• **POOGI of CCPM Promotion –**
• **The Tata Steel Experience**

• Prasanna Kumar Jha
• Tata Steel Ltd.

A century of **Trust**

- Medical aid in remote areas
- Patronizing sports
- Providing water in rural areas
- Empowering women
- Adult literacy
- Happy employees
- **LIFELINE EXPERIENCE**
- **TATA NANO**
- Training Institute
- Theory Of Constraints Practitioners Alliance • TOCPA
Prasanna Kumar Jha

- 21 years of experience in Steel Operations and Supply Chain Management.
- TOCICO Certified Practitioner in Supply Chain and Project Management. Additionally a certified Six Sigma Black Belt
- Involved in implementation and institutionalisation of Supply Chain, Logistics and Project Management solutions at Tata Steel.
- Instrumental in implementing Replenishment solution in Flat Products Division of Tata Steel.
- Also involved in execution of around 300 maintenance and sustenance projects using CCPM.
- Holds a post graduate degree in Business Management with specialisation in Systems and Marketing

Head TQM TOC (Tata Steel Ltd.)
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Agenda:

- **Organisation Profile**

- **Project Management** - The TOC way
  - History of CCPM Implementation in Tata Steel
  - Problems in promotion of CCPM
  - Project Environment at Tata Steel
  - Classification of projects
  - Needs to apply CCPM
  - Issues and obstacles to Buy-In and Execution
  - Approach at Tata Steel
  - Effects
  - Example Case – Primary Crusher Erection
Tata Group - Pioneers in Nation Building
(established in 1868)

Founder

Jamsetji Tata
(1839 – 1904)

Guiding Philosophy: Customer focus, Innovation, giving back to Society

Governed by the Tata Code of Conduct and Tata Group Values

144 year old professionally managed Business Group.

No. of companies: 114 in 80 countries
Revenue: US $ 100 billion (FY12)
Employees: 425,000

TSL is Group’s 2nd largest revenue earner: Turnover US $ 26.13 billion (FY12)

Many first in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1902</td>
<td>Hotels</td>
</tr>
<tr>
<td>1907</td>
<td>Steel</td>
</tr>
<tr>
<td>1910</td>
<td>Power</td>
</tr>
<tr>
<td>1911</td>
<td>Education</td>
</tr>
<tr>
<td>1932</td>
<td>Airlines</td>
</tr>
<tr>
<td>1945</td>
<td>Motors</td>
</tr>
</tbody>
</table>

In a free enterprise, the community is not just another stake holder in the business, but in fact the very purpose of its existence.”

Jamsetji Tata
Tata Steel India
– Organisational Profile

- India’s first steel plant; 100 years old
- Turnover – US $ 8 Billion (FY12)
- Believes that society is an important stake holder in business – 5 to 13% of net profit is spent on society
- Own raw material

Unique Industrial Corporation; often cited as a global benchmark in Corporate Social Responsibility
Tata Steel – Value Chain

Raw Materials

- Ore Mines & Quarries Division
- West Bokaro Division
- Jharia Division

Iron Making

- Sinter Plant
- Coke Plant
- Blast Furnaces

Steel Making

- LD-1
- New Bar Mill
- Wire Rod Mill

Rolling

- Long Product Marketing & Sales
- Wire Rod Mill

Marketing & Sales

- Flat Product Marketing & Sales

Customers

- Long Products Division
- Flat Products Division

Shared Services (Provides Maintenance Services and Operates Utilities)

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TQM the binding glue - from Mining to Finished Products

Key TQM Response

- Benchmarking, Innovation, Expert creation
- Introduction of TQM promotion departments (CQA, CS&P)
- Introduction of “KVHS”: a focused problem solving methodology
- Codifying the Tata Steel Way of creating and sustaining change
- Customer awareness to customer delight - RVM, SVM, CVM, Theory of Constraints
- Integrated TQM framework (complete value chain)
- Start usage of basic TQM tool, Total Operational Performance
  - Revisit Vision,
  - Measuring effectiveness by TBEM
- Introduce TQM, TPM pillars
  - Training & Education
  - Value Engineering, AQUIP
- ISO System, Deployment of IT Systems for Business
  - Initiation of Quality Circles

Business Need

- Cost competitiveness 1997-2004
- Standardization 1988-1992
- Global outlook, Growth 2005-2008
- Seeking world class 2009 & beyond

Improvement Accelerators

- Deming Grand Prize - 2012
- Deming Application Prize - 2008
- TQM Diagnosis for DAP 2005
- TBEM Assessment

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  - Effects
  - Example Case – Primary Crusher Erection
History of CCPM application in Tata Steel

First application in December 2005 – E Blast Furnace top repair

Since the ………….  

- 10 Projects in Mines
- 74 Projects in Blast Furnaces
- 109 Projects in Steel Melting & Casting
- 83 Projects in Rolling Mills
  Strip Mill, Wire Rod Mill
  Hot Rolling Mill, Cold Rolling Mill
- 132 Projects in Sinter Plants
- 12 Projects in Power Plants

Over 400 Major Shutdowns & Upgrade Projects
Problems in promotion of CCPM

1. Let us apply CCPM in your project
   CCPM Facilitator

2. The belief: In order to complete the project on time each task must complete on time

3. .......... We need management commitment
   Project Manager

4. We have his commitment
   Implement CCPM

CCPM will get implemented

.................... Will the results be there ??

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Project Environment at Tata Steel (1/2)

Definition

Maintenance Projects
- Maintenance to overcome normal wear & tear of equipment
- Inspect the components which need repair or change (CDT)
- Cleaning and painting

Sustenance Projects
- Based on the need, equipment need to be upgraded for
  - Higher production
  - Meet certain quality requirement of enriched product mix
  - Modification to reduce cost of operation
  - Modifications to comply with new environmental and safety regulations.
### Project Environment at Tata Steel (2/2)

<table>
<thead>
<tr>
<th>Maintenance projects</th>
<th>Sustenance &amp; Expansion Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BELIEFS</strong></td>
<td><strong>BELIEFS</strong></td>
</tr>
<tr>
<td>• Done similar projects earlier</td>
<td>• Many groups can influence</td>
</tr>
<tr>
<td>• Continuously improved</td>
<td>• Majority external agencies. Very less control</td>
</tr>
<tr>
<td>• More time spent, better the quality of work.</td>
<td>• Penalty clauses help complete on time</td>
</tr>
<tr>
<td></td>
<td>• Management tools cannot help</td>
</tr>
<tr>
<td><strong>Challenges</strong></td>
<td></td>
</tr>
<tr>
<td>• Identifying potential losses</td>
<td>• Minimize transfer batch (improve flow in planning)</td>
</tr>
<tr>
<td>• Convincing - times estimates are variable</td>
<td>• Protect uncertainties with Buffers (placements)</td>
</tr>
<tr>
<td></td>
<td>• Synergizing different groups towards common goal</td>
</tr>
<tr>
<td>• Project teams are independent – takes own decision on how to manage projects</td>
<td></td>
</tr>
<tr>
<td>• Some common resources used as expertise. Free to seek external support.</td>
<td></td>
</tr>
</tbody>
</table>
Need to apply CCPM

As Dr James Holt (WSU) says:

Maintenance is an interesting profession

Hard work    Highly skilled    Rarely recognized

When was the last time some one came and said,

"Thank you very much for Toilets that Flush"

The goal seems to be:

Keep everything running all the time

Ridiculous!! (from a maintenance point of view)

Do you know of anyone who buys a new car and says,

"Oh, I can’t wait to get the first repair done"
Need to apply CCPM (Performance Gap)

**Maintenance** - In terms of statistics:

- We have about 10% down time / year
- About 8% to 9% of which is Planned
- Industry Benchmark ??
- 1% increase in availability - 38 Mil USD in Sales

**Sustenance**

- Huge demand
- Need to augment capacities to meet demand
- Capture desired market segments
- All this would lead to higher down time
## Classification of Maintenance and Sustenance Projects

<table>
<thead>
<tr>
<th>Project Management</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Manage &amp; execute ourselves – some contractor labor used for low end jobs.</td>
<td>A. Short term project</td>
</tr>
<tr>
<td>2. Manage ourselves but use external expertise for execution</td>
<td>- 5 days to 1 month</td>
</tr>
<tr>
<td>3. Offload the entire project including project management</td>
<td>B. Long Term Project</td>
</tr>
<tr>
<td>4. Work coordinated by us – executed by petty contractors but offload project</td>
<td>- 1 month to 1 year</td>
</tr>
<tr>
<td>management &amp; engineering</td>
<td>We have not applied CCPM in projects spanning</td>
</tr>
<tr>
<td></td>
<td>more than 1 year</td>
</tr>
</tbody>
</table>

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Issues in applying CCPM- Buy In

There is a need for the whole project team to complete the project within (a) Budget, (b) Content & (c) Time

If project team becomes job less if project is completed early, then Budget and Content may be okay, but finishing early may not be important.

Getting a Buy-in

- Time is NOT deterministic
- Skewed distribution
- In a series of dependent activities some will happen early, some will be late
- Taking advantage of early finishes
Issues in applying CCPM - Execution

Components of execution

- **Planning**
  - as per CCPM

- **Preparation**

- **Execution**
  - as per CCPM

- **Issues**
- **Staggering**
- **Buffering**

- **Issues**
- **Buffer management**
Issues in applying CCPM - Execution

Planning - Issues

- Resources are never well defined: most resources are often men

- India with its 1 Billion +: men appear to be limitless
  - Very skilled manpower has been a constrained

- Equipment resources can be considered: In these environments it is not very difficult to add another resource if required

- Multi-tasking of resource is often invisible

- Buy-in of aggressive times: Task managers need to plan how to achieve these new times

- Reorganize people if required
Issues in applying CCPM - Execution

Execution - Taking advantage of early finish

- **Short duration projects**: *Less than 10 days*
  - In most cases all resources are available
  - Since the belief in themselves is not there: the resource may not be present when needed.
  - Planning to make sure resource is available is essential
  - When the project starts, facilitator should point out the early finishes that were not capitalized on

- **Long duration projects**
  - Resources are not planned as per aggressive schedules
  - The conflict is - If resources are brought in early and incase activity is delayed - it will increase cost
Issues in applying CCPM - Execution

Execution

The problems faced are common to projects whether CCPM applied or not.

- **Short duration projects** : *Less than 10 days*
  - Scheduling within a shift is very important
  - Major time lost in shift changer over
  - Problems faced during trials remain the same whether the project is short or long
  - The time taken to diagnose the root cause is difficult to crush

- **Believe in aggressive schedules**
  - As long as progress is good - people have no issues with aggressive schedules
  - The moment the curve rises steeply up - instant reaction: crushing time did not help
## Common Promotion Practices

<table>
<thead>
<tr>
<th>INITIATIVE</th>
<th>Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Once people understand the concept they will adopt</td>
</tr>
<tr>
<td>Brochures &amp; Pamphlets</td>
<td>Once peers discuss the concept people will try to adopt</td>
</tr>
<tr>
<td>Slogans &amp; Drives</td>
<td>If demand is created, people will be eager to try the new concept.</td>
</tr>
<tr>
<td>Competition between peer groups</td>
<td>No one wants to be last in the race.</td>
</tr>
<tr>
<td>Reward &amp; Recognition</td>
<td>People will do anything to earn a few extra bucks</td>
</tr>
<tr>
<td>Senior Management Review</td>
<td>Review - forces people to practice, even if they do not believe in it.</td>
</tr>
<tr>
<td>Mandate from top</td>
<td>Management decisions are always adopted</td>
</tr>
</tbody>
</table>

- NONE of these techniques were adopted to promote CCPM
Approach at Tata Steel

Developed expertise

- Checked appropriate ness of measure
- Sanitized present plan

Protected Plan:
- Interruptions
- Variability
- Covariance

Changed priority of measurements

- Maintenance
  1. Content
  2. Budget
  3. Time

- Expansion

New priority of measures

1. Content
2. Time
3. Budget

Made technical schedule using concept of flow

1. Planning – Finish to Start
2. Maximize production batch – minimize transfer batch
3. Stagger tasks – prevent resource contention

Helped teams identify & agree on cause that limit their performance

1. Interruptions
2. Variability in tasks
3. Covariance
4. Exploit the above problems
   4.1 Aggressive scheduling
   4.2 Buffering
   4.3 Buffer management

- When problems really got solved, people adopted the concept.
- Proposed solutions specific to the project. Not suggest generic concepts

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Why was the approach effective?

Assumptions:
If a new concept helps people achieve their goals they will adopt it.

Belief:
Implementing the new concept cannot be a goal in itself. It is only a means to the goal.

1. Teams which saw value, adopted the concept.
2. There was no pressure to adopt the process like a religion.
3. Early project completion was celebrated.
4. The concept became popular by word of mouth.

Project teams were encouraged to share their experiences.
People were encouraged to discuss the pros and cons of the process.
Sixth International TOCPA Conference
18-19 May, 2013, Moscow, Russia

Effects

- Execution of CCPM projects more than doubled in last three years

- Due date performance of projects has improved by 32% over last five years
  - 88% of projects completed within planned time in last two years

Savings Rs 157 Crores
(US $ 30.2 Million) in FY13

New areas of CCPM application were tried (proj < 48 hrs and IT/NPD projects). Some new projects delayed because of people not trained enough.

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Case area described in this presentation
CCPM Case on Primary Crusher Replacement in Noamundi Iron Ore Mines: Business Case

Background: Crusher was installed in 1967 and it was running at high risk due to many defects and at reduced capacity (70% of rated capacity).

1967

Model: T.C./S. NO. - 86555  
Make: Fuller KCP  
Weight: 238 T  
Capacity: 1800 TPH  
Max Feed Size: 900 mm  
Lump size: 175 ~ 200 mm  
Motor Capacity: 450 HP

2009

Hydraulic – Not in operation  
Weight increased due to welding at many places  
Capacity: 1200 TPH  
Max Feed Size: 200 mm  
Lump size: 175 ~ 200 mm  
Motor capacity: 450 HP

New Crusher

Model: CG-820  
Make: SANDVIK  
Weight: 262 T  
Capacity: 1600 - 3500 TPH  
Max Feed Size: 1200 mm  
Lump size: 130 ~ 200 mm  
Motor Capacity: 600 HP

Welded body at very high risk
CCPM Case on Primary Crusher Replacement in Noamundi Iron Ore Mines: Business Case

- **Poor reliability** of the crusher was **hampering the output of the plant** (output reduced by 30%)
- Crusher **Shutdown** of one day meant **loss of 10000 metric ton despatch** of iron ore from Noamundi to Jamshedpur.
- Raw material stock (including transit) was 25 days. Hence any **shutdown beyond 25 days** would have resulted in **production loss** at Jamshedpur.
- **Supplier** Indicated **55 days completion period** - Industry Benchmark – 30 days for Crusher installation only

- Any steel plant is a “V” Shaped Plant with higher capacity upstream
- Shutting down any processes **upstream** of steel melting results in **Throughput loss**
- Shutting down **Blast Furnaces** results in **Throughput loss** of more than $2 Million per day
- **Minimizing shutdown time** would result in **increased Throughput**
  **ABP Target** of production could only be met if this shutdown was for **25 days**.
Factors determining total duration of project

- Resources like crane and skilled manpower not available.
- Working on five different floors and co-ordination with 12 agencies.
- Huge amount of dust due to dumper movement on mining roads.
- Limited space for working and very poor ventilation below 25 meters.
- Low awareness level of contractor workers on safety standards.

Current practices

- Start all activities As Soon As Possible (Early Start Early Finish)
- Resource contention (only one crane for ground level work)
- If project is delayed – Disbelieve plan, Panic & hurry all tasks, introduce more task
- 300 Workmen, 30 Supervising managers, 15 experts and TWELVE external agencies involved in the project
Strategy – Option evaluation and project planning

Shutdown planning using various focused methodologies
Strategy – Option evaluation and project planning

Application of past learning for reducing S/d time

- Dismantling of Bottom shell – 10 hours
- Dismantling of Apron feeders – 12 hours
- Liner removal – 12 hours
- Erection of Apron feeders – 24 hours
- Erection of crusher – 24 hours
- Trial and commissioning – 12 hours

Total reduction in plan through incorporation of past learning – 4 days

Example - Erection methodology of Apron feeder modified and saved 24 hours in critical path.

Total Saving of 24 hours in Apron feeder erection

<table>
<thead>
<tr>
<th>Task</th>
<th>Initial Plan</th>
<th>Revised plan based on learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowering of Apron in single pieces</td>
<td>24 hours</td>
<td>16 hours</td>
</tr>
<tr>
<td>Positioning</td>
<td>24 hours</td>
<td>12 hours</td>
</tr>
<tr>
<td>Alignment</td>
<td>12 hours</td>
<td>8 hours</td>
</tr>
<tr>
<td>Total</td>
<td>60 hours</td>
<td>36 hours</td>
</tr>
</tbody>
</table>

Monitoring and recording of Time and Quality

<table>
<thead>
<tr>
<th>Quality parameters</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheme Approval with Client</td>
<td>Study of time and implication</td>
</tr>
<tr>
<td>Consultant and supplier supervision</td>
<td>Comparison of duration in 1st Apron feeder</td>
</tr>
<tr>
<td>Sign off protocol</td>
<td>Assessment for next feeder and carried forward</td>
</tr>
</tbody>
</table>
### Work centers and cross functioning

<table>
<thead>
<tr>
<th></th>
<th>Apron feeder</th>
<th>Primary Crusher</th>
<th>Civil Works</th>
<th>Hydraulic, Lub oil and water</th>
<th>Electrical and automation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fifth floor</td>
<td>3rd/2nd floor</td>
<td>1st floor/Zero floor</td>
<td>Fouth floor</td>
<td>Zero and 2nd</td>
</tr>
<tr>
<td><strong>29th April’10 Night Shift</strong></td>
<td>Alignment of Apron feeders</td>
<td>Motor alignment and Handing over to electrical</td>
<td>Grouting of Primary crusher and Hopper beam of crusher</td>
<td>Cooling tower Installation</td>
<td></td>
</tr>
<tr>
<td><strong>30th April’10 Day Shift</strong></td>
<td>Fixing of Chain, pan and Drive alignment</td>
<td>Lowering of eccentric ,MPS unit</td>
<td>Fixing of Eccentric and MPS</td>
<td>Balance Hilti of pipe lines</td>
<td>Power cable termination for crusher motor</td>
</tr>
<tr>
<td><strong>30th April ’10 Night Shift</strong></td>
<td>Fixing of Eccentric and MPS</td>
<td>Fixing of main shaft and spider</td>
<td>Lub oil unit piping for crusher</td>
<td>Scaffolding for fixing of control cables</td>
<td></td>
</tr>
<tr>
<td><strong>1st May’10 Day shift</strong></td>
<td>ID Run</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st May’10 Night shift</strong></td>
<td>Motor trials</td>
<td>Fixing of skirts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2nd May’10</strong></td>
<td>Fixing of skirts</td>
<td>Fixing of sensors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Critical stage of project**

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**Theory Of Constraints Practitioners Alliance ● TOCPA**
Implementation – Daily ‘Evening’ Meeting to finalise resource and buffer recovery plans

Organize & Day to Day Manage execution of plan
*Task Managers & Team Involvement*

1. Organize resources day to day to execute tasks.
2. Execute Tasks.
3. Estimate remaining duration and enablers to complete tasks.
4. Identify potential interruptions in project.
5. In case of undue buffer penetration – make buffer recovery plans

*Evening Meeting in progress*
Pictorial Recap – Dismantling of old crusher

Total time – 4 days

Day 1: Removal of Spider cap
Day 2: Removal of Spider and mantle
Day 3: Removal of Top shell
Day 4: Removal of Middle and Bottom shell

Dismantling of Drive, motor, lub oil, piping and electrics was carried out parallel to above.

Before starting of job proper s/d clearance and positive isolation was carried out.
Pictorial Recap – Erection of new crusher

**Day 5:**
- Erection of bottom shell on steel frame.
- Fixing and tightening Bolts & nuts at the four sides of Bottom shell with Steel base frame.
- Check the top level of bottom shell and align

**Day 6:**
- Installation of Eccentric shaft
Pictorial Recap – Erection of new crusher

Day 7:
• Installation of Main Shaft Positioning System

Day 8:
• Installation of Pinion Shaft Assembly
Pictorial Recap – Erection of new crusher

Day 9:
• Installation of dust color over top of bottom shell

Day 10:
• Installation of top shell
Pictorial Recap – Erection of new crusher

Day 11 :
• Installation of main shaft

Day 12-14 :
• Installation of concave liners
Pictorial Recap – Erection of new crusher

Day 15:
• Spider Assembly installation

Parallel Activities:

Day 16-17
Cold trial

Day 18
Commissioning

PLC panel termination

Oil line for MPS

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Achievement

- First time in World, Crusher and Apron feeders replaced in 18 days
- Sandvik, the supplier, published this in Bulk Handling Journal, Australia
- ZERO Accident.
- The plant reached its rated capacity in one week

Savings about US $ 4.2 Million
**Way Forward:** Sustaining improvement and ensuring irreversibility

<table>
<thead>
<tr>
<th>Project</th>
<th>CCPM Plan</th>
<th>Actual achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD#1 Vessel #2 relining, Mar ‘10</td>
<td>8.67 days</td>
<td>8.33 days</td>
</tr>
<tr>
<td>LD#1 Vessel #1 relining, June ‘10</td>
<td>7.6 days</td>
<td>7.6 days</td>
</tr>
<tr>
<td>LD#1 Vessel #2 relining, Sept ‘10</td>
<td>7.33 days</td>
<td>6.83 days</td>
</tr>
<tr>
<td>LD#1 Vessel #1 relining, Dec ‘10</td>
<td>7 days</td>
<td>6.08 days</td>
</tr>
<tr>
<td>LD#1 Vessel #2 relining, March ‘11</td>
<td>6.8 days</td>
<td>5.56 days</td>
</tr>
<tr>
<td>LD#1 Vessel #1 relining, Dec ‘12</td>
<td>5.5 days</td>
<td>5.1 days</td>
</tr>
</tbody>
</table>

After five iterations and incorporating continuous learning from the past, LD#1 vessel relining shutdown has now reached near touch time level - **Best in the world**

......... many more projects have reached this status today
### Way Forward: Sustaining improvement and ensuring irreversibility

#### Process/Product Failure Modes and Effects Analysis (FMEA)

<table>
<thead>
<tr>
<th>Process or Product Name:</th>
<th>LD#1 Vessel Relining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible:</td>
<td>Arunava Das, Mr. Panigrahi</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Key Process Input</th>
<th>Potential Failure Mode</th>
<th>Potential Failure Effects</th>
<th>SEV</th>
<th>Potential Causes</th>
<th>OCC</th>
<th>Current Controls</th>
<th>DET</th>
<th>RPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the process step</td>
<td>What is the Key Process Input?</td>
<td>In what ways does the Key Input go wrong?</td>
<td>What is the impact on the Key Output Variables (Customer Requirements) or internal requirements?</td>
<td>How Severe is the effect on the customer?</td>
<td>What causes the Key Input to go wrong?</td>
<td>How often does cause or effect occur?</td>
<td>What are the existing controls and procedures (inspection and test) that prevent either the cause or the Failure Mode? Should include an SOP number.</td>
<td>How well can you detect cause or effect?</td>
<td>How well can you fix the problem?</td>
</tr>
<tr>
<td>Debrickin g, Vessel shell cleaning</td>
<td>Gradall</td>
<td>Gradall is down.</td>
<td>Relining time increases</td>
<td>10</td>
<td>Driver not available. Gradall is down.</td>
<td>5</td>
<td>Spare gradall is kept. Diver is pre informed about his job.</td>
<td>5</td>
<td>250</td>
</tr>
<tr>
<td>Supervis ion Under Officers</td>
<td>Officers not available.</td>
<td>Relining time increases</td>
<td>10</td>
<td>Unavailability of officers.</td>
<td>5</td>
<td>Officers from both operation and Mechaical is informed about their availability.</td>
<td>5</td>
<td>250</td>
<td></td>
</tr>
</tbody>
</table>
Route was difficult .... initial progress was slow......result was inspiring...

Thank you

Welcome to Jamshedpur, India