

California Based Winery Respiratory Protection Program Cost and Time Reduction Study

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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.*

Key Terms — *Cost Reduction, Lean Waste, Online Respiratory Medical Clearance, Time to Compliance.*

INTRODUCTION

The firm studied is a California based winemaking company. The firm operates in California exclusively. 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 require 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].

Objective

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.

LITERATURE REVIEW

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.

ANALYSIS APPROACH

First Person Interviews were conducted to identify the steps to execute rPPE process. EHS, Human Resources (HR), and Production (PW) departments were interviewed. A standardized interview format was used:

- Describe responsibility in the rPPE program
- Identify steps required to execute
- For each step, identify dependencies
- For each step, identify if activity cost
- For each step, identify time per unit activity

Time data for steps was collected from historical activities in Table 1. The current EHS team

validated completion time and resources for each activity.

Cost data associated with each step was sourced from historical invoices, vendor price list included in contracts, and purchase orders obtained from the Firm's system cost accounting system.

Volume data for employees participating in the rPPE program 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.

Table 1
Baseline Process Data Collection

<i>C</i>	<i>Activity</i>	<i>Dept.</i>	Count	Unit	Direct	Unit	Total	PW Cost	Staff Cost
<i>P</i>	<i>Description</i>			Cost (\$)	Cost (\$)	Time	Time	(\$)	(\$)
<i>M</i>						(hr)	(hr)		
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	-
TOTAL					\$22,718			\$49,250	19,483.30

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.

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

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

The direct compliance cost driver was identified as the third-party medical clearance evaluations. Cost of clearance varied by provider with an average cost of \$95.00ea. CalOSHA paper-based questionnaire assessment used for recertification clearances process costs \$30.00ea. The Firm spent annually \$21,520 in clearances between all service providers, as shown in Table 2.

Table 2
Baseline Clearance Evaluation Annual Direct Cost

<i>Clearance Evaluation Provider</i>	<i>Total Cost</i>
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
Total Medical Clearance Cost	\$21,520.00

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.

Table 3
Baseline Indirect Cost Calculation with \$39.40/hr Wage

<i>Functional Group</i>	<i>Total Cost (\$)</i>
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. The online provider charged \$29 per evaluation.

Purchase orders were confirmed to match the advertised price of \$29.00ea. A total order of 600 evaluations were purchased for consumption during fiscal year 2023. The total purchase order cost \$17,400 is shown in Table 4.

Table 4
Online Vendor Clearance Evaluation Total Cost

<i>Service</i>	<i>Cost</i>	<i>Quantity</i>	<i>Total Cost</i>
Clearance Evaluation	\$29.00	600	\$17,400

Digitalization completely eliminated delivery, transport, and documentation steps, and reduced questionnaire completion time and evaluation turnaround. Time measurements for the steps of medical clearance completion were measured using time study methodology. 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.

Table 5
Time Samples Online Medical Questionnaire Completion

<i>Sample</i>	<i>Date</i>	<i>Completion Time (min)</i>
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

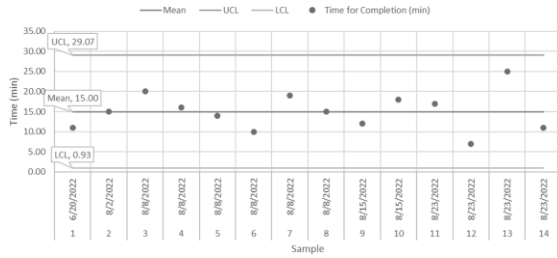


Figure 1
Online Questionnaire Completion Time Sample Plot

Indirect costs were calculated for the optimized process. Table 6 displays the firm’s optimized indirect costs by function.

Table 6
Optimized Indirect Cost

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

Table 7
Critical Path Method Data

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
B	A	Clearance Completion	2.00	Clearance Completion	0.25
C	B	3 rd 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	G	Fit Test	0.50	Fit Test	0.50
I	H	Retrieve List of Employees	1.00	Credit Clearance on LMS	-
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	3 rd 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	T	Fit Test	0.50	Fit Test	0.50
Initial Year CPM (ABCDGH)			5.00	Initial Year CPM (ABCDGH)	2.00
Annual Critical Path (IJKLMNOPQSTU)			60.00	Annual Critical Path (IMPSTU)	1.80

Time to Compliance

Simplified Critical Path Method was applied to identify Time to Compliance dependencies. The analysis completed for the baseline and optimized process, mapped the critical path that describes “Time to Compliance” for one employee. This time represents the time it takes to provide one respirator user respiratory equipment following The Standard requirements. Activities described in the process map were identified alphabetically and are listed 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.

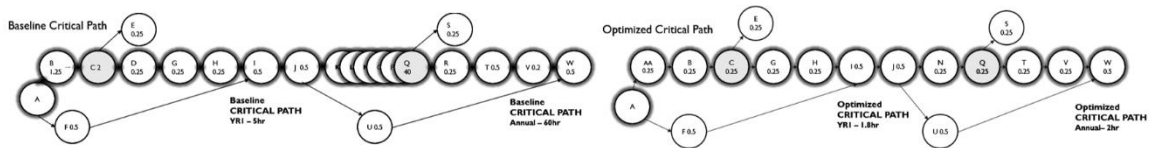


Figure 2
Critical Path Map Comparison

RESULTS

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.

Table 8
Total Cost Savings Summary

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

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.

Table 9
Unit Process Lean Waste Reduction Summary

Waste	Time (hr) reduction
Transport	11.00
Over Processing	6.00
Waiting	39.75
Total	56.75

CONCLUSION

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.

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