Enhancement in Thermal Substitution Rate (TSR) by Maximization of Tyre Dust (Carbon Powder)

ASQ South Asia Team Excellence Award 2016
UltraTech Cement Ltd (India’s Largest & Globally 4th largest Cement Manufacturing Company)

The company has an installed capacity of 69.3 Million Tonnes Per Annum (MTPA) - (91.1 -After JP Acquisition) of grey cement. Its operations span across India, UAE, Bahrain, Bangladesh and Sri Lanka. UltraTech Cement is also India’s largest exporter of cement.

As the largest cement producer in India, we continually strive to play a key role in finding effective and responsible ways to preserve the environment - a Cement Sustainability Initiative.

UltraTech voluntarily joined the Cement Sustainability Initiative (CSI) in 2008, a part of World Business Council for Sustainable Development.
Key Challenges

- Use of marginal grade limestone
- Availability of Alternative fuel
- Use & optimisation of alternative Fuel with hard to burn High Sulphur Pet coke (Fuel Economics)
- Consistent quality of Clinker with Alternative fuel use

Section 1:
Project & Team Selection
Project Selection Process

1.1.1(1) and 1.2.1(1)

1.2.1(1) Project identification group

Organization Structure

Steering Committee

Unit Head

Aditya Birla Business Excellence

Work Environment
Asset Management
Supply Chain Management
Customer Experience Management
Quality Management
People Management
Technology Management
Systematic Improvement
Information & Knowledge Management

Zone 1
Zone 2
Zone 3
Zone 4
Zone 5

1.1.1(1) Responsible for Selecting Project

1.3.1(1) Identification of Stakeholder groups

Improvement Opportunity identification

Management Review Processes

- Benchmarking Report
- Loss Cost matrix
- Energy Mapping for Energy use across Unit
- Plant Performance Report
- Various studies & Audits
- Inputs from COQ analysis

Opportunities for Improvement Identified

Analysis of data w.r.t. Present parameters/technology/Market Condition
Fixing Target, Aiming for Loss Reduction
Opportunity for improving TSR Identified
Selection of area for improvement

Area of opportunity

Total Energy Cost ~56-59%

Cement Industry is an energy intensive industry: Reduction in fuel & power cost through innovations & use of Non-Conventional Energy is need of an hour.

Improvement opportunity - Business Relation

Business Case | Thermal Substitution Rate (TSR): UltraTech

TSR: Thermal Substitution Rate means proportionate heat substitution of fuel by using alternative fuel.

Target TSR: As per Business Head Note: Manufacturing Planning & Budgeting Note: FY’14 to FY’16

Group Sustainability Vision

By 2017, the Aditya Birla Group endeavors to become the leading Indian conglomerate for sustainable business practices across its global operations, balancing its economic growth with environmental and societal interests.
Frequent variation and increase of fuel prices affects our fuel cost as shown, Unit is low in TSR % against the global benchmark and also as compared with its other UltraTech Plants.

**Initial impact study of project**

**Project Matrix:**

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
<th>Consequential</th>
<th>Financial</th>
<th>Business</th>
</tr>
</thead>
</table>
| • Thermal Heat Substitution  
• Thermal Substitution Rate  
• Reduction in fuel cost  
• Conservation of conventional fossil fuel | • Reduction in CO2  
• Reduction in green house gas emissions  
• Energy recovery from waste  
• Increase in Carbon footprint | • Benefits to the society  
• Cleaner green technology  
• Livelihood for society  
• Sustainable cement operation. | • Reduction in fuel cost | • Enhanced goodwill of company. |

**Tyre Dust (Carbon Powder):**

It is waste of small scale industries, which are extracting oil from waste tyres. It is being fine/powder in nature.
**Impact Cost Ease (ICE) analysis**

VCW Project Prioritization

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Loss Type</th>
<th>Process Step</th>
<th>Project Theme</th>
<th>Target Parameter</th>
<th>Prioritization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy</td>
<td>Combustion</td>
<td>1) To enhance TSR with use of MSW</td>
<td>✔ ✔ ✔</td>
<td>4 1 5 20</td>
</tr>
<tr>
<td></td>
<td>Loss</td>
<td></td>
<td>2) To enhance TSR with use of Agro Waste</td>
<td>✔ ✔ ✔</td>
<td>7 2 5 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3) To enhance TSR with use of Plastic Waste</td>
<td>✔ ✔ ✔</td>
<td>3 3 7 160</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4) To enhance TSR with use of Tyre dust</td>
<td>✔ ✔ ✔</td>
<td>9 4 8 280</td>
</tr>
</tbody>
</table>

**Impact** - How much impact does this project has on Unit Objective

**Cost** - What is cost of project as compared to other option and realisation

**Ease** - Ease of operation

---

**Project Selection Process**

**Analysis of the Current Situation**

**Tools**
- Process Mapping
- Control & Capability
- ICE - Impact, Cost, Ease

**Why?**
- To understand the interactions and details of the AFR Process
- Understand Process Actability and Capability
- For prioritization of available solutions

**Who**
- Project team

**Source of Tool**
- Aditya Birla Business Excellence Model

**Why - why Analysis**
- To reach at root cause of basic Problems

**Project Matrix**
- To understand relationship between various KPIs

**Cause & Effect Diagram**
- To understand the relationship between process
Project Selection Process

UltraTech Business objective for enhancing TSR is 5% to 15% by 2020

Project Objective Statement - Vikram Cement
To maximize the Thermal Substitution Rate (TSR) from 2.78 to 4.0% with enhancement in Tyre Dust contribution (0.42% to 1%) as alternative Fuel without affecting productivity.

Team Selection and Preparation
Stakeholders group are identified as per discussion held in Steering committee meeting as shown in 1.1.1

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Services</td>
<td>Feasibility to use tyre dust &amp; various studies related to process parameter</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Erection &amp; Maintenance of infrastructure</td>
</tr>
<tr>
<td>Process</td>
<td>Adjustment in AF feed</td>
</tr>
<tr>
<td>Material</td>
<td>Coordination between plant &amp; vendor</td>
</tr>
<tr>
<td>Quality Control</td>
<td>Sample testing of tyre dust &amp; QA</td>
</tr>
<tr>
<td>Vendor/Supplier</td>
<td>Ensure continuous Provision of material</td>
</tr>
<tr>
<td>MPPCB</td>
<td>Monitoring of Legal requirements</td>
</tr>
</tbody>
</table>
The Power Within

Mr. Upendra M Aole
Team leader
Overall responsibility of Project Execution
Problem solving tool Expert Tech. Services

Mr. K C Depura
Coordination with MPPCB & for Procurement Quality Control

Mr. Chetan Yadav
Process Analysis & Validation Tech. Services

Mr. P Tripathi
Fuel mapping, analysis & development Mechanical

Mr. M D Mali
Process operation & monitoring Process

Mr. B K Jha
On site job modification and execution Mechanical

1.3.1 Team Selection and Preparation

Aditya Birla Business Excellence Model – Systematic Improvement & Innovation

Systematic Improvement & Quality Management Team

Management

Leader

Know How required by Team
- Major Kaizen methodology
- Strategic Vision
- Influence and Leadership
- Coaching and Training
- Effective Communication
- Process Knowledge
- Strategic Vision
- Effective Communication
- Negotiation
- Leadership
- Methodology (Advanced)
- Knowledge of the process
- Leadership
- Decision Making
- Effective Communication
- Vendor Relationships
- Problem Solving
- Major Kaizen

Team determined Current Level of Knowledge/Skills

Team found out Additional Knowledge

- Major Kaizen methodology
- None Additional

1.3.2 Existing stakeholder knowledge/skill

1.3.2 Additional Knowledge or skill needs for project

Using the Stakeholder Matrix Competence Evaluation
Management ensured that Project objective is linked with team KRA (Key result area).
This Improvement project was announced publicly by Unit Head and all resources made available to team. So Team was challenged to get project successful.
Workshop on “Problem Solving Tools” was conducted to enhance the knowledge about the PS tools and create good synchronisation among the team members.

<table>
<thead>
<tr>
<th>SNo</th>
<th>Training /Knowledge</th>
<th>Stake Holder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hazard identification and control measures during loading at vendor site.</td>
<td>Vendor</td>
</tr>
<tr>
<td>2</td>
<td>Precaution during unloading &amp; feeding</td>
<td>Contractor Manpower</td>
</tr>
<tr>
<td>3</td>
<td>Operation of tanker unloading.</td>
<td>Contractor Manpower</td>
</tr>
<tr>
<td>4</td>
<td>How to handle fine material in process &amp; its impact.</td>
<td>Operation manpower</td>
</tr>
<tr>
<td>5</td>
<td>Precaution measure during maintenance and handling of equipment.</td>
<td>Maintenance manpower</td>
</tr>
<tr>
<td>6</td>
<td>Fugitive dust limits and its impact.</td>
<td>All stake holder.</td>
</tr>
<tr>
<td>7</td>
<td>Hazard of tyre dust and how to mitigate</td>
<td>All stake holder.</td>
</tr>
</tbody>
</table>

Team decided to meet daily basis to project progress review and weekly updated to senior management.
Section 2: Current Situation and Root Cause/Improvement Opportunity Analysis

Key Measures Expected of the Project

2.1.1 Specific Goal & measures for project

Specific Goal- Enhancement in Tyre Dust contribution from 0.42% to 1% TSR as alternative Fuel without affecting productivity.

- Mapping of alternative fuels with quantity & quality parameters.
- Ensure availability of material.
- Cost comparison with existing fuels.
- Vendor registration and long term contract.

Goal - Reduction in variable cost of clinker
Additional Potential Benefits

- It will help in absorbing high sulphur in existing fuel i.e. balance the system sulphur chloride cycle in pyro-process of cement.
- Use of tyre dust will be benefit in terms of employment generation in the area of waste tyre industry.
- Reduction in Green house gas emission.
- Cleaner and better society.
- Resources optimization by minimizing use of fossil fuel.

Key Measures Expected of the Project

2.1.1

Pyro Process

In clinkerization process main fuel is fired through burner in kiln & calciner. Alternate fuels (MSW, agro waste etc.) is fed in the existing alternate fuel feeding system at Preheater in calciner.
Possible Improvement Opportunities

2.2.1

Effects of Tyre Dust Use
- Process variation due to uncontrolled material feeding & its size.
- CO generation > 800 ppm against the normal 200-300 ppm.
- Fugitive dust emission & poor housekeeping of plant & safety issue for handling manpower.
- Above phenomenon lead to reduction in Kiln TPH by 10-12%.

Possible Improvement Opportunities

2.2.1

Use of Analytical Tools & Techniques

- Project Matrix
- Cause & Effect
- Process Capability & Gap
- Brainstorming
- PDCA
- Pareto

We decided the priority of causes to attended based on PARETO

Root Causes to be rectified
- Behaviour of raw mix & clinker quality, Burnability to be conducted at lab scale
- Non uniform, uncontrolled flow & residue of the tyre dust.
This C&E is the outcome of Brainstorming carried out by Team (Process, Technical Services, Mechanical, Purchase & Quality) with involvement of engineers, supervisors, operators.

Possible Improvement Opportunities 2.2.1

Scanning Probable Causes

- Adoption
  - No previous experience

- Internal process
  - Circulation of volatile
  - Clogging of system

- Raw Mix design
  - Burnability validation
  - Material Quality CV

- Use of Tyre Dust
  - Manual Feeding
  - Powder form of material
  - Varying in size of receiving material
  - Manual Tyre Dust
  - Uncontrolled feeding of material

- Thermal Effect
  - Characteristic of material

- Methodology

This C&E is the outcome of Brainstorming carried out by Team (Process, Technical Services, Mechanical, Purchase & Quality) with involvement of engineers, supervisors, operators.

Possible Improvement Opportunities 2.2.1

Analysis of the Current Situation

<table>
<thead>
<tr>
<th>Tools</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Mapping</td>
<td>To understand the interactions and details of the AFR Process</td>
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<tr>
<td>Control &amp; Capability</td>
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<tr>
<td>ICE - Impact, Cost, Ease</td>
<td>For prioritization of available solutions</td>
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<tr>
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<td>To reach at root cause of basic Problems</td>
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<td>Project Matrix</td>
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<tr>
<td>Cause &amp; Effect Diagram</td>
<td>To understand the relationship between process</td>
</tr>
</tbody>
</table>
2.2.1 Training on problem solving tools

Possible Improvement Opportunities

2.2.2 Activity -1: Conducted Burnability Study

Possible root cause & improvement opportunity

Stakeholder participation
Burnability Study at Lab Scale

- As per conclusion of cause & effect analysis team decided to execute Burnability test to evaluate existing Raw Mix elements & it’s compatibility with the process.
- Effective Burnability study requires controlled rise & drop in temperature for particular time.
- An electric furnace was conditioned with Process Controller so that required Temperature profile could be gained.

### Possible Improvement Opportunities

**2.2.2**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Raw Mix</th>
<th>Without AF</th>
<th>With AF</th>
<th>With AF+Tyre dust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Modules Values</td>
<td>LSF</td>
<td>93.54</td>
<td>94.10</td>
<td>93.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SM</td>
<td>2.12</td>
<td>2.14</td>
<td>2.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AF</td>
<td>1.145</td>
<td>1.148</td>
<td>1.147</td>
</tr>
<tr>
<td>2</td>
<td>Ash Absorption</td>
<td>0.519</td>
<td>0.665</td>
<td>0.651</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Granulometry</td>
<td>90 Micron</td>
<td>22.12</td>
<td>22.10</td>
<td>22.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>212 Micron</td>
<td>3.10</td>
<td>3.08</td>
<td>3.09</td>
</tr>
</tbody>
</table>

**Possible Improvement Opportunities**

Burnability & Raw mix design data analysis

**2.2.2**

<table>
<thead>
<tr>
<th>Raw Mix</th>
<th>Temperature (°C)</th>
<th>Free CaO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled Kiln Feed</td>
<td>1300</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td>1350</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>1400</td>
<td>0.98</td>
</tr>
<tr>
<td>Raw Mix + AF</td>
<td>1300</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>1350</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td>1400</td>
<td>1.08</td>
</tr>
<tr>
<td>Raw Mix + AF + Tyre dust</td>
<td>1300</td>
<td>1.24</td>
</tr>
<tr>
<td></td>
<td>1350</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>1400</td>
<td>1.03</td>
</tr>
</tbody>
</table>

**Clinker Analysis**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Tyre dust</th>
<th>Without (%)</th>
<th>With (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO2</td>
<td>20.97</td>
<td>20.87</td>
<td></td>
</tr>
<tr>
<td>Al2O3</td>
<td>5.59</td>
<td>5.56</td>
<td></td>
</tr>
<tr>
<td>Fe2O3</td>
<td>5.01</td>
<td>4.88</td>
<td></td>
</tr>
<tr>
<td>CaO</td>
<td>64.19</td>
<td>64.09</td>
<td></td>
</tr>
<tr>
<td>MgO</td>
<td>1.06</td>
<td>1.08</td>
<td></td>
</tr>
<tr>
<td>SO3</td>
<td>1.58</td>
<td>1.67</td>
<td></td>
</tr>
<tr>
<td>K2O</td>
<td>0.44</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>Na2O</td>
<td>0.11</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td>0.002</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>MnO</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>CO (ppm)</td>
<td>21</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

**Chemical Parameters**

| LSF       | 92.1 | 92.1 |
| SM        | 1.98 | 1.98 |
| AM        | 1.16 | 1.16 |

Analysis of burnability study & raw mix design revealed:
- No Impact on Clinker Quality with modified Raw Mix, its resulted Raw Mix is with Low LSF.
- Here We validate the New Raw Mix with Tyre Dust to use in our Kiln. **Best substitute of Conventional fuel**
**Possible Improvement Opportunities**

### Activity -1 : Plant Scale trial

- Bags of Tyre dust, 30 to 40 kg each were manually unloaded in Alternative Fuel - MSW hopper.
- It is consumed in kiln circuit but lead to process instability because of inconsistency and emission.

#### Kaizen -1 : Tyre dust through Wagon tippler

- Normally coal is unloaded through wagon tippler area. So Tyre dust bag was emptied through tippler so that it could easily mix through coal & could be utilized through existing coal feeding belts.

**Benefit:** Uniform mixing with coal, so less variation in process.

**Concern:** Residue of 100% Tyre dust material passing through 500µ sieve as against 10% raw coal base through same sieve resulting in high emission. Utilization is limited & threat to environment & safety.

### Activity-2: Waste feeding hopper utilization

- Trial was taken to direct feed in Pre heater through plastic waste feeding hopper. The vendor was contacted to supply the tyre dust in a bag of 2-5 kg bags instead of 30-40 kg.
- Improve upon environment & safety.
- Total operation cost increased heavily due to involvement of 8-10 labors per day (Rs. 2500/- per day).
- Uncontrolled feeding.
### Possible Improvement Opportunities

#### 2.2.2

**Kaizen - 2 : Provision of Hopper Face gate**

Initially the hopper was with one slide gate only.

- It’s operation impacted on
  1. Infiltration of false air in a circuit
  2. Unsafe feeding in case of kiln pressurization

Provision of Hopper Face gate & interlock with slide gate.

**Installation cost Rs. 35K**

**Slide gate**

#### Kaizen - 3 : Gate Interlock with CO

As it was manual, uncontrolled feeding, resulting in high CO concentration, leading to ESP tripping.

PLC interlocking of closing lower slide gate with CO concentration of 2000 ppm was provided.

Here we overcame the challenges due to manual feeding of tyre dust but still there was issue of less feeding & cost of material feeding

### Final Improvement Opportunities

#### 2.3.1

<table>
<thead>
<tr>
<th>Who</th>
<th>Source of Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project team</td>
<td>Aditya Birla Business Excellence Model</td>
</tr>
</tbody>
</table>

#### Analysis of the Current Situation

<table>
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<tr>
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<td>To understand the interactions and details of the AFR Process</td>
</tr>
<tr>
<td>Control &amp; Capability</td>
<td>Understand Process Actability and Capability</td>
</tr>
<tr>
<td>Major-Kaizen</td>
<td>To analyse best possible solution</td>
</tr>
<tr>
<td>Charts and formats</td>
<td>To generate the data for analysis</td>
</tr>
<tr>
<td>Interactions with Stakeholder</td>
<td>To understand their needs and difficulties.</td>
</tr>
<tr>
<td>Cause &amp; Effect Diagram</td>
<td>To understand the relationship between process</td>
</tr>
</tbody>
</table>
In cement plant, thermal power plant generated waste fly ash is being utilised for cement manufacturing and it is handled and transported by use of bulkers.

The idea came out during the team brainstorming session, tyre dust may be handled through bulkers to eliminate the dust emission, confined handling and transportation.

Team analysed & compared

Analysis of the fly ash physical characteristics:

<table>
<thead>
<tr>
<th>Physical properties</th>
<th>Fly ash</th>
<th>Tyre dust</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk density (Ton/M3)</td>
<td>0.70 - 0.90</td>
<td>0.65-0.75</td>
<td>Similar</td>
</tr>
<tr>
<td>Fineness (M2/kg)</td>
<td>250-350</td>
<td>150-250</td>
<td>Lower</td>
</tr>
<tr>
<td>Residue on 90mic</td>
<td>15-25</td>
<td>60-70</td>
<td>Better</td>
</tr>
<tr>
<td>Moisture%</td>
<td>0.1 – 0.2</td>
<td>0.1 – 0.2</td>
<td>Similar</td>
</tr>
<tr>
<td>Flow-ability</td>
<td>Hygroscopic &amp; sticky</td>
<td>Flow-able</td>
<td>better</td>
</tr>
</tbody>
</table>

From above comparative data concluded that same technique can be used for tyre dust unloading & transportation.

Plant scale trial: Tyre dust through Bulker

Systematic Implementation:
- Feasibility study conducted
- Contacted to vendor to design the bulkers for smooth tyre dust flow ability.
- Use of existing system like compressor, fine coal bin, etc. Expertise to install such system for Fly ash is already exist in unit.
- Installation of Pneumatic unloading system for Tyre dust.

Benefits:
- Unloading & feeding in controlled manner without manual intervention in fine coal bin with bulker of 15 ton.
- Handling cost of tyre dust saved Rs. 200/MT.
- Environment hazards & fugitive emission totally eliminated.
- Significantly increased utilization of tyre dust.
## Project Management Update

### 2.4.1 How corrective of the initial scope, deliverable & timing

<table>
<thead>
<tr>
<th>Title</th>
<th>Responsibilities</th>
<th>Time</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of Dept. (Technical Services)</td>
<td>Overall responsibility of Project Execution. Co-ordination with cross functional teams like materials &amp; Mechanical etc. &amp; approval taken from management.</td>
<td>Apr’15 6month from project start</td>
<td>Project charter, Data Analysis, Root cause analysis,</td>
</tr>
<tr>
<td>Section Head (Quality Control)</td>
<td>Co-ordination with procurement department &amp; vendor development</td>
<td>Apr’15 6month from project start</td>
<td>Improvement Implementation at vendor facility as required</td>
</tr>
<tr>
<td>Section Head (Mechanical)</td>
<td>Mechanical coordination &amp; implementation of schemes.</td>
<td>Apr’15 6month from project start</td>
<td>Improvement Implementation at site</td>
</tr>
<tr>
<td>Section Head (TS)</td>
<td>Monitoring &amp; Analysis of operational data, Modification and execution of work at site, quality check.</td>
<td>Apr’15 6month from project start</td>
<td>Data collection, analysis and validation - Implementation.</td>
</tr>
<tr>
<td>Section Head (Process)</td>
<td>Process Stabilization, Performance Monitoring</td>
<td>Apr’15 6month from project start</td>
<td>Process study and monitoring</td>
</tr>
<tr>
<td>Asst. Manager (QC)</td>
<td>Testing of incoming material, feeding and preparing conclusion report.</td>
<td>Apr’15 6month from project start</td>
<td>Material quality check, material feeding and preparing conclusion report</td>
</tr>
</tbody>
</table>

### Stakeholders

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Services</td>
<td>Support provided for monitoring, analyzing and skill improvement.</td>
</tr>
<tr>
<td>Mechanical</td>
<td>At every stage of plant scale trial, necessary modification and arrangement were done at site.</td>
</tr>
<tr>
<td>Process</td>
<td>At every stage of plant scale trial Process Stabilization, Performance Monitoring</td>
</tr>
<tr>
<td>Quality Control</td>
<td>Quality testing of fuel and results verification at different trial.</td>
</tr>
<tr>
<td>Employee</td>
<td>Suggest small and suitable improvements in execution.</td>
</tr>
<tr>
<td>Vendor</td>
<td>Material was supplied as per specifications provided by plant team.</td>
</tr>
</tbody>
</table>
Project Management Update

Stakeholder resistance:
- Vendor was not agree to provide the material in the bulker, because he was not having the facility to load the bulker.
- Process person was not agree to use of fine coal bin to mix tyre dust with it, may cause the process variation.
- Due to old plant lay out constraint was also there to installation of new air line & pipes.
- Fugitive emission at various stage of transfer point.

Stakeholder resistance addressed:
- Facilitated vendor to modify his facility to accommodate the bulker operation.
- Ensure the proper mixing of tyre dust with coal by scheduled unloading of tyre dust in fine coal bin.
- Study the plant design to overcome the layout constraint.
- Enclosed transportation and handling of tyre dust.

Team was updating management on weekly basis based on which the appropriateness was ensured.

Section 3: Solution/Improvement Development
### Possible Solutions or Improvements

#### 3.1.1

<table>
<thead>
<tr>
<th>Who</th>
<th>Source of Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project team</td>
<td>Aditya Birla Business Excellence Model</td>
</tr>
</tbody>
</table>

#### Methods & tools

<table>
<thead>
<tr>
<th>Tools</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming &amp; affinity diagram</td>
<td>The speed with which generate multiple solutions</td>
</tr>
<tr>
<td>Consultation &amp; Specialists</td>
<td>Incorporate technical expert knowledge</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>To compare the method &amp; material with competitors</td>
</tr>
<tr>
<td>Why - why Analysis</td>
<td>To reach at root cause of basic Problems</td>
</tr>
<tr>
<td>Cause &amp; Effect Diagram</td>
<td>To understand the relationship between process</td>
</tr>
</tbody>
</table>

#### Possible Solutions or Improvements

<table>
<thead>
<tr>
<th>S.No</th>
<th>Knowledge / Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Environment impact of tyre dust burning</td>
</tr>
<tr>
<td>02</td>
<td>Significant impact of minor elements on concrete</td>
</tr>
<tr>
<td>03</td>
<td>Operation of ESP / Bag house</td>
</tr>
<tr>
<td>04</td>
<td>Proximate &amp; Ultimate analysis testing</td>
</tr>
<tr>
<td>05</td>
<td>Operation Knowledge of pyro process. Burning zone of kiln operation</td>
</tr>
<tr>
<td>06</td>
<td>Phase analysis of clinker</td>
</tr>
<tr>
<td>07</td>
<td>Safe browser operation training</td>
</tr>
</tbody>
</table>
Possible Solutions or Improvements

Data analysis for improvement

Feeding of tyre dust on fine coal silo & fired through existing firing system

1. Feasibility analysis: To know the existing system and additional resources requirement:
   - 6 inch line for material & 3 inch line for compressed air for material handling for that coal transfer line can be utilized by some modification.
   - Compressor - 200KW compressor available at VC-II compressor room
   - Space for loading & unloading of bulkers.
   - Manpower for loading & unloading system

   • Problem associated
     - Dust at unloading area if leakage occurs
     - Kiln may disturbed if homogenization not done properly at silo
     - Uneven flow of coal & tyre dust
     - Process disturbance due to Low volatile material (7-8%)

   • Option as per space availability
     - Near VC-II Compressor room
     - Near VC-III Coal mill poldos area

2. Vendor assessment: To explore the possibility to supply required material as per our site condition.
3. Design validation: Validation of the new requirement of system with existing layout.

Possible Solutions or Improvements

3.1.2

Inter transfer line from line 2 to 3

Space near VC-III poldos area

Space near VC-II Compressor room
Installation of tyre dust unloading system

3.2.1 What method used for identify final improvement

We installed pipe line from unloading station to fine coal bin along with compressed air line of 2.0 kg/cm² pressure for pneumatic conveying of tyre dust. Which will be connected through full of tyre dust bulker.

This has been found most suitable way of unloading of tyre dust through bulker and utilisation of existing coal firing system to feed in controlled manner.

Team has prepared themselves with discussion and under guidance of experts from other section of cement mill area.

Final Solutions or Improvements

3.2.2 Why this method used

Final Solutions or Improvements

3.2.3 How was the team prepared to use these tools

3.2.4 What was final solution

Final Solutions or Improvements

3.2.5 Method

<table>
<thead>
<tr>
<th>S No</th>
<th>Method</th>
<th>Impact</th>
<th>Why selected</th>
</tr>
</thead>
</table>
| 1    | Feeding through existing alternative fuel feeding hopper in 30-40 kg bags. | 1. Uncontrolled feeding  
2. Temperature variation & CO generation in system  
3. Jamming into the system  
4. Fugitive emission | Not feasible                  |
| 2    | Feeding through existing coal unload hopper by use of tippler unloading system and feed with coal pile. | 1. Fugitive emission at various transfer point.  
2. Limited quantity use. | Not feasible                  |
| 3    | Feeding through plastic feeding system at Preheater in 2-5 kg bags.    | 1. Small quantity use  
2. Uneconomical               | Not feasible                  |
| 4    | Feeding in existing fine coal bin hopper through bulker and mix with coal to firing in calciner. | 1. Drastically improved use of quantity  
2. Economical feeding  
3. Environment friendly  
4. No process variation | Feasible and implementable    |
### Benefits:
1. Unloading & feeding in controlled manner & mechanized way
2. Handling cost of tyre dust saved
3. Environment hazards & fugitive emission totally eliminated.
4. Significantly increased its utilization

### Loose Handling Turned to Confined one-15T/Bulker

---

### Final Solutions or Improvements

#### 3.2.2 Method-4 : Tyre dust through Bulker

**Inspiration through Fly ash transportation**

**Fine Coal + Tyre dust**

**To Preheater for pyro firing**

3.2.2 What was final solution

3.2.3 How were final solution validated

---

### Final Solutions or Improvements

#### 3.2.3 Cement Quality parameters

Consistent & controlled feeding of tyre dust

---

**Process capability of TriCalcium Silicate C3S Which impact cement strength**

**Process Capability Without Tyre Dust Clinker C3S**

Before Tyre Dust

Cpk - 1.14

During Tyre Dust Trial

Cpk - 0.95

Overall Cpk

Unique Solution
### Final Solutions or Improvements

**3.2.3 Consistent & controlled feeding of tyre dust**

- **Before Tyre Dust**
  - Cpk: 1.49

- **During Tyre Dust Trial**
  - Cpk: 1.11

**Process capability of Free Lime i.e. % CaO**

- **Overall Cpk**

---

#### 3.2.4 Cement Quality parameters

**Process Capability of Clinker Free CaO (With Tyre Dust)**

---

### Additional Potential Benefits

<table>
<thead>
<tr>
<th>SNo</th>
<th>Additional Potential Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fugitive emission totally eliminated.</td>
</tr>
<tr>
<td>2</td>
<td>Safety &amp; occupational health issue eliminated.</td>
</tr>
<tr>
<td>3</td>
<td>Transportation &amp; handling cost reduced</td>
</tr>
<tr>
<td>4</td>
<td>This improve motivate for commitment to achieve Units Key objective.</td>
</tr>
<tr>
<td>5</td>
<td>Work environment improve at shop floor</td>
</tr>
<tr>
<td>6</td>
<td>Help in petcoke sulphur dilution</td>
</tr>
</tbody>
</table>

---

**Stakeholder movie depicting benefits of the solution**
## Final Solutions or Improvements

<table>
<thead>
<tr>
<th>S.No</th>
<th>KPI</th>
<th>Trial</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tyre dust quantity use</td>
<td>35 Tonne bulker unloaded in fine coal bin</td>
<td>Unloaded in bin and mix with fine coal. Fed into the calciner through firing system successfully.</td>
</tr>
<tr>
<td>2</td>
<td>CO - generation at kiln inlet</td>
<td>Measurement during trial</td>
<td>Effect of tyre dust was not observed. CO was within permissible limit.</td>
</tr>
<tr>
<td>3</td>
<td>Fugitive emission</td>
<td>As handling is confined in bulker &amp; pneumatically conveyed</td>
<td>No fugitive emission was observed at any point of unloading &amp; transfer point</td>
</tr>
<tr>
<td>4</td>
<td>Material handling cost</td>
<td>As mechanised handling transportation cost will be lower than manual handling</td>
<td>Mechanised handling cost was less than manual handling cost</td>
</tr>
<tr>
<td>5</td>
<td>Kiln feed variation</td>
<td>Expected variation of kiln feed was 3-5%.</td>
<td>Kiln feed variation was observed less than 2%.</td>
</tr>
</tbody>
</table>
Stakeholder resistance:
- Compressed air was not sufficient to lift the material.
- Foreign material observed during unloading of bulker caused jamming problem.
- Number of bends to carry the material through pipes were high.
- Bulker material line ball valve was choked.
- Unloading of bulker into fine coal bin was time taking process for proper mixing of tyre dust into the fine coal bin.
- Uneven feeding of tyre dust into bin.

Stakeholder resistance addressed:
- Sufficient compressed air was provided for pneumatic conveying.
- Obstacle provided into the line to gravity fall of foreign material.
- Number of bend was reduced by modification in line.
- Foreign material was trapped to continuous feeding of material.

Team was updating management on weekly basis based on which the appropriateness was ensured.
Individual KRA & Goals are monitored on Half-yearly and annual basis.

Section 4: Implementation and Results Verification
### Stakeholder Considerations in Implementation

#### 4.1.1

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Role</th>
<th>Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Services</td>
<td>Overall responsibility of Project Execution. Coordination with cross functional teams like materials &amp; Mechanical etc. &amp; approval taken from management.</td>
<td>Project charter, Data Analysis, Root cause analysis,</td>
</tr>
<tr>
<td>Project</td>
<td>Providing Technical support through vendors &amp; OEM for modification</td>
<td>Technical Know-how</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Mechanical coordination &amp; implementation of schemes.</td>
<td>Improvement implementation at site</td>
</tr>
<tr>
<td>Process</td>
<td>Monitoring &amp; Analysis of operational data, Modification and execution of work at site, quality check.</td>
<td>Data collection, analysis and validation</td>
</tr>
<tr>
<td>Quality Control</td>
<td>Process Stabilization, Performance Monitoring</td>
<td>Process study and monitoring</td>
</tr>
<tr>
<td>Vendor</td>
<td>Responsibility of project. Coordination with MPPCB. Coordinate with procurement department.</td>
<td>Material procurement &amp; sourcing.</td>
</tr>
</tbody>
</table>

#### 4.1.2

- Team meetings were conducted to anticipate various resistances from stakeholders.
- It was anticipated that team will face resistance from process & maintenance section about process variation & jamming.
- During actual implementation process & maintenance team was taken in confidence with the help of management to achieve organisational objective of higher TSR.
- During the trial maintenance people have seen that the issues related with jamming and layout can be resolved with some efforts.
- Trial results was encouraging to team thus the process department agreed to go for maximisation tyre dust.
Problem of jamming of unloading line due to presence of foreign material like tyre pieces & etc.

A chamber was fabricated in between feeding line & Mesh of 15x15 mm was fixed in a passage to restrict such material.

With Above modification tyre bulkers are being unloaded smoothly without impacting Environment and Safety.
4.2.1

Solution/Improvement Implementation

- During implementation of the final solution modified the coal mill operation procedures & prepared SOPs.
- Training was provided to shop floor employee.

Onsite display of method

SOP for tyre dust handling

4.3.1

Project Results

4.3.1.1 How did the results compare with sp. Coal/meas.

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>2012-13</th>
<th>2013-14</th>
<th>2014-15</th>
<th>2015-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyre Dust Consumed</td>
<td>MT</td>
<td>991</td>
<td>1567</td>
<td>4998</td>
<td>9500</td>
</tr>
<tr>
<td>Coal Saved</td>
<td>MT</td>
<td>1021</td>
<td>1752</td>
<td>4610</td>
<td>9204</td>
</tr>
<tr>
<td>Cost Saving</td>
<td>Rs. Lakh</td>
<td>40.5</td>
<td>61.6</td>
<td>161.4</td>
<td>381.5</td>
</tr>
</tbody>
</table>

A. Total Saving - Tyre dust use Rs. Lakh

- Compressor air use for bunker unloading@15 hrs/day
  5.90
- Maintenance cost of mill on account of coal grinding @ Rs 35/t of material 3066MT
  1.07
- Klin stoppage due to firing fail by foreign material (1.45)
  5.75
B. Sub total saving Rs. Lakh
  0.92

C. PAT benefits will be Rs. Lakh
  402.4

Total Saving (A+B+C) Rs. Lakh
  1024.4

Measures to Sustain the Results

1. Replication of Raw Coal Hopper use for Tyre Dust Storage in Line - 1 & 2
Consistent & controlled feeding of tyre dust ........

Kiln operational problems were totally eliminated on account of Tyre dust.

Total Savings: Rs. 1029.70 Lacs

Final Solutions or Improvements

Consistent & controlled feeding of tyre dust

Cement Quality parameters

Overall Improved Cpk

Process capability of Free Lime i.e. %CaO

Unique Solution

Kiln operational problems were totally eliminated on account of tyre dust.

Project Result - Through DMAIC approach

<table>
<thead>
<tr>
<th>Tools</th>
<th>Deciding Factor</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define</td>
<td>Problem Definition</td>
<td>Due to Process instability, we could not use tyre dust in large quantity and achieve target of 1% contribution in TSR</td>
</tr>
<tr>
<td>Measure</td>
<td>TSR %</td>
<td>0.42% TSR Use of Tyre Dust in 2013-2014</td>
</tr>
<tr>
<td></td>
<td>CO generation in ppm</td>
<td>&gt;800 PPM</td>
</tr>
<tr>
<td>Analyze</td>
<td>Area of Improvement</td>
<td>Raw Mix Design, Inconsistent &amp; Uncontrolled Feeding of Tyre Dust, Environment &amp; Occupational Safety Hazard</td>
</tr>
<tr>
<td>Improve</td>
<td>Process Capability</td>
<td>Clinker Quality Parameters Cpk maintained at 1.11 for C3S &amp; 1.36 for Free Lime i.e. CaO</td>
</tr>
<tr>
<td></td>
<td>Unloading &amp; Feeding of Tyre Dust</td>
<td>Unloading through Bulk - Closed condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feeding to firing station: Through Coal mill &amp; after grinding to Fine coal Bin - Around 30-35 MT/Day</td>
</tr>
<tr>
<td></td>
<td>TSR %</td>
<td>2.67% in 2015-16</td>
</tr>
<tr>
<td>Control</td>
<td>Co generation</td>
<td>~200 PPM</td>
</tr>
<tr>
<td></td>
<td>Vendor Development</td>
<td>Around 15000 MT of Tyre Dust is manged</td>
</tr>
<tr>
<td></td>
<td>Feeding of Tyre Dust</td>
<td>FLC controlled Drag chain operation</td>
</tr>
</tbody>
</table>
### Project Results

**4.3.2**

Additional Potential Benefits

<table>
<thead>
<tr>
<th>S No</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fugitive emission totally eliminated.</td>
</tr>
<tr>
<td>2</td>
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<td>3</td>
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</tr>
<tr>
<td>5</td>
<td>Work environment improve in Unit.</td>
</tr>
<tr>
<td>6</td>
<td>Help in utilise petcoke by dilution of sulphur.</td>
</tr>
<tr>
<td>7</td>
<td>Reduction of green house gas emission - 38313 MT</td>
</tr>
<tr>
<td>8</td>
<td>Improvement towards Group sustainability vision</td>
</tr>
<tr>
<td>9</td>
<td>Replication of this achievement &amp; learning benefited total business as TSR due to carbon dust is enhanced to 45%.</td>
</tr>
</tbody>
</table>

#### Project Results - Sustainability

- **Profit**: Rs. 625 Lacs On Account of Coal Cost Saved by Tyre Dust Use as Alternative Fuel (Without CAPEX)
- **Planet: Environment**: Reduction of Green House Gas emission 338113 Tons
- **People: Society**
Section 5: Sustaining and Communicating Results

5.1.1 Sustaining Results Over Time

For 2016-17 & 2017-18, the unit has budgeted for 5% & 7% TSR against the achieved 4.02% TSR in 2015-16. The unit has planned for 13500 Ton Tyre dust to achieve these TSR figure in current Year.

The unit has developed 5 vendors to continue supply of the tyre dust from Manasa, Neemuch, Udaipur, Bhilwara and explore new vendors from Indore, Jaipur & Ahmedabad area for the next year planning of 15000MT availability assurance.

<table>
<thead>
<tr>
<th>Name of AF Mapping for 7%</th>
<th>Quantity (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDF Jaipur</td>
<td>7500</td>
</tr>
<tr>
<td>RDF (Ahmadabad &amp; Indore)</td>
<td>7500</td>
</tr>
<tr>
<td>Plastic Waste</td>
<td>2300</td>
</tr>
<tr>
<td>Agro waste</td>
<td>18300</td>
</tr>
<tr>
<td>Tyre Chips (Indigenous)</td>
<td>300</td>
</tr>
<tr>
<td>Imported Tyre Chips</td>
<td>10000</td>
</tr>
<tr>
<td>Wooden Dust</td>
<td>300</td>
</tr>
<tr>
<td>Carbon Powder</td>
<td>13500</td>
</tr>
<tr>
<td>Paint Sludge</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>60000</td>
</tr>
</tbody>
</table>
### Fuel utilization processing steps

<table>
<thead>
<tr>
<th>Fuel/Steps</th>
<th>Step-1</th>
<th>Step-2</th>
<th>Step-3</th>
<th>Step-4</th>
<th>Step-5</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agri Waste</td>
<td>Storage in Yard</td>
<td>High Volatile matter</td>
<td>Transportation for AFR</td>
<td>Manual dosing in Hopper</td>
<td>Feeding to Calciner through</td>
<td>Higher Handling and reprocessing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Self Ignition in Summer</td>
<td>Feeding point</td>
<td></td>
<td>Weigh feeder, belt conveyor,</td>
<td>time for utilisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Season)</td>
<td></td>
<td></td>
<td>Bucket elevator</td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td>Storage in Yard</td>
<td>Shredding for size</td>
<td>Transportation for AFR</td>
<td>Manual dosing in Hopper</td>
<td>Feeding to Calciner through</td>
<td>Higher Handling and reprocessing</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td>reduction from</td>
<td>Feeding point</td>
<td></td>
<td>Weigh feeder, belt conveyor,</td>
<td>time for utilisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>shredder</td>
<td></td>
<td></td>
<td>Bucket elevator</td>
<td></td>
</tr>
<tr>
<td>Pet coke</td>
<td>Rake / Truck unloading</td>
<td>Transportation system and</td>
<td>Reclaiming and</td>
<td>Grinding in Mill</td>
<td>Firing at Kiln and Calciner</td>
<td>Higher Handling and Grinding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stacking system</td>
<td>Transportation to Coal mill</td>
<td></td>
<td>through Poldos/Pfister/FK</td>
<td>time and Cost for utilisation</td>
</tr>
<tr>
<td>Carbon</td>
<td>Unloading</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Firing at Kiln and Calciner</td>
<td>Minimum handling time and</td>
</tr>
<tr>
<td>Powder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>through Poldos/Pfister/FK</td>
<td>Hazardous</td>
</tr>
<tr>
<td>(tyre dust)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pump</td>
<td></td>
</tr>
</tbody>
</table>

### Fuel Problems & Remarks

5.1.1 What was done to make sure the system/process changes made during implementation (in 4.2.1) continue to followed.

- **Agriwaste**
  - Irregular flow
  - Improper homogenization
  - Firing problem- Calciner temperature variation as variation in calorific value and fired only in calciner

- **Plastic Waste**
  - Reprocessing for size reduction
  - Sticky at burning system
  - hazards for refractory Life
  - Jamming due to high VM at firing Point
  - Firing problem- Calciner temperature variation as variation in calorific value and fired only in calciner

- **Pet coke**
  - Higher NoX generation
  - Coating formation in kiln Inlet, kiln riser, bottom stage feed pipe and bottom cyclone due to higher Sulphur and low alkali
  - Grinding on higher fineness, resulting higher coal mill power consumption (power consumption increased upto 1.5 unit per ton clinker w.r.t imported coal).
  - Higher kiln power consumption because of maintaining oxidizing condition at kiln Inlet.

- **Carbon Powder**
  - As low sulphur content w.r.t pet coke coating formation is lesser.

**Hence Use of Tyre dust leads to Sustenance as it has minimized Hazards & improved stability of process**
Sustaining Results Over Time

5.1.1

- It is win-win project for Unit, vendor, society & towards to Our Group Sustainability Vision.
- Power of replication - Replication of Line 3 phenomenon in Line 1 & 2.
- Bulker Use for Execution of Tyre Dust as AF.
- Critical challenges provide opportunity to showcase talent & leads to unique solutions.
- Usage of problem solving tools & techniques in identifying, selecting, analyzing & systematically solving the problem.

RACI Chart

<table>
<thead>
<tr>
<th>Description</th>
<th>Responsible</th>
<th>Accountable</th>
<th>Consulted</th>
<th>Informed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development New Vendors &amp; Rate contract</td>
<td>SH (Raw Material)</td>
<td>HOD (Materials)</td>
<td>FH (Commercial)</td>
<td>Unit Head</td>
</tr>
<tr>
<td>Feasibility Check</td>
<td>SH-QC</td>
<td>HOD (Materials)</td>
<td>FH (Commercial)</td>
<td>Unit Head</td>
</tr>
<tr>
<td>SOP for Unloading of Carbon powder</td>
<td>FLE (Process)</td>
<td>SH (Process)</td>
<td>HOD (Process)</td>
<td>FH (Tech)</td>
</tr>
<tr>
<td>Maintenance checklist for unloading line and compressor.</td>
<td>FLE (Mech)</td>
<td>SH (Mech)</td>
<td>HOD (Mech)</td>
<td>FH (Tech)</td>
</tr>
</tbody>
</table>

5.1.2 What was done to make sure the system/process changes made during implementation (in 4.2.1) continue to followed.

Sustaining Results Over Time

5.1.2

Yearly
- P & B
- Risk Management Review
- Legal Compliance Review
- MAP Review

Quarterly
- M P R
- ABOE (WCM) Steering Committee
- Capex Review
- WCM Mass Communication
- Apex Safety Committee
- Monthly WCM KFA meeting

Monthly
- Team KPI
- Weekly
- Key value drivers review
- All these forms are used to review project KPI and sustain the results.
Sustainability Reports
VCW Intranet
TRC Interaction
Kaizen Chronicle
KIP Visit
MCM
Kaizen Mela

5.2.1 How did the team communicate the results to the various stakeholders?

Plan to share this achievement through “Confluence” & WCM Meet

Appreciation


Dear Sir/Madam,

We are pleased to inform you the results of your prestigious Technical Paper to be presented at the Annual Conference on

Enrichment in Thermal Substitution Rate (TSR) by Successful use of Tyre Dust in Cement Kiln - Sustainability Initiative

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Best regards,

R.K. Gupta
Organizing Secretary
Appreciation

TOP among 268 Teams of Aditya Birla Group in Best Practice Competition (Group Wide Team Competition)

Thank You

Team
Vikram Cement Works