Enhancement in Welding Performance of 2% Maximum Weld Repair Policy

Firman Edi, Suparno, M. Giatman

Abstract*: In the implementation of welding work on a modular oil & gas fabrication project in PT. X Batam to get welding results that are 100% very difficult to achieve and always obtain welding results through visual inspection tests and Non-Destructive Test is rejected or defect that the repair welding must be done to fix it. The causes of welding repair are classified into two, namely repair due to lack of skill welder or due to engineering aspects. With that the management of PT. X Batam issued a policy of 2% maximum welding repair for each structural welding job as a KPI's and part of the company's quality manual to monitor and control of welder's performance in every project implemented. From the results of the 2% maximum KPI welding repair policy obtained significant enhancement on the performance of welders in every project undertaken and shown from the results of KPI values in 2014 the TEN FPSO E-house project was 1.2%, in 2015 the FPSO Kraken PGM project was 1.5 %, in 2016 the Ghana PGM FPSO project is 0.8%, in 2017 the Adolo Compressor FPSO project is 0.75%, in 2018 the TCO Area E-house project is 0.65% and in 2019 is ongoing the BGC TEG Regeneration unit project is 1.25%.

***Keywords* : Project, welding repair, performance, KPI and policy.**

I. INTRODUCTION

Since 2011 the oil and gas industry has continued to develop projects that are geologically complicated, expensive, and demanding technology throughout the world. Planned new capital expenditures in key oil and gas development areas are on the rise. These projects will compete for technical expertise, essential materials, and capital, many of which will add costs and financial risks.

PT X Batam is one of the modular assemblers who participated in running and supporting the oil and gas projects throughout the world in Africa, Asia, the Middle East, Russia, Australia and America. PT X Batam are flagship 12-hectares fabrication yard is strategically located in Free Trade Zone of Batam island, Indonesia. The yard undertakes project management, detail engineering, procurement and fabrication services for major oil and gas companies. Specializing in e-houses, electric sub-stations and process equipment integrator modules, it caters for both offshore (FPSO) and onshore applications, particularly for LNG plants and headquartered office located in Malaysia.

In the modularization construction works that there are several work breakdown structures (WBS) are structural, architectural, piping, painting, mechanical, electrical, instrument, F&G, HVAC and telecommunication. Where the biggest contribute in WBS is welding work. In the implementation of welding work on a modular oil & gas fabrication project at PT. X Batam, to get welding results that are 100% very difficult to achieve and always obtain welding results through visual inspection tests and Non-Destructive Test is rejected or defect that the repair welding must be done to fix it.

The causes of welding repair are classified into two, namely repair due to lack of skill welder or due to engineering aspects. Welding defects that are commonly found such as porosity, slag inclusion, lack of fusion, undercut generally come from inadequate welder skills to conduct good welding which have an impact on overhead costs, quality and time of the project according to Firman Edi researched in 2017[1]. While welding defects due to engineering aspects can be in the form of defects such as crack and distortion which cause changes in the mechanical properties of the material in the HAZ area and weld ability of the base metal itself according to Gani Trisdyanto and Mochamad Choifin researched in 2017[2] .

With that the management of PT. X Batam issued a policy of 2% maximum welding repair for each structural welding job as a KPI's and part of the company's quality manual to monitor and control of welders performance in every project implemented.

II. MATERIALS AND METHODS

Policy is a provision that shows the direction and guidelines for action. Policies are generally made by institutional leaders, both government and private institutions. One good policy indicator is made scientifically, that is, a policy is made rationally and based on complete, accurate and up-to-date data according to Sugiyono,2017[3].

This policy research uses a policy evaluation research method approach issued by the management of PT X Batam to get the relationship between program policies and the results of the performance welding work on each project implemented.

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A. Weld Repair Policy (KPI)

Table-I. Weld Repair Policy

KPI	Metric Name	Metric Definition & Measure	Target
QAQC	Weld Repair	WELD REPAIRS (STRUCTURAL) The Percentage To Date Of: (Welds Performed By Wasco For Steel Plate/ Steel Structures That Needed Repairs)/ (The Total Number Of Such Weld)	<2%
		WELD REPAIRS (PIPING) The Percentage To Date Of: (Weld length Performed By Wasco For Piping That Needed Repairs) / (The Total Length Of Such Welds)	<2%
		WELD REPAIRS (PROCESS EQUIPMENT) The Percentage To Date Of: (Welds Performed By Wasco During And Process Equipment Welds That Need To Be Repaired (By Joint) / The Total Number Of Such Weld.	<2%

B. Welding Processes Flowchart

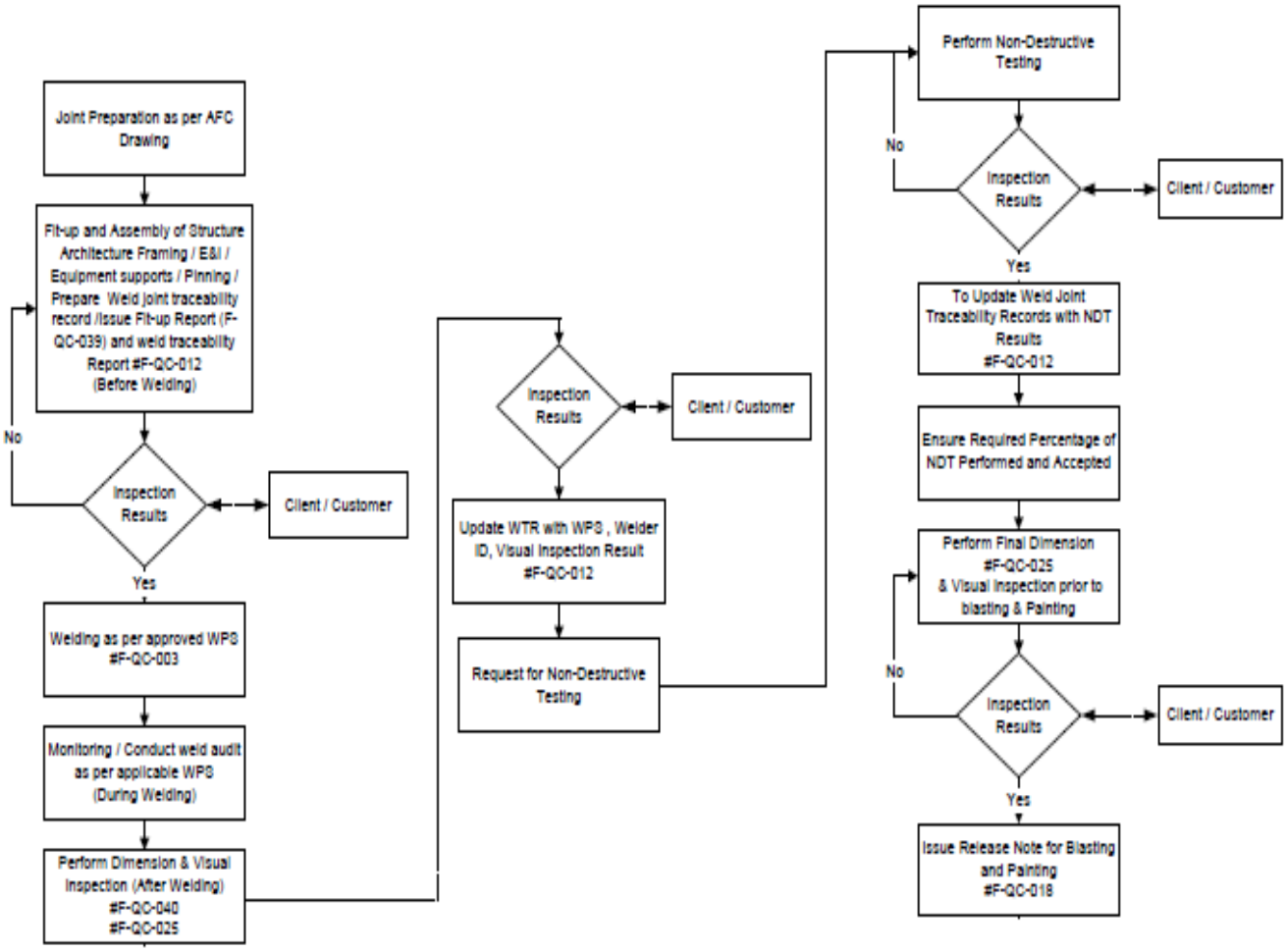

Figure 1. Welding Process Flowchart at PT X Batam

III. RESULTS AND DISCUSSION

A. Result Based on Project Wise

Table-II TEN FPSO Project KPI in 2014

		QA - PROJECT KEY PERFORMANCE INDICATOR
PROJECT TITLE	:	**TEN FPSO EHOUSE PROJECT**
MODULE	:	M-09
PROJECT NO	:	WEI-176
CUT OF DATE	:	2013-12-01- 2014-12-30

1.0 PROJECT WELD REPAIR DATE

	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
	LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
DISCIPLINE / SCOPE OF WORK	(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%
Structure	**1,060,854**	12730	**1.20%**	**1,060,854**	12730	**1.20%**

2.0 PROJECT WELDERS PERFORMANCE RECORDS

	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%
1	B.1028	360.00	0.00	0.00 %	360.00	0.00	0.00 %
2	B.1040	5,781.00	0.00	0.00 %	5,781.00	0.00	0.00 %
3	B.1051	455.00	0.00	0.00 %	455.00	0.00	0.00 %
4	B.1053	3,596.00	150.00	4.17 %	3,596.00	150.00	4.17 %
10	B.1140	46,652.00	0.00	0.00 %	46,652.00	0.00	0.00 %
11	B.1144	482.00	0.00	0.00 %	482.00	0.00	0.00 %
34	B.1916	34,581.00	100.00	0.29 %	34,581.00	100.00	0.29 %
35	B.1918	29,463.00	40.00	0.14 %	29,463.00	40.00	0.14 %
36	B.1920	11,108.00	0.00	0.00 %	11,108.00	0.00	0.00 %
37	B.1921	35,689.00	0.00	0.00 %	35,689.00	0.00	0.00 %
38	B.1925	13,576.00	0.00	0.00 %	13,576.00	0.00	0.00 %

Table-III KRAKEN FPSO Project KPI in 2015

		QA - PROJECT KEY PERFORMANCE INDICATOR
PROJECT TITLE	:	**KRAKEN FPSO PGM Project**
MODULE	:	M 70 A/B
PROJECT NO	:	WEI-159
CUT OF DATE	:	2015-01-01- 2016-04-15

1.0 PROJECT WELD REPAIR DATE

	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
	LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
DISCIPLINE / SCOPE OF WORK	(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%
Structure	**396,268**	5944	**1.50%**	**396,268**	5944	**1.50%**

2.0 PROJECT WELDERS PERFORMANCE RECORDS

	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%
1	B. 1140	803.40	0.00	0.00 %	803.40	0.00	0.00 %
5	B.1086	133.30	0.00	0.00 %	133.30	0.00	0.00 %
6	B.1140	6,624.00	0.00	0.00 %	6,624.00	0.00	0.00 %
7	B.1163	16,982.80	170.00	1.00 %	16,982.80	170.00	1.00 %
11	B.1597	340.00	0.00	0.00 %	340.00	0.00	0.00 %
12	B.1624	6,054.60	30.00	0.50 %	6,054.60	30.00	0.50 %
13	B.1692	133.30	0.00	0.00 %	133.30	0.00	0.00 %
33	B.1967	2,192.00	40.00	1.82%	2,192.00	40.00	1.82%
34	B.1968	23,170.70	60.00	0.26 %	23,170.70	60.00	0.26 %
35	B.1970	1,017.00	0.00	0.00 %	1,017.00	0.00	0.00 %
36	B.1982	6,433.20	300.00	0.00 %	6,433.20	0.00	0.00 %
37	B.1986	4,011.90	100.00	0.00 %	4,011.90	0.00	0.00 %
38	B.1989	11,391.10	150.00	1.32%	11,391.10	150.00	1.32%

Table-IV YINSON GHANA FPSO Project KPI in 2016

		QA - PROJECT KEY PERFORMANCE INDICATOR
PROJECT TITLE	:	**YINSON FPSO GHANA PGM Project**
MODULE	:	P 29
PROJECT NO	:	WEI-169
CUT OF DATE	:	2016-01-10 - 2016-08-31

1.0 PROJECT WELD REPAIR DATE

	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
	LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
DISCIPLINE / SCOPE OF WORK	(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%
Structure	**997,360**	7979	**0.80%**	**997,360**	7979	**0.80%**

2.0 PROJECT WELDERS PERFORMANCE RECORDS

	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%
1	B-1144	191.00	0.00	0.00 %	191.00	0.00	0.00 %
2	B-1172	100.00	0.00	0.00 %	100.00	0.00	0.00 %
11	B.1067	14,701.00	500.00	3.40 %	14,701.00	500.00	3.40 %
12	B.1083	2,750.00	0.00	0.00 %	2,750.00	0.00	0.00 %
35	B.1909	300.00	0.00	0.00 %	300.00	0.00	0.00 %
36	B.1913	2,208.00	0.00	0.00 %	2,208.00	0.00	0.00 %

Table-V BW ADOLO Compressor Project KPI in 2017

		QA - PROJECT KEY PERFORMANCE INDICATOR
PROJECT TITLE	:	4396 - Azurite Redeployment for Ruche - Gas Lift Compressor
MODULE	:	M23
PROJECT NO	:	CP00017
CUT OF DATE	:	2017-05-01 - 2018-05-28

1.0 PROJECT WELD REPAIR DATE

DISCIPLINE / SCOPE OF WORK	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
	LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
	(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%
Structure	**366,085**	2746	**0.75%**	**366,085**	2746	**0.75%**

2.0 PROJECT WELDERS PERFORMANCE RECORDS

	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%
1	B-1083	528.00	0.00	0.00 %	528.00	0.00	0.00 %
2	B.1069	268.00	0.00	0.00 %	268.00	0.00	0.00 %
3	B.1083	26,184.00	150.00	0.57 %	26,184.00	150.00	0.57 %
4	B.1086	17,603.00	0.00	0.00 %	17,603.00	0.00	0.00 %
5	B.1163	4,892.00	0.00	0.00 %	4,892.00	0.00	0.00 %
6	B.1172	35,505.00	150.00	0.42 %	35,505.00	150.00	0.42 %
7	B.1196	10,430.00	0.00	0.00 %	10,430.00	0.00	0.00 %
8	B.1242	300.00	0.00	0.00 %	300.00	0.00	0.00 %
9	B.1247	32,320.00	769.00	2.38 %	32,320.00	769.00	2.38 %
10	B.1313	770.00	0.00	0.00 %	770.00	0.00	0.00 %
32	B.1952	3,329.00	460.00	13.82 %	3,329.00	460.00	13.82 %
33	B.1956	12,451.00	0.00	0.00 %	12,451.00	0.00	0.00 %
34	B.1958	10,394.00	440.00	4.23 %	10,394.00	440.00	4.23 %
35	B.1959	3,256.00	0.00	0.00 %	3,256.00	0.00	0.00 %
36	B.1960	8,916.00	595.00	6.67 %	8,916.00	595.00	6.67 %
37	B.1969	1,324.00	0.00	0.00 %	1,324.00	0.00	0.00 %
38	B.1972	1,116.00	0.00	0.00 %	1,116.00	0.00	0.00 %

Table-VI TCO Future Growth Project KPI in 2018

		QA - PROJECT KEY PERFORMANCE INDICATOR
PROJECT TITLE	:	FUTURE GROWTH PROJECT - GATHERING
MODULE	:	51-SU-3301
PROJECT NO	:	EH-00011-001
CUT OF DATE	:	2018-02-01 - 2018-06-28

1.0 PROJECT WELD REPAIR DATE

DISCIPLINE / SCOPE OF WORK	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
	LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
	(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%
Structure	**157,701**	1025.1	**0.65%**	**157,701**	1025.1	**0.65%**

2.0 PROJECT WELDERS PERFORMANCE RECORDS

	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT		
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT	
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%
1	B.1196	1,799.30	0.00	0.00 %	1,799.30	0.00	0.00 %
2	B.1242	1,691.20	0.00	0.00 %	1,691.20	0.00	0.00 %
3	B.1389	1,091.20	0.00	0.00 %	1,091.20	0.00	0.00 %
4	B.1561	2,523.20	0.00	0.00 %	2,523.20	0.00	0.00 %
5	B.1624	1,424.60	0.00	0.00 %	1,424.60	0.00	0.00 %
6	B.1703	25,401.00	533.20	2.10 %	25,401.00	533.20	2.10 %
7	B.1903	666.40	0.00	0.00 %	666.40	0.00	0.00 %
8	B.1925	7,160.00	0.00	0.00 %	7,160.00	0.00	0.00 %
9	B.1929	23,573.60	0.00	0.00 %	23,573.60	0.00	0.00 %
10	B.1941	7,997.90	1,280.00	16.00 %	7,997.90	1,280.00	16.00 %
11	B.1944	7,231.40	0.00	0.00 %	7,231.40	0.00	0.00 %
12	B.1948	9,286.00	0.00	0.00 %	9,286.00	0.00	0.00 %
13	B.1950	4,363.80	0.00	0.00 %	4,363.80	0.00	0.00 %
14	B.1970	6,251.50	0.00	0.00 %	6,251.50	0.00	0.00 %
15	B.2030	800.00	0.00	0.00 %	800.00	0.00	0.00 %
16	B.2033	15,547.70	266.60	1.71%	15,547.70	266.60	1.71%
17	B.2033/1703	800.00	0.00	0.00 %	800.00	0.00	0.00 %
18	B.467	18,360.50	60.00	0.33 %	18,360.50	60.00	0.33 %
19	B.903	6,546.00	90.00	1.37 %	6,546.00	90.00	1.37 %
20	B.910	9,968.00	0.00	0.00 %	9,968.00	0.00	0.00 %
21	B.910/B.497	3,200.00	0.00	0.00 %	3,200.00	0.00	0.00 %
22	B.934	1,218.00	0.00	0.00 %	1,218.00	0.00	0.00 %
23	B1929	800.00	0.00	0.00 %	800.00	0.00	0.00 %

Table-VII BGC TEG Project KPI in 2019 (Ongoing Construction)

			QA - PROJECT KEY PERFORMANCE INDICATOR					
PROJECT TITLE	:	Gas Dehydration & TEG Regeneration System						
MODULE	:	C027						
PROJECT NO	:	WEI-CP-021						
CUT OF DATE	:	2019-09-18 - 2019-11-15						
1.0 PROJECT WELD REPAIR DATE								
DISCIPLINE / SCOPE OF WORK		ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT			
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		
		(mm)/JOINT	(mm)/JOINT	%	(mm)/JOINT	(mm)/JOINT	%	
Structure		91,420	1142.8	1.25%	157,701	1142.8	1.25%	
2.0 PROJECT WELDERS PERFORMANCE RECORDS								
	WELDER/WELDING OPERATOR	ACCUMULATIVE (TOTAL)			WEEKLY ACHIEVEMENT			
		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		LENGTH TESTED RT or UT	LENGTH REPAIR RT or UT		
NO	NAME	(mm)	(mm)	%	(mm)	(mm)	%	
1	B.1163	4,425.00	50.00	1.13%	4,425.00	50.00	1.13%	
2	B.1242	4,359.00	50.00	1.15%	4,359.00	50.00	1.15%	
3	B.1507	7,868.00	50.00	0.64%	7,868.00	50.00	0.64%	
4	B.1561	7,150.00	40.00	0.56%	7,150.00	40.00	0.56%	
5	B.1597	9,422.00	0.00	0.00%	9,422.00	0.00	0.00%	
6	B.1703	6,480.00	130.00	2.01%	6,480.00	130.00	2.01%	
7	B.1915	1,560.00	0.00	0.00%	1,560.00	0.00	0.00%	
8	B.1929	4,091.00	105.00	2.57%	4,091.00	105.00	2.57%	
9	B.1936	7,166.00	90.00	1.26%	7,166.00	90.00	1.26%	

B. Summary of KPI's Achievement

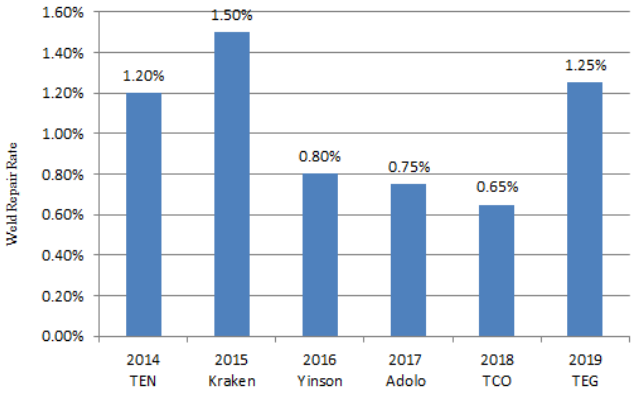

Fig. 2. Summary KPI's Achievement of Repair Rate < 2.0%

C. Discussion

As an evaluation of the maximum welding repair policy (KPI) of 2%, there was a significant increase in the performance of welders in each project carried out and shows the KPI value in figure 2 with the results in 2014 the TEN FPSO Ehouse project was 1.2%, in 2015 the PGM FPSO project Kraken is 1.5%, in 2016 the PGM Ghana FPSO project is 0.8%, in 2017 the Adolo BW Compressor FPSO project is 0.75%, in 2018 the TCO Area Ehouse project is 0.65% and in 2019 Ongoing Regeneration of TEG BGC project units is 1.25%.

IV. CONCLUSION

Based on the above statement, it can be concluded that the implementation of welding repair policies (KPI) can influence and improve the quality performance of welders and as a reference to be measured and controlled in the implementation of welding work in each project. **Firman Edi**, as student at Technology & Vocational Eduction Program, Padang State University, Padang, Indonesia. Email: firmanedi972000@yahoo.com

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