

Lean Lab Includes Lab Safety

Ensure Accuracy, Safety and Efficiency



Lean principles help to systematically enforce order in the workplace down to the smallest detail, and they have typically been applied to heighten productivity, enhance quality, lower production costs and improve profitability. But can these principles also enhance safety? Discover how lean principles, appropriately applied, can increase not only productivity and quality but also safety in your lab.

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1. Introduction: The Importance of Order



Figure 1: Can you carry out a safe process in this situation?

Safety in the lab is critical, and the virtues of safe working conditions are particularly important when dealing with active substances. Analytical accuracy is also of utmost importance. However, in addition to safety and accuracy, there is a third production facet that is not far behind in today's modern lab: speed. This is because time-to-result affects time-to-market. Health and lives may be at stake.

Fortunately, labs have a system they can use to help organize and order their equipment, supplies, and workflows for optimum productivity known as lean. Lean thinking, which originated with Toyota in Japan, provides a framework for assessing resources by focusing on order to improve efficiency.

While a focus on efficiency may seem contrary to concerns for safety, the opposite is true, particularly in the lab: a focus on order can deliver significant safety benefits. For example, on one hand, a lab manager always wants to protect employees by preventing unnecessary exposure to dangerous substances. On the other, he or she must also ensure the purity of substances being handled. Preventing cross-contamination through optimal workflow design, ongoing maintenance of order, and consistent application of cleaning procedures helps to ensure both goals are achieved. Establishing order also reduces time and effort spent searching for items needed, making processes more efficient. It can also help make the use of personal protective equipment more consistent.

While technical aspects of equipment such as safety cabinets and isolators should be designed to help reduce the risk of cross-contamination in the first place, even in these specialized enclosures, results stand or fall based on the basic attitude of staff towards order and, by extension, cleanliness.

This white paper will explore how the lean method known as "5S+1", by helping labs establish efficient workflows, can help enhance not only process efficiency and analytical quality but also safety.

Order for Safety and Efficiency

While the example in Figure 1 may seem extreme, many labs are under time pressure to produce. This can lead to a buildup of equipment, disposables, and other items that can distract operators, which can increase both exposure risk and cross-contamination risk. The simplest way to ensure both safety and efficiency in the laboratory is to establish and maintain order.

2. Establishing and Maintaining Order/Cleanliness Using the 5S Method

From among the many modules that combine to make up the concept of lean, the 5S method is extremely well-suited to creating or improving the basic principles of cleanliness and order. This section explores the 5S method (Figure 2) and discusses its application to labs.



Figure 2: The 5S cycle.

The five distinct actions or goals that serve the higher purpose of creating order and safety in the lab are as follows.

1. Seiri (sort)

The first S, Seiri, can be translated roughly in English to “sorting, clearing, classifying”. In this stage, a lab operator should seek to remove all clutter and unwanted items, leaving only the tools, equipment, and components that are required daily. Basically, this involves checking each item and deciding whether:

- the material or device is needed and remains,
- the material or device purpose is not clear, or
- the material or device is not needed.

If the material has obvious use and remains, it becomes part of the permanent lab order. If the purpose or use for the device is unclear, it can be stored for 3–6 months and then disposed of if it has not been used. If it is obvious the item or material will not be useful, it can be disposed of immediately.



Figure 3: Lab items in a drawer. Are they needed, or not?

2. Seiton (set in order)

The second S stands for Seiton, which can be translated to “straighten, simplify, set in order, configure”. This is the stage where a lab operator organizes remaining items and considers how to systematically store them. This involves carefully considering how and where each item will be used to help ensure optimal placement and to reduce the travel time required to perform a particular function (Figure 5). Ideally, ergonomic principles are incorporated so that items can be placed in such a way that using them minimizes movement and reduces stress. Labels can help to ensure optimal order is maintained.



Figure 4: This assembly station is an excellent example of “2. Seiton”.

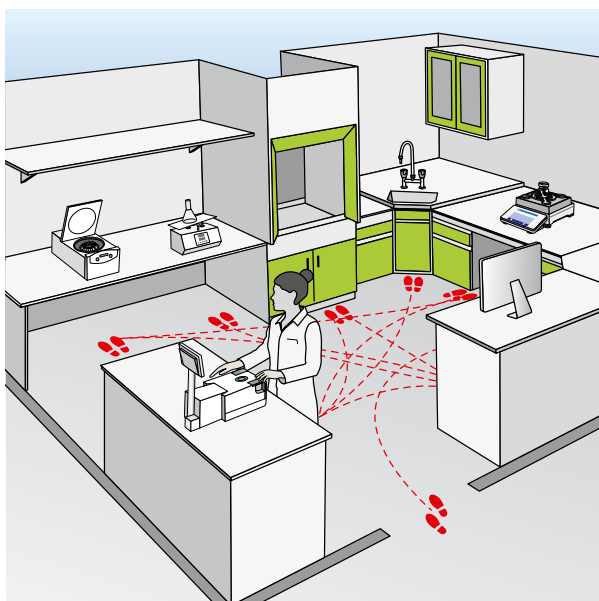


Figure 5: Reduce unnecessary distances in the laboratory.

Whenever possible, the optimization of entire workflows can be established in this step (Figure 6). This means samples reduce their transit through the laboratory to increase efficiency and safety. It should also be noted that these same principles apply to items contained within safety cabinets and isolators (Figure 7).

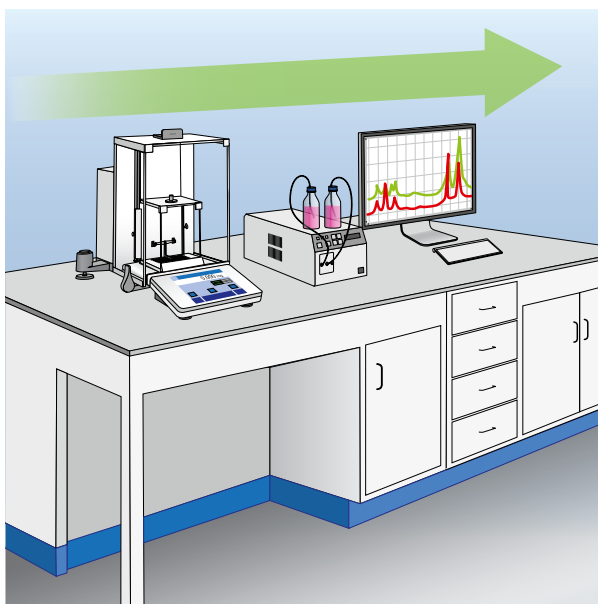


Figure 6: Optimal equipment placement after the application of "2. Seiton".



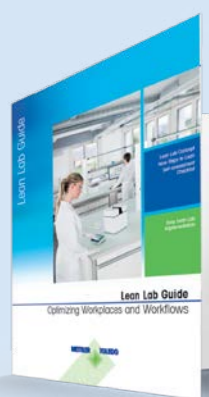
Figure 7: Isolators and safety cabinets must also be organized according to 5S principles.

Building Order into the Process

In the case of a laboratory conversion or new construction, it makes sense to consider the issue of establishing order using lean concepts such as 5S, from the very beginning. It is also a good idea to use lab equipment, furniture, and storage suppliers that take order, hygiene, and ease-of-use seriously.

METTLER TOLEDO lab equipment is always designed with accuracy, ease-of-use, cleanability and durability in mind. For more, visit:

► www.mt.com/lean-lab



If the replenishment of consumables is a recurring theme, the situation can be improved by means of a Kanban supply, which is a method for inventory management based on the pull principle.

3. Seiso (shine)

In English, Seiso translates to “sweep, shine, scrub, clean and check”. This involves not only cleaning but often also painting an existing area to bring it to a new standard, which is important for two reasons:

1. It refreshes the area to ensure it is neat and presentable.
2. It brings out aspects of the area that can be detrimental to cleanliness and safety including leaks so that they can be addressed.

A Clean Balance is the First Step Towards Safety and Accuracy

The third S also involves defining cycles for regular workplace cleaning (Figure 8). An annual cleaning of shelves and other overhead areas should also be scheduled. Checklists (whether manual or electronic) have proven useful in maintaining cleaning frequencies for items, whether they require attention after each use, each day, weekly, etc. Noting how they should be cleaned and with what kinds of implements or solutions is also important. For cleaning guidelines, please refer to the METTLER TOLEDO Lab Cleaning Guide:

► www.mt.com/lab-cleaning-guide



Figure 8: Cleaning is a critical step.

4. Seiketsu (standardize)

“Standardize, stabilize, conform” are the basic actions encompassed by Seiketsu. During this phase, operators standardize the previous stages by ensuring common color codes and ways of working. This includes defining and documenting standpoints/zones, publicizing new standards, and training operators.

Ensuring Accuracy

While a redesigned lab workspace should always include space for a notepad or tablet, many lab instruments now offer automatic data capture which can help to eliminate transcription and calculation errors. For more on eliminating transcription errors and error risk, please see “Management of Weighing Data from Paper to Digital”:

► www.mt.com/lab-weighing-data



Figure 9: Don't accept untidiness anymore! Define and document locations/zones. Present and train standards. Also include writing places!

5. Shitsuke (sustain)

In English, Shitsuke stands for “sustain, self-discipline, custom, practice”. This S is where effort is made to ensure the process of maintaining the 5S method is part of company culture. Actions in this step help to ensure the ongoing implementation and can use audits to preserve knowledge and establish continuous-improvement activities.

New employees should always be included in continuous improvement. They have a perspective on items and processes that is markedly different from long-term employees. The 5S method and systems it establishes can also be useful in educating new employees on lab standards and practices.



Figure 10: Audits are useful in cataloguing items and workflows, thus ensuring 5S activities are carried out.

5S Audit Checklist—Requirements to Sustain a Lean Laboratory

5S for Laboratory Workplace Optimization. This 5S audit checklist provides a structured way to audit your laboratory 5S program. This simple template guides you through assessment of your laboratory, according to the 5S principles. Using a series of questions, the form generates a maximum overall score of 125. A lab scoring below 75 shows significant potential for improvement in their lean lab approach:

► www.mt.com/lean-5S



Overcoming Skepticism

Particularly in established labs, there may be resistance to change on a large scale, even when the benefits of such a change are clearly established. To overcome the skepticism or outright resistance of those affected and bring all lab personnel on board, it can be useful to have the support of professional change-management specialists (either internal or external). If you need assistance in finding Lean Lab or User Safety experts, please contact:

daniel.fuchs@mt.com or branko.radovinovic@mt.com

3. Focusing on “The Sixth S”: Safety

While it may not be necessary to state it so plainly, safety should be considered in all 5S steps. However, establishing it as an independent concept can help to ensure it receives the focus it deserves.

Operators must develop an eye for unsafe working practices (Figure 11). This helps to incorporate the lean concept of Poka Yoke into routine practice. Poka Yoke can be translated to mean “avoiding unfortunate mistakes”. Cables and the hazards they represent should be a particular focus (Figure 12).



Figure 11: Look for precarious situations that could present danger.



Figure 12: Cables often create unnecessary trip hazards or electrocution risk.

Dictionary of Lean Lab Terms

Lean Management principles are being applied increasingly to laboratories to improve efficiency. A Lean Laboratory approach typically involves a variety of different methods, tools and processes. The challenge is that with so many different Lean Manufacturing and Lean Laboratory terms, many of Japanese origin, it can be confusing to remember what all these terms mean!

This Lean Laboratory Glossary is a simple reference guide to help you to understand the terminology used in Lean Laboratory:

► www.mt.com/lean-lab-glossary



4. Results of Implementing “5S+1” = “5S+Safety”

While 5S methods may seem trivial, they are not easy to implement. Most existing labs who undertake this effort find that a thorough application of 5S principles takes 3–6 months. However, this is time well-spent.

By focusing on safety and implementing the “5S+1” model, clean, safe and efficient workplaces are created (Figure 13). Personal protection material can be placed where it is convenient to ensure consistent use. Confidence that items are clean means operators have more time to work. Clear and concise processes become audit-proof as well. All in all, safety, productivity, and analytical accuracy are enhanced, while overall operating expense and use of resources is reduced.

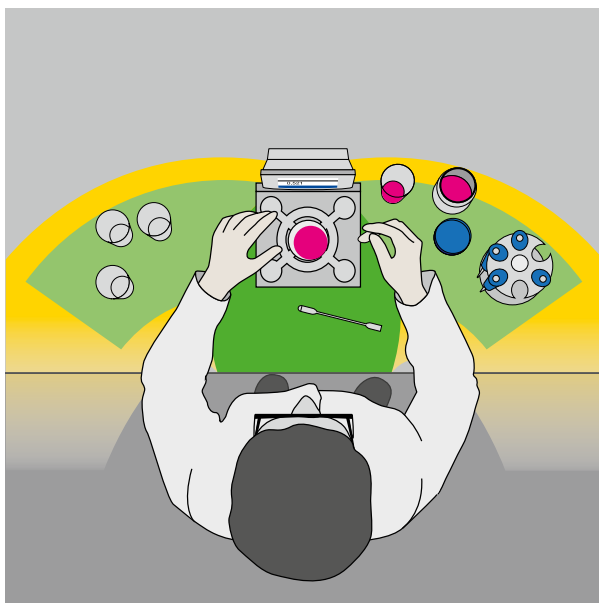


Figure 13: A well-designed workspace creates ease and flow during a workday.

5. Summary

The tools and methods of lean can be applied to the lab as well as to other work environments to improve workflow efficiency and overall productivity. These methods can also be used to enhance efficiency, cost-effectiveness, and safety in a lab.

The application of lean methods is not contradicted by the need to ensure safety. In point of fact, lean methods can help to enhance conditions that ensure a safe working environment for lab operators by providing clarity and organization to equipment, disposables, and workflows.

The 5S method generally comprises a series of 5 “common sense” stages of lab organization:

1. Seiri, or “sorting, clearing, classifying”
 2. Seiton, or “straighten, simplify, set in order, configure”
 3. Seiso, or “sweet, shine, scrub, clean and check”
 4. Seiketsu, or “standardize, stabilize, conform”
 5. Shitsuke, or “sustain, self-discipline, custom, practice”
- +
6. Safety: This paper goes one step further and adds a sixth “S” building safety into all aspects of the application of the 5S method.

In theory, the 5S method may seem almost trivial, but implementation in the laboratory is challenging. Experience shows that the project time tends to be 3–6 months. Regular audits thereafter help to maintain order.

Proven Cleaning Procedures for Lab Balances and Safety Cabinets

Overcoming any resistance and making the journey to establish and maintain order and cleanliness is time well spent. The results are improved efficiency, better productivity, reduced costs, higher accuracy, and enhanced safety:

► www.mt.com/labtec-safety-cabinets



Appendix

Glossary of Terms (*italicized terms are Japanese in origin*):

5S – a method of improving order, organization and cleanliness that consists of the following terms:

1. *Seiri*, or “sorting, clearing, classifying”
2. *Seiton*, or “straighten, simplify, set in order, configure”
3. *Seiso*, or “sweet, shine, scrub, clean and check”
4. *Seiketsu*, or “standardize, stabilize, conform”
5. *Shitsuke*, or “sustain, self-discipline, custom, practice”

Gemba walk – a walk taken by management to assess a workplace

Kanban – a method for inventory management and production control that is based on the pull principle and represents a closed control loop

Poka Yoke – Poka Yoke means “to avoid unfortunate mistakes” and describes a principle consisting of elements that include technical precautions or devices that detect and prevent errors

About the Author

Erwin Studer, born in 1959, worked in the pharmaceutical industry for many years after completing his mechanical engineering studies. In addition to his work as a factory planner, he was involved in the planning and construction of laboratory buildings from their earliest stages to ensure proper form, function and safety.

Today, together with several partners, he leads a practice-oriented team of engineers and business economists that advises manufacturing companies on how to achieve greater efficiency and profitability with a focus on Europe known as Profact. The company offers specialized methods and tools to help personnel in laboratories and production environments actively, measurably and sustainably solve problems. For more, visit:

► www.profact.ch

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► www.mt.com/library



eLearning: 5S+1

eLearning: Workstation Optimisation with 5S+1

Learn more about:

- 5S+1, where and how it is used
- Kanban in the laboratory
- Advantages of the 5S+1 method in everyday laboratory work

► www.mt.com/elearning-lean5s



eLearning: Warehouse Management

Learn more about:

- Inventory management and how to save space
- How to have the right material in stock
- Advantages of Kanban in laboratory warehouse management

► www.mt.com/elearning-kanban

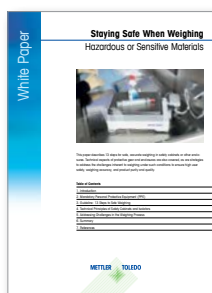


Reference Paper: Proven Cleaning Procedures For Lab Balances and Safety Cabinets

This paper contains helpful information for:

- Cleaning methods and agents
- Gives instructions how to clean a balance and the surrounding safety-cabinet area
- Provides solutions for keeping your balance clean in the first place

► www.mt.com/labtec-safety-cabinets



White Paper: Staying Safe When Weighing

This paper describes 13 steps for:

- Safe, accurate weighing in safety cabinets or other enclosures
- Technical aspects of protective gear and enclosures
- Strategies to address the challenges inherent to weighing under such conditions to ensure high user safety

► www.mt.com/labtec-safety-weighing

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