

Research problem proposal:

How do breakdowns in communication between turn around planners and field execution crews impact cost and schedule during refinery turn arounds?

Communication is key to most jobs being completed successfully around the world. Things like not listening to a customer or missing a key point can be a costly mistake. In the refinery industry, these mistakes can cost millions of dollars and value time, especially during a turnaround. So how can a breakdown in communication between turn around planner and field execution crews impact cost and schedule during a refinery turn around?

First, we must understand what a turnaround is. In a refinery there are planned outages called turn arounds. A turnaround (TA) is a complete or partial shutdown of a specific area for maintenance that cannot be completed while the area is online. These TAs normally last for 3-6 weeks and have a cost of \$50M to \$100M. They will involve a team of planners, 3-6 people, a management team, 2-4 people, and field execution team consisting of 500-2000 people. The turn around planner starts planning the event 18-24 months in advance with the scope of for the project being locked, or finalized, a minimum of 12 months before the TA.

While the planners do their best to plan for everything, there are always unforeseen jobs during the TA. These are typically the results of the first week of a turnaround which is called discovery. This is where the inspection team goes through all the equipment, after it has been cleaned, and finds any unplanned problems. The inspection team will draft a report, bases on the American Petroleum Institute (API) 510 Pressure Vessel Inspection Code, which will include the finding with pictures, the applicable code, and a repair plan for the finding. It is then up to the planners to reach out to vendors that are authorized to make the necessary repairs and get prices and times on when the work can be completed. This is where communication and business overlap.

In CMST 1601: Intro to communication we learned about communication breakdown, noise, through the Shannon-Weaver model of communication. This model says that there are five parts to a message, the information source, the encoder, the channel, the decoder, and the receiver (Shannon & Weaver, 1949) In a TA, the inspection group serves as the information source and the encoder. The planners are the channel and the contractors doing the work are the decoder and receiver. The noise in the TA Process is the different layers it takes to get a repair done. Even if the Inspector authors a flawless report, there are opportunities for the planners and the contractor to misinterpret the information and not perform the correct job. We see this all the time during a TA. To fix these breakdowns, most refineries have implemented procedures for Inspectors to follow the repair until it is

complete. This will involve meetings every day as well as updating the job log with detailed descriptions of what work has been completed as well as what work is to be done during the next shift. These logs are kept public so that the TA managers can check on the update of any job at any time without having to take the inspectors or contractors out of the field.

From an operational standpoint, MGMT 3200: Principles of Management, it is the TA planner's responsibility to maximize the refineries Return on Investment (ROI) and net asset utilization. TA are run based on LEAN project delivery frameworks. These dictate the elimination of non-value-added activities, called "Muda" or waste. Waste can be divided into multiple categories. These include defects (incorrect data entry), waiting (crews sitting idle while waiting for clarification), and excessive time. An excess of any of these wastes can lead to a decrease in profit which will cause a substantial decrease in the refineries ROI, or Return on Investment. These TA s cost the refineries millions of dollars to execute as well as a loss of millions of dollars in product while the units are not operational. Any overage in time or budget creates waste.

The integration of these two disciplines does not come by studying the "noise" and the "waste" separately but by combining the data transmission structures with the LEAN efficiency metrics. There is a positive correlation between noise and waste in the refinery industry that shows as noise increases, so does waste. Research in project management confirms that communication barriers between project teams possess a direct relationship to downstream project delays (Aziz et al.,2022) An example of the intersection of these two concepts would be when an inspector finds a localized erosion defect inside a catalytic cracking vessel lined with 410 stainless steel overlay. The inspector properly "encodes" the finding, but during the "channel" phase the planner enters a generic phrase of "Stainless Steel" into the procurement request. The contractor or "receiver" decodes the message by utilizing the standard 304 stainless steel for the repair. API code 510 dictates any repairs done on pressure vessels. In this case, it states that 304SS is not an approved repair metal due to the temperature and the service. Once the quality assurance team notices the non-compliance of the repair, it must be gouged out, re-inspected, materials re-ordered, and re-welded. This produces several types of waste. These include defect waste, the installation of the incorrect metal, waiting wastes, execution crews sitting idle while the planners try to find the correct materials, and overprocessing waste, the additional 4-6 shifts of unscheduled mechanical rework. These wastes will delay the start up of the refinery by multiple days. If the refinery industry, this intersection of communication noise and operational waste will cost the refinery millions of dollars.

Over the last 20 years of working TAs as an inspector, I have seen scenarios such as this play out. The longest and most costly was a turnaround in 2015. During discovery it was found that the piping inside of the heater was below the minimum remaining wall thickness as per API code 570. The pipe that was originally installed in the early 1970s was carbon steel. Since that time, the code has changed and called for the metallurgy to be upgraded to 5-chrome. The planner noted that the existing material was carbon steel and the contractor spent 2 weeks prefabricating the new carbon steel piping. When the pipe was brought out to the site and the carbon steel was discovered, the project had to be restarted. It took a week to procure the material, 2 weeks to prefabricate the piping spools and 2 weeks to install the pipe in the heater. Overall, the TA was delayed for 6 weeks because of this error. This ended up costing the refinery more than \$100 million in total. additional costs and the lost revenue. This mistake was very easily preventable through better communication.

Overtime I have seen policies and procedures change to combat the breakdown in communication between groups and waste. Some of these include vendor surveillance or sending inspectors out to fabrication shops to ensure that the jobs are being done by code, code training for procurement and planning departments, as well as moving to digital reporting. Through trial and error, communication on TAs has become efficient and effective at eliminating waste and saved the refineries millions of dollars.

References:

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