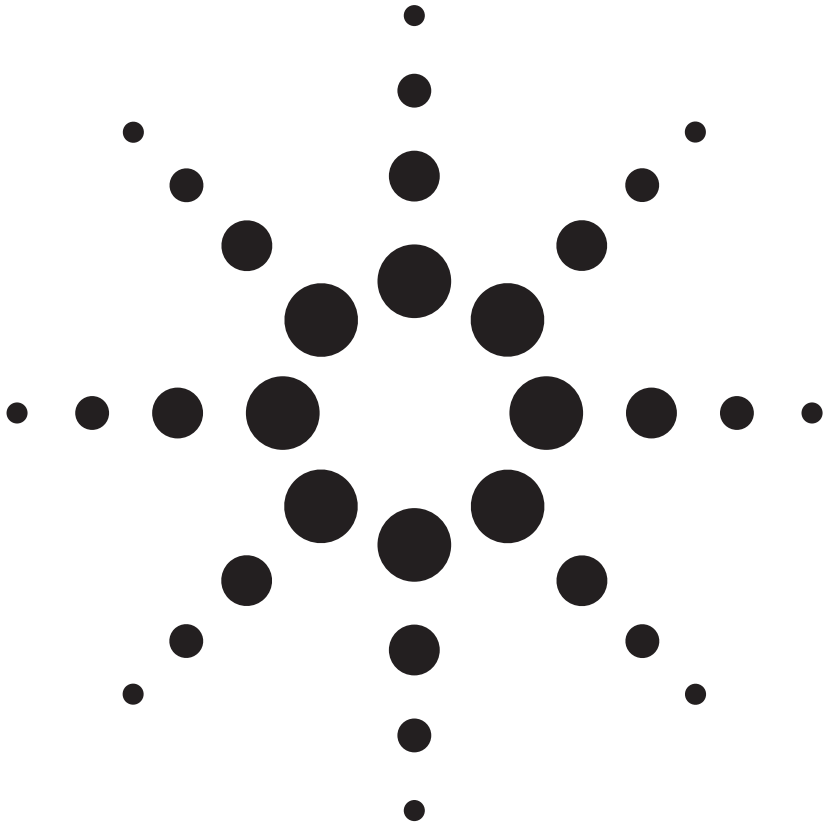
Hidden Costs and Undiscovered Opportunities in Analytical Instrument Qualification

White Paper



Agilent Technologies

Abstract

A revolutionary new model for Analytical Instrument Qualification (AIQ) is to use a single fully automated and harmonized system for routine and unscheduled calibration/ qualification of the primary lab instruments, combined with the essential maintenance and repair support. Benefits of these new paperless automated quality systems include cost savings in terms of fewer person-hours, more efficient protocols, less infrastructure, and less instrument downtime.

Efficiency benefits include faster turnaround times for review and approval of protocols and reports, a single enterprise-wide set of test protocols for all makes of instruments across your enterprise, better decision making with more control over remote aspects of your business, and a streamlined compliance process for audit risk reduction.

Introduction

Every laboratory regulated by cGMPs and GLPs must manage the costs of compliance – the time and expense of implementing adequate Analytical Instrument Qualification (AIQ) procedures and keeping pace with regulatory trends.

Staying current is essential. Assuming your company keeps pace with regulatory trends and implements adequate AIQ procedures, you have a choice in how to implement your AIQ programs. But we should not assume the subject is static. The "c" in cGMP represents the FDA's 'current thinking' and emphasizes the need for continual quality improvement for drug manufacturers. cGMPs also provide consistency in the Agency's regulation, inspection and enforcement procedures. The FDA can issue a warning letter or initiate other regulatory actions against a company that fails to comply with Current Good Manufacturing Practice regulations. Failure to comply can also lead to a decision by FDA not to approve an application to market a drug. As evidence, we have observed a trend, especially from some FDA investigators, to report inadequacies in the approach used by some companies for qualification testing.

Some companies have developed and implemented their own compliance programs. Other companies use the established and well-accepted qualification services offered by the major instrument manufacturers. Most use a mixture of both. How you implement your AIQ program is your decision. You can choose to develop and maintain your own in-house compliance program, outsource to an established and well-accepted qualification provider, or use services provided by the major instrument manufacturers.

When you consider the cost of a comprehensive AIQ program, it is not sufficient to simply compare hard costs. You must identify and consider all the soft costs associated with the alternatives. You should also consider the less tangible benefits in terms of increased efficiency, reduced risk, and positioning for the future.

> *"...when you look beneath the regulatory jargon, there are new opportunities to improve manufacturing efficiencies as well as compliance in ways that benefit the bottom line rather than cut into it."*
>
> Justin O. Norway, "Compliance Opportunities"[1]

A revolutionary new model for AIQ is to use a single fully automated and harmonized system for routine and unscheduled calibration/qualification of the primary lab instruments combined with the essential maintenance and repair support. We'll call this model advanced AIQ or "aAIQ."

This approach incorporates the best features from each traditional AIQ model mentioned earlier and combines them into a single model. The result is a streamlined corporate-controlled system that eliminates the redundancy of multiple quality systems and the inefficiencies of multiple providers.

This paper highlights:

- Trends in compliance and the penalties associated with inadequate instrument qualification (noncompliance)
- Obvious and not-so-obvious costs associated with traditional compliance programs
- Benefits of new advanced AIQ programs

Now is the time to check that your AIQ program is up to date and compliant and then take a close look at the true total cost of your program. Perhaps you have overlooked some novel approaches to saving time and money. While you have several choices in how to implement your AIQ programs, one principle is certain:

Efficiency is key.

Regulatory Trends and Penalties for Noncompliance

More and more, regulatory agencies must balance resource constraints while adapting to advancing technology and industry growth on a global level. As the agencies change, companies must be aware of these changes and adapt their AIQ programs, if they are to be fully prepared for a regulatory audit.

Clearly, there are severe penalties associated with failure to implement AIQ or inadequate implementation. Adhering to the latest revision of a regulation is only the first step. You must also be aware of the latest guidances and drafts issued by the regulatory agencies and the policies for enforcement by inspectors.

To keep current with the latest FDA and USP thoughts on AIQ, you need to continually monitor warning letters and Form 483 citations. Your corporate QA Department probably has this charter. Web resources such as http://www.fda.gov and http://www.labcompliance.com are available to assist.

> *"Regulatory requirements, inspection and enforcement practices are quite dynamic. What is appropriate today may not need to be appropriate tomorrow. Regulations change but more often it is the inspection practices that change. In the early '90s the focus of inspections was on basic requirements of GLP and GMP, but then it changed to equipment hardware and later on to software and computer systems."*
>
> Ludwig Huber, *A Primer: Good Laboratory Practice and Current Good Manufacturing Practice* [2]

Some of the observed trends in government regulations and the industry's approach to meeting those regulations are described here.

Risk-Based and Science-Based Approach

Recently the FDA launched an initiative entitled *Pharmaceutical cGMPs for the 21st Century: A Risk-Based Approach*.[3] Among the goals of this initiative are to incorporate the concepts of risk management and quality systems into the manufacture of pharmaceuticals and to encourage manufacturers to use the latest scientific advances in pharmaceutical manufacturing and technology.

From an inspection perspective, the risk-based approach helps the agency to allocate limited resources effectively and efficiently. By developing a quantitative risk-based model for choosing sites to inspect, the agency will predict where its inspections are most likely to achieve the greatest public health impact. The model will also include risk factors relating to a facility (such as the compliance history) and to the type of drugs manufactured at the facility.

From a company perspective, this means we are being asked to provide a "risk-based" or "science-based" rationale for the exact tests (or lack of tests) prescribed in our AIQ programs. Firms are being asked to go beyond routine conventional good manufacturing practices and to now justify their quality control decisions, including the scope and frequency of AIQ.

USP Chapter on AIQ

In 2008, the United States Pharmacopeia (USP) <1058> on Analytical Instrument Qualification requirements became effective, influencing the FDA's approach to audits of laboratory qualification and calibration programs. The requirements are based on the well-known 4Q model for equipment qualification: Design Qualification (DQ), Installation Qualification (IQ), Operational Qualification (OQ) and Performance Qualification (PQ).

It is important to give careful consideration to implementation of these requirements. Assuming you already have a standard operating procedure (SOP) for analytical instrument qualification, you should verify that it is in line with the 4Q model. Furthermore, the same procedure should be used for one instrument category, independent of the vendor and the location.

Electronic Records

Regulatory agencies have indicated a desire to see firms increase their own efficiency and the efficiency of FDA audits by using electronic records. This approach represents a major advancement, because it signifies a willingness to trust electronic records that are submitted to the FDA or viewed by inspectors.

No one will question the value of computer systems used in the laboratory to create, modify, maintain, archive, retrieve or transmit data. However, although computerized systems are commonly used for processing raw data and storing raw and processed data in electronic form, many labs still decide to store records and conduct the review and approval process on paper.

The decision to migrate to a completely paperless (or at least a less-paper) system requires a careful cost-benefit analysis. In terms of AIQ, using electronic records enables mountains of paperwork to be managed efficiently and can provide a valuable audit trail. In addition, the paperless system can streamline business processes, speed up review cycles, manage work flow, enable data sharing, and provide searchable libraries for more informed decision making.

Of course, companies that choose to use electronic records must do so in a GMP/GLP and 21 CFR Part 11 compliant manner. 21 CFR Part 11 deals with the FDA guidelines on electronic records and electronic signatures in the United States. Part 11, as it is commonly called, defines the criteria under which electronic records and electronic signatures are considered to be trustworthy, reliable and equivalent to paper records.[4]

Inspections and Warnings

Inspection and enforcement practices are quite dynamic, but companies should stay abreast of the latest developments if they are to avoid surprises in their own inspections. Good sources of information are the FDA's Freedom of Information Reading Room at http://www.fda.gov/foi/warning.htm and http://www.fdawarningletter.com.

Warnings have been delivered to companies about not qualifying/calibrating HPLC systems to the full range of use. For example, warnings have been issued for annual OQ/calibration procedures that check a smaller performance range for parameters such as pump flow or column temperature than is actually used for licensed methods. Another observed trend is cGMP warnings for failure to perform a thorough investigation of unexplained discrepancies and make a record of the conclusions and follow-up.

Accelerated Compliance

In a highly competitive market, many companies are adopting strategies for gaining fast FDA approval. This is especially true among generic drug manufacturers, companies in emerging countries, and Contract Research Organizations. In this environment, streamlining the AIQ process is highly desirable. At the same time, there is no room for failure to meet regulatory standards.

Globalized AIQ

The FDA is collaborating with international health and regulatory partners to harmonize pharmaceutical quality standards worldwide. For large companies operating on a global scale, this means better quality control is required over all their labs worldwide to avoid the risk of one lab bringing down the whole company. Harmonization also presents an opportunity, as a uniform set of protocols can be applied to all labs worldwide.

Farsighted companies are looking to harmonize their mosaic of AIQ procedures found in different labs, departments, sites and countries. The twin goals here are cost-effectiveness and worldwide regulatory safety.

An enterprise-wide quality program provides an important level of corporate-level control over individual labs. Consider the scenario where one rogue laboratory jeopardizes the reputation of an entire organization. Investing in good quality control over an entire network of labs reduces the risk of one noncompliant lab affecting the whole company.

Cost Control

Understandably, lab managers are under pressure from purchasing and other financial departments to control the "cost" of compliance. However, such pressure is usually focused only on the top-line "price" with no regard to internal efficiency costs, sometimes called "soft costs."

Before you evaluate a compliance program based on price tag alone, answer some of the following questions. For each day that an LC is out of service for recalibration, what is the cost of instrument unavailability for production sample analysis? If your lab has rooms full of LCs and GCs, the costs accumulate dramatically. Now factor in the person-hours spent running calibration samples, analyzing and reporting results, reviewing and approving reports, and managing the qualification process.

Furthermore, unless your company is confined to only the lab you manage, you ought to think of the bigger picture. Multiplied by several other labs in your department, what are the cumulative costs across the department? For large companies with many departments per location and locations across the world, what are the company-wide costs?

If compliance is to be implemented properly, there are costs to pay. Clearly, companies would like to reduce those costs. However, the price tag of a compliance program cannot be considered in isolation. A more holistic view is required, which includes figuring all the soft costs into the equation.

Costs and Benefits of Traditional Compliance Programs

Several models exist for compliance programs, just as they do for maintenance and repair. As Mike Brown points out in "Tuning-up Lab Instrument Service," each model has its own advantages and disadvantages.[5] Lab managers must find the right balance between risk, quality and cost.

In-House

Many companies strive to keep costs low by conducting their own instrument testing, which we'll call the "in-house" model. Advantages of this approach are greater control and faster response from having an on-site quality staff. In addition to saving the expense of service from the original equipment manufacturer (OEM), this model promises to conserve administrative resources because there are supposed to be no vendor contracts to negotiate and maintain. But in "real life" no in-house model can handle all the range of technologies in a laboratory, so there is always need to hire vendor services for specialist instruments and/or all newly installed instruments.

So a closer look at this model reveals significant costs. Even if the lab manager is not responsible for QA/QC department overhead, he or she should be aware of the associated expenses. These expenses include the head count of testing personnel; quality management and administrative staff; the cost of training to stay current with instrument technology and compliance regulations; the costs of the inevitable "mixed model" where vendor contracts cannot be avoided; and the infrastructure needed to maintain the program. If an in-house metrology group is the primary service provider, be aware of the tendency of practices to become entrenched, for obvious self-sustaining motives, with operating inefficiencies hidden from sight of the lab manager.

In many cases, the in-house model no longer appears so economical. Careful analysis of the costs and risks may show that outsourcing is a better alternative, especially if compliance is not within your core area of expertise.

Outsourcing

Another compliance model used by many laboratories is outsourcing to an independent service contractor for most of the primary instrument testing (LC, GC, dissolution, spectrometers, balances, etc.). The obvious advantage of this model is availability of dedicated workers, usually at a somewhat lower price than using the services of the OEM. Another advantage is having a single point of contact and a single contract.

However, as Brown points out, "...there can be trade-offs in terms of risk, quality and convenience."[6] Much careful research is required to identify a provider who has factory support for your instruments and can deal with more complex systems. There must be clear agreement about what services fall under the contract and how services will be standardized across locations. How a "low-cost" independent service contractor firm keeps its staff up to date with new technologies and new regulatory trends is an evergreen question.

Contracting for the lowest cost may be appealing, but consider the soft costs of researching independent contractors to find the right supplier for your application and then managing the selected provider to avoid delays and ensure a quality outcome.

OEM

Using the services of the instrument manufacturer is generally accepted to be the highest quality and lowest risk of the traditional compliance models described here. You can expect a high level of expertise and up-to-date knowledge of compliance regulations. As Brown points out, "The OEM model is the frequent choice for highly complex systems or those that are critical tolaboratory productivity."[7] In addition, larger companies should be able to obtain consistent service globally.

However, quality comes at a cost. The initial outlay for OEM compliance services is the highest of the traditional models described here. Also, companies using instruments from a variety of manufacturers must address the soft costs associated with managing multiple contracts.

Benefits of New Advanced AIQ (aAIQ) Programs

A revolutionary new model for AIQ is to use a single fully automated and harmonized system for routine and unscheduled calibration/qualification of the primary lab instruments combined with the essential maintenance and repair support. This approach incorporates the best features from each of the traditional AIQ models mentioned earlier and combines them into a single model. The result is a streamlined corporate controlled system eliminating the redundancy of multiple quality systems and the inefficiencies of multiple providers.

Is such a quality system right for your laboratory? Whether you manage a small operation with a few LCs and GCs or a global company with laboratories across the world, your cost-benefit analysis must consider more than just the top-level price of implementation. First, add up the cost savings of combining your maintenance, repair and scheduled compliance under one program. Next, estimate the value of reducing your regulatory risk. Finally, take a hard look at all the "soft costs" of improving your lab efficiency. In the end, premium service saves you money.

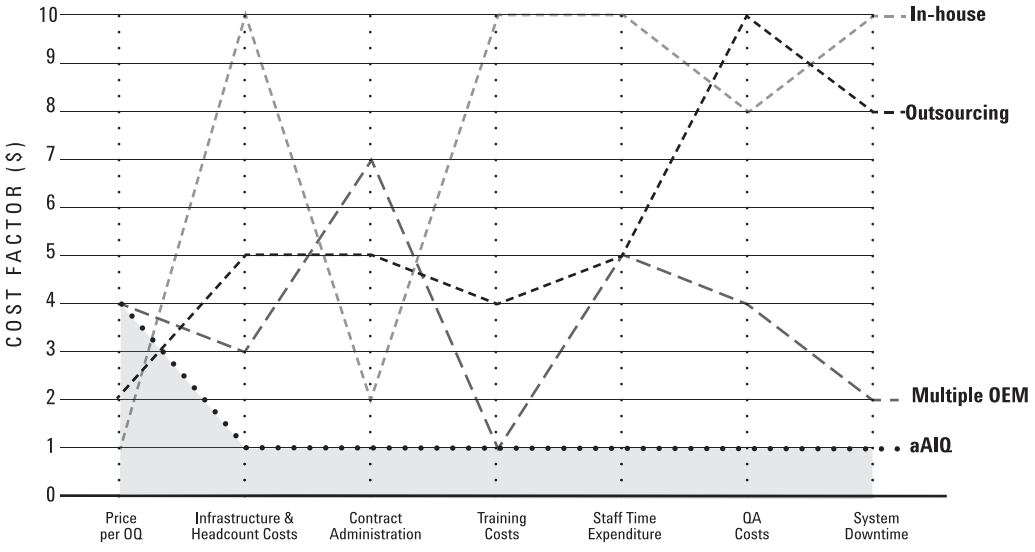
The following chart makes a comparison of the estimated costs of traditional compliance programs to the proposed advanced AIQ program. Notice the shaded area. This represents the estimated overall cost of an aAIQ program.

Cost Savings in Person-Hours

We all know the labor costs of analyst time. But there are many soft costs associated with compliance, which can lead to significant budget expense. For example:

- Your Time Expenditure – Number of hours spent running calibration samples, analyzing results and writing reports, working with in-house groups, contractors, multiple protocols.
- Training Costs – Time and expense for training your staff to stay current with instrument technology and compliance regulations.
- QA Costs – Number of hours spent by your quality staff reviewing reports and developing protocols and SOPs.
- Contract Administration – Number of hours spent by your procurement staff researching and managing contracts.

For maximum savings in time and money, automated AIQ must be combined and streamlined with maintenance and repair and remote engineering support under one program. Your valuable analysts and scientists are finally extricated from the burden of instrument service events. Your administrative and training burdens are reduced.



Overall Cost Comparison of Traditional vs. aAIQ Compliance Programs

Efficient Protocols – Less Infrastructure

Multiple protocols for different instruments increase administrative costs and can be difficult to explain to inspectors. Consider the following excerpt from an FDA report:

> *"During the inspection, the firm did not provide an SOP for the performance verification of the HPLC and GC systems. Actually, they are contracting services for the verification of those systems, and then they are adopting contractor's SOP. Each of them has different SOPs, which includes different types of tests that do not compare. The firm should establish a pro-cedure to assure uniformity providing specific directions and requirements for all GC systems. Also, it will apply to HPLC systems."*
>
> FDA Establishment Inspection Report (EIR)
> Source: Labcompliance.com/usersclub

Unlike the OEM model, which involves multiple procedures from LC and GC manufacturers, aAIQ uses a single equipment qualification protocol worldwide to streamline compliance and reduce regulatory risk.

The infrastructure needed to maintain your program is reduced, along with your costs for developing and maintaining protocols and SOPs. The result is an immediate impact on lab productivity.

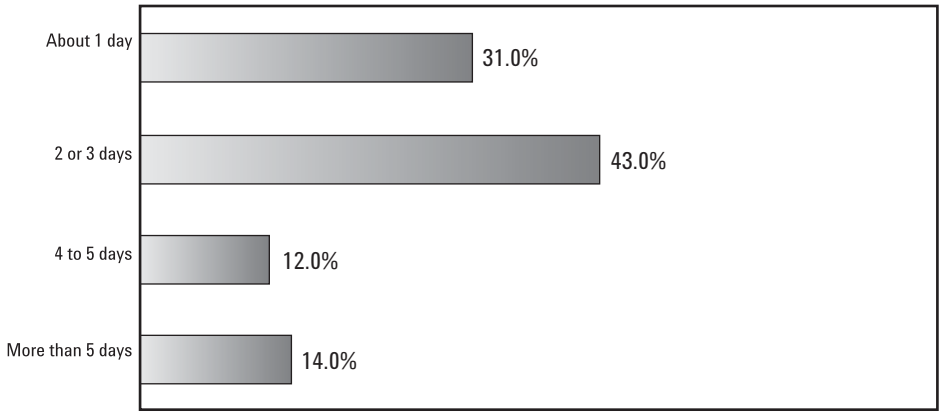
An additional benefit is flexibility with full control. An automated system makes it very easy to develop and maintain, for example, protocols with limits and set points configured to meet different user requirements for different labs – much easier and cheaper than keeping multiple protocols in traditional paper-based quality systems.

Less Instrument Downtime

As stated previously, each instrument that is out of service for OQ or recalibration is costing you in lost time for sample analysis. Re-qualification is closely tied to maintenance, and must be repeated following any major instrument repair or alteration. If your company has labs across the world, the company-wide costs can be dramatic.

On the average, in-house calibration can require three days of downtime. The following chart shows the overall results of a recent independent survey that asked readers for the downtime of instruments during OQ/calibration.[8]

On average, in-house calibration requires three days of downtime. The following chart shows the overall results of a recent independent survey that asked readers for the downtime of instruments during OQ/calibration. As shown below, most labs report typical downtime of two or three days with a significant number of labs suffering considerably longer routine downtime. An established aAIQ program offers a routine downtime of one day if all tests pass. But of course sometimes a system fails the OQ/recalibration due to some genuine equipment malfunction. In these cases the aAIQ or OEM model can get the engineering problems fixed faster because of the expertise of the engineer and parts availability, therefore reducing repair time.



Question: What is the typical downtime between taking an HPLC instrument out of use and when it is released back into qualified use?

2010 Survey of 354 readers: Downtime of Instruments During Calibration

Extended Benefits of Advanced AIQ Programs

Now that we have looked at the hard and soft costs of using a single provider for maintenance, repair, calibration and qualification, let's look more closely at some of the additional benefits that a paperless automated quality system can bring to your lab in terms of efficiency, risk reduction and positioning for the future. These advantages are more difficult to quantify, but are no less important to your bottom line.

For example, an immediate advantage of a paperless system is the savings in printing costs and time. But there are additional efficiency benefits that are not so easily recognized. Storing and maintaining paper records can add up to one or more full-time administrative jobs. Most lab workers don't realize their firm probably will scan and/or microfiche all the lab paper records, then store the original paper records with a commercial records storage firm. The cost is actually very high, but because the lab manager does not actually see the bill, it is usually overlooked or deliberately ignored.

An advanced AIQ program should provide 21 CFR Part 11 compliant records storage and retrieval. This allows secure access to all the calibration data, repair records and configuration data for all the LCs and GCs in your company. All this, without the high cost of archiving paper and binders and the risk of lost or damaged documents.

For companies that want the convenience of a paperless solution but are not prepared to make the complete transition to electronic signatures, there is always the hybrid "ink-on-paper linked to electronic record" approach. This could be called a "less-paper" rather than a paperless system.

Faster Review and Approval

No one will argue the benefits of faster turnaround times for review and approval of protocols and reports. Most labs require a management-level review with two or more signatures for each calibration/qualification report. Considering that some reports can be over 100 pages, requiring all calculations to be checked and every page to be signed and dated, the average turnaround time can be two to three days.

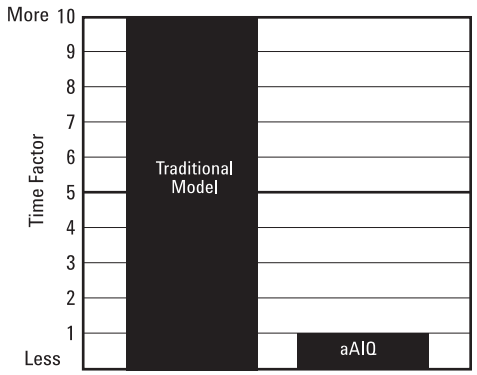
An advanced AIQ system should manage the review and sign-off work flow process for you. Compliance reports and records are consistently configured to streamline the review process. Reports can be e-mailed for remote review and approval and signed electronically, reducing the turnaround time to two to three hours. The process management software should automatically maintain a complete audit trail.

Enterprise-Wide Protocol

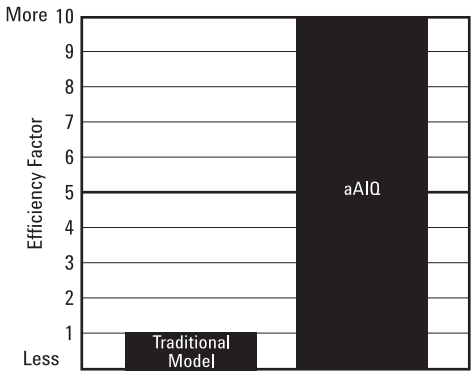
Even if you have an efficient paper-based system and are current with all FDA regulations, you can still improve your effectiveness by having a single test protocol for all makes of GC or LC. For one thing, a single automated protocol makes it easier to control labs outside your immediate sphere of influence.

As noted earlier in this paper, investing in good quality control over an entire network of labs reduces the risk of one noncompliant lab affecting the whole company. Software manages the protocols, work flow, raw data and reports. With enterprise-wide protocols, consistent execution becomes an attainable goal for corporate QA. For research-based major pharmaceutical firms that use contract test laboratories, this is particularly important.

In addition, inconsistencies and inadequacies can be identified and addressed before they become a problem. Inadequate scope of OQ testing can result in lab systems that are "compliant," in that they do have OQ and validation documentation, but the scientific performance across the enterprise is not properly characterized.



Comparison: Review and Approval Time



Comparison: Efficiency of Protocols

Enterprise-Wide Access

Another benefit of enterprise-wide advanced AIQ is access to all of your calibration data in a single lab or across your enterprise. With an enterprise-wide paperless system, lab results become more understandable. Storage and retrieval become more efficient. New ways of comparing scientific data become available, which are not possible with binder archives. The advantages of enterprise-wide access are difficult to measure in terms of soft cost, but whether local or global in scale, there is no doubt that it can improve your effectiveness.

As an example, suppose you had the need for a particularly sensitive HPLC analysis in terms of delay volume or gradient performance. Think of the advantage of being able to electronically search all of your records to identify the five or 10 HPLCs in your company with the best gradient performance and lowest delay volume.

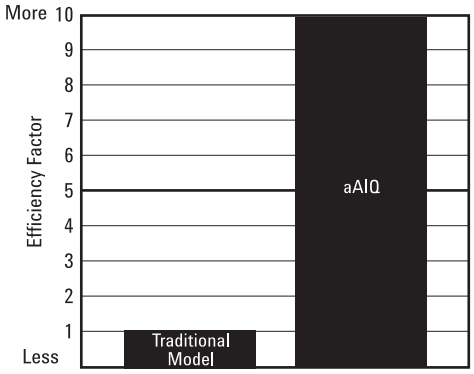
In another example, suppose your company has developed a new product and needs to analyze the product in departments or contract labs across the world. You must find a way to transfer your test method to scores of LCs, each of which performs slightly differently. With global access, you retrieve the calibration data and identify the instruments on which the analysis should be performed...and flag the instruments that should not run the test.

Better Decision Making

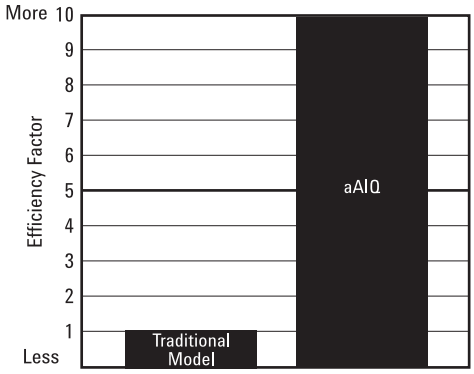
As we have shown, improved reporting and record keeping not only save you time and money, but give you control over remote aspects of your business. What's more, a well-planned paperless system replaces endless AIQ documents with documents that have the most scientific value.

> *"Data-intensive decision making is one of the most challenging aspects for the industry today. Data is everywhere, but very little of it is useful information. Most plants generate mountains of data, but without the right software capabilities to make the information content quickly available to the right people in a time frame that is relevant to the manufacturing process, the data remains essentially untapped."*
>
> Justin O. Norway, "Compliance Opportunities"[9]

Regardless of the size of your laboratory operations, having a single protocol and access to calibration data enterprise-wide is a valuable tool for making informed business decisions and carrying them out effectively. Simplified asset tracking and service reporting give you a major boost toward continuous improvement and optimized deployment of assets. Likewise, you have powerful tools for instrument support, problem solving and product quality improvement. As the FDA prioritizes their responsibilities to apply more resources to areas with the greatest risk to public health, so should we.



Comparison: Access to Data



Comparison: Decision Making

"The challenge is to find a good compromise between not doing enough and doing too much. Let's take validation as an example. When complying right at the beginning of the validation process the additional value to each validation step is tremendous. However, there is no added value in trying to validate each and every step and the incremental costs for validation goes up with each validation effort. The question is 'where is the optimum' or 'how much validation is enough.' The challenge is to find the optimum and this requires a thorough risk analysis."

Ludwig Huber, *A Primer: Good Laboratory Practice and Current Good Manufacturing Practice*[10]

The testing protocols of any AIQ system, advanced or traditional, must be developed with a team of recognized compliance and scientific experts and checked by independent reviewers. A risk-based rationale document for the OQ testing is essential.

Audit Risk Reduction

An advanced AIQ program must provide the same high-quality, low-risk AIQ service that you get from the OEM or the very best, proven "in-house" program. The program must be readily accepted by FDA and EMEA inspectors.

Fully automated instrument qualification techniques using validated software help to eliminate human-error inherent in manual testing while also providing adherence to protocol throughout the qualification process. Consistently configured qualification reports and records should streamline the compliance process and provide easier QA reviews, reducing the risk of errors or noncompliance. Eliminating multiple protocols also streamlines the inspection process. A single protocol is easier to explain and for inspectors to understand.

Conclusions

A revolutionary new model for AIQ is to use a single fully automated and harmonized system for routine and unscheduled calibration/qualification of the primary lab instruments, combined with the essential maintenance and repair support. Benefits of these new paperless automated quality systems include cost savings in terms of fewer person-hours, more efficient protocols, less infrastructure, and less instrument downtime.

Efficiency benefits include faster turnaround times for review and approval of protocols and reports, a single enterprise-wide set of test protocols for all makes of GCs or across your enterprise, better decision making with more control over remote aspects of your business, and a streamlined compliance process for audit risk reduction.

Automate, harmonize and streamline your AIQ system into the kind of advanced AIQ program described above. You will benefit from sustainable regulatory compliance – while saving time and money.

References

1. Justin O. Norway, "Compliance Opportunities," *InTech*, January 1, 2004, www.isa.org (June 4, 2007).

2. Ludwig Huber, *A Primer: Good Laboratory Practice and Current Good Manufacturing Practice*, Agilent Technologies, 2002.

3. United States Food and Drug Administration, *Pharmaceutical cGMPs for the 21st Century – A Risk-Based Approach*; Final Report, September 2004.

4. United States Food & Drug Administration, Code of Federal Regulations, Title 21, Food and Drugs, Part 11, Electronic Records; Electronic Signatures; Final Rule; Federal Register 62 (54), 13429/13466, 1997.

5. Mike Brown, "Tuning-up Lab Instrument Service," *Lab Manager Magazine*, October/November 2006.

6. ibid.

7. ibid.

8. 2010 Survey of 354 readers: Downtime of Instruments During Calibration

9. Justin O. Norway, "Compliance Opportunities."

10. Ludwig Huber, *A Primer: Good Laboratory Practice and Current Good Manufacturing Practice*.

Glossary

21 CFR Part 11
Title 21 Code of Federal Regulations; Electronic Records; Electronic Signatures; United States Food and Drug Administration. Provides criteria under which FDA will consider electronic records to be equivalent to paper records, and electronic signatures equivalent to traditional handwritten signatures.

4Q
4Q model for equipment qualification, defined by the USP in Draft Chapter 1058. States that analytical instruments should be qualified to demonstrate suitability for the intended use. 4Q refers to Design Qualification (DQ), Installation Qualification (IQ), Operational Qualification (OQ) and Performance Qualification (PQ).

aAIQ
Advanced AIQ, a phrase used to describe a single, fully automated and harmonized system for routine and unscheduled calibration/qualification of primary lab instruments combined with essential maintenance and repair support.

AIQ
Analytical Instrument Qualification

cGMP
Current Good Manufacturing Practices (GMPs). Pharmaceutical product regulations, issued in the United States by the U.S. Food and Drug Administration (FDA). Called "current" to emphasize that the expectations are dynamic.

DQ
Design Qualification. First step of the qualification process. Documents the user requirements and instrument functional and operational specifications. Qualifies the vendor for appropriate software devel-opment and support processes.

EIR
Establishment Inspection Report (FDA)

EMEA
European Medicines Agency

FDA
United States Food and Drug Administration

Form 483
"Notice of Inspectional Observations," the report issued to a facility by an FDA field investigator to communicate discrepancies noted during an inspection.

GAMP
Good Automated Manufacturing Practice

GC
Gas Chromatography system

GLP
Good Laboratory Practices. Requirements issued by the FDA and international organizations such as the Organization for Economical Cooperation and Development (OECD).

GMP
Good Manufacturing Practice

HPLC
High Performance Liquid Chromatography system

IQ
Installation Qualification. Establishes that the instrument was received as designed and specified, that the instrument was properly installed in the selected environment, and that the environment is suitable for the operation and use of the instrument.

ISPE
International Society for Pharmaceutical Engineering

LC
Liquid Chromatography

OEM
Original Equipment Manufacturer

OQ
Operational Qualification. Demonstrates that an instrument will function according to its operational specification in the selected environment.

PDA
Parenteral Drug Association. Global provider of science, technology and regulatory information and education for the pharmaceutical and biopharmaceutical community.

PQ
Performance Qualification. Demonstrates that an instrument or equipment consistently performs according to the specification appropriate for its routine use. Conducted under actual running conditions across the anticipated working range.

QA
Quality Assurance

QC
Quality Control

SOP
Standard Operating Procedure

USP
United States Pharmacopeia. The official public standards-setting authority for all prescription and over-the-counter medicines, dietary supplements, and other healthcare products manufactured and sold in the United States.

www.agilent.com/chem/hiddencosts

Published in USA, September 27, 2011
5989-7054EN

Agilent Technologies