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CONTENTS

IMC GLOBAL – APPLYING SIX SIGMA AND WORKOUT TOOLS TO A SHIPPING PROBLEM

by Joe Gliksman

The following is a summary of an IMC Global, Phosphates Business Unit project in which Six Sigma and Workout tools were used concurrently to solve a problem and generate significant savings. Joe Gliksman is the Manager of Continuous Improvement for IMC Phosphates, and Bruce Bodine was the BlackBelt on the project. Both Joe and Bruce are trained Workout coaches.*

The Problem

Starting in 2002, the shipping demands from one of IMC's phosphate mines, to our internal and external customers was expected to reach a record high and to continue to gradually increase until new phosphate rock production capacity was brought on-line. The average number of loaded cars per shift out of the rock production plant was 78 as of August 2001. This average is approximately 20 cars per shift below the 2002 requirements. The only alternative option was to ship rock by truck, which is more expensive (about $1/ton). This is significant when the annual shortfall is >1 million tons/year.

Bruce Bodine, an IMC BlackBelt was assigned the project. He used some of the Six Sigma "Analyze" tools to determine the process capability, and variation over time. Based on his initial analysis, he determined that this problem was better suited for a "Workout" team, and as team leader, he could provide any statistical analysis, or use of Six Sigma tools that might be needed. Workout was the preferred primary technique for this project because very little data analysis was needed, and much of the process improvement could be provided by using what we call 'tribal knowledge'. We leveraged the knowledge and experience of the people closest to the process for most of the gains, and we used the Six Sigma tools to verify the significance of the changes and the gains.

A team was formed with sponsor managers from the production plant and from the rock distribution group. The team included individuals who do the job of loading and shipping rock, a distribution team member, and Bruce Bodine as team leader.

The group assignment was "How can we…..increase the capacity of the Four Corners wetrock load out system? In order to ….increase the loaded rail cars per day to 355 by January 2002,

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without increasing annual maintenance costs and safety incidents". The team was given 60-days to develop a list of ideas and implement as many as they could

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within the time constraint. The 60-day limit is imposed because most teams, we have found, complete 80% or more of their goal in the first 60-days, and typically spend additional months to get very little additional gain.

The group's kick-off meeting took three hours, and over 40 ideas were generated in a brainstorming session. The team then met weekly for 1 hour to prioritize and implement as many ideas as possible in 60-days. Of the 40 ideas, eight were implemented. The ideas were:

I. Direct hit pebble from production bins. Historically, all phosphate rock produced would be conveyed to a storage pile, and then conveyed again from storage to railcars. This idea was to short-cut the process, saving time, energy and cost..

II. Reduce trash on the rock pile. Letter issued by Jeff Greer, plant manager, to Four Corners Plant Operations discussing trash management on the pile.

III. Use the set-up crew at FCO (the Four Corners Plant) more efficiently. The rock shipping department revised the crew structure and took on the responsibility for better utilizing the set-up crew personnel.

IV. Check rail car doors before leaving Agrock. This idea was amended once the crew structure was revised. Doors will be checked at rock shipping (Agrock) when possible, otherwise plant personnel will do it

V. Fix yard/stadium lights on the east and west end of the loadout tracks. Approximately 80 per cent of the lights have been repaired. Improved lighting will improve safety and efficiency.

VI. Four Corners Plant switcher does not leave until tracks #1 & #2 are set-up. Idea was addressed in the crew restructuring at Agrock. With the switch crew at Four Corners more set-up issues are improved.

VII. Repair drain system on loadout bins. Rock is loaded into bins and water is allowed to drain out the bottom — repairs were needed.

VIII. Direct hit concentrated phosphate rock from production bins. Improves flexibility for loading rail cars. Will increase cars loaded during tunnel downtime.

These ideas were all directed at making process improvements, and could not have been generated without the input of the people closest to the process. Each idea was recapped at the end of the 60-days with detailed actions and calculated results. The 8 ideas were recapped as shown below:

I. Direct hit pebble from production bins.

What steps did the team take to accelerate this idea into action?

1. Assessed FCO rock belt configuration.
2. Discussed with rock distribution group.
3. Had maintenance fix diverter gate.
4. Wrote SOP.
5. Issued SOP for review.
6. Test run.
7. Train operators & supervisors.
8. Posted in 07 Control Room.

Benefits:

1. Will increase the ability to load rail cars on a maintenance downday. This will decrease the need to truck wetrock – a more costly option.
2. Will decrease tons from production bins to storage then back to loadout. Now Four Corners has the capability to direct production straight to the loadout.
3. Will decrease the tons pushed out then in by pile tractors.

Total value estimated to be six additional rail cars per shift.

II. Reduce trash on the rock pile.

What steps did your team take to accelerate this idea into action?

1. Discuss with FCO Management.
2. Request letter from Jeff Greer.
3. Start logging complaints regarding trash in product.

Benefits:

1. When cleaning ditches, the material will be reclaimed not dumped directly on the pile.
2. In plant clean up by payloaders should be preferentially dumped at the washer or ensure that the material is free of debris and trash.
3. Hanging return rollers on the trestle belts will be identified and removed before they drop on the pile.

Total value estimated to be one additional rail car per shift.

III. Use the set-up crew at Four Corners more efficiently.

What steps did your team take to accelerate this idea into action?

1. Discuss with Agrock management.
2. Outline new procedures.
3. Implement and monitor procedure.

Benefits:

1. Will increase the ability to load empty rail cars on hand.
2. Will increase the number of trains shipped on time.
3. Will increase customer satisfaction.

Total value estimated to be two additional rail cars per shift.

These ideas were all directed at making process improvements, and could not have been generated without the input of the people closest to the process.

IV. Check rail car doors before leaving Agrock.

What steps did your team take to accelerate this idea into action?

1. Draft letter to Agrock management.
2. Issue letter.
3. Discuss with Agrock management.
4. Agrock management issue letter.
5. Revise loadout log report.
6. Post loadout log sample and instructions in Four Corners doghouse.

Benefits:

1. Idea was amended to fit in with the new Agrock crew reorganization. Car doors will be checked at Agrock when possible, however, FCO crew has ultimate responsibility now that they will be at FCO more of the time.
2. Revised loadout log report now has category for downtime due to "checking doors".
3. Revised loadout will provide management a good tool to assess future opportunities.

All value from this idea is incorporated into ideas III and VI.

V. Fix yard/stadium lights on the east and west end of the loadout tracks.

What steps did your team take to accelerate this idea into action?

1. Draft letter to Four Corners management. Follow-up.

Benefits:

1. Will increase the efficiency of the loadout operation at dark—increase the loaded rail cars.
2. Improve safety of employees at night.

Total value estimated to be three additional cars per day. No savings were attributed to improved safety.

VI. Four Corners switcher does not leave until tracks #1 & #2 are set-up.

What steps did your team take to accelerate this idea into action?

1. Discuss with Agrock management.
2. Draft letter discussing idea and submit to management. Follow-up.

Benefits:

1. Will increase the ability to load empty rail cars on hand — less loader downtime.
2. Will increase customer satisfaction.

Total value estimated to be 1 additional rail cars per shift.

VII. Repair the drain system on loadout bins.

What steps did your team take to accelerate this idea into action?

1. Get a copy of the bin drawing.
2. Assess condition of bin drain system.
3. Discuss with FCO Operations and Agrock. Follow-up.

Benefits:

The drain system on the two loadout bins is in disrepair. In addition, there is no preventative maintenance program to speak of. Both FCO Operations and Agrock are in agreement that correcting the drain system will provide benefit, but the cost of repairs is prohibitive at this time.

Idea was dropped from this Workout team and will be followed through by Operations/Agrock when financing becomes available.

VIII. Direct hit concentrate from production bins.

What steps did your team take to accelerate this idea into action?

1. Wrote SOP.
2. Issued SOP for Review.
3. Posted in 07 Control Room.

Benefits:

1. Will increase the ability to load rail cars on a maintenance downday. This will decrease the need to truck wetrock—a more costly option.
2. Will decrease tons from production bins to storage then back to loadout. Now Four Corners has the capability to direct production straight to the loadout.
3. Will decrease the tons pushed out then in by pile tractors.

Total value estimated to be two additional rail cars per shift.

Results

The savings from all the ideas were combined to determine the overall project results.

Bruce Bodine then used analysis of variance, boxplots, and a control chart to show the process before and after implementing the team's ideas as shown below:

The team's implementation of eight ideas increased rock loading capability by more than 11 cars per shift. This works out to more than one million tons/year.

This team was quite successful in using both Workout and Six Sigma tools to implement several ideas, solve a problem and save money.

The savings from this project are conservatively estimated at US$820,000/year.

***Training**

The Workout Coach training was done at Motorola University in Chicago by Leap Technologies.

Seven of our BlackBelts were trained by GE as BlackBelts, and as Workout Coaches at Motorola U.

The time for BB training was four weeks over four months, and Workout was three days. The cost for Workout training is US$7500 each.