



# California Based Winery Respiratory Protection Program Cost and Time Reduction Study



Carmen del Pilar Márquez-Miranda

Advisor: Héctor J. Cruzado, PhD

Engineering Management Program | Graduate School | Polytechnic University of Puerto Rico

## Abstract

Cost of compliance can be a hidden cost for a firm. This study evaluated a California based winery time and cost of Respiratory Protection Program compliance activities. Time and cost savings were found by digitalization of in-person, paper-based medical clearance evaluations. Digitalization reduced compliance costs by 23% and improved time to compliance by 97% by eliminating transportation and overprocessing lean waste.

## Introduction

The firm studied is a winemaking company operating exclusively in California. Firm operations range the full winemaking lifecycle: grape harvesting, crushing, winemaking, packaging, and distribution. Considered a privately owned large volume producer, the firm distributes more than 500,000 cases of wine per year. The firm has a dedicated Environmental, Health, and Safety (EHS) department to ensure compliance against worker safety requirements.

As a California based employer, the firm requires compliance with California's Occupational Safety & Health Administration State Plan (CalOSHA) [1]. The use of Respiratory Protective Equipment (rPPE) is regulated by a Respiratory Protection Standard [2]. The firm requires use of rPPE to perform tasks required to manufacture the product which triggers the applicability of the Respiratory Protection Standard (The Standard).

The Standard requires employers to have an effective written program that describes how the employer complies with respiratory protection equipment selection, employee medical clearance, training, and respirator fit testing all which have defined requirements [2].

The firm has engaged in a corporate strategy to reduce costs for Fiscal Year 2023 (July 2022-June 2023). The EHS department, considered an expense center for the firm must manage Cost of Compliance. Cost of compliance refers to the necessary costs associated to maintain compliance against legal requirements. EHS identified the Respiratory Protection Program (rPPE) as a target opportunity to reduce annual expense budget and reduce process lean waste [3].

## Background

In 1998 the Occupational Safety and Health Administration standardized Respiratory Protection Standards for all industries [4]. The standard incorporated a medical clearance questionnaire requirement prior to issuing and testing the respirator fit. Fit testing without a medical clearance may result in a violation [5].

Production wastes as described by Taiichi Ohno are steps and processes that do not add value to the customer [3]. There are 8 observed process wastes: Defects, Overproduction, Waiting, Unused Talent, Transportation, Inventory, Motion, and Overprocessing [6]. These wastes consume time and cost without adding value to a process outcome.

## Problem

This study evaluated time and cost requirements for executing the Respiratory Protection Program compliance to The Standard with the objective to reduce the EHS department's annual budget and reduce lean waste such as overprocessing, travel, and waiting associated with the program.

## Methodology

First Person Interviews were conducted to identify the steps to execute rPPE process. EHS, Human Resources (HR), and Production (PW) departments were interviewed using a standardized interview format. Time data for steps was collected from historical activities. Cost data was sourced from historical invoices, vendor price list included in contracts, and purchase orders. Volume data was collected through the Learning Management System (LMS) that assigns training to all participating employees. Human resource records were used to identify how many new employees are hired annually into the program. Human resources provided a weighted average wage of \$39.40/hr for the mix of respiratory users.

## Baseline Process Analysis

Cost was calculated for each activity per unit cost (1), and the total cost (2) accrued by the Firm for the activity.

$$\text{Unit Cost (UC)} = \$39.40/\text{hr} (\text{Unit Time}) (1)$$

$$\text{Total Cost} = \text{UC}(\text{Quantity}) (2)$$

Baseline Process information is displayed in Table 1.

C Activity	Dept.	Count	Unit Cost (\$)	Direct Cost (\$)	Unit Time (hr)	Total Time (hr)	PW Cost (\$)	Staff Cost (\$)
B Clearance Completion	PW	50	-	-	2.00	100.00	3940.00	-
C 3rd Party Clearance Evaluation	Clinic 1	25	100.00	2,500.00	2.00	50.00	-	-
C 3rd Party Clearance Evaluation	Clinic 2	20	131.00	2,620.00	2.00	40.00	-	-
C 3rd Party Clearance Evaluation	Clinic 3	3	90.00	270.00	2.00	6.00	-	-
C 3rd Party Clearance Evaluation	Clinic 4	2	65.00	130.00	2.00	4.00	-	-
D Document Clearance on SP	HR	50	-	0.25	12.50	-	492.50	-
E Credit Clearance on LMS	EHS	50	-	0.25	12.50	-	492.50	-
F Training	EHS	10	-	0.50	5.00	-	197.00	-
F Training	PW	50	-	0.50	25.00	985.00	-	-
G Fit Test Prep	EHS	50	-	0.50	25.00	-	985.00	-
H Fit Test	EHS	10	-	0.50	5.00	-	197.00	-
H Fit Test	PW	50	-	0.50	25.00	985.00	0.00	-
I Retrieve List of Employees	EHS	1	-	1.00	1.00	-	39.40	-
J Generate name slips	EHS	1	-	0.50	0.50	-	19.70	-
K Questionnaire Assembly	EHS	1	100.00	100.00	5.00	5.00	-	197.00
L Delivery to Supervisors	EHS	1	-	2.00	2.00	-	78.80	-
M Clearance Completion	PW	550	-	1.00	550.00	21670.00	0.00	-
N Clearance Supervisor Pickup	EHS	1	-	8.00	8.00	-	315.20	-
O Delivery to Clinic 1	EHS	13	46.00	600.00	1.00	13.00	-	512.20
P 3rd Party Recertification	Clinic 1	550	30.00	16,500.00	0.25	-	-	-
Q Document Clearance on SP	EHS	550	-	0.30	165.00	-	6501.00	-
R Credit Clearance on LMS	EHS	550	-	0.30	165.00	-	6501.00	-
S Training	EHS	50	-	0.50	25.00	-	985.00	-
S Training	PW	550	-	0.50	275.00	10835.00	-	-
T Fit Test Prep	EHS	50	-	0.50	25.00	-	985.00	-
U Fit Test	EHS	50	-	0.50	25.00	-	985.00	-
U Fit Test	PW	550	-	0.50	275.00	10835.00	-	-
<b>TOTAL</b>				<b>\$22,718</b>			<b>\$49,250</b>	<b>19,483.30</b>

The direct compliance cost driver was identified as the third-party medical clearance evaluations. The Firm spent annually \$21,520 in clearances between all service providers, as shown in Table 2.

Indirect cost resulting from time to complete activities by Production Workers and Staff were calculated and summarized in Table 3. The study estimated 600 respirator users with an estimate of 50 employees entering the program annually. The total annual time EHS and Human Resources (Staff) dedicate to rPPE compliance of all 600 respirator users were calculated at 495hrs. The firm accrued an annual expense of \$19,483 in staff activities, as shown in Table 3.

Clearance Evaluation Provider	Total Cost
Clinic 1 In Person Evaluation	\$2,500.00
Clinic 2 In Person Evaluation	\$2,620.00
Clinic 3 In Person Evaluation	\$270.00
Clinic 4 In Person Evaluation	\$130.00
Clinic 1 Questionnaire Recertification	\$16,500.00
<b>Total Medical Clearance Cost</b>	<b>\$21,520.00</b>

Functional Group	Total Cost (\$)
PW	\$49,250
Staff (1)	\$19,483

## Process Optimization

In person, clinic based, third party medical clearance evaluations were replaced with digital online questionnaire based third party evaluations. Digitalization eliminated delivery, transport, and documentation steps, and reduced questionnaire completion time and evaluation turnaround.

The online provider charged \$29 per evaluation. The total purchase order cost \$17,400 is shown in Table 4.

Service	Cost	Quantity	Total Cost
Clearance	\$29.00	600	\$17,400
Evaluation			

Time studies were conducted by EHS using a stopwatch while observing employees complete the online medical questionnaire during seasonal onboarding sessions. Completion times listed in Table 5 had an average questionnaire completion time of 15 minutes as shown in Figure 1. Indirect costs were calculated for the optimized process. Table 6 displays the firm's optimized indirect costs by function.

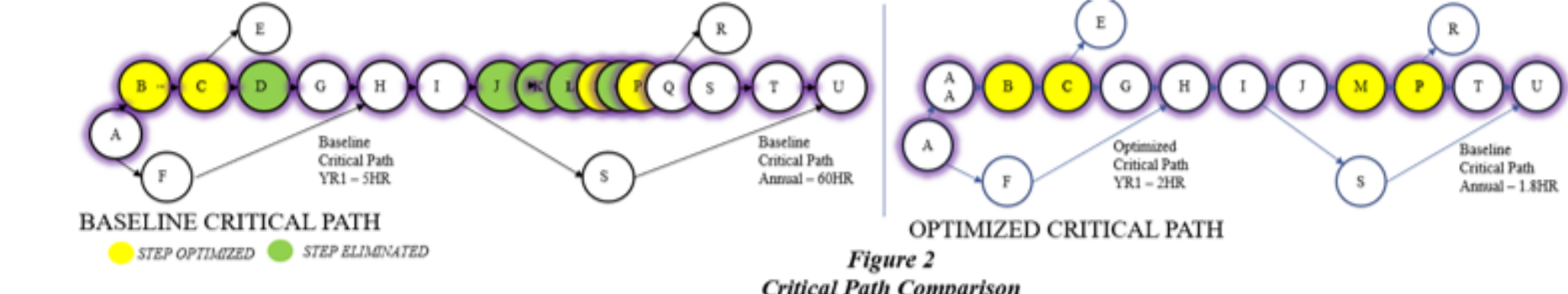
Sample	Date	Completion Time (min)
1	6/20/2022	11
2	8/2/2022	15
3	8/8/2022	20
4	8/8/2022	16
5	8/8/2022	14
6	8/8/2022	10
7	8/8/2022	19
8	8/8/2022	15
9	8/15/2022	12
10	8/15/2022	18
11	8/23/2022	17
12	8/23/2022	7
13	8/23/2022	25
14	8/23/2022	11

Functional group	Total Annual Cost (\$)
Production Worker	\$29,550
Staff	\$9,495

## Time to Compliance

Critical Path Method was applied to identify Time to Compliance dependencies as shown in Table 7. Baseline time to compliance was 5hrs for new employees and 60hrs for employees recertifying annually. Digitalization eliminated 58.2hrs of process lean waste associated with transportation and overprocessing of data resulting in an optimized time to compliance of 2.0hrs. Steps E & R, Figure 2, impact time to compliance but are Standard requirements.

CPM	Pred.	Baseline Activity Description	Baseline Time(hr)	Optimized Activity (Lean Waste Category)	Optimized Time (hr)
A	-	New Hire	-	New Hire	-
AA	-	Add User to Online Database	0.25		0.25
B	A	Clearance Completion	2.00	Clearance Completion	0.25
C	B	3rd Party Clearance Evaluation	2.00	Step Optimized (Waiting)	0.25
D	C	Document Clearance on SP	0.25	Step Eliminated (Overprocessing)	-
E	C	Credit Clearance on LMS	0.25	Credit Clearance on LMS	0.25
F	A	Training	0.50	Training	0.50
G	D	Fit Test Prep	0.50	Fit Test Prep	0.50
H	FG	Fit Test	0.50	Fit Test	0.50
I	H	Retrieve List of Employees	1.00	Retrieve List of Employees	1.00
J	I	Generate name slips	0.50	Step Eliminated (Over Processing)	-
K	J	Questionnaire Assembly	5.00	Step Eliminated (Overprocessing)	-
L	K	Questionnaire Delivery - Supervisors	2.00	Step Eliminated (Transport)	-
M	L	Clearance Completion	1.00	Clearance Completion	0.25
N	M	Clearance Pickup from Supervisors	8.00	Step Eliminated (Transport)	-
O	N	Delivery to Clinic (13x per Year)	1.00	Step Eliminated (Transport)	-
P	O	3rd Party Clearance Evaluation	40.00	Step Optimized (Waiting)	0.25
Q	P	Document Clearance on SP	0.25	Step Eliminated (Overprocessing)	-
R	Q	Credit Clearance on LMS	0.25	Credit Clearance on LMS	0.25
S	I	Training	0.50	Training	0.50
T	Q	Fit Test Prep	0.50	Fit Test Prep	0.50
U	ST	Fit Test	0.50	Fit Test	0.50
Initial Year CPM (ABCDGH)			5.00	Initial Year CPM (AAACBGH)	2.00
Annual Critical Path (JKLMNOPQRTVW)			60.00	Annual Critical Path (JNQTVW)	1.80



## Results and Discussion

Digitalization of third-party medical evaluations resulted in a 37% cost. Savings amounted to \$33,743, including direct cost savings and cost avoidance. Fiscal year 2023 EHS budget total direct cost savings were calculated at \$5,318. Total cost avoidance was calculated at \$28,725 annually. Table 8 summarizes cost saving breakdown by cost type. Digitalization optimized rPPE compliance by streamlining and eliminating 56.76hrs process lean waste for a unit process. Table 9 summarizes time reductions for various waste types of which waiting was most improved.

Total Annual Cost (\$)	Baseline	Optimized	Savings	% I
Direct Cost	\$22,718	\$17,400	\$5,318	23%
Indirect Cost:				
Production	\$49,250	\$29,550	\$19,700	40%
Worker Time				
Indirect Cost:	\$19,483	\$10,758	\$8,725	45%
Staff Time				
<b>Total</b>	<b>\$91,451</b>	<b>\$57,708</b>	<b>\$33,743</b>	<b>37%</b>

Waste	Time (hr) reduction
Transport	11.00
Over Processing	6.00
Waiting	39.75
<b>Total</b>	<b>56.75</b>

## Conclusions

CalOSHA Respiratory Protection Standard requires employers to execute a set of requirements as required by law [2]. The employer has flexibility on how to achieve the Standard execution and maintain compliance. This study met defined objectives of reducing the EHS annual budget by 23% and lean process waste by 45%. Digitalization of paper-based and in-person clinic medical clearances processes provide an opportunity for employers to reduce cost and time associated with compliance requirements without impacting worker safety.

## Future Work

EHS will identify additional paper-based compliance activities outside of the Respiratory Protection Program and apply similar methodologies to reduce cost of compliance.

## Acknowledgements

Special thanks to Héctor J. Cruzado, PhD, The firm's Human Resources, Production, and EHS departments.

## References

- [1] United States Department of Labor. Occupational Safety and Health Administration. California State Plan (1973).
- [2] Cal/OSHA Respiratory Protection Standard, Title 8 CCR; Section 5144 (2012).
- [3] Cunningham, J. (2020, January 18). The Eight Wastes of Lean. Lean Enterprise Institute. Available: <https://www.lean.org/the-lean-post/articles/the-eight-wastes-of-lean/>
- [4] The National Personal Protective Technology Laboratory (NPPTL). (2019, July 31). 100 Years of Respiratory Protection History. Centers for Disease Control and Prevention. Available: <https://www.cdc.gov/niosh/npptl/Respiratory-Protection-history.html>
- [5] Marks, R. (2018, December 4). Top 10 OSHA Violations for FY 2018. The Synergist American Industrial Hygiene Association. Available: <https://www.aiha.org/blog/top-10-osha-violations-for-fy-2018>
- [6] TechSolve.(2022). 8 Wastes Of Lean Manufacturing. Available: <https://www.techsolve.org/8-wastes-of-lean-manufacturing/>