Wrench Time Analysis Study: 1st Site Visit Report

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By:

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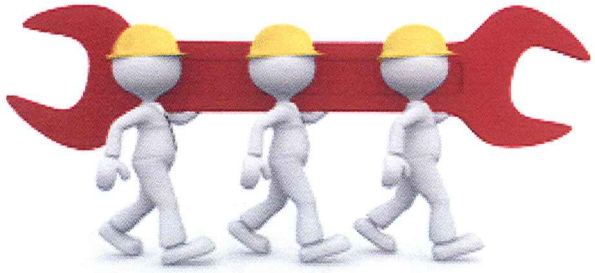
Introduction

Trial Date was on Feb 9, 2018

Study conducted between Feb 16 – Feb 23, 2018

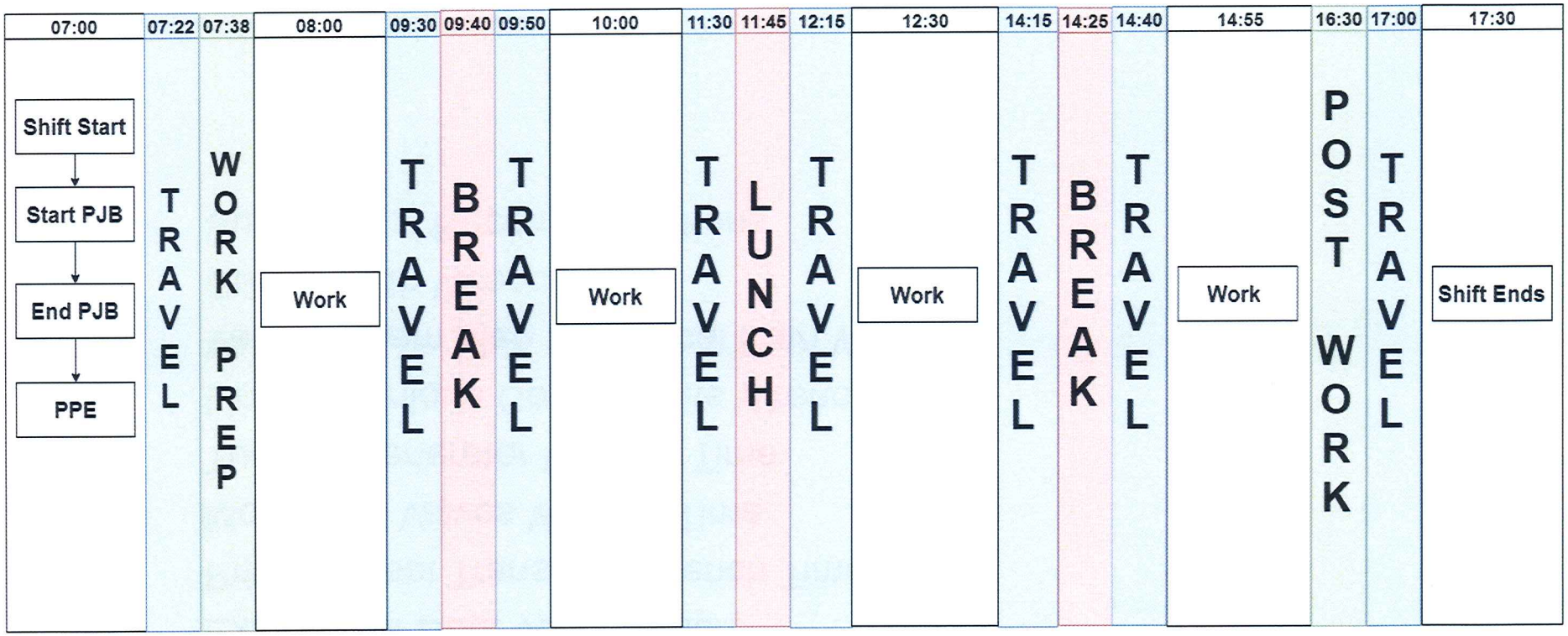
- 24 Wrench Time measurements taken
- 5 Critical Path Wrench Time measurements taken



Outline

1. Value Stream Map for Crew Based Work
2. Example of Data Visualization
3. Primary Heat Transport Wrench Time
4. Moderator Valves Wrench Time
5. Turbine/Generator Wrench Time
6. Line 15/ Unique Components Wrench Time
7. Value Stream Map for Critical Path Work
8. Critical Path Wrench Time
9. Summary of Recommendations

Value Stream Map for Crew Based Work

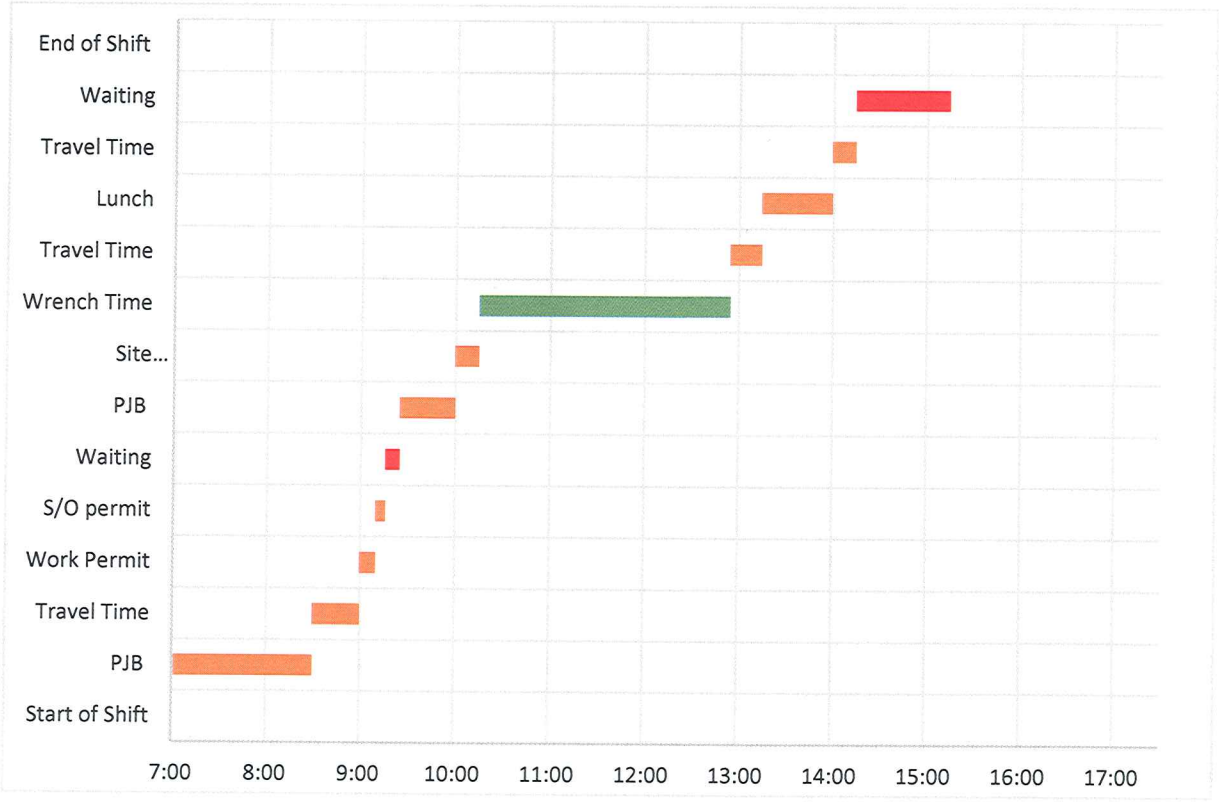


Data Visualization (DV)

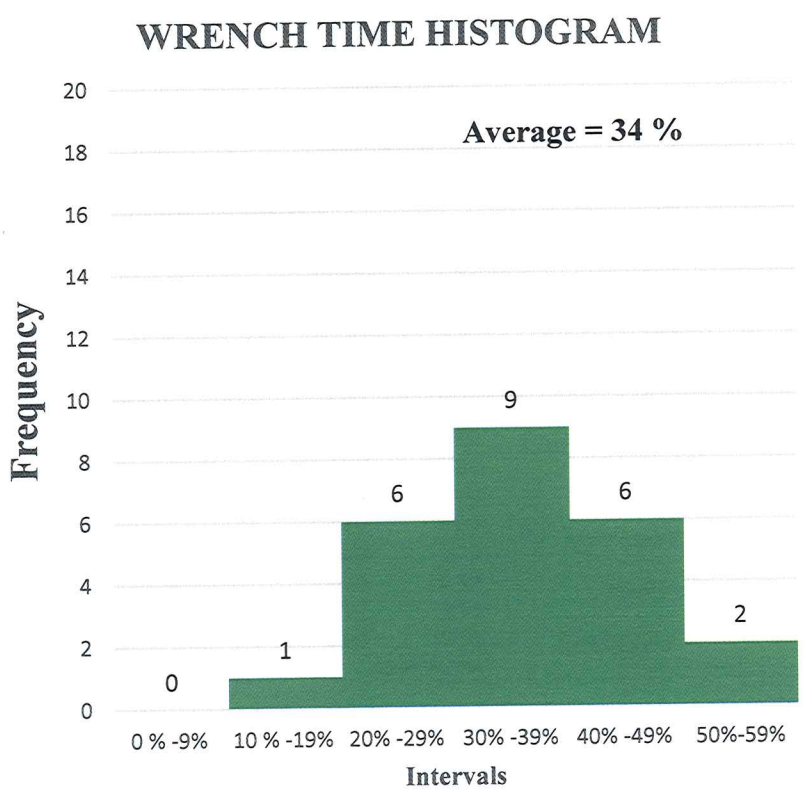
This is a typical DV graph for a sample that obtained for the Primary Heat Transport (PHT) system during the trial day, and it is 1 out of 24 samples.

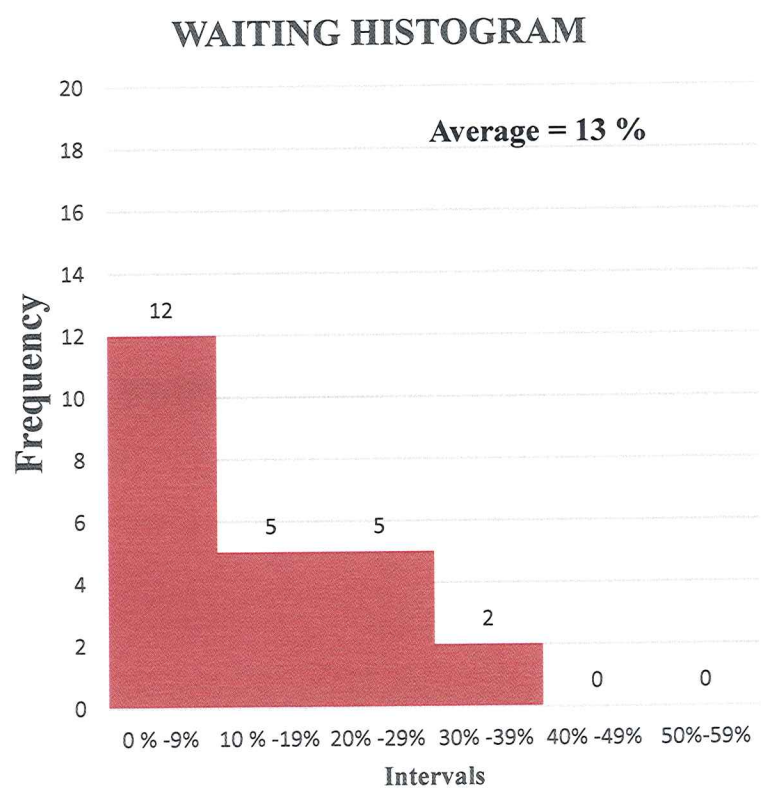
Activity	Start	Duration
Start of Shift	7:00	0:00
PJB	7:00	1:30
Travel Time	8:30	0:30
Work Permit	9:00	0:10
S/O permit	9:10	0:06
Waiting	9:16	0:09
PJB	9:25	0:35
Site Preparation	10:00	0:15
Wrench Time	10:15	2:40
Travel Time	12:55	0:20
Lunch	13:15	0:45
Travel Time	14:00	0:15
Waiting	14:15	1:00
End of Shift	15:15	0:00

Row Labels	Sum of Duration	
Lunch	45	9.1%
S/O permit	6	1.2%
Start of Shift	0	0.0%
Travel Time	65	13.1%
Waiting	69	13.9%
End of Shift	0	0.0%
Work Permit	10	2.0%
Site Preparation	15	3.0%
Wrench Time	160	32.3%
Grand Total	**495**	**100.0%**

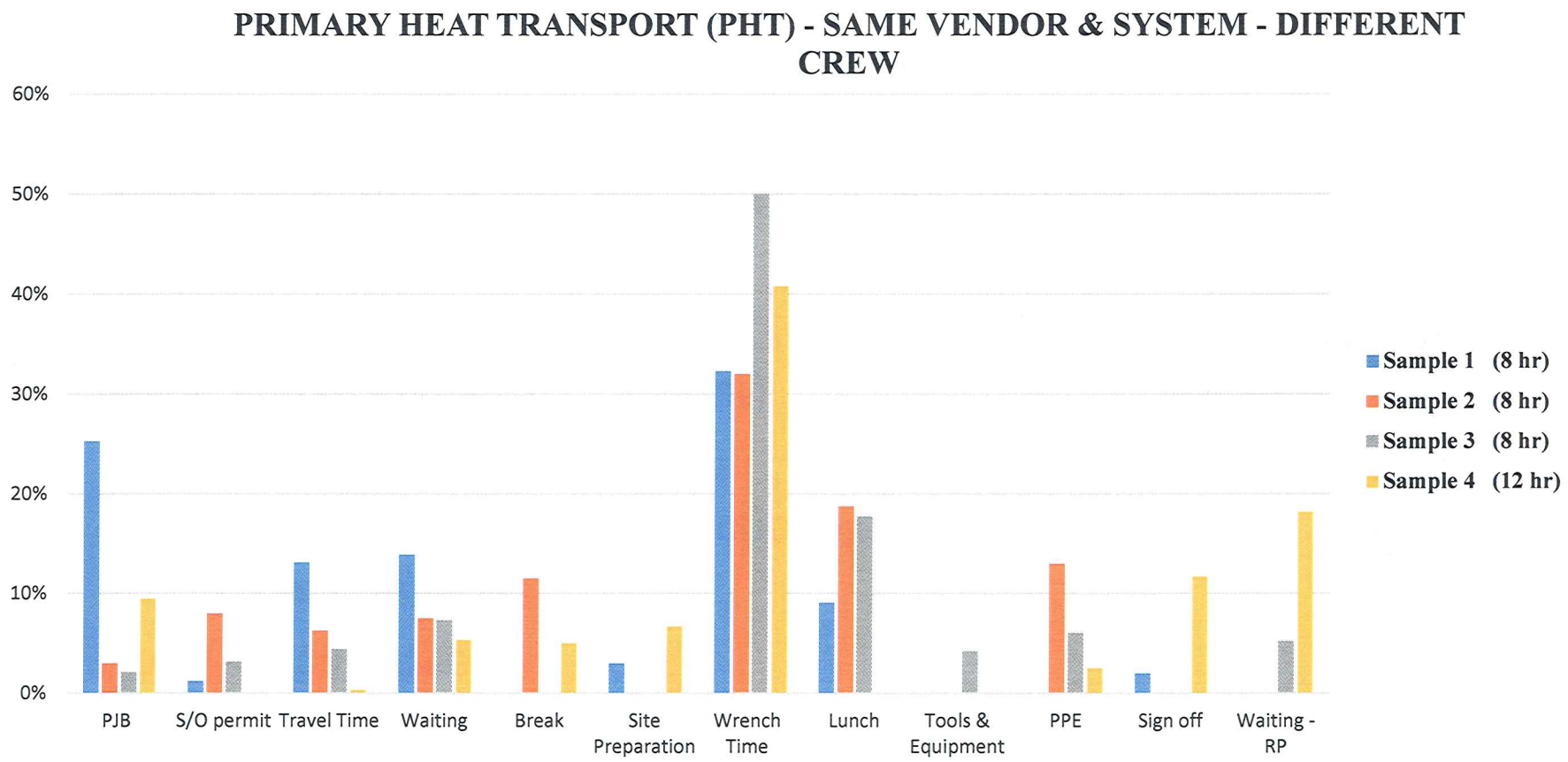


Wrench Time & Waiting Histograms





Primary Heat Transport (PHT) Work



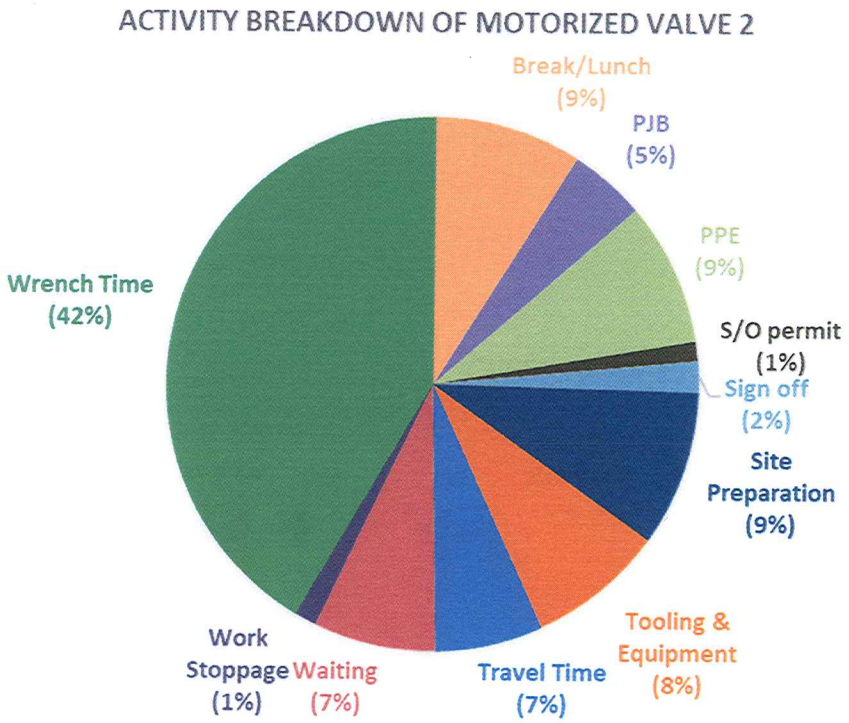
Performance Barriers – Primary Heat Transport (PHT)

- Long waiting time (~ 1 hour)
    - Long lunches
    - Confusion regarding schedule
- Hold point sign offs (~ 1 hour)
- Early end of shifts (~ 1 - 2 hour)

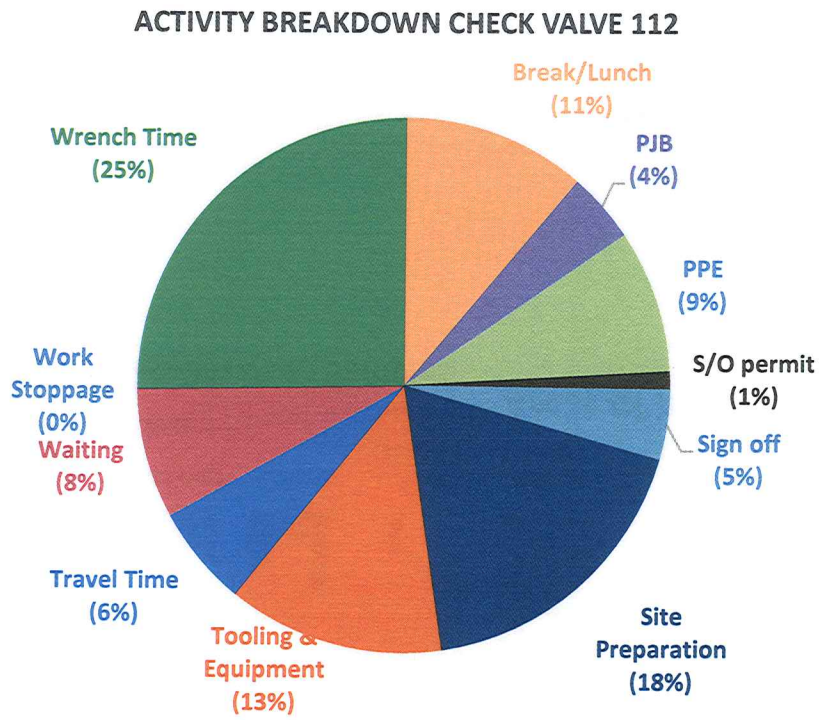
Recommendations

- More emphasis on pre-job brief to avoid confusion regarding the schedule
- More supervision regarding lunch hours

Cumulative Wrench Time

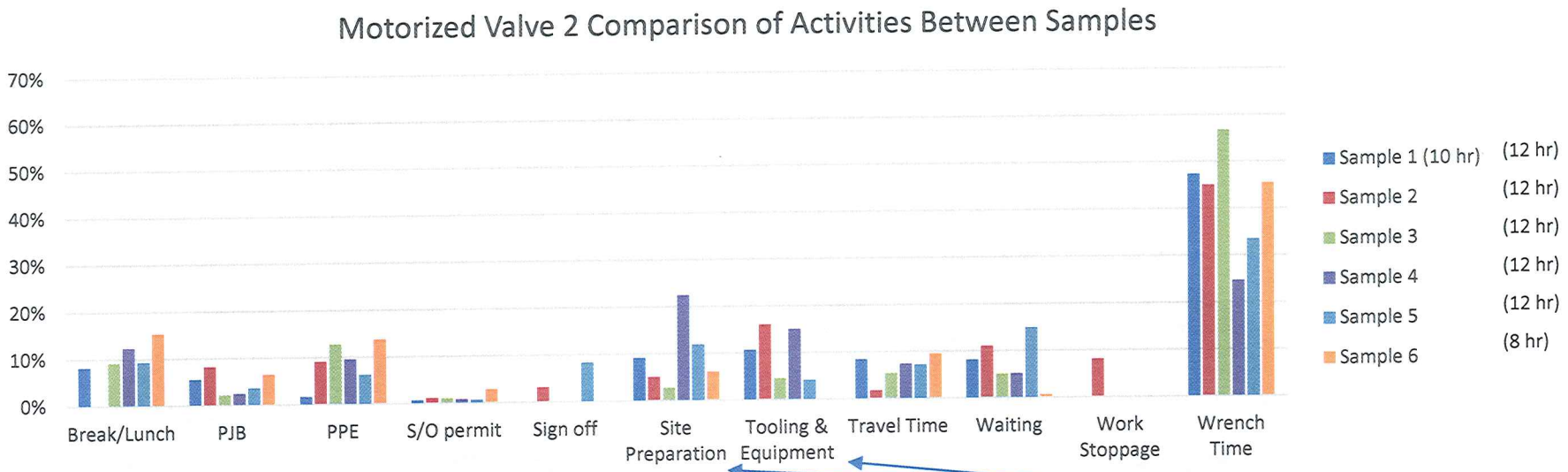


Motorized Valve 2 consists of 6 data points

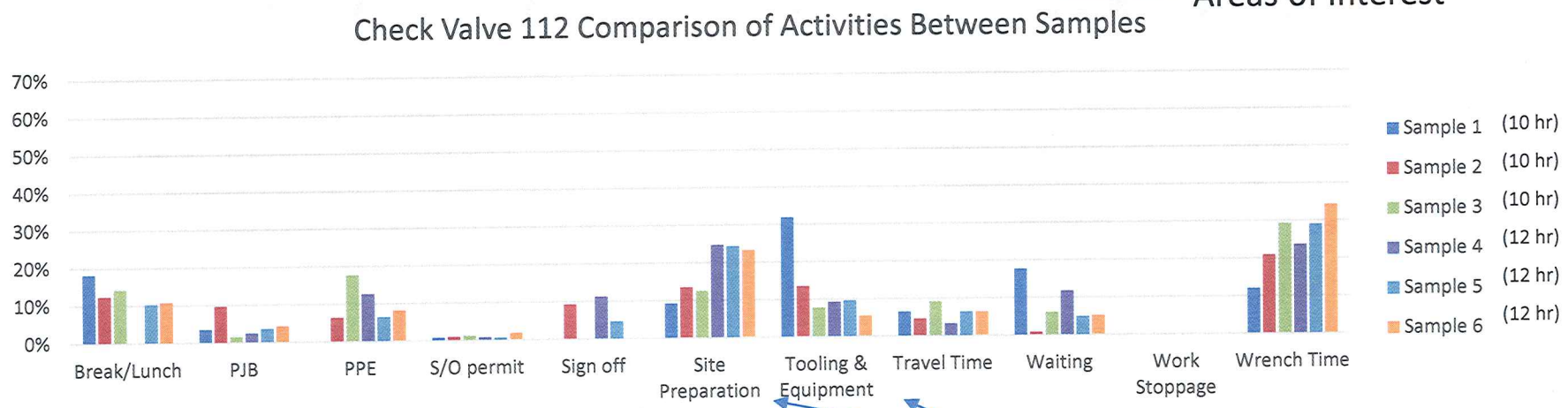


Check Valve 112 consists of 6 data points

Comparison of Activities

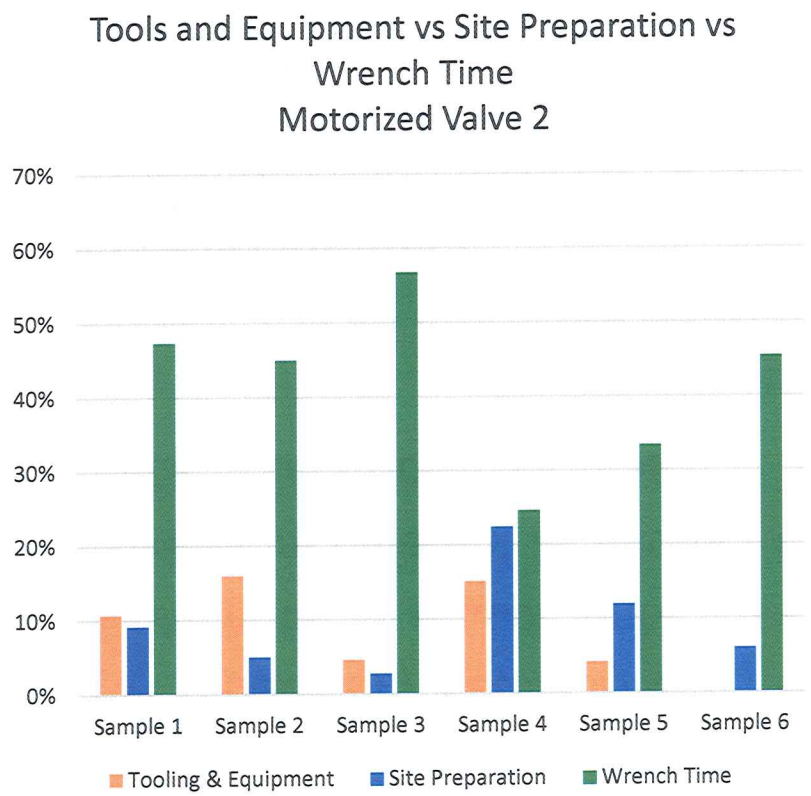


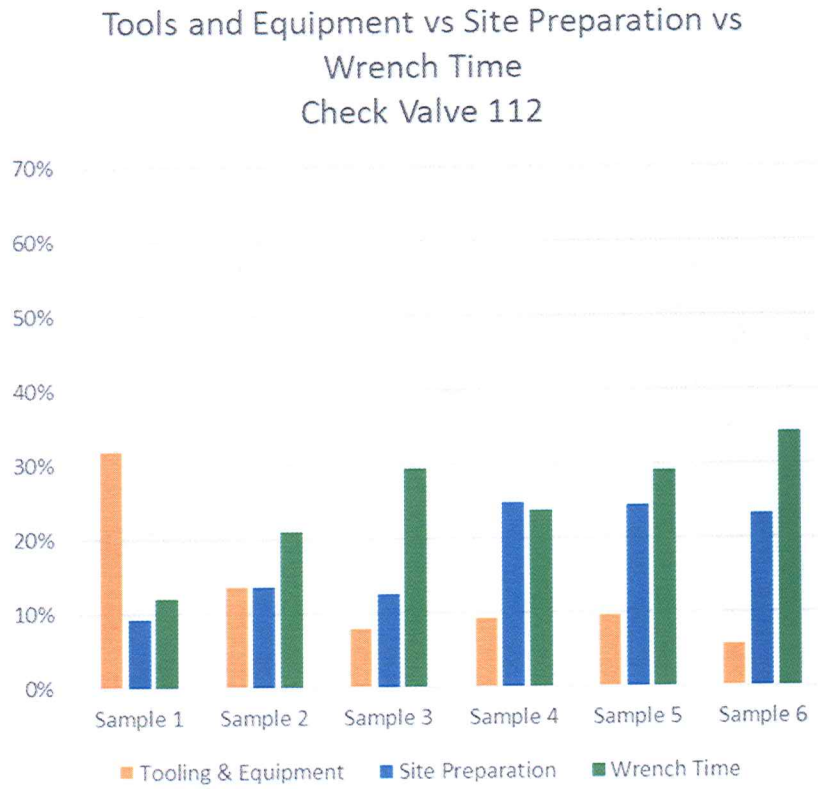
Areas of Interest



Increases in site preparation and tooling/equipment

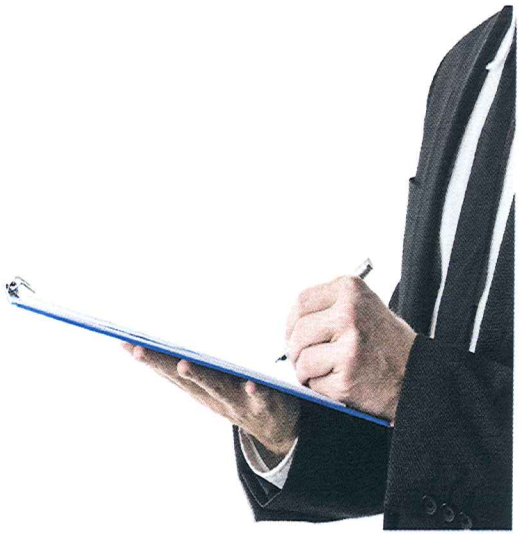
Tools & Equipment and Site Preparation





Performance Barriers – Moderator Valves

- RP scheduling issues exist (~ 0.5 hours)
- Multiple faulty equipment (~ 1 - 2 hours)
- Badges at different locations (~ 10 minutes)
- Lack of urgency (~ 1 hour)

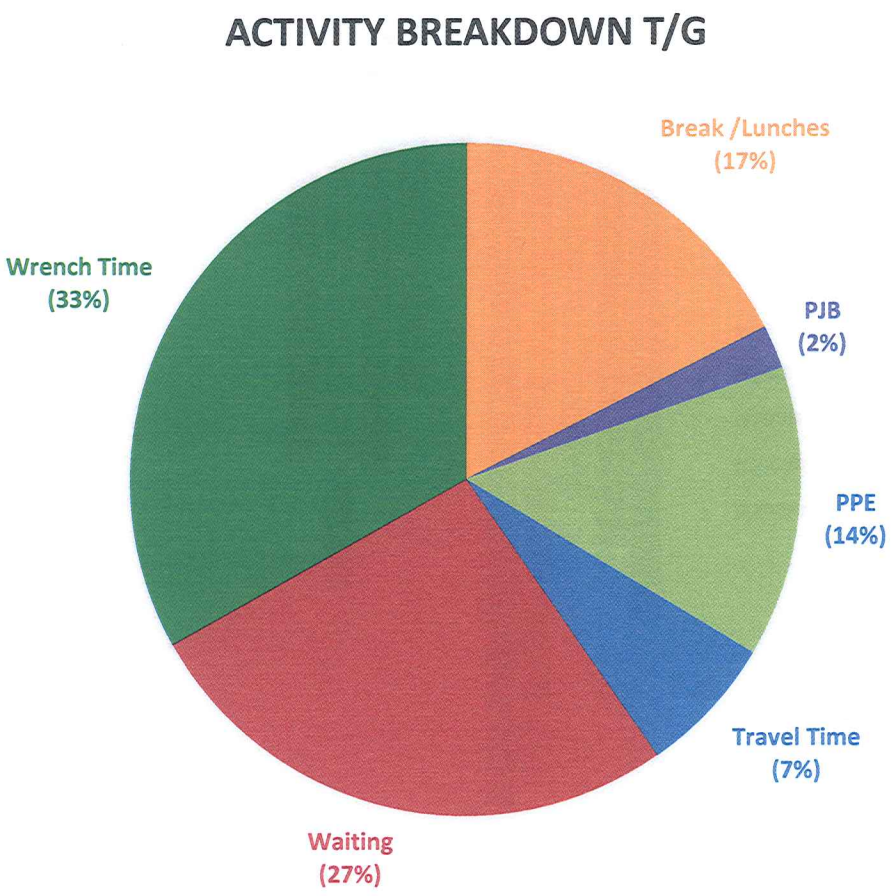


Recommendations

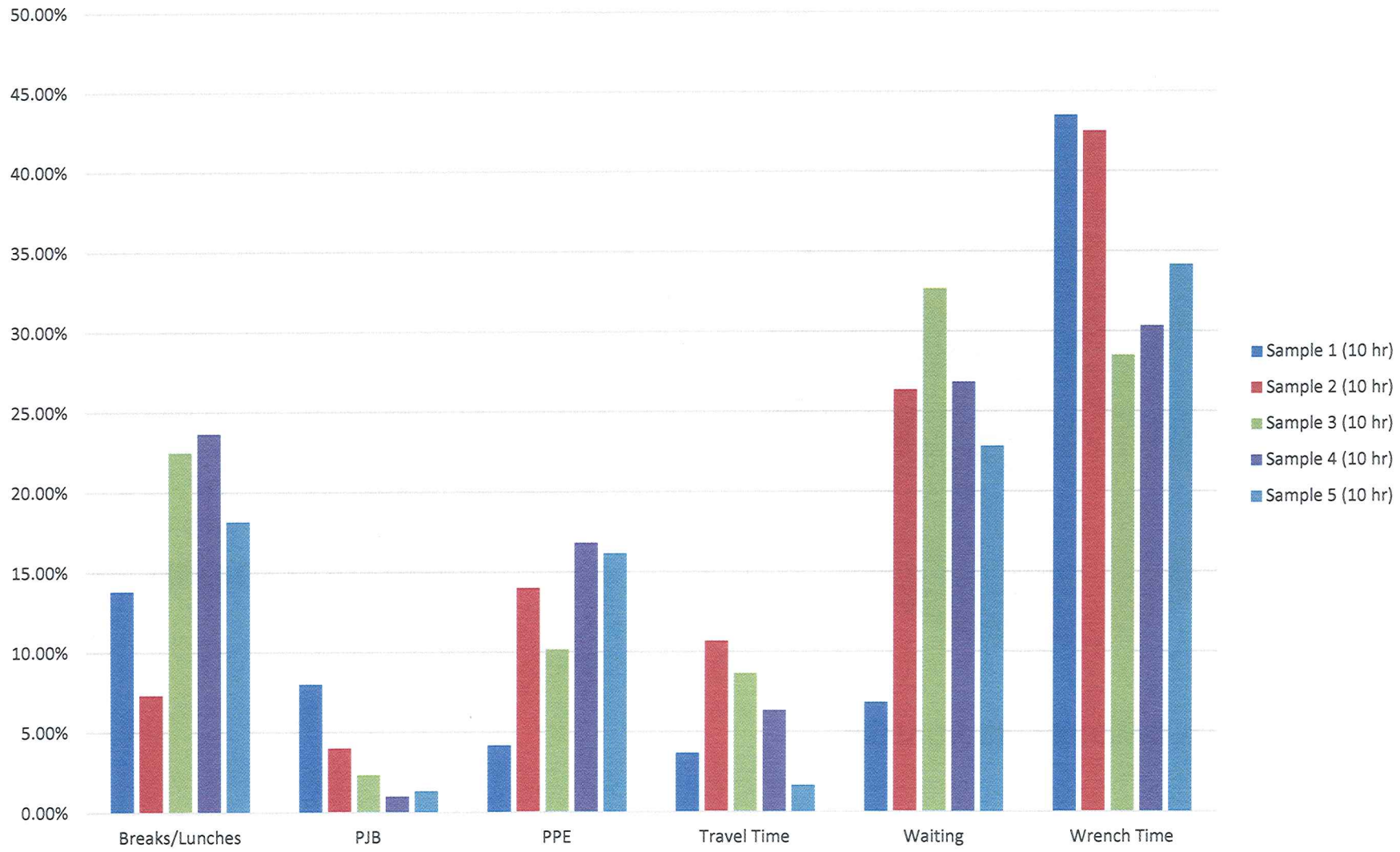
- Communication devices for workers inside containment to communicate with foreman in the event of issues with tools and equipment
- RP enter the moderator rooms to take tritium samples. By enabling RP to perform gas tests, site preparation can be reduced collectively.

Turbine/Generator Work

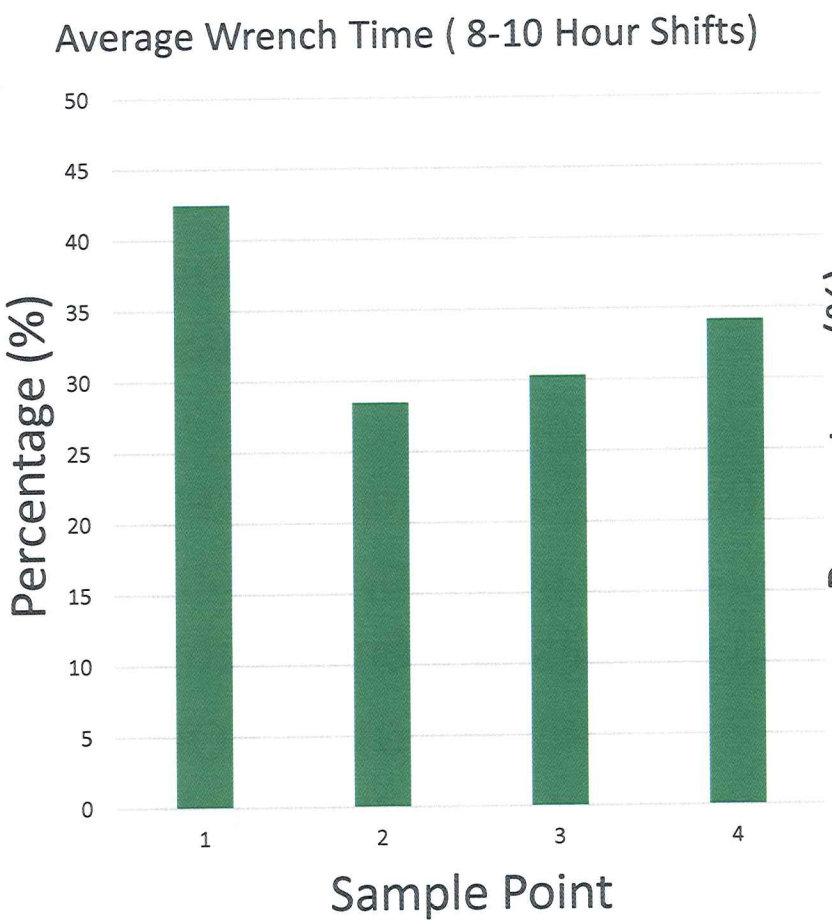
- Five studies completed
  - One data point – Turbine Work
  - Four data points – Generator Work

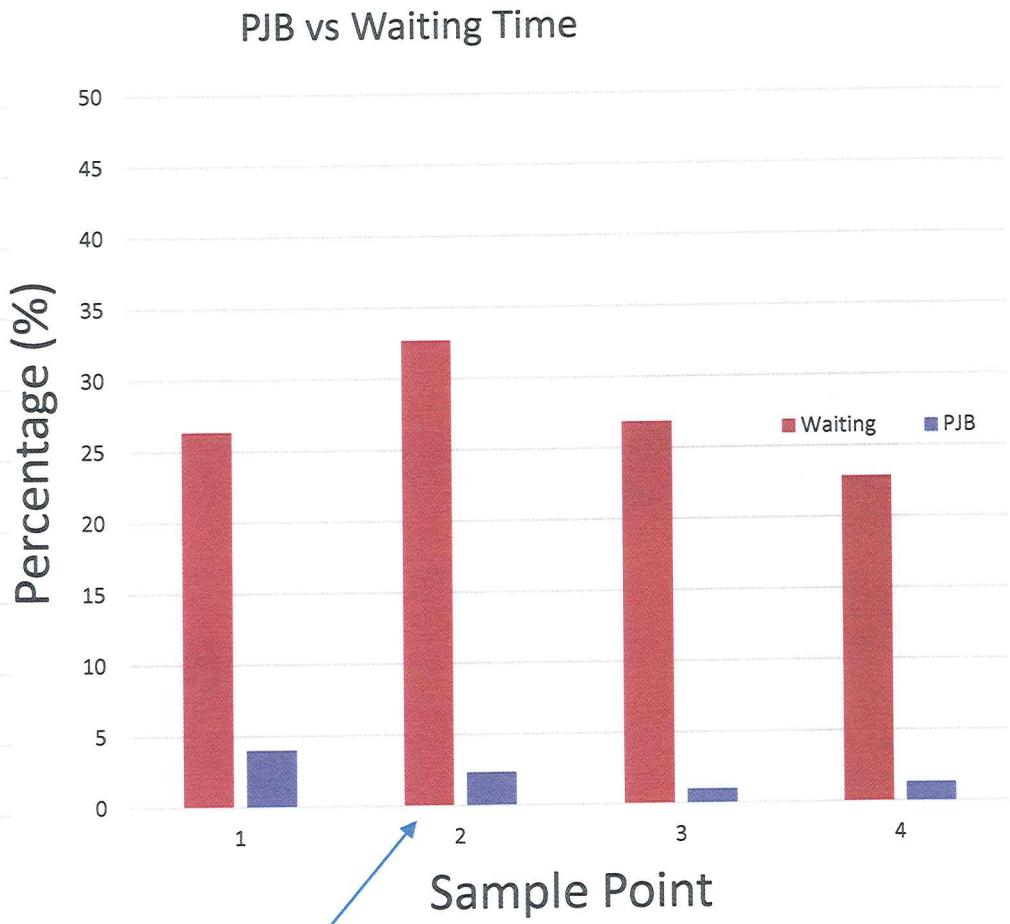


T/G Comparison of Activities Between Samples



Results – Generator Project





As pre-job brief decreases while waiting time increases. This is associated with scaffolding issues.

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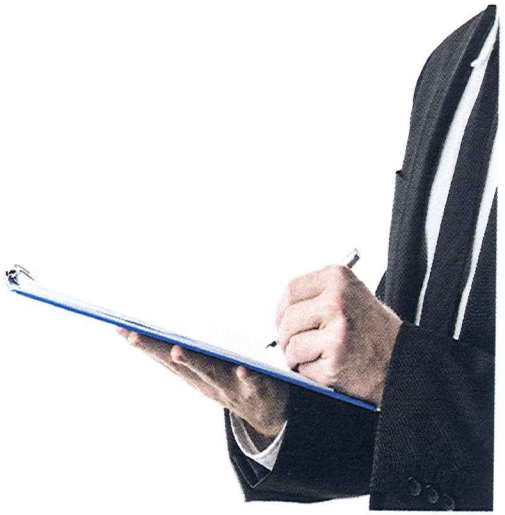
Performance Barriers – T/G Project

- Late starts (~ 10 minutes)
- HOR (~ 10 minutes)
- Scaffolding Adjustments (~ 1.5 hours)
- Lunches taken off site (~ 2 hours)
- Early Finishes (~ 2 hours)

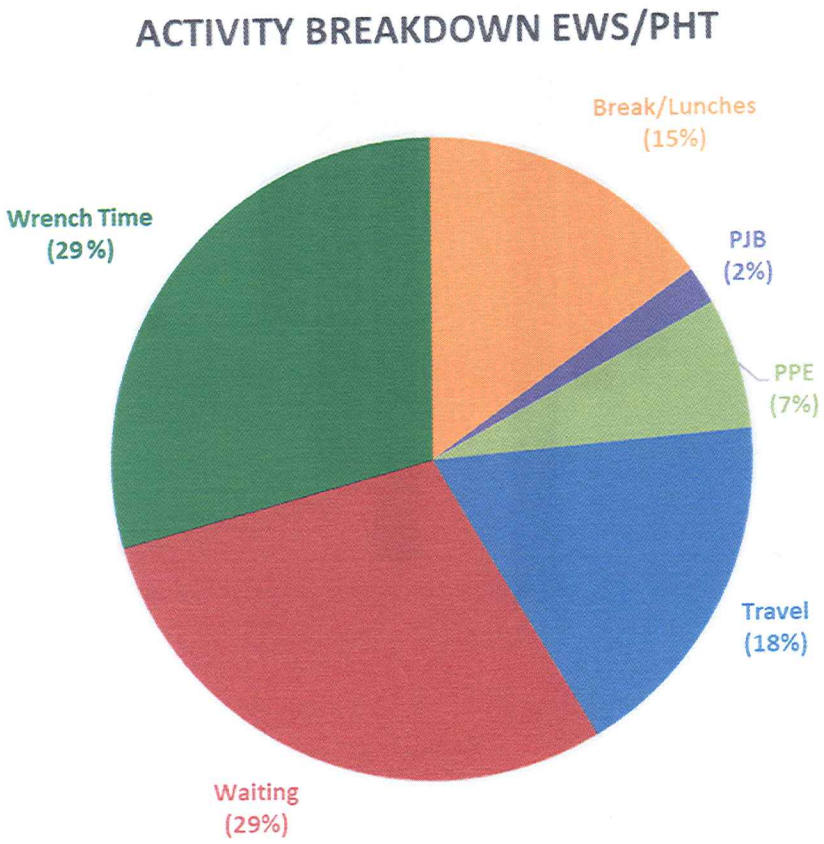


Recommendations

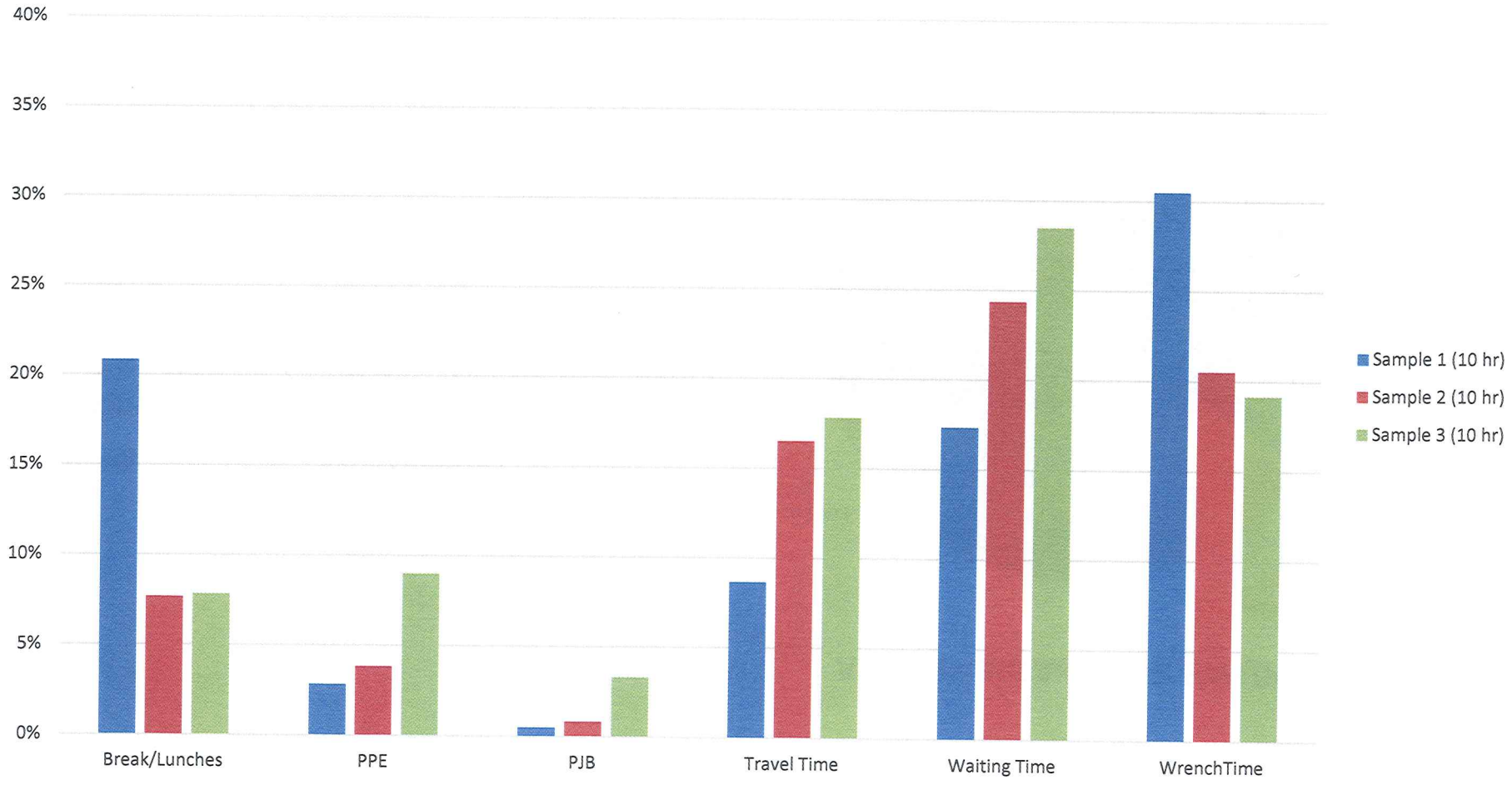
- More emphasis on the PJB
- More emphasis on oversight

Line 15 / Unique Components Work

- Three studies completed
  - One data point – L15 Work
  - Two data points – Unique Components Work



PHT / EWS Comparison of Activities Between Samples



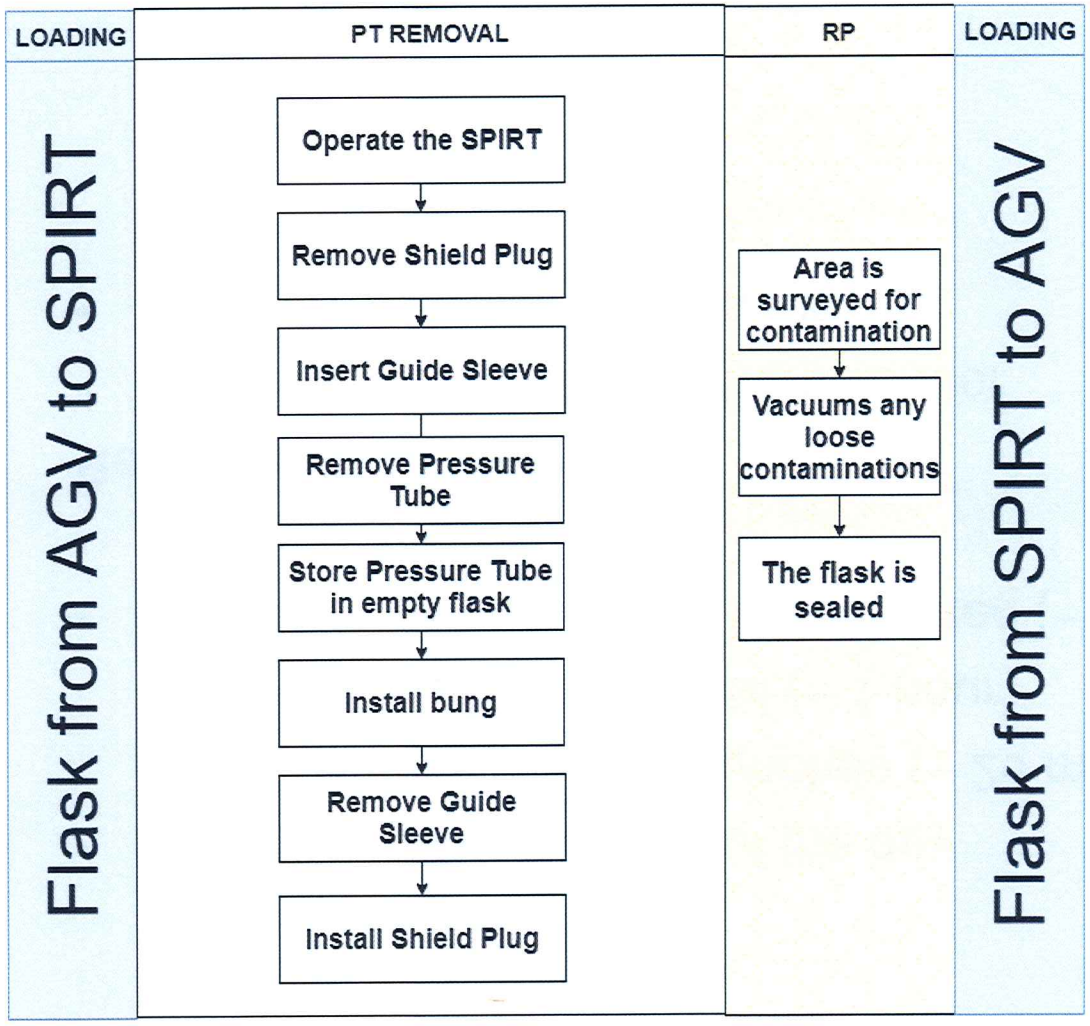
Performance Barriers– L15 / Unique Components

- Waiting around for most of the day
  - Unsynchronized lunches (~ 20 minutes)
  - Equipment retrieval (~ 1 hour)
- Confusion in the work to be executed (~ 10 minutes)

Recommendations

- More front end planning from vendor
- More urgency from the crews

Value Stream Map for Critical Path Work



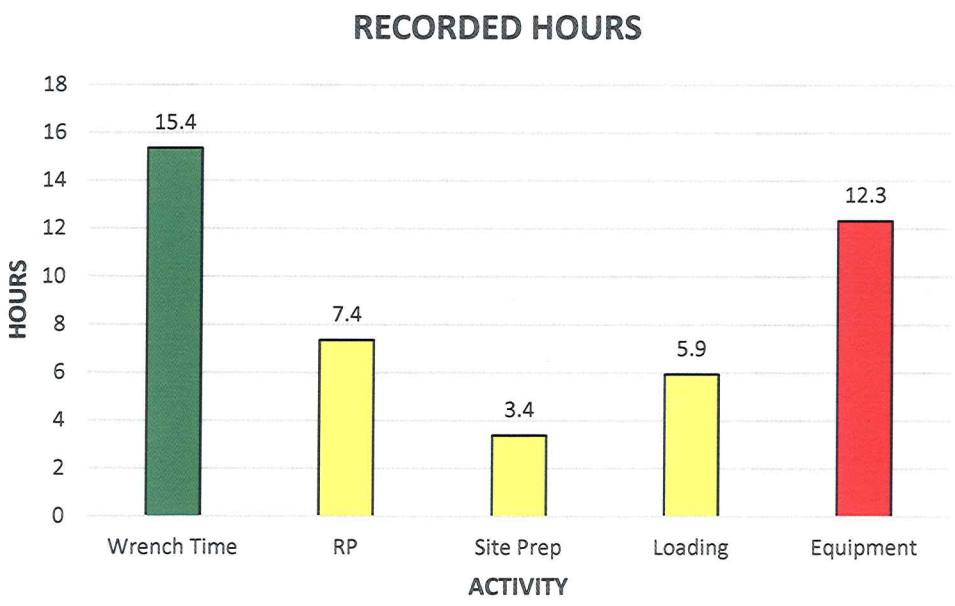
AGV = Automated Guided Vehicle

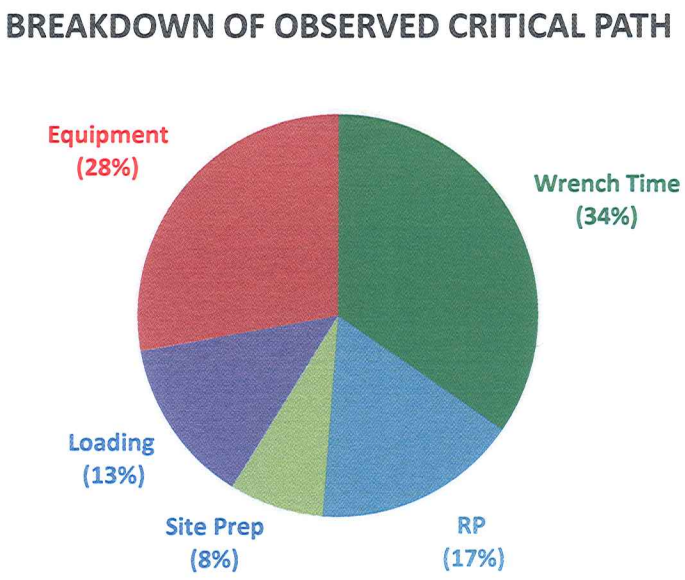
SPIRT = Shield Plug Installation and Removal Tool

Modified the Wrench Time Algorithm to follow the work instead of the crew

This algorithm was used to assess work performance for pressure tube removal

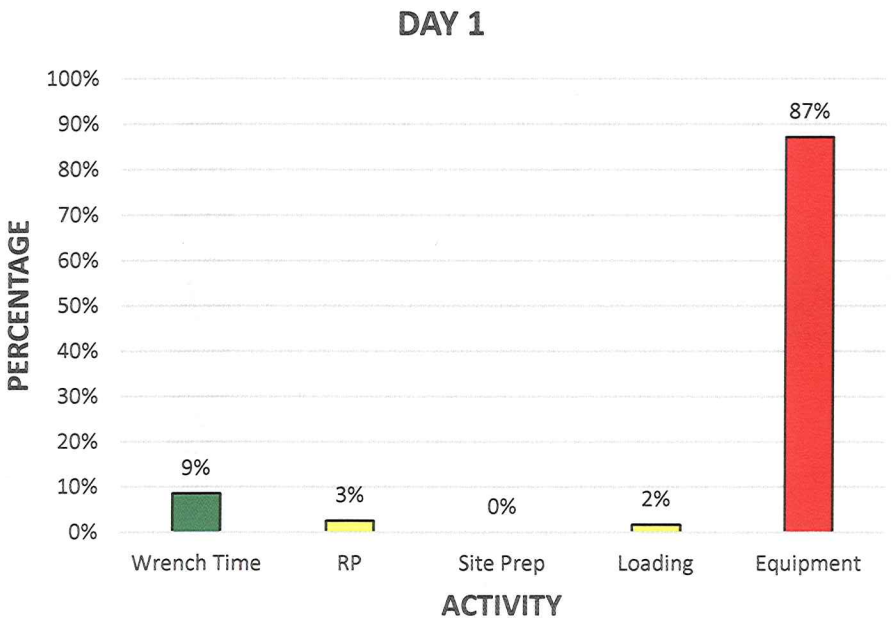
Critical Path (Pressure Tube Removal) Data Overview



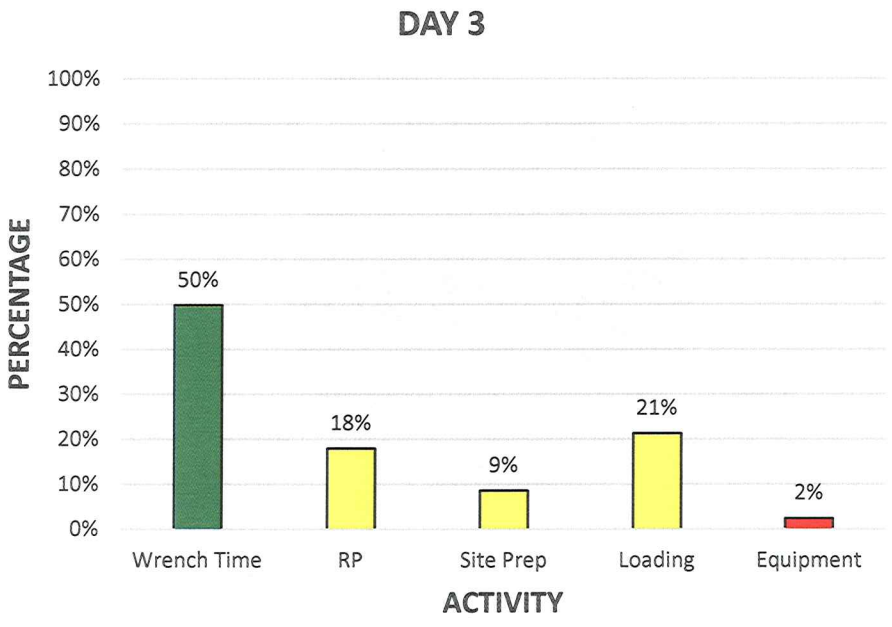


*5 Measurements

Critical Path (Pressure Tube Removal) Best Case VS Worst Case

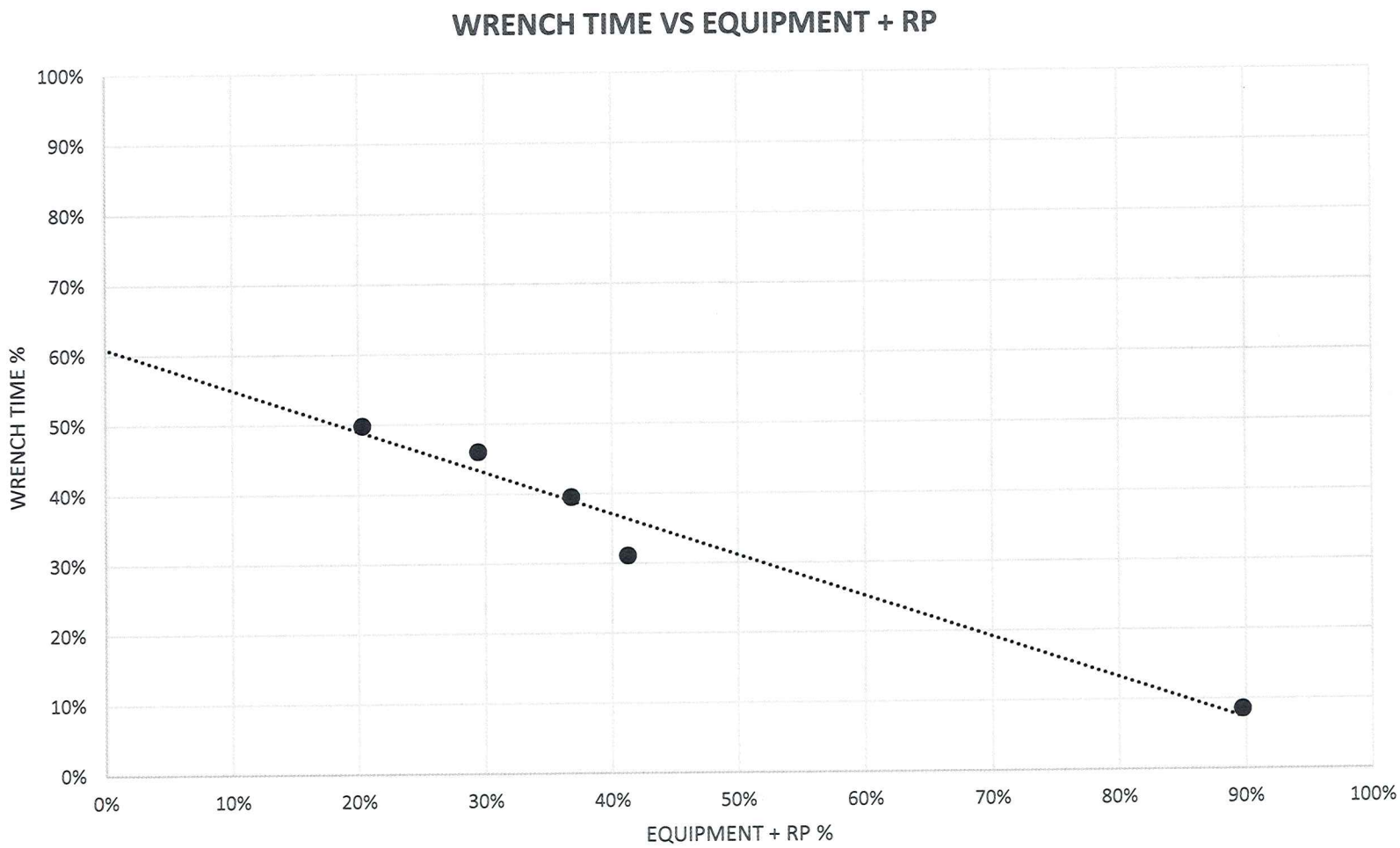


Only 1 Pressure Tube Removed



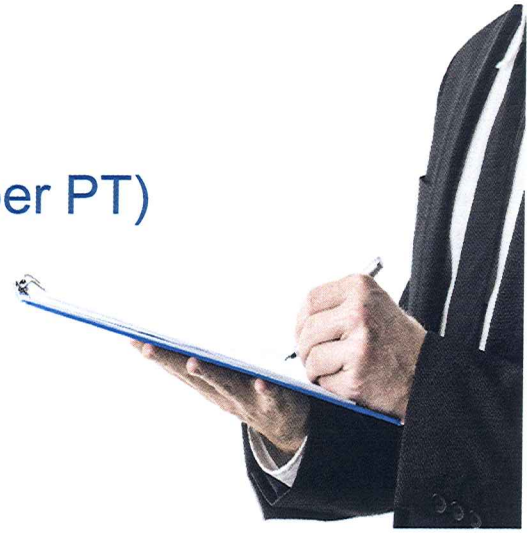
9 Pressure Tubes Removed

Critical Path (Pressure Tube Removal) Impact on Wrench Time



Performance Barriers – Critical Path

- Equipment unavailability/failure (~ 3 hours)
- Software issues (~ 15 minutes per PT)
- Frustrations with RP process (~ 10 minutes per PT)



Recommendations

- Understanding equipment failure causes
- Changing RP process

Summary of Recommendations

Primary Heat Transport

- More emphasis on pre-job brief to avoid confusion regarding the schedule
- More supervision regarding lunch hours

Moderator Valves

- Communication devices in the event of equipment failure
- Enabling RP to perform gas tests for efficient site preparation

Turbine/Generator

- More emphasis on the PJB
- More emphasis on oversight

L15/Unique Components

- More front end planning
- More urgency from the crews

Critical Path

- Understanding equipment failure causes
- Changing RP process

Acknowledgements

We would like to express our sincere gratitude to Mr. Hanrahan for providing us the opportunity to conduct this wrench time study at OPG.

We would also like to thank our professors Dr. Harvel and Dr. Sankaranarayanan for all the support they have provided.

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Thank You for Attending!

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Questions?