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5'S Implementation in Small Scale Plastic Water Tank Industry-Case Study

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Abstract*—Purpose and the aim of this thesis is to provide a very simple tool to small scale industries that will help them ease of work and provide a culture which will increase productivity and profitability. Small and medium scale industries are mainly suffered from marketing and competition from large industries. Hence a very effective tool requires whose implementation is less expensive and step by step implementation is possible in between the running of industry. With the help of literature review and brain storming with experts a Japanese tool "5S" is find out most suitable and appropriate for small scale industry situated in Madhya Pradesh especially in Jabalpur.*

Design of the groundwork of the "5S" is a set of five steps that include "Seiri, Seiton, Seiso, Seiketsu and Shitsuke. These five Japanese words meaning are Sort, Set in order, Shine, Standardized and Sustain as the names implies and the sequence is implementing done to get the desired results. These "5S" was implementing in Utkarsh Ploytank industry situated in Maneri district Mandla. An audit sheet was prepared to analyses the implementation results and 10 weeks audit was conducted. The 5S audit results were shown in graph and results were summarize

Practical implications of the research work was providing a good culture and procedure to the organization by which limited resources of small scale industry can be fully utilized and enhance productivity, profitability and competition from market. The implementation of "5S" also reduces the chance of accidents and safety of all employees also improves.

Keywords:— *Small Scale industry; 5S industrial tool and 5S Audit Sheets.*

1. INRODUCTION

Among the various issues one of the most important issues of conventional manufacturing industrial units in Jabalpur is to try to have workers work in a better working environment in order to make them feel comfortable, efficient and more energetic to do their jobs. By doing so, the company can compete with first changing market; customer demands and at the same time maximizes the profits.

In Jabalpur, there are a large number of employees in small & medium scale industries with employees working in less ergonomic, uncomfortable, dirty, disordered environments which are usually full of unused materials. Because of these circumstances, it is hard to find the correct tools and even medical fast added box which are needed. Trouble are met when the industry is doing the project which has a scheduled due date. Utakarsh Polytank manufacturing industries are the same as many other small & medium

scale firms who are rigorously want for a solution to solve the problems which are caused by the disordered environment in order to enhance the productivity, efficiency, economy and to acquire more projects.

As all of the some facts above, there were many employees unwilling to work long term as was the relationship with the employees working in Utkarsh Poly Tank manufacturing factory. To change this awful condition, it was decided to implement a 5S system within the factory. What is 5S? 5S may be the first step for the company to embrace Lean; this study will focus on 5S. 5S stands for five different characters which are sort, set in order, shine, standardize, and sustain.

The 5S system is a tool, or system that supports a philosophy of operating in an organized fashion. The philosophy that this system supports is one of discipline, efficiency, and attention to detail (Graban, 2009). The idea behind 5S is that if a workplace is clean and well laid out, the identification of waste is much easier (Sarkar, 2005). Most of the manufacturing companies in Taiwan do not run 5S, or they do not even know what 5S is. 5S is a way to help the company to reduce the waste and enhance possible profits.

2. THE OVERVIEW OF 5S

Takashi Osada in 1991 coined the original concept of 5-s in the early 1980s. 5-s is the acronym for five Japanese words Seiri (organization), Seiton (neatness), Seiso (cleanliness), Seiketsu (standardization) and Shitsuke (discipline) respectively. 5-s has been introduced in Japan mainly in the manufacturing and service industries. Toyota, the major car manufacturer is one of the pioneering firms who adopted the 5-s principles. Japanese believe that 5-s Principles are not only valuable at their workplaces but also improves their cognitive sense. Osada refers to the 5-s as the five pillars to establish and maintain total quality environment in an organization [16].

5S is a method to systematize, arranges, clean, standardize and continuously improve a work area. 5S is not just about housekeeping, it is one of the effective working tools for increasing productivity, safety and reduce wastage along with maintain healthy working environment. As the name implies 5S means involves five activities beginning with the letter S, which were came from five Japanese words. The words are Seiri, Seiton, Seiso, Seiketsu and Shitsuke, which when translated mean Sort, Set in Order, Shining, Standardize and Sustain, respectively. Sort helps to remove all unneeded items: only what is needed stays. Set establishes locations and quantities needed for efficient operation. Shine represent cleaning through inspection. Standardize implements visual displays and controls. Sustain helps to keep the organization effort in place through training and total employee involvement. The aim of this thesis is to implement 5S methodology in Plastic tank manufacturing industries and measure the performance improvement.

Gupta and Jain, 2014 demonstrated the application of 5s and Kaizen in a small scale manufacturing organization. Implementation of 5s and Kaizen results in increased efficiency and effectiveness in the processes, improved visibility of the process, improved morale and safety of the employees, reduced delays, searching time and dangerous conditions. In order to make successful 5S and kaizen system most important factors are participation, commitment and support from top level management [6].

3. FRAMEWORK

Literature work of the study done by a frame prepared by the help of guide and experts from the field of similar research work. The knowledge received by guide and experts are shown in the following block diagram given below:

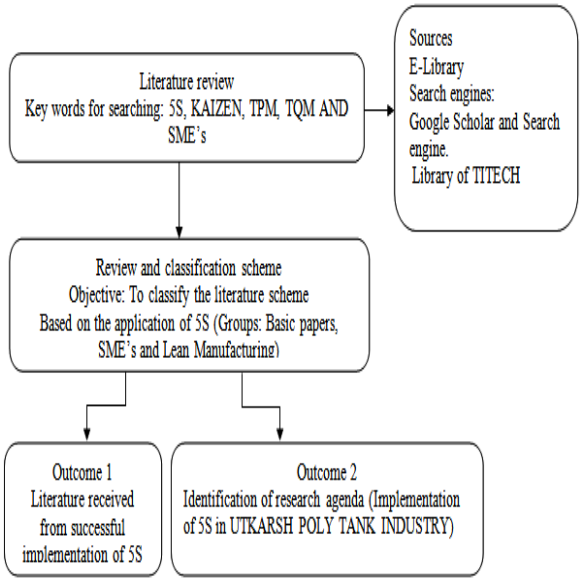

Figure 1: Literature review framework

4. PROBLEM STATEMENT

The small scale industries play an important role in India by creating new jobs and increase economy of India. It has become as powerful sector in providing relatively larger employment next to agriculture. Globalization rapidly increases the markets competition due to continuously changing customer demand and require high quality product at low cost. In India, the MSME's are mainly suffer in capturing market because large industries are capable of investing more money for marketing at the same time their product cost are lesser than SME's. Therefore the survival and the growth of small scale industry largely depend on its ability to innovate, improve operational efficiency, increase productivity and government support. 5S is one of the tools which help the SME's on the cost reduction, increase productivity and by eliminating wastes. Research at Lean Enterprise Research Centre (LERC) U.K. indicates that for a typical manufacturing company the ratio for activity could be broken down as value added activity -5%, non value added activity (waste)-60% and necessary non value added activity-35%. This implies that upto 60% of the activity at a typical manufacturing company could potentially be eliminated.

The aim of this research work was to assist Utkarsh Polytank manufacturing company to develop the process flow uninterrupted, systematic healthy working environment along with reduce cost of product with the use of 5S methods in order to reduce possible wastes and enhance the efficiency of operations so that Utkarsh Polytank can reduce costs. Since Utkarsh Polytank manufacturing company has never done anything with 5S, and no one in the company knows what 5S and how it can help the company to improve the working environment, this study has provide the confirmation that 5 S is a great industrial tool for this organization and result getting from this study also used for other SME's of manufacturing sector.

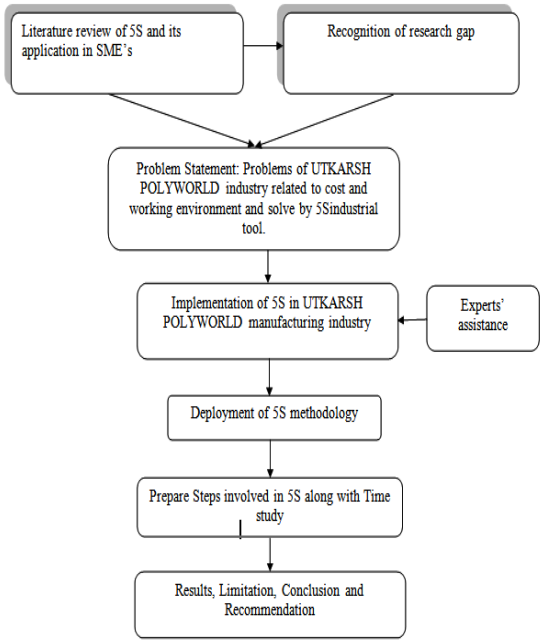

Figure 2: Research Flow Chart

6. 5S CASE STUDY

Observation of 1S "SORT" implementation:

Before implementation of 5S tool status of industry was very poor coordinated and disturbs condition. Stocks were not allotted appropriate place and were lying here and there on the floor. Tools and equipments are not place in right place and are very dirty. Space near the machine and in raw material

area was very dirty. Items are placed in very dangerous way to invite accidents and cleanliness and safety are not in mind to every employee. In the store the scenario was not different from the previous mentioned. We observed that the conditions were very poor and workers were encountering a lot of problems.

Figure 3: Before Useful and Useless Items are Mixed

Figure 4: After Useful and relevant items are Separated

Cost Analysis of Scrap red tagged

1) Cost of damage water tank covers = Rs 35/ Kg

- Quantity of damage water tank covers red tagged= 26 Kg
- Total amount recovered after sale of damage water tank covers= 35*26= Rs 910/- rupees

Table 1 : Implementation of SORT Comparison before & after Cost Analysis of Scrap Red Tagged

S.NO	ITEMS	BEFORE IS "SORT"	AFTER IS "SORT"
1.	Materials (raw materials, grease, oil and water tanks etc)	Placed very unsystematic manner needed and unneeded are mix, causes wastage of raw materials, damage of water tanks, injuries, accidents and irritability.	Raw materials and finished product water tank are segregated; scrap and used oils & grease are sale or dispose properly.
2.	Tools & Equipments	Weighing machine, wrenches, measuring buckcts, hopper arc not in place and placed away from requirements.	all the tools & equipments are arranged according to priority wise and placed near the requirement area.
3.	Connection apparatus	Mould, electric board and cooling fans are not place near the Roto mould machine and causes time delay at the time of production. Long electric extension wire lying on the ground might be causes accidents.	Same size moulds are arrange combined and cooling fan placed in front of machine and electric extensions wire are covered and placed along wall side.
4.	Visual control	Needed and unneeded are mixed and working area is very congested hence causes very poor monitoring and lead to danger situation and workers are not monitor properly.	Needed and unneeded are placed properly and working areas become open, therefore visual control become easy.

2) Cost of empty Plastic bags of raw materials and binders= Rs 12/Kg.

- Quantity of empty Plastic bags of raw materials and binders red tagged= 92 Kg.
- Amount recovered after sale of empty Plastic bags of raw materials and binders = 12*92= Rs 1104/- rupees

Observation of 2S "SET IN ORDER" implementation:

After implementing 2nd S, tools and equipments were arranged and placed properly according to their priority. This will reduce the damage and additional costs of tools and equipments, hence save money from new purchasing.

Table 2: Tool Searching Time comparison before & after "Set in order

S. No.	Tool Searching Time	Minutes/Day
1	Before "2S"	45
2	After "2S"	10

Cost analysis:

- Worker pay per month = Rs 8000/-
- Average working hour per day=8
- Average labor rate per minute=8000/ (30*8*60*) = Rs 0.55/-
- Saved minute per day = (45-10) = 35 min
- Total Money saved per day =35*0.55= Rs19.44/-
- Per month saving=19.44*30= Rs 583.3/-

Observation of 3S "SHINE" implementation:

Properly clean the machines such as the moulds, panels, especially for the raw materials area because dust, loose threads etc may be mix with LLDP and other ingredients and causes production defects. In shine step in 5S, cleaning of the machines is not enough, personnel also need to clean all tools and sweep the floor in order to have a better and cleaner working place.

Utkarsh Polytank Company uses a raw material which is in power form and if it

Table 3: Implementation of 'Set in Order' Comparison Before & After

S.No.	Items	Before 2S "Sent In Order"	After 2S "Set In Order"
1.	Inventory Levels	Inventory level in raw material, finished product and scrap area not indicate Inventory properly due to which per day updating of all not possible due to which number of shortage and delivery issues arises.	Inventory level for raw materials finished product and scrap area are indicate properly by which everyone in industry aware about the stock due to which inventory ordering become timely and easy. Wastage stuck is also known on daily basis by which defects will reduce.
2.	Tools & Equipment's Marking	Tool box and equipments are not mark properly due to which daily basis labours and new employee are not doing work quickly because time wasted in identification.	All the tools & equipments are marked properly and will help to reduce the lead and ideal time.
3.	All Area Name Plated	Maximum area and the departments are not name plated due to which moving and carrying of items take time and time study also not done for it.	All the area and departments are name plated properly which is very useful for reducing unnecessary delay in items and also become good for inspection and customer visits.
4.	Area Dividing Marking	Areas for each section are not divided properly & mark and some areas are merged which create confusion at the time of requirement and working area become congested.	Area properly divided and mark which will free large area and moving path become accidents and injuries free.

spread on the ground makes it slippery and causes accidents. Whenever the raw material bags are put on the ground makes it slippery due to power on the bags lying on the ground and hence worker need to done cleaning at the same time. To do the shine step in the industry the 5S head lets all employees know they are in danger if they do not clean the floor because it is easy to slip and fall down.

Observation of 4th S "Standardized" and 5th S "Sustain" Implementation

As the name implies standardized meaning that every worker have to follow and maintain above "3S" and make it a habit to perform above steps regularly at their own levels. A weekly check was done in order to keep an eye on workers. The weekly check was done for 12 weeks as an audit pattern and rated in terms of scores from 0 to 4. After this results received from audit was share with all the employees and it was found that workers and employer were motivated with great satisfaction and self-confidence.

Outputs from development of 5S

Working environment drastically improves because of proper arrangement of the inventory and this will increase the productivity because no irritability causes in finding the inventory.

- Inventories handling cost reduce and protected from the damage.
- Floor areas between the stations were clean and spacious due to which moving time of items reduces and prevent from any kind of accidents.
- Monitoring and inspection were become very easy and on the daily basis stock level and production level known to the managers.
- A culture and habit of cleanliness and discipline was developed among the all employees.
- Retention of the worker also improves.
- Any decision making related to new bit and financial level become easy to employer.
- Self-esteem and satisfaction of employer and workers was increased and they are working together to achieve company goal.

7. 5S AUDIT OF UTKARSH POLYTANK

5S activities are very effective and fruitful tool for continuous growth but regular and sustainable implementation it's important to the industry owner has been conducted audit at regular interval. 5S activities applied in whole industry on department level and audited company have been reviewed for 10 weeks and the audit sheets have been filled as a result of the weekly basis. Scores of each week are added and the weekly total assessment scores are represented on the weekly scores on the graphics. All the weeks audit score was shown in Table 4 and for example point of view week 8 score is shown in table 5. In this research work questions are prepared for each 5S's and the data on these forms have been used to analyze the implementation success of 5S within the industry. The audit checklist is having four categories for assessment scores on weekly basis as 0 = Very bad, 1 = Bad, 2 = Average, 3 = Good and 4 = Very good have been determined.

5S Audit Results

I. Sort Audit Result

In Figure 5 it has been observed that from week 1 and 2 sort score is zero because workers are not completely done sorting work hence score was zero. From week 3 to 6 sort scores increases continuously because sorting work done properly but in week 7 it was decline by 1 point because of items are not put in place after used. After week 7 workers are properly understand the benefits of sort and follow it heartedly hence from week 8 to 10 this become consistent.

Table 4: 5S Audit Check Sheet (Week 8)

5S Audit Check form for Utkarsh Poly Tank Industry Maneri, Mandla (M.P.)									
0=Very bad; 1= Bad; 2= Average; 3= Good; 4= Very good									
S. No.	**5 S**	**ITEMS**	**GENERAL ASSESSMENT CRITERIA**	**SCORE**					
				0	**1**	**2**	**3**	**4**
1	**SEIRI (SORT)**	Materials (raw materials, grease, oil and water tanks etc)	Raw materials, water tank, scrap and used oils & grease is segregated or not.				1	
2		Tools & Equipments	All the tools & equipments are arranged according to priority wise and placed near the requirement area.				1	
3		Connection apparatus	Same size moulds are arrange combined and cooling fan placed in front of machine and electric extensions wire are covered and placed along wall side.			1		
4		Visual control	Needed and unneeded are placed properly therefore visual control become easy.			1		
1	**SET IN ORDER (SEITON)**	Inventory Levels	Inventory level for raw materials finished product and scrap area are indicate properly.				1	
2		Tools & Equipments Marking	All the tools & equipments are marked properly and will help to reduce the lead and ideal time.			1		
3		All Area Name Plated	All the area and departments are name plated properly.			1		
4		Area Dividing Marking	Area properly divided and marked.		1			
1	**SEISO (SHINE)**	Machines	Machine clean from inner & outer side before & after use				1	
2		Floors	Floor should be free from loose raw materials and threads				1	
3		Cleaning and control	Inspected all the area and take corrective actions			1		
4		Cleaning responsibility	All persons in the organization have cleaning responsibility					
5		Cleaning habit	Cleaning should become the daily routine work		1			
1	**SEIKETSU (STANDARIZED)**	Working environment (ventilation/lighting)	Working area should be neat & clean, Air is fresh & odorless				1	
2		Tools & Equipments	All tools & equipments are arrange according to priority basis				1	
3		Working clothes	Safety gloves and shoes are used or not			1		
4		Daily Basis Information	Daily basis inventory level information update or not		1			
1	**SHITSUKE (SUSTAIN)**	Revision & Training	Weekly revision of 5S practice & training programs				1	
2		Safety Wearing	Safety become habit like wearing of helmets/gloves/shoes			1		
3		Coordination between people	5S become a culture & teamwork			1		
4		Rules and guidelines	Up to date & regularly reviewed					1
5		Regular Practice	Check for 5s implementation follow		1			

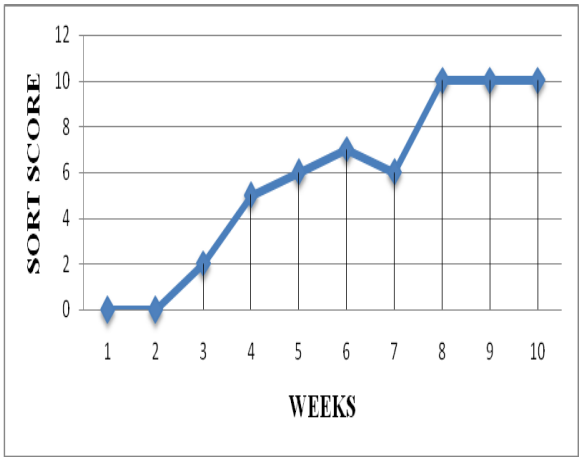

Figure 5: Sort Score Graph

II. Set In Order Audit Result

In Figure 6 it has been seen that in week 1 & 2 set in order score was zero because in these weeks sort work was not done completely. In weeks 3, 4 and 5 no major improvement shown because of no major improvement in sort. After week 5 set in order score continuously improve up to 8th weeks because of sorting and inventory level marked and inventory area properly divided and the maximum score was achieve in 10th week.

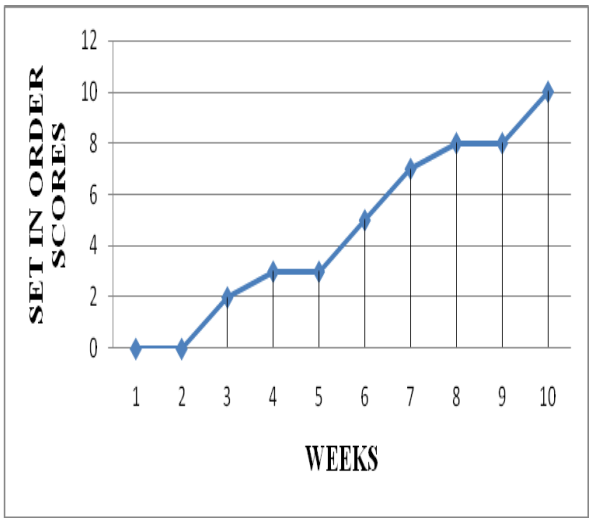

Figure 6: Set in Order Score Graph I

III. Shine Audit Result

From figure 7 it is clearly seen that the shine score continuously increases from week 1 to week 5.In 6th week shine score was reduce by one point because workers were not aware about their cleaning responsibilities. After that shine score continuously improve because of health involvement of workers in cleaning objectives.

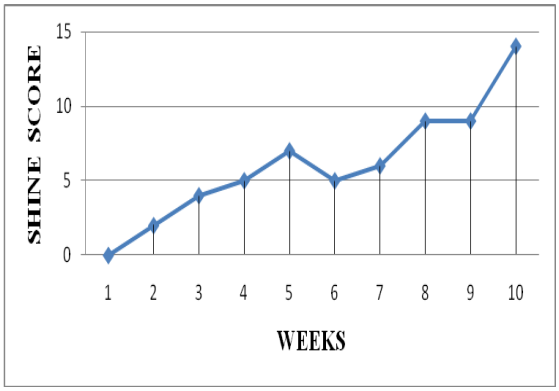

Figure 7: Shine Score Graph

IV. Standardized Audit Result

There is two main reason for maintaining standardized in industry, first one was that the above three "S" should be implemented properly and second one was the problem of human psychology that is unwillingness to change. Hence there is so much variations shown in the standardization graph. But after the 8th week of the results were very favorable towards the implementation of "5S" because above written two problems were solved by time & continuous effort itself.

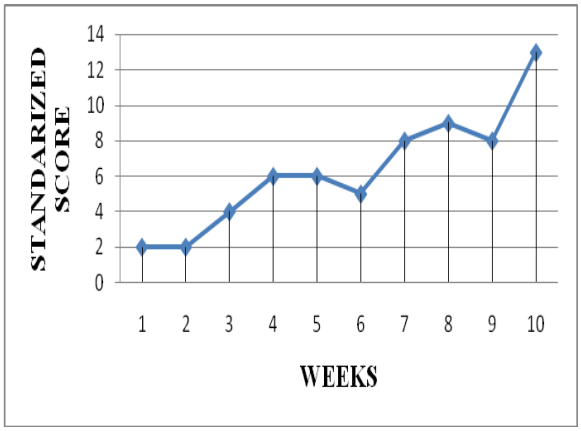

Figure 8: Standardized Score Graph

V. Sustain Audit Result

This last "S" is very important and typical to implement because to fulfill the requirement of "sustain "its utmost important to successfully implement above "4S". To

successfully implement sustain it is very important that the "5S' should become a culture of an organization and it become a routine job of all persons of the organization. By the continuous and regular effort of all persons of the organization sustain achieved its goal after 7th week and this was clearly seen in the consistency of the graph by scoring 12 point in last three weeks.

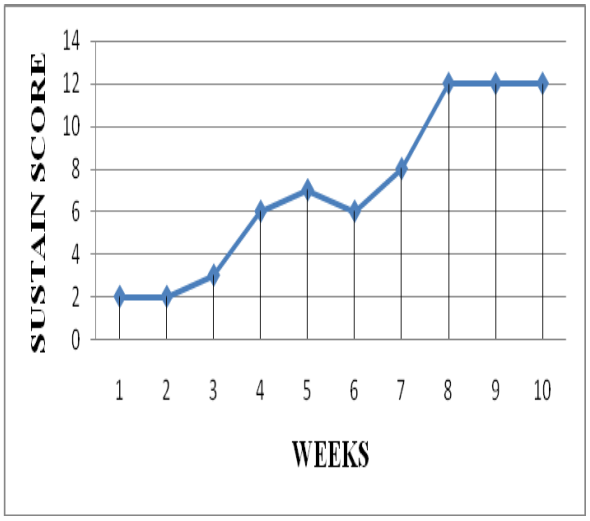

Figure 9: Sustain Score Graph

Audit was conducting for 10 weeks and all the parameters were checked and the results were shown with the help of graph. One sheet of 8th week was shown in table 1 which gives the way of audit done. Following below given the summarize audit results in table form:

8. CONCLUSION

The merits of implementing 5S in industry:

"1S" Sort:

- Regular basis useful and useless items were segregated
- All the materials and tools are placed according to priority wise near the requirement area
- Same size moulds and tanks are arrange properly
- Red tagging has been done by which visual inspection become easy

"2S" Set in Order :

- Inventory level of raw material and finished product were indicate properly
- Lead time and idle time reduce drastically
- Inspection and audit become easy by proper name platting
- Floor area properly divided and moving of items become easy and safe

Table 5: 5S Audit Weekly Score

5S Activities (Weeks)	Seiri (Soft)	Set in Order (Seiton)	Seiso (Shine)	Seiketsu (Standard)	Shitsuke (Sustan)	Total Score
1	0	0	0	2	2	4
2	0	0	2	2	2	6
3	2	2	4	4	3	15
4	5	3	5	6	6	25
5	6	3	7	6	7	29
6	7	5	5	5	6	28
7	6	7	6	8	8	35
8	10	8	9	9	12	48
9	10	8	9	8	12	47
10	10	10	14	13	12	59

"3S" Shine:

- Working environment and work satisfaction improve
- Neat and clean working area improve the working condition of worker
- Machine maintenance cost reduce and cleaning become a habit
- Industry layout become pleasant for customer visit and for inspection

"4" Standardized:

- Standard working culture develop which very helpful for new employee
- Safety level increase and records are up to date maintain
- All the worker are aware about their duties and responsibility
- Discipline and cleaning become a habit

"5" Sustain:

- Worker retention increase and team work improve
- Enhance the knowledge of 5S in all employee
- Quality improves by reduction in mistakes and defects
- Communication improve between departments
- 5S become a culture of the organization

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