MAGAZINE

Lab Manager™

Where Science and Management Meet™

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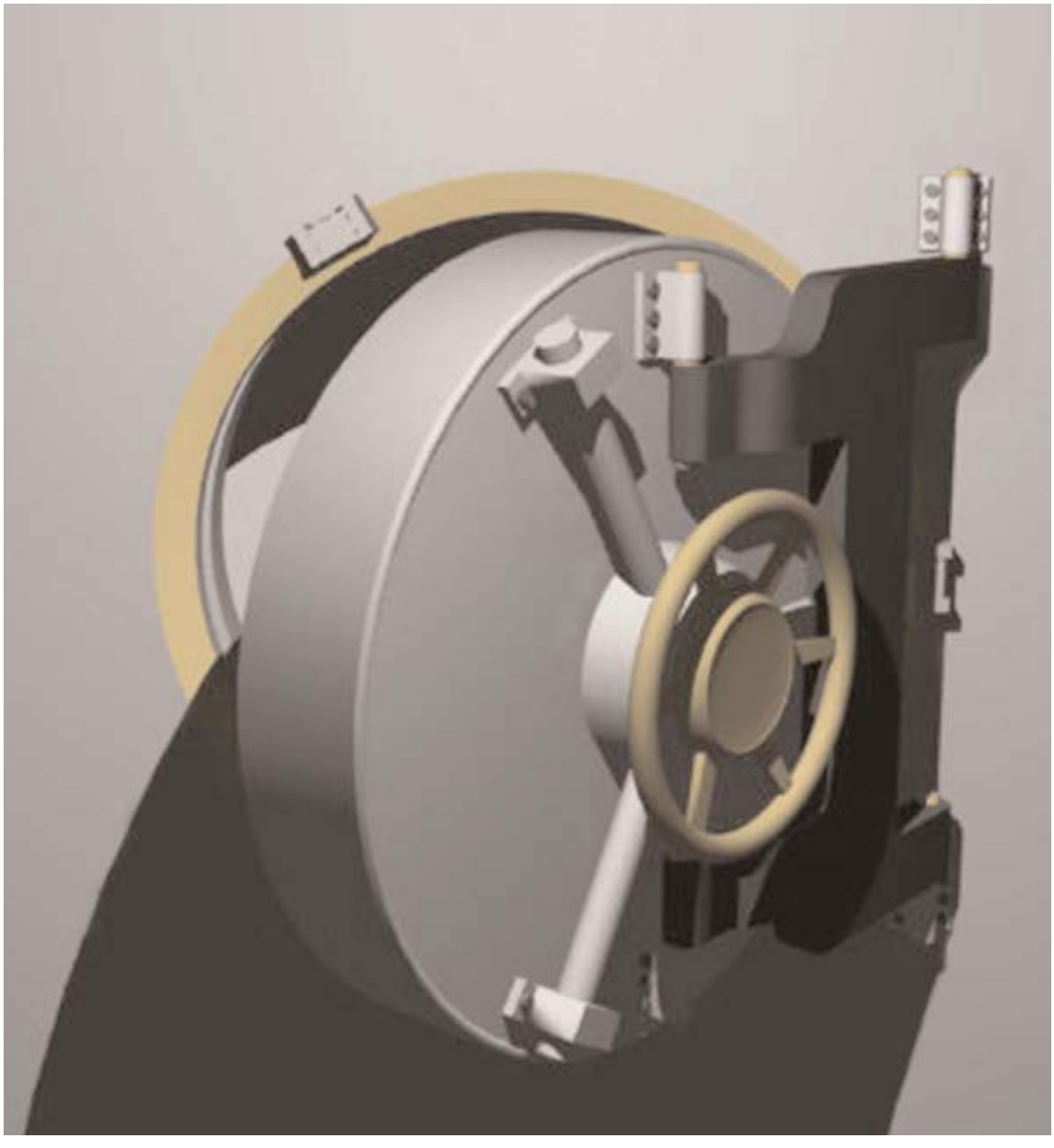

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Where Science and Management Meet™

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Lab Manager MAGAZINE

Author Guidelines

Lab Manager Magazine is a printed publication of resources, products, and information for today's laboratory manager. Articles should address some aspect of laboratory management from the perspective of a professional who is both a scientist and a manager. Topics areas would include: managing budgets, personnel, technology, information, funding, training, safety, risk, expansion, building or renovation, among others related to the role of a lab manager.

The article review process should begin with a query by e-mail or phone followed by a brief abstract or outline. Please state your topic and objective, and indicate your perspective as well as your professional relationship to the topic. Content must be unbiased and cannot promote a particular product or company. Article length may range from 1500-2500 words. All manuscripts must be submitted electronically by email or disk.

To submit an article query contact:

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Working Yourself Out of a Job

Essentially, the best managers endeavor to become useless.

This may not sound like a good strategy for those who value some level of job security but a manager's role is to guide and oversee the process rather than be the one to actually perform the tasks. Not that there aren't days when someone's out sick, or there's a critical deadline and it's all hands on deck but, on a day-to-day basis, a manager's goal should be to work yourself out of most every job.

It's not as easy as it sounds.

For managers who have risen through the ranks, it's a good feeling to keep doing what you always did well. You may feel that you achieved the position of manager because you did the tasks better than anyone else. You may do it faster or know that you will do it right the first time. It's often easier to do it yourself than to review what someone else has done. Despite the skill and knowledge, you should allow and encourage others to do all the tasks in your area of supervision. But that doesn't mean that the manager's role is passive one.

A manager needs to provide staff with the tools to do their jobs. There are many forms of tools. And depending on the person and the task, no two staff members or tasks may need the same tools. Identification of needs and their fulfillment is where a lot of time and attention should be focused. Staff tools can include:

- Technical equipment
- SOPs
- Training / Re-training
- Checklists
- Continuing ed
- Satisfactory work environment
- A mentor or coach
- And many more

A manager also has tools. Identifying the tools in your managerial arsenal can help determine which one(s) is the right one for the job. Manager's tools include:

- Experience
- Talking/Discussion
- Persuasion
- Coaching
- Tact
- Observation
- A healthy dose of listening
- Among many others

Every new project, new staff member, change, or problem is a manager's opportunity to put these tools to work. It's not exactly a race to see how quickly you can pass along the work to a staff member but always keep the goal in mind – performing the tasks of the department or area through the staff. The more you are involved in the doing of these tasks, the less you are doing your own job.

Working yourself out of a job isn't a cause for concern. I have yet to meet the manager who has nothing to do. You don't have to be grateful for problems to keep you employed, you can work to avoid them as much as possible but they will still find you. Job security is only the next crisis away.

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FUELING INNOVATION usb

CONTRACT MANUFACTURING:

Small company, small market concerns

HARDLY A DAY GOES BY THAT SOMEONE WORKING IN A RESEARCH LABORATORY DOESN'T COME UP WITH AN IDEA FOR A NEW, IMPROVED TOOL TO BE USED IN THE DISCOVERY PROCESS.

Whether it's a new instrument, a new detection system, new process, or simply a new component that makes existing tools work better, researchers are never content with the status quo. The drive to get better answers and new discoveries faster and at a lower cost forces the marketplace to be ever evolving.

New tools, new solutions, and discoveries are rarely kept solely for the purpose of a single lab. The excitement surrounding an enhancement in improving the discovery process drives the innovators to share their tool and processes. Some develop the solution and let everyone know about it through publications while others try and commercialize their tool. Commercialization can be a rewarding outlet for many innovators. Commercialization should generate revenue for the person or group that developed the technology and it means many scientists can benefit from the standardized use of the new tool.

Commercialization can be done in the form of licensing the discovery and associated IP to a larger company that has complementary products in that application area. Some researchers seize the opportunity associated with their discovery to become entrepreneurs. They take their discovery, start their own company, and head down the pathway of bringing their product to market. The written instructions are easy to follow: have or get money, start a company, hire people to engineer and build the product, sell the product, and collect the profits. Too often the founders of these companies find reality never follows a simple flow chart. People are expensive and manufacturing a consistent, reliable product is not the same as designing one to two systems for their own use and often the money originally budgeted never covers the actual cost. Very often a new product comes to the market too early or is too expensive, doesn't deliver all the benefits promised, or simply is not profitable enough to sustain the company. I am confident that everyone in research today has some experience with a very promising product or technology that they bought as a tool and it just didn't quite live up to expectations. How often do we ask about a company that had a promising technology or product that suddenly is gone from the market?

The use of an outside manufacturing company as well as contracting out for certain services can be a very good solution for dealing with both internal and external challenges a start-up company faces.

Some companies survive these growth pains. They learn and adapt quickly to internal and external forces. They stay focused on their customers, their market, and their core competencies. Successful companies try and limit duplicating expertise internally when it can be acquired externally faster, more reliably, and at a controlled cost. Successful companies always ask: How can I get that done quickly and at a controlled cost? What do my customers really want and how can I best serve them?

Companies that struggle with growing pains don't ask many questions. They try to have all the expertise needed internally and drive their innovation. The company becomes a "not invented here" practitioner. The company management and key personnel are so focused internally, on handling every detail as well as managing the learning curve, that the external focus is limited. The company should be customer focused. Successful companies think two to three steps ahead. They try and get answers to questions like: What features are really neces-

Scott VanderWoude

sary for the product launch? What are the competitive options? What benefit will the customers have from using our system?

When companies don't deliver on their promises, everyone suffers. It becomes harder for all the customers to get money for new technology and tools when the tools fail to deliver. Customers are increasingly demanding acceptance tests and performance criteria before purchasing expensive systems and new technology. Looking under the surface, there are four common external pressures new companies face when bringing equipment to the market.

- Too little money: The product was supposed to be completed in six months at a cost of only $100,000. Six months later and $400,000 into the development, the company founder realizes he needs help.
- Too complex: The company wanted to run lean and use outside manufacturing as much as possible. The challenge is many of the components are customized and the cost to prototype and manufacture each part is prohibitive. Additionally, there isn't enough expertise at the small shops to understand all the technical requirements.
- Too problematic: The product works when an experienced user runs it. The start-up time and complexity of operation limits the customer base.
- Too crowded: The product works great, but the market is crowded. Competition is quickly coming in with lower cost systems and the company finds themselves trapped in the middle of the market.

Internally, the company also has many questions to answer. How do you get your idea from concept to prototype to production to market and avoid major problems along the way? How many beta units should be produced? When will Generation II be released? Will it be backwards compatible to Version 1? What price will you have to charge to recover development costs while remaining competitive? How will you provide service for the units once they are sold?

CONTRACTING OUT

The use of an outside manufacturing company as well as contracting out for certain services can be a very good solution for dealing with both internal and external challenges a start-up company faces. Companies that specialize in providing contract manufacturing help develop, manufacture, and market better quality and more profitable product lines. Contract manufacturing companies are hired by a company that has a design, possibly a prototype, and a plan for what they need. For an agreed-upon price, the contract manufacturer then acts as the hiring firm's factory, producing and shipping either the entire unit or select subassemblies on behalf of the hiring firm. Contract manufacturing providers normally do not post their brand name on any product, and the rights to both the design and the brand name belongs to the originating designer.

Since contract manufacturing firms make their money on volume, the more manufacturing and more guarantees in the contract the lower the cost. For many start-up companies in the life science market, this becomes a dilemma as the builds are typically small and the products relatively complex. Contract manufacturing companies typically seek high guarantees for parts, have long lead time schedules, and charge for any changes to the design. Start-up companies have a dilemma. They don't have accurate figures to build in advance of orders, but they also can't wait six months for parts and assemblies to be delivered. Learning how to work effectively with a contract manufacturing company can help bridge the gaps and will improve the chances of a successful project.

CHOOSING A PARTNER

There are contract manufacturing companies that do work as a partner and offer an extensive variety of services. Vertically integrated companies exist that are great choices for companies with small, complex builds. These companies have all the resources within their four walls to machine parts, form metal, test electrical and mechanical specifications, do assembly work, and provide quality control. They bring all the value of one-stop shopping to the project. Finding the company that fits well with the needs of your company or project may take time and some resources. Be prepared to ask questions, ask for examples, ask for references, and invest in the process. Some companies can take an early prototype product, complete the design, create the documentation, and do the manufacturing. Other engineering and manufacturing companies are better equipped to handle just part of the process for a client. The start-up company may want to do final assembly and QC testing at their plant. They need and want select subassemblies built without all the added services. Small, local machine shops and manufacturing facilities may offer everything they need. Still other companies may provide services related to marketing and business development to expand the product use for markets outside of the intended application.

Sometimes different partners are needed for different projects and at different stages of a company's development. The full service partner who helps a company leverage their intellectual property and customer knowledge in the market may be the perfect choice for an innovator looking to commercialize their idea, but remain close to the science. Other companies are best served with picking and choosing the services needed, such as manufacturing review, cost reductions, assembly, inventory management, quality control, UL and CE compliance certification, and service. If there are no project managers, manufacturing engineers, and system engineers at the company then consider capturing the value of a full service company. Every

company can benefit from paying the lowest possible cost for the system provided quality and reliability are never sacrificed. The lowest possible cost basis allows customers to face less price pressure from competitors and have the product in the market longer. The higher margins improve the financial health of the company allowing for better investment in new products and more application support.

The use of contract services doesn't stop at manufacturing services. Companies can provide early product support including installation and field service on an outsourced basis. Removing that high overhead and variable costs in the early days allows companies to focus externally on customers and internally on sales and marketing.

I am presently working with a company that has a new detection system that they want to bring to market. They're a very technical, very capable company and were looking to have this product manufactured for them. They have much experience with contract manufacturing companies and never felt they were treated as any more than a vendor. The contract manufacturer would take their specifications as is, give them a price, and then build the product exactly to the specs.

As expected, the products always needed little tweaks and the CM was happy to get that done at $300 per hour for engineering time as well as the cost of replacing any parts already acquired. The life science company ended up paying for the project two or three times over before they got what they felt was a commercial product.

BRIDGING THE GAP

Working with a contract manufacturing company is new to many start-up companies. There is a different language, different goals, and an entirely different set of references. Understanding these differences and investing in communications will make the experience with outside contractors more successful. I'm not saying that every experience will be a positive one. That would be great if there was a way to guarantee that. Recognizing when a relationship and process isn't working is arguably more critical than recognizing when it is on target.

Maybe you only want or need a vendor relationship with the machine shop, engineering firm, or manufacturing company. Have you identified the project manager within your company? What is that person empowered to do? Even if your product could change the face of scientific research, save lives, and improve our world, the business person on the other side has the responsibility to make money for the company that builds this product. The contract manufacturer or shop may find satisfaction in working on your project, but they must make money if they want to run a profitable business. Many times their vision is simply to make a profit at the end of the quarter.

Make the investment in your company's success. Hire and use the right professionals to help your team understand the different language of manufacturing and QC as well as the ins and outs of establishing contracts with vendors. Engineers are

not always experienced in manufacturing and QC processes. A mechanical engineer, EE, and manufacturing engineer all have different roles and training. A project manager is typically a specialized engineer who has the vision and responsibility for the entire project. Often, it's not effective to hire all the resources internally just to work with outside vendors. Consider using a consultant to help bridge the gaps. Invest in your internal people with as much training as possible so they can handle multiple roles. Learn from your partners.

Below are some dos and don'ts for working with a contract manufacturing company:

DO:

- Hire an experienced person early in the process so they have time to develop relationships and find the best fits.
- Seek out companies that are vertically integrated and can handle more than just one small piece of your business.
- Think through the process before meeting with manufacturers.

Ask the questions:

- What volumes are you really able to commit to?
- What are the payment terms I am comfortable with?
- What are the QC specifications and who is doing the inspection?
- What about parts supply, what is acceptable?
- What protection do I need for IP?
- What are the backup plans?

DON'T:

- Be dependent on one supplier for critical parts and components.
- Become the largest single customer for a small machine shop or engineering company.
- Trust someone else's QC.
- Believe everything will work out as planned.
- Believe people are too smart to do stupid things.

The use of an outside contract manufacturing company can help your company address the common problems you are likely to face externally. When done right, using a CM provides flexibility, price and cost controls, improved reliability, and a faster time to the market. Internal questions can be answered as your team has the time to focus on the customers and the market. Once answered, your CM partner can execute the task.

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AVOIDING PREMATURE PUBLIC DISCLOSURE of inventions

UNDERSTANDING DISCLOSURE CAN PREVENT THE LOSS OF VALUABLE PATENT RIGHTS.

An inventor may be precluded from obtaining a patent on an invention, no matter how innovative, brilliant, or insightful the invention may be, if the invention is disclosed to the public before a patent application is filed. The problem of premature disclosure is particularly pervasive in academia, where the advancement of knowledge, rather than commercial gain, is the goal. However, even in sophisticated technical companies, many inventors are not aware of how easily patent rights may be compromised or lost by public disclosure of the invention prior to filing a patent application.

WHAT CONSTITUTES A PUBLIC DISCLOSURE?

Generally, a public disclosure is any divulgation to the public, whether written, oral, or electronic. Obvious examples include written publications, oral presentations, and information published electronically (e.g., on a website). Examples of less obvious, but no less damaging, disclosures include offers for sale, beta testing, disclosure of plans or a prototype at a scientific or business meeting, technical discussions at scientific conferences, dissertations, grant proposals to a government agency, and information disclosed in business plans or documents filed with the Securities and Exchange Commission. All of these disclosures create prior art that may limit or preclude patentability, especially in jurisdictions outside of the United States.

A common pitfall that results in loss of patent rights is failing to understand the "public" nature of a divulgation.

PRIOR ART UNDER THE U.S. PATENT LAW

The U.S. is among the most liberal jurisdictions in permitting an invention to be patented after public disclosure. Under the U.S. Patent Law, the patentability of an invention is precluded by "prior art" disclosing the invention. The invention is deemed to be in the prior art if it was known or used by others in the United States, or was patented or described in a printed publication anywhere in the world prior to the date when the invention was made. The phrase "known or used" means publicly known or used. Mere knowledge of the invention or use of it abroad does not preclude patentability in the U.S. The date of invention is presumed to be the filing date of the patent application, but the patent applicant can submit evidence to the U.S. Patent Office that the invention was made before the filing date, a process referred to as "swearing behind" a prior art reference. Swearing behind a reference removes it as prior art. There are limits on how far back in time an inventor may swear behind a reference, however: anything published anywhere in the world, or publicly known, used, or on sale in the U.S., more than one year prior to the U.S. filing date is unremovable prior art. Such prior art creates an absolute bar to patentability.

Printed publications are the most pervasive form of prior art. Any printed publication anywhere in the world, including patents and published patent applications, can constitute prior art. "Printed" publications include electronic as well as paper publications, and also may include slide shows, films, pictures, drawings, plans, posters, etc. Any type of informa-

Paula Campbell Evans

tion in almost any medium can constitute a printed publication if it can be found by members of the public seeking the information. For example, in certain regions of the world, patent publications are "laid open" for inspection—laid open patent applications constitute printed publications. The region of the world in which the publication originates is irrelevant, as long as the information is accessible to those interested in the subject matter. Some technical journals are adopting a form of "open" peer review in which the draft is published for comment on the Internet. Publication of the draft for review would be considered a printed publication.

A common pitfall that results in loss of patent rights is failing to understand the "public" nature of a divulgation. For example, merely indexing or cataloguing a document, in a library index or on a web index, so that it is "findable" by the public may constitute a public disclosure of the document. The standard for when indexing constitutes a public disclosure was stated in a much-cited 1989 Federal Circuit decision, In re Cronyn. In this case, Cronyn, who was a chemistry professor at a college, had applied for a patent on a new chemical compound. The claim to the compound was rejected by the patent examiner as lacking novelty over three student theses from the same college, all of which disclosed the compound. A copy of each thesis was filed both in the main college library and in the chemistry department library. The theses were listed on cards containing the student's name and the title of the thesis, and the cards were filed alphabetically by the author's name. Both the card index and the theses themselves were available for public examination; however, the theses were not generally catalogued in either the main library or the chemistry library, that is, they were not listed in the main catalogues of the libraries, nor were they assigned Library of Congress numbers. The Patent Office Board of Appeals upheld the examiner's rejection for lack of novelty, stating that the theses were printed publications under the patent law, and that "reasonable diligence" by a researcher would have uncovered the documents. The Federal Circuit Court reversed the decision on the basis that in order to be con-

sidered "publicly available" the theses had to be reasonably accessible to the public. The court stated that the theses were not accessible to the public because they had not been indexed or catalogued in a meaningful way.

Another form of statutory bar is created under the U.S. Patent Law if the invention was in public use or on sale more than one year prior to the U.S. filing date. Public use of the invention more than one year prior to the filing date of the patent application raises an absolute statutory bar. For purposes of precluding patentability, "public use" is any non-secret use of the invention. A single public use is sufficient to create the statutory bar. A common public use is disclosure of a new product or plans to make a new product at a professional meeting or trade show. It is immaterial that the public use may have been performed by a third party without the knowledge or consent of the inventor. All that is necessary is that the invention is used by or exposed to anyone other than the inventor or a person under an obligation of non-disclosure to the inventor.

A sale of the invention, or an offer to sell the invention, more than one year prior to the patent filing date creates an absolute bar to patentability. A single offer to sell is sufficient, and the bar is created whether or not the offer is accepted. An invention is considered to be on sale when it is sold or a definite offer to sell the invention has been made. There are two conditions that must be met to trigger the on-sale bar: there must be a sale or offer to sell the invention, and the invention must be "ready for patenting." In a 1998 decision, Pfaff *v.* Wells, Electronics Inc., the Supreme Court stated that an invention is ready for patenting if it is reduced to practice or if the inventor had completed drawings or other descriptions of the invention that are sufficient to enable one skilled in the art to prac-

tice the invention. It is unlikely that the on-sale bar would preclude patentability if the invention is not substantially complete with a reasonable expectation that it will operate for its intended purpose. Courts have held that offering to sell a concept of an invention, rather than the invention itself, does not trigger the on-sale bar. In another case, however, a sale that occurred more than one year prior to the patent filing date between parties who jointly developed an invention was deemed to bar patentability.

PRIOR EXPERIMENTAL USE OR SALE

In some instances, the prior art effect of the public use or sale of an invention may be negated if the use was experimental in nature or for a research purpose. The experimental use negation applies to a prior public use if it can be shown that the use was for the purpose of testing, or performing research or experiments, on a claimed feature of the invention. Some of the factors considered by a court in determining whether a prior public use is experimental include the degree of control over the testing exerted by the inventor or patent holder, the existence of a confidentiality agreement, the obligation of the user to keep a record of and to report test results to the inventor or patent holder, the existence of a testing protocol or other restrictions on the user's activities, and whether the use was performed to perfect the invention.

Similarly, a sale of an invention for purposes of experimentation may negate the prior sale bar to patentability. The factors stated above with respect to prior use also apply to prior sale; however, in the context of a sale, the patentee or inventor must prove that the sale was made in pursuit of experimentation rather than as a straight commercial transaction. The courts have refused to negate a prior sale based on experimental use when the inventor or patent holder has been unable to show that it maintained control over the purchaser's testing of the invention, the purchaser was not required to keep records of or provide reports of the testing to the inventor or patent holder, or the purchaser was unaware that the sale was made for experimental purposes.

A LOOK AT SOME NON-U.S. JURISDICTIONS

The U.S. is one of a minority of jurisdictions that grants a one-year grace period to file a patent application after public disclosure. Many important market countries are "absolute novelty" jurisdictions, meaning that any public disclosure of the invention prior to filing the patent application precludes patentability in those countries. The novelty requirements of a few selected jurisdictions are briefly summarized below—they are presented for exemplary purposes only and are not intended to be comprehensive summaries.

To obtain a patent in Australia, the patent application must be filed before the invention is disclosed in a printed publication anywhere in the world, and before the invention is publicly used in Australia. Certain limited exceptions exist for inventions disclosed at an officially recognized exhibition, provided that prior notice is given and the application is filed within six months after the exhibition; for unauthorized public disclosure by a third party, provided the application is filed as soon as the unauthorized disclosure is discovered; for disclosure to a scientific society provided the application is filed within six months; and for public use of the invention for trial purposes where such public use is reasonably necessary, provided the application is filed within one year.

In Canada, patentability is precluded if the invention was disclosed anywhere in the world prior to the application filing date. However, a limited exception exists for disclosure by the inventor, or by a person who obtained knowledge of the invention from the inventor, provided that the application is filed in Canada within one year of the disclosure.

Under the European Patent Convention, patentability is precluded if the invention is publicly disclosed anywhere in the world in any way prior to the filing date of the patent application. Limited exceptions exist for wrongful disclosure or disclosure at a certified exhibition, provided the application is filed within six months of the disclosure.

In Japan, patentability is precluded if the invention is publicly known or used in Japan, or described in a printed publication anywhere in the world in any way prior to the filing date of the patent application. Limited exceptions exist for experimental use, unauthorized disclosure or disclosure at certain scientific meetings, and disclosure at certified exhibitions, provided the application is filed within six months of the disclosure.

Most other countries have loss of rights provisions similar to those described above. Important rights outside of the U.S. may be irretrievably lost by a single instance of premature public disclosure.

DON'T CREATE YOUR OWN PRIOR ART

To avoid the loss of valuable patent rights, it is crucial to protect the secrecy of the invention until a patent application is filed. This means ensuring that a patent application is filed that covers any information that, prior to its disclosure, will be published in a journal, disclosed at a meeting, sold or offered for sale, presented or discussed at a scientific conference, or in some instances, shared with collaborators. If prior to filing a patent application, it is necessary to disclose an invention to a third party for the purpose of further testing or perfecting the invention, such as in a clinical trial, taking the proper steps to implement the safeguards necessary to prove experimental use may preserve patent rights that otherwise would be lost or compromised.

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INCREASING THE PRODUCTIVITY OF LABORATORY ASSETS THROUGH Effective Management

WHILE THE MAJORITY OF A LAB MANAGER'S TIME AND EFFORT GOES TOWARD MANAGING THE PERFORMANCE OF HUMAN ASSETS, THE JOB ALSO CARRIES A SIGNIFICANT RESPONSIBILITY FOR MANAGING THE PERFORMANCE OF CAPITAL ASSETS.

Although of central importance to lab operations, capital assets are typically managed as a series of ad hoc activities drawing extra attention only when circumstances bring issues to the forefront. Critical elements such as instrument maintenance are certainly systematized and actively managed, but few managers have considered asset management as an integrated function and some don't appreciate the full scope of this responsibility. As a result, management styles tend to be reactive and piecemeal which implies that this may be a fertile area to explore for improvement opportunities.

Asset management is not a familiar term within the context of laboratory operations. Therefore, the first step toward improvement is to establish boundaries and limits on the elements included in the function with at least a general explanation of the management roles encompassed. A little reflection on the performance expectations for lab managers might suggest that the following elements could reasonably be included in asset management:

- Capital Planning
- Capital Acquisition
- Maintenance
- Quality
- Regulatory/Accreditation Compliance
- Operational Productivity
- Management of Change
- Disaster Recovery
- Monitoring/Measures

Wise asset management asks that decisions pass through the rigor of the entire process to confirm that the preferred instrument is indeed the best choice to bring the organization the most benefit for its investment.

These are familiar functions within the realm of responsibility of laboratory managers but are rarely considered as part of the same performance dimension. It is instructive to examine the management expectations that go with each of these functions to gain an appreciation for the scope of the responsibility and to identify areas where new improvement opportunities might lie.

CAPITAL PLANNING

Capital planning management involves three activities — capacity management, re-deployment strategy, and retirement/obsolescence decisions.

Capacity management refers to the process of assignment and scheduling of work to take full advantage of each instrument so that the lab realizes the maximum benefit from its assets. This includes an ancillary responsibility for monitoring usage rates as a feed into the capital cycle for timing the introduction of additional capacity when needed. Since analyst labor is usually the limiting

Dr. Wayne Collins

resource determining utilization rates, capacity optimization is generally addressed in the human resource and workflow management issues that dominate a lab manager's attention. However, the connection into the capital cycle is more loosely managed which can result in operational bottlenecks if staff members fail to inform the manager until instrument limits are reached. Without active monitoring, the lab manager might not have sufficient time to introduce an additional instrument into the capital cycle or might lack appropriate data for economic justification to shepherd the request through the approval process.

In addition to planning for capacity expansion, effective management identifies under-utilized assets for redeployment to other labs or other parts of the organization where they can derive greater value for the business. In cases where redeployment is not an option, the strategy might be to lower the cost of ownership by adjusting maintenance schedules to more closely match the utilization level. That is, if the equipment is underutilized, preventive maintenance is likely performed more frequently than necessary so that the interval between services can be lengthened to save labor and material costs. Also, under-utilized equipment might signal an outsourcing opportunity.

The last portion of capital planning is management of equipment obsolescence and retirement. There are several critical factors to monitor to guide these decisions — condition of the equipment, timing of the capital cycle, state of the technological, criticality of the equipment, and economic cycle. Rising maintenance costs foretell the end of the useful life of an instrument as the increased cost of ownership begins to exceed its benefit. Managers must be alerted at the appropriate time in order to enter replacement equipment into the capital cycle so that approved budget is available before the equipment fails. Timing is especially important for critical equipment since the replacement cycle can take over a year from start to finish. The manager must also be aware of technological advances that might warrant replacement before the end of the useful life of the equipment. For example, some improvements in sensitivity or automation yield such significant increases in productivity that it is more cost effective to dispose of even partially depreciated fully useable equipment than to forego the new technologies. And, of course, the phase of the economic cycle for the particular industry determines availability of capital funds which must be factored into capital planning management.

ACQUISITION

Some lab managers end their involvement in the capital cycle by delegating acquisition to the scientists once they obtain the financing approval. However, managers have a fiduciary responsibility to see that the appropriated funds are used wisely and in accordance with business goals. This requires some oversight of the actual buying cycle and is not a trivial task. Due diligence in purchasing requires an investment in time and resources to manage risk and obtain the most value for the money. The elements of the capital buying cycle have been described in detail by Klink. [1,2] Many chemists have preconceived ideas or preferences for specific brands of instruments and will skip the thorough analysis embodied in the buying cycle if permitted. Wise asset management asks that decisions pass through the rigor of the entire process to confirm that the preferred instrument is indeed the best choice to bring the organization the most benefit for its investment. The process also provides the best opportunity to embed service options such as guaranteed response times or software upgrades at the point where these concessions are more likely to be granted by the vendors. Experience has shown that competitive market comparisons can often lower the capital investment.

MAINTENANCE

Maintenance is the most familiar of the asset management tasks and typically is the function that receives the most attention from the lab manager. The two areas of responsibility are preventative maintenance aimed at preserving function of the asset and repair aimed at restoring function. As one of the most costly items in the typical laboratory budget, this function has received some attention so that more advanced models have evolved to streamline management and introduce more efficient operations. The management philosophies surrounding laboratory maintenance have already been described in some detail[3] so that the specifics will not be rehashed here. Suffice it to say that considerable opportunities for improved productivity and efficiency remain for most lab managers and this remains a fertile area for investigation by those labs facing cost reduction mandates.

QUALITY

The laboratory quality system encompasses virtually all aspects of operations and imposes responsibility for execution directly on management. Naturally, these responsibilities touch asset management, primarily in two areas — validation and calibration. The first responsibility, validation, means that each asset must be proven to be fit for its intended purpose by objective evidence. This responsibility goes beyond merely verifying that instruments meet manufacturer's specifications as is done during the buying cycle but requires the additional step of proving capability of delivering data at the precision required for each method assigned to the instrument. This can range from a relatively simple procedure in unregulated basic chemical or petrochemical labs to a very complex task requiring special expertise for regulated industries such as pharmaceuticals.

The second quality element, calibration, falls into the core competency of a test laboratory so that virtually all have well developed reliable systems. While oversight responsibility is clearly within the management sphere, failures in this area are so intolerable that accountability is shared by the entire staff. Issues typically arise only when external contractors are used

and there are no management controls in place to insure that the work is done properly. Simply requiring certificates or other documentation is no guarantee that calibrations are actually performed correctly — good asset management practice requires performance based acceptance criteria based on replication of results for standard reference or monitor samples.

REGULATORY/ACCREDITATION

Regulatory requirements touch asset management primarily through the documentation system. Compliance requires rigorous recording of all activities associated with use and maintenance of quality critical assets as well as QC data proving instrument performance. Thus, management of assets requires the establishment of a systematic method for collecting required information plus periodic audits to insure that the system is being properly used and maintained by the staff.

Accreditation requirements impose an additional onus on calibration and maintenance systems for assets that fall within the scope of the quality system. For example, the laboratory may be required to use only accredited vendors for servicing these assets which limits choices, raises costs, and imposes additional documentation requirements. Even when services are performed by internal personnel, there are additional requirements such as construction of uncertainty budgets, traceability of standards, and proof of the competency of the technician. While the management bureaucracy surrounding the regulatory and accreditation requirements associated with each asset is often regarded as a nuisance, it can become even more time consuming and expensive when it is not seriously followed.

OPERATIONAL PRODUCTIVITY

The techniques for extracting maximum value from assets are embodied in "lean" concepts[4] and require managing human and capital assets in concert. The operators and equipment are viewed as a single system that seeks to optimize performance by elimination of waste. Location of assets in a manner that minimizes operator movement and provides easy access to logistical support is a key concept of this approach. Thus, part of asset management is matching physical location with assigned job responsibilities so that all equipment for a specific job is conveniently grouped near the appropriate supply lines to minimize technician transit time between tasks. This takes skill and ingenuity to organize the work and is typi-

cally an on-going activity since most labs are dynamic organizations experiencing frequent change.

MANAGEMENT OF CHANGE

Management of change is a mechanism for anticipating safety or regulatory issues associated with modification or movement of assets so that the priority assigned to this task typically varies with the degree of risk — it is a high priority for labs in the chemical and petrochemical industries where the consequences of a mistake can be loss of life and property. This function recognizes that the lab does not operate in isolation but is part of a larger system that is impacted by its actions. For example, the physical act of moving an instrument from one laboratory to another is easily accomplished by lab staff without the assistance of others in the organization. But, in fact, this simple act may have significant implications for others. Management of change is a process for examining these secondary consequences and communicating the change throughout all systems that connect with the lab. While the management of change process can vary from organization to organization, certain elements are included in nearly all systems.

Stakeholders that have an interest in asset changes occurring in the laboratory might include:

- Engineering
- Facilities
- Environmental
- Safety
- Financial
- Purchasing
- IT/LIMS

This is not meant to be an all inclusive list but illustrates the types of stakeholders that should be included. It is instructive to examine the asset change issues for each of these.

Engineering typically maintains plat drawings of the facility showing the layout and location of all equipment. Any movement of the equipment requires that these drawings be updated. There may also be engineering drawings of the asset itself which must be updated if the equipment is modified. In a plant environment, these drawings are used in the mandated process hazard analysis (PHA) function so that accuracy is vital to maintaining safe operations.

Facilities managers have an interest when usage of electricity, water, air, or other utilities decreases in one area and increases in another. This function manages utility consumption to insure that demand does not exceed capacity and that adequate safety margin is available to support future business goals and initiatives. They are also concerned about the ability of building systems such as air conditioning or ventilation to accommodate the equipment and possible interferences with surrounding tenants or assets. Signage in both the old and new locations may need to be modified and the vacated area may need to be refurbished to support other uses.

Movement or modification of equipment may produce changes in waste streams that are managed by the environmental function. These changes might require different segregation or collection schemes and might even impact the site environmental permits. For example, discharge of cooling water into a drain might seem innocuous but could impact regulated water use permits in subsidence prone areas or outfall limits into public facilities.

Safety specialists need to be consulted to evaluate any compatibility issues between reagents associated with the equipment and other chemicals in the area. Documentation of all the materials in an area is also important for the safety of emergency responders in the event of a fire or other incident. New chemical exposure monitoring programs may be needed in some cases or even new alarm systems, such as low oxygen monitors, if the equipment uses nitrogen.

Changes that might affect overhead allocations or shared service agreements need to be recorded in the financial systems. There may be tax implications if the equipment will be used for a different purpose since R&D often falls under different tax statutes than other operational expenses. Service or lease contracts might be affected if the equipment is transferred to a different organization or to a different usage. And, of course, if equipment is sent for disposal or salvage, the details of these transactions must be recorded so that assets are correctly valued in the financial statements — a much more important consideration since the advent of Sarbanes-Oxley.

If the laboratory is part of an organization that maintains a warehouse operation for common expendables, the purchasing function should be notified of asset changes that might affect usage rates of stocked items so that reorder points and quantities can be adjusted. If equipment is removed from the site, unused supply inventories can sometimes be returned to the vendor for credit before they become obsolete.

The information technology (IT) function and the LIMS administrator have an interest in asset changes that might affect network traffic or laboratory workflows. Routers, servers, and firewall configurations might need reprogramming. The instrument interface might need to be reconfigured and different shared services such as printers or faxes may require installation of new software drivers.

Management of change is the system that identifies all of these stakeholders and links them into the asset management system to insure that all of these activities are accomplished. Health, safety, and environmental effects are the overriding considerations in this process and take precedence over all other factors. A robust system will track location of capital inventory, insure that the extent and nature of all changes are documented throughout the organization, and that support personnel are notified and aware of the implications of the changes.

DISASTER RECOVERY

Within any lab, there is some risk of loss of critical assets due to accidents or gross equipment failures. For those labs supporting an industrial operation such as a large chemical plant, plans must be in place to quickly restore service to avoid significant economic loss. Options might include switching critical tests to backup instruments, using a contract lab, obtaining temporary mobile lab facilities, locating critical equipment in unit control rooms, or similar tactics. Typically these plans also consider reduced testing schedules and general paths to restoring full functionality of the lab. The main point of the plan is to identify these contingencies beforehand in order to restore function in the shortest possible time.

MONITORING/MEASURES

Any complex system needs monitors or measures to insure that it is functioning as intended and the asset management system is no exception. The system needs to generate data that can be collected and compiled into reports that reflect asset performance and allow the manager to correct non-conformances by exception. Given the number of instruments in a typical lab, reports on the performance of individual assets is simply not practical. Ideally, reports should identify exceptions such as:

- Instruments ≥ 75% Capacity
- Instruments ≤ 25% Capacity
- Instruments with > 1 Repair per 2yr.
- Instruments with cost of ownership increasing by > 10%/yr.
- Instruments with > 7 days/yr. Downtime
- % Missed PMs
- Repairs > 2 days
- Maintenance budget variance

Just as many labs use standard test times to track productivity, standard maintenance times and costs assigned to each piece of equipment can be compared to the actual data collected in the maintenance management system to identify outliers. Other measures may be appropriate depending on the type of laboratory.

MANAGEMENT OPTIONS

The majority of lab managers administer the asset management function through delegation and reactive responses. Due to the nature of the tasks, failures and omissions can go unnoticed for long periods of time allowing the system to degenerate. Many labs are unable to produce even basic elements such as an accurate inventory of assets and fail to appreciate the importance of tools such as management of change until a crisis erupts that highlights the problem.

As with most repetitive functions, asset management requires a systematic approach. Stakeholders and issues should be identified as in the described examples so that appropriate workflows can be designed to fulfill data collection requirements. The system may be as basic as an assortment of forms to collect the data along with routing instructions to distribute it to the appropriate stakeholder or as complex as a computer database with automated workflows and custom reporting tools. The manager usually occupies a position somewhere in the workflow as a means for monitoring the system and maintaining an awareness of lab operations. Unfortunately, these activities consume scarce resources which are usually obtained at the expense of the core testing function.

As might be expected for a complex, largely secondary function, a marketplace has developed for service providers who furnish and administer some of the elements of the asset management system (e.g., Thermo Electron's *LIFECYCLE* program). The initial focus of these services was on providing maintenance options for instruments and equipment but the offerings are growing beyond this segment to include cradle-to-grave management of the lab's assets. These providers promise lower costs while relieving the lab manager of the daily management burden and freeing lab personnel for the core analytical function. The best of the services provide extensive reports and metrics to assure the manager that the system is functioning properly.

CONCLUSION

Effective system management can yield significant benefits for a laboratory as illustrated by the efficiencies and cost savings in maintenance operations reported in a case study by Rohm & Haas.[5] When the same systematic approach is expanded to encompass all of the activities surrounding management of capital assets, even more benefits can be realized. As lab managers are pressed to control costs, this is an area worth looking at for productivity gains.

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NED'S Rules of Engagement

THESE ARE NOT RULES TO LIVE BY;
THEY ARE RULES TO ENJOY LIVING BY.

I developed a particular passion during 22 years of service in uniform. That passion was how leaders work — what they did, and more importantly, why they did it. In 1998, I began to articulate some guidelines that I had learned over time, both in and out of uniform, about how people (who are responsible for the work of others) should conduct themselves as leaders. The important consideration here is: "It is not important what we do, rather it is why."

These guidelines grew into what I now call "Ned's Rules of Engagement." The quirky title comes from two separate concepts. First, people who are responsible for the work of others need to live by a code of conduct in order to ensure success in their own work —being responsible for the work of others. This is an "engagement" to live by a code of the type given below — just like any other promise made to oneself. The other connotation of the title phrase comes right out of its military meaning and can be applied in the same context. That context is a set of allowable actions leaders may take when faced with a pre-defined set of circumstances or, "if circumstance A occurs then I am allowed to take action B." So, the second implication is that these rules help focus a leader's vision on the best set of responses they may use to react to developing circumstances.

Good leaders can motivate dispirited teams of people to achieve difficult objectives under impossible circumstances.

"Ned's Rules of Engagement" are about what we do as leaders and which set of circumstances would normally trigger each one of the rules. In the end, they are not really my rules. Others really did all the work in developing them and I cannot claim credit for the wisdom they provide me. All I did was catalogue them into my own list.

Based on this approach ("what" is less important than "why"), I have attempted to articulate the reason behind the most desired approach for each circumstance. The best reasons we can have for doing anything affecting our team are those most clearly understood by our team members and most acceptable to them. When we are responsible for the work of others, therefore, the best "reasons" we can have for our actions are based on a principle or a set of principles. Leaders who are remembered not only for their successes (because simple success is not enough) but also for their positive contributions to their group, are those that followed this very approach.

Today, these rules are posted on my door at work. If I breach any one of them, my colleagues have the right, and are encouraged to exercise the duty, to call me on the breach. They are automatically in the right.

The rules are not so tough to follow and I really enjoy the simplicity they can provide when faced with complex circumstances that may include conflicting requirements. They are how I measure my own performance — and some-

J.E.J. (Ned) Gravel

times how I measure the performance of others (who are responsible for the work of others). My colleagues are exempt from this examination because very few of them have had the opportunity to experience the types of situations where understanding these is critical to survival.

Some of my bosses, however, have not been so lucky — especially those who have had access to the same type of common sense training that I enjoyed. There have been occasions when I have demanded adherence to one aspect or another of these rules from those for whom I worked. In fact, one of the reasons that I really enjoy my current appointment is that our Executive Director can quote these to me. Which brings me to my last consideration.

These rules are not copyrighted. If I were to define the single greatest reward from having spent the time to write them (actually re-write them into one list), then that reward would be defined as knowing that more leaders and managers use them. It would make life so much easier for me in a number of different ways, not the least of which would be an ability to get more done within the common constraints of time and other resources. I have the advantage of working for someone who understands and applies them but many people work in organizations where leadership authority is exercised by those who do not or will not.

Conversely, application of these rules by leaders, whether or not they have managerial authority, can remove 95% of all job-related dissatisfaction experienced by their team members.

If anyone needs to know what implementation of these rules can accomplish, here it is:

Good leaders can motivate dispirited teams of people to achieve difficult objectives under impossible circumstances.

And this is the most that any organization can ask of its leaders — at any level.

J.E.J. (Ned) Gravel *is the Manager, Quality and Training at the Canadian Association for Environmental Analytical Laboratories (CAEAL). The association is a public-private partnership which provides services to over 400 member laboratories including PT services, accreditation, and training. Ned represented Canada on ISO/CASCO Working Group 10 — the group which developed ISO/IEC 17025, and Working Group 25 — the group which was assigned the task of aligning ISO/IEC 17025 with ISO 9000:2000. Canadian Association for Environmental Analytical Laboratories Suite 310, 1565 Carling Avenue, Ottawa, ON K1Z 8R1, Canada; (613) 233-5300; www.caeal.ca.*

NED'S RULES OF ENGAGEMENT

1. Selection and Maintenance of the Aim is a concept that was invented to focus one's efforts for the conduct of war. It is also the first principle of success. When you are up to your backside in alligators, it may be difficult to remember that your original aim was to drain the swamp. Remember it – find the plug – drain the swamp. Most of the alligators will follow the water.
2. Leadership is defined as the Art of Motivating People to achieve a common goal. Management is defined as the Science of Planning, Co-ordinating, Directing, and Controlling resources to achieve an organizational goal.
3. People are not resources…they are people.
4. Believe in your people first. They will look after the rest.
5. The first goal of a true leader is to write his/herself out of the job – become dispensable. All parts of the organization should be able to function without the leader's direct intervention. The true leader need not worry about loss of job – there are always enough new challenges to prevent this occurrence.
6. The first task of a leader is to name his/her successor. The people in the organization need to know that there will be continuity of leadership. (See Rule #5.)
7. People will only follow leaders who believe in something more important than oneself. No person willingly follows someone whose first interests are self-serving. They will tolerate such a person, but they will not follow them.
8. Leaders need to do three things well to succeed, and they need to do them in the following order:
    - Develop and articulate a vision for their team,
    - Sell the vision and its associated aims to everyone on the team,
    - Help the members of the team to achieve their aims.
9. Leaders will achieve success only when the success of the team is written in the eyeballs of the members of the team.
10. Organizational success can be defined as the moment that the last person in that organization adopts their portion of the organizational vision, the main proponent of which is the organization's leader. In this way, the organization can continue to function as a coherent whole, without the necessity of constant leadership intervention. (See Rules #5 and #6.)
11. Not making a decision is never an option. A decision to do nothing is still a decision.
12. Responsibility is the sum of the authority to do what is needed and the accountability for the results. No person can be responsible for something over which they have no authority, or for the results of which they cannot be held accountable. Authority is derived from the same entity that holds the individual accountable for the results – the organization or person that delegates the responsibility.
13. The success of any meeting between two or more people rests solely with the person who wants the meeting. This is the person who has an idea or vision to transmit, especially if they wish other people to accept and act upon their ideas. Anyone having trouble accepting this truth should consider the person with the idea to be a vacuum cleaner salesman and then try to blame the housewife for his failure to sell her his idea – that she needs to buy his vacuum. Better still, consider the idea person to be an infantry battalion commander and then blame his soldiers for not getting the plan on how the unit is supposed to take their objective. If you try to allocate any of the responsibility for the successful outcome of these meetings to the housewife or the soldiers, consider whose responsibility it is to deliver clarity, establish understanding, and instill acceptance of the ideas being sold. Good Luck!
14. Effective communication consists of two parts listening and one part talking.
15. Companies do not make purchasing decisions. People do. People buy from others (including you) by going through the following purchasing sequence. (Remember Rule #13.):
    - First, they buy you,
    - Second, they buy your idea,
    - Finally, they buy your product or service.
16. Anyone trying to make a presentation, teach others, or sell an idea to others will have their credibility based on the following criteria with the annotated weighting factor:
    - Physical appearance and movement (Visual) 55%
    - Quality and tone of voice (Vocal) 38%
    - Content of the idea presented (Content) 7%
17. A sale is defined as the happy exchange of product or service for dollars. Marketing is defined as doing something today to ensure sales tomorrow. The process of marketing is the eliciting of a specific, desired behavior from a specific target market.
18. The Communications function is a subset of Marketing. Marketing is about convincing the people in a target market to do something. Communications is about how to get the message to them that best motivates this desired behavior.
19. A Business Plan is the articulation of business rules to live by and how to live by them. The same is true of Strategic Plans, Quality Management Systems, Marketing Plans, Corporate Plans, and so on. These plans tell organizations (us) about which things we are going to do. The hard part is defining what those things are. (See Rules #1, #8, and #10.)
20. All personal endeavour requires the use of four available resources. These are Energy, Knowledge, Time, and Money. All of these are renewable resources, except Time.
21. In my professional life, they are colleagues. In my personal life, they are the most precious creatures in the universe. (This one may get me into trouble.)

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Glenn Ketcham, CIH and Vince McLeod, CIH

Chemical Safety in the Laboratory- Part 1

The thought of using "chemicals" can bring about a wide range of individual emotions in people. These may range from a total lack of concern and contempt for any suggestion of hazard, to overwhelming apprehension at the thought of the slightest exposure. In reality, the mishandling of many chemicals can have serious health and safety consequences. However, even the most dangerous chemicals can be used with a high degree of safety in the laboratory if people recognize the hazards to which they may be exposed, are trained to deal with those hazards, are diligent and consistent in the use of appropriate safeguards, and are committed to preventing injuries and illnesses.

KNOWING THE HAZARDS

The OSHA Hazard Communication Program (HCP) and the OSHA Chemical Hygiene Plan (CHP) are cornerstones for chemical safety and health in the workplace[1]. The plans are similar, in that the goal of each is to have workers understand the chemical hazards to which they may be exposed and understand how to adequately protect themselves from those hazards. In addition, the CHP also requires the development of standard operating procedures (SOPs) for using laboratory chemicals that describe the hazards and what measures will be used to protect against them. The SOP basically requires the laboratory worker to pre-think and preplan the experiment to account for and address the potential hazards. We always like to see notation in the lab notebook addressing the SOP elements when designing an experiment (e.g. do in fume hood, use nitrile gloves, etc.). The CHP covers the use of materials that meet the OSHA definition of "laboratory scale" and "laboratory use:"

"Laboratory scale" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those processes whose function is to produce commercial quantities of materials.

"Laboratory use" means handling or use of chemicals in which all of the following conditions are met:

(i) Chemical manipulations are carried out on a "laboratory scale"
(ii) Multiple chemical procedures or chemicals are used
(iii) The procedures involved are not part of a production process, nor in any way simulate a production process
(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals

Those uses of chemicals in the laboratory that do not meet the requirements above, such as filling vacuum pumps with oil, some uses of tissue fixatives, use of liquid nitrogen for sample preservation, or use of acrylamide for pouring gels (for those few still doing this) fall under the Hazard Communication Standard (a.k.a. "Haz Com").

The primary elements for both Haz Com and the CHP include: a chemical inventory; material safety data sheets (MSDS); labeling of containers with the product name and an appropriate hazard warning; training of staff on safety and health aspects of using the materials; and

development of a written program. MSDS and primary container labels contain much of the safety and health information required to safely work with chemicals.

Employees must be trained before they actually use chemicals at work. One method of training and documentation we have seen that can be effective is the use of an "open book/fill in the blank" type quiz. Employees complete the quiz as the training is conducted. They record the key points in their own handwriting as they are being trained. These key points might include a mix of general and site-specific information (e.g. the written program is available for review and is kept on the bookcase in room 232, MSDS are maintained in a binder in the main office and on top of the file cabinet in the lab). A second training exercise, often used in conjunction with the quiz, is to provide the MSDS for a material commonly used in the facility along with product-specific questions (e.g. phenol has a variety of potential hazards). Employees working either singly, or in groups, use the MSDS to answer the questions. These exercises can help reinforce the information provided during training and provide much more defensible proof of training than a simple sign off sheet.†

PHYSICAL HAZARDS

The physical hazards of chemicals are often the best understood. These hazard classes include flammability, reactivity, explosivity, and corrosivity. In the laboratory there are a few materials of note that present physical hazards. Diethyl and isopropyl ethers are extremely flammable and are often some of the most dangerous fire hazards often found in the laboratory. This is due to their high volatility and extremely low flash point. Electrical arcs from equipment motors and switches or from static electricity discharges may ignite ether vapors. Most flammable liquids have vapors that are heavier than air and may travel surprisingly long distances to an ignition source and flash back. Never use a household-type refrigerator to store flammable liquids (ethers, alcohols, etc). In the event of a container spill or leak, an explosive concentration can quickly develop with ignition occurring when the unit cycles. Every year or two there is a new story of a university lab destroyed as a result of a refrigerator fire. Many ethers, tetrahydrofuran, dioxane, and several other flammable solvents have the additional hazard of forming unstable peroxides over time, especially with exposure to air. When sufficiently concentrated (e.g. around a container cap or through distillation) detonation can occur. Because of their tendency to form peroxides on contact with air, date containers upon receipt and at the time they are opened. Many organizations require peroxide formers to be either disposed of, or tested, within three to six months after opening. If unopened, they should always be disposed of by the expiration date on the container.

Flammable and combustible liquids (including organic acids) are best stored in Factory Mutual (FM) approved flammable liquid storage cabinets or in a specially designed flammable liquid storage room. There are often local and state requirements or fire codes that limit quantities of flammable liquids and other classes of chemicals within portions of a building and within the building as a whole. Chemical compatibility is critical when storing chemicals. Inadvertent mixing of incompatible chemicals may result in fire, explosion, or evolution of extremely toxic gasses.

On a frequency basis we have probably seen more reported injuries in lab settings from corrosives (acids and bases) than any other class of chemical. In part, this is due to the fact that the pain starts within seconds (or hours with inhalation of some acid vapors) and thus is tied directly to the exposure event. Of these injuries, spray/splash to the eyes is near the top of the list and is among the most preventable. The use of protective eyewear is paramount wherever chemicals are mixed, dispensed, or used. Using regular prescription glasses alone does not count as protection. If one is not using protective eyewear when using chemicals, then a splash to an eye should not be considered an accident. It is a planned event. One may not know exactly when it will happen, but chances are, sooner or later it will. If a chemical splash or spray to the eyes or skin does occur, prompt action can greatly reduce the severity of injury. Time is critical and seconds count. Unless flushed immediately and thoroughly, tissue destruction may occur. Corrosives denature eye proteins causing them to become opaque (just as when you fry an egg and the albumin goes from clear to white). This is not reversible, you can't unfry an egg. You should know exactly where the nearest safety shower and eyewash is for each part of the facility in which you work. The open area under the safety shower is often choice space for putting boxes or storing a cart. Resist the temptation and keep access to it free and clear of obstacles. One day you may need to find it quickly and with your eyes closed.

Many chemical suppliers offer plastic dipped reagent bottles to prevent release of the chemical if struck or dropped. In several close calls we have seen, this system worked well to prevent spilling and injury, and was well worth the slight extra cost.

As we have seen, there can be many hazards in the laboratory associated with the physical hazards of chemicals. In any experiment or chemical process it makes sense to preplan the procedure with a thorough understanding of the experiment and the role and properties of each of the materials used. Incorporating safety planning into the procedure or experiment should be a natural and integral part of this process. We will continue the discussion of chemical safety in the next issue with a focus on the toxicity and other biological concerns of chemical exposures. As always, make safety in the lab a habit for life.

RESOURCES

Prudent Practices in the Laboratory: Handling and Disposal of Chemicals. National Research Council, National Academy

Press, Washington, D.C. 1995
http://www.osha.gov/SLTC/laboratories/index.html
http://www.osha.gov/SLTC/hazardcommunications/index.html
http://www.cdc.gov/niosh/topics/chemical-safety/

- NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals.
- National Fire Protection Association (NFPA).

† Hazard communication violations are among the most frequently cited and easily substantiated serious violations during OSHA inspections. During an inspection a compliance officer (CSHO) will often select a product at random, then ask an employee in the area to secure an MSDS or show an SOP for that product. One must be able to do it without confusion or delay or a violation will probably exist. The CSHO will probably also ask the employee to describe some of the hazards of the product and what safety precautions they take when working with it. Improperly or inadequately labeled containers are also easily sustainable violations and are commonly cited. Unimpeded accessibility of the MSDS during any work shift is required by OSHA and of paramount importance in the event of a chemical accident. MSDS indicate the type of material and procedures to be taken in the event of exposure. Without the MSDS the physician may not know how to provide treatment and valuable time may be lost.

REFERENCES

1. Hazard Communication Program (29 CFR 1910.1200) and Laboratory Safety Standard - Chemical Hygiene Plan (29 CFR 1910.1450).

Glenn Ketcham *is a Certified Industrial Hygienist with 22 years experience in the health and safety field. He is currently the Risk Manager for the University of Florida with responsibility for the loss prevention, ergonomics, disaster preparedness, and the occupational medicine surveillance programs. He has managed the laboratory safety programs for both the University of California, San Diego (UCSD) and the University of Florida. In addition, he served as an industrial hygienist with federal OSHA compliance and has a masters degree in environmental engineering sciences with a health physics concentration.*

Vince McLeod *is a Certified Industrial Hygienist and the senior IH with the University of Florida's Environmental Health and Safety Division. He has 17 years of occupational health and safety experience in academic research with focus in the research laboratory. His specialties are in hazard evaluation and exposure assessments.*

The Safety Guys welcome your comments and questions. You can email them at thesafetyguys@labmgr.com.

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The Zetasizer Nano light scattering particle characterization system is being used in a novel carbohydrate-lectin binding-inhibition assay. The assay was developed as part of a project to investigate the binding activity of both naturally occurring and engineered galactose-specific C-type lectins from a marine invertebrate. It is designed to meet the low sample volume and high sensitivity requirements essential for protein characterization. Malvern Instruments www.malvernusa.com

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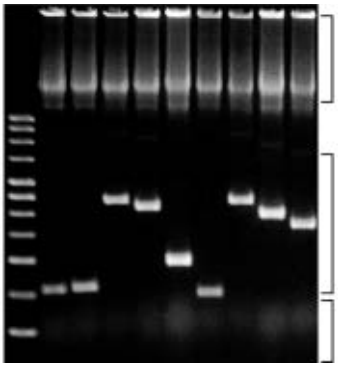

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CELL CULTURE DISHES

The SUREGrip 100x20mm, 60x15mm, and 35x10mm cell culture dishes are designed for easy, comfortable, and safe handling, even when dishes are stacked. The raised ring around the circumference of the dish provides a secure grip of both the dish and lid, reducing the risk of contamination due to unintentional removal of the lid. Sarstedt www.sarstedt.com

MICROPLATE DATA COLLECTION AND ANALYSIS SOFTWARE

The Gen5™ Microplate Data Collection and Analysis Software is designed for the requirements and preferences of microplate instrumentation users. It offers a clean, uncluttered interface with multiple options for access to the most common tasks. Several versions are available, including Gen5 Secure compliant to 21 CFR Part 11. BioTek Instruments www.biotek.com

CELL DISPENSER

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PLASTIC LAB JACK

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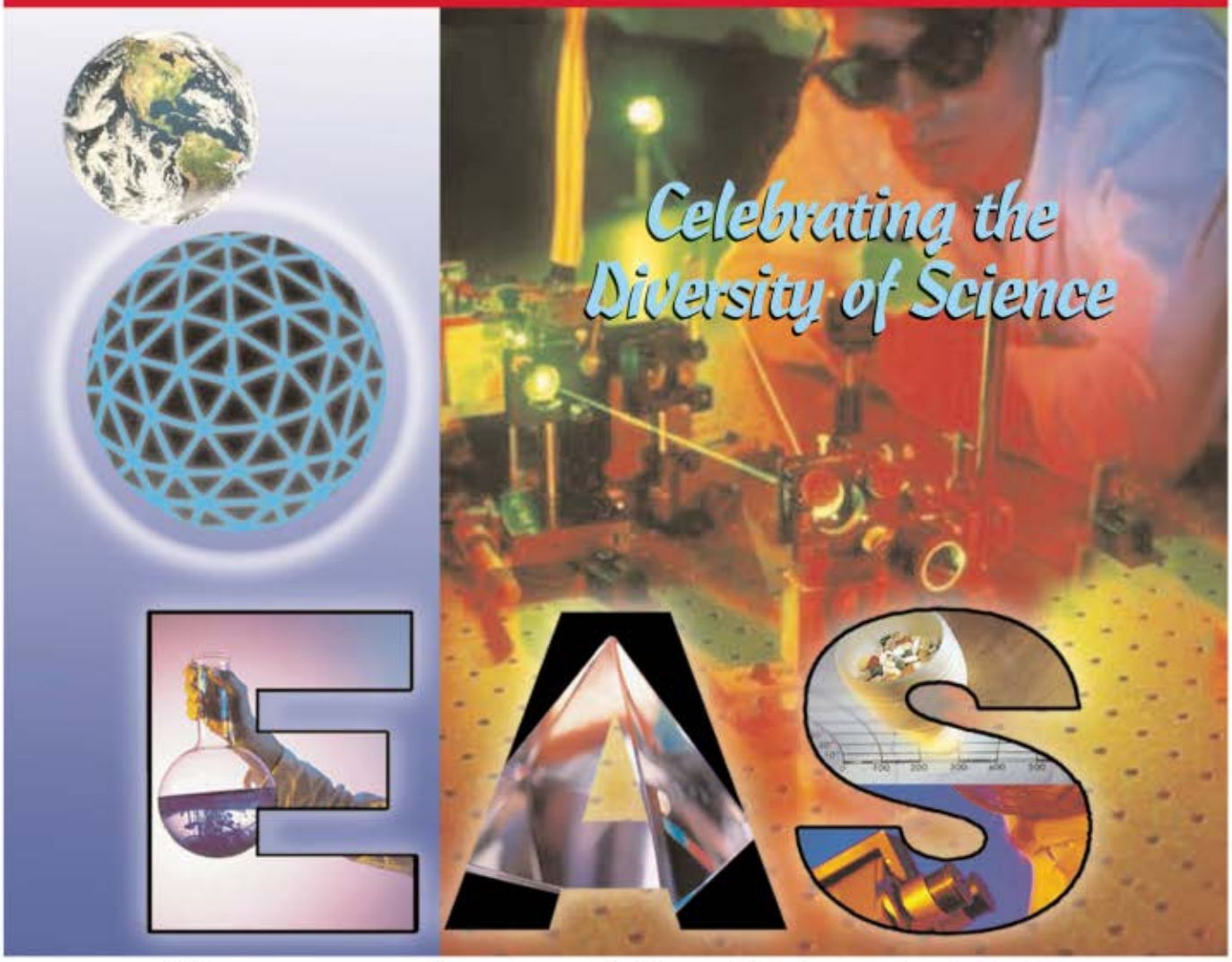

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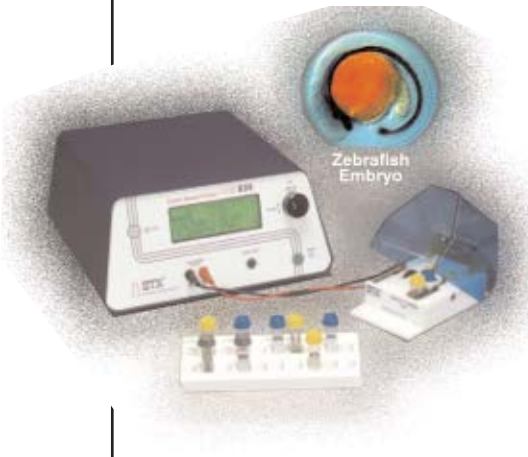

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Speakers :

Jennifer Davis is a senior scientist with Environmental Health & Engineering, Inc. (EH&E). She has a master's degree in Engineering Management from The Gordon Institute, part of Tufts University. Ms. Davis currently oversees the environmental health and safety program managed by EH&E at the Harvard Institutes of Medicine and New Research Building located in Boston, Massachusetts. Ms. Davis has experience in preparing, submitting, receiving approval, and maintaining permits regarding air emissions, chemical storage, controlled substances, hazardous waste, recycling, storm water, and wastewater. Periodically, she conducted environmental health and safety audits and environmental site assessments on facilities to ensure regulatory compliance.

Susanne Simon is the Environmental Health and Safety Manager at the Partner's HealthCare Research Building in Cambridge, Massachusetts. She has a master's degree in Microbiology from Ohio State University and a master's degree in Industrial Hygiene and the Work Environment from the University of Massachusetts, Lowell. Her experience includes work with the public, media, local, state (environmental and public health departments), and federal governmental agencies (Department of Defense, U.S. Fish and Wildlife Service, Federal Emergency Management Agency, Coast Guard, EPA, CDC, and OSHA).

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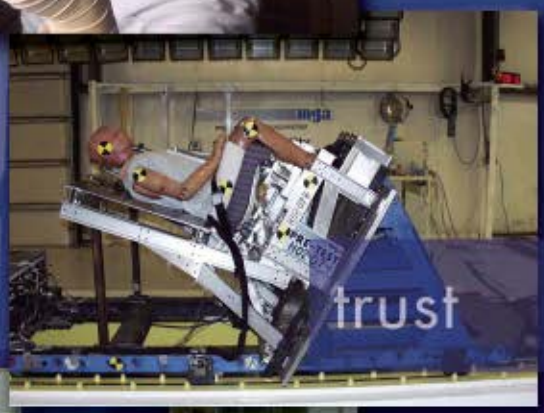

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How it Works

Calibration of Automated Liquid Delivery Systems

Problem: Automated liquid delivery systems can increase throughput and decrease labor costs for a number of laboratory applications. Because these applications demand a high level of data integrity, they rely on the intrinsic accuracy and precision of automated systems. To maintain confidence, it is important that these systems be calibrated and their volumetric performance frequently verified.

To verify automated liquid delivery device performance, the validation method must be able to measure small volumes and verify the performance of each individual channel and dispense. It is also important that the method produce standardized and traceable results for inter-laboratory comparability. Finally, the method must be robust, rapid, and easy-to-use by in-house personnel so performance can be verified frequently without extensive downtime.

Solution: To satisfy laboratory demands for a commercially-available solution meeting all of these requirements, ARTEL developed Ratiometric Photometry,™ a dual-dye, dual-wavelength method for accurate and precise measurement of minute volumes. This technology employs two colorimetric dyes with distinct absorbance maxima at 520 nm (red) and 730 nm (blue). By measuring the absorbance of these dyes under controlled conditions and applying the Beer-Lambert law, the MVS determines both the precision and accuracy of each channel and dispense in a multichannel liquid delivery device in one experiment. By measuring the path length through the solution and knowing the dye concentration, the unknown volume can be calculated with accuracy and consistency, regardless of environmental influences in the lab.

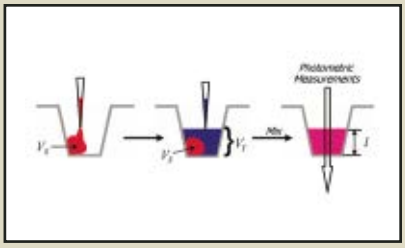

Figure 1: For small test volumes (Vs), a dispensed droplet of sample solution will adhere to the well sidewall and will not spread across the plate bottom. For accurate photometric measurements, the well is backfilled with diluent to a total working volume (VT) of 200 µL. Because the sample contains the same concentration of blue dye as diluent, the total working volume is determined from a photometric measurement at 730 nm of the beam path through the solutions.

Figure 2: ARTEL's MVS (Multichannel Verification System) verifies the performance of automated liquid delivery devices.

This process is accomplished with (1) dimensionally characterized microtiter plates; (2) highly characterized and standardized dye reagents, diluent, and baseline solutions; (3) specialized calibrator plate to provide NIST traceability, consisting of sealed precision quartz cuvettes containing the same dyes used in the sample solutions (the calibrator plate calibrates the microplate reader to specific tolerances); and (4) Data Manager software with a user-friendly interface and data archiving and analysis tools.

The absorbance per unit path length of the red and blue dyes is determined by ARTEL for each MVS solution. This traceable information is recorded on a barcode on each bottle, further reducing measurement variability and uncertainty. Barcodes on the microtiter plates, sample solutions, and calibrator plate contain performance information that is passed to the software through the barcode reader. The plate reader collects photometric measurements of the dye solutions dispensed into the microtiter wells by the liquid delivery device. These measurements, together with the barcode information, are used to determine both the precision and accuracy of the volume delivered from each tip of the liquid delivery device.

The MVS verifies performance in minutes, allowing for periodic device calibration, more frequent spot verifications and routine protocol optimization. The ability to report both the accuracy and precision in one simple test provides the user with a full assessment of liquid delivery device performance, thus ensuring the integrity of data produced.

For more information on Ratiometric Photometry™ or ARTEL's MVS,™ visit www.artel-usa.com/mvs.

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Real-time Markets – Is Your Laboratory Prepared?

As the use of electricity skyrockets, what can laboratories do to insure that consistent and quality power delivery is available for sensitive instrumentation?

Real-time markets are a part of our everyday lives. Whether it's the crude oil market, of which we are all feeling the effects because of its climb to $75 a barrel, or the American Stock Exchange, which requires diversification and knowledge to yield success, we can either be proactive or reactive when caveat emptor is the phrase of the day.

In reaction to the increased price of gasoline, some individuals are re-evaluating the utility of high fuel consumption SUVs and opting for hybrid vehicles or carpooling to save energy costs. Some proactively respond to the dynamics of this real-time market phenomenon, make adjustments, and find better ways to maximize their lives, while others will be caught unaware, only to suffer the consequences. Times are changing and so must we.

The American Stock Exchange (NYSE, NASDAQ, and/or OTC) is another example of a real-time market that can have a profound effect on our daily lives. Though investor goals vary widely from short-term trading to long-term growth, all investors are subject to the rise and fall of the market. Some choose to be proactive in their knowledge of market trends, etc., while others are more reactive, and thus, at heightened risk. If you are successfully diversified and hedged, the market yields rewards, but only if you diligently watch the trends and are not caught unprepared by recession.

IN THE LABORATORY

An important real-time market that affects our daily livelihood in the laboratory is electrical power. As long as the lights are on and we are not threatened by rolling blackouts, as California experienced in June 2001 and the Northeast during the week of August 11, 2003, we take the availability and quality of electrical power for granted. If any resource is the subject of a real-time analysis, it is the electrical power market, because we do not have an economical way of storing electricity for peak demand use. While we can convert energy from fossil fuel (coal, oil, or gas), thermo-mechanical (steam/hot gases), petrochemical, hydro-electric, nuclear, or wind energy into electrical energy, the only way to store electricity is via storage batteries (direct current), a rotating apparatus such as a fly wheel (mechanical), capacitors (charge storage), or inductors/electro-magnetics (coils). All of these methods are short-term power bridges.

The electric power industry is a classic oligopoly that is highly regulated by local, state, and federal government agencies. There are no less than six regulatory agencies that govern power generation, distribution, and initial power quality. Power generation is regulated for an average 7% reserve capacity. That number can easily be exceeded due to weather and environmental factors, as well as local events, such as the Northeast Power Grid failure—an event that started in Michigan and progressed throughout the Northeastern states, including NY and Canada. The generation and transmission of electrical power is a closed-loop system that is based upon 18th century technology and 20th century controls. Energy is sourced (generated) and must

Raymond L. Hecker

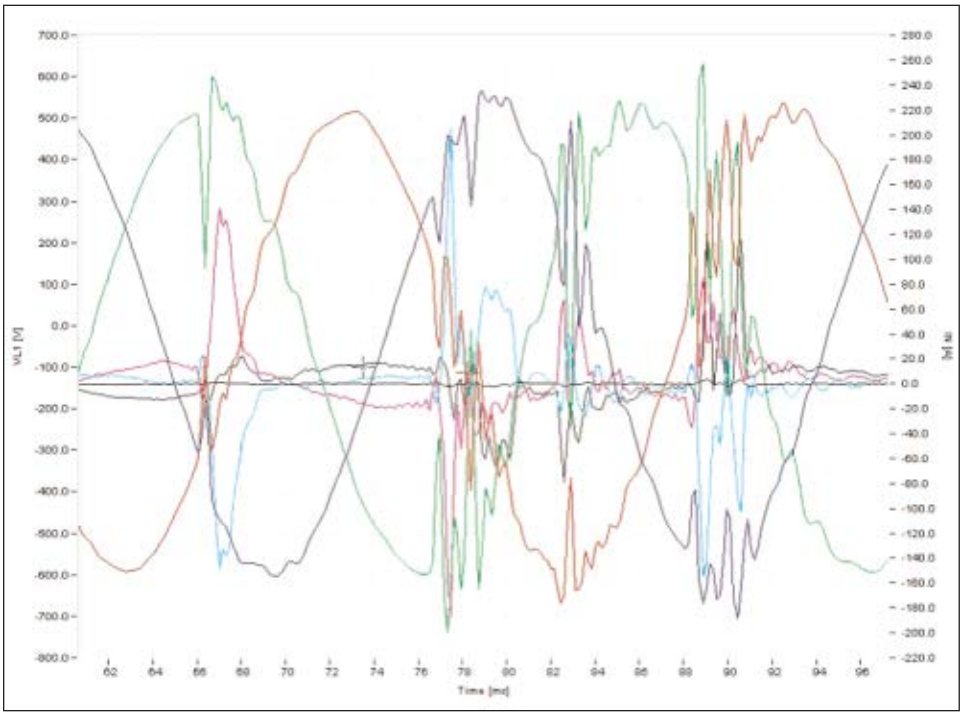

Figure 1 illustrates typical electrical power when closely examined in small millisecond (ms) intervals. It is quite obvious that the electrical power is not the smooth, traditional sinusoidal wave. While this quality is acceptable to power lighting, it is totally hazardous to the life of the sensitive electronic circuits found in both analytical instrumentation and informatics.

return via a sink (ground) in a closed-loop system. All users of electricity are common "party line" users. Whoever consumes electrical power and modifies its wave form (quality) via their use processes affects us all. When initially generated, the quality of electrical power is exceedingly high and tightly regulated. The problem with power quality is that it is a pooled, contaminated resource by all other users. Power quality must be corrected locally.

Figure 1 illustrates typical electrical power when closely examined in small millisecond (ms) intervals. It is quite obvious that the electrical power is not the smooth, traditional sinusoidal wave we are all used to seeing in textbooks. The power in this example has been adulterated by digital signals, switching power supplies, collapsing electro-magnetic fields, storm- and switching-induced transients, variable frequency drives, power factors, harmonics, surges, voids, low lines, and spikes. While this quality is acceptable to power lighting, it is totally hazardous to the life of the sensitive electronic circuits found in both analytical instrumentation and informatics.

Dr. Kevin Rosenblatt, Assistant Professor of Pathology, Associate Director of the Translational Pathology Division, and Director of the Clinical Proteomics Program at the University of Texas Southwestern Medical Center, learned first-hand the challenges and true costs of unconditioned electrical power. The power-related problems at the medical center were causing his key instrumentation to be inoperable 50% of the time. Dr. Rosenblatt, in conjunction with the instrumentation manufacturer, PerkinElmer-Sciex, determined that one of the root causes of the laboratory's instrumentation performance problems was inconsistent power delivery, including power fluctuations, harmonics, and transients. At the request of PerkinElmer, we worked diligently to solve the laboratory's inconsistent power delivery problems, and since installation of a certified category III-3 instrumentation laboratory protection system (LPS) device, the medical center has not experienced a single power outage or blip, resulting in an annual cost savings upwards of $500,000 for a single MALDI-TOF mass spectrometer.

While skeptical at first, Dr. Rosenblatt quickly learned the effects of real-time markets, how to manage and hedge his investments with certified category III-3 LPS solutions, and the steps to take to maximize the performance of his highly automated laboratory and its associated research instruments. He responded to the dynamics of this real-time market phenomenon, made proactive adjustments, and found ways to operate his laboratory efficiently. The question for the laboratory manager is whether the laboratory is prepared or will it be caught unaware by the hazards of the real-time electrical power market and suffer the consequences—caveat emptor.

Raymond L. Hecker *is the Vice President of Franek Technologies, Inc. He can be reached at 800-326-6480; www.franek.com; info@franek.com.*

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HOW SOME NEW MANAGERS SUPERVISE Their Former Peers

Erin White
From CareerJournal.com

Last November, veteran nurse Dianne Baker was named acting supervisor for the outpatient cardiac rehabilitation center at a hospital near Philadelphia.

Ms. Baker, whose new duties included managing three other employees, quickly found herself at sea. She wasn't sure how to oversee former peers and stumbled over the paperwork and finances. Monthly financial reports were "like reading gibberish to me," she says. After operations meetings with a hospital executive, she asked colleagues, "What is he talking about?"

"I'm a clinical expert in what I do, and that doesn't always translate into skills for management," she says. "You have to learn all new skills."

It's an experience all too familiar to new managers. Employers often promote strong individual performers to supervisory roles with little instruction. But people who excel among the rank-and-file don't automatically have the skills or knowledge to manage well.

Companies call it " 'on the job' training, but it's really trial by fire," says Robert Kelley, an adjunct management professor at Carnegie Mellon University's Tepper School of Business in Pittsburgh. New managers mostly learn by trial and error, he adds, and find the transition difficult. "They're very ill-prepared for all the routine things that managers do."

As corporate profits rebound, employers are spending more on training, but most are skimping on help for first-rung managers. An average of just 7% of employers' training budgets was aimed at first-line supervisors in 2003, down from 12% in 2002, according to the most recent data from the American Society for Training & Development. Much of that training goes to help managers comply with workplace rules on issues like sexual harassment, or to teach them financial basics such as budgeting.

That leaves little time for training on "soft skills," such as coaching, leading, disciplining, giving feedback, and resolving conflicts. As a result, human-resource consultants say, new managers struggle to strike the right tone with former peers, with some trying too hard to stay one of the gang and others asserting their authority too harshly. New managers are also notoriously inconsistent, confusing staffers with intermittent or conflicting feedback.

Big multinational corporations are more likely to offer comprehensive training than smaller companies, where instruction is hit or miss, consultants say. Among the worst offenders are organizations filled with professionals, such as lawyers, doctors, and journalists, who consider themselves masters of their craft first and managers second.

Whatever the field, one of the toughest issues for new managers is supervising former peers. After mechanical engineer Donald Pierce was promoted to supervise a few employees at the National Institute of Standards and Technology several years ago, he had to confront an employee about tardiness. Mr. Pierce was good friends with the man — they take an annual fishing trip together — and with others he now managed at the government agency, and he sensed that his employees were watching to see what he would do.

Mr. Pierce hadn't had any coaching on how to handle this kind of tricky situation. He decided to talk to the employee privately, but firmly. "I didn't yell, but I was serious," he says. "I was like, 'I'm calling you in here not to B.S. about outside work stuff' " but about a job issue. "I told him, 'you know, part of my job is to make sure you're doing yours and that

you're showing up on time.' " Although it was uncomfortable at first, Mr. Pierce says, the employee was "conciliatory" and agreed to start coming in earlier. Today, Mr. Pierce is confident he took the right approach.

Ms. Baker, the Pennsylvania nurse, faced a similar issue when one of her former colleagues told her about a personal problem. Ms. Baker says she reacted as a friend, not a boss, offering specific advice on what the woman should do. Now she worries her approach was inappropriate for a boss, and she should have referred the woman to counselors at the hospital rather than giving off-the-cuff help herself.

"I offered advice as a friend but that's not really what I needed to do," she says. Instead, she says, she should have listened to the woman and served as a sounding board.

Eventually, another manager told her that her hospital, a part of Main Line Health, offers a lot of training for new managers, including a class called Peer to Boss. She enrolled in it, as well as in a basic-finance class. "Although you can learn a lot from your peers, you don't always learn the right way," she says. Last spring, just before starting her first training class, Ms. Baker agreed to become a permanent supervisor.

Main Line Health has increased management-training offerings in recent years in response to requests by managers, says Betty Hulton, the organization's director of education and development. In the late 1990s, Main Line added classes on customer service and workplace rules on sexual harassment and family leave. But managers asked for more soft-skills training, Ms. Hulton says, which has led to courses like the Peer to Boss class.

Other times, the impetus for training comes from senior management. Schwabe, Williamson & Wyatt, a 160-lawyer firm based in Portland, Ore., is bolstering its formal management training following a merger and a round of new hires. Senior leaders decided the firm had grown too big to continue to rely on informal collegiality for training, says President David Bartz. Supervising attorneys weren't exactly clamoring for the instruction, though. "You find a lawyer that wants more training and I want to buy that lawyer," Mr. Bartz quips.

Without instruction, some managers just wing it. Heather Spyke says she has gotten no formal management training since being promoted in late 2004 to head the customer-service department at a small Georgia company that makes wireless medical devices. While drafting her first-ever performance review, she struggled with how to tell an employee to curtail his social chit-chat.

The company had a template for reviews, but it wasn't very detailed. So she went on instinct. She first praised his good qualities and then gently explained how his conversations consumed too much time and distracted co-workers. The approach worked. "I was lucky," she says.

But instinct has also led her to make mistakes. A couple of months ago, Ms. Spyke learned that an employee hadn't entered an order because he didn't know the product number. Rather than confront the employee, Ms. Spyke just entered the order herself. "I have avoided saying things because I don't like conflict," she says. "That's something that I've really had to work at."

Some middle managers who oversee first-time supervisors notice, and lament, the lack of training. Nancy Meiers, a senior program manager at a government contractor in Washington, D.C., has worked in management for two decades at seven employers, ranging from accounting to pharmaceuticals. Frustrated with the dearth of formal training, she devised her own curriculum for new managers. She tracks employees in line for promotion and the skills they lack. Sometimes, she recommends external courses; other times, she teaches the employees herself after hours, offering pizza as an incentive.

In her classes, she helps would-be managers work through tricky problems, such as handling a new employee who messes up from day one. She also explains how to manage budgets. If employers were training "and doing it effectively," she says, "I wouldn't have been doing all this."

Charles Homestead
General Manager,
SGS Environmental Services, Inc., Anchorage, AK

SEASONAL CHANGES IN WEATHER AND WORKLOAD PRESENT CHALLENGES

"HELP WANTED: Last full-service environmental testing lab in nation's icebox seeks a few stout souls. Applicants must have an appetite for voluminous data analysis, and high tolerance for mind-numbing climate and workload fluctuation. If you can make it in Alaska, you can make it anywhere."

If this fictional but reasonably factual job description sounds like your idea of paradise, Charles Homestead wants to talk to you.

As the Alaska Division General Manager for SGS Environmental Services, Inc. in Anchorage, staffing is Homestead's number one job — over and above the vexing but garden-variety industry issues like sample anomalies and a plague of audits.

It's bad enough that Homestead, 46, must match wits with better-bankrolled oil and biotech firms for talent, he also competes for new hires against industry rivals in the lower 48 bedeviled by their own attrition problems.

But when you're in a region where some locals traditionally throw parties on the last day of winter to watch "The Shining" – the Jack Nicholson classic about a man driven insane by winter's isolation – hiring and retention issues spike.

While acknowledging that staff development remains a "work in progress," Homestead does have a few trusty tricks up his sleeve: mining area colleges for interns, employee sabbaticals "where they can go someplace warm," and an incentive program allowing core staff who head for exits in winter to carry their health benefits.

It all points toward his essential duty to maximize SGS resources for the summer season, when Homestead's workload increases fourfold and staff peaks at about 70 employees, divided among the operational (laboratory, client services, business development, and data services) and managerial units in Anchorage, which also oversees Hawaii and the Pacific Rim.

Homestead is passionate about his adopted state, a far cry from 1980, when he "hitchhiked up just for the summer and ended up staying, which happens a lot in Alaska."

Homestead arrived with a two-year chemistry degree in hand from the State University of New York in upstate Canton and every intention of returning to continue his education and "have a career working outside in forestry or outdoor biology and grow old in the woods somewhere."

But his career track was derailed when he was hired as a technician for a small Alaska lab, since acquired in 1990 by SGS, an international conglomerate now operating in 130 nations. SGS offers a range of inspection, testing and verification services, including environmental labs in eight U.S. states.

During Homestead's early Alaska years, "all the big names (in environmental science) were here, the gorillas like Severn Trent and Columbia Analytical, but they all left because they realized how difficult it was to manage such a high summer workload with very little work in winter. They try to buy markets by pushing unit pricing down so low they put competitors out of business, except it didn't work in Alaska.

"The underlying theme of our business practice, and it's something we talk about all the time to our staff, is our turnaround time and our quality. We have to ask for the highest prices, meaning we must provide the best service and turnaround time. One of the lessons I've learned is that this industry sometimes treats data like a commodity instead of professional service. We don't sell boxes of paper; we sell paper with data on it."

When SGS tapped Homestead as Alaskan manager in 1996, the maturing environmental lab industry was in the throes of a shakeout he attributes to over-capacity. Tasked with jump-

F. Key Kidder

starting the lab, Homestead was given free rein by SGS – "they're very hands-off" – to design a flat organizational system featuring open lines of communication. Homestead describes his management style as "transparent and very open door…we're accountable to ourselves about how our work process meets our clients needs."

The lab performs 100,000 analyses annually, reporting out a half-million individual results and an equal number of quality control samples. "Our business," says Homestead, "is producing data" – primarily for U.S. Department of Defense (DoD) remediation work and mining industry, in addition to analysis of drinking water, hazardous waste, and wastewater discharge for other clients.

The industry's "evolution is huge" regarding data management, said Homestead. Standardization of electronic data transfers, and the enabling infrastructure, is a "rate determining step for labs. Little guys don't enjoy the advantages of working for a well-funded company like SGS, with the resources to make programmers available to me." Homestead has spent five years developing and implementing a "PDF solution" for online reports to clients, and believes clients will further have the ability to query data out of an SGS database within three years.

The move toward more automated lab processes will also enable Homestead to diversify and import work into his home state, "which is very unique in our business. Everybody sends samples down to the lower 48, but we'll break that trend." And he entertains still greater possibilities down the road, should SGS build a new Alaska lab to spec and free Homestead from the retrofitted newspaper building that now houses his lab operations. "SGS has built some very good mass flow labs, especially in Germany."

Things are looking up, but when Homestead takes the long view, he sees barriers to continued growth in the form of "empires that get in the way of producing useable data that decision-makers can use, the regulatory and auditing complexities. We need regulatory simplification and standardization of measurement."

His worst days? Homestead notes, "I have over 3000 active analyses right now. Just this morning I learned of 15, all high priority, that we can't get to our clients. We spend huge amounts of my time, and the time of my project managers and organic or inorganic managers on a very small percentage of problem jobs. This is very different than the med-tech field, where you have two indices – urine and blood – and it never changes. We get waste oil, grease, monkey wrenches, you name it. That's how you lose control on turnaround."

And his best days? As Homestead takes the pulse of his lab, "things are going out on time, and clients are getting their data. If clients are happy, everything else falls into place. We have profitability, and the staff is happy because of what they're accomplishing."

Francis Key Kidder started out as a journalist before moving on to politics and government relations, where he still keeps his hand in writing. He may be reached at 410-828-6529; info@labmgr.com.

Challenges Facing THE YOUNGER MANAGER

Firms are increasingly promoting younger employees to fill management positions. This is one way to assure continuity as baby boomers begin to retire. Also, younger managers often are less attached to out-dated corporate cultures that many firms are trying to discard. They also are more diverse than older peers because more women and minorities have entered the science professions in recent years. Consequently focusing on younger employees for management assignments makes it easier to meet corporate diversity goals.

OLDER STAFF MEMBERS — YOUNGER MANAGERS

However, many mid-career professionals dislike taking direction from younger managers sometimes young enough to be their child. These scientists can learn from their technicians. Many technicians have long reported to younger scientists. Indeed, some firms make an effort to assign their most experienced technicians to work with newly hired scientists. This helps rookie scientists "get up to speed" quickly.

Some older employees incorrectly believe that a younger manager has nothing to teach them. This can create an uncomfortable working relationship. In reality, both parties have much to offer the other. Younger managers may have a better grasp of new techniques that can improve researchers' productivity. Older staff members have an in-depth knowledge of past R&D programs — knowledge often difficult to locate in corporate records.

THE MANAGER'S PERSPECTIVE

Some younger managers fear appearing overbearing. Consequently, they may be reluctant to criticize or mentor staff members who report to them. Others, with inadequate management training, may forget a basic rule: critique and discipline staff members in private and praise in public. Younger managers also need to realize that what motivates them may not motivate their staff members. To be meaningful to staff members, rewards must be something they value. This means the manager must understand what "makes them tick."

To do this, managers should spend enough time with each staff member to learn their professional and personal goals. Younger employees more often have value systems and motivations similar to the young manager's. For that reason, the younger manager may feel more comfortable with them, spend more time with them, and neglect learning what motivates their older staff members. Younger managers need to overcome this to work productively with older staff members.

BRIDGING THE GENERATION GAP

To earn the acceptance and respect of employees considerably older than they, supervisors are best served by adopting a participatory management style in which staff members are involved in planning projects and have a sense of ownership in them. It is often difficult for younger managers to delegate responsibilities to staff members. However, they need to remember that nobody micromanages their way up the corporate ladder.

It is difficult to fake a relationship of mutual respect. Older employees, in particular, soon "see through" highly self-centered young managers who only use staff members to advance their own careers while pretending to be interested in them. Conversely, managers recognized as truly supporting their staff will find that people throughout the company will be eager to work with them.

Effective listening skills help younger managers avoid giving the impression that they think they are young hotshots who know it all. Listening skills are important in learning the ideas of employees who may be reluctant to share them with younger managers.

Consciously deciding to "get along" and work productively with each other is the necessary first step in enabling staff members and younger managers to establish good working relationships. Newly appointed younger managers should consult with colleagues and mentors to develop techniques to work productively with older staff members.

THE EMPLOYER'S ROLE

Continuing education also can help younger managers work more productively. Many young managers find that professional society activities develop valuable skills that help them perform better in their company role as a team leader or manager.

John K. Borchardt

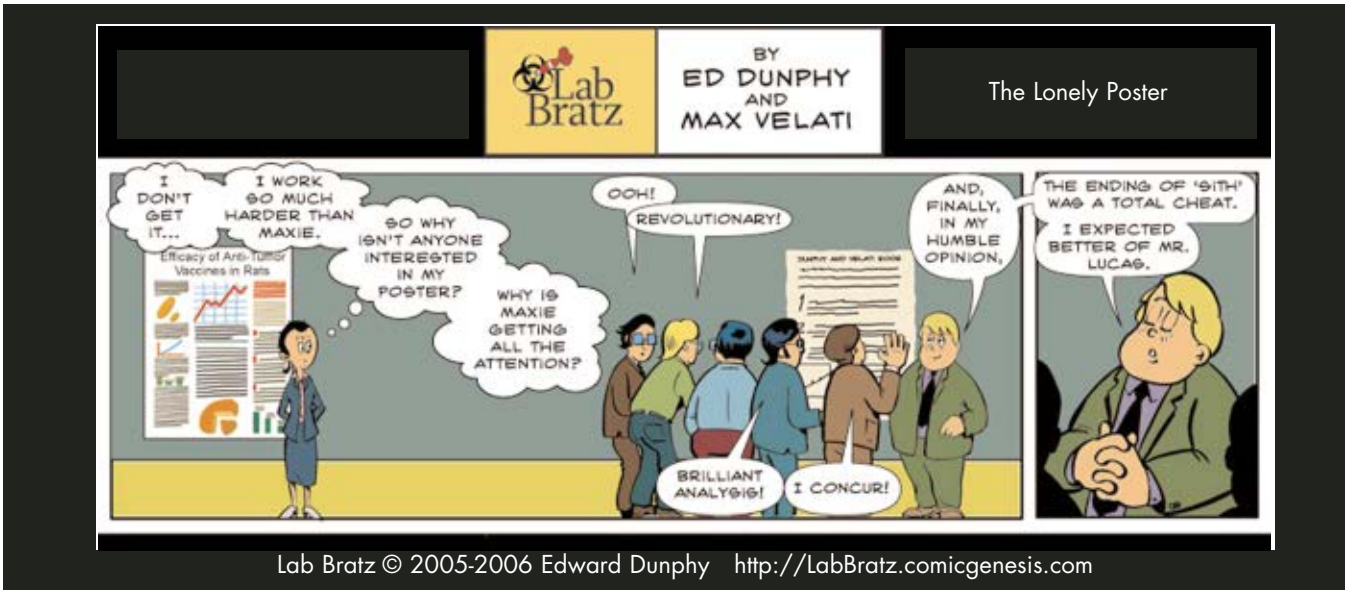
Employers also should do more than just sending young management candidates to take classroom courses. Supervisors should work with them to find on-the-job opportunities to develop management skills so they are better prepared when transferred to management. Project leader assignments are an excellent way to do this. In this assignment, the younger employee learns how to delegate responsibilities, rely on team efforts, and knit team member's efforts into a unified whole while permitting individuals to shine.

Supervisors should also assign younger employees to cross-functional and cross-department teams so they develop useful contacts throughout the company. Assignments in non-business functions such as United Way also can provide opportunities to develop management skills and contacts in many parts of the company.

Younger managers also need to develop timely decision-making skills. Indecision can lead to missed opportunities while frustrating staff members and causing them to lose respect for their manager.

The complementary skills of younger managers and older staff members can be a source of career advantage for both parties if they can develop a successful relationship.

Dr. Borchardt *is a consultant and technical writer. The author of the book "Career Management for Scientists and Engineers", he writes often on career-related subjects. He can be reached at jkborchardt@hotmail.com.*



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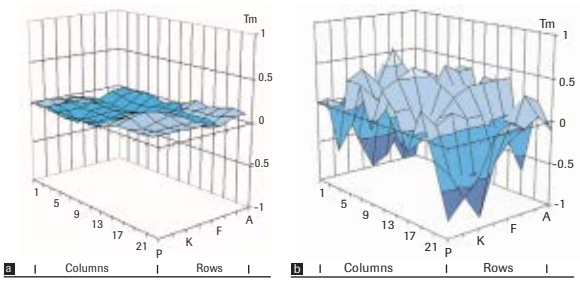

Figure 1: Graph of temperature consistency across a 384-well plate: a) LightCycler® 480 Instrument, b) the other 384-well instrument.

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