Phosphate Waste Reduction Initiative

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Abstract *— Budget Waste Expense increased by more than 20% due to incremental phosphate waste (PHOW) during new product lot campaign at Amgen Manufacturing Limited. This constant PHOW increase was pointing toward a possible root cause in the utilities system. During a drains/utilities walk down it was found a constant discharge of cooling water for a pump seal draining to PHOW tank. The malfunction was identified and fixed in the intermediate phosphate waste storage tank pump. Another opportunity was identified to continue reducing the phosphate waste discharge. The option to discharge a specific buffer used for the process from PHOW to normal waste drain was evaluated and approved by quality assurance department since the small amount of phosphate solution in this buffer was considered insignificant based on the laboratory results. Improvements revealed a significant reduction (65%) in phosphate waste generation (26,760 gal/lot) during the first quarter of 2013 and a cost reduction of $807K projected for 35 lots on 2013*

Key Terms *— PHOW, Cost Reduction, Phosphate, Waste.*

INTRODUCTION

During new product campaigns at Amgen Manufacturing limited, several materials are used for the process including phosphate. During one of these campaigns, unexpectedly, the phosphate waste generation increased from 27,700 gal (105,000L) per lot (2011) to 41,000 gal (155,000L) per lot. This material requires a specific treatment with higher workload and physical capacity. Therefore, the amount of phosphate waste generated during these campaigns cannot be treated in the Water Treatment Plant. Phosphate waste is being managed by using Mobile Truck Tanks. This project was focused on eliminating this expense with an extensive evaluation of process and utilities operations to obtain a considerable reduction of phosphate waste.

PROBLEM STATEMENT

Non-expected phosphate waste generation increased with new product lot campaigns. Phosphate waste cannot be treated in the water treatment plant causing external waste management expense. Figure 1 shows lots per phosphate waste produced by month. It can be seen that the phosphate waste has increased. The reasons for this increment were unknown.

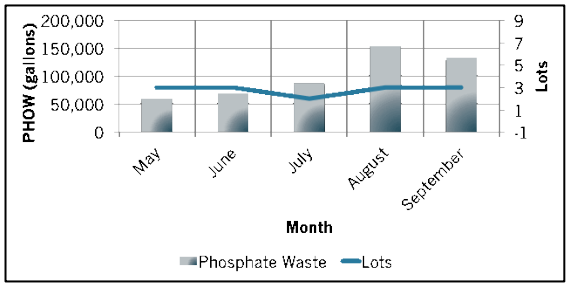

Figure 1
2011 Phosphate Waste per Month

METHODOLOGY

Several activities were performed to understand the problem and identify the potential solutions. The manufacturing process was evaluated to determine the amount of Phosphate Waste (PHOW) buffer produced per lot to establish

minimum discharge amount. The baseline of phosphate buffers produced was 20,000 gal. Also, additional phosphate waste produced by other process activities such as washes, drains and others (8,200 gal) was estimated. This estimated value was obtained with the evaluation of requirement documents that establish a theoretical PHOW volume discharged during several operations of the process.

The utilities and equipment operations were also verified to ensure proper functionality of waste discharge. The amount of phosphate waste is being monitored in the waste storage tank based of the tank level. Therefore, a re-characterization on the level transmitter of the Waste Collection Tank was performed to confirm that Tank level reading is aligned with the volume of PHOW in the Tank. In addition, samples of PHOW at Waste Collection Tank were collected during key steps of the process that should be discharging phosphate waste. This task was very important to identify if other solution than phosphate waste is being discharged into the Phosphate Waste Tank.

A walk down was performed to verify phosphate waste drains, pump functionality, flow controllers and electrical sources. As a result of the walk down, a malfunction in the intermediate PHOW storage tank pump was identified as a key contributor for the increase in waste. It was observed that solenoid to allow water flow to the pump seal was not working properly and constantly opened. This water drained with backflow to phosphate waste tank. The actual water flow amount was 8 LPM instead of the expected water flow amount of 0.3 LPM. This excessive amount of water is estimated in 11,520L/day (8.0LPM x 60min x 24hrs = 11,520L/day). This value is equivalent to 19,270 gal / lot. (Please refer to Figure # 2 for more details).

Another opportunity to reduce phosphate waste was the option to discharge a specific buffer used for the process from PHOW to normal waste drain. The MES buffer is a solution that was initially identified with small amount of phosphate. Therefore, the specific tank for this buffer solution discharges 28,000 L per lot to phosphate waste drains.

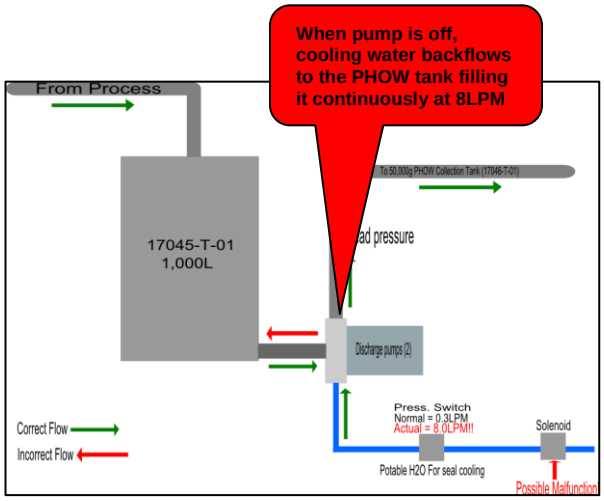

Figure 2

Pump Cooling System of Waste Storage Tank

RESULTS

Based on the baseline established for minimum phosphate waste discharge, it was determined that the excessive amount was being discharged into the Phosphate Waste Tank. This information was confirmed with the following findings:

- **Level transmitter**: Phosphate waste tank evaluation demonstrated no characterization issues with tank levels. Therefore, level transmitter was reading real amount of phosphate volume into the tank.

- **PHOW samples:** Collected PHOW samples at the Waste Collection Tank during key steps of the process demonstrated that other solution than phosphate waste was being discharged into the Phosphate Waste Tank. This solution was essentially water. Therefore, this information reinforced the possible root cause of some malfunction in the utilities operation.

- **Utilities walk down:** As immediate corrective actions, the solenoid was fixed and the pressure switch set point was adjusted to normal flow (0.3L/min).

- **Buffer Discharge:** Buffer assessment confirmed that the Waste Treatment Plant has the capability to process and treat the buffer waste. This change will reflect an expected waste reduction of approximately 7,500 gal (28,000 L) / lot.

CONCLUSION

This project established excellent standards in terms of phosphate waste generation, the waste treatment plant capabilities and lean manufacturing in order to reduce phosphate waste during process and cost reduction.

Cost reduction was definitely the best outcome of this project. Initially, the estimated budget on 2011 to cover phosphate waste treatment was $398K, but the opportunities identified in the utilities system and process operations increased the waste treatment operation in $773K at the end of the year. This operational impact was resulting in 94% over the initial estimated budget, (as shown in Figure 3). As shown on Figure # 3, items like MES buffer, pump solenoid malfunction and external company contract for phosphate waste treatment and labor were the major offender for the increased cost.

Figure 3
2011 Budget

During 2012-2013, a significant reduction was rapidly identified and estimated for every lot processed during 2013. These opportunity areas resulted in 26,670 gal/lot of phosphate waste reduction. The decision to discharge MES buffers from PHOW to normal process drain was evaluated and approved. It was confirmed that the waste treatment plant had the capability to process and treat the MES buffer waste. This resolution provided a considerable waste reduction of 7,400 gal (28,000 L) / lot, approximately. Also correcting the solenoid and flow rate resulted in 19,270 gal/lot of phosphate waste reduction. This amount represented a substantial waste treatment reduction of 26,670 gal/lot and cost reduction of $807K based on total of lots that will be processed at the end of 2013. This reduction represents a significant reduction of 65% in Phosphate Waste Generation and Cost due to improvements (as shown in Figure 4).

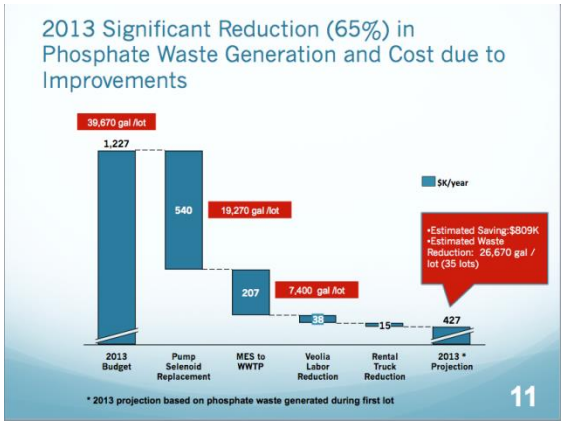

Figure 4
2013 Estimated Cost Reduction

FUTURE WORKS

As part of the findings in this project, several opportunities were identified as preventive maintenance like periodic verification of the Water Cooling System, phosphate drain samples included as part of periodically monitoring in the drain ports and initial cost and process evaluation for any future project that involve phosphate waste generation.