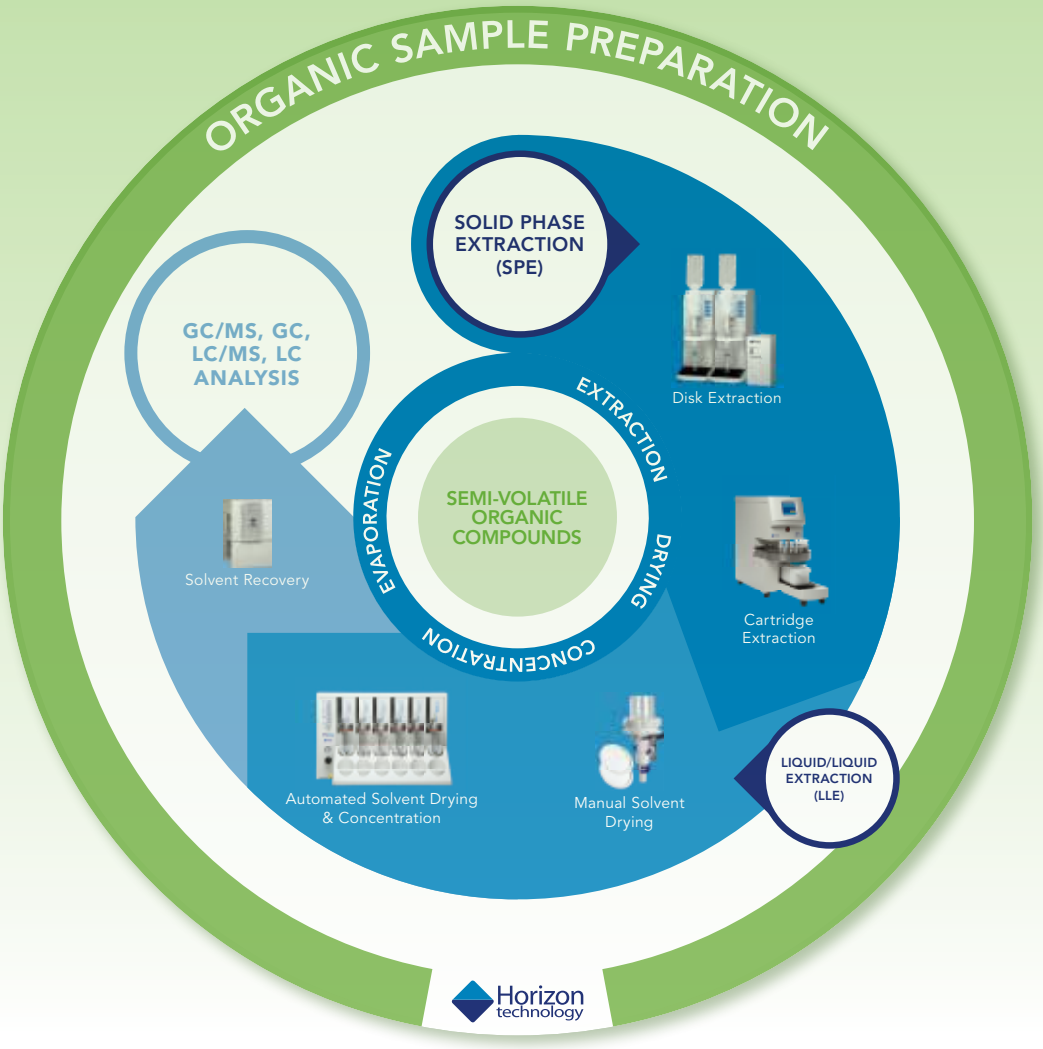

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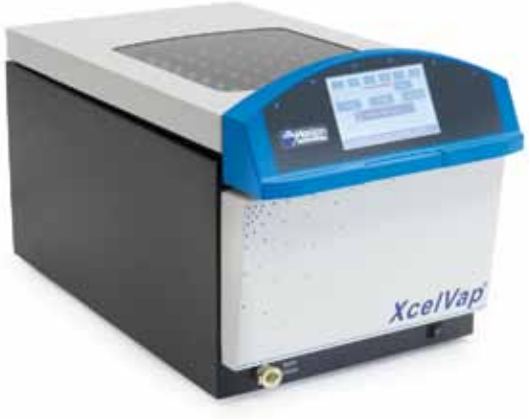

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GET READY FOR PRODUCT RESOURCE MADNESS!

Our annual August Product Resource Guide isn't far off and we're already hard at work gathering information to help you make the best purchasing decisions you can. The 2013-2014 edition of the guide brings back all the product categories from last year and you may even see some new ones, with each section including the top questions to ask when buying equipment, the latest product introductions, and information from our surveys—everything you need to get you started on making a new equipment purchase. New in this year's guide will be the top signs to look for that will let you know it's time for a piece of equipment to be serviced or replaced; we'll also have a slightly new layout to make it easier to search among product categories.

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What Cost Safety?

We've all done it. Either in a rush, under pressure, or trying to save money, we've gambled with our safety. Opting not to wear the bike helmet for a quick ride around town; skipping the sunscreen since it's really not *that* sunny; not flossing, despite the dental hygienist's threats and pleas. While these examples are fairly trivial and affect only oneself, other safety gambles have much more serious consequences.

The question I posed to my children when they were risk-taking adolescents, "What do you win when you win? What do you lose when you lose?" is the same question lab managers need to ask themselves everyday when they consider their safety practices. And based on this month's cover story as well as the results of our 2013 Lab Safety Survey, the time for asking that question is now.

This month author and safety expert Vince McLeod describes three recent headline-making industrial accidents and examines the organizational and technical failures behind them. Regarding the recent West Chemical and Fertilizer Company disaster, McLeod asks, "How much would it have cost to write a safety plan, prepare a true and complete emergency response plan, and conduct a risk assessment? Would these have prevented the disaster? Maybe, maybe not, but surely they would have helped lessen the severity." Most troubling is McLeod's suggestion that such failures are increasing. "Too often we are seeing similar failures or safety-averse decisions in recent times. And the disasters are not only increasing in numbers but becoming more serious," he says.

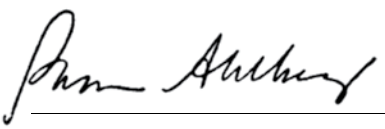
Supporting his observation are the results of this year's Lab Safety Survey, in which we found across the board declines in lab safety practices throughout all types of labs—academic, medical, industrial, and government. Turn to page 16 for the particulars.

In addition to lab safety, our June issue focuses attention on two other important aspects of lab management, namely onboarding and negotiating salaries. In "Effective Laboratory Onboarding," (page 28) author Bernard Tulsi discusses the increased attention being given to the onboarding process as a way to retain your best employees. "The most urgent corporate goal now is to use onboarding as an effective employee retention tool. To accomplish this, onboarding must be perceived as an 'ongoing conversation' and not just a week or two of front-end induction and orientation." He also makes the case that lab managers need to focus as much on their relationships with employees as they do on their technical ability, especially with regard to the next generation. "From a new employee standpoint, the incoming generation of new technicians in labs want an environment that is more interactive, conversational, and informal, so that they can have a voice that management must respond to." Additional tips and insights into the onboarding process can be found in Mark Lanfear's Science Matters column on page 26.

As for negotiating salaries—always a difficult and sometimes confusing part of the hiring process—turn to Allison Kerska's article on page 20 in which she demystifies the process with information about the new global workforce. "First and foremost, as the world has morphed into a truly global, connected economy, we've seen that salaries do not exist in vacuums anymore. They involve real people, demonstrated skills, supply and demand, and a whole host of other highly nuanced factors."

Technology news this month covers INSIGHTS on laboratory data systems and product focuses on LIMS, fume hoods, HPLC systems, particle sizing and chromatography data systems. If you're in the market for any of those technologies, check out the appropriate pages for the latest product trends and developments.

In the meantime, here's to safety!



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CALCULATING WORKPLACE TRAGEDY

WHAT RECENT INDUSTRIAL DISASTERS CAN TEACH LAB MANAGERS ABOUT THE COST/BENEFITS OF SAFETY

by Vince McLeod

A predominant perception among too many workplaces is that safety is expensive. That it costs too much to comply with all the personnel training, hazard assessments, workplace surveillance, medical evaluations, record keeping, etc. But have you ever really stopped to consider the full cost of a workplace mishap? Even a "minor" one? What about a serious or catastrophic accident? What would that end up costing? This article takes an in-depth look at the big picture and reveals a disturbing trend.

"This plant ... [decided] that compliance was more costly than paying fines."

Is there a pattern emerging in American business?

At about 7:30 p.m. on April 17, 2013, a fire started at the West Chemical and Fertilizer Company plant in a small town 75 miles south of Dallas, Texas. Just 20 minutes later the fertilizer plant blew up. The blast flattened homes within a five-block radius and destroyed a nursing home, an apartment complex, and a nearby middle school. The explosion was so powerful that the United States Geological Survey registered it as a 2.1-magnitude earthquake and it shook houses as much as 50 miles away. According to one *New York Times* article, the blast left a crater 93 feet wide and 10 feet deep.[1]

The detonation killed at least 15 people, most of them firefighters and other first responders, and injured almost 200 others. West, Texas, has a population of only 2,800 people, so chances are good that if you live there you know someone who was killed or injured. A whole community was devastated in an instant.

It will take months or maybe years to piece together the chain of events that led to this disaster. But some basic facts are evident. This plant chose to ignore many environmental and safety regulations including the lack of an adequate risk assessment, apparently deciding that compliance was more costly than paying fines if and when inspections found issues serious enough to warrant them. Here are some of the facts so far:

The Occupational Safety and Health Administration (OSHA) had not inspected the fertilizer plant since 1985.

The plant stored more than 270 tons of ammonium nitrate. After the attacks of September 11, 2001, Congress passed legislation that any plant storing more than 400 pounds of ammonium nitrate is supposed to report it to the Department of Homeland Security. The West Chemical and Fertilizer Company did not report the ammonium nitrate even though the plant had more than 1,350 times the reportable quantity on hand.

The Environmental Protection Agency (EPA) requires companies that store high-hazard chemicals to prepare an emergency response plan. In 2011 West Chemical and Fertilizer Company filed its emergency response plan with the EPA. The company reported one-tenth of the amount of ammonium nitrate on-site and indicated that the facility did not pose an explosion or fire hazard. Why? Since 1995, when Timothy McVeigh bombed the Federal Building in Oklahoma City using this same chemical, everyone knows how dangerous it is under the wrong circumstances. And West Chemical and Fertilizer Company had more than 135 times the amount McVeigh used.

West Chemical and Fertilizer Company was fined by the EPA $2,300 in 2006 and $5,250 in 2011 for failing to have a safety plan for the large, 12,000-gallon pressurized cylinders of anhydrous ammonia on-site.[2] Investigators suspect this dangerous chemical may have played a role in the explosion.

How much would it have cost to write a safety plan, prepare a true and complete emergency response plan, and conduct a risk assessment? Would these have prevented the disaster? Maybe, maybe not, but surely they would have helped lessen the severity. What are the costs faced now by West Chemical and Fertilizer Company?

"The company reported one-tenth of the amount of ammonium nitrate on-site."

West Chemical and Fertilizer Company is just one very recent catastrophic accident among U.S. businesses. Too often we are seeing similar failures or safety-averse decisions in recent times. And the disasters are not only increasing in numbers but becoming more serious. Another example is the 2005 Texas City refinery explosion where 15 workers were killed and 170 injured.[3] According to the U.S. Chemical Safety and Hazard Investigation Board, an independent federal agency charged with investigating industrial chemical accidents, a production tower (technically the isomerization tank) became over-pressurized, discharging fuel into the blowdown drum, overwhelming the system, and forcing liquid and vapors up the 120-foot stack. As the petroleum rained to the ground, it was ignited, resulting in an explosion powerful enough to rip the roof off a benzene storage tank three football fields away.

Blowdown tanks are a common feature at petroleum refineries, as are stacks used to release gases and vapors. However, safe stack vents include a flare system—a sort of pilot light that burns potentially hazardous vapors as they exhaust out. In 1992 OSHA mandated that the Texas refinery switch to a flare system. Amoco, which merged with BP in 1998, appealed and OSHA withdrew the request. The refinery continued to use stacks without the flare system, which allowed explosive fumes to escape.

How much would it have cost to install a flare system in the stack? Would a flare system in place have prevented the explosion? Probably, but even if it didn't, it would have given plant personnel more time to respond to the situation and control it. What costs has BP incurred as a result of this disaster?

And yet another example: In 2008 an explosion at the Imperial Dixie Crystal sugar refinery in Port Wentworth, Georgia, killed 14 workers and injured 42 others. This blast resulted from an over-accumulation of combustible dust, in this case sugar dust, which was most likely ignited by an overheated bearing on a loading conveyor. The explosion originated in the basement of one of three 100-foot-tall storage

silos holding refined sugar. Poorly designed dust collection systems, antiquated construction, and inadequate housekeeping practices allowed the dust and spilled sugar from conveyors and handling equipment to build to dangerous levels. Once an ignition source was introduced, the first explosion, or "primary event," occurred. This set off a powerful cascade of secondary explosions as sugar dust and spilled sugar on equipment, floors, and horizontal surfaces were dislodged, producing an ever-expanding cloud of explosive dust.

The Chemical Safety and Hazard Investigation Board indicated in its 2009 report that "Imperial's management as well as the managers at the Port Wentworth refinery did not take effective actions over many years to control dust explosion hazards—even as smaller fires and explosions continued to occur at their plants and other sugar facilities around the country."[4] In fact, the sugar industry was very familiar with the dangers of sugar dust explosions dating as far back as 1925. The Port Wentworth refinery was built in 1916 and much of the equipment and machinery were more than 28 years old.

Obviously, the cost to upgrade dust collection equipment and handling/loading machinery and conveyors would have been a major expense for Imperial. But hadn't the company recovered the initial cost of investment many times over during the previous 28-plus years? Was the decision to put off the needed safety and equipment improvements worth the consequences?

"The disasters are not only increasing in numbers but becoming more serious."

Let's take a quick look at one final example—probably the most expensive of all those given so far. On April 20, 2010, an explosion on the Deepwater Horizon semi-submersible mobile offshore drilling unit killed 11 workers and injured 16 more. The subsequent fire caused the $500 billion MODU, or drilling rig, to sink, resulting in a massive offshore oil spill. When the drilling platform sank, the deep water well casing broke off near the sea floor and gushed for 87 days before a temporary cement cap could be installed to plug the flow. It is considered the largest marine oil spill in the world and was the largest environmental disaster in U.S. history.

The explosion and fire that sank the Deepwater Horizon drilling rig were basically the result of a blowout—which is "the uncontrolled release of crude oil and/or natural gas from an oil well or gas well after pressure control systems have failed."[5] Most likely, a huge bubble of

methane gas escaped the wellhead and blowout preventer and expanded rapidly as it shot up the well casing. Upon reaching the top of the casing, it engulfed the platform and exploded as the large diesel generators provided the ignition source. The subsequent fire could not be extinguished and the Deepwater Horizon MODU sank on April 22.

> "The total costs from the spill, property loss, environmental cleanup, and subsequent lawsuits would top $41 billion."

Blowouts are, in fact, a fairly common occurrence while drilling for oil. Usually there are many warning signs leading up to a blowout, and if they're heeded, a blowout may be prevented. There was a history of previous fires on the Deepwater Horizon. The U.S. Coast Guard investigated 16 fires and other incidents between 2000 and 2010. In March 2010 the rig experienced problems that included sudden gas releases and at least three occasions of the blowout preventer leaking fluid. The MODU's head mechanic stated that the well had problems for months and that the drill repeatedly kicked due to high gas pressure providing resistance.[6]

Despite the many problems encountered with drilling this particular well on the Deepwater Horizon, there were at least six major operation, test, and equipment failures that led to the massive blowout and explosion. (These are detailed in the technical investigation report compiled by BP and released in September 2010.[7]) Two of the most publicized are the improper cement used to plug the well and failure of the blowout preventer. But perhaps the most important one, which may have prevented the explosion even after all the other failures allowed the blowout, was that had the diesel generator engines been fitted with automatic combustion inlet shutdown valves, Pyroban kits, or gas detection systems that shut down generator room HVAC systems automatically, the ignition source could have been eliminated, thus breaking the fire triangle.[7]

In May 2011 BP estimated that the total costs from the spill, property loss, environmental cleanup, and subsequent lawsuits would top $41 billion. What would it have cost to install shutoff valves and gas detection systems in the generator rooms?

Changing our safety culture

Granted, the extreme disasters mentioned above do not represent the average research or production laboratory. But the point we are trying to make is that more and more large U.S. businesses seem to be deciding that safety and regulatory compliance are too costly. And that it is better business to run the risk of fines or accidents than to spend money on proper safety controls, safety equipment, and risk assessments. Will

small businesses and other sectors follow the big boys' lead? We want to ask the decision makers: Is the devastation of local communities and economies worth the price of operating safely? Are the costs of the medical and life insurance claims, property damage, loss of product, loss of production, workers' compensation claims, regulatory fines and penalties, and years of lawsuits less than the cost of running a safe facility or business?

There are many similar failings identified in the follow-up investigations of these catastrophic industrial accidents. In-house as well as independent units, such as the Chemical Safety and Hazard Investigation Board, usually find numerous technical and organizational problems. Organizational flaws include corporate cost cutting, failure to invest in plant infrastructure, and lack of corporate oversight and major accident prevention programs, among others. Too often the focus is on occupational safety while process safety is overlooked. Inadequate training of personnel and a lack of competent supervision combined with poor communication and perhaps the use of outdated or ineffective work procedures are a recipe for disaster. Technical failings are facility and task specific but would include insufficient design of safety systems; lack of preventive maintenance, especially on safety-critical systems; nonexistent or inoperative alarms; and the continued use of outdated technology when replacement with available, safer equipment is feasible.

How do you calculate the true, full cost of a workplace tragedy? Is the company bottom line our raison d'être? What should be our holy grail? Do we ignore and avoid safety no matter the ultimate costs or consequences?

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Vince McLeod *is an industrial hygienist certified by the American Board of Industrial Hygiene and the senior industrial hygienist in the University of Florida's Environmental Health and Safety Division. He has 22 years of occupational health and safety experience at the University of Florida, and he specializes in conducting exposure assessments and health-hazard evaluations for the university's 2,200-plus research laboratories.*

THE FOURTH ANNUAL LABORATORY SAFETY SURVEY

RESULTS INDICATE SIGNIFICANT BACKSLIDING IN LAB HEALTH AND SAFETY PRACTICES

by Pam Ahlberg

Last year we happily reported that "despite continuing economic pressures that might have made lab health and safety a 'nice to have' rather than a 'must have,'" there had been substantial improvements in lab health and safety practices. Unfortunately, we cannot report the same trend this year. In fact, what we learned from this year's survey is that there has been a significant across-the-board decrease in all aspects of laboratory safety practices, which begs the question "Why?"

"There has been a significant across-the-board decrease in all aspects of laboratory safety practices."

Demographics

This year 579 lab professionals participated in the survey, compared with 464 last year. Most of the respondents—43 percent—were again from the supervisor, director, or manager levels. Their areas of work were distributed fairly evenly among the environmental, chemical, microbiology, biotechnology, cell biology, food & beverage, forensics, and energy industries. A slightly smaller percentage of respondents were involved in cancer/oncology, clinical, immunology, pharmaceutical, genetics, neuroscience, and "other."

As for the types of research organizations respondents worked in, the majority were university or college (25 percent), clinical or medical (21 percent), industry (14 percent), and government (8 percent). The balance of respondents, at much smaller percentages, worked in contract labs, private research, and manufacturing. These numbers were fairly similar to last year's with one exception. The number working in "other" types of labs increased from 2 percent to 17 percent. However, nearly identical to last year's results was the size of respondents' labs, with almost half (42 percent) working in labs with ten or fewer people. Only 12 percent worked in labs with 101 or more people.

Safety and hygiene

This year we found that laboratory safety and hygiene practices from 2012 to 2013 had taken a serious turn in the wrong direction. For example, this year 59 percent of respondents said their labs have designated chemical hygiene officers compared to 75 percent last year. And 4 percent fewer respondents said that their labs had a designated safety officer (77 percent versus 81 percent last year.) But these are just two examples of this downward trend.

Equally troubling were reported declines in laboratory recordkeeping practices. This year's survey reports a 15 percent decrease in the number of respondents current in their annual chemical and hygiene planning and training (71 percent versus 86 percent), an 8 percent decrease in those having a complete and current chemical inventory (83 percent versus 91 percent), and a whopping 17 percent fewer labs having a current biological safety manual (56 percent versus 73 percent). As for materials safety data sheets and the UF Laboratory Safety Manual being available to lab personnel, both remained constant year over year.

Health and safety

In basic laboratory health and safety management practices, we also saw consistent declines. Eleven percent fewer labs reported that hazards identified by previous safety audits had been abated (81 percent versus 92 percent). Ten percent fewer respondents said that workers using biohazards, toxins, and regulated carcinogens had received special training (80 percent versus 90 percent). There was a 5 percent drop in the number of labs reporting that current chemical and lab safety manuals were accessible to every worker in the lab and that workers had been trained in how to respond in the event of an accident such as a chemical spill (both 91 percent versus 96 percent). Another 5 percent fewer respondents said that standard operating procedures (SOPs) had been written for each laboratory task (76 percent versus 81 percent). Smaller percentage declines (2 percent) were reported for workers being properly trained in chemical safety, physical hazards, and laboratory safety; instructed in laboratory emergency action/fire prevention plan procedures; and performing periodic laboratory safety inspections.

Inspections

When it came to laboratory safety inspections, the same number of respondents (32 percent) said that their labs conducted those annually. Also constant was the number who said they conducted inspections every two years or more (4 percent) and biannually (13 percent). Drops in inspection intervals were reported for those who perform inspections monthly (26 percent versus 30 percent) and those who perform inspections quarterly (14 percent versus 17 percent).

General safety practices

When asked eighteen questions concerning general safety management practices, such as labeling, clutter, lighting, first aid kits, and protective clothing,

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the answers also indicated a negative trend. While most of the reported declines were relatively insignificant, a few were notable and troubling. For example, the largest drop in compliance was to the statement "Sinks are labeled 'Industrial Water—Do Not Drink,'" with yes answers down 21 points, from 50 to 29 percent. To the statement "All shelves have lips, wires, or other restraints to prevent items from falling," the yes answers were down twelve points, from 65 to 53 percent. Another notable decrease was the response to the statement "The furniture is ergonomically adequate," with 13 percent fewer yeses (70 percent versus 83 percent). When asked whether there was adequate noise control in their labs, respondents answered in the negative, with 80 percent yeses compared to 87 percent last year and 90 percent in 2011—a full 10 percent drop over the past three years. Possible explanations might include more open floor plans or greater use of personal electronic devices.

"Eleven percent fewer labs reported that hazards identified by previous safety audits had been abated."

Hazardous materials

Of the nine statements concerning hazardous materials management in the lab, declines over 2012 numbered six, no change was indicated for one, with only two statements showing improvement. Those statements that had the only jump in yes answers were "Hazard evaluations and exposure assessments have been conducted for high-hazard/low-PEL material use in the lab," moving up ten points from 82 to 92 percent, and "Chemicals are inventoried (chemical name, quantity on hand, amount used per year)," moving up six points, from 87 to 93 percent. Besides the same year-over-year response to the statement "All regulated carcinogens are handled safely to reduce employee exposure" at 96 percent, the balance of statements all showed a decline in yes responses. The most significant had to do with chemical management, with a troubling 27 percent fewer respondents saying yes to the statement "Chemicals are separated by hazard class and stored to prevent spills (acids, bases, oxidizers, flammables, etc.)" (68 percent versus 95 percent) and 12 percent fewer yeses to the statement "Chemical waste containers are properly segregated, sealed with tight-fitting caps, and stored with EH&S Hazardous Waste labels attached to the containers" (81 percent versus 93 percent). Four remaining statements all shared a reduced percentage of yeses in the three- or four-point range for issues concerning chemical labeling, showers, eyewashes, and sharp objects.

Fire and electrical

In the category of fire and electrical safety, we saw a very similar downward trend, though nothing too dramatic. Of the eight statements, all responses indicated declines in fire and electrical safety practices, with the average overall drop being 3.6 percent. The greatest was to the statement "All circuit breakers are labeled to indicate what equipment is served by each," with 7 percent fewer respondents answering yes (72 percent versus 79 percent).

Laboratory equipment

Of all the categories, laboratory equipment safety represented the greatest and most disturbing decline in laboratory safety practices, with an average drop of nine points across all twelve statements. This category covered BSCs, fume hoods, and gas cylinders. And as you can see in the chart below, every single yes answer showed a decline, with the most dramatic being to the statement "Non-spark-proof refrigerators (household types) are labeled 'Unsafe for Flammable Storage,'" dropping a full 20 points, this after a six-point increase the year before. Other significant drops in safety practices concerned gas cylinders.

Changes in Lab Safety Practices from 2011 to 2013

Please respond to the following Laboratory Equipment safety statements.	2013 Yes	2012 Yes	2011 Yes
All biological safety cabinets and chemical fume hoods have been tested within the past year.	82%	92%	89%
Test labels are properly affixed to the fume hoods and biological fume cabinets tested.	83%	93%	90%
Storage in fume hoods and biological safety cabinets is kept to a minimum and is placed so as to not impede proper airflow.	89%	93%	93%
All rotating or movable parts and belts are properly guarded with screens.	79%	90%	89%
All refrigerators/freezers used for storage of flammables (non-sparking/laboratory safe) are properly labeled.	83%	90%	92%
Non-spark-proof refrigerators (household types) are labeled "Unsafe for Flammable Storage."	52%	72%	66%
All gas cylinders are chained to an immovable object to prevent tipping or falling.	91%	93%	96%
Valves of gas cylinders are capped when not in use.	87%	91%	94%
Gas cylinders are stored with other compatible gases.	87%	93%	95%
Gas cylinders are not emptied completely, but left with 25 psi to prevent backflow.	59%	73%	73%
Empty cylinders are marked "MT" or "EMPTY" and stored separately.	77%	86%	87%
Rooms containing compressed gases have a sign outside the room stating COMPRESSED GAS and the name of the gas and hazard class.	57%	69%	67%

So as this year's lab safety survey reveals, lab safety practices have declined significantly from last year and hopes for continued improvement from the year before have been seriously dashed. Whether we can attribute this to economic pressure, lax management, or lack of regulatory or enforcement muscle is anyone's guess. We can only hope that whatever is creating this distressing trend improves over the next 12 months.

NEGOTIATING SALARIES

FACTORS TO CONSIDER WHEN DETERMINING THE RIGHT PRICE FOR THE RIGHT PEOPLE

by Allison Kerska

Figuring out what to pay someone for the work they do is an age-old question, and it never seems to get any easier despite all the metrics, data, and real-life anecdotes we acquire along the way. Practically every industry, corporation, and small business—in other words, practically all of us around the globe—will struggle with the issue of pay at some point, whether we're on the giving or receiving end. And even in industries or particular jobs where it would seem more cut and dried, there are many factors to consider.

In a particular lab, for example, where 50 people might do the exact same job, how many salaries do you think are going to be exactly the same as well? In fact, most of them probably are not, and it can confound a hiring manager who no doubt only wants to get it right for both parties involved.

So how, exactly, are we supposed to approach the issue of pay? That's a good question—but it's not necessarily the right question. First and foremost, as the world has morphed into a truly global, connected economy, we've seen that salaries do not exist in vacuums anymore. They involve real people, demonstrated skills, supply and demand, and a whole host of other highly nuanced factors. And while isolated salary "data" may indeed help a hiring manager make an informed decision in one instance, there are some pretty big examples lately in the science world of what can happen when the larger picture of a fully integrated workforce plan is not considered.

Take, for instance, the assumption that a particular place has exactly the right type of talent that you need. Recently, a large pharmaceutical company decided to build a huge research and development facility overseas. This decision was based largely on the belief that the particular global city they had chosen already had a wealth of highly trained talent that the company would be able to eventually tap to make their operation successful. Research and data, after all, had shown that within this city, there was plenty of talent to fill all the jobs.

> "Workforce planning can affect the types of salaries involved in hiring new talent."

Unfortunately, it hasn't turned out that way. The data the company initially used to analyze talent supply no doubt might have been relevant at one time. But in the last couple of years, market forces had driven some of the country's best talent to other locations. Surprisingly, many of them had chosen the U.S. to pursue their careers. And yet, these were the exact kind of employees that the U.S.-based company would need to work in its new facility in the workers' home country.

All of a sudden, the pharmaceutical company had a major dilemma on its hands that it had never thought it would have to consider. How was the company going to lure these workers back? How was it going to get this R&D facility fully functioning without the right supply of talent? With the help of a workforce solutions company, the organization is in the process of doing just that. But a major consequence of not having an initial workforce plan is that these workers now might be in a position to command much higher salaries. Clearly, there

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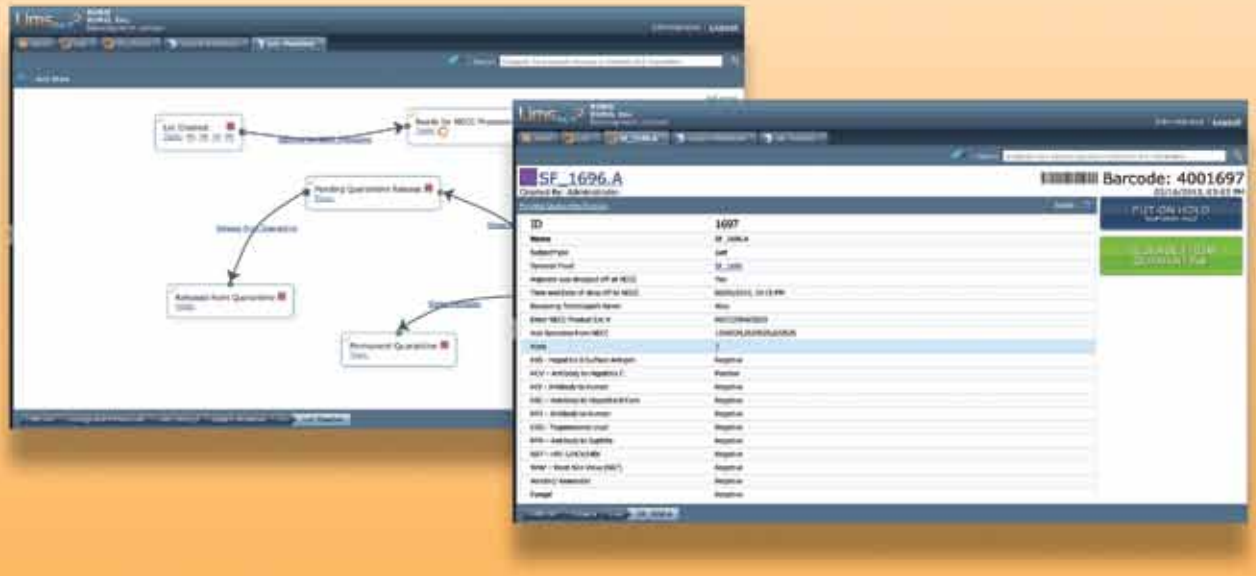

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are hidden costs—such as a higher price tag for talent—when companies forget that workforce planning is just as important as finding a seemingly good location for a new operation.

"In STEM professions that demand across the board is still outstripping supply."

In another high-profile example, a different pharmaceutical company decided to move its drug development operation to Europe in order to take advantage of a production facility that had gone unused because of prior cutbacks. It seemed like a good idea—why let a perfectly good infrastructure go to waste? But here again, there was a major problem. In the city where the production facility was located, there was a complete shortage of key talent that the company needed for its drug development. The company, in fact, never even looked at whether there was talent to support the major move to this particular facility. And because they never looked at the people component of their operation, this company is dealing with the same ramifications as in the first example—they'll have to deal with those hidden costs of finding the right talent because of a lack of proper planning beforehand.

Luckily, not every situation has to turn out this way—and even small labs can benefit from the kind of workforce planning that will help ensure that an organization is using all its resources effectively to set the right salaries. In fact, the tide is just now turning, and we are starting to see companies that are coming to understand how much workforce planning can affect the types of salaries involved in hiring new talent. And as human resources become perhaps the single most important component of an organization's competitive strategy in a highly competitive global market, we will see workforce planning become increasingly more critical.

But what if a company is ahead of the game and already has a good workforce plan in place? Often, with the help of workforce solutions companies, organizations are starting to really be on top of the latest data and statistics when it comes to setting salaries. Unlike in the example above where a company was misinformed about the talent supply in a particular location, knowing and truly understanding the workforce market of a particular place is often the most important key to setting a level playing field when it comes to salaries.

Once a company understands that critical workforce market terrain, it will often truly come down to supply and demand. And unfortunately, we've seen in STEM professions that demand across the board is still outstripping supply. This is why people with highly coveted skills are often in a better position to negotiate for more pay. This is something that we may not always be able to control—that's economics 101, after all, and if your organization badly needs certain skills, you'll probably have to pay more for them.

But there are certain things that a company *can control*. For instance, in the world of laboratory science, the talent supply and the talent demand has actually remained pretty steady over the past year, according to several outlets like CareerBuilder that compile and report such statistics. This means that there's

a nice balance for both job seekers and hiring managers for a variety of positions in the lab. Hiring managers aren't calling all the shots. But neither are the job seekers. Both parties, therefore, are likely to be satisfied with the outcome of salary negotiations. But, of course, hiring managers need to be aware of these current conditions to make the situation work for them—they need to know that they are in as good a position to negotiate as are the job seekers.

Another interesting and current dynamic that hiring managers may not be aware of is that they are currently in a position to control the level of education and experience with regard to lab technicians. This is because data shows that there is not a huge differential in salaries between people with a little experience and those with a lot. For example, technicians with two years of experience are now commanding close to what those with, say, 10 to 15 years of experience are commanding. This bodes well for hiring managers if they are looking for someone to hit the ground running. They've got the leeway they need to hire someone with more experience, without sacrificing a majorly higher amount of funds to get that level of talent.

Ultimately, it's a combination of all these things—data and real knowledge—that is going to make the most of salary negotiations for your organization. Whatever you do, however, don't make the mistake of thinking that workforce planning and salaries are not linked. They are, and the sooner an organization develops a workforce plan, the sooner that organization will be negotiating the right salaries and benefits for all involved.

Allison Kerska *serves as vice president of Global Solutions Life Sciences at Kelly® and is currently engaged as the global client relationship leader. Allison is responsible for engaging with global clients as a strategic advisor, addressing total workforce needs within the life sciences industry. Allison holds a Bachelor of Arts degree from the University of Michigan in organization design and previously served as chief learning officer for Kelly. She can be reached at allison.kerska@kellyservices.com or 248-244-4569.*

RESILIENCY LESSONS FROM THE CHILEAN MINE TRIUMPH

By Eileen McDargh

YOU REMEMBER! A worldwide web of viewers watched 33 miners being pulled to the surface following a 600,000-ton cave-in that happened nearly one-half mile below the ground on a barren plain in southern Chile. Besides showcasing the tenacity of rescuers and the miracle of technology, the miners themselves offered dramatic lessons in resiliency that can teach everyone.

Lesson one: Hope relies on possibility, not certainty. Shift foreman Luis Urzua practiced intelligent optimism when he reframed the event and steadfastly refused to give up. He maintained his leadership position and convinced the miners to eat only every 48 hours for 17 days. Without optimism, it could have been anarchy in that dark hole. When the probe reached the men, Urzua's note that came to the surface expressed that hope: "We are fine in the shelter, the 33 of us." This is not a note of desperation, but one of optimism.

Lesson two: Action is the antidote to anxiety. The miners stayed busy, continually clearing away rubble, monitoring gas levels, praying, and using the materials and medicine that eventually were sent down the shafts. In short, they controlled what they could control.

Lesson three: Play to your strengths. Reports indicate that different men served different roles. Victor Rojas kept a journal throughout the ordeal and became the writer who sent updates to the rescuers. Yonni Rojas used his experience in nursing to serve as the chief paramedic. Mario Heredia and Jose Gonzalez became the spiritual leaders, with Mario even requesting that a crucifix be sent down so he could erect a shrine. Edison Villaroel led the group in song, requesting that Elvis Presley songs be sent down. Imagine Elvis the Pelvis gyrating more than a half-mile into the earth!

> "Many of the miners expressed finding another side to themselves and their lives."

Lesson four: Laughter lightens the load. Surely bringing a load of rocks to the surface as a memento for rescuers showed a sense of humor. Singalongs, as described by reporters, did not appear to be funeral dirges.

Lesson five: Faith can move mountains. Many of these miners expressed a deep religious conviction through their Catholic faith. Faith, however, is not the sole property of one religious group. To have a sense of a power beyond one's human limitations is to tap into a wellspring of confidence and courage.

Lesson six: Don't bounce back. Grow through. After 69 days, many of the miners expressed finding another side to themselves and their lives. Changed men rose from the earth—men who vowed to live differently. Whether marrying a longtime girlfriend, finding new comfort in family, or advocating for changes in mining operations, each of the 33 now has the possibility for becoming better through his ordeal.

So it is for all who face events that might seem as dark and crushing as what happened on a cold day in Copiapó, Chile. The lessons offered by 33 miners might spark a chord to help many discover personal resiliency.

Known as a powerful presenter and facilitator, ***Eileen McDargh****, CSP, CPAE, has been creating conversations that matter and connections that count since 1980.* Executive Excellence Magazine *ranks her among the top 100 thought leaders in leadership development. She's the author of five books, including* The Resilient Spirit.

LABCAST Be sure to attend Eileen McDargh's Lab Manager Academy webinar "Radical Resilience," on Wednesday, July 10 (or afterward at www.labmanager.com/resilience, to watch the archived video).

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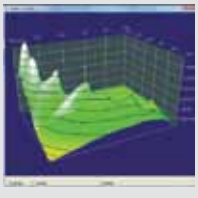

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A BETTER WAY TO ONBOARD

By Mark Lanfear

There is no making up for a first impression, especially when the relationship starts online. After so much time and effort is taken to attract the right person, you want to be sure to put your best foot forward at that first face-to-face meeting.

Now you may think that I'm talking about social media or relationship sites. But the match I'm talking about is your onboarding process. If you or your company isn't ready for that first date (the start date), you may be leaving the wrong impression with the top talent you've recently hired. And just as with social media or real-life dating, word gets around.

So let's talk about what it really takes to lead a successful onboarding process and how it can build your overall talent pool—leading to a deep pipeline of top talent that can help you weather whatever workforce storm or drought you may face in the future.

First, dare to be different. Sure, onboarding is about standard operating procedures, technology hardware and software, safety rules, and OSHA regulations. But let's get creative. You only have one chance to make a first impression. Use your creativity to get the foundational messages out in the best possible orientation an employee can have. Your goal is to get the new employee hooked right away so that he or she can start contributing as quickly as possible. Consider techniques such as prehire orientation, which helps prospective employees understand your company and see how their skills and talents complement the organization. You may want to consider hiring a company that will produce orientation videos that are different and that can communicate your message in a highly creative way.

That said, your second goal is to be sure to cover the basics and to lay a solid foundation for an employee's new role, so get it all out there! Onboarding can be an overwhelming process for new employees, but presenting a methodical written plan

> "Make sure everyone is properly introduced to all participants, opening the door for good dialogue."

will put their minds at ease so they know exactly what the expectations are for their roles and for their participation in orientation. Do them a big favor and get rid of electronic distractions like email and mobile phone use, and make sure everyone is properly introduced to all participants, opening the door for good dialogue. Finally, make sure that all administrative forms, from direct deposit applications to health benefits and emergency contacts, are available and ready to be completed. Getting these foundational but highly important items taken care of right away will provide relief and allow for new employees to focus on the unique information that you and your team are presenting, which is what's at the core of importance for your company.

Another critical "do" for the onboarding process is spreading it out over time. It's been misrepresented for years that a short onboarding process, such as a standard one-day orientation, is a successful one. I remember many orientations that I attended where the instructor "hoped" to get finished an hour or two early; however, this is one time that winning the race against time is not a positive. The thought that all onboarding needs to be completed in a day or so just isn't the right fit for the employees of this generation, or for the highly specialized and complex work that we do now with the additions of technology and transformational work environments. A successful onboarding process is one that does not bombard new colleagues in one day with all the information they're going to need for their career. Getting foundational information to the employee up front is what he or she really to needs—and allowing for additional information down the line will give everyone the time they need to acclimate to the new corporate environment they have entered.

This "additional information" can be delivered in the form of a mentor or a group of experienced employees assigned to the new team member in

order to foster a continual link to institutional knowledge and experience. Although this could be seen as a drain on resources, in fact, a mentoring program has been shown to make the onboarding process smoother and quicker for the new employee in leading him or her to become more productive. Ultimately, these relationships lead to a deeper employee connection to the corporation and a deeper understanding of the corporate culture—and hopefully, long-term retention.

All too often the organization puts so much time and effort into the recruiting process—as it should. And there seems to be a collective sigh of relief when the right person finally accepts the job. I would warn that that's not the end of the race but only the beginning. The most important window of opportunity to influence a new employee is during the orientation process, when he or she is wide-eyed and enthusiastic about coming on board.

The benefits to an organization that has a great onboarding program will be increased employee engagement, reduced turnover costs, and a more successful and productive organization as a whole as colleagues come to truly understand their roles.

And finally, don't forget that a successful onboarding program is there to serve the individual, but ultimately, it's your organization that reaps the true and long-term benefits of a great program and a great launch to these new colleagues' careers.

Mark Lanfear *is a global practice leader for the life science vertical at Kelly Services, a leader in providing workforce solutions. He has operated clinical trials around the world for almost two decades. In addition, Mark is a featured speaker at many life science industry conferences and a writer for life science periodicals. He can be reached at MARL773@kellyservices.com or 248-244-4361.*

EFFECTIVE LABORATORY ONBOARDING

AN ONGOING CONVERSATION THAT GOES WAY BEYOND FIRST-WEEK ORIENTATION by Bernard Tulsi

Onboarding is a series of initial steps aimed at helping new workers become integrated into the laboratory workforce. While this process appears deceptively simple, complete with cordial first-day introductions and nice team lunches, when not executed adeptly, onboarding commonly fails to deliver on a central objective: the retention of good workers.

Of necessity, onboarding incorporates a number of "the way things are done here" routine operational details, including human resources (HR) procedures or how to access information repositories or order new supplies, much of which is provided via canned orientation presentations, the corporate intranet, or both. Sometimes, attempts are made to discuss the prevailing corporate culture and explain where new workers' roles may be situated in the overall schema.

While these are important features typically prominent in HR playbooks, the most urgent corporate goal now is to use onboarding as an effective employee retention tool. To accomplish this, onboarding must be perceived as an "ongoing conversation" and not just a week or two of front-end induction and orientation, according to Dr. Edward G. Verlander, chairman, Verlander, Wang & Co., LLC, who provides consulting services and training in leadership, change management, and professional development.

Proper onboarding remains urgent, says Verlander, who adds, "Employee retention is critical for managing and lowering operational costs in the whole process of finding, hiring, placing, promoting, and rewarding workers. If you can keep good people around longer, that will, in fact, lower costs."

Amid the staffing tumult in the lab sector, exacerbated by waves of consolidation and outsourcing to lower-cost operations overseas, "the urgency is as great today as it has ever been," he adds.

"There is probably a greater emphasis today to move to further lab consolidations," says Dr. Martin Evans, former associate director of the Public Health Laboratory of the City of New York and a member of the Board for Clinical Laboratory Technology of the New York State Department of Education. The focus of these consolidations is to improve the return on investment and reduce the unit cost of testing as well as turnaround time.

> "The most urgent corporate goal now is to use onboarding as an effective employee retention tool."

The goal of consolidation is to become "faster, bigger, better, and cheaper, and much of the success of this approach depends on the ability to attract and retain good people," Verlander says.

Despite the current higher unemployment rate in the U.S., Evans says, "There is still what many term a crisis in employment in laboratory staffing," alluding to the difficulties in recruiting qualified lab staff.

"If you look at the staff needs projections in many lab disciplines, the current training systems cannot match those needs over the next ten years," says Evans. The problem is compounded by the "out flux" of retiring

baby boomers. Statistics from the Association of Public Health Laboratories indicate that 15 to 50 percent of all laboratory personnel are slated to retire within the next ten years. "In light of this, it becomes really important to retain the people you have," says Evans.

He adds, "So the question really becomes, when you have good people, how do you keep them?" Evans cites several ways to keep lab personnel interested and motivated. These include sending staffers to national scientific meetings, cross-training them, and publicly acknowledging and recognizing their work. He explains that in cases when managers cannot increase salaries, sending workers to such meetings could be a good way to make their lives more interesting in the workplace. Cross-training also has that effect, "while increasing workers' future viability and employability, because it gives them a broader range of capability and experience." As for employee recognition programs, he says, "If you can't pay them more, at least you can publicly thank your workers."

There are three main categories among the general principles for laboratory personnel motivation, Verlander says. "People are motivated and can be retained when they work with people they respect and like and enjoy being with." Since the workplace is such a social environment, "the quality of the people you bring in is important," he adds.

He says the work itself is a key motivator. "Are workers allowed to perform the tasks they were trained or licensed to do? And is it challenging enough for them so that over time they can grow and develop?"

The third category is the culture of the laboratory enterprise. "Management must give employees a voice in how the laboratory is run and in decisions that affect the people in the workplace," Verlander says.

Turning to the interests of the newest workforce entrants, Verlander says, "With the newest generation of employees going into the labs, given their great interest in technology and what that leads to in terms of social media networking, it is clear that the onboarding process could be facilitated if the networking aspects of these young peoples' interests could be capitalized on.

"These new employees will be naturally interested in the social aspects of the work environment so that they can socialize and network with other people in their laboratory workplace. Management that encourages this will increase the likelihood of retention," Verlander says.

But changing the culture in the laboratory organization will require a concerted effort. Evans says, "Most of management tends to be old-

school in their values, and there has been little effort on the part of senior managers to adjust, fully interact and engage with, and capture and maintain the interest of the young, newer generation of employees coming in."

Verlander notes that in general "there is a natural tension in the management of laboratories that is driven by control and safety versus the empowerment of people. Such tension between control and empowerment is an important factor, one that requires management to carefully think through the kind of organizational style and culture it wishes to foster in the workplace."

He concedes that allowing for both is a substantial challenge. "Labs typically deal with sensitive work, sometimes highly toxic substances, and issues that impact the lives of people. They need to be safe, well managed, and efficient. They must be stable, orderly, and controlled, and yet they also need a culture and environment that is also organic, changing, and learning over time."

Evans notes that in the midst of large-scale and rapid consolidation, "Little attention is paid to culture and core values. Even if they are thought about, they are often secondary or tertiary matters. The greater focus is always on efficiency of utilization, consolidation of computer systems, and other technical and financial issues; not much attention is paid to culture, and that is a mistake."

Considering the potential consequences of not getting onboarding right, Verlander says, "You may have workers joining a lab organization and after a while starting to seriously question their decision." He says that to overcome this, "People need to feel connected and develop an identity with the place, and those who raise such questions may not be getting the personal attention they need and want."

He says that when the traditional onboarding process is computer-driven it is not nearly as effective as the face-to-face version. Without such personal interaction, "there could be a number of unanswered questions that may lead to uncertainty, confusion, and ambiguities."

Evans says there are many ways to get onboarding right. "When new workers come in the door, take the time to get to know them, establish a relationship, and really care—and show that you care—about them." Research data suggests the main reason people choose to stay in their jobs involves the relationship they have with their boss, he adds.

"When the traditional onboarding process is computer-driven it is not nearly as effective as the face-to-face version."

Verlander concurs. "The manager must pay attention to the psychological contract that new employees have joining an organization. By this I do not mean the forms they fill out in the HR department." The psychological contract is "the identity formation process," he explains.

"Fundamentally, this is the assessment that employees make about what they are giving to an organization in time, expertise, ideas, work, labor, and effort in relationship to being cared for, looked after, and networked by the organization—not only in terms of having a good job but also opportunities for promotion and, over time, a worthwhile, paying career," Verlander says.

The relationship between what the employee offers the organization and the available reward structure forges that psychological contract. "Managers must absolutely be careful about what they say in this process; they must make sure that they are managing expectations and not overpromising and under delivering."

He says that over time, disruptions can occur, such as when pay increases and training opportunities do not materialize. "This could lead to distortions in the psychological contract and create problems with morale, motivation, and productivity."

Evans notes that in general laboratory managers and supervisors, whose emphasis is on technical training and expertise, are not trained in the area of employee relationships. There is a need for managers to show they care. "Give your employees a comprehensive performance review each year, which is typically a requirement. Really sit with them and say, 'What do you want to do this year? How can we work on this together?'

"When the supervisor and employee sign the review, that's really a contract. There is a need to make it substantive, honor it, and check in and review it periodically, perhaps monthly," says Evans.

Verlander says that the review process is essential. "Management must think through and deploy a performance management system, which involves setting up specific performance goals and objectives with the employees, irrespective of their roles in the lab."

He adds that management must monitor and track employees' progress and ensure that the resources are in place to enable the employee to perform the expected task. Supervisors and managers must coach new employees, providing guidance, help and support, new skills,

and additional instruction aimed at helping them overcome any knowledge and performance deficiencies.

"When you have good people, how do you keep them?"

Onboarding is an ongoing conversation where managers discuss employees; inform and give them ideas about operations, missions, strategies, forthcoming changes, new rules, procedures, standards, and requirements; and how such changes may impact the organization and staff, according to Verlander.

He says during the initial onboarding employees are more receptive and willing to learn, but interest starts to wane as work becomes routine, more predictable, and well-understood. "Management must supply the learning and ensure that an ongoing conversation takes place."

Turning to likely future trends, Verlander says, "From a new employee standpoint, the incoming generation of new technicians in labs want an environment that is more interactive, conversational, and informal, so that they can have a voice that management must respond to."

"Social networking may be the avenue that helps to get to that—that is a part of the new generation's world, and they want that experience on the job."

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THE NEXT *wave* IN LAB SERVICES

HOW INTEGRATED FACILITY MANAGEMENT PROVIDERS CAN DELIVER BETTER OPERATIONAL SYNERGIES AND STRATEGIC PARTNERSHIPS

by Maurizio Sollazzo and John Wilkinson

Over the past decade, the pharmaceutical industry has experienced a period of unprecedented change driven by both internal and external factors that is forcing the industry to transform in order to survive. Diminishing returns despite spiraling R&D costs, major patent expirations, austerity measures and regulatory pressures, in addition to poor investor confidence, have made the pharmaceutical industry an increasingly challenging environment. As a result, the industry is being forced to reorganize and rethink its business model. Within this context, both R&D operations and, more so, the majority of its supporting functions have been the subject of intensive sourcing in an attempt to drive productivity and manage costs.

Laboratory services and Integrated Facility Management (IFM) trends

As strategic sourcing is increasingly embraced across the industry, laboratory support functions have also been progressively out-tasked or strategically sourced to multiple players. For the scope of this article, we focused on how these services can be further optimized in the broader context of the Integrated Facility Management (IFM) framework. The ultimate aim is to achieve significant operational synergies coupled with flexibility and optimization of financial and business performance, and at the same time simplify customer engagement.

Increasingly, there has been a move away from the traditional service provider relationship—focused primarily on cost performance—to more strategic partnerships. These partnerships are about more than just utilizing the specific capabilities of third-party contract service providers to reduce costs; the partnerships now reflect the drive for innovation by taking advantage of external specialized skills, expertise and resources. Finding the right partner generally presents a key success factor. Here we provide an outlook of what we see as the future state of lab services based on trends and an intimate understanding of the demand for efficiency and ease of customer engagement.

Over the past four to five years, IFM has exploded within the biopharma landscape, including the management of R&D space. In parallel, many different specialized firms have expanded their service offerings in the specific areas of lab services, including glassware cleaning and lab cleaning, waste management, veterinary and vivaria services, lab consumables inventory management, lab equipment management, and data management. As a result, current service offerings are quite fragmented and suffer vast inefficiencies.

Future state

Here we suggest that the next wave of lab services optimization would benefit from integration across multiple suppliers, infrastructure, and systems, and we propose a model that leverages efficiencies and facilitates end users' engagement. At the same time, this model, through proper governance, will ensure that performance outcomes can be managed effectively even in such a complex environment. We firmly believe that the key to success depends on supplier capabilities and, as importantly, on the retained organization at the customer level. The size (the smaller the better), skills, mindsets and end-user representation within the governance model are critical to ensure that proper engagement occurs on both sides of the relationship. Based on our research and understanding of demand and lessons learned over the past ten years, we propose the "integrated architectural model" as displayed in Figure 1.

Considerations and rationale

Currently (non-integrated) service offering models are inefficient due to multiple and often redundant infrastructure, governances and processes. At the same time, end users overwhelmingly prefer the significant advantage of "one stop shop" vs. multiple points of contact,

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such as facilities, space planners, move planners, IT, lab services, equipment services, vivaria operations, etc. Although some suppliers in traditional lab services may claim to have the necessary capabilities to manage the entire scope illustrated here, no single supplier currently, to our knowledge, handles the total footprint that we envisioned in the proposed model. We further acknowledge that there is a perceived advantage to having an unbiased "agnostic" entity (that does not manufacture or commercialize lab supplies or equipment) as a business integrator. The largest gap is still at the "platform level," as many systems are available or have been developed *ad hoc* and there is therefore an opportunity to rationalize and simplify infrastructure by adopting a single IT platform across the entire spectrum of the service portfolio.

The closest potential for playing the Integrator role exists with some of the largest IFM companies that have entered this space. In some instances, lab equipment and lab space maintenance are outsourced along with other services in an IFM contract. Increasingly, the scope of services outsourced to IFM providers includes general services such as lab space cleaning and procurement of consumables. With the increasing capability of IFM providers, the scope of services outsourced can be further expanded to include services that were traditionally considered to be core R&D. By leveraging their capabilities (infrastructure, sourcing leverage, talent management and transition expertise), the operational model and know-how of IFM companies lends itself to become the integrator of choice.

IFM suppliers as integrator

From a buyer's perspective, the entire IFM service portfolio is outsourced to one or two suppliers that can cater to the buyer's requirements on a global scale. Services that support this portfolio (HR, IT and procurement) are being integrated, thus increasing the value and the attractiveness of the partnership. Outsourcing complex categories with multiple services bundled under a single contract will place more pressure on suppliers, as buyers are demanding lower prices. Consequently, the buyer's leverage in this segment will significantly increase. Additional opportunities exist within more heavily regulated environments as many of these services are required to support GxP operations. As the IFM industry matures, there is an increasing movement to support these activities and further leverage the economies of scale. The opportunity for the buyer can result in cost savings in excess of 10 to 20 percent, and buyers can enter into long-term contracts to capitalize on suppliers' currently low operating margins.

Market development diversification and risk management

With buyer outsourcing categories becoming more complex, suppliers must look to diversify their service portfolio. Diversification will not be through subcontracting alone, as the open-book pricing model would discourage pass-through costs. Suppliers will explore self-performing additional tasks by increasing their capabilities through strategic mergers and acquisitions. The shift of global outsourcing to a single provider will lead to increased subcontracting, which in turn will drive an increase in management fees charged to the IFM provider, which would be passed on to the client. Additionally, by increasing the scope of the service outsourced to a single integrator, the contract will become complex and will make it challenging to incorporate the KPIs across the portfolio, hence the importance of appropriate deployment of relationship management, contract governance and commercial agreement execution.

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Change in contract management strategies

There are currently multiple pricing models in this segment, but for a buyer to reposition itself from multi-suppliers to integrated sourcing, it should formulate effective supplier management strategies. Mutual dependency can be encouraged by switching from a total IFM contract to a shared savings approach. This approach would mitigate supply risks and encourage cost savings, as an increase in supply chain costs decreases the supplier's returns. If the open-book pricing is adopted, the value chain of the IFM provider becomes transparent to the buyer. This will ensure that the buyer knows: the exact number of staff hired for all the services by the IFM provider and the wages paid; the monetary value of the overheads borne by the provider in carrying out the services; the investment made by the IFM provider in different areas like technology; and the sub-contracting fee charged by subcontractors for their services to the IFM provider. Ultimately, this will help the buyer identify and address the existing redundancies in the pricing structure and the bottlenecks in the IFM provider's supply chain.

Barriers to new entrants

With the adoption of a global, integrated business model, suppliers should have significant capabilities in terms of service offerings and geographical spread. Suppliers are likely to enjoy significant leverage as there will be very few large "integrators" who will be able to cater to this segment. However, their power will be constrained with the advent of the open-book pricing policy. On the other hand, threat of substitution will be very low as in-house service delivery or partial outsourcing will not prove to be cost-efficient for buyers.

Intensity of rivalry

With the increasing consolidation of FM players and the adoption of a global, integrated business model, the number of suppliers would decrease, leading to a decrease in the industry rivalry. However, given the complexity of the outsourcing category and the volume of business involved, there will continue to be considerable competition between major suppliers.

Operating margins efficiencies

The service providers in due course will gain process efficiencies through the deployment of platform technologies, leveraging larger volumes, replicating proven models across their clients, and improving their talent pool by providing career opportunities. We foresee the further deployment of rugged handheld digital assistants to enhance and expedite service delivery. The deployment of standardized asset management and reliability engineering platforms will optimize maintenance, reduce energy consumption, increase reliability, reduce capital expenditures and improve safety.

"Current service offerings are quite fragmented and suffer vast inefficiencies."

Required skills

The skills that are considered most important are customer service, operational, communications, project management, general management, finance and strategic planning. In addition, with the potential acquisitions by big IFM (integrators) players of other specialized service providers, the direct labor saving will become visible with the ability to self-perform specialized services. Other services that the integrator can offer include customized reporting procedures, subject matter expertise for consultations, and energy management and sustainability, as well as new technology implementation. Most of these offers will become a regular feature as a part of the service offering. Customizations and innovations will help reduce redundancies in the client's process and in turn reduces cost.

Additional market considerations

We believe that as large CRO and CMO companies mature and their labor arbitrage leverage diminishes, cost pressures will also force this industry to embrace strategic sourcing in their business model to find additional cost efficiencies to achieve reasonable operating margins, and the integrated model described here will be a valid option.

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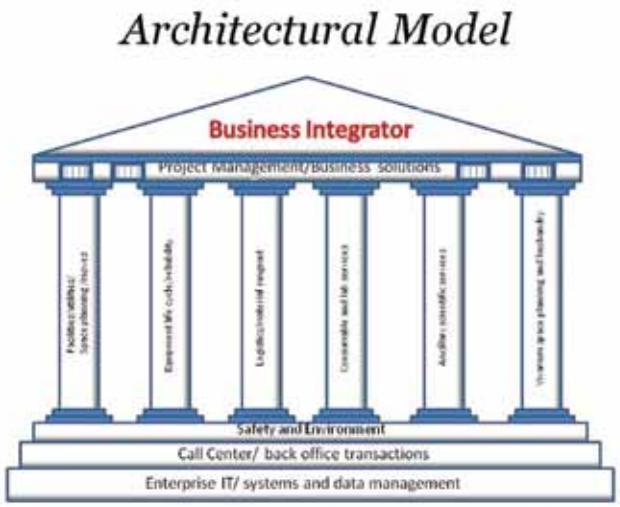

▲*Figure 1. The "architectural model" for delivering fully integrated, cost-effective lab services. A strategic partnership with sophisticated services integration and optimization, not just a plethora of sub-optimized service providers. In analogy with the architectural motifs of classical Greek architecture, we envision the following structure:*

The Foundations: Built on a robust enterprise IT platform to execute transactions, data and processes across all service portfolios; one call center to simplify customer engagement, to track performance, SLA, WO; an overarching function that ensures safety and environmental compliance across functions.

The Columns: Discreet bundles of services either self-performed or subcontracted to specialist partner(s) will include facility and space planning, a lab asset management program, consumable and soft services (requisitions, inventory stock management, controlled temperature storage program management, waste management, cleaning, GXP and non-GXP, hazardous waste management, glassware washing, sterilization, distribution and collection); logistics and material management (internal and external, shipping, receiving, archiving, reagent inventory management, storage/retrieving); ancillary scientific services (media, plasmid prep, low complexity bio/chemical analytics, small-scale fermentation: yeast, E. coli, cell culture), other time-sensitive activities as appropriate; vivaria services (space planning/optimization, husbandry services, veterinary procedures); electronic and hard-copy record management.

Trabeazione: Project management function to drive process innovation and continuous improvement across the entire portfolio of services, working in partnership with SME within functions, in addition to engineering projects and capital planning services.

The Pediment: Provides the business integrator function to cap all structures and make it work holistically; its responsibility will include the governance and business strategy alignment; accountability for overall performance management, outcome and relationship with client and other partners. This role will be the key interface into the client-retained organization and to ensure a strong and lasting partnership and should be embedded within the leadership team of the retained organization.

This model can deliver the efficiencies and the value that R&D is demanding from its suppliers and, at the same time, it can provide optimal performance in a highly coordinated and cost-effective manner.

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Gary W. Procop, MD, MS

ASK THE EXPERT

SETTING UP A NEXT-GENERATION MICROBIOLOGY LAB

by Tanuja Koppal, PhD

Gary W. Procop, MD, MS, chair of the Department of Molecular Pathology, section head of molecular microbiology, and director of mycology and parasitology at the Cleveland Clinic, talks to contributing editor Tanuja Koppal, PhD, about the clinic's $75 million state-of-the-art medical testing laboratory that opened in 2012. The building houses microbiology, molecular pathology, cytogenetics, and immunopathology as well as administrative offices. He talks about the thinking that went into designing the building and its labs and shares some insights on what people need to consider when embarking on such initiatives, however small or large. He emphasizes that both people and laboratories should always be open to change, making way for new advancements in science and technology.

Q: What is the challenge with microbiology labs today?

A: Our mission here at the Cleveland Clinic is the diagnosis of infectious diseases in a timely manner using laboratory testing. The main challenge in microbiology is that a lot of things are still done manually, and that increases the costs. This is a very rapidly evolving field, and there is not much room for waste in the system. It is important for a lab manager to look at the introduction of new technologies that can help specimen handling or diagnostics to identify microorganisms better, faster, and cheaper.

As the section head of microbiology, I oversee various groups and staff members who have various areas of expertise, and they are all continually looking to improve. Each of the areas of the laboratory has a lab coordinator who is the interface between the bench technologists and the administration. The work done is mostly all clinical, but there is some applied research going on that involves validation of tests and testing of new methods to be used in the clinic.

Q: Are the laboratories required to follow regulations and adhere to certain standards?

A: We must follow many different regulations. Being a lab that serves a hospital, we have to have a Clinical Laboratory Improvement Amendments license, which means that we have to be inspected by either a joint commission of hospital accreditation or by the American College of Pathologists. They both have very rigorous standards. So all the tests that we perform for the clinic have to undergo rigorous validation, and when the test goes into operation in the clinic it has to have a high degree of quality control and quality assurance.

Q: When and why did you move into your new facility?

A: We moved into the new facility over a year ago. The laboratory had grown in terms of volume (of activity) over the years. Much of clinical microbiology is now molecular microbiology, and so we had an opportunity to expand.

Q: Can you talk about some of the design elements of the building?

A: This new building is the first Leadership in Energy and Environmental Design (LEED) certified building on the campus. It's a beautiful building with lots of open space and large windows all around. There is a lot of natural light, and it has been purposely designed that way. However, we have discovered that some instruments are sensitive to direct sunlight, and that can raise the instrument temperature and cause problems. So sometimes on sunny days we have to draw the shades. That was an unforeseen complication that was adequately dealt with. It was a great opportunity to be able to work on the design of a laboratory from scratch, because we could actually plan the specimen flow through the lab. In our hospital we have process engineers and a continuous improvement group, and we were able to utilize their skills to look at workflows in the lab using tools like spaghetti diagrams and such to plan the best placement of equipment for testing. In addition, all the laboratory workspace is movable, so if you ever had to redesign a workflow it would be relatively easy to do.

Q: Can you highlight some of the technologies and instruments you work with?

A: We perform all the direct examination and culture-based methods, such as growing the microorganism and identifying it, using biochemical means that are all a part of traditional microbiology. More exciting is the introduction of automation to microbiology testing. We have just finished validating an instrument called the Walk Away Specimen Processor (WASP), which is an automated specimen handler. This helps automate all the front end of microbiology to increase reproducibility and reduce the number of full-time employees

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required. The other major advance for a traditional microbiology lab is the use of mass spectrometry, particularly matrix-assisted laser desorption/ionization time-of-flight, for the rapid and inexpensive identification of bacteria. This is all the rage in clinical microbiology now and it's replacing the traditional biochemical identification, which relied on the growth and metabolic activity of the bacteria or the microorganism, with a protein-based identification method. In molecular microbiology it's common to use rapid-cycle polymerase chain reaction, both qualitative and quantitative, for detecting microbial pathogens. DNA sequencing is also commonly used for the identification of microorganisms and certain viruses in determining their susceptibility. Those are some of the major instruments and technologies we currently use. We do our best to stay up with the times and look at new and emerging technologies to see if any of them can more rapidly identify the etiologic agents of the disease.

Q: What have you done to automate processes to minimize contamination and other problems?

A: Much of the processes are still manual. The WASP, which is an automated specimen handler, has been set up for processing urine cultures. We have also automated molecular microbiology protocols such as DNA and RNA extraction. The manual extraction methods are very tedious, whereas the automated extraction robots are really good. We have certainly looked into the possibility of automation where it exists, and if the test quality remains high we will certainly automate.

Q: Did you make any mistakes along the way, and what would you do differently the next time around?

A: We did not plan the warehouse component of our lab well, and that was one of the things that we had to backtrack on a little bit. We had worked hard, as we wanted to allow medical technologists to be able to do their jobs and not spend time going around finding gloves and pipettes. We ended up having a warehouse group deliver those supplies to them daily, in a timely manner. That was decided relatively late in the planning process. It ended up finishing well, but we had to do some last-minute changes to the design, and we could have done it better. There will always be some hiccups along the way when moving into a new facility, and you have to do the best you can.

Q: What advice would you give people who are looking to redesign their labs with limited resources?

A: Over the years I have found that laboratories and hospitals are sometimes set in their ways. So my advice is to be willing to change and look at new advances that may make testing faster and better. Second, it might be worth consulting with people who have skill sets that are different from your own. The interactions that we have had with our process engineers have been very useful, and there are now companies that offer to send in their process engineers to provide workflow assessments. That is something that we, as medical and lab professionals, are not trained in, and having that modern understanding of process engineering and how to examine workflows is very important. If the lab cannot do it for budget reasons it's still worth a consult to figure out whether the existing workflow is optimal. Laboratories should also embrace some of the lean concepts such as 5S methodology to create a sustained neat workplace in order to decrease medical errors. Continuous quality improvement to obtain better patient results is a must.

We did some site visits early on, but we were fortunate to have process engineers embedded in our labs who had the expertise we needed to get the job done. At the beginning we hired a lab consultant who had designed some large reference labs, and we did get some good information from him. It all depends on the scope of the project. With a large new facility you need the architects, lab designers, process engineers, and administrative leadership at the table. If it's a small space that you are looking to redesign, then you can make do with a lot less.

Q: Should you design a lab based on present or future needs?

A: You should try to do a little of both. The challenge with designing a lab based on tomorrow is that the technology is rapidly changing, and we don't honestly know what's coming down the road. So you have to address the issues at hand and plan for current optimal workflows. But it's wise to make the workspace as versatile as possible so that you can implement new technologies as and when they come along.

BLOOD, SWEAT, & FEARS

BLOOD-BORNE PATHOGENS, PART II

by Vince McLeod

Welcome to part two in our series on blood-borne pathogens. The first part discussed the basics of BBP:

- Which fluids present the most risk – Human blood and body fluids such as semen, vaginal secretions, and cerebrospinal fluids
- How to recognize the potential exposure routes – Mucous membranes of eyes, nose, and mouth; skin (especially non-intact skin); and inhalation in certain instances
- Developing an Exposure Control Plan (ECP) and the elements it should address — Exposure determination, communicating hazards to employees, and recordkeeping, among others

The first article ended by touching on Universal Precautions and minimum personal protective equipment or PPE. In our second part of the series we want to pick up where we left off and delve into the OSHA BBP standard a little further by examining the elements of an ECP more closely.

Potential exposure presents a risk to laboratory employees working with biohazards, especially those whose research or work involves human body fluids, such as those in the medical research or the health care industry. Preventing exposure begins with knowing and following the Centers for Disease Control and Prevention's universal precautions,[1] the assumption that all fluids are infectious, and preventing contact by use of appropriate personal protective equipment such as gloves, lab coats, and eye protection. Additional measures might entail face shields or respirators, depending on the activity.

In 2000, Congress passed the Needlestick Safety and Prevention Act[2] (NSPA) that led OSHA to revise its BBP standard. Though most of these revisions are applied to health care settings, it is important to note the emphasis on engineering controls and improved equipment design such as needleless systems for the collection or withdrawal of body fluids. The NSPA mandated changes to the OSHA standard regarding the exposure control plan as well. It requires an annual review and update to reflect changes in technology that reduce exposure to blood-borne pathogens and to consider use of effective safer medical devices to eliminate or minimize occupational exposure.

"Hand-washing facilities are examples of proper engineering controls."

With the NSPA and its revisions in mind, let's take a closer look at the Exposure Control Plan, where everything begins in implementation of OSHA's BBP standard, 40 CFR 1910.1030.[3] In the first article we mentioned that the ECP must address 1) exposure determination, 2) communication of hazards to employees, 3) compliance methods, and 4) record keeping. We discussed the first two at length and said that the key to the BBP standard is in the methods of compliance section. So, let's start there. Compliance methods begin with the application of Universal Precautions, which by now we know by heart, right? Next we get to engineering and work practice controls. As with most OSHA standards and best practices for

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SAFETY TIP

INVOLVE EVERY STAFF MEMBER IN SOME ASPECT OF THE SAFETY PROGRAM

By James. A. Kaufman

There's a tendency to think that if someone is appointed safety coordinator, they have to do all the work for the rest of us. False! A coordinator is just that. He or she is not a "parent." Each person needs to be responsible for safety in general and for a specific part of the program in particular. Here's a list of a number of different specific assignments:

Lecture bottle gas cylinders	Chemical inventory
Highly toxic compounds	Heavy metals
Emergency response	Pyrophorics
Reference materials	Oxidizers
Alcohol inventory	Acids and bases
Fire equipment	Refrigerators
Flammables storage	Showers and eye washes
Specimen storage	Electrical hazards
Accident records	In-service training

Get the idea? Everyone has a job to do. Everyone participates. Take turns doing a monthly lab inspection. Take turns presenting a five to ten minute safety topic at department meetings. Take turns telling the principal/superintendent about needed repairs (with the department head's permission)!

Who is going to be responsible for the department's laboratory health and safety bulletin board? How about the "safety drawer" in each lab? Who makes sure that the drawer is properly stocked?

Want to review your emergency procedures? There are more than a dozen common types of lab emergencies. Why not have a different employee/student conduct the review at the monthly staff meeting?

Who does your chemical hygiene plan review? The CHO, the safety committee? Give it up! Give it to three, four, five members in your department and treat them to the CHP review luncheon. Don't forget to give your boss or your boss' boss the leadership opportunity to send the reviewers a thank you note.

The best safety programs are the ones that get everyone most involved. Safety is not a spectator sport!

Source: Kaufman, James A., Laboratory Safety Guidelines - Expanded Edition, The Laboratory Safety Institute, www.labsafetyinstitute.org.

employee health and safety, engineering controls and work practices take precedent. Controls to eliminate or minimize employee exposures are always the first means of protecting workers. Where exposures remain following installation of controls, personal protective equipment must be used. The OSHA standard requires that these controls be regularly inspected and maintained to ensure their effectiveness.

Hand-washing facilities are examples of proper engineering controls. All laboratory workers know that we wash our hands immediately after removing gloves or following contact with blood or other potentially infected material (OPIM). Employers must provide these hand-washing facilities or, if that is not feasible, an effective antiseptic cleanser with clean towels or antiseptic towelettes. Sharps containers are another example of engineering controls. Immediately or as soon as possible after use, contaminated sharps such as needles and scalpels are placed in puncture-resistant, labeled, and leak-proof containers. Reusable sharps are separated for reprocessing. We all know, and for good reason, to never attempt recapping, bending, or breaking of contaminated needles or other sharps unless we use a one-handed technique or a mechanical device designed to accomplish this.

While on the subject of sharps, it is worthwhile to mention another revision to OSHA's BBP standard required by NSPA. This one pertains to record keeping and mandates establishing a sharps injury log for the recording of percutaneous injuries from contaminated sharps. The employer must record and maintain information in the sharps injury log while protecting the confidentiality of the injured employee. At a minimum the sharps injury log shall contain:

- The type and brand of device involved in the incident
- The department or work area where the exposure incident occurred
- An explanation of how the incident occurred

Work practices, like engineering controls, offer effective exposure elimination if they are followed. Employees must receive the training on the facilities' work practices, commit to adhering to them, and know that management supports their use and will audit compliance with appropriate consequences

when work practices are not followed. One common work practice is to ensure that all procedures involving blood or other potentially infectious materials are performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances. Another is to prohibit eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses in work areas where there is a reasonable likelihood of occupational exposure. Most facilities will not allow food and drink to be kept in refrigerators, freezers, shelves, cabinets, or on countertops or benchtops where blood or other potentially infectious materials are present.

One more work practice rule running a close second to the golden rule of Universal Precautions is the prohibition of mouth pipetting/suctioning of blood or other potentially infectious materials. Although this practice is easily controlled by supplying and using mechanical pipettes, and most would consider it common knowledge today, lab training should still cover this important safety precaution.

Be sure to look for our final installment of this series, where we discuss housekeeping, waste handling, and exposure incident/post-exposure procedures. Remember: Safety First.

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FUME HOODS

ENERGY EFFICIENCY OFTEN PROMISES A QUICK RETURN ON INVESTMENT

by Mike May, PhD

Universities are fuming over the money that hoods suck out of their systems. There's good reason to get upset—research indicates that a traditional fume hood can use as much energy as a house, and some studies say as much as a few houses. Consequently, many universities run contests to reduce the energy consumption of fume hoods. Best of all, several advances in fume hoods can dramatically raise their efficiency.

When asked about the key trends in fume hoods, Andrew Sinnamon, technical adviser for lab products at Mott Manufacturing (Brantford, ON, Canada), starts out with energy. "In terms of energy costs, the trend is for high-performance, reduced-velocity designs." Despite the energy concerns, other trends exist in fume hoods. For example, Sinnamon points out the need for flexibility. "You are seeing fume hoods that are height adjustable for standing or seated use. This makes them accessible to anyone." Last, he adds, "The current generation of fume hoods has improved aesthetics."

To duct or not to duct

In general, fume hoods come in ducted and ductless forms. There are pros and cons to both. For example, a ducted hood requires a complicated installation, including ductwork that goes from the hood to the exterior of a lab building. Nonetheless, ducted hoods have been around for a long time and they work with essentially any chemical that a scientist needs to use in one. Ductless filtering fume enclosures, on the other hand, trap fumes in a filter. These do not consume any air and can even be portable within or between labs. The filter is the strength of this approach—and a potential shortcoming, because it must be changed after saturation. A variety of opinions exist on which type makes the best choice.

Stephane Hauville, president of ERLAB (Rowley, MA), says, "In 1968, the founder of our corporation invented the ductless filtering fume hood." He adds, "By attaching advanced carbon filtration to a fume hood body, the ductless fume hood was born." Still, many things needed to be improved. The filter needed to be formulated for specific chemicals, and traditional fume hoods handled most anything. That triggered better and better filters, such as the Captair line from ERLAB. Today, Hauville believes that ductless filtering fume hoods work in almost any situation.

"Why should a lab manager care about such technology?" Hauville asks. "It allows labs to be designed like simple spaces. You can have a very flexible, very simple, very easy design that is not dependent on a duct system."

> "For most of today's lab managers considering replacing a hood, it often comes down to energy."

It's also possible to put a ductless filtered hood where a traditional one existed before. For example, ERLAB developed its GreenFumeHood technology for this purpose. This technology exists in various hoods, available through partnering agreements with ERLAB, including the Green Solution Hood from Air Master Systems, the Dimanlab Fume Hood, and the Thermo Scientific Hamilton Infinity Fume Hoods.

Sinnamon points out, though, that "Canadian standards do not consider ductless hoods to be an acceptable substitute for a chemical fume hood." He makes sure to add, "Standards vary in other parts of the world."

Mostly about energy

Some fume hoods are old enough to need replacing

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because of being worn out from the years of harsh exposure to chemicals. Also, a hood system might fail an assessment, and solving the problem could lead to replacing the hood itself. For most of today's lab managers considering replacing a hood, it often comes down to energy.

TOP TEN FEATURES/FACTORS RESPONDENTS TO OUR LATEST SURVEY SAID THEY LOOK FOR WHEN BUYING A FUME HOOD:

1. DURABILITY OF PRODUCT
2. PERFORMANCE OF PRODUCT
3. EASE OF USE; ERGONOMIC OPERATION
4. SAFETY AND HEALTH FEATURES
5. LOW OPERATING COSTS
6. LOW MAINTENANCE / EASY TO CLEAN
7. VALUE FOR PRICE PAID
8. TOTAL COST OF OWNERSHIP
9. SERVICE AND SUPPORT
10. WARRANTIES

"The cost of energy is not going down," Hauville says. For example, data from the U.S. Energy Information Administration indicates that the average retail price of commercial electricity increased by more than 25 percent from 2003 to 2012. That means that many of the inefficient hoods out there will keep costing more and more if they are not replaced.

According to Sinnamon, a current-generation fume hood can reduce operating costs by 40 percent, especially in comparison to a 10-year-old unit. As he says, "That makes it quite an important consideration." In fact, Sinnamon says that the energy costs of an existing fume hood could even warrant early replacement." Given the potential savings, he says, "That would warrant looking at replacement from an energy-saving point of view."

Even a ducted fume hood replacement can quickly pay for itself. "If you can make the needed adjustments to the ventilation system to reduce the airflow," Sinnamon says, "you can get a decent return on investment. Depending on the energy costs, a two-to-three-year return is not out of the question."

Concepts to consider

In shopping for a new fume hood, many elements come into play. For one thing, it depends on whether it's a new or replacement situation. In designing a new lab or redesigning an existing one, Jim Lynch of School Specialty Career & Technical Education (Mansfield, OH) recommends asking three questions:

1. What level of protection will the lab worker require?
2. What materials are going to be used under the hood?
3. How much space is available in the lab for the fume hood?

The answers to these questions provide a starting point for fume hood shopping and also help you work with a vendor to find the best fume hood solution for your situation.

These considerations also apply to replacing a hood. For replacements, though, Sinnamon adds some additional points. For one thing, he says, "Look at the ventilation system available, which might require selecting the best fume hood that works with the existing ventilation system."

Do you have hoods that need to be replaced? Hauville suspects that you do. "Not every hood in America needs to be replaced," he says, "but the majority of installations out there would benefit from modern technology."

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FOR ADDITIONAL RESOURCES ON FUME HOODS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT **WWW.LABMANAGER.COM/FUME-HOODS**

LIMS

MOBILE TECHS GAINING GROUND

by Angelo DePalma, PhD

Mobile technology is finally picking up steam in laboratory information markets, says Colin Thurston, director of product strategy, process industries, at Thermo Fisher Scientific (Waltham, MA). "We've observed the trend, throughout informatics, to support different platforms, particularly in the LIMS space." The sweet spots for mobile access are sample collections occurring outside the lab, for example, taking health and safety samples throughout a pharmaceutical facility, in collecting environmental samples in the field, or when testing labs become too cramped to house stand-alone data systems and hardware. On one hand developers of mobile applications strive to be platform-agnostic, but many are now developing dedicated "apps" as well.

Tablet interfaces are of course simplified, with a specific look and feel for specific tasks. "We don't anticipate that a tablet would become the only device someone uses," Thurston explains, "but they more than serve the purpose in specific situations such as off-site sample collection." Tablet functionality being what it is, a field specialist miles from home can log a sample, read its barcode, input the precise geophysical location through global positioning, date/time stamp it, and transmit all metadata back to the data repository (usually a laboratory information management system [LIMS]) through remote Internet access. (Field analysis and data transfer are also possible through field instruments and even tablet-like devices, but that is the subject of another article).

Build vs. buy

For an interesting take on build vs. buy for LIMS, see the accompanying article in this issue, INSIGHTS on Data Management Systems, page 60, "A Q&A with Two Laboratory Data Systems Experts." Yes, research organizations routinely built their own proprietary scientific data management systems from the ground up, using in-house IT personnel. Scott Kuzdal, PhD, life science business manager at Shimadzu Scientific Instruments (Columbia, MD), has "seen a lot of changes in LIMSs. Over the past decade, large clinical labs expended time and effort building LIMSs. Now many large institutions are moving to fully commercial LIMSs. The days of creating their own LIMSs are disappearing."

There are several reasons why commercial LIMSs have become a viable option. Integration between LIMSs, electronic lab notebooks, instrument data systems, and other lab- or organization-wide software used to be a hurdle. Increasingly, it is viewed as an essential. Kuzdal gives the example of mass spectrometers, whose instrumentation and software were created first, then made to fit a LIMS. "Integration was not a top priority. We now see that next-generation spectrometers are designed to integrate seamlessly with LIMSs. Instrument makers are much more proactive, as they learned that customers look for this functionality."

Why would anyone bother to build a LIMS? Peter Nollert, PhD, chief technology officer at Emerald Bio (Bainbridge Island, WA), faced this question some time ago. Labs do this when they can't "find anything that fits."

While buying is the *only* alternative for most smaller laboratories, managers might consider noncommercial or academic software as an alternative. PiMS, an Oxford University software development project, focuses on labs involved in protein structure determinations. PiMS is freely available to academic laboratories and commercially available through license. One can view it as a type of hybrid—not quite fully developed for every workflow, but close enough so customization does not involve reinventing the wheel.

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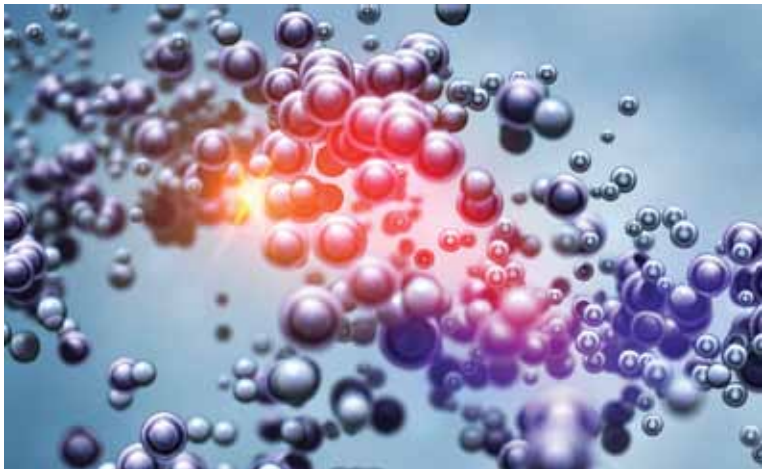
FOR ADDITIONAL RESOURCES ON LIMS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT **WWW.LABMANAGER.COM/LIMS**

PARTICLE SIZING

MANY SIZE DOMAINS, MANY APPROACHES

by Angelo DePalma, PhD



Particle sizing methods range from simple sieving to microscopy, imaging, and laser-based techniques that measure and characterize down to molecular scale. Approaches to particle sizing differ as widely, technologically, as the sample types, but in many instances the approaches are orthogonal or complementary.

Lew Brown, marketing director at Fluid Imaging Technologies (Yarmouth, ME), says his company was one of the first vendors to introduce automated imaging-based particle sizing instrumentation. As the company name implies, Fluid Imaging specializes in characterizing particles suspended in fluid, in motion, in real time, through what is essentially an automated microscope.

"Most of the automated particle sizing techs are volumetric-based," Brown explains. All such instruments measure a signal that is proportional to the particle's volume. Coulter counters, laser diffraction, and light obscuration all work this way, but they work on the basis of a signal that is proportional to volume.

"Their main drawback is they're indirect. They have to compare the signal they measure to a signal of known volume. This requires an enormous leap of faith," Brown says. "It assumes all particles are spherical." Delivering an "equivalent spherical diameter of x" is satisfactory for obtaining particle size distributions. But a particular equivalent diameter could represent particles of vastly different shapes and sizes, such as rods and spheres or irregularly shaped particles. "These particles are obviously quite different, but volumetric particle sizing says they're the same." Morphology and shape can have profound effects on the quality and physical characteristics of small particles, such as in paints or electronic materials.

Fluid Imaging, by contrast, takes an image of every particle and measures 30 or more parameters such as length, width, perimeter, and circularity.

But as every analyst knows, microscopes have their own shortcomings, specifically an analysis size domain restricted to about two microns and larger. Particles smaller than that require an advanced microscopy technique, such as electron microscopy (EM), but EM for particle characterization is extremely slow and labor-intensive—too much so, Brown says, to be practical.

Brown describes his instrument as a "hybrid between classical particle sizers and microscopy." He claims the ability to make 30 measurements per particle, at a rate of up to 50,000 particles per minute. Once images and data are acquired, the data system performs statistical pattern recognition, such as looking for particles of similar size, shape, and properties. Brown mentioned its use for monitoring seawater for organisms that cause red tide. "We can train the system to look for that organism and monitor its appearance over time, and then we can proactively shut down shellfish beds to prevent illness." Another use is distinguishing impurities and aggregates in mixtures for quality control.

An emerging trend

Unlike some particle size companies, Microtrac (Largo, FL) covers most of the bases in terms of instrumentation: diffraction, dynamic light scattering (DLS),

image analysis, scanning electron microscopy, surface analysis, and particle charge systems. "We cover a lot of territory," says Microtac's advanced applications engineer Philip Plantz, PhD. DLS capabilities range from 0.8 nm to 3,000 nm (three micrometers). A water molecule's diameter is about 0.3 nm, so DLS can easily characterize larger molecules and aggregates such as carbon nanotubes, buckyballs, and proteins.

Plantz calls image analysis one of the emerging trends in particle characterization. This technique is similar to imaging methods in biology, which capture real-time microscopic events. Data-rich images permit a range of calculations to determine a particle's shape and morphology, and how shape and size change over time.

"If particle size distribution has shifted, process and quality control people will ask why." Imaging helps with root cause analysis of what went wrong: the process, milling, raw materials, etc. "Imaging can give you an idea of what is actually happening," Plantz adds.

Many quality and environmental labs use one sizing technique that provides a signature measurement or proxy for critical attributes. As one delves into product development and research applications, particle characterization becomes more multifactorial, less of a black-and-white exercise. Methods diverge, overlap, and complement each other, not only in size domain capabilities but in the information they provide about shape, surfaces, and other characteristics.

Dig deep

Particle Sizing Systems (Port Richey, FL) specializes in high-resolution instrument systems that characterize single particles, one at a time. According to company president Kerry Hasapidis, a few large particles can ruin the process, sample, or quality of the material. "We specialize in identifying those at part-per-trillion levels."

Digging deeply into individual particles, viewing particle events individually is an emerging trend in particle characterization. This contrasts with "macro" methods that look for averages among very large collections of particles.

Hasapidis likens his approach to panoramic photography. "A panoramic lens will give you a lovely photo of a sunset behind a bridge. Techniques like laser diffraction provide this sort of data. But if you want to focus on small sections of the structure, to look for cracks or failures, you need a telephoto lens. Many companies that specialize in laser diffraction, even some of the larger players, are now selling more and more into specialized niches that involve higher resolution and single particle image analysis."

"Particle sizing consists of dozens of different methods and hundreds of device choices."

Single particle sizing efficiently characterizes a mixture of particles not by their average properties but by some outlier such as abnormally large or small size, pointed or angled shape, etc. In fields like nanotechnology the outliers may be as significant, with respect to quality and performance, as "average diameter."

Unlike other techniques explained in *Lab Manager*, particle sizing consists of dozens of different methods and hundreds of device choices. "Each instrument provides another tool," says Plantz.

Moreover, the choice of approach is more heavily industry- and application-oriented. "Particle sizing touches so many industries," says Gilbert Vial, product manager for physical measurement at Shimadzu Scientific Instruments (Columbia, MD). Each product or process operates within its own size domain, and each requires different types of particle characterization to get the job done. "Trends in particle size instrumentation tend to track the successes and needs of the industries they serve."

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FOR ADDITIONAL RESOURCES ON PARTICLE SIZING, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABMANAGER.COM/PARTICLE-SIZING

CHROMATOGRAPHY DATA SYSTEMS

VERSATILITY, INTEROPERABILITY KEY ATTRIBUTES

by Angelo DePalma, PhD

Chromatography data systems (CDSs)—the data "back end" for gas, liquid, ion, and supercritical fluid analytic chromatography—have evolved over the decades from simple chart recorders to onboard processors with minimal storage and analysis to personal computer-based and, finally, to connectivity with "peer" instruments and supervisory software systems.

Today's CDS is multifunctional, multitasking, and often vendor-neutral. "The need for chromatography data systems to support chromatography equipment from multiple vendors is an absolute must," says Dan Holmes, senior R&D manager at Agilent Technologies (Santa Clara, CA).

Holmes explains that his firm's OpenLAB CDS controls chromatography systems from competitor companies, including those that are no longer in business as independent vendors. "This capability is expected from CDSs today."

In January, Agilent introduced OpenLAB Data Store with Lab Applications, an application that provides secure central storage of data produced by Agilent's OpenLAB chromatography data systems. The software streamlines the management of laboratory operations, assets, and regulatory compliance, according to the company. Data Store circumvents the enterprise-level software, typically designed for larger laboratories, that combines electronic notebooks, laboratory information management systems (LIMSs), and scientific data management systems. By focusing on essential tasks, OpenLAB Data Store simplifies scientific data management for smaller organizations that lack deep IT expertise.

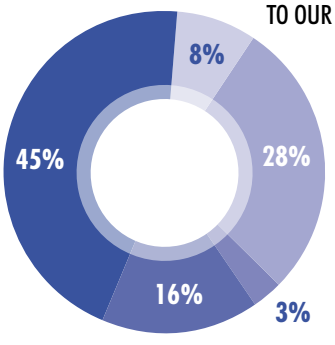
> "Today's CDS is multifunctional, multitasking, and often vendor-neutral."

Working together

Interoperability and versatility are the emerging "next big things" in CDSs. In addition to managing and controlling chromatography systems, CDSs need to be

As CDSs become more technologically sophisticated, their interfaces continue to evolve toward greater intuitiveness and accessibility. "Operators used to be PhDs, then college grads, now they're often 'technician' level. That has increased the demand for data system simplicity, down to counting the number of mouse clicks required to perform an operation," Holmes says.

THE TYPES OF CDS INSTALLATIONS RESPONDENTS TO OUR LATEST SURVEY HAVE IN THEIR LABS:



WEB-BASED	16%
STAND-ALONE	45%
THIN CLIENT/SERVER	8%
CLIENT/SERVER	28%
OTHER:	3%

mass spectrometry (MS)-capable and connect with larger data repositories such as LIMSs and laboratory execution systems. This is in stark contrast to previous control and data software, which were instrument-specific.

For example, Agilent's ChemStation software controls liquid chromatography and MS triple quad instruments. Similarly, Thermo Fisher Scientific's (Waltham, MA) next-generation Chromeleon CDS, introduced at Pittcon 2013, also supports MS along with mainstream separation techniques in one software package. The added functionality was introduced to accommodate the growing acceptance of MS in chromatography detection. "Growing numbers of customers want to apply mass spectrometry to routine and quantitative analyses," says David Leitham, VP for chromatography software at Thermo Fisher. "This is the latest step in our campaign to simplify the use of analytical tools."

"As CDSs become more technologically sophisticated, their interfaces continue to evolve toward greater intuitiveness and accessibility."

Chris Stumpf, PhD, senior product managing marketing manager, informatics, at Waters (Milford, MA), views interoperability as a value strategy, both from users' and information technology perspectives.

"You have all this functionality on a chromatography workstation, but conventionally it will run only one system," Stumpf tells *Lab Manager*. The duplication itself is inefficient, not to mention the training and learning curves. "Standardization—the ability to control several instruments and import data from other systems—helps reduce training costs and improve efficiency and consistency."

In the absence of interoperability data, convertibility is probably the next best thing. All major vendors provide means to "translate" data from competitors' CDSs into their systems, although Stumpf notes that data standardization has been a slow-moving process.

THE TOP 5 MOST IMPORTANT FACTORS IN OUR READERS' DECISIONS TO BUY A CDS:

1. EASE OF USE
2. SERVICE AND SUPPORT
3. PRICE
4. VERSATILITY
5. SEAMLESS COMMUNICATION BETWEEN DIFFERENT INSTRUMENTS AND SOFTWARE

The solution is for chromatography system manufacturers to provide drivers that work with competitors' data systems. Drivers consist of software similar to what enables printers and computers from two different manufacturers to work together.

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FOR ADDITIONAL RESOURCES ON CHROMATOGRAPHY DATA SYSTEMS, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABMANAGER.COM/CDS

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

NEW PLATFORMS SAVE TIME AND MONEY

by Mike May, PhD

Many scientists separate solutions with high-performance liquid chromatography (HPLC). "With this technology and others, users need data faster," says Michael Frank, PhD, analytical HPLC marketing manager at Agilent (Santa Clara, CA). Other factors must also be considered. Ade Kujore, marketing specialist at Cecil Instruments (Cambridge, UK), says, "Users require HPLC systems that are fast, sensitive, stable, and easy to operate, with wide dynamic ranges." She adds, "The ability to efficiently perform robust method development and to produce consistently reliable, inter-laboratory data are also requirements of HPLC systems."

"Users require HPLC systems that are fast, sensitive, stable, and easy to operate, with wide dynamic ranges."

A particular scientist's needs depend on the work at hand. For example, Glenda Gillaspy, PhD, professor of biochemistry at Virginia Tech (Blacksburg, VA), says, "My lab mostly examines a specific type of signaling molecule, so my HPLC needs are fairly specialized." She adds, "What matters most is that we can separate different inositol phosphate molecules and simultaneously measure radioactivity from eluted samples."

Controlling costs

"The running cost of the system is a key point, including the initial capital investment and longer-term cost of ownership," Frank says. "For someone still using conventional HPLC, purchasing a new system can be monetized in just one year for some customers." The return on investment comes in several forms: higher throughput with the same or higher quality results and saving on solvents. Frank adds, "This is extremely important for people doing contract work, because they have to account for every cent of expense to earn a profit."

In some cases, modern HPLC technology can also reduce the number of runs. For example, to separate a sample into components that vary widely in concentrations often takes multiple HPLC runs. Nonetheless, Agilent's High Dynamic Range Diode-Array Detection Solution can, as Frank says, "do it all in one run." He adds, "You turn a several-hour project into half the time, and you save on standards and blanks."

Costs can also be cut with platforms that accomplish multiple tasks. For instance, Kujore says, "Our WaveQuest ultra-fast scanning UV/visible HPLC detector will perform the work of both a diode array detector and a variable wavelength UV/visible detector."

TOP TEN FEATURES/FACTORS RESPONDENTS TO OUR LATEST SURVEY SAID THEY LOOK FOR WHEN BUYING AN HPLC SYSTEM:

1. ACCURACY
2. PRECISE AND ACCURATE FLOW RATES
3. QUALITY OF DATA
4. RESOLUTION
5. MAINTENANCE
6. SENSITIVITY
7. AVAILABILITY OF SUPPLIES AND ACCESSORIES
8. PRICE
9. EASE-OF-USE
10. SERVICE AND SUPPORT

Time for a change

Sometimes, economics alone encourage HPLC upgrades. Other aspects can also signal that it's time for a new system. As an example, Kujore says, "If the software is too inflexible to meet current requirements, then an alternative software package should be considered." She adds, "If an item of hardware of the HPLC system is not sufficiently flexible to cope with current or future requirements, then an alternative item of hardware should be considered."

In shopping for a new HPLC system, though, Frank says, "Think about what you really need. What is the most important point that you'd like to improve?" It could be sensitivity or throughput, for instance. Keep in mind, however, that no single system can do it all. "There are some limitations dictated by nature," Frank says. So know what you want, but also keep in mind what is possible and discuss this with your sales representative.

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FOR ADDITIONAL RESOURCES ON HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY, INCLUDING USEFUL ARTICLES AND A LIST OF MANUFACTURERS, VISIT WWW.LABMANAGER.COM/HPLC

INSIGHTS
LAB TECHNOLOGY BUYER'S REPORT

INSIGHTS ON DATA MANAGEMENT SYSTEMS

A LAB MANAGER TECHNOLOGY BUYER'S REPORT

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All articles by **Angelo DePalma, PhD**

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INSIGHTS ON DATA MANAGEMENT SYSTEMS

LIMSs DOMINATE, BUT CONVERGENCE RULES

The drive toward fully paperless operation is causing laboratories to rethink their investments in data management software, particularly in LIMSs and ELNs, and to ask how these tools could provide an integrated flow of information from instrumentation through to enterprise systems, helping managers make informed decisions while eliminating manual steps. "It's all about operational efficiency and using information to inject responsiveness and agility into an organization," says Trish Meek, director of Product Strategy, Life Sciences for the Informatics business at Thermo Fisher Scientific (Philadelphia, PA).

A holistic information strategy demands that users and vendors collaborate to identify gaps in information flow and understanding that thwart the implementation of end-to-end data "solutions" for laboratory organizations seeking to deliver a paperless lab.

"Customers keep relating to us the need to derive value from their information systems, while focusing not on systems themselves—the individual software packages—but on processes and workflows," Meek adds. Among the evolving tools for process understanding are integration of software from different areas and levels of the workflow and data visualization tools. Together, these enable labs to take advantage of where information and processes originate and where the resulting data is eventually used. "Lab informatics relates not only to the lab generating data but to the wider environment or enterprise, for example, for decision-making during a critical juncture in manufacturing or for batch release.

Integration and advanced data handling technologies existed a decade ago, but laboratories lacked the desire or will to implement them. What has changed is how organizations now view information: not as a point event belonging to a single instrument or laboratory domain, but as a valuable deliverable from the laboratory with impact ripples organization-wide—what Ms. Meek calls an "end-to-end data solution."

Data handling technology has changed, Meek observes, but "managers felt that integration projects were difficult, costly, time-consuming, and could not provide adequate ROI." Today, with a greater appreciation for web-based services and more open architecture designs on the part of vendors, integrations are achievable—if not ready-made. "Integration has become more cost-effective, and people are beginning to see that."

SPECIALIZATION

A 2012 Gartner Group report by Michael Shanler advised potential buyers to focus on vendors with the greatest "domain expertise"—industry-specific experience—before selecting a LIMS. Shanler writes that while all products from top vendors are adaptable, they "require different levels of investment through customization or configuration." Moreover, customers have reported that vendors lacking specific domain expertise often rely on excessive customization that adds to downstream complexity. Finally, companies with complex product portfolios should "resist the urge to consolidate into a single centralized LIMS." The same could be said for complex organizations that perform discovery, R&D, product development, and manufacturing within a narrow product focus, for example pharmaceuticals or semiconductors.

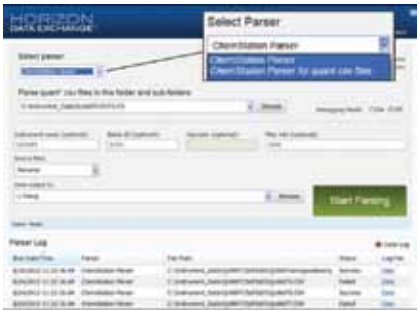
Bob Meyer, executive VP at Lab Answer (Sugar Land, TX), a laboratory and science informatics consultancy, concurs. "The more specifically a vendor's products attempt to solve a single problem, the more purpose-built the product will be." The more vendors attempt to brand their data products as general purpose, the greater will be the need to add or modify to meet specific workflows.

Customers quickly come to recognize domain expertise. Agilent (Palo Alto, CA) plays in the laboratory data marketplace through its OpenLAB Enterprise Content Manager (ECM), a product it assumed through the acquisition of Scientific Software in 2005. Where LIMSs manage samples, ECMs are more comprehensive, gathering data from ELNs, LIMSs, instruments, and other data systems under one umbrella.

INSIGHTS ON DATA MANAGEMENT SYSTEMS

Senior R&D manager Dan Holmes estimates that 60 to 70 percent of the world's pharmaceutical data is archived in ECMs. Pharmaceutical users are big on data systems because their data storage/retention policies span many decades—as much as one century. When everything was recorded on paper, business and scientific records were gathered periodically and stored in depots that resembled bomb shelters more than libraries. Today everything may be managed remotely through electronic data management. In the case of OpenLAB, the data exists in a technology-neutral, human-readable format. That includes pictures, reports, tables, experiment data entry, and instrument data. "Customers can bring that data back and do what they need with it," Holmes says.

▲ *Chromatography Data System / Dionex Chromeleon 7.2 CDS / Thermo Fisher Scientific www.thermoscientific.com*



▲ *LIMS / HORIZON Data Exchange ChemWare / www.chemware.com*

PAPERLESS OUTSOURCING?

Accelrys' acquisition of VelQuest in 2012 amounted to a strategic investment to enter markets downstream of R&D, such as product development. Ken Rapp, managing director for Accelrys' Analytical, Development, Quality and Manufacturing business unit (and former VelQuest CEO), explained the move within the framework of his company's business transformation based on eliminating paper and manual processes, management of externalization and collaboration, and improving quality through better visualization and analytic tools.

"I'm amazed that modern notebooks still employ paper and manual processes and have not yet been transformed. This must change." Rapp notes that while routine analyses involving hundreds of samples have caught on to barcoding and advanced data entry, much lab-bench experimentation still employs traditional record-keeping.

Paperless operations play into collaboration as well. "The landscape for externalized activities has completely reversed from ten years ago," Rapp notes. "Back then, 70 percent of customers' work occurred within their four walls, where today the ratios have reversed." Last, few industries have exploited the value of visualization tools in the manner of online giants like Google. These tools spot trends but during laboratory and manufacturing processes can also pick up excursions that predict results that will be out of specification.

CONVERGENCE

LIMSs have emerged as the most easily recognized laboratory data systems, but they did not always provide the wide-ranging capabilities of today's software systems. "In the early days all LIMSs did was manage samples," explains Bob Meyer. "A LIMS took note of a sample, assigned a test, and captured the results. Then the operator would often run to his or her paper notebook and enter the data manually."

ELNs provided greater functionality in their ability to store instrument traces, photos, and other data that was unsuited to LIMS. ELNs became searchable (provided data was entered into the proper format) and provided a validatable means to protect intellectual property. Another data product, approximately a decade old, was the laboratory execution system (LES), which is offered by several vendors interviewed for this article. LESs are primarily used in quality laboratories that run a lot of tests. Like ELNs and LIMSs, LESs provide a structured, all-electronic means of automating and controlling testing operations. Like LIMSs, LESs connect to instruments and can monitor calibration, training, and instrument usage.

Now, Meyer says, these three data packages have evolved to the point where they share significant functionality. "This is natural, as each of the vendors tries to capture more of the marketplace. They'll say, 'Well you don't need a LIMS, you can do that with our ELN' or 'You don't need a separate ELN, we've built it into our LIMS.'"

The convergence of LIMSs with other data systems, says Alan Vaughan, Content, Business Development and Training manager at LabLynx (Smyrna, GA), is "an ongoing process" but one of the hot topics in laboratory data.

Terry Smallmon, director for Life Science Sales at LABVANTAGE Solutions (Somerset, NJ), says "Lines have been blurring for a while, especially between LIMSs and ELNs." Several companies now sell both products, and even more are porting the functionality of one package into the other.

Data system proliferation has given rise to an alphabet soup of "solutions" that include LIMSs, ELNs, SDMSs (scientific data management systems), visualization software, electronic data capture, lab execution systems, and clinical LIMSs. "The acronyms are confusing clients," Smallmon adds. "It's no longer black and white." He believes that instead of discussing or specifying individual products, one should consider the process and the solution, which might incorporate several products. Or, if it's configurable, maybe just one.

"The modern LIMS market has become a matter of connecting point solutions, islands of disparate data, and providing a portal. Take a step back and determine what specific problems you're trying to solve. There's definitely not enough of that happening. The players who survive when this all clears out are the ones who are conscientious in trying to solve problems."

In addition to a problem-centered philosophy, these "players" should possess a baseline product on which they can build. Products will need to be more modular, more versatile, to accommodate the widely different needs among and within industries.

All major vendors recognize the utility of cooperating on data formats. Dan Holmes of Agilent relates that he has monthly contact with some of his competitors, focusing predominantly on data systems and software driver exchange. "Why should I write drivers for their instruments when I could repackage theirs and pull it into my data system, and vice versa? Why should they write drivers for an Agilent LC when Agilent knows the internals of that instrument better than anybody and can provide maximum performance for the customer?" he asks. "Nobody has equipment from just one vendor. Labs are heterogeneous environments."

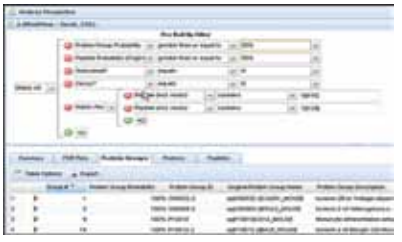
OPERATING IN THE CLOUD

INSIGHTS ON DATA MANAGEMENT SYSTEMS

ALLOWING DEMOCRATIZED ACCESS TO ADVANCED DATA PRODUCTS

Cloud-based LIMSs are part of an evolution, from do-it-yourself to employing outside IT service groups to having the software and cloud storage provider do all the heavy lifting, profiting from the economy of scale transparently and behind the scenes. As lab data products become more flexible, more suite-like, customers can pick and choose the modules they need, as they would with a set of office applications. The subscription model ensures that companies consume only the services they need, at the appropriate scale. Hardware investment similarly becomes minimal when processing and storage occur off-site.

And because they are subscription-based and scalable, cloud-based services also have democratized access to advanced data products. Organizations, including academic laboratories that would not have considered acquiring data software, can now participate.



▲ *Enterprise Informatics Service / i3D Shimadzu / www.ssi.shimadzu.com*

One objection to cloud-based services generally is the belief that data is less secure than it is when stored on-site. In fact the opposite is true. "Do you keep your money under your mattress or in a bank?" asks Alan Vaughan of LabLynx.

Wayne Verost, president of QSI (Ramsey, NJ) is even more blunt: "It is as easy to break into someone's internal network as it is to compro-

mise a cloud-based service." In an effort to cut back on IT expenses, most large companies have already moved data services off-site. The cloud has simply removed geographic limitations.

QSI offers two Windows-based LIMS products, including one in a cloud format. "It's the same software. The only difference is where it's located," Verost says.

Inspired by services from Microsoft, Apple, and Google, laboratories are increasingly exploring the potential of cloud computing to enhance the versatility and productivity of their LIMS software, according to Clive Baron, chief business development officer at STARLIMS (Hollywood, FL).

"It is no longer unusual for an IT RFP to include cloud questions," Baron says. "We see strong demand for cloud services, and customers say they are enthused about the potential of the cloud to reduce hardware or software purchases and to eliminate the need to reconfigure existing system infrastructure. The cloud significantly reduces time required to begin a project and saves resources otherwise expended for hardware purchases or IT support staff."

Data security is the leading concern expressed by customers considering a cloud-based system. To ensure optimal data protection, STARLIMS Cloud Services encrypts data in transit and at rest to make sure that all information remains intact. Data is stored in a secure, cloud-based infrastructure and is delivered, managed, and accessed via the STARLIMS application.

Earlier this year Shimadzu (Columbia, MD) partnered with Integrated Analysis (Bethesda, MD) to introduce the i3D Enterprise Informatics Service. The subscription-based cloud product facilitates data capture, storage, and reporting from any digitally enabled lab device or operation. The i3D tagline—Your Lab Can Now Do What the "Biggest" Labs Do, Only: 100x Faster Computing, 1/5th Cost, and Zero Installations—could be the epitaph of conventional organization-wide scientific data management software. Or at the very least, it points to where this field is heading: nimble, scalable, distributed, integrated, vendor-neutral, cloud-based, browser-accessed data repositories that communicate with everything in the lab.

Is this just another cloud-based LIMS or ELN? "That's a good question," answers Scott Kuzdal, PhD, Life Science business manager at Shimadzu. "It resembles a LIMS, but it goes one step beyond that, and beyond cloud-based storage as well."

Through i3D data automatically migrates to a private cloud maintained by Integrated Analysis. Kuzdal claims speeds 100x faster than local PCs for accessing and querying, which frees computers to capture more data. "It changes how people work with instruments and PCs."

The idea of i3D arose at Integrated, which noticed that laboratories do many of the same things, except they apply different algorithms, filters, and search engines. So the company created modules for specific operations. "Any command line-driven program can be made into a module and represented on the desktop," Kuzdal explains. Modules control data conversion, searching, or any other type of query or manipulation. One such module invokes the Mascot search engine, which identifies proteins from their fragmentation patterns in a mass spectrometer. Dozens of specialized scientific search engines exist, and many of them are free or close to it.

Kuzdal says the i3D platform will eventually allow organizations that conduct proteomics, genomics, and metabolomics on different instruments from different vendors through proprietary applications to coexist and even collaborate within a unified, cloud-based platform.

The other advantage is speed. In addition to freeing up desktop computers and more powerful servers, complex searches such as matching protein digests to fragment libraries can benefit from having up to 100 processors working on the problem; in other words, much faster results for critical experiments. "What used to take two months can now be done in less than a day," Kuzdal says.

When Thermo Fisher acquired Dionex and its Chromeleon chromatography software a few years back, the two former competitors were free to exchange information freely on data standards and interfacing products through web services. "The great benefit of web services is there is no requirement to understand the underlying data structure," says Thermo's Chris Meek. "As long as we can talk to the web service that sits atop Chromeleon, we can access its data. That is our integration approach not only within our instrument/software portfolio, but with other vendors' software as well."

Cloud computing services make convergence easier too, because everything is under control of the service organization. Problems arise when third-party gatekeepers become involved at the insistence of the customer. "They create all kinds of security and administrative obstacles," notes Wayne Verost. But within the cloud proper, through a tightly hosted service, changes are under the complete control of the vendor. "It's the opposite of what you'd expect," Verost adds.

A DRIVE TOWARD MORE OPENNESS & ACCESSIBILITY

No topic is more salient when discussing LIMSs than integration, says Tom Dolan, sales director at RURO (Frederick, MD). "In the end, a LIMS must provide value as an essential data repository. If it doesn't serve that function, then it cannot serve as an effective tool for automation, compliance, and disaster recovery. It all centers on integration."

Traditional LIMSs suffered from a lack of versatility and adaptability to changing workflows. The number one complaint most users have is that significant changes must go through a lengthy process mediated by their IT staff, or the vendor's, and almost always include time and money that were not originally allocated for the deployment.

"Some RURO LIMS 24/7 customers go through the process of developing advanced requirements with our staff, deploy the system, then realize six months later that they forgot to mention some other critical function, for example, tracking staff performance in addition to instrument scheduling." Or perhaps adding capability like field sample collection or an app on a remote-access device (e.g., a phone or tablet) to alert off-site workers to adverse weather conditions.

According to Dolan, users' existing IT staff should be able to modify and embellish the capabilities of his company's LIMS 24/7 without going through the vendor. "If you mix application programming interface (API) with effective training, users should be able to integrate instruments post-implementation without contacting us. For example, they can set up external databases to automatically transmit data 24/7. Customers should not need to go back to the software provider to set up these integrations. You most likely have staff already who can work with API."

Data formats have been a perennial hurdle for lab informatics and integration, as they often contain intellectual property. Historically, this caused a surge in proprietary formats, between which communication among instruments, and between instruments and LIMS/ELN, was impossible. We are now seeing much more openness and accessibility.

Top instrument companies have for many years attempted to remain vendor neutral and support each other's data formats. The stark reality is that customers use instruments from multiple vendors. "It's rare to walk in and find a lab is strictly Thermo Fisher or another vendor," says Trish Meek. "We have to be realistic and manage the different data types from different vendors. It plays the other way too. If other vendors can't get information into and out of our systems, they may not be able to sell an instrument into a lab that uses our LIMS. That is why we maintain ongoing conversations with all the vendors we can and continue to support their instruments' file formats as they develop new equipment for our customer base."

Interconnectivity and interoperability with instruments and other data systems are a "huge" component of return on investment, according to LABVANTAGE's Smallmon. "In the early days making things talk to one another was a dream. Now connectivity is here, and it has produced massive time savings."

A Q&A WITH TWO LABORATORY DATA SYSTEMS EXPERTS

Because our user-experts had widely varying experiences with data management systems, we asked them questions that reflected their situations.

OUR EXPERTS:

Marlene Lawley
Senior IT Specialist
Southern Research Institute
Birmingham, AL

Bob Plastridge
Lab Manager
University of California,
Morse Laboratories, LLC
Sacramento, CA

MARLENE LAWLEY

Q: What type(s) of laboratory information system(s) are you most familiar with, and for what types of lab work?

A: Provantis is an integrated Windows-based system designed for nonclinical evaluation studies. Instem Life Science Systems of Staffordshire, England, is the vendor and provides support from its Plymouth Meeting, Pennsylvania, location. Types of information include pre-study data (e.g., body weights), in-life activities (dosing, food and water consumption, weights), reproduction, and pathology. The system generates reports that include audit trails, data tables, and report summaries with statistical evaluations.

Q: Compare the system's strengths and weaknesses.

A: The system collects, stores, and reports toxicological, reproductive, and fetal pathology data, which are retrievable by study, animal, date, activity, or any other desired grouping. Complete audit trails are easily generated and provide all the necessary GLP requirements.

As for weaknesses, a few elements may require extra time and familiarization. We look forward to the addition of full Windows functionality in the clinical pathology portion of the system that interfaces with the analyzers. It has been noted that access to online data review of gross and histopathology can be laborious; however, the essential security aspects of the system are part of this.

Q: Was there any notable pain, discomfort, or resistance when the system was first deployed?

A: When we first deployed Provantis in 1995, some users were uncomfortable with it and resisted using computers in the laboratory. The system, which was a DOS product, was not completely intuitive at that time, so there was a big learning curve for most users. The vendor provided good training, and the users now prefer the paperless data collection.

Q: How helpful was the vendor in resolving problems?

A: The vendor communicates with us regularly, always seeking input and ideas for upgrades. Problems reported to their help desk are usually addressed

rapidly, and most are resolved. Others are marked for correction or enhancement in future upgrades. The support manager is always receptive to our concerns.

BOB PLASTRIDGE

Q: Describe your experiences with LIMSs.

A: I have used LIMSs in two different companies, both pharmaceutical CROs. Company A concentrated on GLP bioanalytical work and dabbled in agricultural-chemical work. This company also built their data system themselves. Company B was split 50/50 on cGMP pharmaceutical work and GLP ag-chem work. Each company was at a very different stage in the development and use of their LIMS and held different philosophies with respect to use and implementation.

Q: Can you describe these differences?

A: Company A believed in putting significant resources into LIMS development and in pushing the limit of what the LIMS could do. Their system was home-built, and it was incredible. It was the fabric of the company and permeated every part of the lab. The LIMS tracked every sample and supply that came into the lab, every controlled document, every freezer/refrigerator and lab temperature, and right before I left the company, they rolled out a way for it to parse data for review and table development. The idea was to exploit the system to the fullest, even if that meant writing and validating code.

Company B approached their LIMS much more conservatively, by purchasing and developing a commercial program. Initially, they allocated fewer resources for the LIMS, so development lagged. To their credit, as management recognized this, they allocated more resources to the LIMS. In all fairness, Company B was much more diverse, with more complex regulatory challenges.

Q: What kinds of resources were required to build and maintain a home-built LIMS?

A: The company had four dedicated programmers and one validation person who took care of the LIMS system. This was their "only" responsibility, and the LIMS system evolved as the work and needs evolved. I think that today the same ownership would make the same commitment to technology and a LIMS as they did then. Since there are more commercial systems available now, they might begin with that, but I think the commitment of resources would be the same.

Q: How responsive were your companies' IT professionals in terms of adapting the LIMS to changing workflows?

A: Company B decided to purchase a LIMS system. Good idea, but the resources to develop and use the system were not initially put in place. As with a lot of companies, the IT group was expected to add this to their list of responsibilities and a LIMS group was not set up. The initial implementation took longer than anticipated, and when rolled out, the use of the system functionality was not where it needed to be. This caused staff support for the system to diminish, and there was less momentum to push the system forward. I have to add that senior management realized this, and more resources, in the form of programming consultants and such, were added to the project.

Q: If you were managing a midsized company today, would you build or buy?

A: That is a tough question. I think it would depend on whether I had staff to develop the program. If I did, I would relieve them of some other responsibilities. Two concerns would be regulatory compliance and validation and what happens if the programmer leaves. These concerns can be mitigated by validating the system as it is developed and insisting on GLP-level documentation during development.

I think that developing it in-house is less expensive and provides greater flexibility and easier system evolution. Even as it grows larger and permeates more of the company, hiring several programmers would be cheaper than hiring the LIMS company consultants.

The World's Largest Gas to Liquids Facility Runs on Thermo Scientific SampleManager LIMS

By Colin Thurston
Thermo Fisher Scientific

Pearl GTL has no shortage of world records: Established by Shell and Qatar Petroleum in 2006, the facility is the largest gas to liquids (GTL) plant on earth. GTL technology enables Qatar–in partnership with Shell–to open up new opportunities in new markets, monetizing its enormous natural gas resources through the creation of high-quality, easy-to-export liquid fuels. The facility processes 1.6 billion cubic feet of wellhead gas per day, using the proprietary Shell Middle Distillate Synthesis process to convert gas field output into fuels, lubricants and other high-quality products that Shell ships to markets around the world.

It was clear from the beginning that Pearl GTL would need a highly sophisticated software solution to manage the data coming out of a quality control system that receives a constant stream of 34,000 transmitted measurements. These tests gauge well content, volume, emissions, equipment condition and hundreds of other issues integral to the plant's operation. In addition to collection and storage, the data also needed to be organized, integrated and analyzed to ensure product quality, plant and customer safety, environmental protection and production efficiency.

"A project of Pearl GTL's magnitude hasn't been attempted before," said Ajith Kumar, senior business analyst for Qatar Shell GTL. "With billions of investor dollars and tens of thousands of jobs at stake, data management was a major priority. To maximize production with quick decisions, we needed condensed, accurate information at our fingertips at all times."

With so many prerequisites for success, Pearl GTL needed a proven solution. The right laboratory information management system (LIMS) would allow Pearl GTL's sampling program to meet its designers' sophisticated ambitions. It would present accurate, unbiased information that enabled Shell to maintain the highest standards of safety, regulatory compliance and environmental commitment without sacrificing financial performance. In fact, a LIMS would enhance Pearl GTL's bottom line by collating testing data, which allows managers to make impactful business decisions quickly.

In addition to organizing sample results, Pearl GTL's LIMS would need to be fully integrated and communicate with a variety of other systems or a venture the size and scale of Pearl GTL would be nearly impossible. Shell chose Thermo Scientific SampleManager LIMS for its state-of-the-art testing laboratories, because the solution offered unparalleled support for each of its stringent requirements.

One of Shell's principal reasons for choosing the LIMS was its ability to work with

other systems. At Pearl GTL, the LIMS is integrated with an operations management system (known as OTTER), process historian (PI), the oil movement and batch tracking system, laboratory instruments and other production systems. The way the LIMS integrates with PI is a particular source of efficiency. Where some labs manually send test results to operations, technologists and process engineers, among other users, at Pearl GTL results become available to all relevant parties within the PI system as soon as they are authorized in SampleManager. This means that the many employees whose work hinges on quality sampling are receiving the information they need in real time.

> "Field operators can do their jobs faster and also more accurately, since they're not recording readings by hand. And ultimately, it's SampleManager that enables the real-time aspect of the OTTER system to be possible."
>
> **— Mansoor Al-Shamri, Laboratory Manager, Qatar Shell GTL**

Another critical consumer of lab data is Pearl GTL's oil movement and batch tracking system. Again, the LIMS creates efficiencies by eliminating wait times. When panel operators need to move oil to new tanks in preparation for shipping, for example, they do not have to wait to be notified of test results, minimizing demurrage charges for loading delays that can cost as much as $35,000 per day. As soon as the results have been issued in the lab, SampleManager notifies operators through the oil movement system, with which it is seamlessly integrated. Since Pearl GTL opened, the facility has incurred no demurrage charges, an incredible feat for an operation so large.

A LIMS also helps Pearl GTL operators more efficiently collect data from the field for analysis in the lab. Using the OTTER system, all sample points in the field are marked with radio frequency identification tags. When field operators perform sample rounds, a handheld computer guides them to each sample point and then automatically records the required information, whether the sampling task is routine or non-routine. The data are then instantly transferred to SampleManager from the field, saving Pearl GTL an estimated 2,400 hours worked per year.

"It's amazing how much overhead we were able to eliminate with the OTTER system," said Mansoor Al-Shamri, laboratory manager for Qatar Shell GTL. "Field operators can do their jobs faster and also more accurately, since they're not recording readings by hand. And ultimately, it's SampleManager that enables the real-time aspect of the OTTER system to be possible."

Pearl GTL is unique as an integrated upstream/downstream facility that entails

the full value chain of gas extraction and processing from offshore development through onshore refining. Shell and Qatar Petroleum used a LIMS to help their ambitious vision excel by managing a highly sophisticated sample program. Pearl GTL's testing program enables the world's largest gas to liquids facility to operate efficiently and safely while adhering to regulations and maintaining profitability, and Thermo Scientific SampleManager is the lynchpin that makes it all possible.

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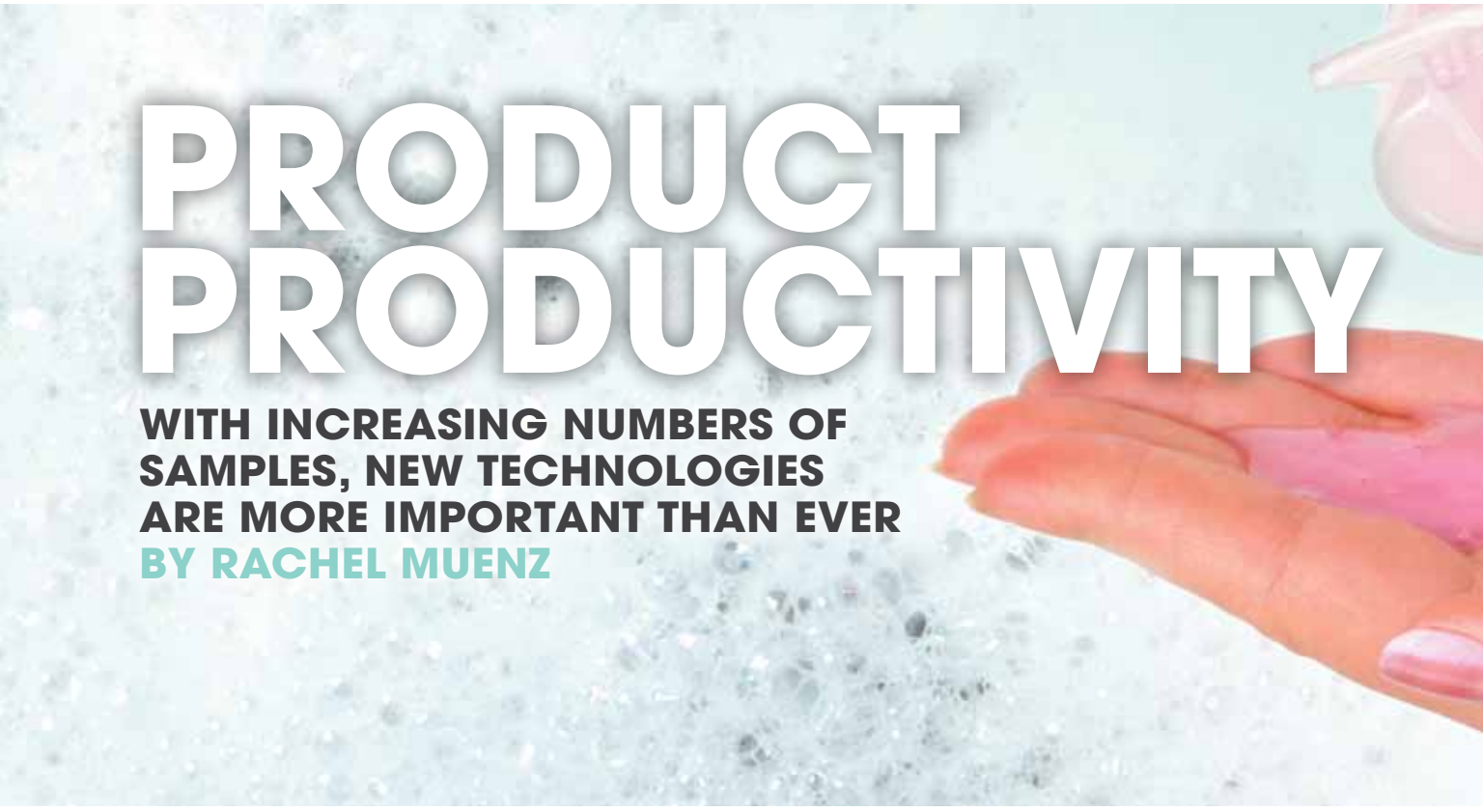
For more information, please visit www.thermoscientific.com/informatics or email us at marketing.informatics@thermofisher.com.



PRODUCT PRODUCTIVITY

WITH INCREASING NUMBERS OF SAMPLES, NEW TECHNOLOGIES ARE MORE IMPORTANT THAN EVER

BY RACHEL MUENZ

Like many laboratories nowadays, personal care labs face increasing workloads, needing to test more samples with the same number of staff. Notoriously secretive because of the competiveness of the industry, these types of labs must also meet the challenges of strict industry regulations. All these factors make technology and equipment very important in personal care laboratories, ensuring that products such as shampoos and lotions are as attractive as possible to the customer while also being safe to use.

Robert McGregor, marketing manager at Brookfield Engineering, which manufactures viscometers, rheometers, texture analyzers, and powder flow measurement instruments used in many personal care labs, says the kinds of tests personal care labs are able to do are quite amazing.

For example, texture analyzers, which apply compression or tension to materials to test how well they stand up to being pulled or squeezed, have attachments that enable a variety of tests. One device can be used with a texture analyzer to comb hair in order to see how shampoos and similar products will behave in the hair.

> "Changes in personal care lab instrumentation have been both mechanical and electronic."

"It's very simply a fixture that pulls a comb through a piece of sample hair that has been treated with a shampoo or conditioner," McGregor explains.

Another fixture allows labs to test the internal strength of lipstick when it's extended from its container, while another measures the amount of force needed to squeeze a product out of a tube or to push the plunger on a container. Texture analyzers can also be used to test the uniformity of the powder in a compact and how much force it can withstand before it cracks.

"Once you see what happens, it opens your eyes up and makes you say, 'Wow, I didn't know they could test those kinds of things,'" he says of the different capabilities texture analyzers bring to personal care labs.

Another key part of labs that develop and test such products is the rheometer.

"Rheometers may be used to fully profile a personal care product before, during, and after its application stages," explains Anton Paar USA applications engineer Maxine Quitaro. "Rotational and oscillatory tests may be performed on the materials to mimic rest and shear conditions from processing to packaging and end use of the product."

She adds that rheometers can also be used to measure material properties, such as viscoelasticity, recovery after shear, change in viscosity, effects

of additives, strength, tackiness, and stability. Accessories can also allow users "to precisely study temperature effects of the material as well as the material's friction and wear properties on a system, such as skin or hair."

Oscillatory tests could also be run by a rheometer to further investigate the internal structure of the product for formulation modification purposes, Quitaro explains. After those tests are run, "comparative tests can then be performed by the rheometer to isolate the optimal formulation for a personal care product," she says.

Stirrers can also be found in many labs that develop personal care products and are used for applications such as oil and water emulsions, batch work, viscous product mixing, and multiphase processes, says Marta LaForest, sales and marketing manager for laboratory products at Caframo.

Caframo's new Sweep blade, designed for high-viscosity, low-speed mixing, has received good reviews from the cosmetics industry.

"Our stirrers are recognized for their durability and power to mix heavy, viscous product at the lab bench level," she says.

The overhead stirrer manufacturer's new Sweep blade, which was recently displayed at the New York Society of Cosmetic Chemists (NYSCC) meeting in New Jersey, has gotten great reviews in the cosmetics market, LaForest says.

"It is designed for viscous mixing and fits onto an anchor paddle and pulls product off the side walls of a

"The capabilities are moving faster than the labs themselves."

four-liter vessel," she says about the blade's unique features.

To measure the flow behavior of liquids and semisolids, personal care labs turn to viscometers.

"The companies that produce shampoos, hair conditioners, mascaras, lotions of various kinds—they will typically measure those products in quality control for viscosity to make sure they will not only flow out of the tube correctly, but that they will apply correctly when used by the customer," McGregor says of how viscometers are used in the lab.

These instruments ensure that such products squirt properly out of the bottle, hold their position in your hand, and can be easily rubbed into the skin.

"The viscosity measurement gives an indication of how easy or how difficult that transfer process will be," he says.

Powder flow testers, on the other hand, allow labs or manufacturers to predict the ability of the powder to discharge from the bins they are stored in, McGregor adds. Normally, in the manufacturing process the powder needs to come through a hopper at the bottom of the bin. Flow testers let the user know exactly how powder will flow before that process begins.

Changing technology

Changes in personal care lab instrumentation have been both mechanical and electronic.

In terms of rheometers, those changes fall mostly on the mechanical side.

"Over the past few years, the advent of air bearing motors has led to very sensitive torque measurements in rheometers," says Prajakta Kamerkar, PhD, a product specialist at Anton Paar. "We have also seen the movement toward rheology measurements coupled with optical or application-specific accessories to study the structure in samples."

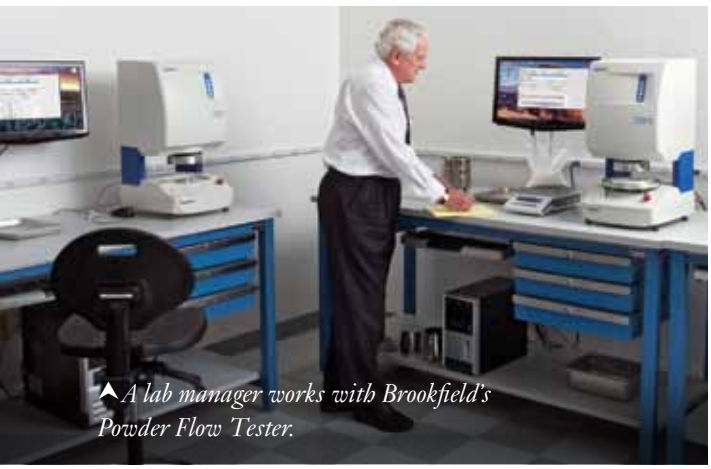
A lab technician works with a Brookfield CT3 texture analyzer.

Dr. Kamerkar adds other changes include tool recognition systems, such as a Toolmaster device, true gap measurements, and increased accuracy of temperature control due to the temperature-controlled hood system. That system "covers not only the sample but the measuring system and the surrounding atmosphere as well, thereby reducing temperature gradients."

For texture analyzers, viscometers, and powder testers, most of the changes have been electronic.

"What you see happening now is that smartphones are being built into these instruments, so the way that you interface with the instruments is just the same way that you interface with a handheld device like an iPhone," McGregor explains.

Such devices now have touchscreens, users can run any number and type of test they want, and everything is in the memory of the instrument, he says. "Every piece of data that is measured during the test is recorded by the instrument."



A lab manager works with Brookfield's Powder Flow Tester.

Lab technicians work with various Brookfield viscometers during a viscosity training session.

Engineer notes viscosity reading on Brookfield DV3T Rheoemeter.

Users can now transmit that data to central databases or use memory sticks and flash drives to transfer data to other devices, he adds. "The way in which data is being generated, gathered, and analyzed has changed significantly, and that's because of the ease with which you can do that with today's technology."

McGregor says lab technicians no longer need to watch over their instruments, because the devices do everything automatically. For example, in a viscosity test, the user may need to rotate a spindle in a fluid for two minutes and then take a data point. Before, users would have had to sit and watch until two minutes were up, but that's not the case anymore.

"Technicians no longer have to babysit the instruments," he says. "The instrument knows automatically and it records the data for the technician."

New technology is also helping labs meet the tough regulations of the industry, particularly 21 CFR Part 11, which stipulates that access to instruments must be controlled to ensure that only those with the proper training are allowed to run certain tests on the equipment. Labs must also make sure the data that comes out of that test is saved, cannot be modified, and is routed to the correct location, where it's maintained as a permanent record.

"Instruments now have the intelligence built into them to comply with that requirement," McGregor says.

As far as service goes for viscometers, texture analyzers, and powder testers, McGregor says

these instruments come with calibration tools so customers can run verification checks themselves, adding it's up to the labs how often they want to run those checks.

"Some very busy labs might actually do a calibration at the beginning of every shift," he says. "Labs that are part of somewhat smaller companies may feel the need to check their instrument only when something is wrong."

He adds users normally send their instruments to Brookfield for service and recertification on an annual basis, but, again, it's up to the labs how often they want to do that.

"Lab managers need to do their homework and look at as many vendors as possible."

Industry challenges

One of the major challenges for personal care labs is just staying on top of new technology and how it can enhance productivity. But with the increasing workloads of these labs, it can be tough to find the time to research new technology and implement it as quickly as possible, McGregor adds.

A TECHNICAL NOTE

According to McGregor, it's important for lab managers who use viscometers to learn as much as they can about viscosity measurement and be aware that it is not just one number.

A viscometer has a spindle connected to the instrument that is immersed in the fluid being measured and rotates at a defined speed. The resistance to rotation is what is measured by the instrument.

"What you learn about most materials, like shampoos and conditioners, is that if you change the rotational speed, you get a different number than the one you got at the first speed," he explains. "That's just the nature of viscosity."

Taking an additional one or two measurements at different speeds is important for that reason, as it gives lab managers a better control point for their products, he says, adding that technology built into today's instruments does all that automatically.

He sees more lab managers moving to this technology in the future as they become more aware of this aspect of viscosity.

"I think that as education continues in the lab manager world, they will start to appreciate this reality about viscosity and you'll see them migrate more rapidly to the instrumentation because it's got the intelligence built into it to do these types of tests automatically."

"The capabilities are moving faster than the labs themselves," he explains. "There's also got to be an investment to upgrade from older equipment that they use to new equipment."

While one might expect personal care labs to constantly be adopting the newest technology to keep pace with their competitors, like many of today's cash-strapped facilities, these labs actually tend to be very careful about new purchases.

"Labs are very cautious about upgrading because they don't have unlimited budgets to do that," McGregor says, adding Brookfield instruments have a long life, with many personal care lab customers using products that are 10-15 years old.

He says lab managers need to do their homework and look at as many vendors as possible to ensure they get the best bang for their buck.

"They need to compare the capabilities and features of the instrumentation and make sure that they match the ways in which they want to use the instruments in their lab," McGregor advises, adding users should think of whether they want to keep the equipment in the lab or on the production line and where they want to position it in the facility. Calling vendors and asking for product demos, whether through videos or in-person classes, is also important.

▲ *Anton Paar's MCR family of rheometers*

"The bottom line for these lab managers is, 'How can I continue to support the increasing volume of samples that I'm being asked to test every day with no increase in lab staff and how can I get more out of the instrumentation so that I don't need human resources to keep expanding to meet these growing requirements?" he says.

INSTRUMENTS USED IN A PERSONAL CARE LAB:

- Rheometers
- Stirrers
- Texture analyzers
- Viscometers
- HPLC systems
- Microbiology instruments to test for things such as bacteria and fungi

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PIPETTES

LIQUID HANDLING TECHNOLOGY ALWAYS IMPROVING

by Rachel Muenz

Pipettes. They can be found in almost every laboratory and, if you're looking to buy one, there are many options— manual or electronic, single or multi-channel. Luckily, a few main considerations can help in deciding whether or not to buy the latest pipette technology.

First, a user should check their current pipettes to see if they are working properly and if they still fit the user's needs. Consulting with vendors and their technicians is also helpful.

▼ Eppendorf original, the first piston-stroke pipette.

Melissa Winters, filtration and purification and liquid handling sales specialist at Sartorius Laboratory Products and Services, says there are a number of signs that signal a pipette may need replacing. The pipette may no longer be accurate, the volume is drifting, or lab techs may be experiencing repetitive motion injuries from heavy or non-ergonomic pipettes. If tip cones are visibly worn and tips aren't sealing well, the piston surface is worn or corroded, or the batteries of an electronic pipette are no longer holding a charge, it could be time to go shopping, she says.

In such cases, a user should probably send their pipettes to their vendor's service center, says Melinda Sheehan, liquid handling product manager at Eppendorf.

"[The vendor] can supply the most updated and current replacement parts and probably the lowest cost for that particular product if you go directly to the manufacturer to have it repaired, calibrated or checked," Sheehan says, adding the center will also provide users with a quote to determine if it's worth it to repair the pipette or more cost-effective to buy a new one.

Sheehan adds that once a warranty is up on a pipette, users should pay special attention to make sure it's performing properly.

Despite the up-front cost, buying new means better precision, accuracy, ergonomics, programming, and usability, so users can be more productive and save on reagent costs, both Winters and Sheehan say. The newest model often includes new features that can improve performance even more.

However, if users' current pipettes aren't causing any ergonomic injuries, are still accurate, aren't being used to pipette harsh solutions, and are being maintained and calibrated regularly, there is probably no need to upgrade Winters says. Or, the pipette "may be written into operating procedures so it would be difficult to change," she adds.

▲ Eppendorf's latest series of electronic pipettes, the Xplorer.

Sheehan says a quick repair can also suffice.

"Sometimes a pipette is simply out of calibration or an O-ring needs to lubricated, a spring needs to be replaced, and it's good as new for under $40 even with the cost of shipping," she says.

Regular pipette maintenance is important and how often it needs to be done depends on how often the pipette is used, the types of solutions being pipetted, how many people are using the pipette, and if the user's industry is regulated, the experts say. In general, yearly calibrations are recommended.

"Generally, pipettes should be maintained and calibrated on a regular schedule," Winters says. "This will extend the life of the instruments and significantly reduce failure rates."

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Eppendorf sets a new standard in pipetting. The ultra light Eppendorf Research plus pipette meets the highest needs in precision and accuracy—combined with ultimate ergonomics and increased flexibility.

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▲ Biohit's first pipette, the Proline E (now discontinued) was launched in 1990.

▲ Sartorius Biohit launched the Red Dot Award-winning Picus in 2012.

Upgrading a pipette really has only two cons, the specialists add: the up-front cost to purchase and the time it takes to adjust to the new instrument.

"A pipette is a very personal thing," Sheehan says. "They [users] get used to the touch and the feel of it and often there is an adjustment period of getting used to a new product."

OPTIONS FOR USERS WITH AN UNLIMITED BUDGET

- Buy the latest and greatest technology available
- Go for an electronic pipette—the increased accuracy is worth it
- Purchase a pipette that uses a positive displacement system, which provides the best precision and accuracy
- If the budget is truly unlimited and the need is there, an automated system is the way to go

OPTIONS FOR USERS WITH A TIGHT BUDGET

- Ensure pipettes are checked/maintained frequently
- Make sure to buy pipettes that are easy for users to maintain and calibrate themselves
- Send current pipettes to a service center for a quick check up (can be done for under $20)
- Check out the trade-in or lease programs available
- Look into replacing several manual pipettes with one electronic one

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Any Bandwidth.
Any Assay.

Anything Is Possible.

CLARIOstar® - High Performance Microplate Reader with Advanced LVF Monochromators, Spectrometer, and Filters

Advanced Detection for Fluorescence and Luminescence Assays:

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CLARIOstar Additional Features:

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- Fluorescence Intensity, FRET, Fluorescence Polarization, TRF/TR-FRET/HTRF®, Luminescence, and BRET
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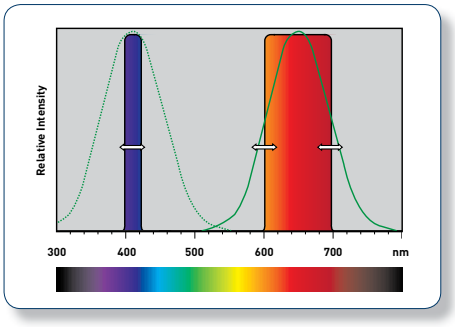

The CLARIOstar's monochromator has continuously adjustable wavelengths and bandwidths for excitation and emission, giving it filter-like performance

www.bmglabtech.com

BMG LABTECH

The Microplate Reader Company

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ARE YOU IN THE MARKET FOR A... MICROPLATE READER?

Microplate readers are widely used in research, drug discovery, bioassay validation, QC, and manufacturing processes for the detection of biological, chemical, or physical processes in samples contained in microtiter plates.

Types of microplate readers currently used by survey respondents

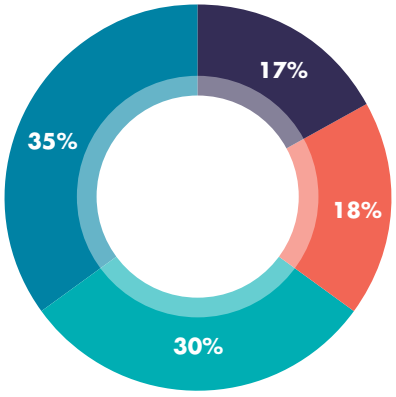
Absorbance	25%
Microplate Spectrophotometer	17%
Luminescence Reader	12%
Multi-mode Reader	9%
Fluorescence polarization	6%
TR-FRET	5%
TRF	4%
Alphascreen	2%

Top 5 microplate reader applications reported by respondents

Assay Development	16%
Cell Biology	13%
Biomolecule Concentration Measurement	12%
Bioassay Validation	9%
Biomarker Research	9%

Over 25% of respondents currently using a microplate reader plan on purchasing a new microplate reader in the next year for the following reasons:

- New application requiring a different type of reader
- Setting up a new lab
- Replacement of an aging microplate reader
- Addition to existing system; increase capacity



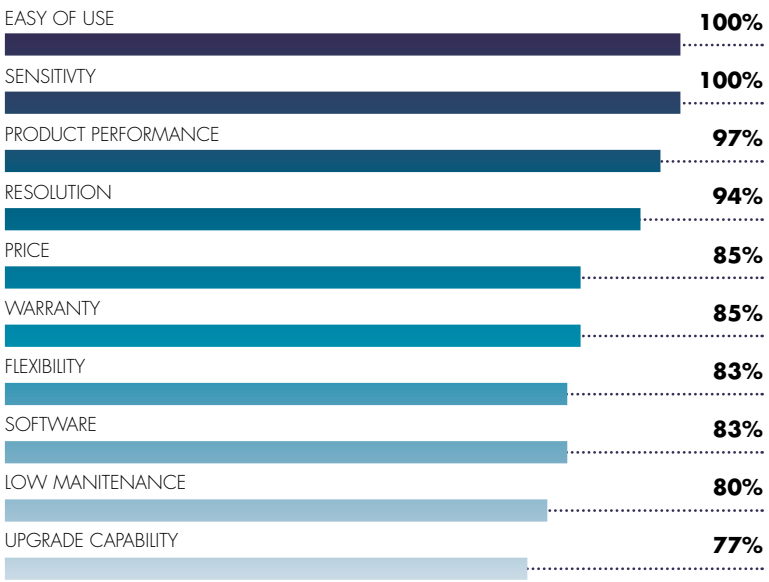
TOP 8 QUESTIONS

You Should Ask When Buying a Microplate Reader

1. **How many read modes are offered?** Multiple read modes offer greater flexibility and value than single read modes.
2. **What kind of detection technology is used?** Monochromator-based detection offers flexibility, convenience and spectral scanning; while filter-based detection is characterized by precise sensitivity and may often switch rapidly between distinct wavelengths for kinetic assays. Hybrid detection systems combine both technologies for the utmost in flexibility and sensitivity.
3. **Is it upgradeable? If so, can the upgrade be installed on-site?** On-site installations reduce overall downtime, and often the technician is available to answer questions or conduct training.
4. **Is the reader automatable?** Automating the process with a compatible microplate stacker increases throughput with walk-away operation.
5. **Ask about the software—is it integrated and user-friendly?** Does it allow for pre-programmed and custom protocols? What kind of analysis is offered? How is data exported?
6. **Is on-site training available?** Is there a fee? On-site training provides an opportunity for all staff to learn about the reader, reducing the number of subsequent trainings needed.
7. **What options are available?** Options such as gas control, barcode scanning, shaking, and injecting increase assay flexibility for those that need these features.
8. **What assay validation data is available for the reader?** Assay validation data specific for the reader provides proof that the reader performs as indicated.

TOP 10 FEATURES/FACTORS

respondents look for when purchasing a microplate reader



For more information on microplate readers, including useful articles and a list of manufacturers, visit www.labmanager.com/microplate-tech

CYTATION 3
imaging reader

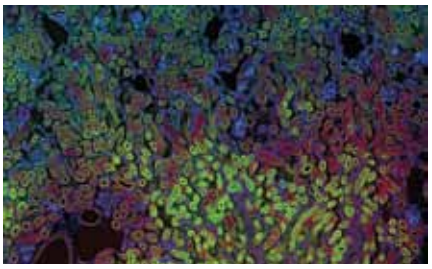
Auto XY Stage

Auto Focus

Auto Cell Counting

Auto Image Capture

AutoEasy



High quality, automated imaging made simple.

With so many ways to automate cell counting and image analyses, the Cytation™3 Cell Imaging Multi-Mode Reader saves time and improves your workflow; all at a reasonable price. It can also be upgraded at any time to a Hybrid multi-mode microplate reader for enhanced flexibility and value.

To see all it can do for live cell applications, visit **www.cytation3.com**.

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ARE YOU IN THE MARKET FOR A... GAS GENERATOR?

In many laboratories, gas generators are quickly replacing traditional tanks offering greater flexibility, convenience, safety and cost-effectiveness. Gas generators offer the ability to produce on-demand supply and specialty blends of highly pure gases for various applications.

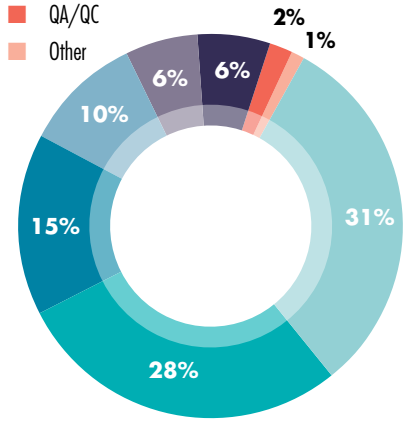
Types of gas generators currently used by survey respondents

Hydrogen	38%
Nitrogen	30%
Zero Air	18%
Calibration	5%
Purge	5%
TOC	2%

Gas generator applications reported by survey respondents

Gas Chromatography with mass spectrometric detection	31%
Gas Chromatography with flame ionization detection	28%
High performance liquid chromatography	15%
Other (e.g., LC-MS, SAA)	10%
TOC analysis	6%
Fourier transform infrared spectroscopy	6%
Inductively coupled plasma systems	2%
Nuclear resonance spectroscopy	1%

Over 55% of respondents currently using a gas generator plan on purchasing a new or additional gas generator in the next year for the following reasons:



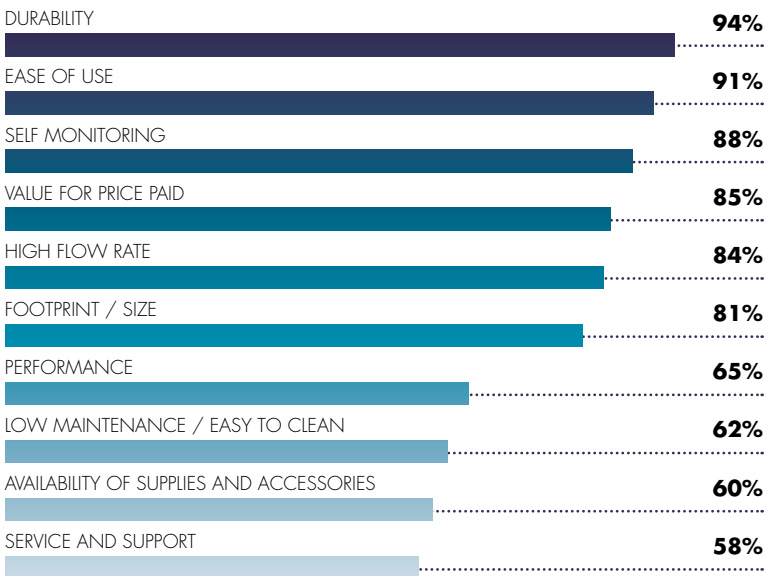
TOP 6 QUESTIONS

You Should Ask When Buying a Gas Generator

1. **What is your application?** As the range of available gas generators continues to expand, consider what it will be used for. For example, Fourier transform IR spectroscopy operates best in the absence of carbon dioxide so users will require a generator that creates CO_2-free gas.
2. **Do you require high quality gas?** In many cases gas generators can produce a superior product both in purity and consistency without the risk of contamination during gas-line changing.
3. **What volume of gas do you require?** Many instruments now require higher volumes of gas. If your space is small, or you expect your needs to increase over time you may wish to consider a gas generator which will take up much less space than storing tanks of gas.
4. **Are long-term cost savings important to your project?** Beyond convenience, gas generators save on shipping costs, time-related costs for changing tanks, and managerial costs for managing safety and supply of tanks.
5. **Is noise a factor in your lab?** Noise can be both bothersome and present a real health concern for those exposed. If low-noise is desirable, consider a gas generator with detachable or low-noise compressors.
6. **What sorts of service agreements are available?** Is training in self-maintenance sufficient, or are service representatives available?

TOP 10 FEATURES/FACTORS

respondents look for when purchasing a gas generator



For more information on gas generators, including useful articles and a list of manufacturers, visit www.labmanager.com/gas-generators

Together, we can eliminate helium, reduce costs, and improve lab safety.

The global shortage of helium has caused prices to increase significantly. Many GC users are considering switching to hydrogen as a carrier gas. Hydrogen provides many advantages over helium including, higher resolution, shorter run times, longer column life, and cost savings. Many instrument manufacturers now provide resources to make switching carrier gas easier.

Using a Parker Balston hydrogen gas generator will eliminate safety concerns associated with storing and handling pressurized cylinders; instrument downtime due to gas interruption and calibration; inconsistent gas purity; dependence on outside vendors; and the concern of running out of gas during analysis.

Convert from Helium to Hydrogen as a Carrier Gas

Download Step by Step How To Guide

www.parker.com/H2

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ENGINEERING YOUR SUCCESS.

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ARE YOU IN THE MARKET FOR A... UV-VIS SPECTROPHOTOMETER?

One of the oldest and most common forms of absorption-based analysis, ultraviolet-visible (UV-Vis) spectrophotometry continues to evolve. Increased mobility, reliability, ease of use, speed, and overall miniaturization will be the major trends in these instruments.

Types of UV-Vis spectrophotometers currently used by survey respondents

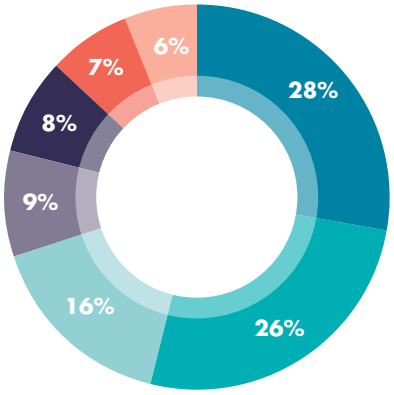
Single Beam	48%
Dual Beam	35%
Array Based	12%
Handheld	4%

Top 5 UV-Vis spectrophotometer applications reported by survey respondents

Biochemistry and biology	20%
Chemical analysis	19%
Environmental	11%
QA / QC	11%
Clinical analysis	6%

Nearly 30% of respondents currently using a UV-Vis spectrophotometer plan on purchasing a new or additional system in the next year for the following reasons:

- Addition to an existing system
- Replacing an older spectrophotometer
- Require an instrument that is simple to operate and maintain
- Require an instrument with faster acquisition and data analysis
- Require an instrument with excellent reproducibility
- Require an instrument with a broad range of accessories
- Other



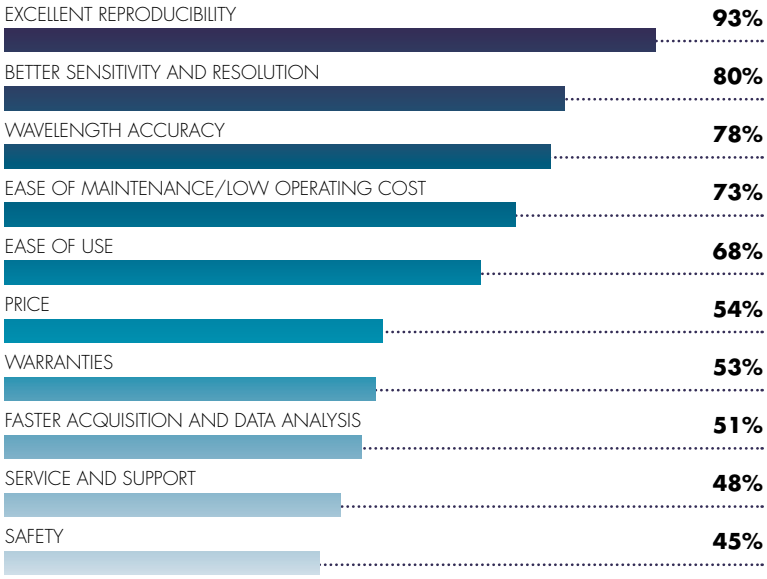
TOP 7 QUESTIONS

You Should Ask When Buying a UV-Vis Spectrophotometer.

1. What are the key elements you need to have from the data system?
2. What differentiates the vendor's software from others offered, in terms of chromatography data handling, customization and powerful analysis?
3. How do you validate the specification claims presented by the vendor?
4. Has the data processing software been designed for enhanced analytics, with lab workflow in mind and does it support critical compliance requirements?
5. What are important price points to keep in mind when selecting a GC software package?
6. Laboratories need fast and effective services. This includes an effective distribution of installations, help desk, education, and service personnel. How does the company serve these needs globally?
7. Is validation, like support for 21 CFR Part 11, critical for you?

TOP 10 FEATURES/FACTORS

respondents look for when purchasing a UV-Vis spectrophotometer



For more information on UV-Vis spectrophotometers, including useful articles and a list of manufacturers, visit www.labmanager.com/spectrophotometers

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Introduced at Pittcon 2013

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- DelsaMax PRO provides precise measurement of the size, structure and charge of particles 0.4 to 10,000 nm in diameter in as little as one second
- Instruments in the family utilize two independent detection systems that operate in parallel—a configuration that significantly streamlines workflows in biological, chemical, material and polymer science applications

Beckman Coulter www.beckmancoulter.com

Moisture & Fat Analyzer

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- Combines microwave moisture analysis with a second generation, patent-pending NMR system
- Provides fast, accurate results in a diverse range of products
- Can be used in the QA/QC laboratory or at-line to help companies make ingredient adjustments, optimize their process, and maximize least cost formulation
- Able to complete a test in only 2 minutes for dry samples

CEM www.cem.com

Microspectrophotometer

20/30 PV™

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- Analysis of samples can be done by absorbance, reflectance, Raman, luminescence and fluorescence with speed and accuracy and all with the same instrument
- Can be used for numerous applications

CRAIC www.microspectra.com

Tandem Micro-Reactor System

Rx-3050TR

- Designed for the rapid evaluation, characterization and performance of catalysts
- Interfaced to the inlet of a GC/MS System with PC-based control software to set up each mode of operation
- Software can be set to control separate temperature zones, cryogenic trapping, and analytical modes
- Features multiple modes of operation

Frontier Laboratories www.frontier-lab.com

Raman Mini-Spectrometer

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- Expand on the existing TG series and adopt a high sensitivity, silicon back-thinned CCD image sensor, specially selected to match the optical arrangement
- Offer a very narrow spectral resolution of 0.3nm
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Hamamatsu Photonics www.hamamatsu.com

Mini PDA Spectrometer

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- Features the most popular UV-VIS ranges in a miniature grating spectrometer, including UV-VIS (200–860 nm), VIS (380–750 nm), or UV-NIR (200–1050 nm)
- Provides excellent peak symmetry at affordable volume pricing
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- Operates on a minimum amount of liquid helium
- Will substantially reduce consumption of liquid helium by reliquifying the helium gas generated by evaporation of the helium in the magnet
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- System design allows for biannual maintenance without affecting the high magnetic field

JEOL Resonance
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Vis/NIR Spectrophotometer

CLARiTY 11

- Makes it possible to obtain accurate absorbance and fluorescence spectra from historically challenging turbid samples
- Uses a gas of photons as the measurement beam and a unique integrating cavity as the sample holder which makes it possible to collect accurate spectra from samples which are clear, cloudy, murky, gelatinous, fibrous, or frozen

On-Line Instrument Systems www.olisweb.com

Microscope Illumination Spectrometer

LumaSpec 800

- Provides quantitative spectral data for virtually any microscopy light source
- Uses an illumination target in a 3" x 1" glass slide format; able to check microscope illumination at the sample plane
- Provides quantitative and graphical information from 350nm to 800nm with 1.5 nanometer resolution
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Prior Scientific www.prior.com

Elemental Analyzer

NEX OL

- Features advanced third generation EDXRF technology
- Designed to span from heavy industrial through to food grade process gauging solutions
- Configurable for use in both classified and non-classified areas
- Delivers rapid, non-destructive, multi-element analyses—from parts-per-million (ppm) levels to high weight percent (wt%) concentrations—for elements from aluminum (^{13}Al) through uranium (^{92}U)

Rigaku www.rigaku.com

Portable ED-XRF Analyzer

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- Enables rapid, laboratory-class elemental analysis of environmental and geological samples even in remote locations
- Light weight (12 kg/26.46 lb) and small (270 x 306 x 306 mm/10.7 x 12.1 x 12.1 in)
- Includes a large sample compartment, X-ray tube, onboard processor, and high-yield battery pack
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SPECTRO www.spectro.com

Electrochemical Detector

Dionex UltiMate 3000

- Makes the speed and resolution of UHPLC separation available with electrochemical detection
- Compatible with the current family of Thermo Scientific Dionex Ultimate 3000 EC-optimized HPLC and UHPLC systems
- Features coulometric and amperometric sensors that are designed for simple, flexible and low-maintenance operation
- Can be used with gradients for method flexibility and high throughput

Thermo Fisher Scientific www.thermoscientific.com

ICP-OES

iCAP 7000 Series

- Designed to streamline workflows and minimize cost per sample
- Facilitates trace elemental analysis in pharmaceutical, environmental, industrial, and food and beverage analysis applications, including regulated environments
- Accommodates multiple sample types at high sensitivity
- Features an advanced loop sample introduction design to enhance productivity
- Instrument's newly designed optics offer high sensitivity

Thermo Fisher Scientific www.thermoscientific.com

Advanced Polymer Chromatography System

ACQUITY APC

- Quickly yields improved molecular weight information about polymeric species
- Delivers improved polymer peak resolution, particularly for low molecular weight polymers and oligomers up to 20 times faster than traditional gel permeation chromatography (GPC)
- Allows scientists to run diverse polymer applications on a single system, on one bank of columns with a variety of solvents

Waters www.waters.com

PRODUCT SPOTLIGHT

IDENTIFYING A WIDER RANGE OF MATERIALS

HANDHELD DEVICE FIRST TO FEATURE 1064NM WAVELENGTH EXCITATION

One of the standout new technologies featured at this year's Pittcon conference and exhibition in Philadelphia was Rigaku Raman Technologies' FirstGuard™ handheld Raman analyzer.

The system, the latest addition to the FirstGuard series, is the first handheld device equipped with 1064nm wavelength excitation and it also features an updated architecture and several new software upgrades.

While 785nm wavelength excitation products can only identify approximately 70 percent of encountered raw materials in pharmaceuticals and consumer goods manufacturing due to chronic fluorescence interference, the FirstGuard 1064 can reliably identify those same materials and also identify many more materials that 785nm excitation cannot, the company said.

"Rigaku Raman is committed to making the world a safer place by leveraging the power of science and technology to deliver innovative products such as our 1064nm FirstGuard analyzer," said Bree Allen, general manager at Rigaku Raman. "When dealing with safety-critical applications, our customers can't afford to be 70 percent accurate in their on-site RMID process, having to rely on validation of 30 percent of their materials by other time-consuming techniques. The FirstGuard can quickly and simply analyze many more of these raw materials which is why it is becoming the world's number one choice for a Raman handheld analyzer"

The 1064nm technology also enables analysis through many dark glasses and plastics—something that is difficult to impossible with 785nm spectrometers.

"We look forward to bringing the FirstGuard's new capabilities to our customers and are committed to leading the industry with the type of innovation that can contribute to the enhancement of humanity," Allen added.

For more information, visit http://www.rigakuraman.com/

HPLC System

Alliance

- Includes new design improvements such as updated electronics and user interface
- Updated system maintains key Alliance performance specifications and control algorithms to ensure that catalysts can seamlessly replicate their existing methods
- Changes will not affect established, validated HPLC methods
- Suited to help scientists enhance their HPLC methodologies through the use of Waters eXtended Performance [XP] 2.5 μm columns

Waters www.waters.com

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- Features ChromScope™ software intended for scientists and technicians of all skill levels with minimal training
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Waters www.waters.com

Cyanide Analyzer

OI Analytical CNSolution™ 9310

- Can facilitate significant cost savings for gold mill operators
- Measures available cyanide in precious metal leaching solutions per U.S. EPA Method OIA-1677 and ASTM D 6888-09
- Responds quantitatively to cyanide, as well as zinc, copper, cadmium and silver cyanide complexes over the entire instrument calibration/measurement range (0.2 to 2,000ppm)

Xylem www.xylemanalytics.com

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Portable Ultra-Low Temperature Freezers

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- Features a -86ºC to -20ºC temperature range
- Offers secure mobile transport of high-value vaccines or biological specimens
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- Includes visual and audible alarms

Cole-Parmer www.coleparmer.com

Temperature Control Systems

PRESTO® W91 and W92 Series

- Cover a working temperature range from -92 °C to +250 °C
- The W91 provides 11 kW of cooling capacity with the W92 capable of 19 kW at 20 °C and 31 kW at 200 °C
- Six configurable models of each unit with 12, 24 or 26 kW of heating power and a centrifugal pump or gear pump can be sized to meet application requirements

JULABO USA
www.julabo.com

Powder Whiteness Tester

C130

- Provides instant whiteness testing of powder samples and tests are able to be completed without sample preparation
- Instrument automatically detects the sample and provides a measurement in less than two seconds
- Simple to use and includes a variety of calibrations
- Includes a digital output for connection to an optional thermal printer or PC

Kett www.kett.com

Digital Temperature Controller

5R6-900

- Can be plugged into a wall as a self-contained temperature control system, which has its own power supply
- Can also be used universally, which allows the user to access the device wherever they are located
- Capable of loading currents up to 10A
- Easily connects to a computer through the electrically isolated RS232 communications port

Oven Industries www.ovenind.com

Portable Sanitary Mixers

- Feature the M5 Quick-Lock mounting system which has two ergonomic hand-wheels and interlocking wedge components with enhanced locking force for installation and repositioning without tools
- For users who want added leverage, the mount has a hex base that accepts an open-end wrench
- Suitable for blending liquids from 50 to 5,000 gallons at viscosities from 1.0 to 50,000 cps

Sharpe Mixers www.sharpemixers.com

Bottle-Top Dispensers

Calibrex™ *organo* and
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- Provides safe and reproducible liquid distribution of volumes up to 25, 50 and 100 mL
- Calibrex™ *organo* 525 model includes a ground glass plunger, best suited for organics, and non-crystallizing solutions
- Calibrex™ *solutae* 530 model has a PFA coated plunger preventing plunger and barrel from seizing together; enables trouble free distribution of a variety of liquids

Socorex www.socorex.com

Air Sampling Products

CLAIRION™

- Line includes a hand-held battery powered air pump, along with conventional and needle trapping devices for air sampling
- Pump has a flow rate range of 100 mL/min to 5 L/min under flow control (used with conventional traps) and 5-15 mL/min (45-50 inches of water) under pressure or speed control
- Completely compatible with the new FUZION™ air sampling accessories

Torion www.torion.com

Accelerated Diffusion Sampler

CUSTODION®-ADS

- Designed to collect volatile and semivolatile organic compounds from fixed surfaces for easy transfer to instrumentation such as a GC or GC-MS
- Creates an enclosed volume that has a reduced pressure, which speeds the process of compounds diffusing from the solid surface into the gas phase of ADS chamber
- Delivers a consistent vacuum over multiple uses

Torion
www.torion.com

Air Sampling Products

FUZION™

- Enhance the capabilities of Torion's person portable TRIDION-9 GC-TMS instruments
- The FUZION-3 will accommodate up to three different modules including sample desorption (SD), heated headspace (HS), purge and trap (PT) and internal standard (IS) additional modules
- FUZION-3 can be easily configured to meet user's specific application requirements for sample prep and analysis

Torion www.torion.com

Refractometer

Bellingham + Stanley Pro-Juice

- Can achieve the same high accuracy results for orange juice as it can for other fruit based juices
- Provides a measurement accuracy of 0.01 °Brix for sucrose solutions and a reproducibility of 0.02 °Brix between orange juice samples, regardless of temperature deviation or operator skill level
- Allows for cost savings and higher profits from increased concentrate yield

Xylem www.xylemanalytics.com

CELL CULTURE

Freezing Medium

STEM CELLBANKER®

- Optimized formulation for stem cells and iPS cells storage as well as other valuable cells
- Supplied ready-to-use with a simple usage protocol
- Completely free of serum and animal derived components, and contains only Japanese, European or US Pharmacopoeia graded ingredients
- hESC, MSCs and iPS cells cryopreserved with STEM CELLBANKER produce significantly higher cell viability (> 90%) over conventional freezing medium

AMSBIO www.amsbio.com

Cell Culture Shelving and Incubation Products

Gelf™

- Use a combination of thermal active gel insulation technology (patent pending) and the antimicrobial properties of copper to enhance everyday cell culture applications
- Products address two critical incubation needs: eliminating contamination and maintaining constant cell temperature in and out of the incubator
- Line includes the Gelf Pod, Pod Incubator, and Shelf

Caron
www.caronproducts.com

Bioreactor System

XRS 20

- Incorporates a single-use, easy-to-use Allegro™ 3D biocontainer
- Unique bi-axial agitation promotes better mixing and higher mass transfer, which expedites transport of nutrients and metabolites in the cellular micro-environment
- Allows cultures to reach higher densities with overall greater viabilities, leading to significantly higher protein expression levels
- Includes controller with touchscreen interface

Pall Life Sciences www.pall.com

Analysis module

ambr™

- Provides accurate automated pH calibration for enhanced bioprocess control for the ambr™ micro bioreactor system
- Enables more accurate feedback and pH control of cultures
- Gives users fully automated at line pH calibration during culture set-up and pH re-calibration at any time during the run
- Designed to use small culture samples

TAP Biosystems www.tapbiosystems.com

CHEMICALS, KITS & REAGENTS

Quantification Kit

ddPCR Library

- For Illumina TruSeq sample preparation protocols and used with Bio-Rad's QX100™ Droplet Digital™ PCR system
- Offers researchers a way to precisely and directly measure amplifiable library concentrations
- Using the ddPCR library quantification kit to quantify TruSeq DNA libraries maximizes the number of useable reads, enables consistent loading, and optimizes the utilization of every sequencing run

Bio-Rad www.bio-rad.com

Solid-Supported Cyanine Dyes

540 and 650

- With 3'-modified 1000Å CPG supports, users can add cyanine dyes directly to their oligos of interest without any additional modification step
- Save time by reducing the number of experimental steps and avoid the unnecessary cost of amino-modified oligos or the inconvenience of combining cyanine phosphoramidites and universal supports

Link www.linktech.co.uk

Reagent Reservoirs

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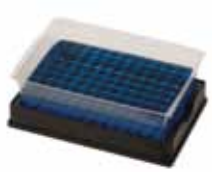
- The new 100ml and 300ml reservoirs adopt a standard SBS / SLAS footprint
- Individual pyramidal indentations (96 or 384) in each reagent reservoir allow maximum liquid recovery when using INTEGRA's VIAFLO 96 and VIAFLO 384 electronic pipettes as well as other platforms
- Include reusable reservoir base



INTEGRA www.integra-biosciences.com

LAB AUTOMATION

Headspace Autosampler

TriPlus 300

- Designed for fast start-up, high productivity, and flexibility for analyzing organic volatiles
- Includes a 120-vial sample tray capacity and large 18-vial incubation oven overlap capacity
- After initial setup, the device's timing is automatically optimized to maintain constant equilibrium intervals, further enhancing throughput
- Compatible with standard GC and GC-MS systems

Thermo Fisher Scientific www.thermoscientific.com

Sample Transport & Management System

lab2lab

- Connects remote analytical instrumentation and research laboratories by transporting tubes using compressed air
- Ensures that samples are scheduled and analyzed at the right time, in the right place
- Allows existing centralized analytical instrumentation to be connected with several remote labs, ensuring access to the analysis at a much lower cost

TTP Labtech www.ttplabtech.com

PRODUCT SPOTLIGHT

LARGER SAMPLES, FASTER DIGESTION

NEW SAMPLE PREP SYSTEM DESIGNED FOR LABS NEEDING QUICK TURNAROUND

CEM Corporation released its latest acid digestion system, the Discover SP-D 80, at Pittcon 2013 in Philadelphia in March. The system allows users to perform acid digestion for trace metals analysis in as little as ten minutes, including cool down.

"The key is fast turnaround on a single sample," said CEM president and CEO Michael J. Collins at CEM's press conference at their Pittcon booth, adding the new instrument is especially suited to laboratories that need immediate turnaround.

The system handles larger sample volumes of 1-2 grams and features full pressure and temperature control of every sample. It is also capable of temperatures up to 260°C and can accommodate a variety of different samples including pharmaceutical, food, plastics, oils, organics, inorganics, metals, and US EPA Methods 3015, 3051, and 3052.

That means the SP-D 80 handles about 95 percent of the types of metals analysis out there, Collins explained, adding the system can also do both sequential and simultaneous sample prep, which is why it can handle many different types of samples.

The system also features individual sample programming so that samples with different parameters or methodologies can be run in any sequence, with vessels available in sets of six or 12.

An optional, automated 24-place sample deck allows the system to run unattended overnight and the compact system can be placed on a benchtop or in a fume hood for added safety and durability.

"We think we're offering labs the opportunity of doing microwave sample prep in the best way," Collins said.

For more information, visit www.cem.com

LIFE SCIENCE

Custom Oligos Ordering Tool

AptaBuilder™ BETA

- Enables researchers to create custom oligo sequences
- Users select their desired base pairs, type in the oligo sequence, and AptaBuilder instantaneously generates statistics including molecular weight, extinction coefficient, and GC content
- Modifications including 3′ (prime), 5′ and/or internal modifications can be added, if desired, and the resulting sequence either saved for future ordering or processed immediately

Aptagen www.aptagen.com

Sample Concentrator

miVac

- Provides an efficient and cost effective alternative to membrane centrifugation techniques for protein concentration prior to separation or analysis
- Ensures complete sample recovery even when taking proteins to very high concentrations
- Offers the benefit of greatly reduced spending on consumables
- Capable of removing water and organic solvents from a variety of sample formats

Genevac www.genevac.com

Portable Rapid DNA System

ParaDNA®

- Determines the quality of human DNA faster and more economically than any existing method
- Allows onsite rapid identification of samples suitable to submit for more detailed analysis
- Helps reduce laboratory backlogs and turnaround times for processing, so investigators can focus their attention on samples most likely to generate a genetic profile

Life Technologies www.lifetechnologies.com

2D Coded Sample Storage Packs

Starterpacks

- Contain everything needed to start using 2D coded sample storage tubes
- Enable laboratory workers to ensure a secure sample logistics system and eliminate the costly possibility of false sample identities
- Available with a choice of either screw cap or TPE cap tube closure
- Offered in a range of sizes: S, M, L and XL

Micronic www.micronic.com

Purification System

Amicon® Pro

- Streamlines the affinity purification workflow and minimizes protein loss
- Provides consistent, accurate sample preparation, resulting in more reliable recovery, uncompromised purity and easier data generation
- Combines the bind, wash, elute, buffer exchange and concentration steps into one device
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EMD Millipore www.millipore.com

Microarray for Cancer Research

CytoSure™ Cancer +SNP array (4x180k)

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- Allows any reference sample to be used for analysis without changes to the standard aCGH protocol
- Requires no restriction digest due to novel SNP probe chemistry

Oxford Gene Technology www.ogt.com

(ChIP) Assay Range

Chromatrap

- Uses a solid phase porous polymer functionalized with protein A, allowing the chromatin capture to be more efficient than bead based methods
- Has demonstrated levels of DNA pull down up to 25 times higher than with traditional bead based procedures
- Provides top performance even with samples as small as 50ng or as much as 3000ng chromatin per immunoprecipitation

Porvair www.porvair-sciences.com

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- Abbott also now offers cloud services for laboratories

Abbott www.abbott.com

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Spectrus DB

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- The platform puts an end to the "one-and-done" life cycle of analytical data to aid chemistry groups who are trying to maximize their return on investment for data generation
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ACD/Labs www.acdlabs.com

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Computational Chemistry Workbench

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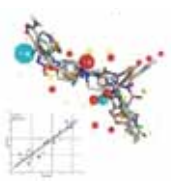

- Provides flexible handling of multiple reference molecules giving improved results during analysis of structure activity relationships
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- Features the ability to download protein crystal structure files and rapidly split them into protein and ligand

Cresset www.cresset-group.com

GC-MS Analytical Software

CHROMION Release 1.1

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- Software is easy to operate and evaluation of the results is accomplished using an easy-to-learn Windows-based graphical user interface
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Torion www.torion.com

Chromatography Data Software

Empower 3

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Scientific Information System

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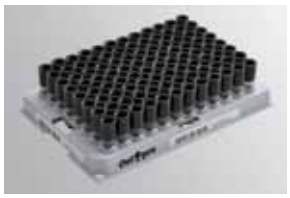

- Features ultra-compact design at just 25.6mm tall to deliver 475µl working volume
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Micronic www.micronic.com

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Phenomenex www.phenomenex.com

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- Axia packing eliminates the drawbacks of traditional slurry packing, delivering uniform bed density and dramatic performance advances

Phenomenex www.phenomenex.com

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Automating Sample Preparation

Problem: While laboratory instruments have become faster and more automated to increase productivity, sample preparation has continued to remain a bottleneck and source of variability for most labs. The complexity and variety of samples that typically pass through labs makes this area one of the most difficult to automate.

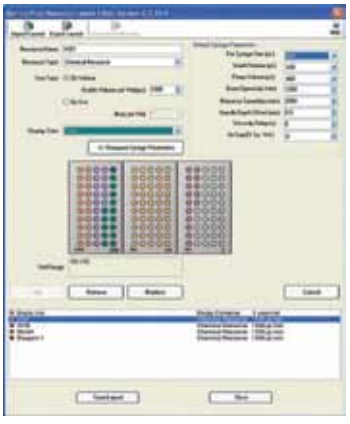
Solution: One example of an important step forward in automating sample preparation for chromatographic analyses is Agilent Technologies' 7696A Sample Prep Workbench (Figure 1). Many of the common preparation procedures for chromatography samples can be done by incorporating precision liquid dispensers along with mixing and heating capabilities into a stand-alone instrument such as Agilent's new workbench. A large capacity syringe provides the capability to precisely dispense liquids into a sample vial for common operations such as internal standard addition, solvent dilution, and addition of derivatizing agents. Also, since many ASTM methods, particularly those for petroleum tests, require confirmation by weight, an optional microbalance with a five gram capacity and capable of weighing to 0.01 milligrams can be integrated into the instrument and software. A bar code reader/stirrer station that heats up to 80 °C is sufficient for most dissolution or derivatization procedures and the heater/chiller module has the ability to simultaneously heat a single 50-vial tray (25 °C - 80 °C) and cool a second 50-vial tray (40 °C - 5 °C) through energy-efficient Peltier cooling. To accommodate the in-vial chemistry strategy, it was also necessary to provide the capability to sample at any point in the vial to allow the analyst to select the correct liquid phase for transfer operations. As with any complex technology, software automation is necessary in order to reap full benefit. A highly visual "drag and drop" programming interface was developed that allows the analyst to set up and save methods within a matter of minutes (Figure 2).

Lab managers know that any innovative solution must also be vetted against sound business requirements in order to be successful. In developing the business case for this product, the following benefits show that the solution meets financial, safety, quality, and environmental requirements:

- *Productivity*: Automated sample preparation can save ½ hour or more of analyst time per shift which translates to ≈ 550 hours labor savings per year (0.5 hrs per shift x 3 shifts per day x 365 days per year).
- *Safety*: Automated sample preparation typically reduces personnel exposure time to potentially toxic solvents and reagents by more than 75 percent. Reduced quantities used in small scale preparation also limit exposure and reduce risks associated with other solvent properties such as flammability. Ergonomic issues are also eliminated for labs with high pipetting requirements.
- *Quality*: Precision of automated sample preparation exceeds the precision achieved by multiple analysts across shifts which improves the quality and reliability of results. The repetitive nature of automation is more consistent than manual preparation which reduces the risk of analyst errors. This in turn lowers laboratory costs by reducing rework and lowers the risk of price concessions for off-spec product due to lab error for the client.
- *Environmental*: Small scale sample preparation reduces waste volume which lowers disposal costs. Waste reduction of >50 percent is typical. This approach also supports green waste reduction initiatives such as CMA's Responsible Care® program and ISO 14001.

For more information visit http://www.chem.agilent.com/en-US/products-services/Instruments-Systems/Gas-Chromatography/7696A-Sample-Prep-Workbench/Pages/default.aspx

▲*Figure 1: Agilent 7696A Sample Prep WorkBench.*



◀ *Figure 2: Sample preparation screen for the Agilent 7696A Sample Prep WorkBench.*

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Closing a Lab

Problem: Whether a small enterprise or large institution, many organizations have and will be faced with the challenge of closing a lab. No matter what the size or scope of the closure, the person tasked with closing the facility faces a daunting task as millions of dollars in real estate, laboratory equipment and research devices will need to be redeployed, sold, or disposed of. With that comes teams to manage, logistics to sort out and inventory to be accounted for, all the while adhering to a budget, timeline, and environmental and safety standards.

A lab closure is usually a race to the finish, but a short, unrealistic timeline combined with lack of operational forethought can have disastrous results. So how do you maximize the value of your assets while minimizing potential risks?

Solution: As soon as a lab closing is confirmed it's imperative that you take some first steps that will serve as the basis for the project including: formation of a closing team, development of a plan for redeployment or sale of items, establishment of a budget and timeline, and complete an inventory of the facility.

The team you enlist should consist of staff most familiar with the facility; this will most likely include security, environmental safety, facilities and lab maintenance managers, and the accounting team. In order to develop a closure plan, the team should understand the current situation in the lab including the biosafety level and whether the equipment has completed the decontamination process. Some basic questions the team should be prepared to answer include:

- Is the facility being shut down completely?
- What in-house resources do we have available to assist in the closure?
- When must the lab be vacated?
- Can certain assets be redeployed to other labs?
- Which assets will be sold?

If you are planning to redeploy or sell a large number of assets, you may want to hire external resources to help you to determine asset value, increase the number of potential buyers, oversee the previewing and marketing, and assist with redeployment.

A closure plan is the catalyst for determining a budget for the marketing, redeployment and removal of assets, as well as a timeline. Note: a short timeline is the number one mistake a company can make when shutting down a facility; plan on a minimum of three to six months and don't leave equipment and logistics until the last minute.

Regardless of whether you are selling, redeploying or disposing of assets, you'll need to inventory everything and determine the best channel for them. For those assets you plan to sell, focus on the highest-value items as they will allow you the greatest return on investment. Other tips for greater ROI include: scheduling a preview period so potential buyers can come inspect the equipment, taking quality images to provide to potential buyers through online channels, and attracting buyers both domestically and internationally. Keep in mind that biotech and pharmaceutical equipment is in high demand across the globe, therefore it is advisable to have international support for a global base of buyers interested in the equipment. You'll want to be aware of which items have characteristics that make them subject to export compliance.

Above all, give yourself time: time to get a plan in place, to establish a budget, to hire external resources, to inventory assets and to find buyers for your equipment in order to maximize the value.

For more information, visit www.Go-Dove.com or contact sell@liquidityservicesinc.com

▲ *Figuring out what to do with lab equipment such as this mass spectrometer with a UPLC system is one of the big challenges when closing a lab.*

Happy 20th Anniversary Horizon Technology!

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Twenty years of development of equipment to help with sample preparation, from extraction using solid phase disks or cartridges to extract drying and evaporation/concentration or a full system for Oil & Grease analysis. Automation can increase safety, reduce expensive solvent usage and minimize variability for better results with less attention.

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- Atlantic 8270 One Pass Disk, 2011
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- DryDisk Barrel, 2009
- Atlantic HLB Disks, 2009
- Atlantic SPE Disks – C18, DVB, 2008
- DryVap Solvent Evaporation System, 2006
- Reclaimer – Solvent Recovery System, 2005

2003

- Pacific Oil & Grease SPE Disks, 2003
- DryDisk Separation Membrane, 2002
- SPE-DEX 4790 Extractor System, 2001
- Solvent Trap – Solvent Recovery System, 2000
- 3000XL Oil and Grease Extractor System, 1998
- 1000XL Oil and grease Extractor System, 1998
- SpeedVap Solvent (n-Hexane) Evaporator, 1998
- SPE-DEX 4770 Extractor System, 1996
- SPE-DEX 4750 Extractor System, 1995

1993

- SPE-DEX 4700 Extractor System, 1993

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Downstream Plasma Cleaning

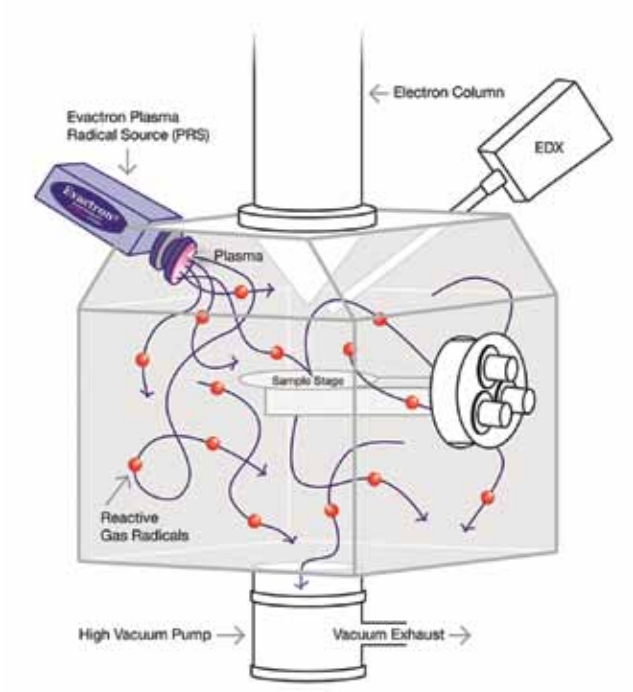
Problem: Users in EM facilities with several current generation tools including FE SEM and dual beam FIB/SEM will, despite taking precautions to insert only clean specimens, sometimes get contamination introduced into their microscopes. This manifests itself as a dark rectangle on areas which have been exposed to the incident beam. How can this be prevented? Can it be removed from the previously exposed samples?

Solution: Even minute amounts of hydrocarbon contamination can be precipitated onto the sample surface when exposed to the energetic electron or ion beam. Routine sample cleaning before insertion helps, but inevitably the interior of the instrument gets contaminated and requires cleaning. Downstream plasma cleaning has been shown to be very effective at removing these contaminants.

An RF plasma product that used the technique of secondary or downstream plasma cleaning to address the problem of cleaning internal surfaces of the vacuum chambers in electron microscopes was patented and introduced in 1999 (XEI Scientific). The product is called the Evactron® De-Contaminator, and a schematic of its downstream plasma process is shown here.

This type of system produces the active plasma in a remote chamber (called a Plasma Radical Source or PRS) and transfers the active species to the cleaning chamber via gas flow relying primarily on the chemical activity of the reactive radicals produced by the plasma. Experiments with different gases to create the plasma have shown room air to be an excellent source of oxygen to create reactive radicals and efficiently crack hydrocarbon molecules. It has the benefits of being available, free, and safe. Also, via the choice of other non-corrosive gases for producing radicals, different chemical etch processes may be selected and benign regimes for sensitive components may be obtained as well as optimized chemistries for the fast removal of unwanted contaminants.

While the energetic ions are contained in the external Plasma Radical Source, reactive gas radicals are allowed to drift through the vacuum chamber and come into contact with the sample and internal surfaces. Photons in the plasma are in the Vacuum UV (VUV) wavelengths, and VUV energy is very effective in breaking most organic bonds, i.e., C-H, C-C, C=C, C-O, and C-N. Thus, high molecular weight contaminants are broken into smaller components. A second cleaning action is carried out by the various oxygen species created in the plasma (O_2^+, O_2^-, O_3, O, O^+, O^-, ionized ozone, meta-stably-excited oxygen, and free electrons) which combine with organic contaminants to form H_2O, CO, CO_2, and low molecular weight hydrocarbons. Exhibiting relatively high vapor pressure, these compounds are easily pumped out of the microscope by the vacuum system.



▲ *Schematic of the XEI Scientific Evactron® De-Contaminator's downstream plasma process.*

The downstream plasma technique has proven extremely useful and is now well accepted. There are over 1,400 installations of the XEI tool on nearly all makes and models of SEM and Dual Beam FEB/SEMs. And with this system being portable and easily moved among several columns, a modest investment can provide the solution to the entire lab's contamination problem.

For more information, visit www.evactron.com, email information@evactron.com , or call 1(650) 369-0133

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MARK YOUR CALENDAR!

Microarray Analysis for Cancer Research

Problem: Cancer is one of the most genetically complex conditions faced by modern medicine. Displaying a significant capacity to evolve in terms of its genomic make-up, malignant tumours can accumulate a variety of mutations depending upon the type, clinical stage and also in response to selective pressures such as anti-cancer therapies. Despite significant treatment advances, cancer remains the predominant cause of premature death, and was responsible for 28 percent of all UK deaths over a two-year period during 2007-2009; representing a higher proportion than coronary heart disease or stroke mortality (CRUK 2012). As such, cancer has remained a top research priority, with extensive resources currently being utilized to advance our understanding of the complex underlying heterogeneity of the disease.

Traditional approaches for research into tumor formation have revolved around histological classification, using karyotyping for the identification of gross chromosomal aberrations. However, considering the extensive depth of genomic analysis required, it is unsurprising that such techniques are no longer sufficient for producing data at the resolution required for progressing cancer research. Consequently, molecular methods, such as microarray analysis, have been used for the identification of genetic markers associated with disease predication, progression and prognosis.

Solution: Microarrays are a well-established technique for genomic research and have proven an important tool for delving into the complex genetic basis of cancer. Ideal for large-scale screening, microarrays provide whole genome coverage in a cost-effective manner. Additionally, when utilizing an expert service provider, samples can be processed with relatively high throughput.

Requiring knowledge of the genome sequence for probe design, microarrays have been significantly more valuable since the completion of the human genome project at the turn of the millennium. With the opportunity for flexible array layouts and probe design, including the ability to generate custom arrays, researchers have significant scope to scan the genome for sequence variations or to analyze gene expression profiles related to disease.

The latest developments in microarray technology are further advancing the capacity of microarrays for cancer research applications. For example, Oxford Gene Technology's (OGT) latest line of arrays combine array comparative genomic hybridization (aCGH) and SNP probes on a single chip, with hybridization conditions optimized to allow both analysis techniques to be performed during a single experiment. This permits the simultaneous detection of larger genetic aberrations such as copy number variants (CNVs), alongside smaller variations and loss of heterozygosity (LOH). For example, OGT's *CytoSure™ Haematological Cancer +SNP array* is optimized for the study of a number of haematological malignancies.

Of further benefit to researchers are the current collaborative efforts between commercial technology providers and academic experts, where combining knowledge and expertise permits informed, rational design of specific arrays. OGT has recently worked alongside Professor Jacqueline Schoumans, Head of the Cancer Cytogenetic Unit at the University of Lausanne and a world leader in cancer cytogenetics. This led to the development of a combined aCGH and SNP array targeting haematological and solid tumours. Importantly, this new *CytoSure™ Cancer +SNP array* enables the use of a matched reference from the same sample source in the same hybridization reaction, for a more accurate, direct comparison.

Microarrays being loaded into a scanner at OGT's high-throughput genomic services facility.

The Cytosure Haematological +SNP array combines aCGH and SNP probes for accurate detection of CNV and LOH.

With these developments, microarrays remain a versatile and efficient tool for research into the genetic basis of cancer, providing whole genome coverage for the accurate detection of CNVs and LOH across many samples. Microarray analysis is an established, well-practiced procedure, with the majority of clinical labs having accumulated all the necessary array equipment, training and experience. As such, microarrays often provide the initial go-to solution for cancer research projects.

CytoSure™ products are for research use only; not for use in diagnostic procedures.

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For more information visit www.biotix.com

Contact:
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CaptairFlex ductless fume hoods are a safety device used to protect users when handling chemicals that pose an inhalation risk.

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Erlab, Inc.
www.captair.com
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PRE-OWNED EQUIPMENT MARKETPLACE

PARTING POINTS

Takeaways from this month's issue:

CALCULATING WORKPLACE TRAGEDY

A predominant perception among too many workplaces is that safety is expensive. But the consequences of a catastrophic accident go far beyond cost. In follow-up investigations of recent industrial accidents, the following technical flaws—which should have been addressed—were identified:

- Insufficient design of safety systems
- Lack of preventive maintenance, especially on safety-critical systems
- Nonexistent or inoperative alarms
- Continued use of outdated technology when replacement with available, safer equipment is feasible

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NEGOTIATING SALARIES

Figuring out what to pay someone for the work they do is an age-old question, and it never seems to get any easier despite all the metrics, data, and real-life anecdotes we acquire along the way. In a truly global, connected economy, salaries do not exist in vacuums anymore. They involve:

- Real people
- Demonstrated skills
- Supply and demand
- And a whole host of other highly nuanced factors

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EFFECTIVE LABORATORY ONBOARDING

The most urgent corporate goal now is to leverage onboarding activities into an effective employee retention tool. To accomplish this, onboarding must be perceived as an "ongoing conversation" in which managers discuss:

- Operations
- Strategies
- Rules, procedures, standards, and requirements
- Missions
- Forthcoming changes

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THE NEXT WAVE IN LAB SERVICES

As strategic sourcing is increasingly embraced across the industry, laboratory support functions have also been progressively out-tasked or strategically sourced to multiple players. These services can be further optimized within an Integrated Facility Management framework, which offers:

- Customer service
- Operational communications
- Project management
- General management
- Finance and strategic planning

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INSIGHTS ON LABORATORY DATA SYSTEMS

The drive toward fully paperless operation is causing laboratories to rethink their investments in data management software. Data system proliferation has given rise to an alphabet soup of "solutions" that include:

- LIMSs
- SDMSs (scientific data management systems)
- Electronic data capture
- Clinical LIMSs
- ELNs
- Visualization software
- Lab execution systems

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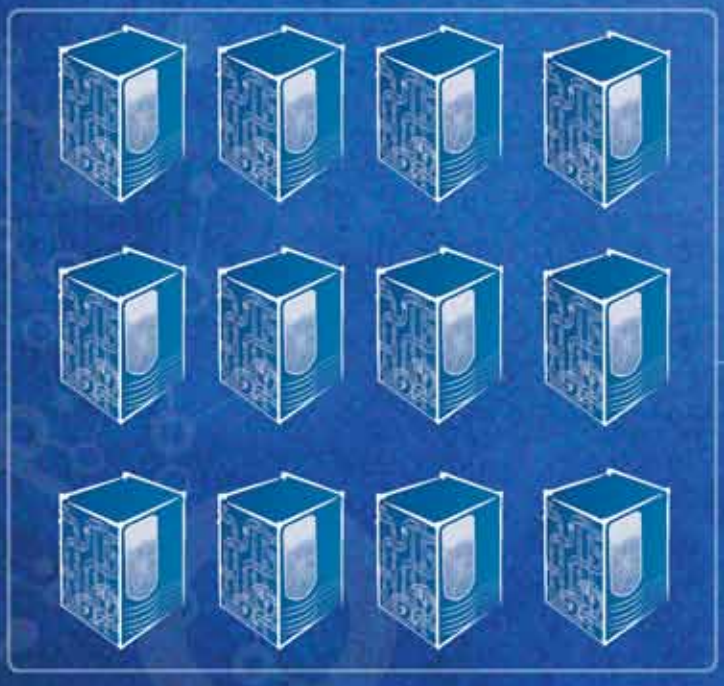

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