FLUKE®
Reliability

Practical Creation and Use of the Planned Maintenance Schedule

Best Practices Webinar Series

Meet the Speakers

Blake A. Baca, CMRP, CRL

Owner/Asset Management Coach, BDB Solutions LLC

- Asset Management professional with over 34 years of experience in industry including mining, refining, refining, smelting, oil & gas, power generation, foundry, manufacturing, and material processing.
- Worked for Alcoa, Inc. for the first 20 years of career.
- Finished up Alcoa career as the Maintenance and Engineering Manager at Alcoa Rockdale Operations in Rockdale, Texas as the facility was shut down due to business conditions in December 2008.
- Asset Management Consultant for over 14 years.
- Bachelor of Science in Mechanical Engineering degree from Texas Tech University.
- Certified Maintenance and Reliability Professional (CMRP) and a Certified Reliability Leader (CRL).
- Served as Maintenance Manager for Barrick Gold Corporation (Goldstrike and Cortez Hills Mines) in Elko, Nevada from 2017-2019.

POLL QUESTION

Why are we here?

- Provide for attendees the ability to create a shared Planned Weekly Maintenance Schedule for Operations and Maintenance to review
- Provide for attendees a methodology to keep for all individuals to be abreast of what is happening in maintenance on a daily basis.
- Provide attendees with a methodology to manage Urgent and Immediate Break-in work in conjunction with the Weekly Maintenance Schedule
- Provide attendees with a practical example of a shared Planned Weekly Maintenance Schedule and Sheets for assigning Work Order to Maintenance Technicians (Lineout Sheets)

Asset Management

Asset Management

Per ISO 55000, the Institute for Asset Management definition:

- “coordinated activity of an organization to realize value from assets.”
- “An asset is an item, thing, or entity that has potential or actual value to an organization.”

Simply put, Asset Management is a systematic process of deploying, maintaining, upgrading, and disposing of assets cost-effectively

Requirements for Asset Management = Reliability Excellence

- Operations & Maintenance Partnership
  - Partnership Agreement
- Maintenance, Operations, and Management working together for common goals
- Active participation by all employees, not just maintenance employees
- An understanding of the Maintenance Department's role in Asset Management versus subservience to the Operations Department for repair ("customer")
- Asset Ownership including Reliability by Operations
- Work Management Process Buy In and Accountability
  - Well defined roles and responsibilities (operations and maintenance)
    - ***Not guidelines***
- Computerized Maintenance Management System (CMMS) utilization
- Utilization of asset life cycle management practices from cradle to grave – Total Cost of Ownership (TCO)
- A culture that understands the business case and the works to continuously improve

Requirements for Asset Management = Reliability Excellence

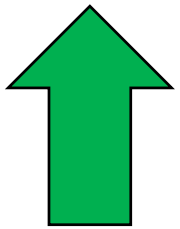
- Reliability Engineering
  - Application of appropriate Reliability Methodologies (Criticality, RCFA, FMEA, RCM, RAM, etc.)
  - Application of effective Condition Based/Predictive/Proactive Maintenance Tactics
  - **Reliability (Eliminating Failures) focus**

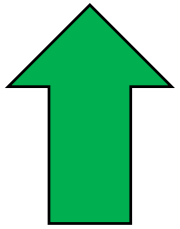
Reliability Principles Related to Asset Management

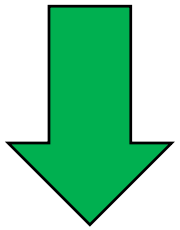
- Reliability is about eliminating the defects that result in failures, reduced ***availability***, ***and costs***

- If we’re unable to eliminate the defects, we must detect them early, plan and schedule them, minimize their consequences ***and costs***, thus improving ***availability***

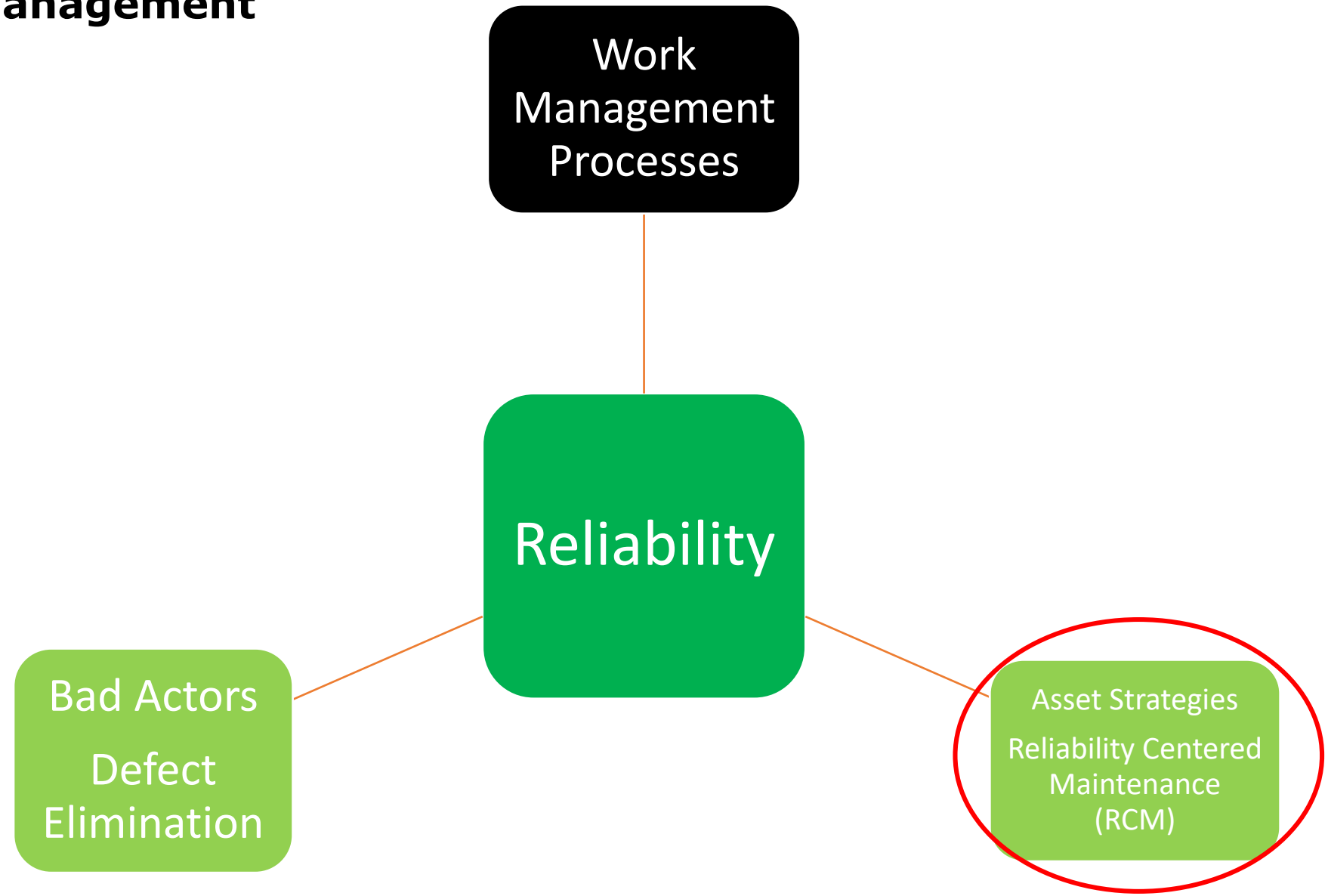
Why Asset Management?

Reliability 

Availability 

$$/unit 

Asset Management

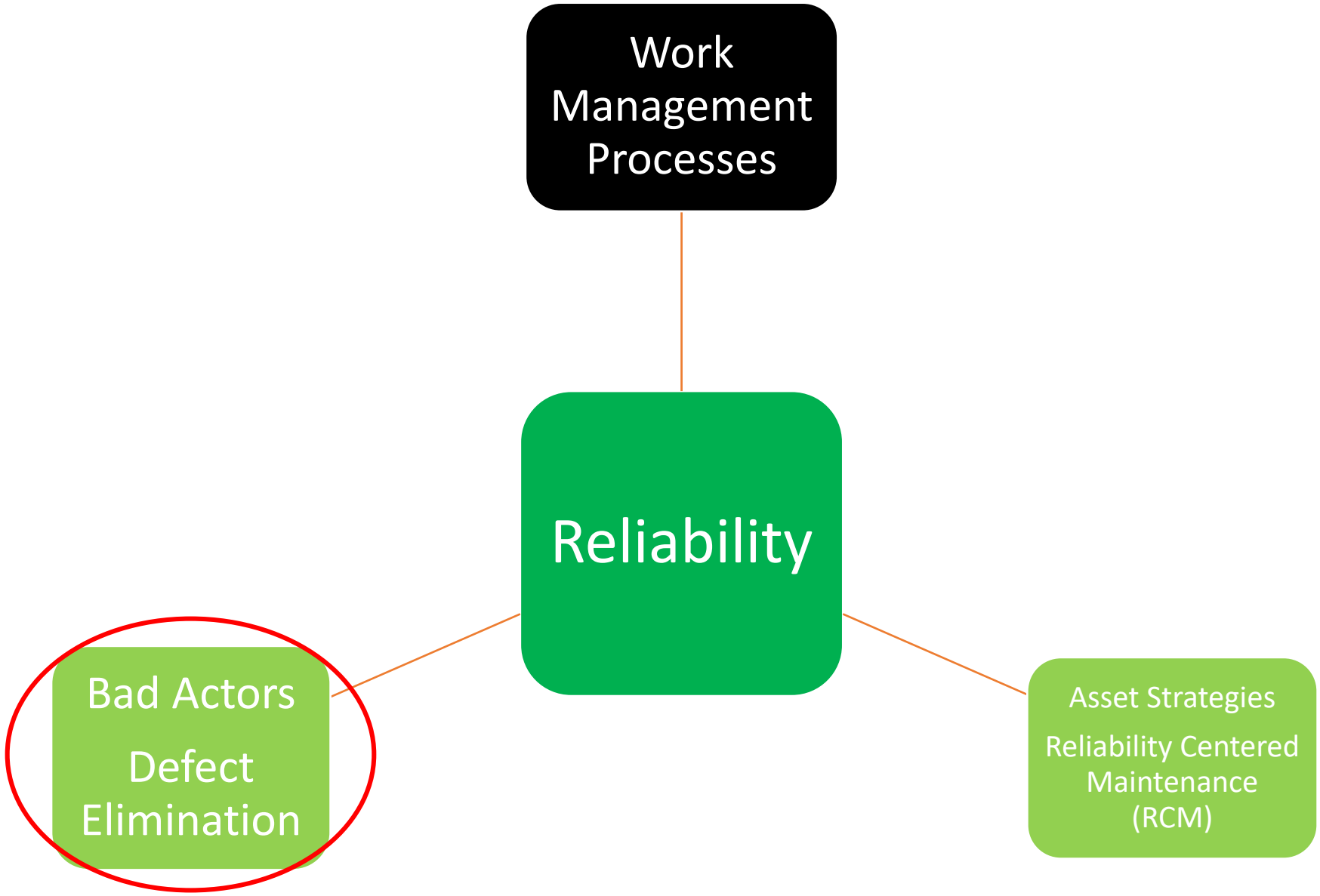


Recognizing Interdependence – The Philosophy

Asset Strategies

- **Do you have Asset Strategies?**
  - Preventive Maintenance (PM's)
  - Condition Based Maintenance (CBM)
  - Run to Failure (RTF) or No Scheduled Maintenance (NSM)
- **How were they created?**
  - OEM Recommendations
  - Failures
  - Best Practices
  - Someone requested them because of a failure
  - Reliability Centered Maintenance (RCM)?
- **Have the Asset Strategies been optimized?**
  - PM Optimization

Asset Management



Recognizing Interdependence – The Philosophy

Bad Actors/Defect Elimination

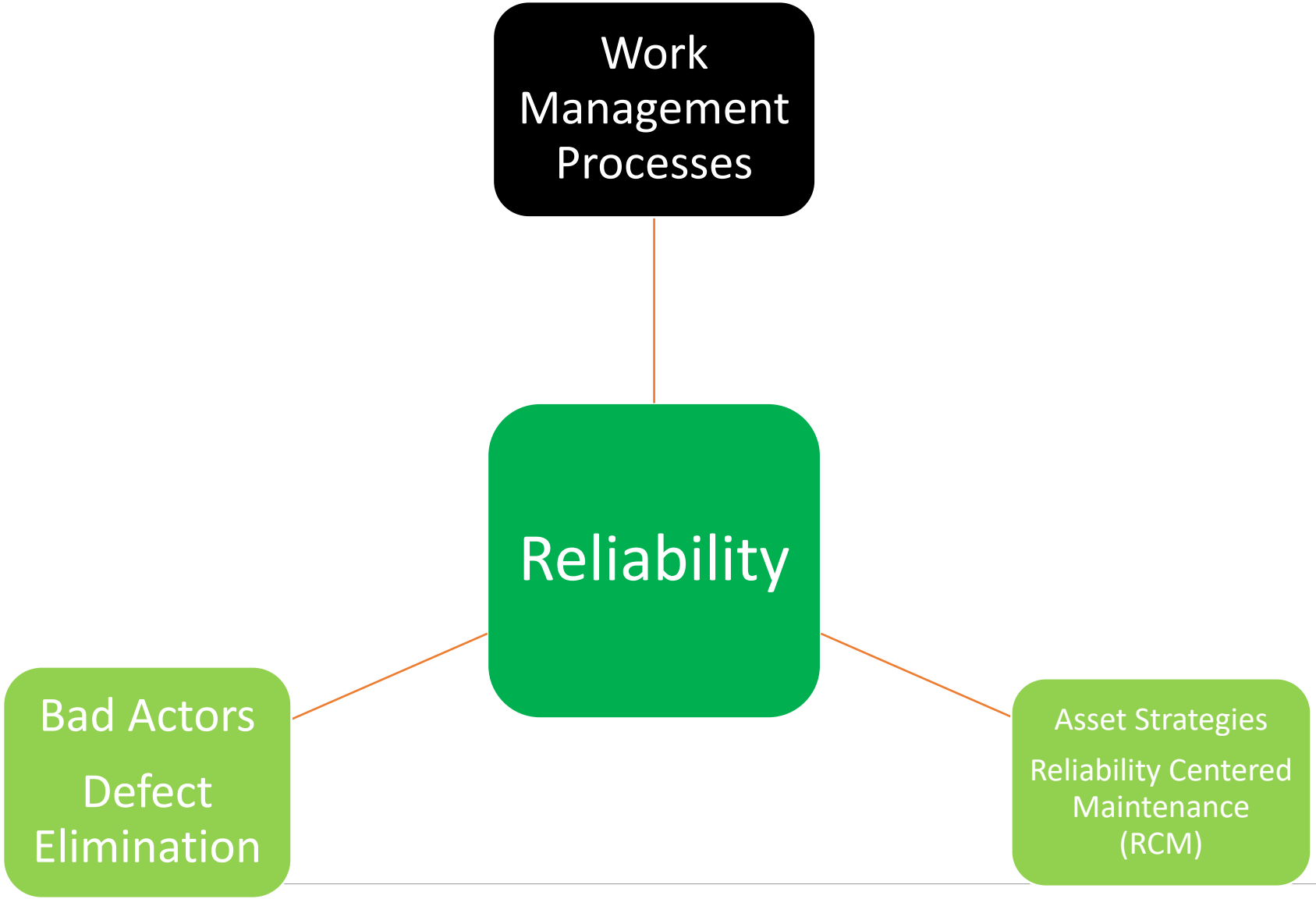
- Through the Work Management Process, are you capturing the frequency and associated **cost** (labor and materials) in the CMMS associated Urgent/Immediate Break-in work orders?
  - Is pareto analysis available?

- Does a process exist with roles and responsibilities to formally and periodically review the pareto of high frequency and high **cost** failures associated with those Urgent/Immediate Break-in work orders **with Leadership?**

  - Do reliability engineers exist who are **focused** on the elimination of failures?
    - Are they trained in formalized Root Cause Failure Analysis (RCFA)?

  - Is the **cost** associated with those failures or the impact to cash flow from lost production understood?
    - Corrective actions can result in improved asset strategies and reduced labor and materials associated with Work Management.

Asset Management



Shouting from the rooftops

Key Benefits of Planning and Scheduling

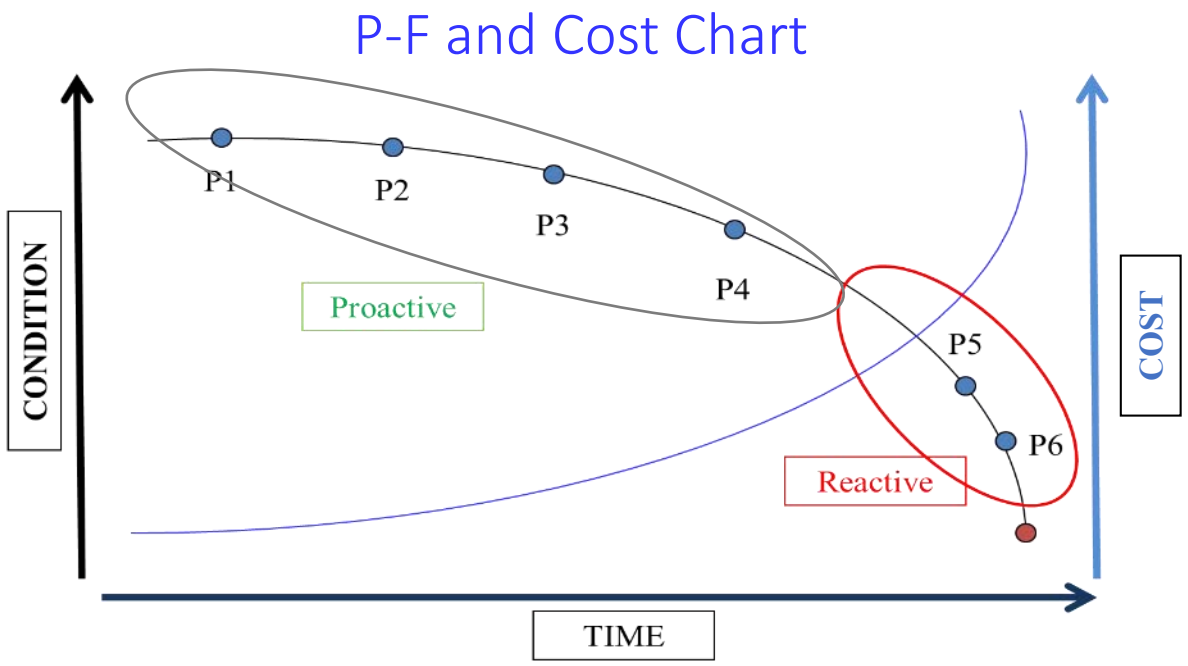
- Increased Safety of personnel
- Execute more work through better utilization of resources
- Reduced Maintenance Costs over time
- Improved Production (If working on the right things)
- Builds alignment on facility priorities
- Promotes/Facilitates Culture Change
- Improved Communication and Transparency

Why Planning and Scheduling?

Has this ever happened?

1. PdM Tech identifies an issue (potential failure)
2. PdM Tech documents via Work Request
3. Work request is approved and parts are ordered
4. Parts are received, kitted and verified
5. 2 months later failure occurs

Where did the process breakdown?



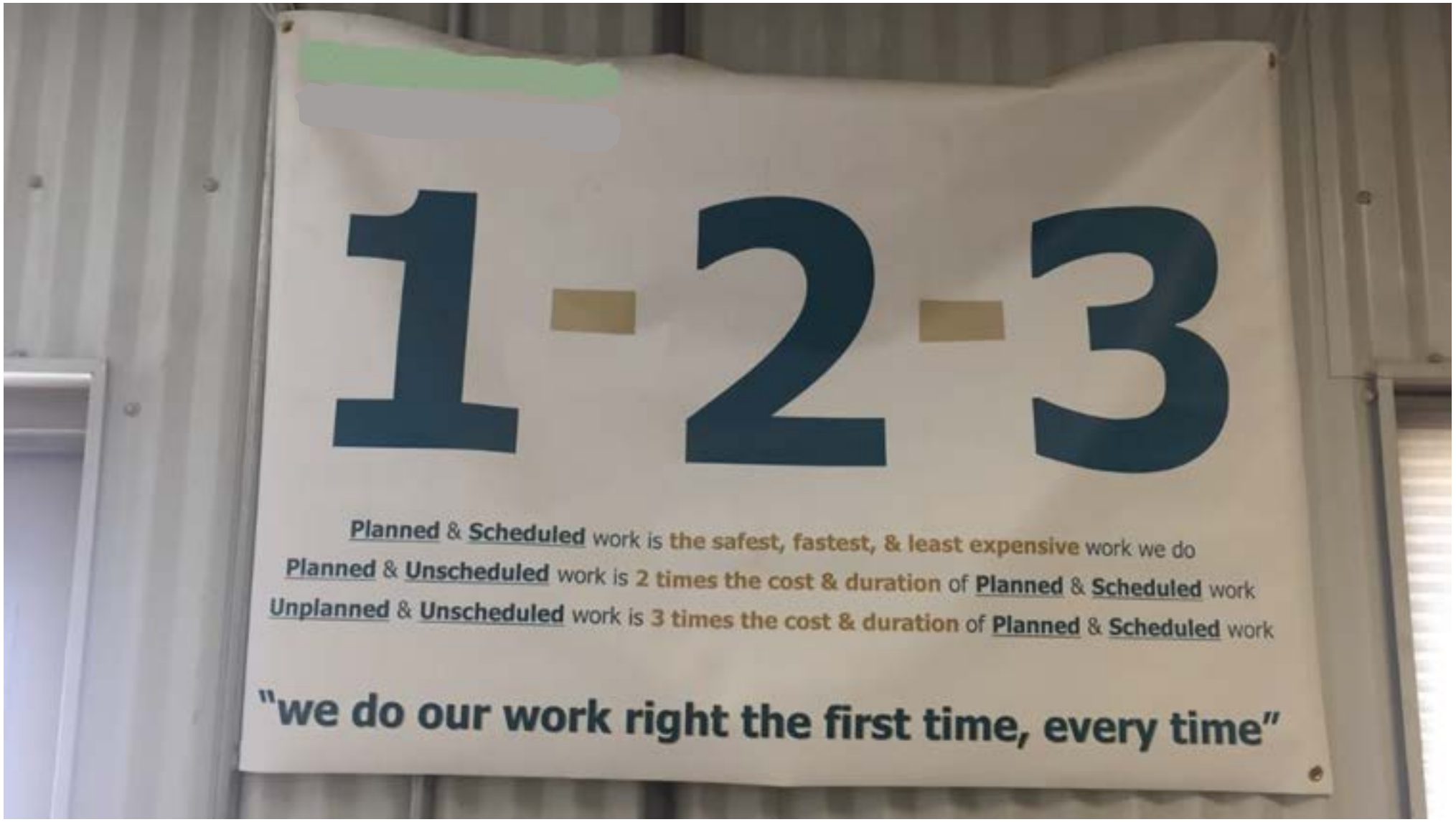
Work Management

- **Planned** & **Scheduled** work is the **safest, fastest, and least expensive** work.

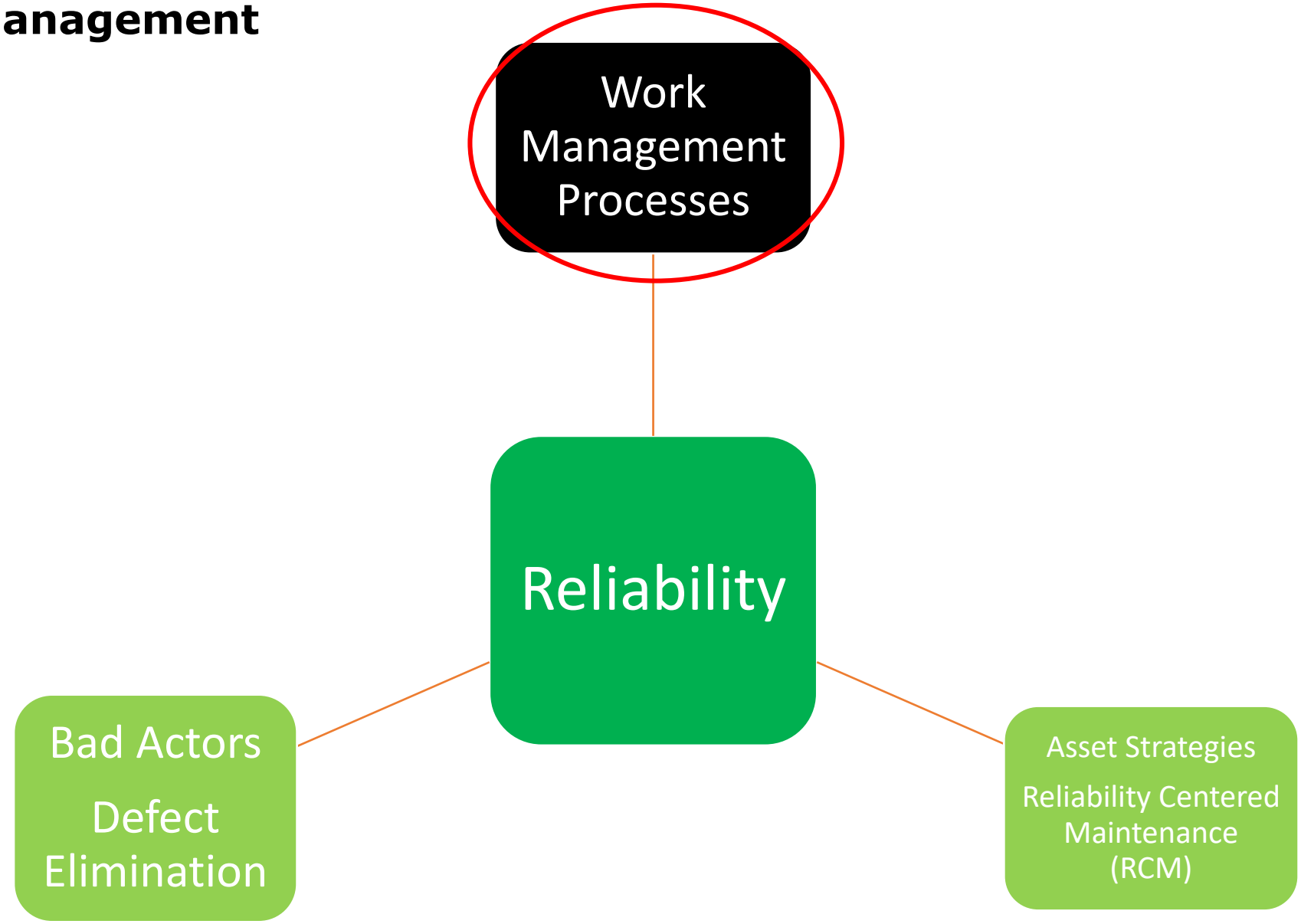
- **Planned** & **Unscheduled** work is at least **2 times the cost and duration** of **Planned** & **Scheduled** work.

- **Unplanned** and **Unscheduled** work is at least **5-7 times the cost and duration** of **Planned** & **Scheduled** work.

Work Management



Asset Management



Work Management

Work Management Goals and Expectations

- Leadership and Operations must have confidence in Maintenance execution to see the ***value*** in the investment of the Work Management versus the ***cost*** of the Work Management
- Maintenance must provide efficient, effective, and quality work to:
  - Allow for efficient execution of the schedule to reduce scheduled down duration to improve availability
  - Eliminate or substantially postpone failures
  - Increase the Mean Time Between Failures (MTBF) or Failure Free Period
  - Eliminate or reduce rework

Zero Injuries

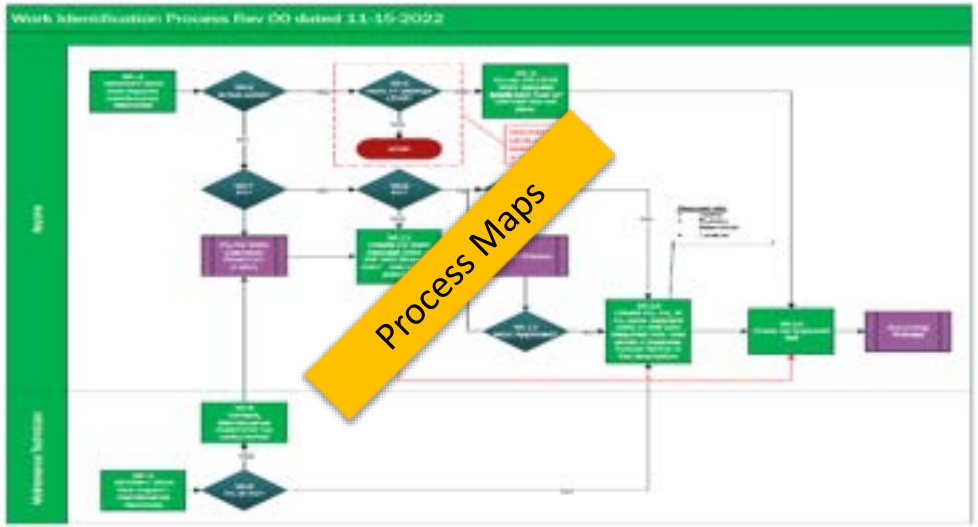
100% Availability

Work Management Philosophy

Work Management

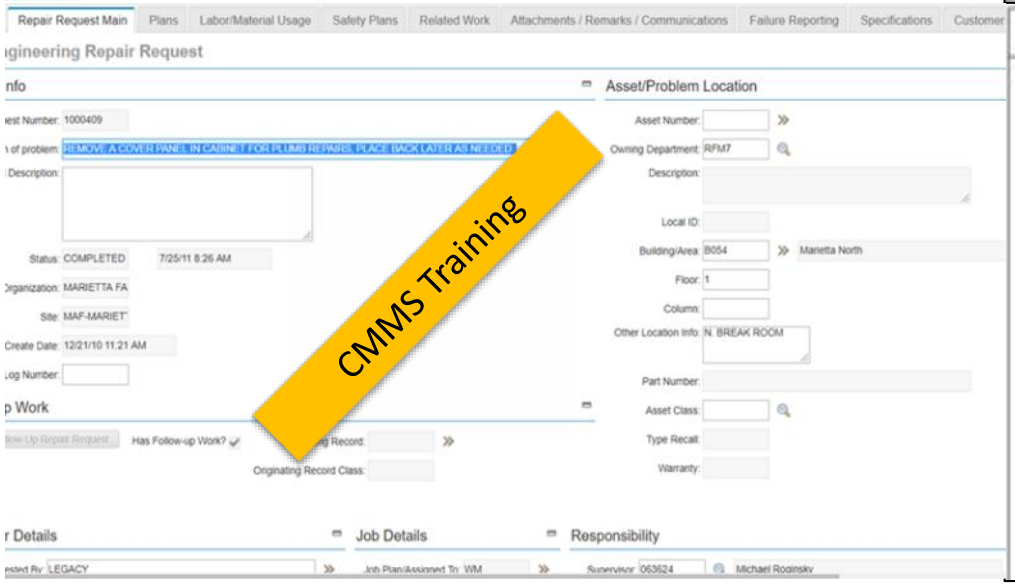
- Are processes developed, communicated, and utilized with well-defined roles and responsibilities to:
  - **Identify** Maintenance-related work
  - **Screen** for appropriateness and impact to the business
  - **Manage the backlog** such that planners work is forced ranked
  - **Plan the work** – the WHAT and HOW
    - Includes a Kitting and Staging process to provide the required parts and materials for efficient maintenance execution
  - **Schedule the work** – the WHO and WHEN
    - Begins first with the scheduling the PM's and CBM's
  - **Execute the work** - complete the planned and scheduled work as well as any urgent work in a safe and efficient manner
    - Includes and Urgent/Immediate (Break-in) Work Execution process with a ***philosophy to never break-in to PM's as they are what eliminate or substantially postpone failures***
  - **Complete Work Orders and Capture History** - historical purposes and Reliability Engineering, which can support updates to Asset Strategies

Work Management – Tools



Roles and Responsibilities								
No. Flowchart	Task Description	Operator	Maintenance Craft Person	Dispatch	Maintenance Supervisor	Operations Supervisor	Technical (Maintenance Reliability Engineer)	Process/Underground Mobile Equipment
PW-1	Operator identifies Work	X						
PW-2	Priority 0 or 1?	X						
PW-3	Submit Operator Pre-Use Inspection Form	X						
PW-4	Enter Inspection in Jigsaw	X						
PW-5	Collect Operator Pre-Use Forms					X		
PW-6	10 AM Operations/Maintenance Stand Up Meeting				X	X		
PW-7	Enter Work Request in Oracle				X			
PW-8	Maintenance Person Identifies Work		X					
PW-9	Priority 0 or 1?		X					
PW-10	Note Exception on Work Order		X					
PW-11	Notify dispatch	X						
PW-12	Contact Maintenance Supervisor		X	X			X	X

RRE's



No. Flowchart	Task Description	Function	Step Description
PW-7	Enter Work Request in Oracle	Maintenance Supervisor	...e results from the meeting, the maintenance ...r (or the Admin. Tech.) will enter appropriate work ...sts in Oracle. The following criteria is required for all ...rk requests: • Asset ID – **lowest level possible** • Short/Detailed Description • Priority 2: o A standby or alternative machine is available or stockpiling is possible o Production capacity will not be immediately affected o Minor Production Loss or potential production loss is possible based on operating plan. o Hazard that can be isolated or guarded o Failure does not create a safety risk o Due within 14 days • Priority 3: o Risk of production being affected is low o Hazard can be isolated or guarded o Failure does not create a safety risk o Due within 30 days

Backup Documentation

Work Management Workflows

1

Planned Workflow

- How proactive and planned work is requested and generated and executed from a PM, CBM, or work ticket from maintenance or operations
- Includes the life of a work request from work ticket to completion
- In house and contractor

2

Unplanned Workflow

- How work that results from an unplanned event is requested and executed from maintenance or operations
- Includes the life of a work request from work ticket to completion
- In house and contractor

Definitions

- **Planned Work**
  - Job Package is **complete** and materials are available onsite by the day before the scheduling meeting
  - Owned by the planner
  - Material is kitted prior to scheduled execution

- **Planned Work is NOT**
  - Material will be delivered during the week the work is scheduled
  - A job that someone want added after the scheduling meeting for the following week

Definitions

- **Unplanned Work**
  - Any work that:
    - Is not on the weekly schedule
    - Must be done
    - Cannot wait until the following week
- **Urgent Work**
  - Any work that stops production as determined by Operations
  - Maintenance Supervisor owns management and execution
  - **No Planner Involvement**
- **Break In Work**
  - Any work that breaks into the published weekly maintenance schedule

Asset Management

Work Management

Work Order Priority - Purpose

- Agree to standardized definitions, processes, and guidelines for assigning ***urgency*** rankings to work orders and work requests

Recognizing Interdependence and Where to Start – The Philosophy

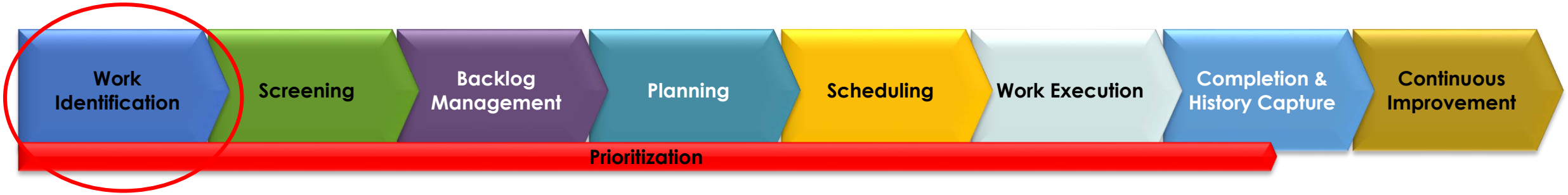
Work Management

- Prioritization
  - Do you have well defined, documented, and communicated work prioritization (urgency) with specific criteria?
    - Today and this shift
    - Within the next 7 days
    - Beyond 7 days
  - How was prioritization created?
  - Is ***EVERYONE*** **held accountable** to follow?

Determine Criteria for Priority Codes – Example

Plant Priority Codes			
Priority Code	Priority	Criteria	Expected Action
1	Urgent Break-in - within 24 hours (this shift or next shift)	Emergency Break-in Work Order A safety or environmental issue has been identified that will cause immediate harm and cannot be mitigated. Repairs for active Loss of Primary Containment (LOPC's): hydrocarbon (diesel or lighter), caustic or acid PRV/PSV relief/leaks. Remediation of any hazardous waste spilled to soil. Environmental issue that has been identified that will cause immediate harm and cannot be mitigated. Actual or potential violation of operating permits. A regulatory item is out of compliance. A major Production Loss or Equipment Loss is causing an immediate XX% or greater impact to production compared to plan Product quality adversely impacted and customer needs cannot be made up. A critical asset type is down per the Critical Asset Type List - see example	Interrupt the current approved work schedule or unscheduled work and attend to the issue immediately. Work is performed immediately and documented.
2	Break-in - Due less than 7 days	Urgent Break-in Work Order Controllable or potential safety hazard (condition in conjunction with other failures could result in injuries/incidents) that can be mitigated through some other means. Environmental situation that can be mitigated through some other means. Repairs for active LOPC drips/losses to secondary containment: hydrocarbon (diesel or lighter), caustic or acid. Remediation of a heavy hydrocarbon (heavier than diesel) to soil. Asset is down, and will soon cause serious disruption of production or plant operations Asset is down, but backup is available. Expedite repairs to support operations based on the criticality of the asset. Any situation resulting in a rate reduction on a process line and production can be made up. A situation where production can still be met, but with elevated risk. A work around allows production to continue based on operating plan A minor production loss or a potential production loss is possible based on operating plan	Attend to the work order within the next 7 days.
3	Routine - beyond 7 days	Normal Schedule Work Request Safety or environmental improvement Minimal or no immediate safety/environmental impact - unlikely to result in injuries/accidents Asset in need of routine service or maintenance, but not out of service Unit running on reliable spare or backup No current impact to Production or considered deferred Repair of critical spares. Repair of non-critical equipment. Non-production related repairs (buildings, grounds, painting).	Put this work into the next available schedule once the work is fully planned and deemed "Ready to Schedule."
4	Outage/Shutdown/Turnaround Planning	Outage/Shutdown Work Request Work has been identified that can only be performed during a significant outage or turnaround. Needs to be bundled with other work for coordinated planning, scheduling, and execution. New construction or projects requiring detailed engineering.	Put this work into the next available outage or shutdown once the work is planned and deemed "Ready to Schedule."
5	Small Projects	Small Project Work Request Work has been identified that is an improvement to the plant. This work may be capital or expense. Has not been approved to be paid for by operating budget. Will required an approved capital expediture by management. Could require Management of Change (MOC). This work may or may not require an outage.	Put this work into the next available schedule once the work is planned and deemed "Ready to Schedule." MOC is signed off, large expenditure complete and approved.

Work Management



Work Identification

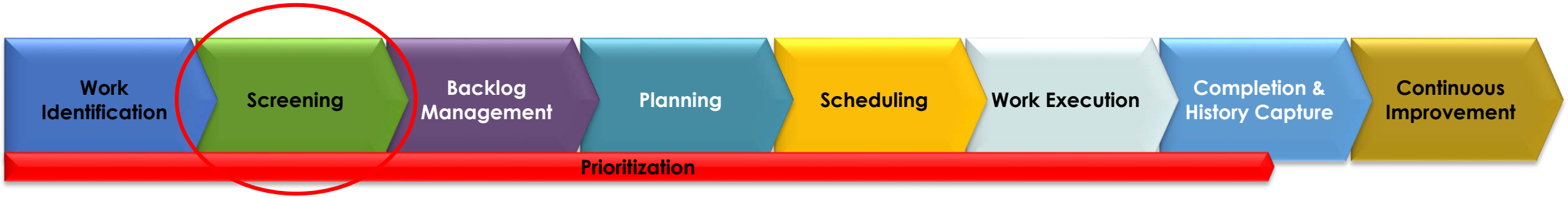
To determine and document equipment and facilities risks that could cause safety, health and environmental issues, on-time delivery issues, equipment failure/repairs, maintenance cost concerns and equipment improvements.

Work Request/Work Order?

- Work Request
  - A request for the Maintenance Department to perform some type of work based on Priority (Urgency), that needs to be planned by a maintenance planner

- Work Order
  - Work required by the Maintenance Department that has a Priority of Emergency (today) or Urgent (less than 7 days)
    - Already “approved”
  - An **approved** Work Request for the Maintenance Department to perform some type of work based on Priority, that needs to or has been planned by a maintenance planner

Work Management



Screening

To review the entire population of work identified, screen for appropriateness, and approve as necessary to meet safety, health, environmental, and business objectives. Everything should go through Screening.

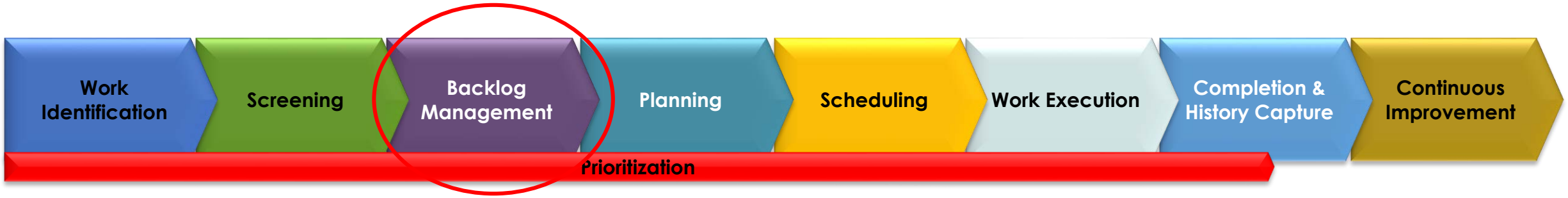
Work Request or Work Order?

- Work Request
  - Who will approve/reject Work Requests?
    - For Operations requests?
      - Operations understands business impacts and utilization priority
    - For Maintenance Requests?

Screening

- Prevents duplication of work requests
- Verifies that request is consistent with business needs
- Ensures completion of all required data to support Work Prioritization and Work Planning
- Can be AUTOMATED via the CMMS search functions or predefined criteria??

Work Management



Backlog Management

To review new as well as entire population of Work Orders to ensure all information is available for planning, to verify responsibilities, to verify priority for planning and execution, and to verify the economic justification of the work to be performed.

Backlog Management (Approved Work Orders)

- How will Planned (non-Urgent/Immediate) work orders be force ranked?

“What do you want the planner to work on first?”

Backlog Management

- Weekly, typically NLT Tuesday at a set time and location

- Maintenance Planner(s)
- Operations Area Stakeholders
- Others as determined by Maintenance/Operations Leadership

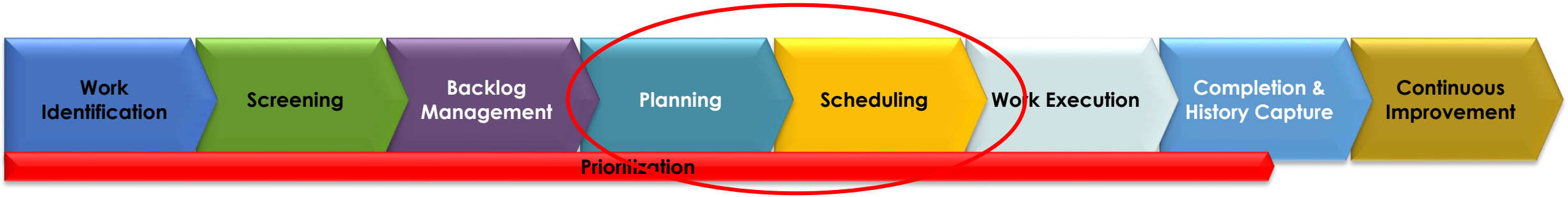
- Objective: understand and clarify priority by Operations for planners to focus on next week, next month, next year

- Pre-work: List of screened and approved Work Orders sent to Operations Stakeholders by COB on Monday

- Force rank list of screened and approved Work Orders

- Status of jobs with Status “Planning in Progress”

Work Management



“Words are free. It’s how you use them that may cost you.”

Are you “Planning” to do the job next week or are you “Scheduling” to do the job next week?

Planning

Work Management Process

- The “WHAT” and “HOW”
- Determine the detailed scope of work, skills, parts, tools, durations, costs, specifications, drawings, and other artifacts required to perform work safely, effectively, and efficiently
- Optimize the use of resources (labor, contractors, parts, tools, etc.) required to perform maintenance activities

Scheduling

Work Management Process

- The “WHEN” and “WHO”
- Determine when maintenance tasks can be performed safely based on availability of labor crafts or contractors with required skills, parts, tools, drawings, and equipment availability
- Minimize the impact of maintenance tasks on the production schedule

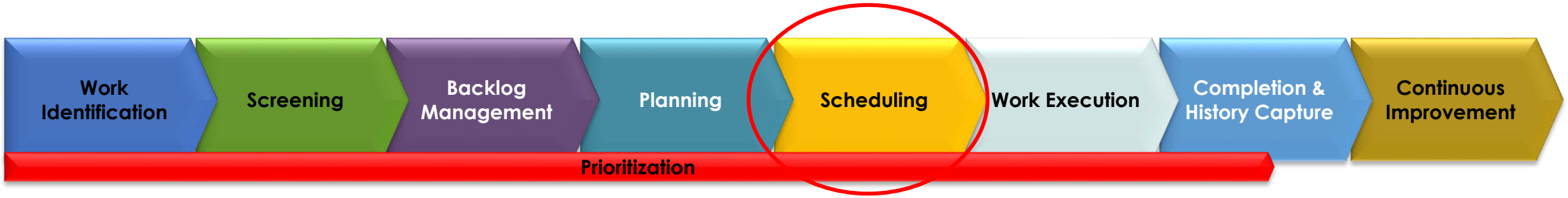
Planning

- To determine the detailed scope of work, skills, parts, tools, drawings and other artifacts, durations, and costs required to perform the work safely, effectively, and efficiently.
- The “What” “How” &“Duration”.
- Goal of Planning is to optimize the resources (labor crafts, contractors, parts, tools, drawings, etc.) required to perform maintenance activities

Common Causes of Failure

- Over Worked Planners
- Unqualified Planners
- Overlapping Job Responsibilities
- Careless Planners
- Lack of cooperation

Work Management



Scheduling

To determine when maintenance tasks can be performed safely based on availability of labor crafts or contractors with the required skills, parts, tools, drawings, and equipment availability.

The “When” and “Who”.

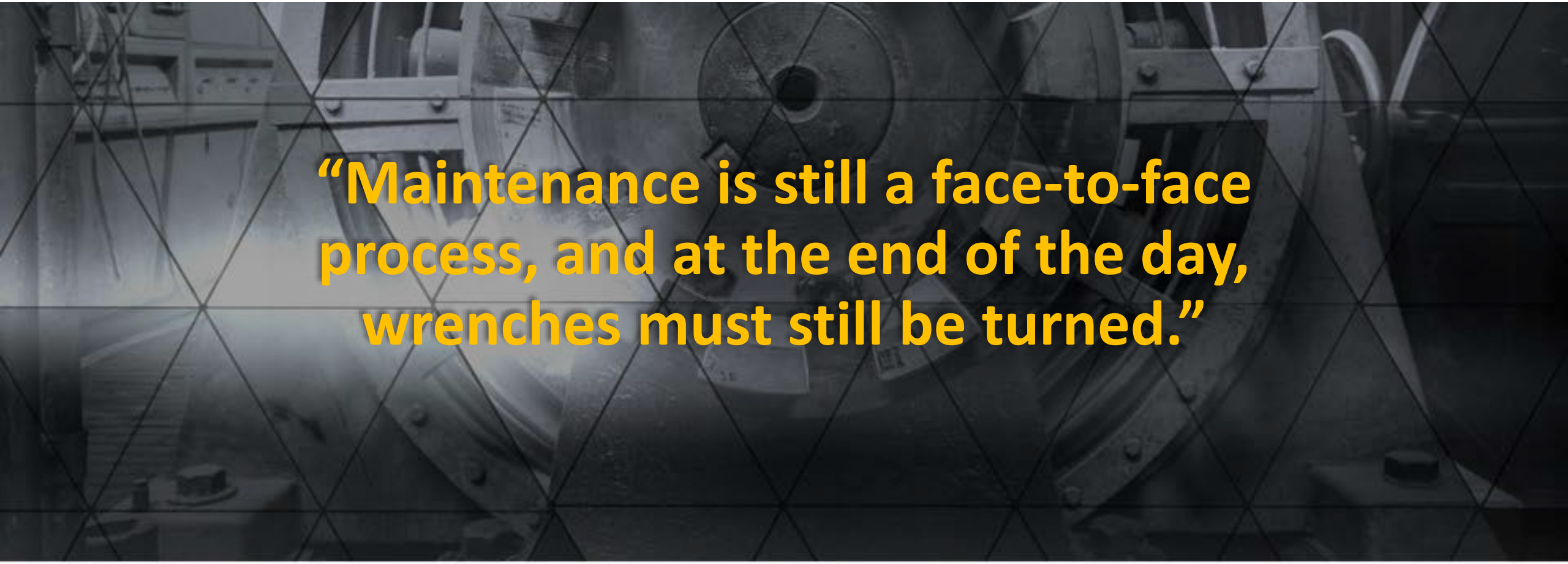
The goal of Scheduling is to minimize impact of maintenance tasks on the production schedule

Scheduling - Philosophy

- With all attempts, the schedule is 100% full, or as full as it can be with planned work

- If contractors are being used, their work is planned and scheduled by Planner/Schedulers as well
  - Why are they being used?
    - Special skills
    - Supplement Workforce

Asset Management



FLUKE® Reliability

Scheduled jobs	26
Break into (hours)	4
Tasks completed	14
Tasks On Going	10
Daily sch. attainment %	92%

Wednesday, September 21, 2022

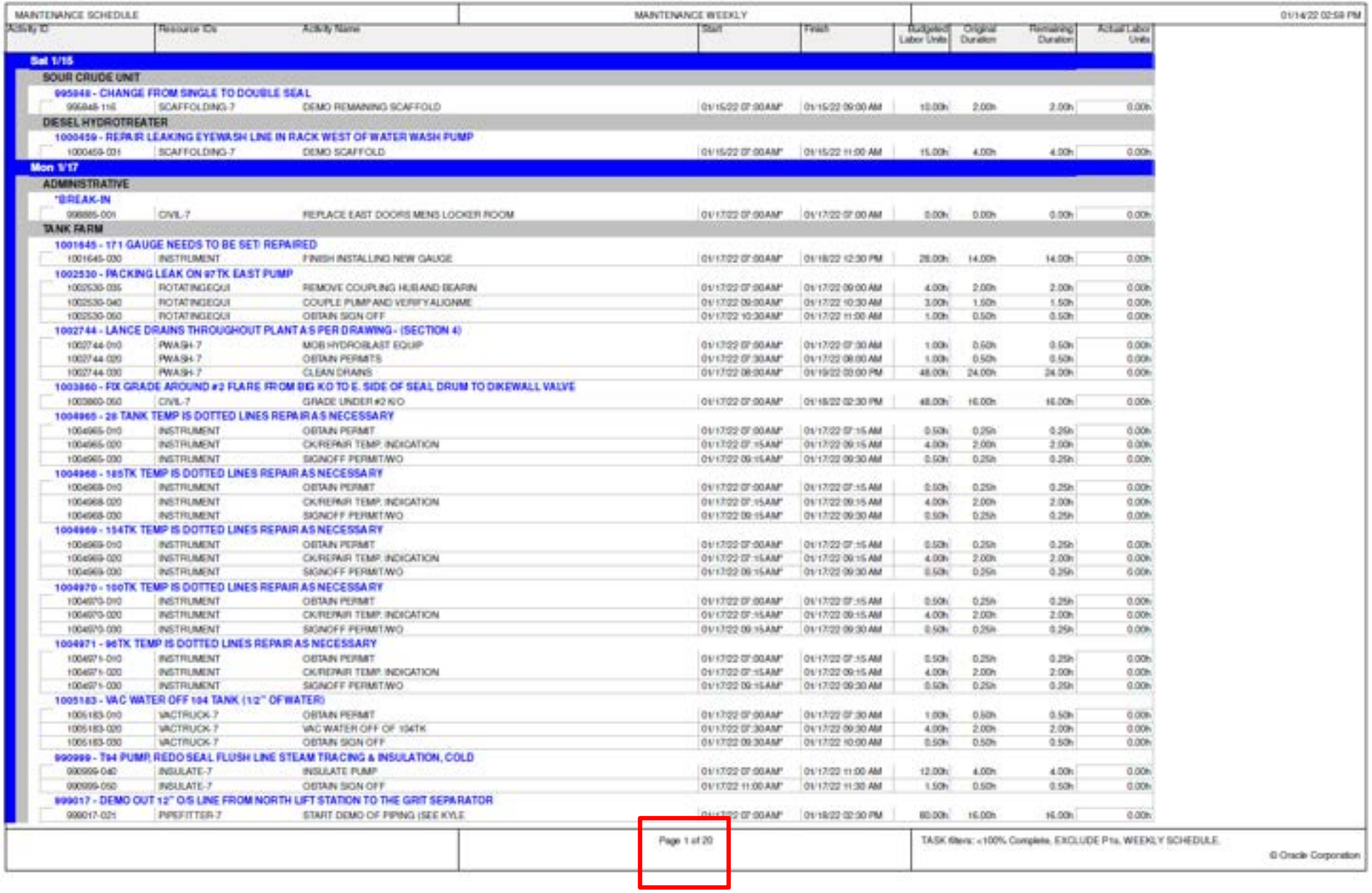
Craft	WO Number	WO Type	Description	Priority		I&E - Kyle Stevens	I&E - Micah Rider	I&E - Ronnie Dunham	I&E - Jacob Gauthier	I&E - George Hunter	I&E - Cory Folks	I&E - Brenden Todd	I&E - TBD	Mech. - Damon Ricketts	Mech. - Madison Leroy	Mech. - Marquan Gilmore	Mech. - Nick Nelloms	PF - Taylor Thomas	CW - Blake Edwards	PF - Bee Savoy	CW - Tyler Thomas	MW - Pat Malone	Crane - Steve Allen	Crane - Ronnie Bourg	Laborer - Chris Bailey	Laborer - Kevin Perry	APACHE Scaffold	APACHE Insulation/Paint	MI APACHE Scaffold	MI APACHE Insul./Paint	MI Spartan - Andrew Jones	MI Spartan - David Jozwiak	MI Spartan - Jared Berenguer	MI Spartan - Job Dunn	TBD	TBD	TBD	TBD	Count of MHRS Assigned	Work Comp.	Barrier Code	Comments/ Barriers
Mech.	89854	PM	Daily Equipment Checks: Wednesday	1	Sched.												10																					10	Yes		
I&E	89603	PM	MSA Eagle Meter Calibration: Wednesday	1	Sched.					2																												2	Yes		
APACHE	83093	Safety	Scaffold Inspection/Update Tags:Wednesday	1	Sched.																					4												4	Yes		Training Geroge on MSA calibration
MOC																																					0	On Going		
PSSR																																					0	On Going		
Mech.	90139	PM	F-1625 change out leaf filter	1	Sched.														6	6	6																18	Yes	PC	
Mech.	89959	PM	C-7009-A&B yaap air comp check oil, filter	2	Sched.											2						2															4	Yes		
Mech.	90399	CM	P-6092 pull pump change seal	1	Sched.											6						6															12	Yes		
Mech.	90396	CM	P-1503 not enough flow trouble shoot with OPS	1	Sched.											2						2															4	No	RS	
Mech.	90485	CM	PK-1501 centrfuge bowl clean replace gaskets install	1	Sched.														4	4	4																12	On Going		
Mech.	88638	Project	Assist with Fog truck unloading commissioning	1	Sched.										10																						10	On Going		
I&E	90095	PM	Monthly AC filter change out plant wide for all window units	1	Sched.						2																										2	Yes		
I&E	89041	CM	Repair/Replace lights that's out in the Admin building interior and exterior	1	Sched.																																0	No		
I&E	90418	CM	Replace flood lights that's out on the coolant tower	2	Sched.	2																															2	Yes		small one hour power outage for permit office
I&E	90281	PM	Weekly inspection of the motor bearing greasers plant wide	2	Sched.						5	5																									10	On Going		
I&E	87547	CM	F-1625, replace broken air supply regulator filter for shaker I during filter change out)	1	Sched.				4	3																											7	Yes		
I&E	88638	Project	Support and Commission all equipment on New Fog Unloading System Project	1	Sched.	2		8																													10	Yes		
I&E	78066	Project	GTB project, scan grounds through out the day as needed for excavation permitting	1	Sched.	4																															4	Yes		
MI	90539	MI	MI to inspect 50-AC-5503-1	1	Sched.																										5		5				10	On Going		
MI	90538	MI	MI to inspect 50-V-5302	1	Sched.																										5		5				10	On Going		
MI/APCH	90216	MI	Page 436 paint	1	Sched.																									10							10	On Going		3 scaffold needed
MI/APCH	90261	MI	Page 107 build scaffold	1	Sched.																								70								70	On Going		
MI/APCH	88809	MI	Page-152 demo scaffold	1	Sched.																																0	On Going		
MI/APCH	89914	MI	Page 1237 remove insulation	1	Sched.																									2							2	Yes		
APACHE	90259	CM	P-5507-B install insulation	1	Sched.																							4									4	Yes		
MI	90535	MI	MI to inspect circuit 172	1	Sched.																											5		5			10	On Going		
MI	90536	MI	MI to inspect circuit 87	1	Sched.																											5		5			10	On Going		
Mech.	90652	CM	F-5202 filter bank change out 2"ball valve for outlet of filter	1	Break in													6																			6	Yes		
Mech.	90568	CM	F-5202 filter bank change out 4ea 3/4"ball valve for blow down	1	Break in													4																			4	Yes		
Other	90436	Other	F-1629 Clean harbor to wash area down	1	Sched.																													10			10	Yes		

Weekly(Job Description)	WO#	Estimated Hrs	Equipment#	WO TYPE	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Status	Actual Hrs	Seq
Remove TSF eastern extention	Projects				x	x	x	x						
Install temporary reclaim water line	Projects				x	x	x	x						
Concrete for booster pad	Projects				x	x	x	x						
East destruct tank agitator	Projects				x	x	x	x						
500 area piping	D&J				x	x	x	x						
MONTHLY CRANE INSPECTIONS/ PM	W0034721		300-HO-001	PV		x						C		
Rebuild sump for projects	W0034976	15	450-PP-008	PM	x	x	x					C	18	
Prep pebble crusher mainshaft	W0033731	30	300-CR-201	PM				x	x			I	0	
Replace 420 air receiver	W0031982	16	420-PV-001	PM		x		x				C	16	
Replace lime tank agitator	W0034096	23	660-AG-004	PM		x						I	24	
Convert Kemix wedge wire screens to Derrick screens- TK 5 Screen 1	W0035267	38	450-TK-005	PM				x	x			I	22	
Convert Kemix wedge wire screens to Derrick screens- TK 5 Screen 2	W0035268	38	450-TK-005	PM								I	0	
Replace lime fill ceramic elbow	W0014637	8	800-PK-010-TK2	CM					x			I	0	
Replace lime valves with new Flowrox Valves	W0031248	4	800-PP-043	PM				x				C	6	
Install new WTP sump pump	W0031879	12	660-PP-027	PM	x							C	10	
Furnace cylinder is leaking	W0035000	4	500-FU-001-FP1	PM				x				C	4	
Replace acid wash feed spool	W0034607	4	Cancelled	PM			x			x		I	0	
Replace HDPE 90's	W0032656	6	500-PP-021	PM			x					C	6	
Add lateral wye for flush point	W0031299	2	500-PP-021	PM			x			x		I	0	
Rplace Kiln feed brass. Thermo fab seals and shim Seal Mating face	W0034459	23	500-KN-001	PM			x					C	20	
Wet end inspection	W0032270	8	Cancelled	CM			x					I	0	
INSPECT THE COMBUSTION AIR BLOWER FILTER	W0033442	0.5	500-KN-001-DR	PV			x					C	0.5	
CHECK THE GRAPHITE BLOCK FOR WEAR.	W0033443	0.5	500-KN-001-DR	PV			x					C	0.5	
CHECK THE GRAPHITE BLOCK FOR WEAR.	W0033441	0.5	500-KN-001	PV			x					C	0.5	
Monthly Pre-Dryer & Kiln Lubrication PM	W0033444	2	500-KN-001-DR	PV			x					C	0.5	
Quarterly Mechanical Demister Screen Inspection PM.	W0034736	4	500-MS-012	PV			x					C	4	
Monthly Flop Gate Operation Inspection PM.	W0034735	2	500-KN-001-DR	PV			x					C	0	
Weekly 100 Area Mechanical Inspection PM	W0035198	2	100	PV	x							C	2	
Weekly Jaw Gap Adjustment and Die Inspection PM	W0035200	4	100-CR-001	PV	x							C	2	
Weekly 150 Area Mechanical Conveyor Running Inspection PM	W0035202	2	150-CV	PV				x				C	2	
Weekly 200 Area Mechanical Apron Feeder Running PM.	W0035205	2	200	PV				x				C	2	
Weekly 200 Area Mechanical Conveyor Running Inspection PM	W0035207	1	200-CV	PV				x	x			C	1	
Weekly Cyclone Feed Pump Heat Exchanger Cleaning PM	W0035209	1	300	PV		x			x			C	1	
Weekly Pebble Crusher Area Mechanical Inspection PM	W0035213	2	300-CR-201	PV		x						C	3	
Weekly 300 Area Mechanical Conveyor Running Inspection PM	W0035214	3	300-CV	PV	x		x					C	3	
Gland Pump Health Daily Checksheet.	W0035223	7	420-PP-001	PV		x			x	x		C	9	
Monthly 500 Area Natural Gas Piping Inspection PM	W0034033	1	500	PV	x							C	2	
Weekly Lime Area Mechanical Inspection PM	W0035231	6	800-LS	PV	x							C	2	

Week: Sept 4-10, 2020

Maintenance Schedule -

									Per Damore	Justin Wayne	Mason Chapp	Mike Williams	Mike Miller	Steve Williams	Alexis Erwin	Gen Unfilled 1	Gen Unfilled 2	Total	Total Man-hrs Scheduled
					Available Weekly Hours for Productive Work:				40	40	40	30	40	40	40	40	40	350	190
					Available Daily Hours for Productive Work:				10	10	10	10	10	10	10	10	10		80
ID					Administrative														
AD1					Safety Meeting			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	2.5
AD2					Turnover shift change meetings			0	0	0	0	0	0	0	0	0	0	0.0
AD3					Vacation			10	10	0	0	0	0	0	0	0	20	20.0
AD4					Sick			0	0	0	0	0	0	0	0	0	0	0.0
AD5					Training			0	0	0	0	0	0	0	0	0	0	0.0
AD6					Starts and Quits / Shower, Breaks, Lunch)			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	14	7.5
AD7					Time Off / Holidays			0	0	0	0	0	0	0	0	0	0	0.0
					Net Available Daily Hours for Productive Work			38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	312	160.0
					Resource load			95%	95%	74%	67%	95%	95%	21%	5%	5%	17%	80%
Comp. in eMaint (LITTHC)	PM / CBI	Work Order Number	Priority #	Equip #	Planned & Scheduled Work Short WO Description	day scheduled	Est Job Duration	Per Damore	Justin Wayne	Mason Chapp	Mike Williams	Mike Miller	Steve Williams	Alexis Erwin	Gen Unfilled 1	Gen Unfilled 2		Man-hrs Scheduled
		1219		700GN002	Gen 2 DAILY CHECKS	Monday	0.25										0.00	0.00
		1219		700GN002	Gen 2 DAILY CHECKS	Tuesday	0.25	0.25	0.25								0.00	0.50
		1219		700GN002	Gen 2 DAILY CHECKS	Wednesday	0.25		0.25	0.25							0.00	0.50
		1219		700GN002	Gen 2 DAILY CHECKS	Thursday	0.25										0.00	0.00
		1219		700GN002	Gen 2 DAILY CHECKS	Friday	0.25		0.25	0.25							0.00	0.50
		1219		700GN002	Gen 2 DAILY CHECKS	Saturday	0.25			0.25							0.00	0.25
		1219		700GN002	Gen 2 DAILY CHECKS	Sunday	0.25			0.25							0.00	0.25
		1227		400SORBLD	Daily Lab Mechanical Inspection	Monday	0.25										0.00	0.00
		1227		400SORBLD	Daily Lab Mechanical Inspection	Tuesday	0.25	0.25	0.25								0.00	0.50
		1227		400SORBLD	Daily Lab Mechanical Inspection	Wednesday	0.25		0.25	0.25							0.00	0.50
		1227		400SORBLD	Daily Lab Mechanical Inspection	Thursday	0.25										0.00	0.00
		1227		400SORBLD	Daily Lab Mechanical Inspection	Friday	0.25		0.25	0.25							0.00	0.50
		1227		400SORBLD	Daily Lab Mechanical Inspection	Saturday	0.25			0.25							0.00	0.25
		1227		400SORBLD	Daily Lab Mechanical Inspection	Sunday	0.25			0.25							0.00	0.25
		1220		700GN001	Gen 1 DAILY CHECKS	Monday	0.25										0.00	0.00
		1220		700GN001	Gen 1 DAILY CHECKS	Tuesday	0.25	0.25	0.25								0.00	0.50
		1220		700GN001	Gen 1 DAILY CHECKS	Wednesday	0.25		0.25	0.25							0.00	0.50
		1220		700GN001	Gen 1 DAILY CHECKS	Thursday	0.25										0.00	0.00
		1220		700GN001	Gen 1 DAILY CHECKS	Friday	0.25		0.25	0.25							0.00	0.50
		1220		700GN001	Gen 1 DAILY CHECKS	Saturday	0.25			0.25							0.00	0.25
		1220		700GN001	Gen 1 DAILY CHECKS	Sunday	0.25			0.25							0.00	0.25
		1221		700GN003	Gen 3 DAILY CHECKS	Monday	0.25										0.00	0.00
		1221		700GN003	Gen 3 DAILY CHECKS	Tuesday	0.25	0.25	0.25								0.00	0.50
		1221		700GN003	Gen 3 DAILY CHECKS	Wednesday	0.25		0.25	0.25							0.00	0.50
		1221		700GN003	Gen 3 DAILY CHECKS	Thursday	0.25										0.00	0.00
		1221		700GN003	Gen 3 DAILY CHECKS	Friday	0.25		0.25	0.25							0.00	0.50
		1221		700GN003	Gen 3 DAILY CHECKS	Saturday	0.25			0.25							0.00	0.25
		1221		700GN003	Gen 3 DAILY CHECKS	Sunday	0.25			0.25							0.00	0.25
		1222		650GN006	Booster Area DAILY CHECK	Monday	0.50										0.00	0.00
		1222		650GN006	Booster Area DAILY CHECK	Tuesday	0.50	0.50	0.50								0.00	1.00
		1222		650GN006	Booster Area DAILY CHECK	Wednesday	0.50		0.50	0.50							0.00	1.00
		1222		650GN006	Booster Area DAILY CHECK	Thursday	0.50										0.00	0.00
		1222		650GN006	Booster Area DAILY CHECK	Friday	0.50		0.50	0.50							0.00	1.00
		1222		650GN006	Booster Area DAILY CHECK	Saturday	0.50			0.50							0.00	0.50
		1222		650GN006	Booster Area DAILY CHECK	Sunday	0.50			0.50							0.00	0.50
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Monday	0.50										0.00	0.00
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Tuesday	0.50	0.50	0.50								0.00	1.00
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Wednesday	0.50		0.50	0.50							0.00	1.00
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Thursday	0.50										0.00	0.00
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Friday	0.50		0.50	0.50							0.00	1.00
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Saturday	0.50			0.50							0.00	0.50
		1223		400ADRBLD	Daily ADR Mechanics Inspection	Sunday	0.50			0.50							0.00	0.50
		1229		100CR001	Crushing and Conveying Daily Checks	Monday	0.50										0.00	0.00



MAINTENANCE SCHEDULE | MAINTENANCE WEEKLY | 01/14/22 02:59 PM

Activity ID	Resource IDs	Activity Name	Start	Finish	Budgeted Labor Units	Original Duration	Remaining Duration	Actual Labor Units
Sat 1/15								
SOUR CRUDE UNIT								
995848 - CHANGE FROM SINGLE TO DOUBLE SEAL								
995848-116	SCAFFOLDING-7	DEMO REMAINING SCAFFOLD	01/15/22 07:00 AM*	01/15/22 09:00 AM	10.00h	2.00h	2.00h	0.00h
DIESEL HYDROTREATER								
1000459 - REPAIR LEAKING EYEWASH LINE IN RACK WEST OF WATER WASH PUMP								
1000459-031	SCAFFOLDING-7	DEMO SCAFFOLD	01/15/22 07:00 AM*	01/15/22 11:00 AM	15.00h	4.00h	4.00h	0.00h
Mon 1/17								
ADMINISTRATIVE								
"BREAK-IN								
998885-001	CIVIL-7	REPLACE EAST DOORS MENS LOCKER ROOM	01/17/22 07:00 AM*	01/17/22 07:00 AM	0.00h	0.00h	0.00h	0.00h
TANK FARM								
1001645 - 171 GAUGE NEEDS TO BE SET/ REPAIRED								
1001645-030	INSTRUMENT	FINISH INSTALLING NEW GAUGE	01/17/22 07:00 AM*	01/18/22 12:30 PM	28.00h	14.00h	14.00h	0.00h
1002530 - PACKING LEAK ON 97 TK EAST PUMP								
1002530-035	ROTATINGEQUI	REMOVE COUPLING HUB AND BEARIN	01/17/22 07:00 AM*	01/17/22 09:00 AM	4.00h	2.00h	2.00h	0.00h
1002530-040	ROTATINGEQUI	COUPLE PUMP AND VERIFY ALIGNME	01/17/22 09:00 AM*	01/17/22 10:30 AM	3.00h	1.50h	1.50h	0.00h
1002530-050	ROTATINGEQUI	OBTAIN SIGN OFF	01/17/22 10:30 AM*	01/17/22 11:00 AM	1.00h	0.50h	0.50h	0.00h
1002744 - LANCE DRAINS THROUGHOUT PLANT AS PER DRAWING - (SECTION 4)								
1002744-010	PWASH-7	MOB HYDROBLAST EQUIP	01/17/22 07:00 AM*	01/17/22 07:30 AM	1.00h	0.50h	0.50h	0.00h
1002744-020	PWASH-7	OBTAIN PERMITS	01/17/22 07:30 AM*	01/17/22 08:00 AM	1.00h	0.50h	0.50h	0.00h
1002744-030	PWASH-7	CLEAN DRAINS	01/17/22 08:00 AM*	01/19/22 03:00 PM	48.00h	24.00h	24.00h	0.00h
1003860 - FIX GRADE AROUND #2 FLARE FROM BIG KO TO E. SIDE OF SEAL DRUM TO DIKEWALL VALVE								
1003860-050	CIVIL-7	GRADE UNDER #2 KO	01/17/22 07:00 AM*	01/18/22 02:30 PM	48.00h	16.00h	16.00h	0.00h
1004965 - 28 TANK TEMP IS DOTTED LINES REPAIR AS NECESSARY								
1004965-010	INSTRUMENT	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:15 AM	0.50h	0.25h	0.25h	0.00h
1004965-020	INSTRUMENT	OK/REPAIR TEMP. INDICATION	01/17/22 07:15 AM*	01/17/22 09:15 AM	4.00h	2.00h	2.00h	0.00h
1004965-030	INSTRUMENT	SIGNOFF PERMIT/WO	01/17/22 09:15 AM*	01/17/22 09:30 AM	0.50h	0.25h	0.25h	0.00h
1004968 - 185TK TEMP IS DOTTED LINES REPAIR AS NECESSARY								
1004968-010	INSTRUMENT	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:15 AM	0.50h	0.25h	0.25h	0.00h
1004968-020	INSTRUMENT	OK/REPAIR TEMP. INDICATION	01/17/22 07:15 AM*	01/17/22 09:15 AM	4.00h	2.00h	2.00h	0.00h
1004968-030	INSTRUMENT	SIGNOFF PERMIT/WO	01/17/22 09:15 AM*	01/17/22 09:30 AM	0.50h	0.25h	0.25h	0.00h
1004969 - 154TK TEMP IS DOTTED LINES REPAIR AS NECESSARY								
1004969-010	INSTRUMENT	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:15 AM	0.50h	0.25h	0.25h	0.00h
1004969-020	INSTRUMENT	OK/REPAIR TEMP. INDICATION	01/17/22 07:15 AM*	01/17/22 09:15 AM	4.00h	2.00h	2.00h	0.00h
1004969-030	INSTRUMENT	SIGNOFF PERMIT/WO	01/17/22 09:15 AM*	01/17/22 09:30 AM	0.50h	0.25h	0.25h	0.00h
1004970 - 150TK TEMP IS DOTTED LINES REPAIR AS NECESSARY								
1004970-010	INSTRUMENT	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:15 AM	0.50h	0.25h	0.25h	0.00h
1004970-020	INSTRUMENT	OK/REPAIR TEMP. INDICATION	01/17/22 07:15 AM*	01/17/22 09:15 AM	4.00h	2.00h	2.00h	0.00h
1004970-030	INSTRUMENT	SIGNOFF PERMIT/WO	01/17/22 09:15 AM*	01/17/22 09:30 AM	0.50h	0.25h	0.25h	0.00h
1004971 - 96TK TEMP IS DOTTED LINES REPAIR AS NECESSARY								
1004971-010	INSTRUMENT	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:15 AM	0.50h	0.25h	0.25h	0.00h
1004971-020	INSTRUMENT	OK/REPAIR TEMP. INDICATION	01/17/22 07:15 AM*	01/17/22 09:15 AM	4.00h	2.00h	2.00h	0.00h
1004971-030	INSTRUMENT	SIGNOFF PERMIT/WO	01/17/22 09:15 AM*	01/17/22 09:30 AM	0.50h	0.25h	0.25h	0.00h
1005183 - VAC WATER OFF 104 TANK (1/2" OF WATER)								
1005183-010	VACTRUCK-7	OBTAIN PERMIT	01/17/22 07:00 AM*	01/17/22 07:30 AM	1.00h	0.50h	0.50h	0.00h
1005183-020	VACTRUCK-7	VAC WATER OFF OF 104TK	01/17/22 07:30 AM*	01/17/22 09:30 AM	4.00h	2.00h	2.00h	0.00h
1005183-030	VACTRUCK-7	OBTAIN SIGN OFF	01/17/22 09:30 AM*	01/17/22 10:00 AM	0.50h	0.50h	0.50h	0.00h
990999 - T94 PUMP REDO SEAL FLUSH LINE STEAM TRACING & INSULATION, COLD								
990999-040	INSULATE-7	INSULATE PUMP	01/17/22 07:00 AM*	01/17/22 11:00 AM	12.00h	4.00h	4.00h	0.00h
990999-050	INSULATE-7	OBTAIN SIGN OFF	01/17/22 11:00 AM*	01/17/22 11:30 AM	1.50h	0.50h	0.50h	0.00h
999017 - DEMO OUT 12" O/S LINE FROM NORTH LIFT STATION TO THE GRIT SEPARATOR								
999017-021	PIPEFITTER-7	START DEMO OF PIPING (SEE KYLE	01/17/22 07:00 AM*	01/18/22 02:30 PM	60.00h	16.00h	16.00h	0.00h

Page 1 of 20

TASK filters: <100% Complete, EXCLUDE P1s, WEEKLY SCHEDULE

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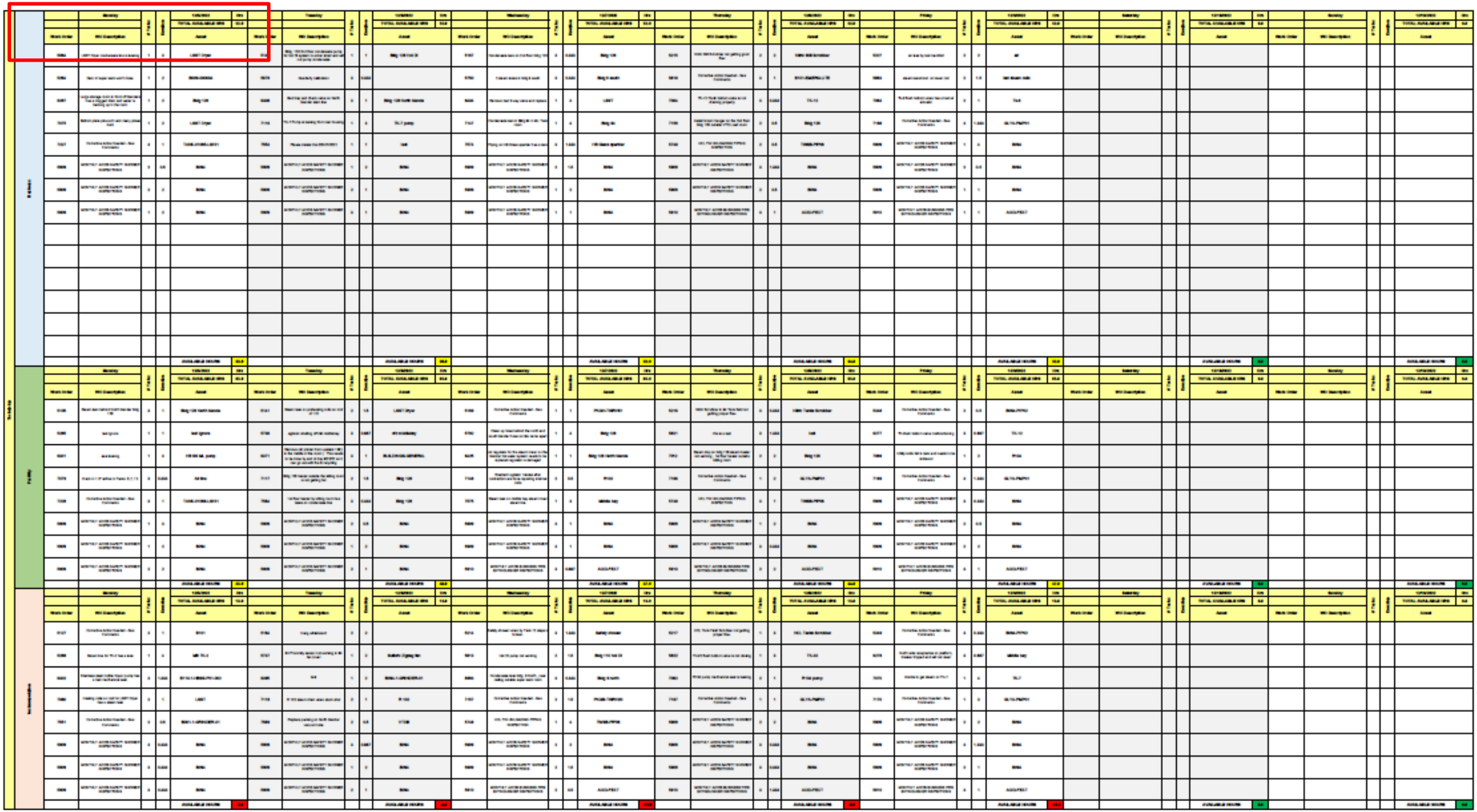
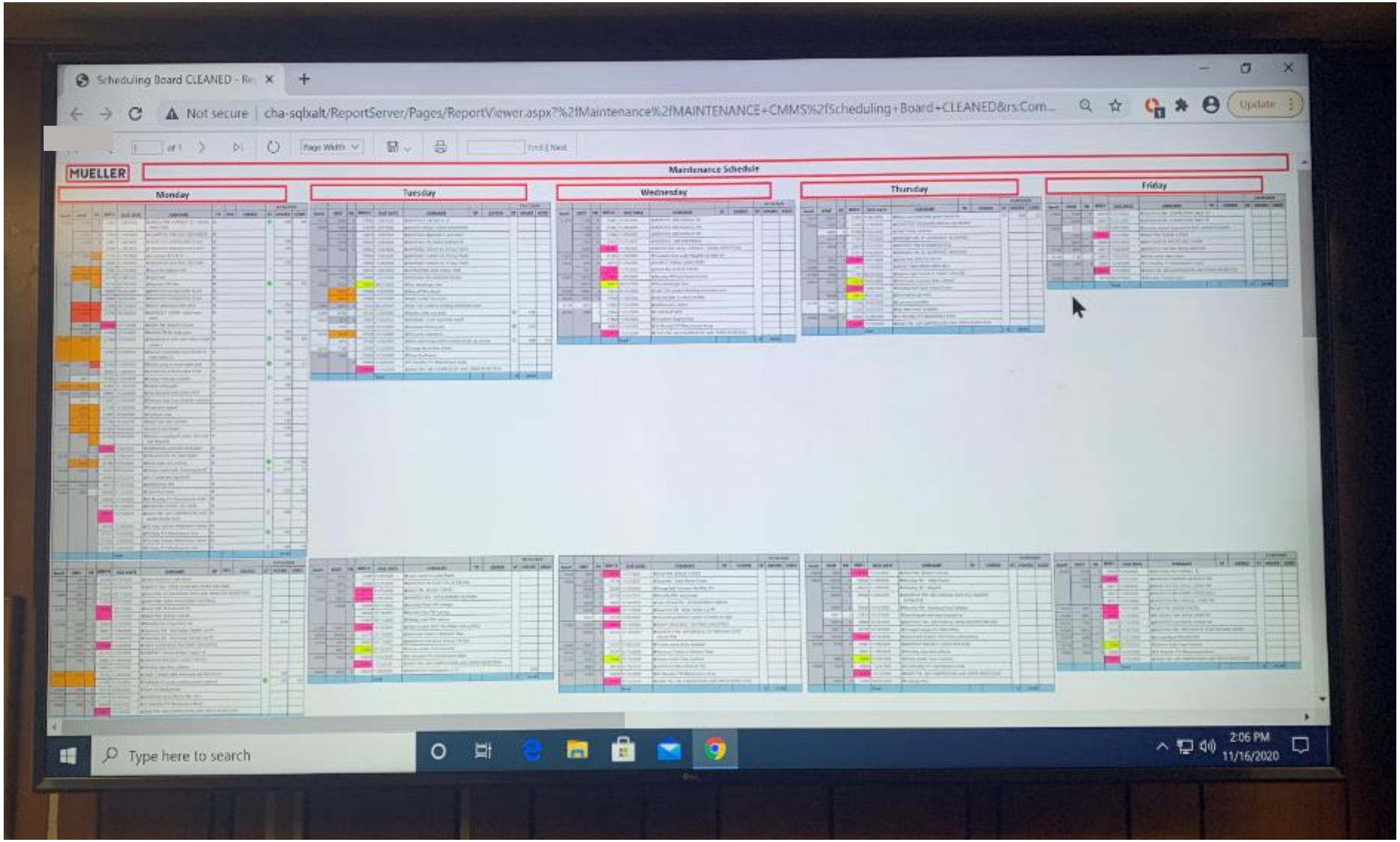
Visual Daily Management for Maintenance

FLUKE® Reliability

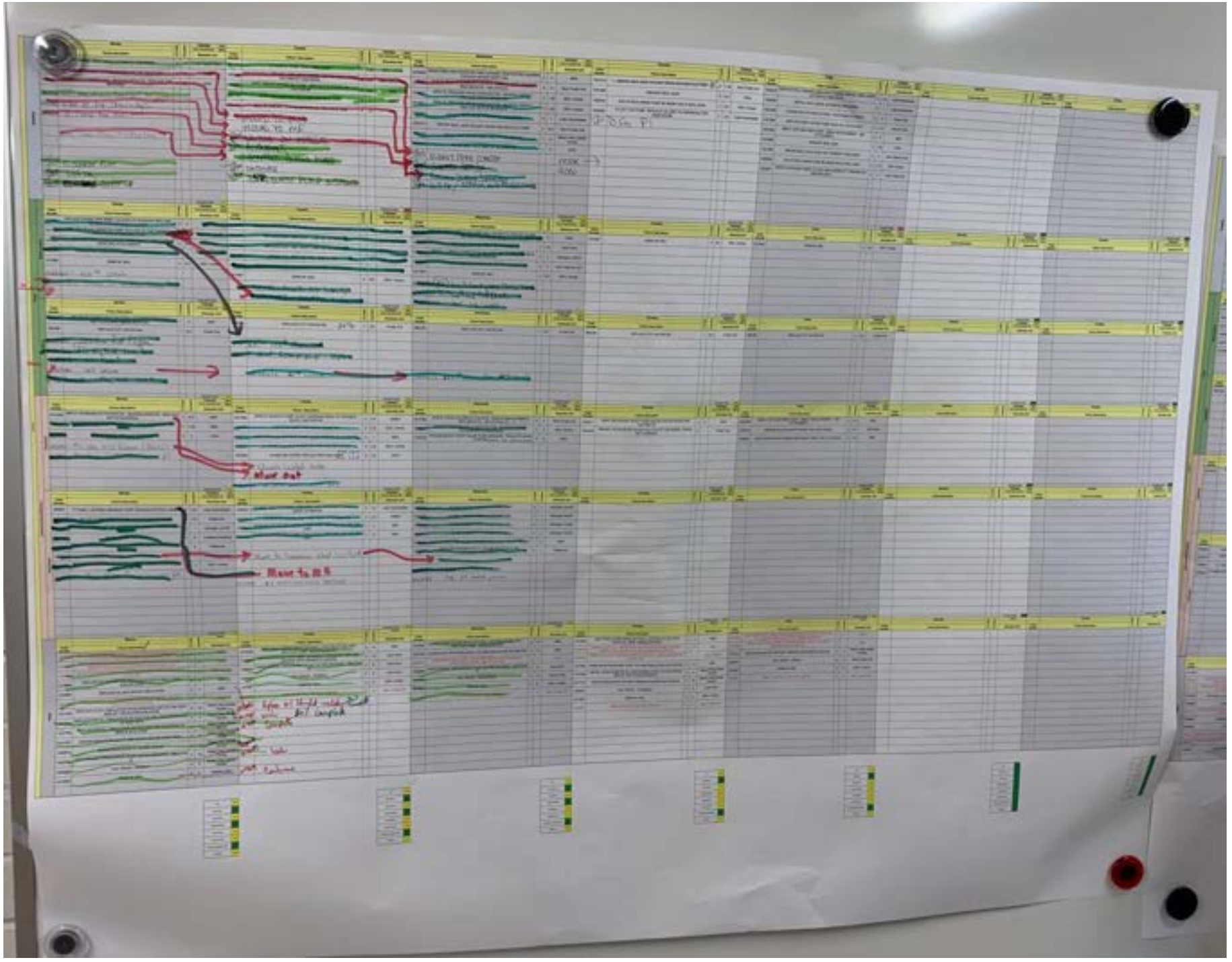


		Monday	# Techs	Duration	12/5/2022	Hrs
					TOTAL AVAILABLE HRS	52.0
	Work Order	WO Description			Asset	Wo
Business	5064	LSST Dryer condensate line is leaking	1	3	LSST Dryer	
	5264	Door of super sack won't close.	1	2	B009-000004	
	6287	Large storage room in front off blenders has a clogged drain and water is backing up in the room	1	2	Bldg 128	
	7075	Bottom plate plow arm and many plows bent	1	2	LSST Dryer	
	7227	Corrective Action Needed - See Comments	3	1	TANK-01065-LSHH	
	5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	2	0.5	B094	
	5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	2	2	B094	
	5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	1	2	B094	



Maintenance Schedule

FLUKE Reliability



FLUKE®
Reliability

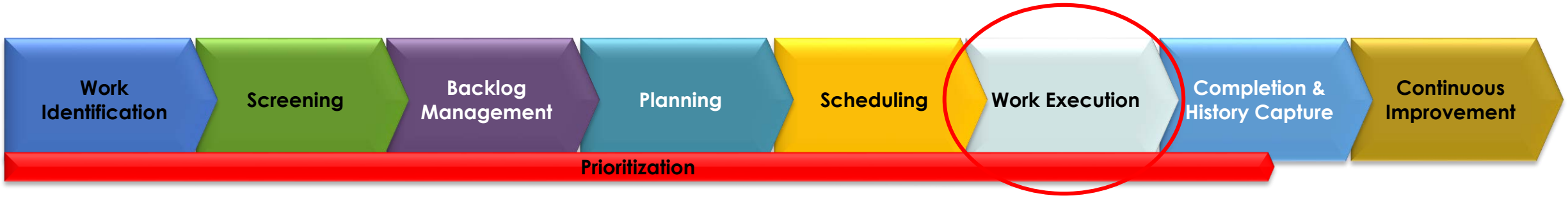
Line Out Sheets

BUSINESS TECHNICIANS

for the day of MONDAY *12/5/2022*

Work Order	WO Description	Planned Start Date	# Techs	Duration	Asset	Notes	Status
5064	LSST Dryer condensate line is leaking	12/5/2022	1	3	LSST Dryer		
5264	Door of super sack won't close.	12/5/2022	1	2	B009-000004		
6287	Large storage room in front off blenders has a clogged drain and water is backing up in the room	12/5/2022	1	2	Bldg 128		
7075	Bottom plate plow arm and many plows bent	12/5/2022	1	2	LSST Dryer		
7227	Corrective Action Needed - See Comments	12/5/2022	3	1	TANK-01065-LSHH		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	2	0.5	B094		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	2	2	B094		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	1	2	B094		

Work Management



Work Execution

To complete the planned and scheduled work as well as any urgent work in a safe and efficient manner while meeting the business and operating objectives of the plant

Line Out Sheets

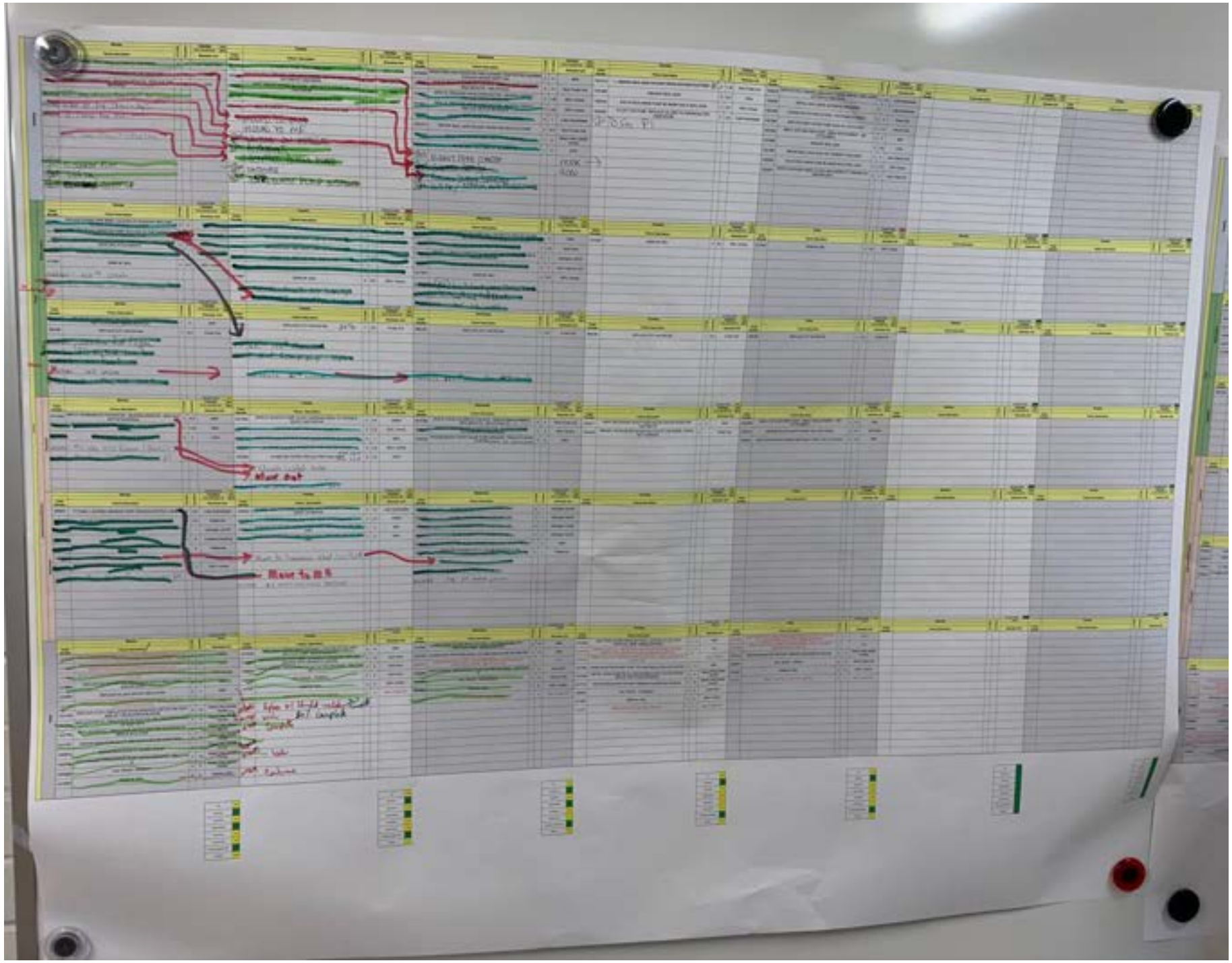
BUSINESS TECHNICIANS

for the day of MONDAY *12/5/2022*

Work Order	WO Description	Planned Start Date	# Techs	Duration	Asset	Notes	Status
5064	LSST Dryer condensate line is leaking	12/5/2022	1	3	LSST Dryer		
5264	Door of super sack won't close.	12/5/2022	1	2	B009-000004		
6287	Large storage room in front off blenders has a clogged drain and water is backing up in the room	12/5/2022	1	2	Bldg 128		
7075	Bottom plate plow arm and many plows bent	12/5/2022	1	2	LSST Dryer		
7227	Corrective Action Needed - See Comments	12/5/2022	3	1	TANK-01065-LSHH		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	2	0.5	B094		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	2	2	B094		
5909	MONTHLY ACIDS SAFETY SHOWER INSPECTIONS	12/5/2022	1	2	B094		

Scheduling/Execution

- Utilize the Work Order Priority Matrix with Criteria
  - For determining if work must be done immediately and not planned and scheduled



FLUKE® Reliability

<u>Mandatory</u>

Daily Schedule Control (DSC)

FLUKE Reliability

Typical Agenda - Daily Schedule Control (DSC)

Times:

- Frequency: Daily
- 1st Shift – Preferably before the shift starts, but not required (piggyback on another daily meeting)
- Standard location

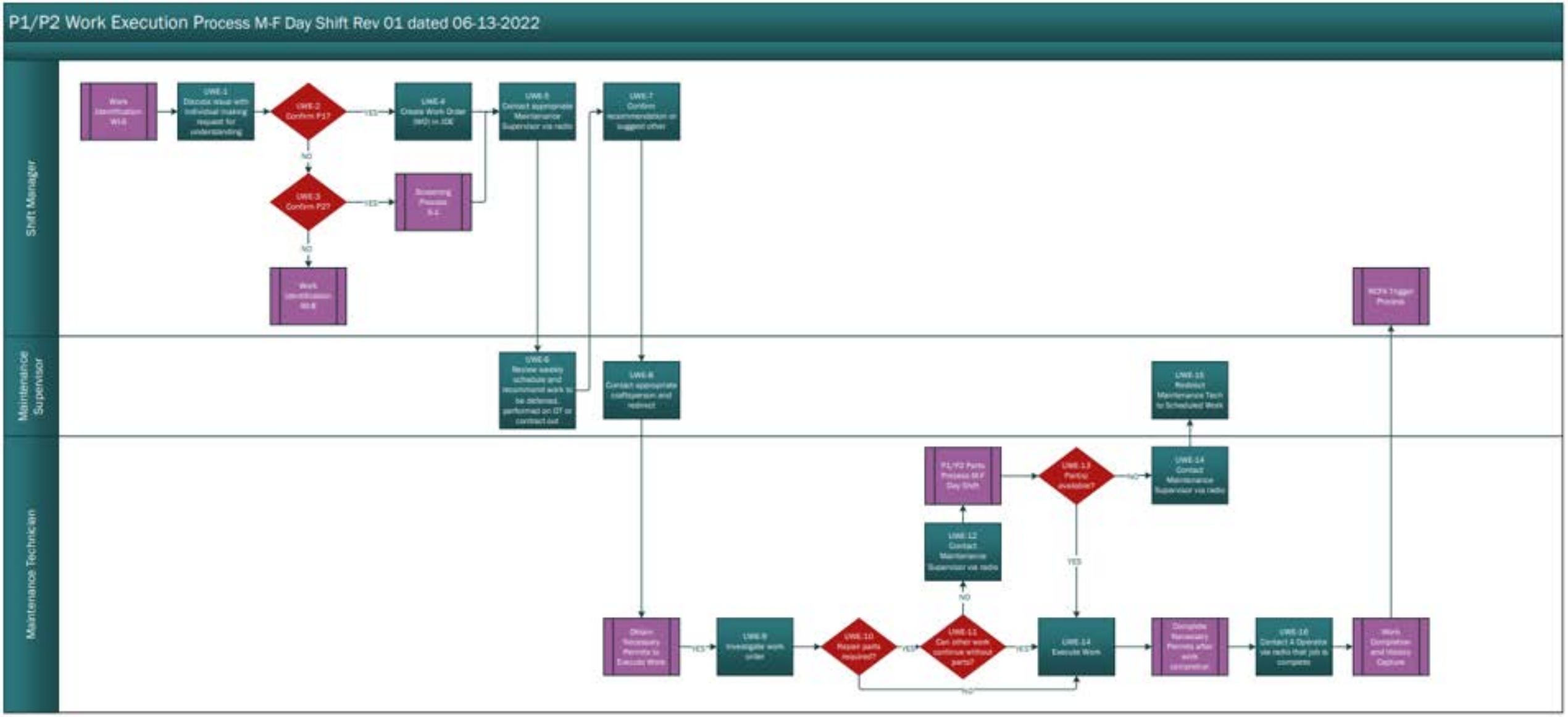
Required Attendees:

- Maintenance Supervisor - Leader
- Scheduler
- Production Supervisor(s)
- Others as determined by Maintenance/Production Leadership

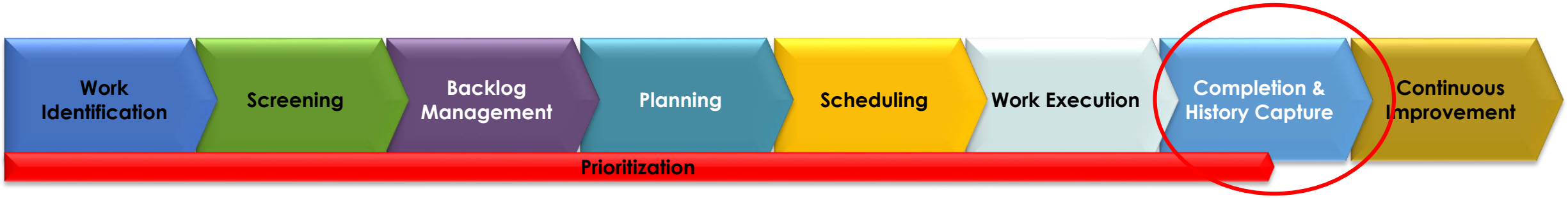
Activity:

- Review Agree-to and Posted Maintenance Schedule
- Discuss scheduling issues only
  - On schedule
  - Off schedule
  - Rescheduling of work in current agreed-to week as necessary

P1/P2 Work Execution Process M-F Day Shift Rev 01 dated 06-13-2022



Work Management



Completion & History Capture

To assure sign off & completion of work as required by the Work Management Process to ensure work is completed adequately and pertinent data is recorded in JDE for historical purposes and Reliability Engineering. Work orders are to be completed by the Technician executing the work as well as notations of significant details.

Simple Work Order: 624722-1

As Found:

As Repaired:

Who Performed Work & Time:

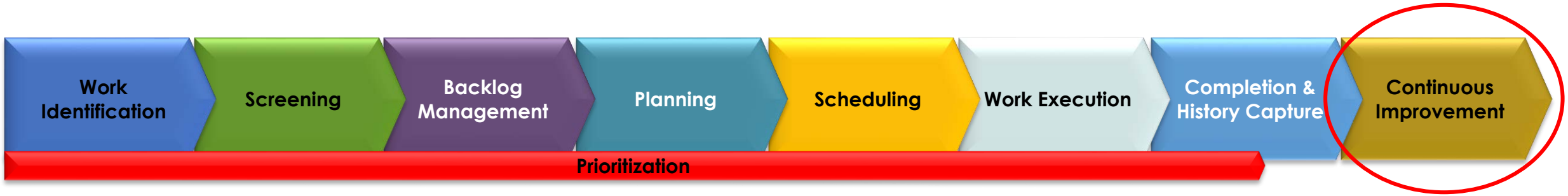
Additions needed for Future scope:

Additional Parts, Tools, Permits:

Follow Up Work Needed:

Make It Happen Safely!

Work Management



Continuous Improvement

To utilize information collected during the Work Management process as well as feedback from Planners, Supervisors, Technicians, Operators, and Engineers to improve the MTBF, Availability, and OEE.

How To Improve?

- Management Reporting and Control
- Establish objectives, goals, and targets
- Develop Key Performance Indicators (KPI's)
  - Are the PM procedures working?
    - Proactive/Scheduled Labor Hours vs. Unscheduled Labor Hours
  - Are the PM frequencies accurate?
    - Ratio: # of Work Orders - PM vs. PM Corrective vs. Urgent/Immediate (Unscheduled)
  - Where is maintenance spending their energy?
    - Labor hours – Urgent/Immediate (Unscheduled), Preventive, Condition Based, Projects

What Gets Measured Gets Improved!

Recommended Initial Work Management KPI's

1) **Resource Allocation**= Total number of HOURS of scheduled work X 100 = 100%
Total maintenance hours available

2) **Schedule Completion (Count)**= Total # of scheduled work orders/operations completed and closed for the week X 100
Total # of work orders scheduled for the week

Total # of work orders scheduled for the week = Total number of work orders on the **Weekly Maintenance Schedule**.
Weekly Maintenance Schedule= The list of maintenance work to be done in a week finalized three to four days before the start of the work week.

3) **Schedule Compliance (hours)**= Total number of HOURS of scheduled work charged for the week X 100
Total number of hours scheduled

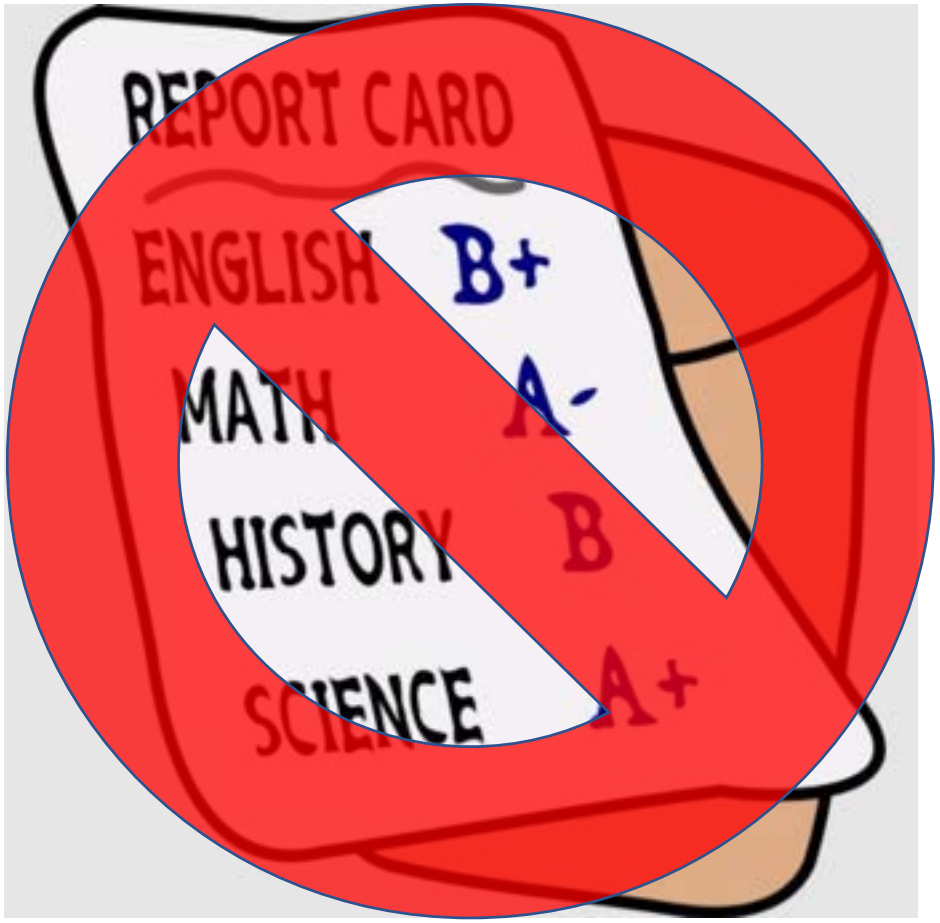
4) **PM Completion (10% Rule)**= Number of Scheduled and completed PM work orders by the due date X 100
PM work orders due

The window of acceptable tolerance around the due date is defined as 10% of the periodicity, usually expressed in days, i.e. a 30-day PM must be done within a 3-day (10% of 30) window around the scheduled date.

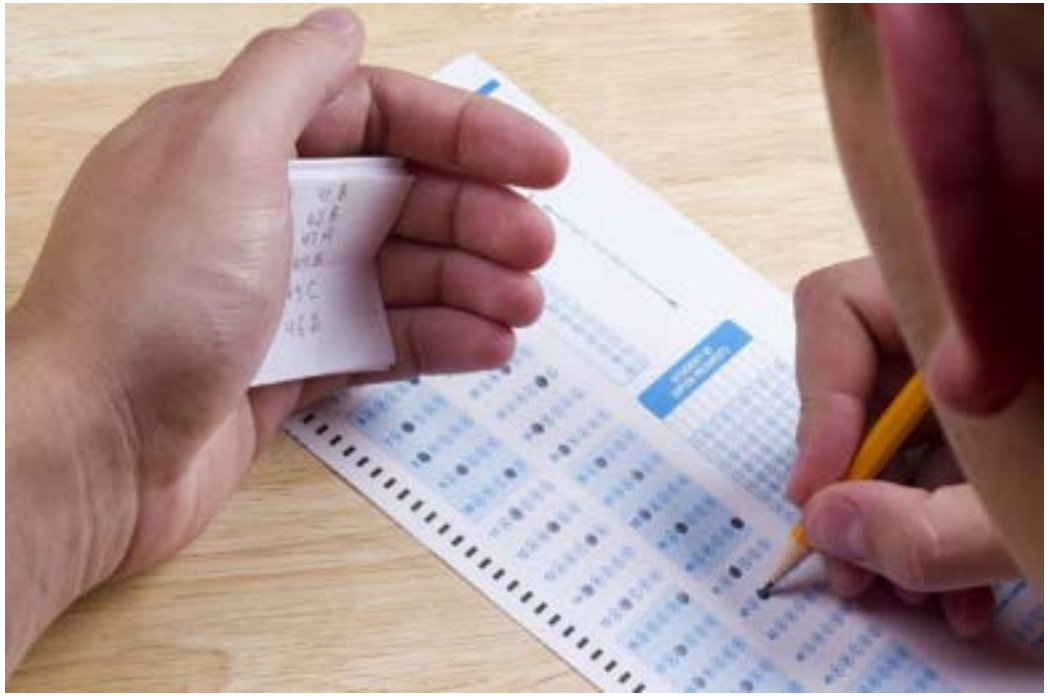
5) **Urgent/Immediate Break-In %**= Hours of unscheduled work charged to work orders X 100
Total number of hours worked (includes overtime)

Key Performance Indicators (KPI's)

Not trying to make a "B"



- ✓ Where are we?
- ✓ How can we improve?
- ✓ *Do not* put KPI expectations in yearly performance expectations



KPI's will be what they need to be to meet or exceed performance expectations…..

Questions

QUESTIONS?

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Thank you!

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THANK YOU!