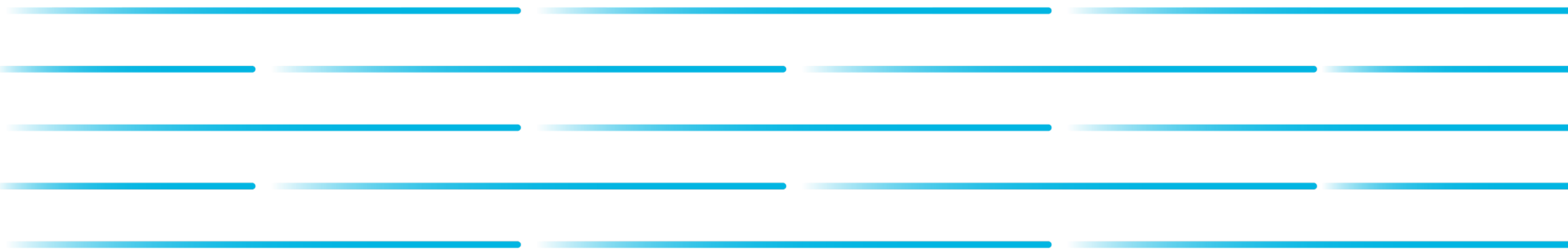




An overview of some industrial use cases for technical language processing (TLP)

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12 April 2021

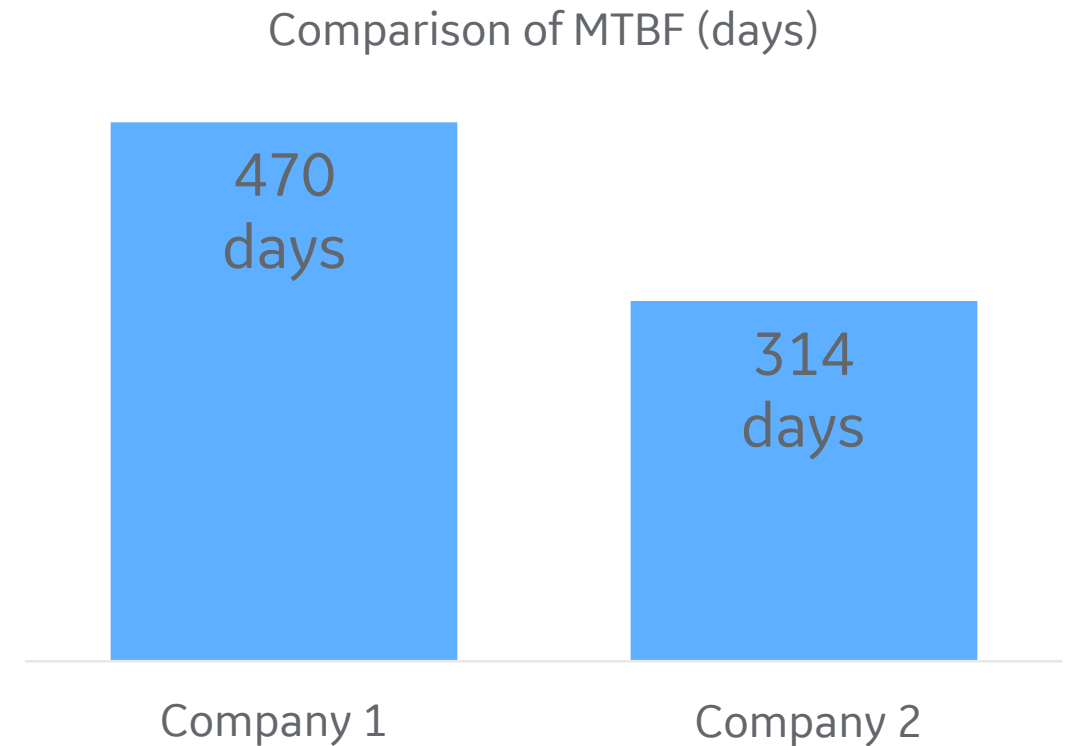


Use case #1: Enables consistent reliability metrics

Before: Inability to calculate Mean Time Between Failure (MTBF)

After: Benchmarking comparison of MTBF is possible

Description	Before: Breakdown Indicator	After: Is a Failure event?
Seal is leaking badly	FALSE	True
Block valve is broken open and inoperable	FALSE	True
00120-Pump 1 work request	FALSE	False
Check impeller size	FALSE	False



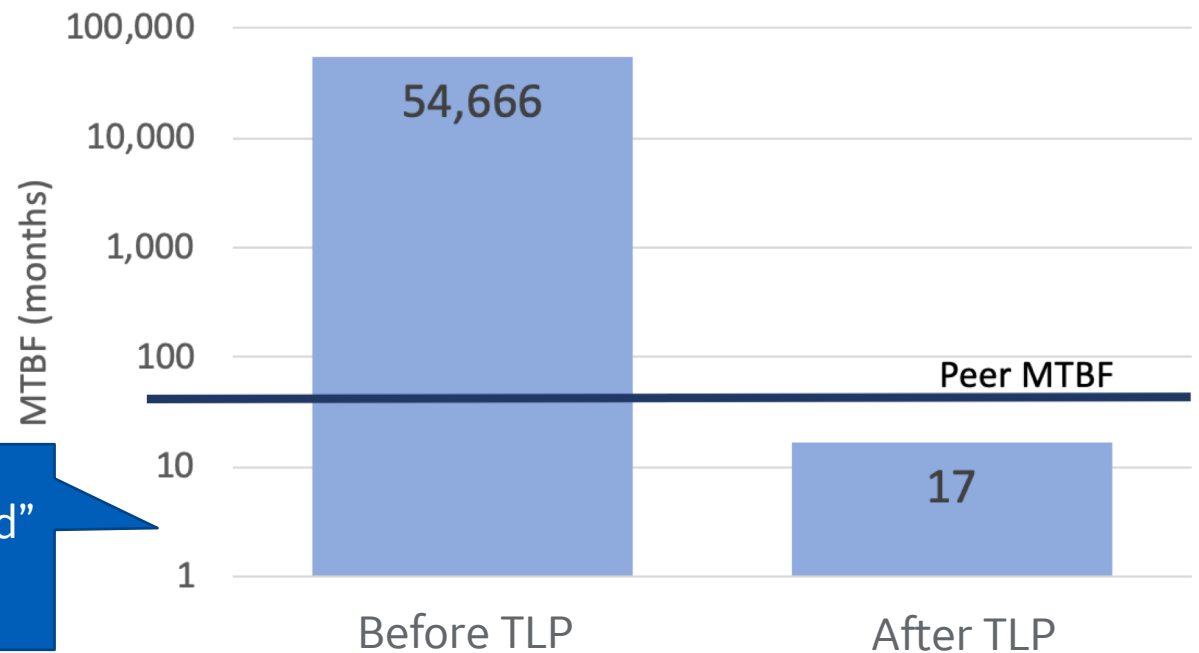
Accurate reliability metrics enables identifying opportunities

Example: Chemical company is missing \$1.5 million annual savings and does even not know it

- If performed as well as peers, would save \$850/pump for ~1800 pumps
- Avoiding about 600 failures
- Resulting in \$1.5 million annual opportunity

Unrealistically “good” MTBF values

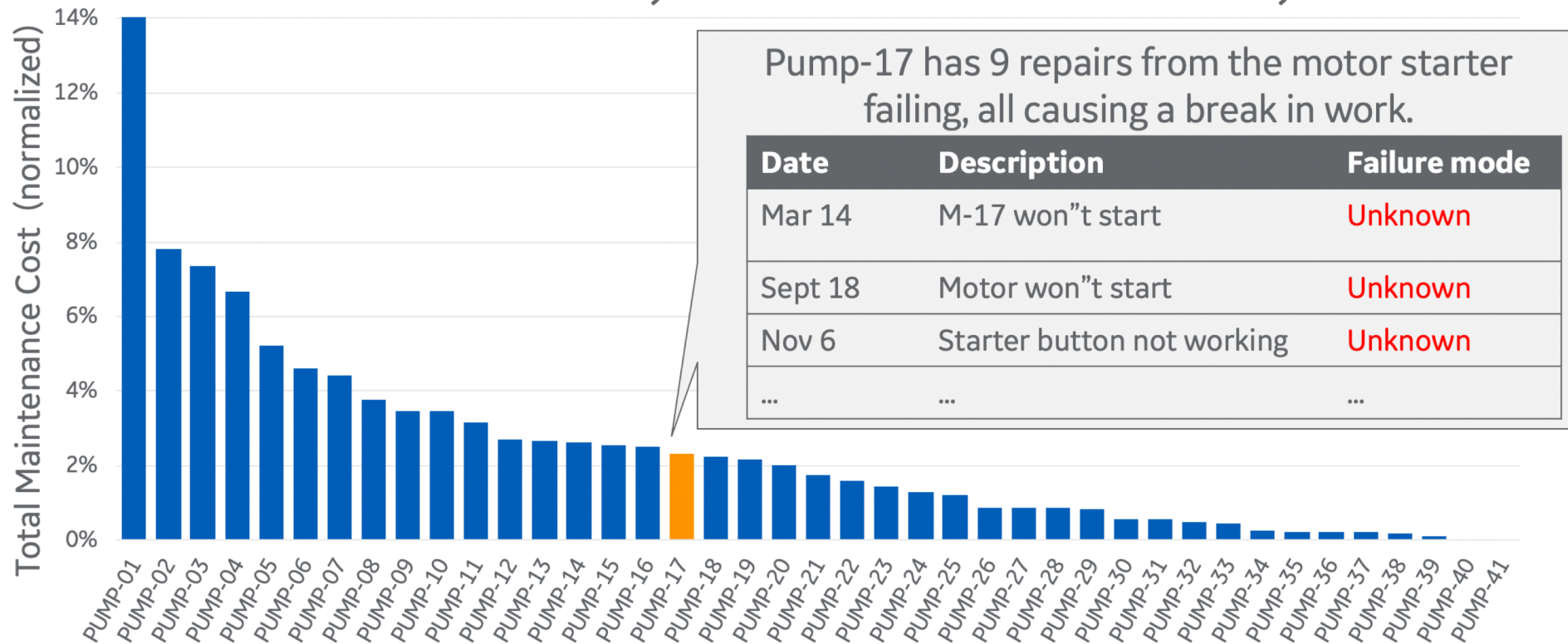
Comparison of MTBF of pumps before and after TLP utilized on data



Use case #2: Finding hidden bad actors

Root cause analysis revealed no proper procedures in place for motor maintenance. Once remedied, failures ceased with estimating annual savings of \$54,000 for the one pump alone

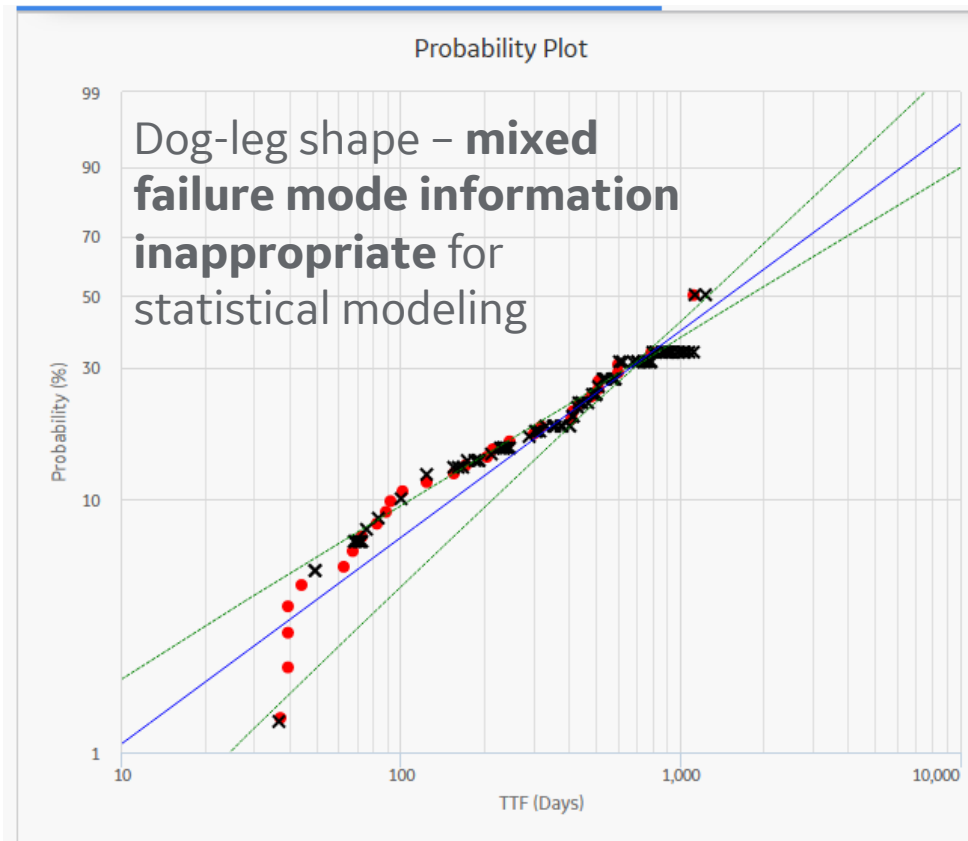
Bad Actors List – by total maintenance cost over 2 years



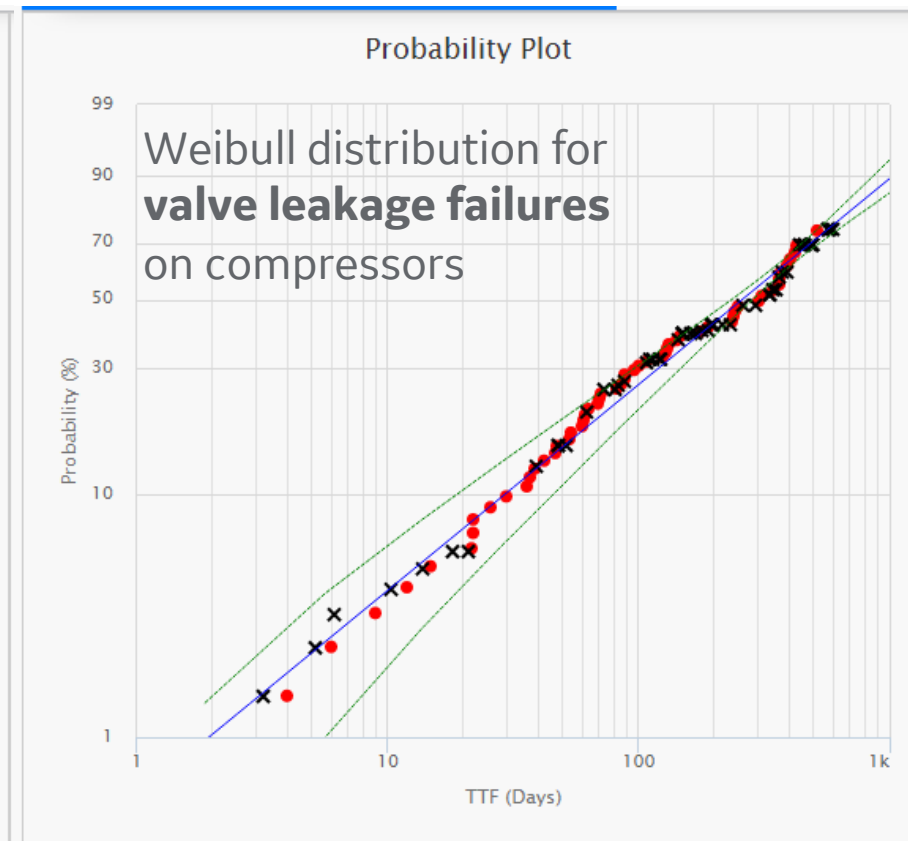
Use case #3: Enables reliability distribution fitting

Failure mode characterization can be used for reliability-data based survival models such as Weibull analysis

Before

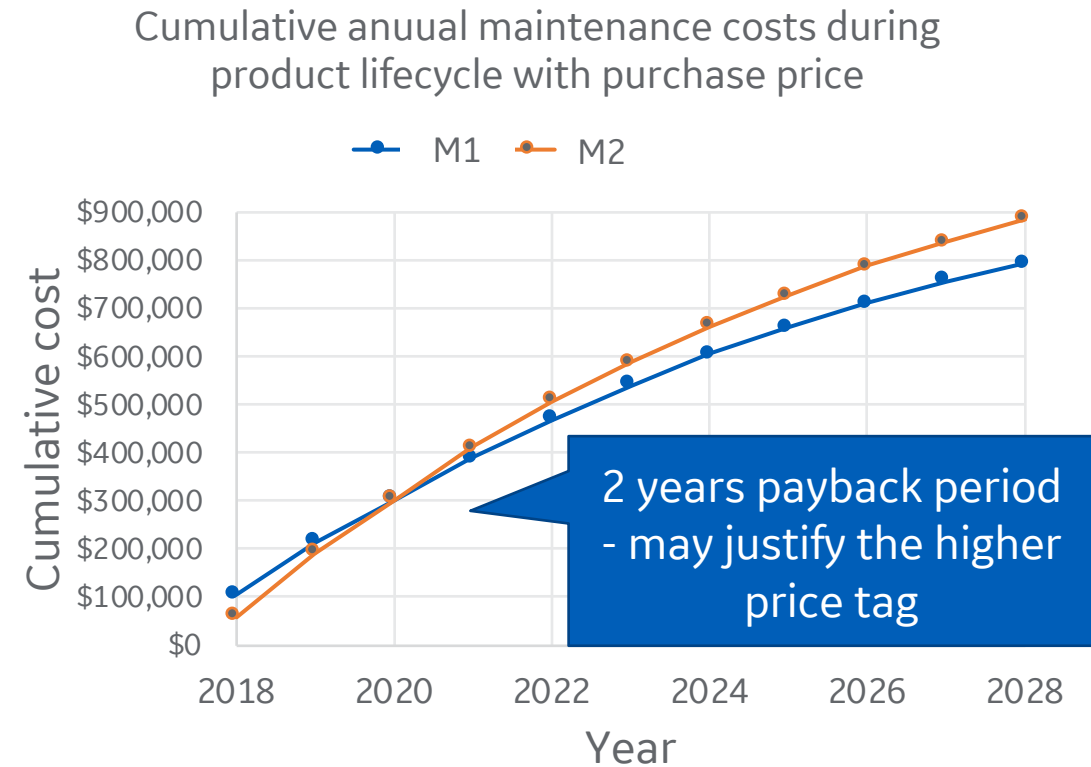
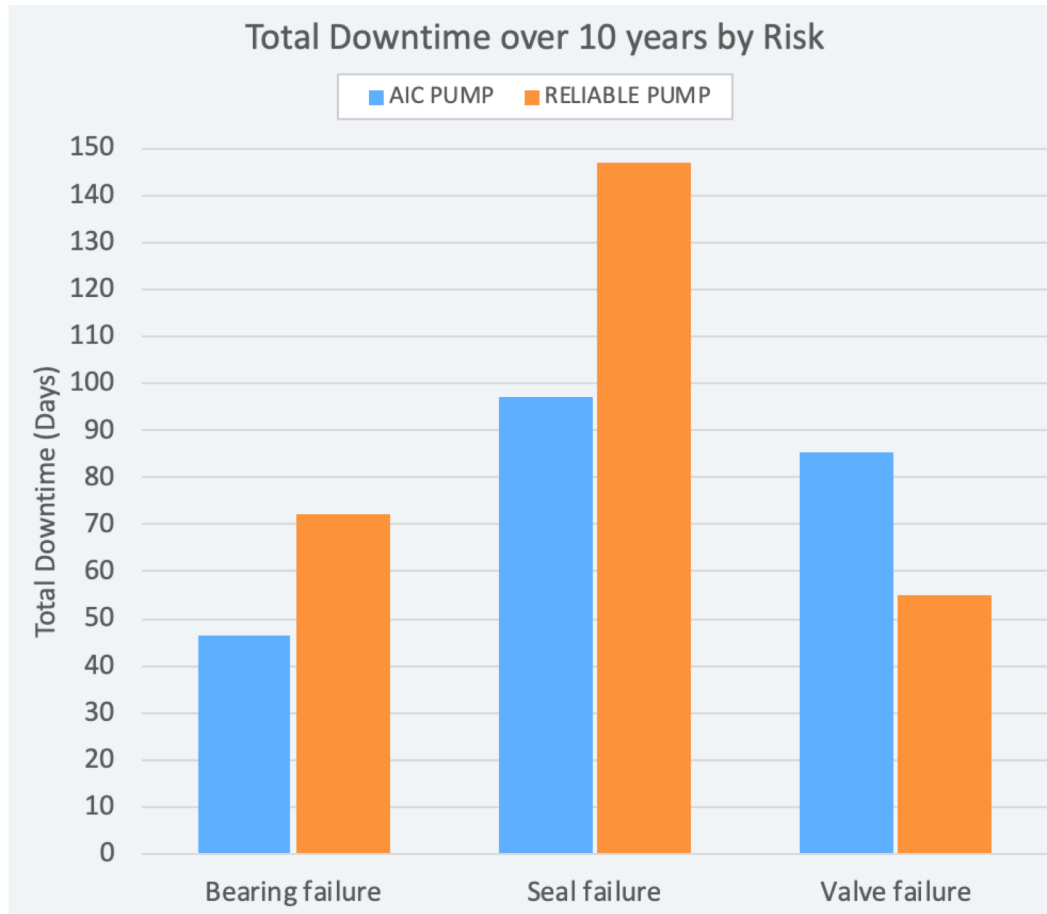


After



Reliability distribution fitting can be used for decision making

Repair or replace? Simulation model:



Model 1 is more reliability but costs more than Model 2



Use case #4: Framework for prescriptive maintenance

Event Short Description	Work done
UV 6818 fuel gas vent valve stuck	valve overhauled
Worn pump bearings	Performed vibration analysis
WORN OUT TIE ROD PIN AND BEARING	Replaced bearing
WORN OUT TIE ROD PIN AND BEARING	bearing lubricated
Wet oil tank pump suction valve	Replaced filter

Objective: Identify recommended fix

Value: Reduce repeat maintenance trips, reduce downtime, and reduce maintenance costs

Interface: Tool usable by the **maintenance technician** or **engineer** in the field

Data: any historical data which captures asset failure, maintenance events, and repair actions



Enables APM workflow which can recommend fix based on historical data

Example: Degraded seal

Enter Parameter Values

Enter Parameter Value

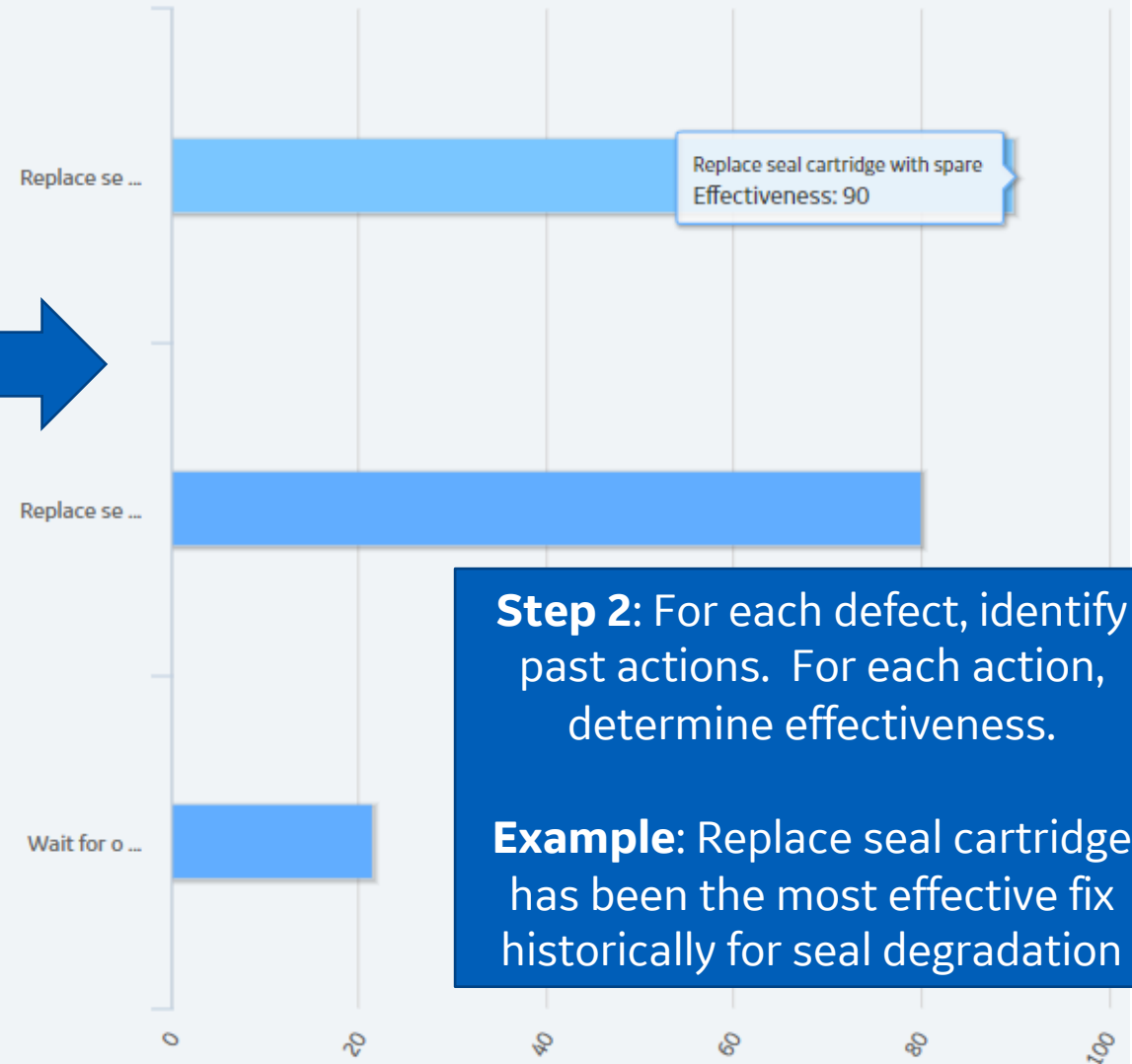
Degradation

Step 1: Classify & structure failure events/defects from repair data

Failure Mode	Count
Seal - Degradation	44



Graph of Effectiveness by Action for a risk on a compressor



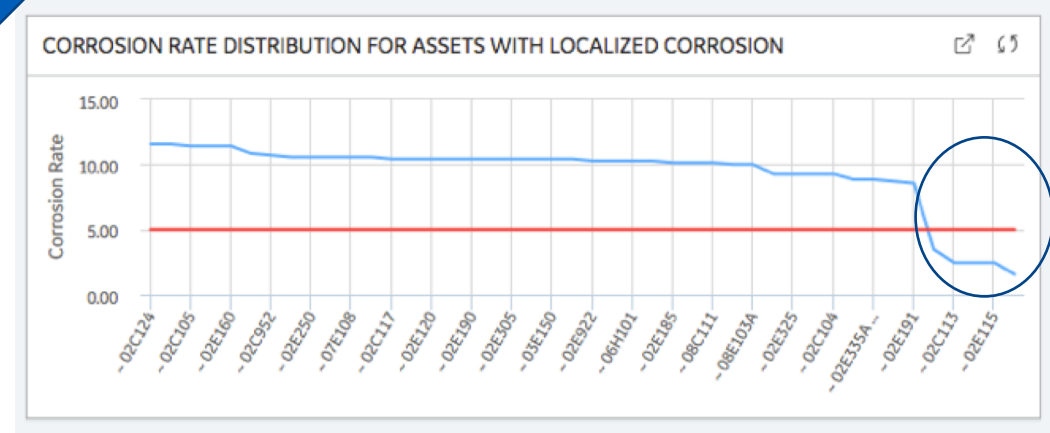
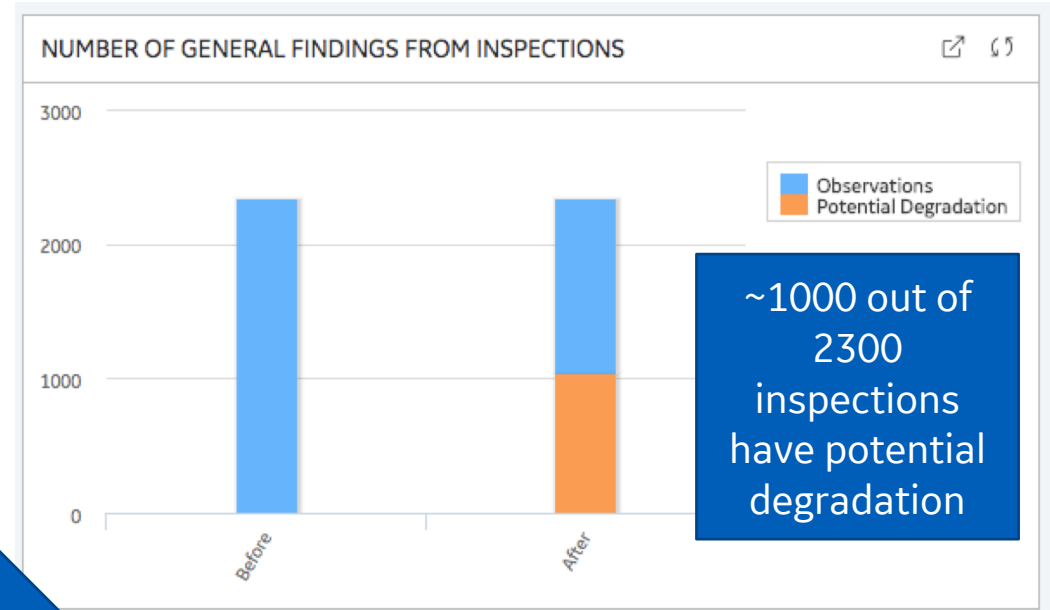
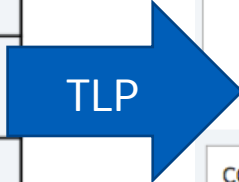
Step 2: For each defect, identify past actions. For each action, determine effectiveness.

Example: Replace seal cartridge has been the most effective fix historically for seal degradation



Use case #4: Inspection analytics

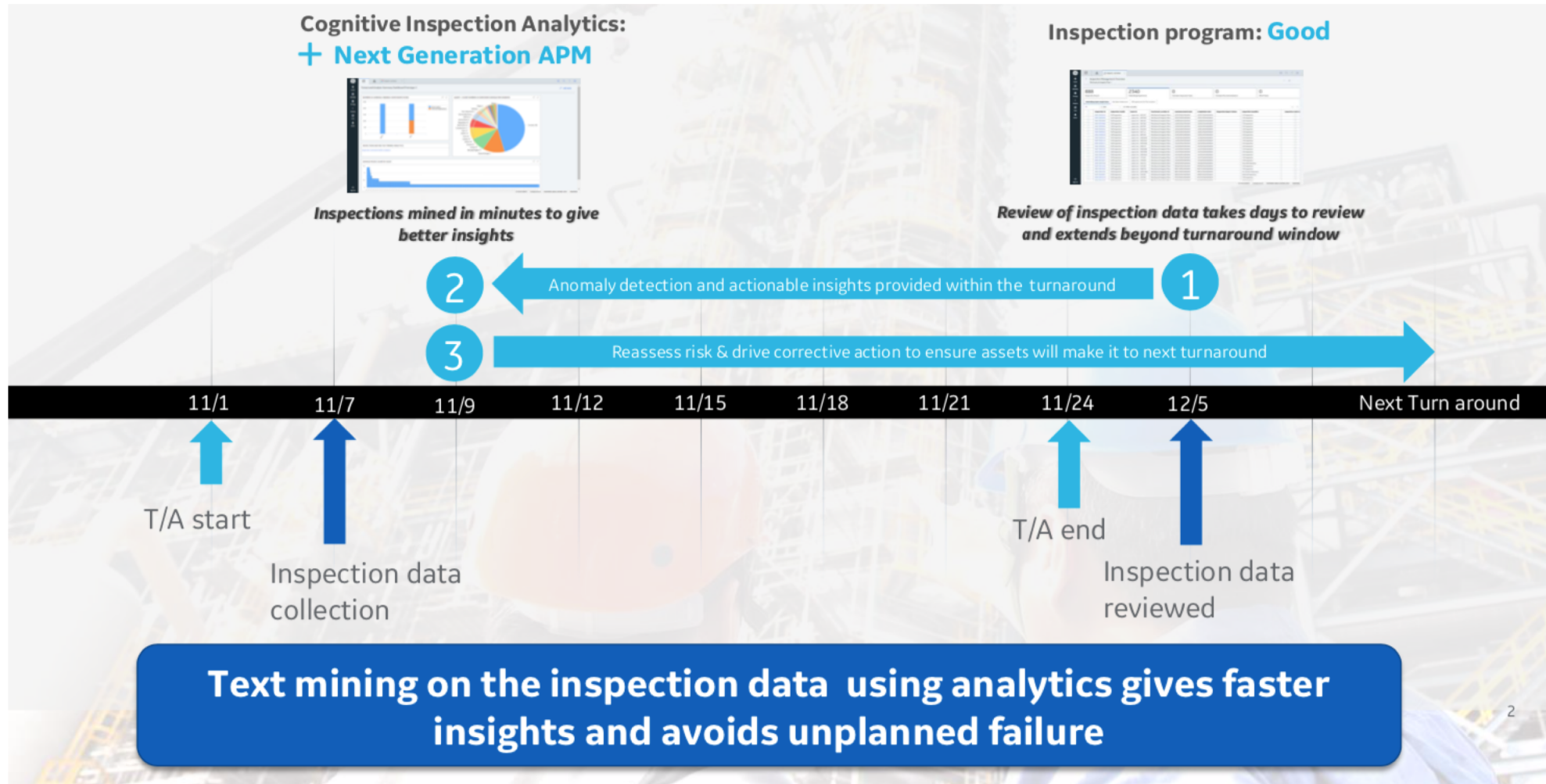
Observed Failure Mode	Inspection Summary
Fouling- Tray, Physical Damage- Cover	As found inspection, Manhole opened and trays 49 to 52 removed. M/hole 1- Trays and wall found with collected thick adherent greenish yellow deposit. M/hole 2 - with heavy collected rust scales. M/hole 7 - with black adherent deposit. M/hole 8 - generally manhole cover roughened
Fouling- Unknown	During the T&I Column was opened and cleaned for inspection. The top section had heavy scale present on all surfaces.
Corrosion- Piping, Fouling- Tray, Corrosion- Tray	During T&I crude column was opened and sectional cleaned for visual inspection. Existing top distributor pipe found severe corrosion. The distributor pipe was replaced by carbon steel pipe. Trays #45 to #48 were found to have moderate corrosion and sticky product like salt deposit.
Localized corrosion- Nozzle	During the T&I eq105 was cleaned and inspected. The inspection was limited due the size of the internal manways. The inspection found light general pitting on the bottom head and on the bottom manway nozzle and cover.
	No significant corrosion was found on vessel. All internal were found to be in serviceable corrosion and no issues noted. Available UT data was reviewed and all readings were found to be close to nominal thickness.



Assets with localized corrosion and UT programs with corrosion rate lower than 5 mL/yr are candidates for RBI analysis



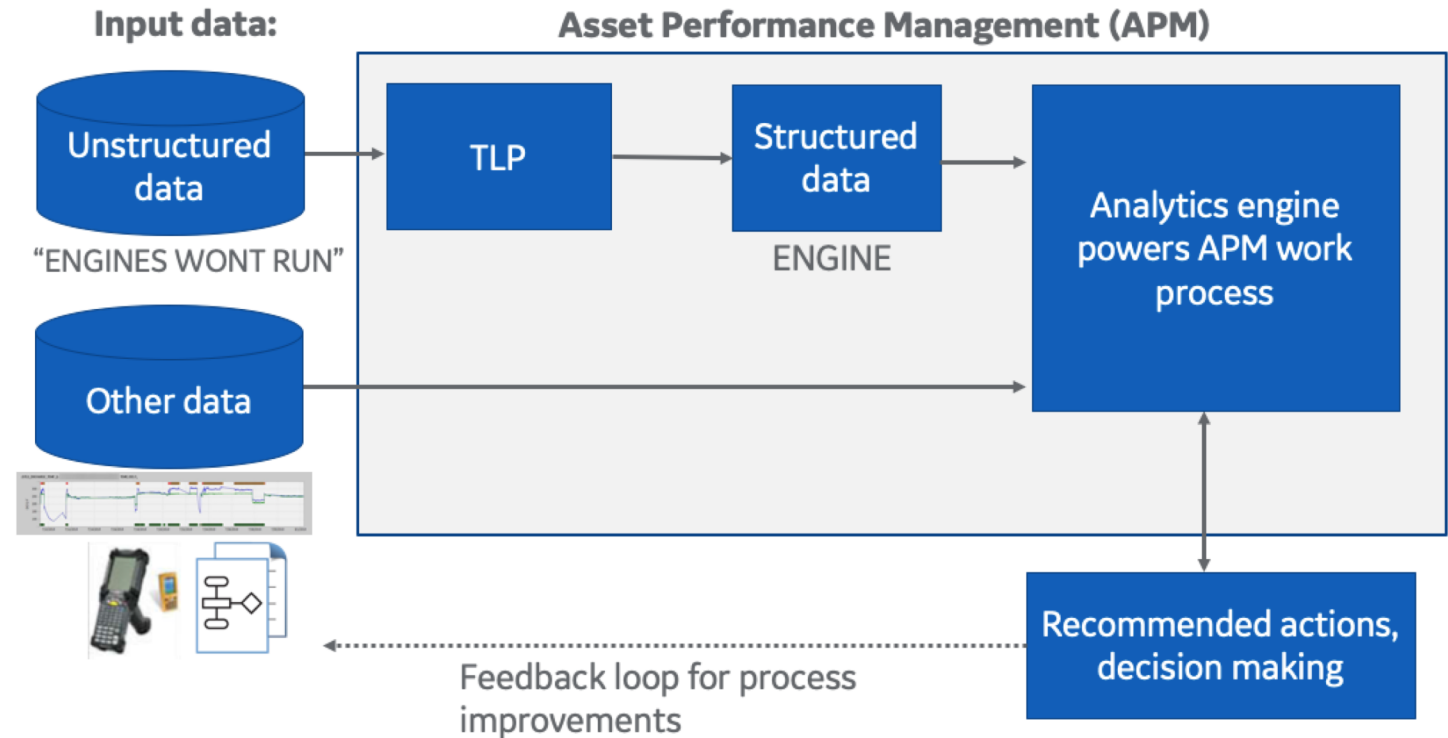
Inspection analytics enables making intelligent decisions during a turnaround



Putting industrial data to work with TLP

TLP enables industrial companies to make decisions using their historical data.

The value of TLP comes with integrating the data into business processes in ways that create value.



Thank you!

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