



Author: Veruschka N. Echevarría Rosa
 Advisor: Carlos González, PhD
 Industrial and Systems Engineering Department

Abstract

This project will be demonstrated how a layout in the workspace can impact the efficiency of a process. An optimal design in the location of equipment and materials needed to execute a task can reduce all those activities that do not add value to the process allowing a continuous workflow. As a result, the aim is to reduce the time of the process, which increases productivity without compromising the quality of the product.

Introduction

Safety at work comes first. In the workplace, we often carry out different tasks or activities that require using dangerous reagents, glassware, the movement of heavy objects, etc. Additionally, there is a constant flow of people entering and leaving the work area, which can make the task we are performing even more difficult. This entails being cautious and alert as we want to work in a safe place and avoid accidents. Currently, I work in the laboratory of the biotech industry. Part of my tasks as a laboratory technician is to run a biochemistry test that requires equipment and reagents located in two separate laboratories.

Background

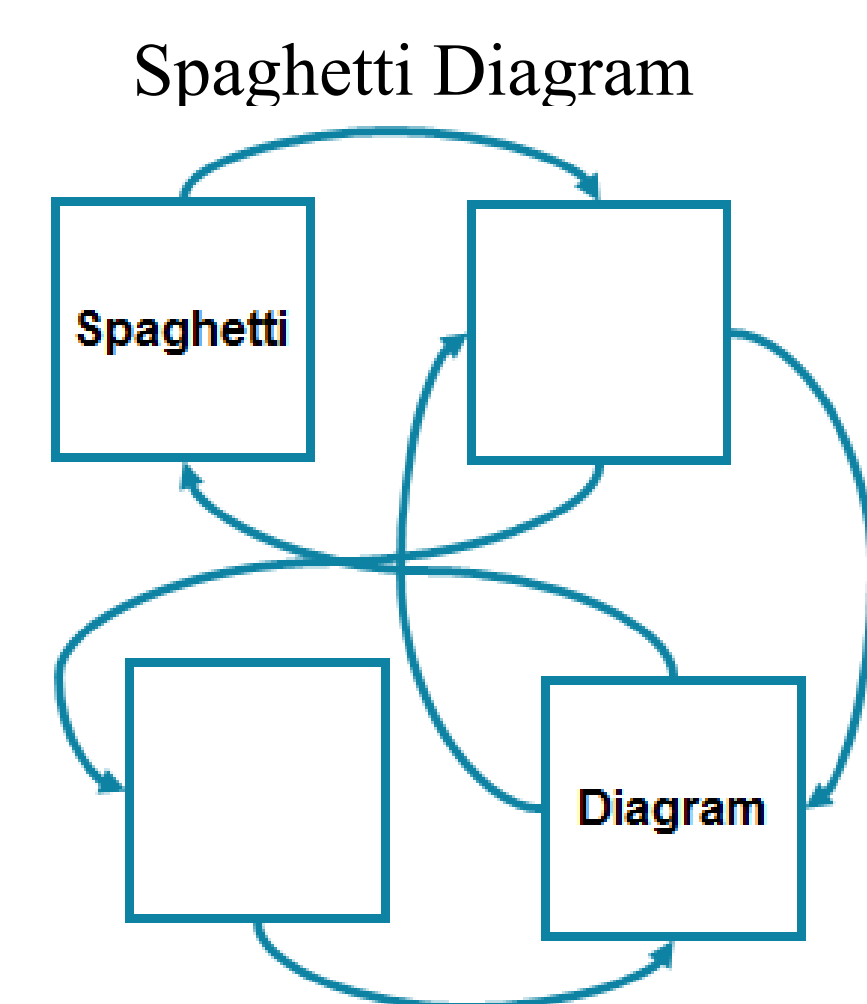
Among the tasks and duties of an analyst is running a biological assay to determine the product's identity. This assay identifies the molecular weight of the protein of interest by gel electrophoresis. This assay can take two to three days to execute. One opportunity for improvement is that this test is carried out between two different laboratories. The biochemistry laboratory consists of two rooms; in one room are all the needed reagents and materials, and in another room is the equipment where the electrophoresis occurs. I understand that if the layout of the work area is improved and everything is located in the same place, this process can be optimized.

Problem

If we have a clean and organized space, we can find what is necessary for less time, which increases productivity since the task can be fulfilled without mishaps. It decreases the possibility of making mistakes because everything will be in the same place, but it provides security for the employee. The prevention of occupational risk must be the priority of any industry. The workspace design is critical to reducing the waste generated and increasing the optimization of the task or activity carried out. As part of the project design, the objective is to redesign the workspace layout where the task is executed so that everything necessary is found under the same laboratory and, with this, reduce the waste by above 20%.

Methodology

For this project, quantitative data will be collected so that a progression in the efficiency of the task and a decrease in the waste it generates can be measured. The time it takes and the efficiency of the process will be considered. This will be done over six consecutive weeks, and the progress obtained will be evaluated. It must be regarded that getting the final result of this test takes about two or three days. First, creating a layout of both laboratories with the reagents and equipment used is necessary. Second, a spaghetti diagram will be made to visualize the entire process. A spaghetti diagram is a powerful tool used to visualize the waste of a poor design in the layout of the work area. As a benefit, we can maximize the workspace and improve the area to increase efficiency. Here we can see the different stages of the process reflected and have a current representation of what it takes to carry out the task. Third, the time it takes a technician to complete the job will be measured using a timer. Fourth, the data obtained from the employee will be compared. Then everything will be reordered in one place, the technician will be asked to do the task, and new data will be collected with the change. Ultimately, we seek to compare the data, evaluate the difference, and determine if there was a significant impact.



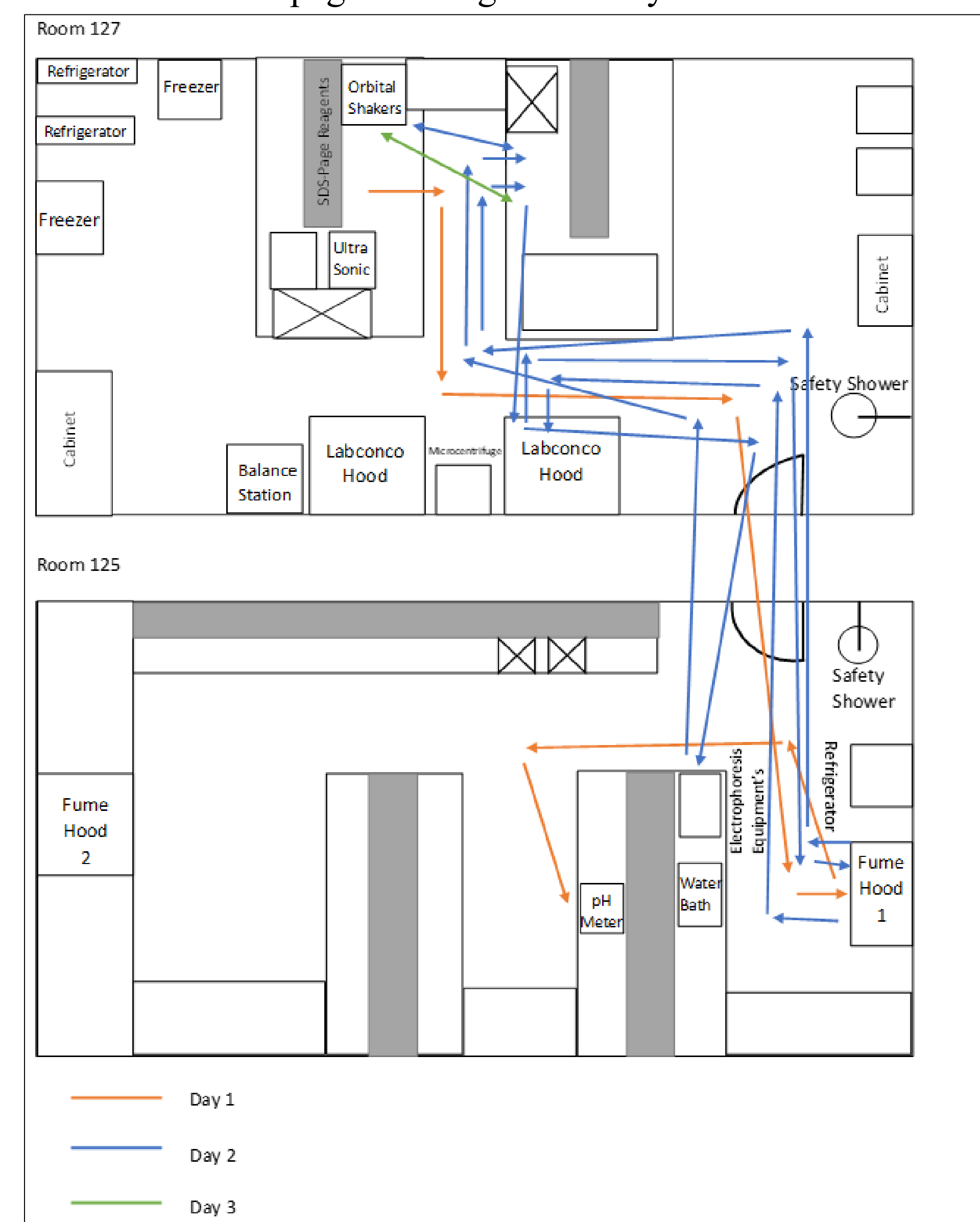
Milestone

Phase	Description	Due date
Phase 1	A current layout of the laboratories will be made with the location of equipment and reagents.	March 20, 2023
Phase 2	Certified laboratory technicians run the assay	March 23, 2023
Phase 3	A spaghetti diagram will be made to visualize the current situation	March 31, 2023
Phase 4	Everything necessary to run the test will be reorganized in a single laboratory.	April 10, 2023
Phase 5	The test will be rerun with the new layout	April 13, 2023
Phase 6	A new spaghetti diagram will be drawn	April 21, 2023
Phase 7	All collected data will be compared and analyzed.	April 26, 2023
Phase 8	Report data obtained	April 28, 2023

Results and Discussion

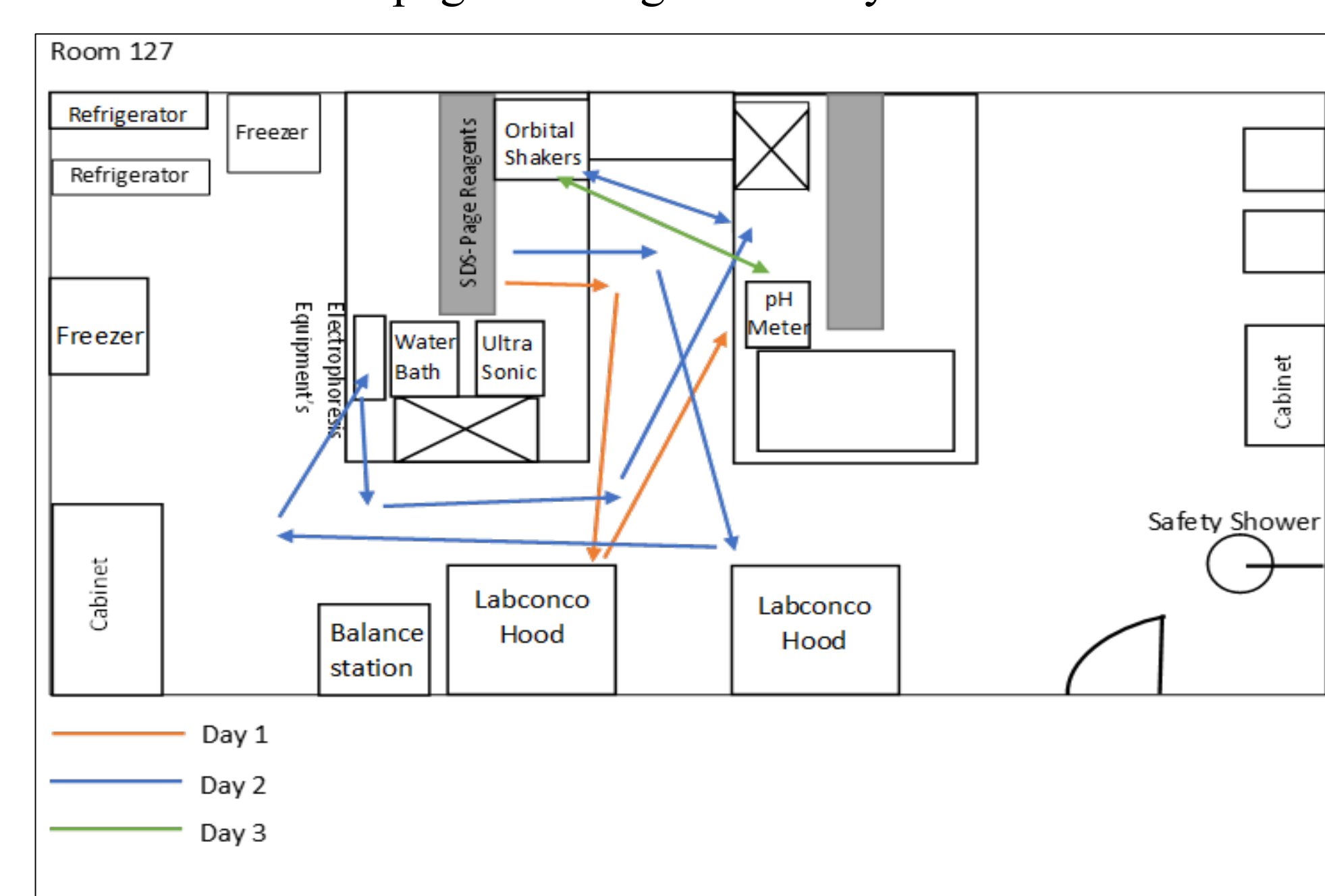
Using the spaghetti diagram we will make the current layout of how the equipment, reagents, and materials are located to visualize what a normal workday is like.

Spaghetti Diagram of Layout 1



Then we will relocate the necessary equipment to increase the efficiency of the process and improve the occupational safety of the employees who carry out this test.

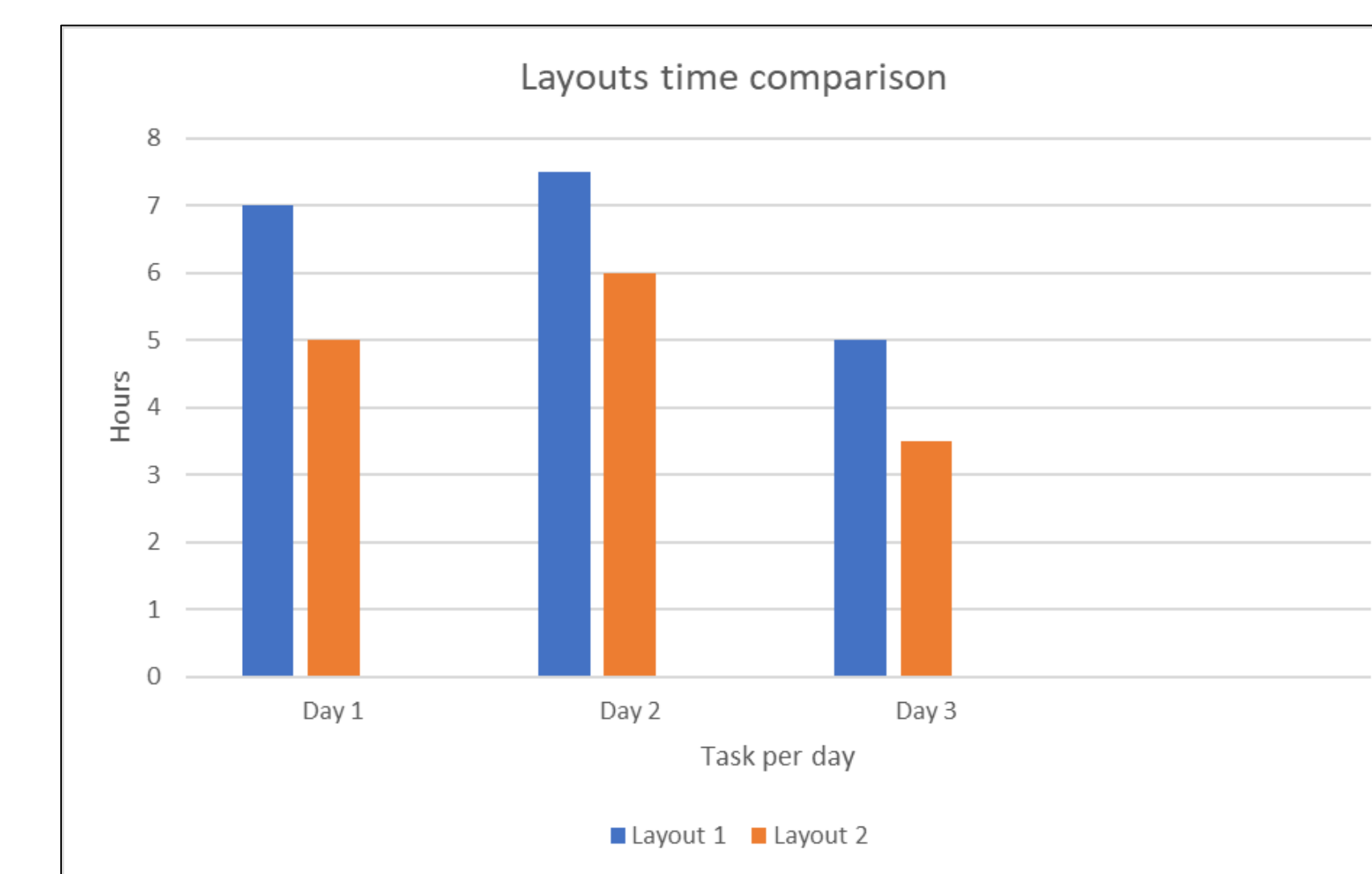
Spaghetti Diagram of Layout 2



As we can see, the first layout took more time to complete the process since the reagent equipment and materials were distributed between two separate laboratories. By relocating everything within the same space, process times were reduced, and waste was minimized to 25%.

Conclusions

It has been shown that the layout of the work area is an important aspect to consider in order to increase efficiency in daily tasks. As a result in the first layout, day one takes approximately seven hours to complete the activity, day two takes seven and a half hours, and day three takes five. This was for 19.5 hours between the three days of testing. In the second layout, where an arrangement was made and all the equipment was relocated in room 127, the task of day one is reduced to five hours, the activity of day two is reduced to six hours, and the activity of day three is reduced to approximately three and a half hours. This was for 14.5 hours between the three days of testing.



It is important to take advantage of the maximum time possible, for this reason, it is important to consider all the factors that may be affecting a process, such as the design of the work area. There are several tools that could be of great benefit in minimizing or eliminating this waste. The spaghetti diagram is one that helps to detect this waste visually, so it is easier to rearrange the work design to maximize the efficiency of a process.

Future Work

Waste in this process was reduced by 25%. But that does not mean that it cannot be further improved. Therefore, following the Kaizen management methodology, I will seek continuous improvement in this process.

Acknowledgements

I want to thank all my master's professors. I also want to thank my mentor, Dr. Carlos Gonzalez, who has been my guide during this project design, and Daimarik Torres, who helped me review the project.

References

- [1] N. Daneshjo, V. Rudy, P. Malega & P. Krnáčová, "Application of Spaghetti Diagram in Layout Evaluation Process: A Case Study," in *TEM Journal*, 2021, vol. 10, no. 2, pp. 573-582. DOI:10.18421/TEM102-12.
- [2] ASQ. (2023). *What is a Spaghetti Diagram?* [Online]. Available: <https://asq.org/quality-resources/spaghetti-diagram>.