Leveraging Best Practices When Implementing a Chemical Inventory System Helps Ensure System Adoption and Successful Incorporation into Lab Processes

ABSTRACT
Companies that utilize chemicals in their labs and their manufacturing processes must manage those chemicals in a safe environment in accordance with government regulations. At a minimum, to ensure that this is accomplished, a system for managing information about the chemical safety and inventory data should be established and maintained. Best practices, on the other hand, take this minimum and leverage the management of the chemical inventory by taking full advantage of the people, processes, and technology involved. This white paper delves into the best practices involved in managing chemical inventory to achieve the most effective, holistic chemical inventory system.

What’s harder than turning Lead into Gold? Getting scientists interested in using a laboratory Chemical Inventory System! Well, perhaps not that hard, but it isn’t easy. The best way to go about ensuring success is to implement best practices so that it becomes easy for all your users, inside the lab and out, to get the most out of your chemical inventory management system.

WHAT ARE BEST PRACTICES?
Best practices are “best in class” business policies, procedures and processes that have continuously proven successful for many organizations. However utilizing best practices is a moving target, as technology or the marketplace changes, so must the practice.

Best practices as applied to an organization’s chemical inventory system are significantly different today than they would have been even a decade ago. With the increased use of commercial software and the outsourcing of Information Technology (IT) tasks, many organizations have implemented an off-the-shelf solution to ensure that the processes used to manage the chemical inventory are the most effective possible.

Best practices in Chemical Inventory Management (CIM) require taking advantage of the latest strategies—such as Pareto analysis, Just in Time (JIT), and Material Requirements Planning (MRP)—and implementing them in the chemical inventory system. Further, with the heightened attention on regulations and hazardous materials, integrating Regulatory Lists of those chemicals and links to Safety Data Sheets (SDS) help ensure risk mitigation and regulatory compliance. Attention to these strategies and tactics will enable your organization to perform effective chemical stock monitoring, forecasting and setting and assessing chemical stock levels. You should also be able to reduce stock levels, costs, liability and environmental impact.

WHAT IS A CHEMICAL INVENTORY SYSTEM?
The management and control of chemicals is the responsibility of everyone involved in the acquisition, use and disposition of them. In addition, many organizations are responsible for complying with numerous federal, state and local regulations covering chemical purchase, use, transportation, storage, emergency planning and disposal. A comprehensive chemical inventory system satisfies these obligations by maintaining up-to-date inventories of the laboratory chemicals.

Such a system helps minimize the number and amount of chemicals stored, as well as minimize waste generation and control waste disposal costs. This, in turn, facilitates budget preparation and planning by maintaining information on usage patterns, age, shelf-life and cost.
A Commercial-Off-The-Shelf (COTS) chemical inventory system enables organizations to keep track of where chemicals are and how much are available, as well as generate reports listing chemicals by location, vendor, name, CAS number, formula, etc., and quickly access hazard information during an emergency.

A truly effective best practices chemical inventory system, however, goes beyond inventory management and regulatory compliance. Such a best practices solution will address each stage of the chemical management lifecycle, which begins with procurement and extends through use and disposal of chemicals.

Best practices chemical inventory systems provide a high-performance system for tracking chemicals and other laboratory supplies. Accurate, real-time inventory information enables all types of laboratories to operate more effectively, regardless of the application or type of research. A chemical inventory system that works with other IT solutions can be seamlessly integrated with other systems, such as purchasing, accounts payable, etc.
WHY INVENTORY SYSTEMS FAIL IN THE LAB

There are a number of reasons why chemical inventory systems do not work as hoped or promised. First, your company must overcome the perception that chemicals are a small percentage of the overall operating costs. Often chemical purchases and management can have a significant impact on operating costs. Lack of information on chemical usage affects the ability to manage chemical costs efficiently, which can lead to underestimating the resources required. For instance, if chemicals in existing inventory can’t be readily found, then more must be ordered. If the misplaced chemicals are found after expiration, then they must be discarded, resulting in wasted inventory. In addition, chemicals that are not retested in a timely manner before expiration must also be discarded. Discarding inventory because of poor chemical management increases company expenditures unnecessarily.

TOP 7 REASONS WHY CHEMICAL INVENTORY PROCESSES FAIL

1. Perception that chemicals are only a small part of overall costs
   The purchase and management of chemicals can have a significant impact on operating costs. Lack of information on chemical usage affects the ability to manage chemical costs efficiently, which can lead to underestimating the resources required. Discarding inventory because of poor inventory system management increases company expenditures unnecessarily.

2. Inventory information isn’t kept up-to-date
   A common problem many labs stumble over is how to keep track of bulk chemicals, equipment and solvents. Knowing who has taken an item, what condition the item is in upon return and whether it needs to be reordered are just a few of the questions that need to be addressed to ensure accuracy.

3. Inventory logistics are convoluted and difficult to follow
   Many custom-designed chemical inventory management solutions are too difficult to use, hence only a few people have the knowledge and patience to perform inventory logistics correctly. As a result, accuracy and timeliness of the chemical inventory data suffer. Valuable time may be lost when experiments must be stopped because the necessary chemicals are not on hand.

4. Users aren’t adequately trained on processes
   Performing any process or using any system requires training, thus lack of training can be a barrier to use. Obviously, the simpler the processes and software involved, the better. A best practices chemical inventory management solution is straightforward and intuitive, enabling users to learn the steps easily, retain the details and perform logistics to the requirements.

5. No process in place for timely notification of inventory status
   If chemicals in existing inventory can’t be readily found, then more must be ordered. If the misplaced chemicals are found after expiration, then they must be discarded, resulting in wasted inventory. In addition, chemicals that are not retested in a timely manner before expiration must also be discarded. A best practices solution can eliminate these problems and associated costs.

6. Processes are reactive, not proactive
   A best practices chemical inventory management solution acts proactively to supplement lab processes, not waiting for input. It addresses the above and other problem areas, allowing the organization to make the best use of all chemicals in all facilities. Features like barcode labeling and tracking, remote inventory control and automatic e-mail notifications, are all part of a best practices solution that enables the organization to maintain accurate chemical inventory information in real-time.

7. Inventory solution is an add-on to another lab system
   Many laboratory software solutions offer add-on inventory modules. While these may be bundled with another system, they are rarely comprehensive and tend to have limited functionality, nor do such add-ons represent a core competency of the solution vendor.
Lack of strong management support is also a reason why a chemical inventory system fails. The idea that COTS chemical inventory solutions are like any other off-the-shelf software is erroneous. Management must support its implementation and encourage its use, ensuring that the users are trained and understand how best to use the system so that they do indeed use it. Management that does not stay engaged after the system is purchased should not be surprised to find that it is not used consistently or accurately.

The corporate culture can also be a stumbling block for chemical inventory system usage in the lab. Often the system’s users may resist any reform or controls on chemical inventory management. If there isn’t a strong corporate culture for leveraging tools and systems to the advantage of the organization, then there’s little incentive to start using the new solution.

Lack of manpower is another reason the systems can fail. The chemical inventory system needs to be populated with the existing inventory data, which can be a time-consuming task if the data is not already available in an electronic format. Even if it is available electronically, the person transferring the data must know how to do it efficiently. Because it can be time-consuming when there is little manpower available, it can be put on the low priority list of tasks indefinitely. The result of not entering all inventory data will be an awkward, discontinuous collection of inventory management solutions.

Lack of training can be a barrier to use. Obviously, the simpler the system is to use, the better, but any new system requires users to spend some time learning how to use it.

Finally, while poorly designed software can also be a roadblock to inventory management success, it is not usually the reason why a system fails. A poorly designed chemical inventory system, however, can drive many of the problems listed above if it is difficult to learn and use, or if it was chosen based on price rather than on the best fit for the lab and the corporate environment.

Consider too that many of the software solutions available focus on compliance issues involved in waste management, such as hazardous waste storage and disposal. This is only one aspect of chemical inventory management and while not a “poor design” per se, because of the narrow scope these solutions offer a poor fit for many organizations.

As can be seen, a number of factors can operate independently or together to derail usage of a new system in the lab. Knowing these stumbling blocks helps to ensure their avoidance. The focus can then be on the aspects that help ensure successful implementation.

Many of these problems are driven by solutions that involve highly decentralized chemical procurement and use. These can make it difficult to develop or maintain an effective organization-wide chemical inventory management program. Centralization is one of the keys to success.

**WHY INVENTORY SYSTEMS SUCCEED IN THE LAB**

Once the system is up and running, a shared inventory solution provides quicker access to in-house materials. Your users will know what’s in stock and where to get it. Your management will know how fast materials are being used and what they cost. Your accounting department will know when to order and how much. It sounds so easy and straightforward, and it is, but certain things will need to occur to make this shared inventory solution work.

**TOP 6 REASONS WHY PEOPLE PERFORM INVENTORY CONSISTENTLY**

1. “I found stuff we never knew we had.”
2. “Between 10-25% of total chemicals needed to be destroyed. Some dated back to 1990. In fact, I found things with Mercury in them!”
3. “If it’s barcoded people are more apt to pay attention to it.”
4. “Once we got it done, it was really easy to isolate where the hazardous materials were.”
5. “It saved money because we bought fewer chemicals and had less disposal costs.”
First, inventory management requires basic compliance. The system must be used the way it is supposed to be used. Do not force a system to state that more or less inventory is actually in stock. Do not push back expiration dates because there isn’t time to do revalidation tests before expiration. Skipping steps is going to make users question the accuracy of all the information in the system. You do not want noncompliant usage.

The corporate culture will need to evolve to accommodate the new system. By implementing the new system you will be changing the culture of how your organization performs inventory tasks. Don’t expect the new system to conform to your existing processes – the system is creating a new process. Expect this and rise to the challenge.

Make it easy to participate. It should be easy to use. It should be easy to integrate with other systems in the organization. Don’t make users jump through hoops to pull items from inventory. Automate the reports to management. Create triggers in the system so that when inventory is low, an alert is sent to the responsible person who can reorder it in a timely fashion.

Training should be minimal. An easy-to-use system is one that doesn’t require much training and is easy to remember how to use. Look for a solution that takes only a few hours to learn. A chemical inventory system should supplement the tasks in the lab, not replace them. Keep personnel focused on priority tasks, not frustrated by a system that hides items they need to get their job done.

Above all, remember that software saves time. Technology can expedite processes in ways that manual records can’t.

**BEST PRACTICES IN CHEMICAL INVENTORY MANAGEMENT**

Effective inventory management involves getting the right inventory in the right place at the right time in the right quantity. Chemical inventory management focuses specifically on controlling the activities involved with chemicals used by the organization. To ensure chemical inventory accuracy, your organization must control not just the processes, but also the users. Implementing best practices software technology is one way to ensure user adoption and process compatibility.

There are hundreds of intricate inventory management processes that involve optimizing inventory levels, logistics and deployment, replenishment, disposition and forecasting. Many organizations are tracking their chemical inventory on paper, or with a basic spreadsheet program, or with ancient in-house solutions. Unfortunately, these solutions typically can’t provide accurate, up-to-the-minute information. The result is often unnecessary, duplicate ordering and high disposal costs due to inefficient use of purchased materials.

Real-time information is essential. In this Internet age, everyone expects accurate data to be at their fingertips instantly. This is not always the case with many chemical inventory systems. For instance, a common problem many organizations confront is how to keep track of bulk chemicals, equipment and solvents. Knowing who has taken an item, what condition the item is in upon return and whether it needs to be reordered are just a few of the questions that need to be addressed to ensure accuracy. A spreadsheet may be easy to implement, but if the information is not kept up to date, it will not yield accurate chemical inventory information, resulting in frustration and discontinued use. Consider too that the system utilized must not only maintain information about what chemicals are being distributed in an efficient and logical manner, but users must also still be able to locate chemicals in the system even if they do not type in the exact name(s) or identification number(s) for the compound, or if they make spelling errors. Users should not be expected to second-guess the system.

A best practices chemical inventory system addresses these and other problem areas, allowing the organization to make the best use of all chemicals in all facilities. Features like barcode labeling and tracking, remote inventory control and automatic e-mail notifications, are all part of
a best practices solution that enables the organization to maintain accurate chemical inventory information in real-time.

What are some of the criteria that should be tracked? The ability to search the chemical inventory system for pre-existing material records and view required data associated with the unique material record is an important feature. Users should be able to search for materials by: trade name, chemical name, vendor barcode, CAS# and structure (any synonym).

In addition, current, up-to-date safety information concerning the chemical container – particularly hazardous materials – should be maintained by the system to ensure immediate facility-wide access to SDS or in-house handling instructions in the event of an accident. The most robust solutions even address not only Tier II, EPR, GHS and OSHA regulations, but also local, state and federal Fire Code requirements.

Finally, the downfall of many custom-designed inventory management solutions is that they are too difficult to use. The result is that only a few people in the company have the knowledge and patience to use the system. As a result, accuracy and timeliness of the chemical inventory data suffer. Valuable time may be lost when experiments must be stopped because the necessary chemicals are not on hand. A best practices solution is easy to learn and use, ensuring adoption and use.

Best practices in chemical inventory management enable chemical inventory accuracy driven by errorresistant processes, well-trained users and intelligent use of technology. Understanding how to achieve best practices involves understanding the conditions under which errors occur and why systems fail.

**CHEMICAL INVENTORY MANAGEMENT BEST PRACTICES ATTRIBUTES**

Best practices in chemical inventory management drive operational excellence and risk mitigation in the management of chemical inventory. Tactics that support those strategies include:

- Identify and optimize inventory system components
- Optimize chemical safety & inventory data
- Manage and mitigate the quantity of chemicals on-site
- Address regulatory requirements such as EPA and OSHA
- Access current SDS information in real-time
- Eliminate chemical safety deficiencies
- Address regulatory requirements, such as EPA, OSHA, GHS, ECHA, SAICM, EC Directives
- Streamline lot tracking & qualification for process efficiencies
- Automate regulatory reporting
- Automate audit trails and facilitate compliance
- Accurately quantify inventory management costs
- Reduce inventory management costs

**BIOVIA Chemical Inventory Management White Papers**

For more about chemical inventory management best practices, please request these other white papers from BIOVIA:

- Best Practices: Quantifying the Financial Benefits of Chemical Inventory Management
- Best Practices: How to Gain Complete Control of your Chemical Inventory
- Best Practices: How to Successfully Contract Chemical Tracking to Managed Service Providers
- Best Practices: Integrating SDS’s with your Chemical Inventory System
- Best Practices: How to Survive a Chemical Management Audit
- Best Practices: How to Ensure Accurate Fire Code Reporting of your Chemical Inventory
- Best Practices: How to Drive Down Lab Operating Costs with Web-Delivered SaaS Solutions
- Best Practices: How to Ensure Chemical Inventory Safety and Compliance with Regulations
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About BIOVIA CISPro
The BIOVIA CISPro chemical inventory management system enables organizations to manage chemicals safely from receipt to disposal along the entire lab-to-plant value chain, ensuring Environmental Health and Safety (EH&S) compliance across the enterprise. For more information about BIOVIA CISPro, visit www.accelrys.com/cispro

APPENDIX A

Components of a Best Practices Chemical Inventory System
A chemical inventory system should accommodate all basic inventory management tasks. It should manage all the steps associated with registering a material, including receipt (data entry and barcodes), sample collection, results entry, verification, approval, lot release, re-labeling, re-issuance, dispensing, storage and container deletion.

Any well-designed inventory system should enable the organization to avoid duplicate ordering and high disposal costs. Features like barcode labeling and tracking, remote inventory control and automatic e-mail notifications enable the organization to know exactly, real-time, where materials are and what they are, as well as when those materials are set to expire, regardless of how many users and material classes the system must accommodate.

The system should provide a wide range of functionality, including listing expired materials for a user (owner) and for a site; a mechanism for deleting individual containers or a series of scanned containers; create, edit and delete permissions for various operations in the system; the ability to accommodate parent/child or split container relationships; and, duplicate materials clean-up. In addition, because raw material lots are typically only approved for certain periods, the system should also be able to automatically initiate re-sampling and re-testing prior to materials going out of date.

The organization will need to be able to search the chemical inventory system for material that has been approved for use. All material usage should be logged into the system, so that the system is always current and can reflect exact amounts of any specific material in inventory.

It is important to consider who will be using the system. A large production line will utilize a dedicated production system with a dedicated team of users. A lab, however, typically does not have the luxury of staff that perform only one function. The optimal chemical inventory system for a lab would thus be a versatile solution with which anyone in the lab or Environmental Health & Safety (EHS) department can interact at various defined permission levels. For instance, the system should be able to define a general user who will be able to view all screens and write/edit requisition screens; an analytical user who will view all screens and have permission to perform write/edit requisition, result and verification screens; container owners who can manipulate containers they own; and higher level groups (e.g. raw material groups) who have the ability to manipulate containers under their group control.

Obviously a web-based solution that utilizes familiar web browser screens and resembles typical work processes would entail the least amount of training and easiest adoption. The downfall of many customdesigned chemical inventory management systems is that they are too difficult to
use. The result is that only a few people in the company have the knowledge and patience to use the system. Accuracy and timeliness of the chemical inventory data suffer. Valuable time may be lost when experiments must be stopped because the necessary chemicals are not on hand. In a research organization, EHS and lab personnel should both be able to interact directly and intuitively with the system.

With regard to regulatory issues, the frequency with which federal, state and local safety regulations are being updated is not only occurring more often, but those regulations are also increasing in number and complexity, making it confusing and difficult to ensure compliance. When those regulations concern chemicals, it is vital therefore that the system enable the organization to easily comply with the regulations, ensure safe chemical management and produce accurate chemical inventory reports.

Most laboratories today must be operated in accordance with a variety of government regulations; thus it is important to avoid noncompliance situations caused when chemical inventory management is inconsistent or ineffective.

Any time chemicals are in use, safety is an issue. In the event of an accident, the correct information needs to be available on the spot. A chemical inventory system should provide details about exactly what chemicals are available and where they are. Safety information about those chemicals should be readily available, whether as an SDS or as customized handling instructions.

The features described above list the minimum functionality an effective real-time chemical inventory system should provide. However, a robust comprehensive solution should also manage material lifecycle from “cradle-to-grave”.

The material lifecycle starts with receipt and tracks material quantities, analysis, and disposition, as well as controlled use (where used and when). This capability is important because it allows the organization to have better accountability and visibility for their chemical inventory. By knowing and being able to track this aspect of operations, the organization is better able to estimate the material demands by department.

Going beyond the minimal requirements for a chemical inventory system frees the organization to focus time and energy on better managing their products and processes rather than on managing their inventory. A lifecycle-oriented system thus provides numerous additional benefits, not the least of which are a higher level of material data lifecycle and approval processes, automatic retesting, permission controls levels and complete archiving and versioning.

After ease of use, perhaps the most important capability of all is regulatory compliance. Most labs must be operated in accordance with a variety of government regulations; the lab should not be noncompliant because a system isn’t effective or used properly.

Systems fail because they aren’t easy to use. This touches on two issues: internal compliance and regulatory compliance. Internal compliance is driven by usability. If users find it difficult to use the system, they may use it incorrectly or only occasionally, so that material could be exceeding limits or be so far out of compliance it impedes workflows. And the organization might not discover this until an external audit takes place – a poor time to find out.

With regard to regulatory compliance, a difficult-to-use system can generate numerous problems. Not only should it be easy to receive material into the system, it should be easy to remove material and empty containers. If material and/or hazardous waste don’t get disposed of properly, the facility is out of compliance.

Finally, not only is it important to ensure that the system gets used properly and effectively, the organization needs to determine whether the system can perform auditing and what types of audit control it has. The chemical inventory system should support inspections by the fire department, EPA, FDA and OSHA by providing tools for compliance. The system should accurately track chemical inventory and allow the design and generation of reports that document compliance at any time. The system should assist in preparation for OSHA audits or SARA and Tier II reports by producing accurate, thorough reports quickly and easily.

A best practices chemical inventory system will provide end-to-end assurance that your organization manages chemicals safely, in compliance with regulations, and takes advantage of opportunities to control chemical costs and streamline chemical workflows.
APPENDIX B

How Effective Is Your Chemical Inventory Management?

15 questions for a self-diagnostic test. Answer these questions to find out if you should investigate changing the way you manage your chemical inventory:

1. Does your system provide cradle-to-grave container tracking?
2. Is the information in your chemical inventory system accurate and up to date?
3. Is somebody responsible for the chemical inventory “process” (i.e., the whole lifecycle) in your organization?
4. Do you need dedicated people to use your chemical inventory system, or can any approved user search for materials within the system?
5. Is all material usage logged into the system so that the system is always current and can reflect exact amounts of any specific material in inventory?
6. Does your system provide cradle-to-grave container tracking?
7. Can your chemical inventory system automatically report the actual inventory; i.e., the actual amount stored in the inventory database as well as the amount available, i.e., the actual inventory minus all requisitions against the material?
8. Do you know how many of your chemical supplies are out of date or close to expiration, and do you have procedures for resampling those supplies in a timely manner?
9. What are the costs associated with tossing supplies that have expired versus resampling those supplies so that they can remain in active inventory?
10. Can your chemical inventory records be audited successfully without impacting operations?
11. Can you ensure compliance to government regulations?
12. If a key employee leaves, could you guarantee no loss of system integrity?
13. Can you quickly locate and review all your records regarding a specific chemical, or chemicals stored at a specific site, or automatically calculate your total chemical usage for the month?
14. Do you know how much time staff spend trying to find chemicals that have been moved from one location to another, determining exact status of chemicals, or ordering more chemicals when there is already a supply on hand that’s not reflected in your system? Is this acceptable?
15. Is chemical inventory management in your organization as efficient as other key functions such as accounting?