Electronic Oversight: Electronic Record of the daily Audits of the Plant Quality Assurance personnel in the Manufacturing areas

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Abstract *— In support of the Organization's goal, we are challenged to convert manual documentation of team executions into electronic registration. The challenge of this project is to reduce by 100% the number of documents used in quality areas by end of 2021.*

This project describes how to convert manual audit records performed by Quality staff to an electronic record. We will see how to perform electronic documentation and the challenges that come with the project. How change is implemented in manufacturing areas and what the results are. After the implementation of electronic documentation, we analyze the scope and improvements of the audit program and as this project changes the current vision, it creates a process where observations are evaluated in real time. This new vision of audits allows us to monitor, make decisions, prevent, and predict future major events in a manufacturing area.

Key Terms *— Oversight, Audit process, Electronic Documentation Observation.*

PROBLEM STATEMENT

How to carry out the documentation of audits of the manufacturing areas electronically, is the goal of this quality project. In support of the plant goal, in the Quality team we identified that 100% of our documentation was generated by documenting the audits of the manufacturing areas daily. The challenge and objective of the project is to reduce the amount of physical documentation and pass this documentation to an electronic execution record.

To achieve this goal, we need to convert the documentation daily audits to the areas of manufacture by quality personnel in physical ways, tied to a logbook to electronics. The project needs to implement an assessment of the requirements required to run the project and a deployment schedule by functional area to begin the deployment phases.

The project is divided into 3 fundamental phases. The strategy phase where we will see the different requirements necessary to execute the project. The pre-implementation phase that involves coordinating staff access and training requirements, such as the process of training designated personnel. The final phase is the implementation where we seek to organize the timetable for the implementation of the task and the fulfillment of the task, in addition we would give the support to the personnel they need during the execution of the project.

These actions ensure the success of the first electronic documentation project in quality organization and the first Quality group to document quality audits to the manufacturing process throughout the plant.

Research Description

This project seeks to implement electronic documentation of audits conducted by quality personnel in the manufacturing areas of the final filling building at AMGEN Manufacturing Limited (AML) in Juncos P.R. Amgen is a pioneer in the science of using living cells to make biologic medicines [1] AMGEN, 2021. Amgen’s medicines treat serious illnesses and typically address diseases with a limited number of treatment options, with a market value of 129,000 million dollars. Amgen M.L. at Juncos P.R, it is the largest manufacturing site in the entire corporation. currently on the Juncos site, it manufactures 93% of Amgen brand drugs and 100% of biosimilars drugs. The manufacturing building of the final filling is also known by the No. of the building, who in this case is No. 14 or for us AML-14. AML-14 being the main building of

manufacturing operations in the organization, is the building with the highest audits carried out by quality personnel. According to effective procedures where the frequency of quality audits establishes between 12 and 15 daily audits carried out which involves the use of 4 hours of printed paper per audit. These papers are organized into logbooks, controlled books where the shapes are attached. Each logbook contains 100 pages with 25 forms of audits. With the reference established in the procedures for each functional area is audited in its entirety every day. This generated the generation of 52 logbooks on average monthly. By the end of the year, more than 625 logbooks would be generated for which more than 62,400 sheets of paper would be required. We seek to change the way audits are documented to an electronic audit record. Reducing the generation of documentation in physical form (paper) to 100%. In addition, we estimate that we can obtain savings in manufacturing and quality operating costs between 60 to 80 thousand dollars.

The documentation process flow diagram (Figure 1) shows us how to generate the documentation and implement the audits of the manufacturing area. Quality staff generate the form or use the logbook for documentation. Document the findings, if you find some kind of observation, you create an action plan to correct it. This action plan is approved by the Area Manager or designated, who is committed to monitoring that it is completed. Once the action is complete, the observation is complete and closed. This document is reviewed by another PQA (Plant Quality Assurance Staff) partner and at the end of the year the observations data is evaluated, looking for some pattern.

Research Objectives

The objectives of this project are to implement electronic registration for audits of the manufacturing process. With the implementation of these audits, we would be reducing in those of 100% of the documentation generated physically in the Organization of Quality for manufacturing area. This in support of manufacturing area goal of being a manufacturing plant with all documentation electronically, free from the use of papers

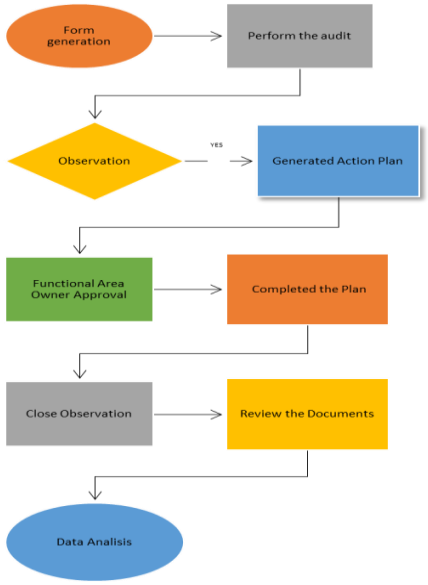

Figure 1
Documentation Process Flow Diagram

Research Contributions

At the end of this improvement project, we would be carrying out the documentation of the manufacturing audits by the Quality staff in manufacturing area, electronically. In compliance with the requirements of the procedures and in support of the goal of reducing the documentation of the plant. To achieve the realization of the project we would be the first Quality department to document the authorism of manufacturing processes electronically.

LITERATURE REVIEW

To achieve the goal of this project of changing the way we document audits of manufacturing processes from a manual to electronics, we must keep in mind compliance with the regulations and commitments made between the company with drug regulatory organizations and manufacturing practices in each market in which it has business. The main regulatory body for manufacturing practices is the U.S. Federal Government Agency, the Food and Drug Administration (FDA), whose

mission is to protect public health by ensuring that food, cosmetics, and nutritional supplements are safe for use and that the information on the label is true. Regulates electronic records, their retention, and Change History. These requirements are contained in Part 11 of Title 21 of the Code of Federal Regulations; Electronic records; Electronic signatures (21 CFR Part 11) [2] Administration, August 2003. Under these requirements we must use a documentation system that follows Part 11 of CFR 21. To comply with it the system to be used in the project needs to have the following compliance requirements that include the use of a Validated Documentation System. The second requirement is the Audit Trail documentation system able to maintain an auditable record for any changes to have electronic documentation. The system must have the ability to save any change or modification record that the document has in its history, as well as can know who the staff is making the change. It is the equivalent by GDP (Good Documentation Practices) to sign the execution of a task with its signature or initials at the time of performing the task or correcting any entry. The third section is Legacy Systems, which the system meets some specifications: that the system entered operations after the effective date, that the system met all the requirements established before the effective date and that it currently continues to meet them. As a last time, the system has documented and justified evidence that the system is suitable for use as validated.

When electronic documentation systems meet all regulatory requirements, we have a reliable system for great advantages, including permanent and reliable records, real-time documentation, decreased documentation time, deletion of physical or printed documents, a system with fewer documentation and interpretation errors, as well as an easily auditable system.

When we evaluated the advantages of electronically documenting versus manual documentation [3] Wroten, Zapf, & Hudgins, 2020, hey conducted a case study which they obtained by comparing manual vs electronic documentation in medical records. The study finds that electronic documenting improves the score by 61% and has a saving of 10 min in the execution of the task when performed manually. The study concludes that documenting electronically is more accurate and complete than manually in health systems.

Another advantage present in electronic documentation is saving time spent performing the task. [4] (Chand & Sarin, 2014) explains that as an advantage of the process of documenting electronic health records, there is an advantage because of saving time when documenting electronically. By documenting in this way, you get the benefit of saving time and in health systems, this time saving translates into better patient care. The article warns us that the challenge of electronic documentation is its implementation considering that any change in the health work system impacts suppliers and patients; but the ultimate benefit deserves it.

This project explains the process of implementing the electronic registration of quality staff Oversight to manufacturing areas, what are the challenges, requirements, changes implemented, improvements and advantages of electronic documentation.

PROJECT METHODOLOGY

The methodology for the project is one step by step, divided into three main stages: planning, implementation, and analysis. The project seeks to make the implementation of this new process have the least impact on the manufacturing operation and a benefit in equal parts for departments. That is why we made the decision that the project will be implemented at the outset in a single area of manufacturing, with the purpose of analyzing the mode of execution, difficulties of the new process and lessons learned before starting implementation in the rest of the manufacturing areas.

The manufacturing area in manufacturing area, Ease of formulation and aseptic filling, is divided into 7 main areas, out of a total of 150 rooms. Each of this area has an owner of the process which is pending and is responsible for the activities that take

place in these rooms and for whatever happens in the process rooms, including observations from quality staff. Each area is composed of more than a quarter which support the manufacturing operation present in this place. The owner of the area is the manager of the manufacturing process but has the power to delegate responsibility to supervisors and/or group leaders to ensure that any situation that arises in the areas is addressed quickly and if decision is necessary, it is made at the level closest to the process.

The areas of manufacturing in manufacturing area are: Vial Filling Area, Syringe Filling, Formulation, Cartridge Filling, Clean Utilities, In process Sample Laboratory, Equipment Preparation Area, Support Area.

As part of the implementation phase and we consider the audit requirements set out in the process SOP, we conduct a review of the frequency of daily audits performed by PQAs. At this point the execution of the task is well above the execution of the task. The requirement of the procedure told us that the frequency of the audit was daily per area per shift. So, the initial implementation was to perform audits at 100% of the manufacturing rooms on a workday. In our quality team we work 3 8-hour shifts and look a goal for 100% of the rooms to be audited at the end of the 3 shifts. This meant that a total of 1,050 audits are audited in a working week. Each of these audits is documented in a form of four pages that in turn is placed in the documentation logbooks. The logbook is used as a means of control, to ensure document retention. Each of these logbooks consists of 100 sheets that equal 25 forms of audits and at the end of a month on average we are generating 44 logbooks, which in their creation requires a total of 4,400 sheets of paper, which equate to 1,100 audits in a month. The project seeks to eliminate by 100% the generation of the documentation physically and as a result the elimination by 100% of the retention process of these documents.

The planning phase begins with the evaluation of the audit schedule. Recognizing that the process of learning and implementing electronic documentation could take some time, considering that we would be the quality department to perform this task for the first time on the site; the first planning challenge is to evaluate the current process, seeking to gain more time in the overall process, to dedicate to this new task. As a first step we need to align the SOP requirement with the task execution. In other words, we were auditing more times than necessary.

We create a multidisciplinary group to support the project with members of the Training, Manufacturing, Quality, Compliance and Systems department; We will establish the necessary requirements to carry out the audit. We set up meetings at this stage, to follow up on the actions of each department. The project schedule plan on Table 1 presents to us that the project target on July 1, 2020 as the start date of the audits documented electronically. We reach the agreement that after initial implementation every two weeks we will be adding additional areas to the audit process. The Project Schedule Plan presents us with the following work schedule:

Table 1
Project Schedule Plan

Task	Start Date	End Date	Duration
Planing	5/1/2020	7/1/2020	61
Training time	6/1/2020	7/1/2020	30
Inicial implementation Vials Area	7/1/2020	8/1/2020	31
Syringe Area	8/1/2020	8/16/2020	15
Room 1420	8/16/2020	9/1/2020	16
Formulation Area	9/1/2020	9/15/2020	14
Labotaroty Area	9/15/2020	10/1/2020	16
Compont Prep Area	10/1/2020	10/16/2020	15
Support Area	10/16/2020	11/1/2020	16
Clean Utility Area	11/1/2020	11/15/2020	14
Final Evaluation	11/15/2020	11/30/2020	15

As part of the implementation, we land what would be the documentation system to be used and the requirements of it. We determine that we would be using the documentation system already implemented on the site for access to controlled documents, in it is created a template of the form of documentation of the oversight in electronic format. Given the system to be used we focus on the requirements necessary to use the electronic form. The requirements were associated with the tasks to be executed according to the role within the documentation system. The requirements of

electronic documentation require that any execution or documentation be reviewed or approved by a second operator. Taking advantage of this same requirement we determine that the person reviewing or approving this documentation would be the owner of the area. In audit SOP it asks us to have the audit communicated and explained to the owner of the area, in this way we comply with the two requirements of the system and the SOP. When the PQA completes the electronic audit documentation, it sends the electronic form to the area owner for final review and approval.

After the planning phase is complete, move to the deployment phase. In this we seek as a goal to comply with the work schedule where we set the start date of the task for July 1, 2020 in the road area. As a learning time for the parties, we are giving a month in this area to adapt to the change process, after this date each work area will begin its implementation given two weeks, until completing 100% of the audits electronically by the end of the year.

The most important thing for this stage of the project is the commitment of area owners and managers to commit to meeting the system requirements to execute the task in the set time.

At this stage we will be supporting the multidisciplinary team for any support in carrying out the task considering the new task to be carried out. In the Analysis or Evaluation phase we will analyze whether the deployment was completed according to the work schedule. What were the biggest challenges and how we can improve the process? As a goal we seek to have an improvement at all stages.

RESULTS AND DISCUSSION

In the implementation phase we evaluated the requirement of compliance with the practices of the moment and when we aligned the two requirements, we had a saving of 30% of the execution time. This time savings equivalent to 45 hrs. work of quality staff. Which translates to about $20,000 a year. Thanks to this time savings we were able to successfully implement in the different areas of manufacturing the electronic audits of the oversight by the end of October 2020 (Figure 2), ensuring that the learning process is one more agile considering that they have fewer rooms to audit in a work shift. The case study submitted [4] (Chand & Sarin, 2014), confirms the project's findings. That when you convert a manual documentation operation to electronics**,** we can be more agile**,** and we have a gain in time reduction.

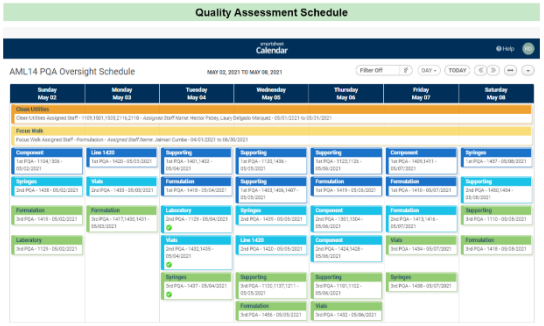

Figure 2
Oversight Schedule

By performing the electronic documentation task, we reduce the printed documentation for this task by 100%. We removed over 44 logbooks per month and the entire creation process. The Annual cost savings about 7,920 hrs. of work on this task a year that would equal $158,400 a year, see Table 2.

Table 2
Annual cost savings

Implementation results for logbook generated		
Annually	**Before the Project**	**After the Project**
Logbooks generated	528 units	0 units
Work hours	7,920 hrs	0 hrs
Annual cost	$158,400	$0.00
Document system	$0.00	$0.00
Savings	$0.00	$158,400

When we started this project, we had the goal of transferring manual documentation of PQA audits to manufacturing areas to an electronic form and the purpose of supporting the site's goal of eliminating the use of papers to document daily tasks. But we found advantages additions in the process. First, we update the frequency of audits to the requirements of the SOP, being an improvement to the processes because it frees us time for other tasks. The direct benefit of not printing logbooks that we impose on

$150,00.00 in savings for not performing the task. The case study submitted [3] Wroten, Zapf, & Hudgins, 2020, confirms the project's findings. That when you convert a manual documentation operation to electronics, we can be more agile, and we have a gain in time reduction.

One challenge we encountered in this project was how to audit the electronic records that are generated. To ensure this we create a page in database to keep a list of the records that are generated, the status of this, whether it is approved or pending approval. Using this list of records, we saw the ability to carry out a process of reconciliation of audits and ensure that we follow the requirements of the process.

Another advantage to using this list system is that the page allows us to tabulate the data and present real-time graphs of the number of audits performed and the number of observations generated by area and category. The audit SOP asks us to classify the audit process among Housekeeping, Facilities, Personal, Behavior or Training if we have an observation in the audit process. With these classifications we can determine trends in manufacturing areas, and we can determine an action plan to correct them.

CONCLUSIONS

Plant Quality Assurance staff's internal audit program to manufacturing areas aims to always keep areas ready, from manufacturing processes to regulatory agency audits. The goal of the plant is to be always ready for an audit process. Key to this process is the oversight audits by the PQA team. At the end of this project, we can say that he is contributing with this goal in real time.

When this project began its objective was to eliminate printed documentation, electronically documenting audits to manufacturing areas. In the evaluation process we realize that we need to implement a mechanism for reconciling the audit process, considering that electronic documentation is more complicated to audit. When reconciliation control was established, we were presented with the opportunity to create a database with the oversights carried out. In this reconciliation list, PQA staff document the audit with their established frequency and to obtain some observation of the manufacturing process documents the observation generated. At the time of documenting the observation it also classifies it by area, the type of observation, the area to which it belongs and whether the observation was corrected. With all this information we can classify and quantify the number of audits performed and the number of observations, so that we can create a visible audit process in real time, see Figure 3.

Figure 3
AML-14 Quality Routing Assessment Findings per Area

Following the guides and procedures, in the past we had to generate an annual observation report. To accomplish this task, we had to wait until the end of the year to collect all the information from the audits in more than 500 process logbooks. This task could take us about 80 hrs. of work, with the purpose of generating a report, which told us what last year's audit process was like, without any practical value to a year of observations, other than knowing the number of observations for its classification and area but did not allow decision-making or improvements. Table 3 presents us with a comparison of the time we spend on the task and the time waiting to analyze the data before and after the project deployment.

Table 3
Observation Data Analysis Process

Observation data analysis reconciliation process.		
	Before the project	**After the project**
Observation Analysis	End of Year	At the same date was generated
Time to task	Over 80hrs	At the same process documentation time One hr. per audit.

Using the task reconciliation process, we ended up creating a database with all the observations of the building and thus creating a system for

evaluating audits and manufacturing areas in real time. The PQA documents the task, and the information is updated now.

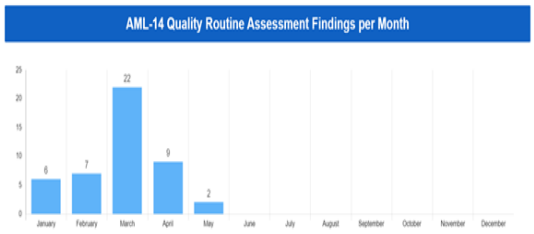

Figure 4
AML-14 Quality Routing Finding per Month

Figure 4 presents the data collected from the observations made to the manufacturing areas per month. And Figure 5 presents the comparison between observations by area and by month. This gives us an idea of what were the biggest months of observations and which area were the most impacted. In this way we can evaluate the behavior of manufacturing processes on the moment, act, see trends, analyze, and compare different aspects that can increase the findings.

We can conclude that at the end of this project we eliminate by 100% manual documentation in forms by electronics but creating a system of monitoring observations in real time.

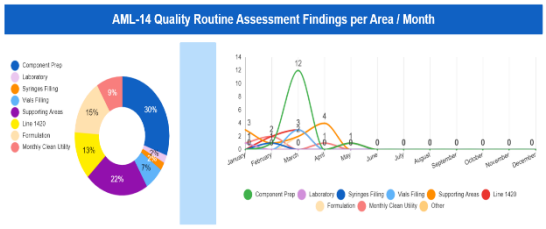

Figure 5
AML-14 Quality Routing Flinging per Area / Month

If we analyze the data obtained so far using a Pareto chart in figure 6, we can see that the main observation is related to equipment & materials with 90% and secondly the facilities with 50%. This allows us to focus improvement efforts on manufacturing areas at these main points we can improve processes by 85%.

The rest of the topics on which we regroup the other observations so far have not reported any observations, as would the sampling and testing process. This can give us two different points of view, which we are in control in that area of the process or that we are not correctly auditing this area.

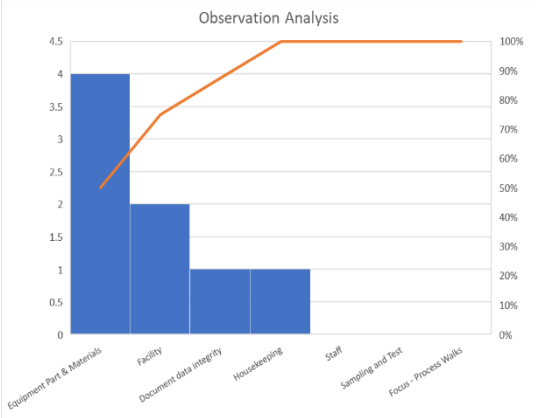

Figure 6
Observation Analysis

This project was presented to the quality management of the plant and it was welcomed with great craving. The next step of the project is to carry out the same implementation in the other buildings of the plant with its reconciliation platform where they can document observations at the level of the other buildings. As future actions we see the possibility to create a page that reconciles all observations of the other buildings on a single page, in complain with FDA requirements [2] Administration, August 2003. This will give us a clear view of the observations from a floor view and not only by building, which is fed with the documentation of the audits at the time of execution and entry into the system.

FUTURE WORK

The next step of the project is to carry out the same implementation in the other buildings of the plant with its reconciliation platform where they can document observations at the level of the other buildings. As future actions we see the possibility to create a page that reconciles all observations of the other buildings on a single page. This will give us a clear view at the organization level of the observations from a floor view and not only by building, which is fed with the documentation of the

audits at the time of execution and entry into the system.

This will allow us as an organization to be able to make decisions and create action plans immediately, supporting functional areas with situations that are happening and are not taken care of on time or do not have the visibility wanted. It also allows us to establish a culture of preventing and anticipating future latent events or events before they scale to some larger or out-of-control situations.

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