RESULTS. BY THE NUMBERS. GUARANTEED.℠

SBTI

Sigma Breakthrough Technologies, Inc.®

Applying Lean & Six Sigma to a Chemical Process

Rev. A. Printed 6/22/2005

Increased Capacity & Reduced Cost in a Chemical Batch Manufacturing Process: Applying Lean and Six Sigma together
Executive Summary

Company Background:

OSRAM SYLVANIA is the North American operation of OSRAM GmbH, Germany, one of the world's leading lighting manufacturers, and a member of the Siemens international family of companies. OSRAM SYLVANIA, part of the Siemens family of companies, has global reach and global promise. Together with our parent company, OSRAM, we are the second-largest lighting and materials enterprise in the world, serving companies in more than 100 countries. We are the North American subsidiary of OSRAM, headquartered in Danvers, Mass., just a short ride north of historic Boston.

Industry Served: Chemical and Glass Manufacturing

Process: Chemical, Batch Manufacturing Process

Objectives:

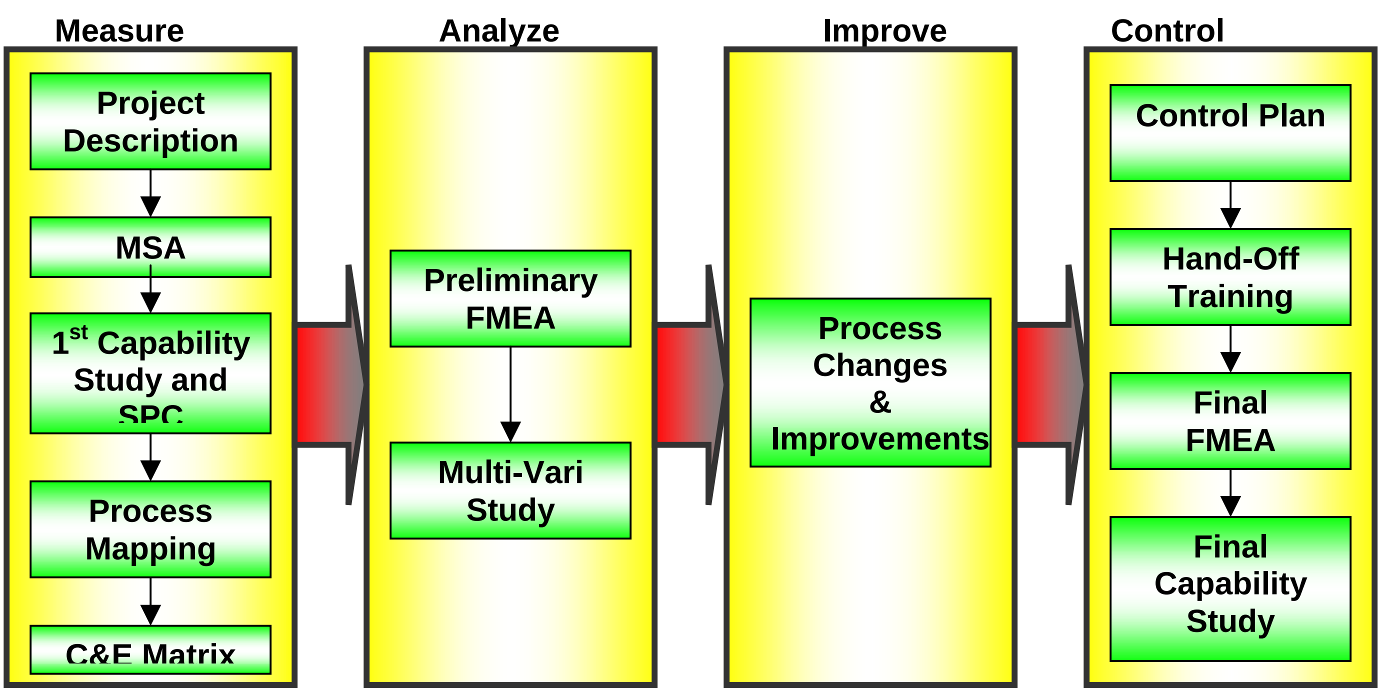
- Increase Capacity, potential increased demand, a business consideration,
- Cost Reduction, lower-cost foreign competition is second consideration

Financial Results:

- **Total savings of $2.9M annualized**

Timeline:

- 4 months.

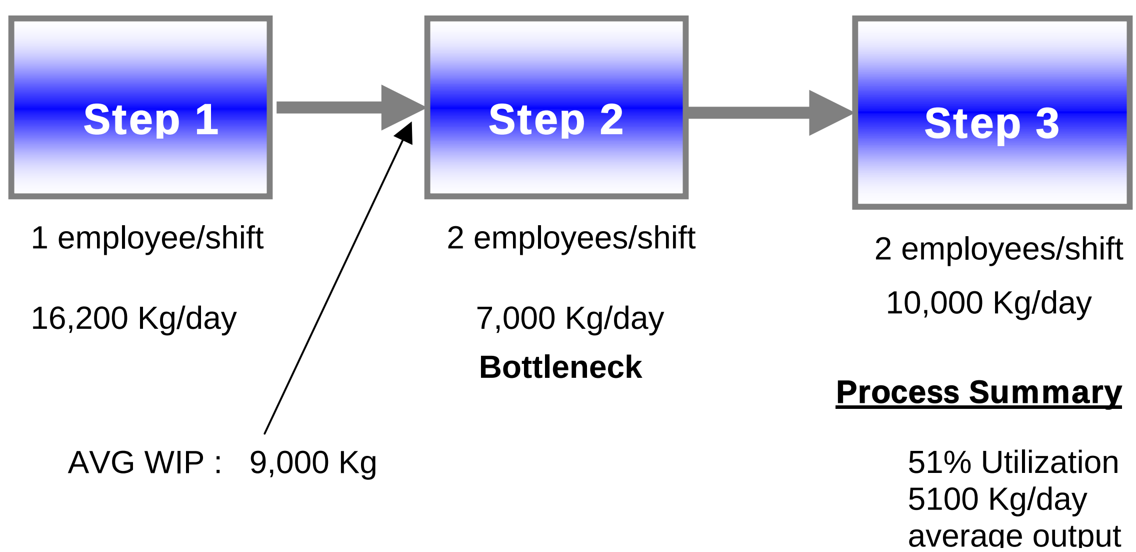


Description:
This case study is about work that was conducted by Mr. Todd Smith of Sylvania, who is credited for his hard work and contributions at integrating Lean and Six Sigma early on, prior to the existing K-Sigma™ roadmap. The forecast for a potential increased demand is one business consideration, and lower-cost foreign competition is another consideration, which may impact the first item.

This effort involves a 3-step chemical manufacturing process as depicted in diagram 1. By evaluating the quantity produced and the cycle times, it became clear that step 2 is the bottleneck of the process. This was one initial focus as it is the pacing item in flow of the entire process.

Diagram 1

Process Diagram



Focusing on the bottleneck revealed some additional aspects of this step in the process. There were 3 furnaces, with a theoretical capacity of 7000 kg per day of materials processing. However the uptime for this step was 71%. The scrap rate was 9.2%, and rework is not possible for out of spec batches.

Since this is bottleneck, increasing the uptime would be beneficial to the entire process. Utilizing the toolset of TPM and some Six Sigma tools reduced the guesswork at maintenance schedules and improved the predictability of uptime.
Key items that were discovered to have synergy between Six Sigma tools and TPM can be seen in Table 2.

Table 2 TPM Link to Six Sigma

TPM item	Six Sigma Tools
Initiate Downtime tracking	Failure Mode Pareto, Time Series analysis
Operator Based Maintenance	Process FMEA
Preventative Maintenance Plan	Process FMEA
Cleaning and Inspection	Process FMEA
Wear Part replacement frequencies	CpK > 1.5
SPC on key parameters	Variable Priority Filter, Multi-vari Analysis
Process Control Plan	Process FMEA

After applying these tools together, the uptime increased to 91%, with a 6300 kg/day average output. Time series analysis revealed that start up and shut down were major sources of inefficiency so a 7 day schedule was implemented. Maintenance costs were reduced by over $10k per month. Additionally, the scrap rate was reduced to 5.1%, and breakage of a key handling item was reduced by 66%, for a net annualized savings in this step over $250k.

Returning to Step 1, it was discovered that while rework is possible, it takes 4 days to rework a faulty batch. The first pass yield in this step was 92%, with corresponding subjective criteria for the rework decision. A measurement systems analysis revealed that the measurement system contribution was 56% of total variation in the data. Correction of measurement system deficiencies resulted in a first pass yield of over 99%. Additionally, a second shift employee was able to run another process due to the lack of rework. The net annualized savings at this step was over $150K.

The final effort was to look at Step 3, which had been ignored previously because it followed the bottleneck. The total output initially was only 5100kg/day. This step had a utilization of 41%, meaning that one shift too many existed. This buffer was unnecessary and was costing money. The third shift was then staffed with only 1 operator to build ahead for shifts 2 and 3. The second issue in Step 3, was an unknown scrap cause. This work followed the traditional Six Sigma roadmap. Work on a faulty measurement system followed by a multi-vari study of key factors resulted in over $500k of additional savings.

Case Summary

- 3 additional projects generated from this project, netting $600,000 annually.
- Over 50% of the savings in this project were realized just by correcting poor measurement systems.
- The total project time was 4 months
- The total analysis resulted in a 26% reduction in labor cost with no loss of production capacity and much greater flexibility with which to serve the customer.
- The total savings annualized were projectedkf at $2900k.