Warm & Hearty Welcome

CREATING WEALTH FOR WELLBEING

LOGIC CONTROLLERS QC

Name of the QC case study team : **"LOGIC CONTROLLER"**

Name of the Organization : **NLC INDIA LIMITED**

Address : **Neyveli-607801, Tamilnadu, South India.**

QC Co-Ordinator : **Shri. B.Mathivanan, DGM/Elec.**

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Names of the QC team

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DY.LEADER : S.KUMAR,DCE /E
MEMBERS : S.GNANAM,SFM /E
: J.SELVAPANDIAN FM/E
: G.IYYAPPAN FM/E

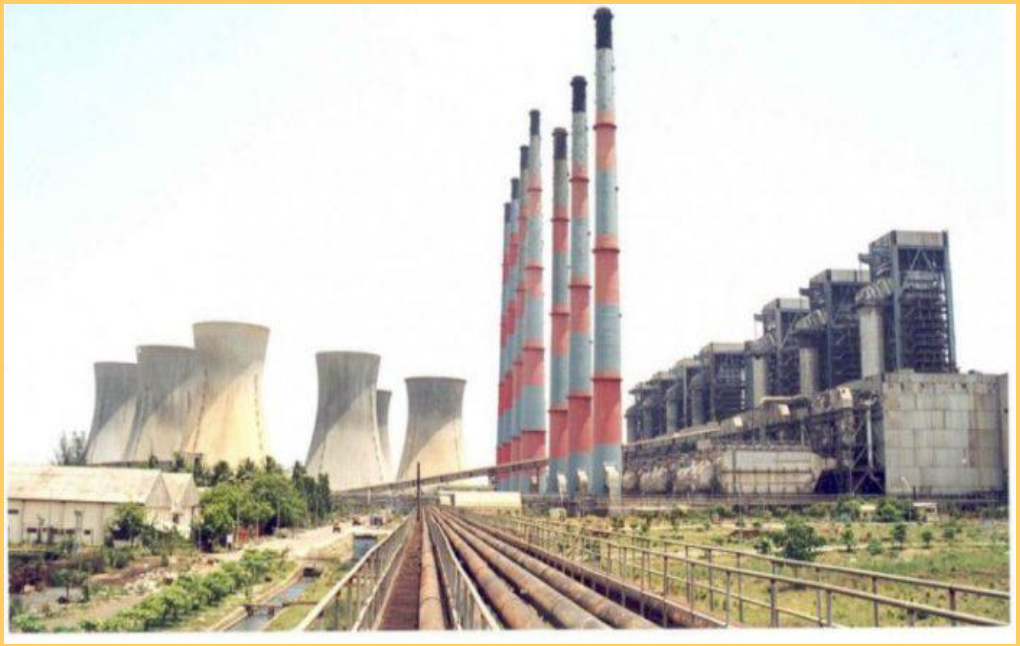
Title of the Case Study: **"FREQUENT "SEQUENCE" PROBLEMS IN CONVEYOR 4A TO RECLAIMER-A**

QCFI Institutional Membership No: **0817990038**

We won the **Par Excellence** award from pune chapter NCQC 2013-14

N L C INDIA LIMITED

'Navratna' - A Government of India Enterprise



THERMAL POWER STATION-II

7X210 MW

MEETING DETAILS

EVERY MONTH – FIRST AND THIRD THURSDAY FOR 30 MINUTES

No. of meetings for this QC study :24

Overall Attendance % : 98%

Project No.:5

Step-1 IDENTIFICATION OF PROBLEM

60 Problems Identified

S. No	Problems Identified
1	Frequent sequence problem in Conveyor- 4A to Reclaimer-A
2	Magnetic separator not lifting weight
3	Conveyor stopping before limit.
4	Conveyor tripping frequently
5	Conveyor starting on its own
6	DSS not working frequently.
7	Pull chord switch not working
8	Travel position disturbance.
9	Acceleration fault in Conveyors
10	Machine hoisting (Raise/ Lower) problem.
11	UPS battery getting hot
12	AMWSS –MCP acted annunciation persisting
13	RA - Slewing operating brake fire
14	Bunker shuttle conveyor encoder value not matching.
15	Conveyor (B motor problem
16	Stage II PLC hanging.
17	DSS - Water pumps could not be stopped.
18	Con 12B starting problem
19	Con 21 b! travel not possible
20	Shuttle conveyor – siren not coming on starting.
21	Machines frequent Thyristor fault.
22	Stacker discharge belt frequently tripping
23	RB – LT breaker not closing
24	CON 21D1 – Emergency switch not working
25	PDG A – frequent power fuse blown out
26	CON 17X – Position disturbance while giving command
27	RB – Discharge belt Gear box oil pressure low
28	CON 20C Hydralic changeover not possible
29	Frequent breakdown of machines

S. N	Problems Identified
31	Stage II RIO ventilation fans frequent failure.
32	RB – CCRD over tension
33	AMWSS – Zone 13 & 15 acted frequently
[illegible]4	CON 6A – Both position to 7A & 7B glowing.
[illegible]	RB – frequent tripping of Bucket wheel on over load
[illegible]	[illegible]S 1A – starting problem
[illegible]	[illegible]ON 12B – Tripping without annunciation
[illegible]	Stacker D/B 630A SFU burning problem
39	Conveyor 14B thrust brake limit switch problem
40	MS 7A OLR acted frequently
41	CON 7A – Control MCB tripped frequently
42	CON 21B1 – Unit 2 side travel not possible.
43	Conveyor tripping on Walky Talky interference
44	CON 12B IRD acting frequently
45	AMWSS – LHS cable frequently damaged .
46	RB – Fast travel not working
47	RB – Grease pump not working.
48	CON 14A not tripped when CON 18A tripped
49	Auto bunker filling – Stage II Bunker level value and bar not matching
50	WTP – PHL 4 starting problem.
51	CON 2 – 3.3 KV MOCB not holding
52	CON 2 – Motor 2 taking more current than Motor 1
53	Mborewell pump D not working
54	CON 18D – Running indication not available at bunker floor
55	Stacker discharge belt tripping if height is raised
56	Shuttle conveyors frequent damage of sresors
57	Machines - PCRD loose cable
58	RIO overheating problem
59	RB –Ht tripped on NDR

No	ABC Analysis	Rank
1	Frequent sequence problem in Conveyor-4A to Reclaimer-A	A
2	Magnetic separator not lifting weight	A
3	Frequent damage of Sensors in shuttle conveyors	A
4	Conveyor tripping frequently	B
5	Conveyor starting on its own	B
6	DSS not starting frequently.	B
7	Pull cord switch not working	A
8	Frequent Hoist problems in SME Machines	A
9	Acceleration fault in Conveyors	B
10	Machine hoisting (Raise/ Lower) problem.	A
11	UPS battery getting hot	A
12	AMWSS –MCP acted annunciation persisting	A

No	**ABC Analysis**	Rank
13	RA - Slewing operating brake fire	B
14	Bunker shuttle conveyuor encoder value not matching.	A
15	Conveyor 12b TRIPPED ON motor problem	B
16	Frequent Hanging in Stage II PLC .	A
17	DSS - Water pumps could not be stopped.	B
18	Con 12B starting problem	A
19	Con 21 b1 travel not possible	A
20	Shuttle conveyor – siren not coming on starting.	B
21	Frequent slewing problems in Machines.	A
22	Stacker discharge belt frequently tripping	B
23	RB – LT breaker not closing	A
24	CON 21D1 – Emergency switch not working	A

No	ABC Analysis	Rank
25	PDG A – frequent power fuse blown out	B
26	CON 17X – Position disturbance while giving command	B
27	RB – Discharge belt Gear box oil pressure low	B
28	CON 20C Hydraulic changeover not possible	B
29	Frequent breakdown of machines	C
30	Bunker filling delay due to machine break down	C
31	Stage II RIO ventilation fans frequent failure.	A
32	RB – CCRD cable over tension	B
33	AMWSS – Zone 13 & 15 acted frequently	B
34	CON 6A – Both position to 7A & 7B glowing.	A
35	RB – frequent tripping of Bucket wheel on over load	B
36	MS 1A – starting problem	A
37	CON 12B – Tripping without annunciation	A
38	Stacker D/B 630A SFU burning problem	A

No	ABC Analysis	Rank
39	Conveyor 14B thrust brake limit switch problem	B
40	MS 7A OLR acted frequently	A
41	CON 7A – Control MCB tripped frequently	B
42	CON 21B1 – Unit 2 side travel not possible.	B
43	Conveyor tripping on Walki-Talki interference	A
44	CON 12B IRD acting frequently	B
45	AMWSS – LHS cable frequently damaged .	B
46	RB – Fast travel not working	B
47	RB – Grease pump not working.	B
48	CON 14A not tripped when CON 18A tripped	A
49	WTP – PHL 4 starting problem.	B
50	Auto bunker filling – Stage II Bunker level value and bar not matching.	A

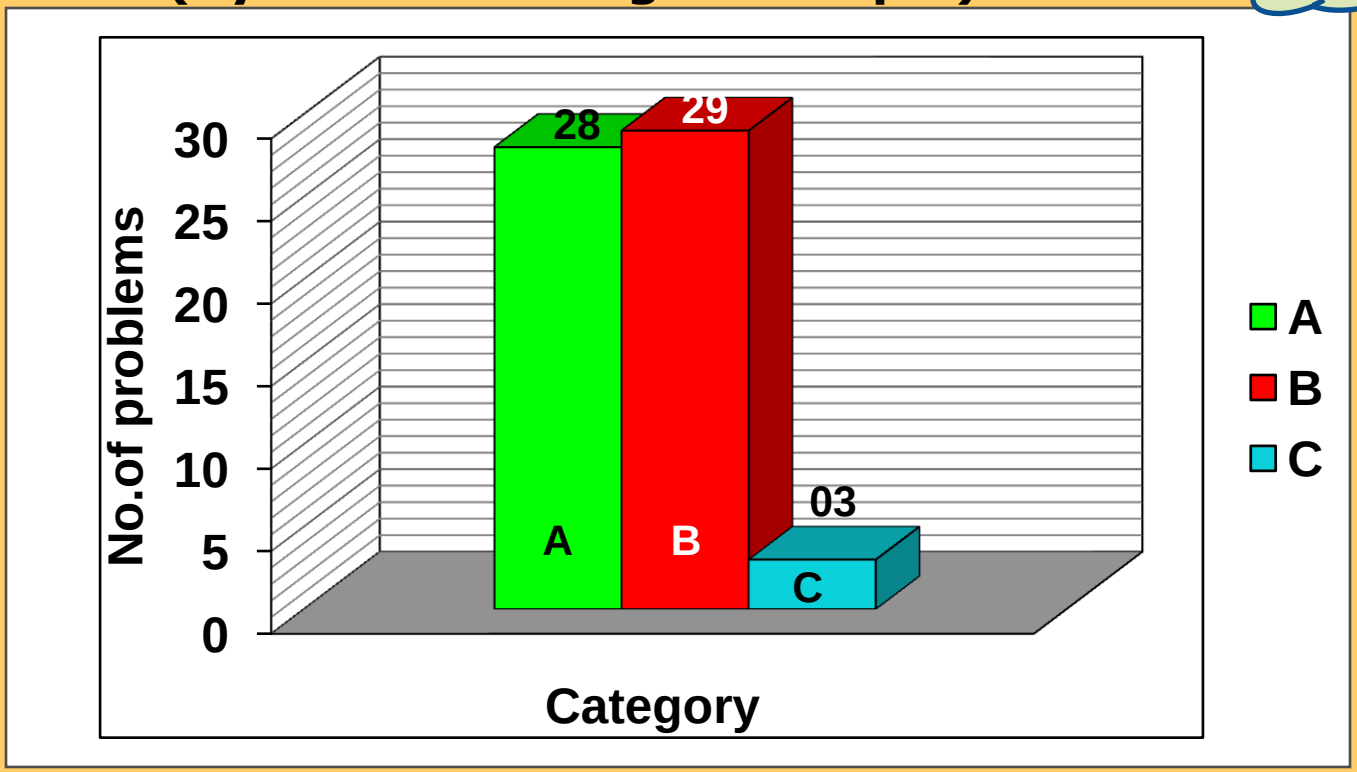
No	ABC Analysis	Rank
51	CON 2 – 3.3 KV MOCB not holding	B
	CON 2 – Motor 2 taking more current than Motor 1	B
53	Borewell pump D not working	B
54	CON 18D – Running indication not available at bunker floor	A
55	Stacker discharge belt tripping if height is raised	A
56	Shuttle conveyors- frequent damage of sensors	A
57	Machines - PCRD loose cable	B
58	RIO overheating problem	A
59	RB –Ht tripped on NDR	B
60	Conversion of Relay logics	C

Step-2

SELECTION OF PROBLEM

Logic controllers

CATEGORIZATION of A,B & C analysis (By Brainstorming Technique)



Sl.No	Category		No. of problems
1	A	work done by us	28
2	B	support from other agencies	29
3	C	support from management	3
	Total		60

Step-2

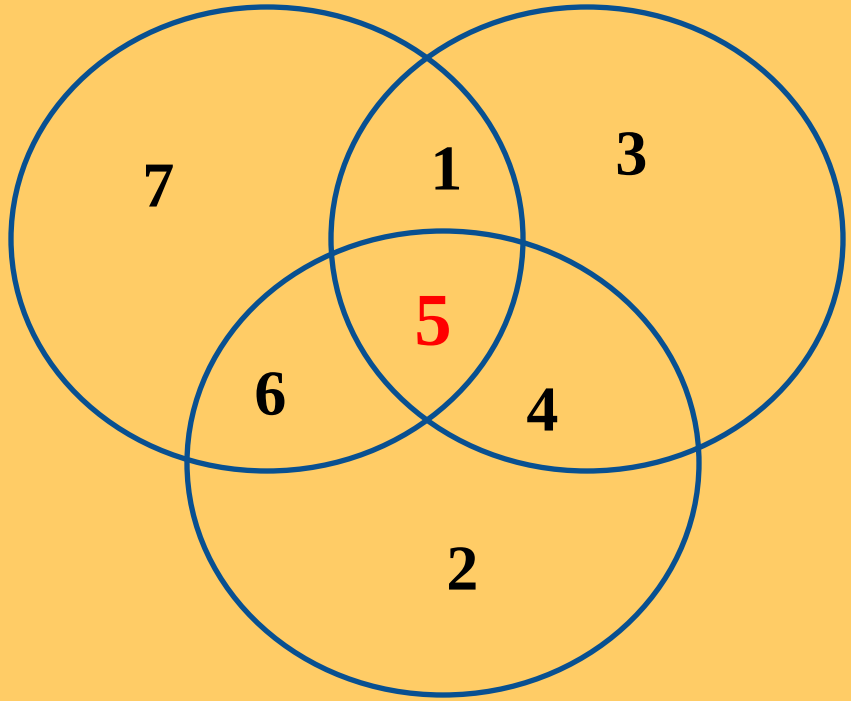
SELECTION OF PROBLEM

Logic controllers

IDENTIFIED PROBLEMS

From the list of "A" category Problems (28 nos.)

5 Nos. Selected



Step-2

Logic controllers

SELECTION OF PROBLEM

Identified Problems for further Analysis

1. Ms-1A starting problem
2. FREQUENT SEQUENCE PROBLEM IN CONVEYOR -4A TO RECLAIMER-A (SL NO.1)
3. Frequent hanging problem in Stage II PLC(sl:no.16)
4. Conveyors tripping on waki-taki interference (sl:no.43)
5. Auto bunker filling – Stage II Bunker level value and bar not matching.(sl:no.50)

Step-2

SELECTION OF PROBLEM

PQCDSWE

Ranking of "A" Type Problems

Problem Selection Matrix

slno	Identified problem / issues	Ranking Related to						total marks (P*Q*C*D*S*WE)
		P	Q	C	D	S	WE	
1	Frequent slewing problems in Machines (sl:no.21)	2	2	2	2	1	2	32
2	Frequent problem in conveyor-4A to Reclaimer-A sequence (sl:no.1)	3	2	2	2	1	2	48 ✓
3	Frequent hanging problem in Stage II PLC(sl:no.16)	2	1	2	2	2	1	16
4	Conveyors tripping on waki-taki interference (sl:no.43)	2	1	1	1	3	3	18
5	Auto bunker filling – Stage II Bunker level value and bar not matching.(sl:no.50)	2	2	2	2	2	1	32

Ranking

1 - Low

2 - Moderate

3- High

Total Marks Formula :

*P*Q*C*D*S*W.E =*

*Production * Quality * Cost * Delivery* Safety * Work Environment*

Problem selected: **Frequent Sequence problem in "Conveyor-4A to Reclaimer-A"**

Step-2

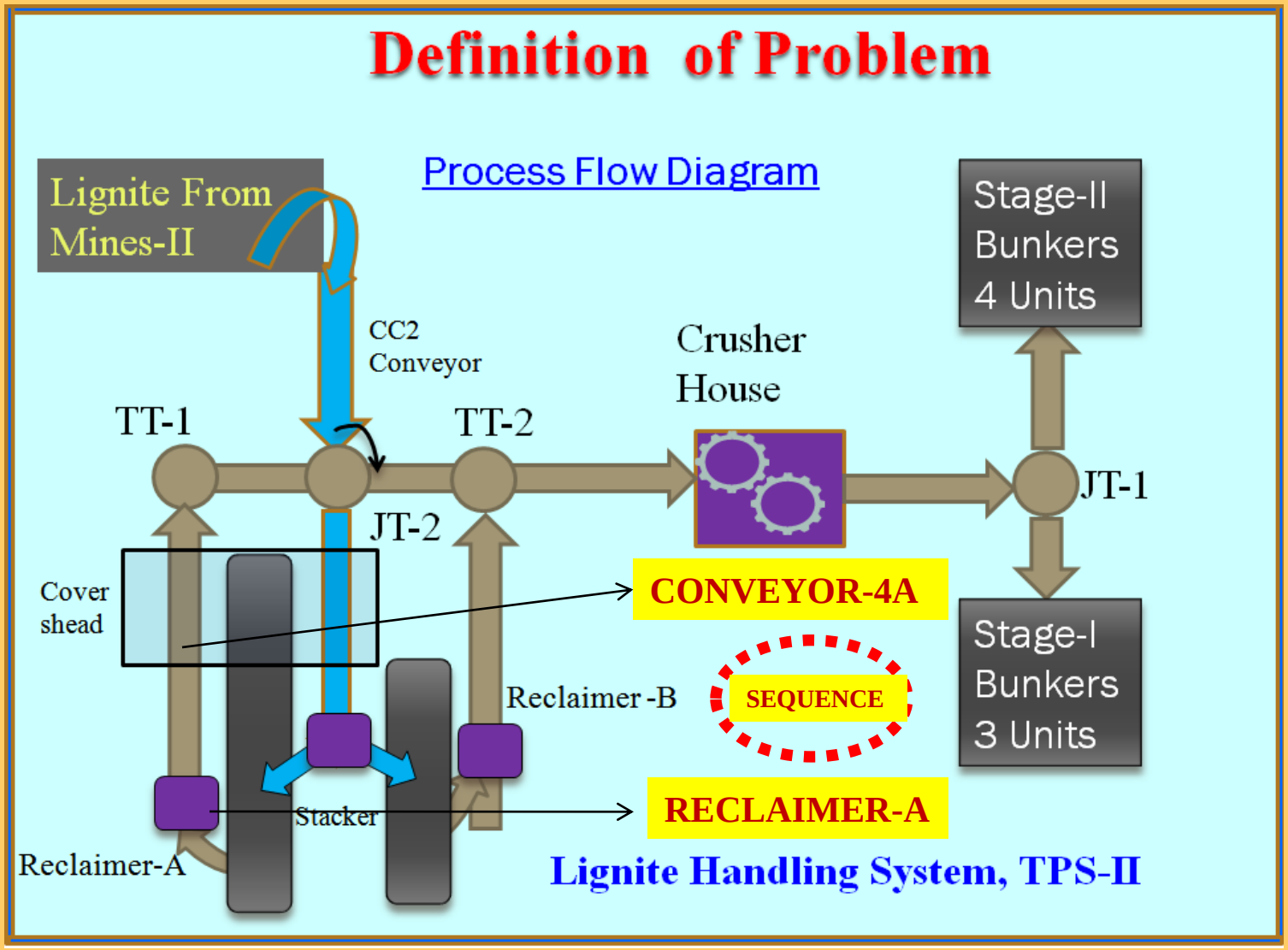
SELECTION OF PROBLEM

Logic controllers

Topic of the case study:

Elimination of Sequence Problems in CONVEYOR- 4A TO RECLAIMER- A

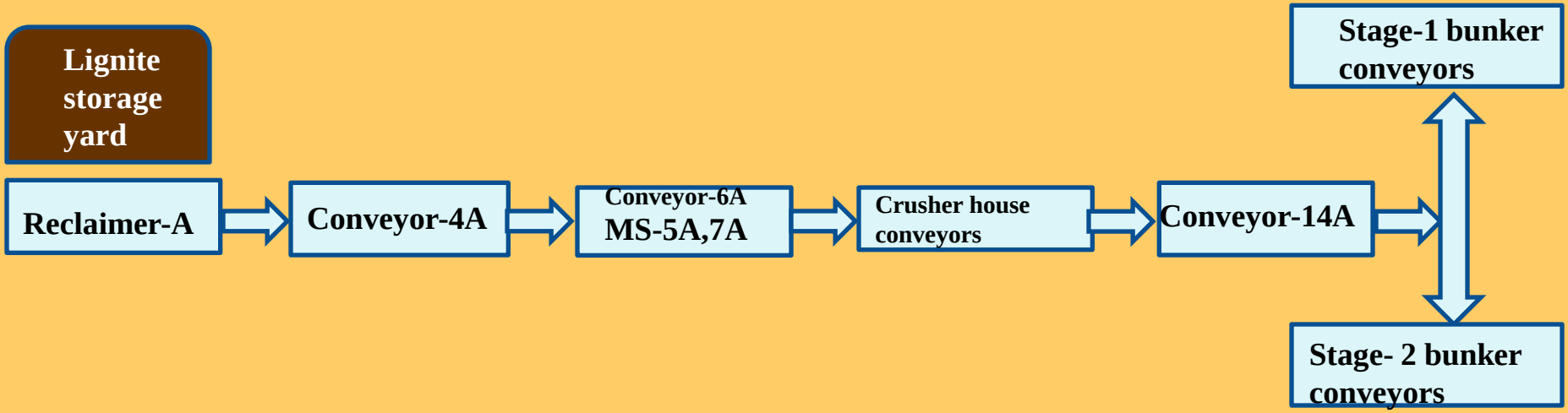
STEP 3: DEFINITION OF PROBLEM



DEFINITION OF PROBLEM

FLOW DIAGRAM

Transferring system:



1. Bunker conveyors started first and then followed by yard and crusher conveyors and finally Reclaimer started.

2. The above flow diagram represents the transfer of lignite from yard to bunker.

Step-3

DEFINITION OF PROBLEM

Logic controllers

- The Lignite Transfering system consists of Reclaimers,yard conveyors, crusher conveyors and bunker conveyors (approx.1km of up-stream conveyors.)

Starting procedure of Tranfering system: First, bunker conveyors is to be started and only, after getting **"running feedback"** crusher and yard conveyors started fianally reclaimer is started for filling.

- In absence of sequence, lignite reclaiming not possible eventhough all other equipments are in service.

- when sequence fails machine should be tripped unless other wise it leads to choke the machine chute.

- It leads to affects lignite transfer from yard to bunker.

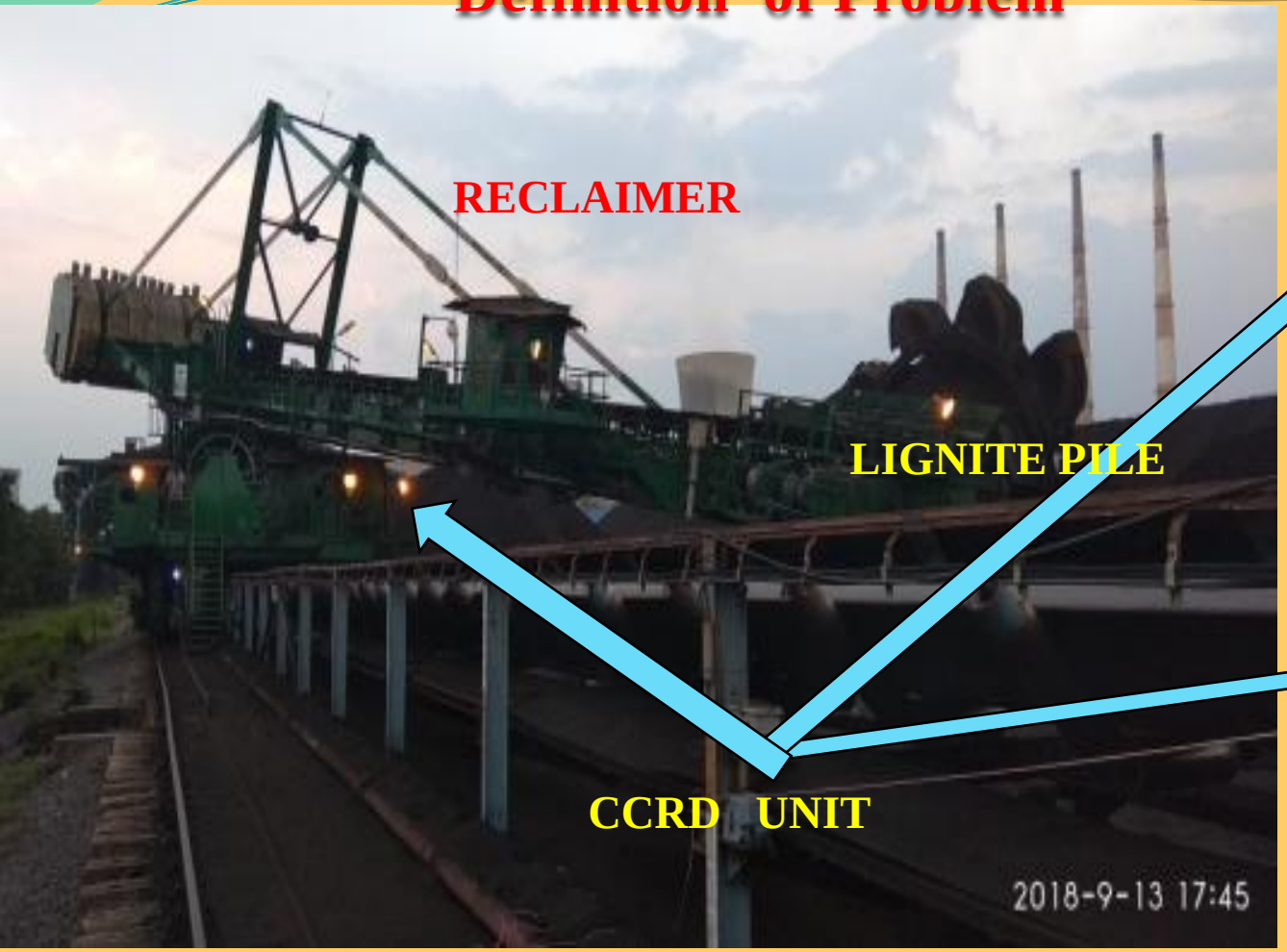
- Subsequently storage of bunker is drastically reduced.

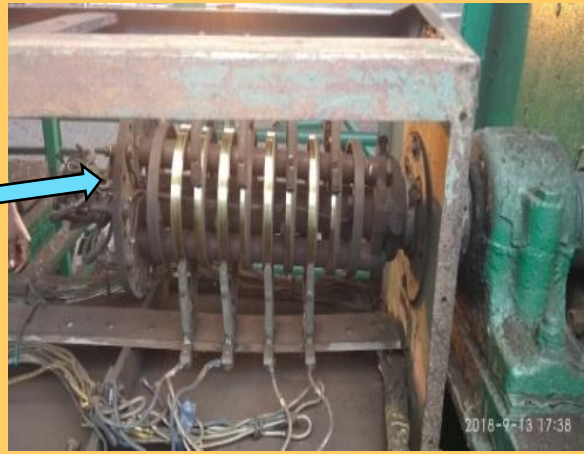
- Ultimately it affects the generation.

Step - 3

Background of the Problem

Definition of Problem





Control Cable Reeling Drum(CCRD) units are used to receive **sequence** interlock from conveyor-4A to Reclaimer-A through control room and centre pit JB control

Step-3

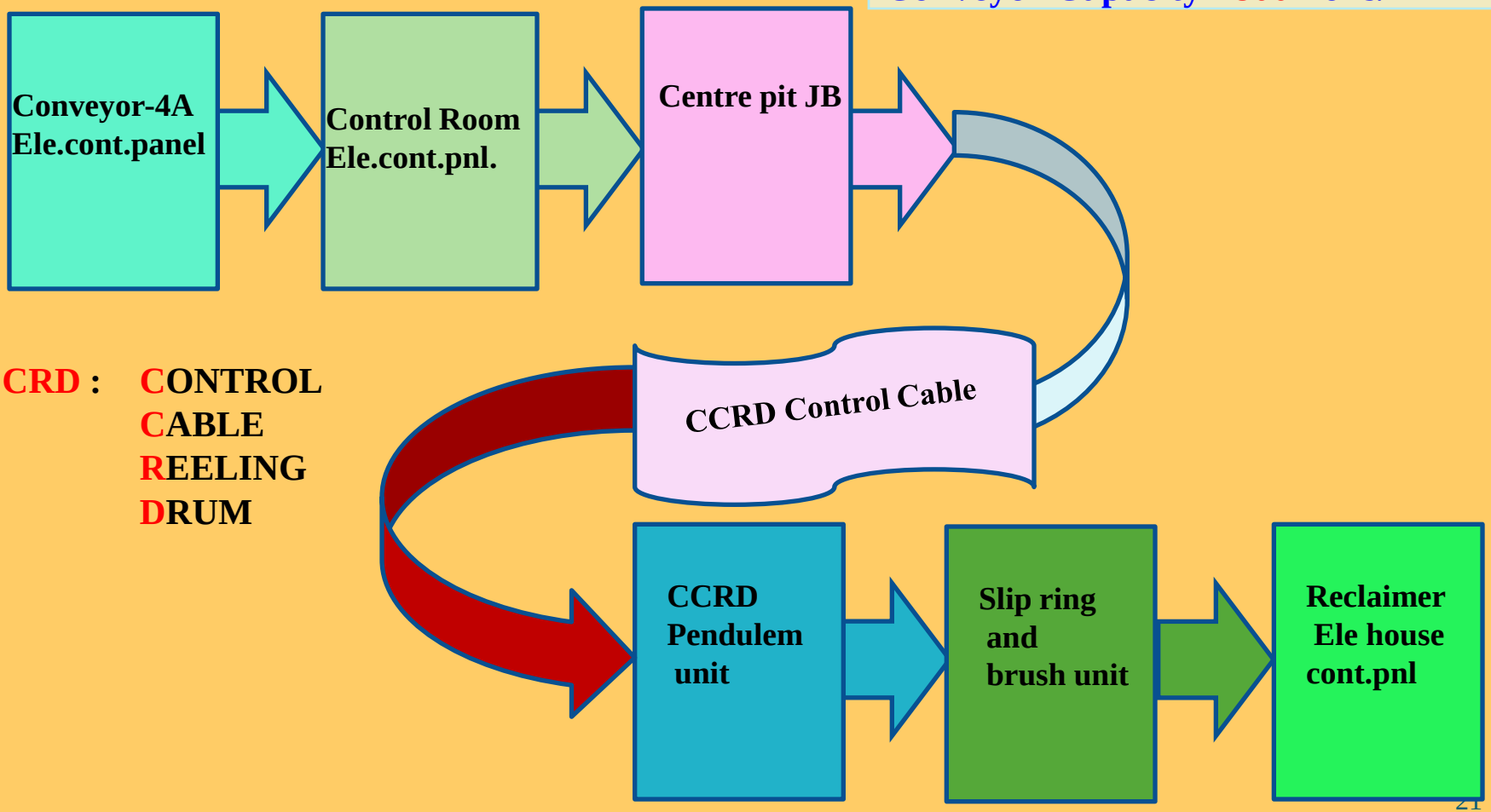
DEFINITION OF PROBLEM

Handling of Lignite by our system 35,000 Tons per Day

The Transfering system and Reclaimers runs 19 Hours Daily.

Conveyor Capacity 2800 Tons/Hr

FLOW DIAGRAM



CCRD : CONTROL CABLE REELING DRUM

Step - 3

Definition of Problem

CCRD RELATED DEVICES

LOGIC CONTROLLER

Reclaimer-A m/c

CCRD & cable

Slipring unit

CCRD motor

Accessing, taking Maintenance and replacing of components are very difficult in SME Machines.

Guide roller unit

Pendulum unit

Limit switch unit

Slipring unit

Rotor resistance

Step -3

Definition of Problem

Logic contrller

Background of the Problem

Breakdown of SME machines due to "CCRD" problems leads to stoppage of Lignite Transfer.

The SME machines are away from Control room about 2 KM.
Lignite Dust and slush are unavoidable.
Reaching of Reclaimer and centre pit JB Only by Walking and minimum two persons are need for checking healthiness.

Step-3

DEFINITION OF PROBLEM

SEVERITY OF THE PROBLEM

Sequence disturbance frequently happening in the following causes

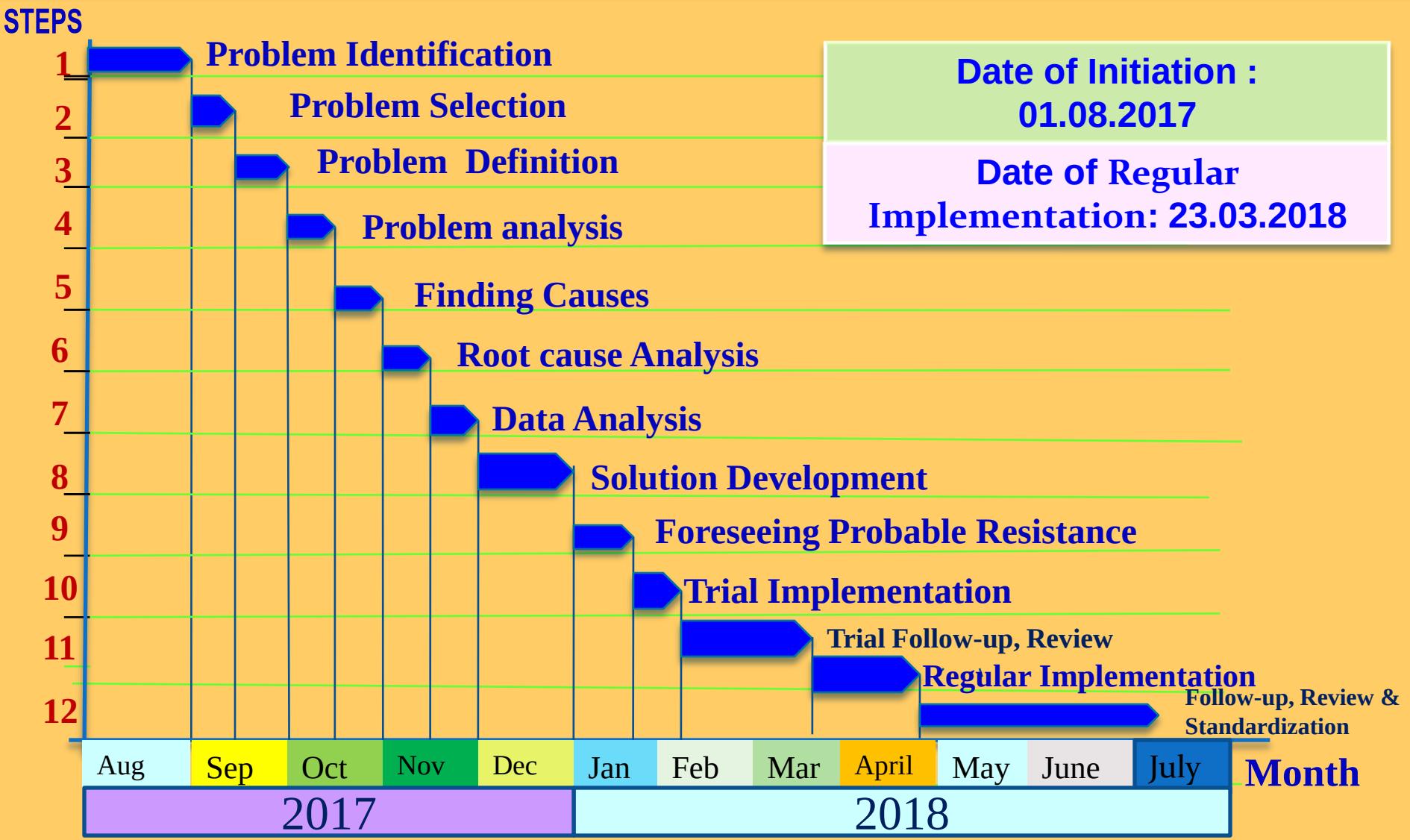
Sl.no	Causes	Breakdown time	Man-power	Material	Most
1	Damages of control cable	More than 8 hrs needed to restore jointing work.	more	Special cable jointing kit	Rs 25000
2	Limit switch setting disturbance or damages	Replacement and limit setting is more difficult	minimum	Imported limit switch	Rs 300000
3.	Failure of Rotor resistance box	Minimum 3 to 4hrs needed	minimum		Rs 12000
4.	Failure of Special torque motor	More than 8 hrs needed to replacement	more	Imported motor	Rs 100000
5.	Failure of Slipring and brush unit	Minimum 3 to 4hrs is needed	minimum	Limited suppliers	Rs 150000

The above causes lead to affect the transfer rate of lignite to the bunker and ultimately reduce the power generation.

Step -3

PLAN OF ACTION

Milestone of GANTT Chart for this Case Study



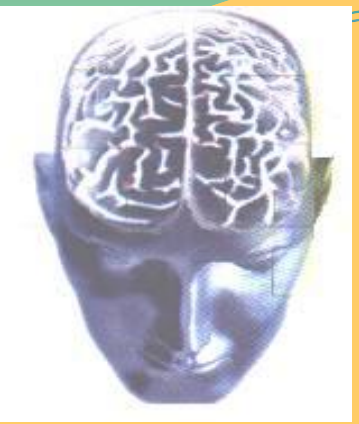
Step-4

ANALYSIS OF PROBLEM

Understanding the problem by 4W & 1H

WHAT is the problem?	Reclaimer‘starting sequence’ not getting from conveyor-4 even when entire system is healthy
WHERE does this problem frequently occur ?	In the CCRD ,slipring brushes and control cable of Reclaimer & the control contactor and concern Terminal blocks in Control room
WHEN does it occur ?	At any time – frequently during starting / running
WHO notices this problem ?	Reclaimer operator, LHS Operation Executives and local persons.
HOW much is the severity ?	Reclaimer not possibe to start with out sequence it lead to affect the transfer rate of lignite to the bunker and ultimately reduce the power generation.

Step-4



Problem Analysis using Brain Storming

Major reasons identified for the Reclaimer sequence problem

- conveyor-4A 'Auxiliary contact' problem.
- Slip Ring & brushes problem.
- CCRD Motor & Rotor Resistance problem.
- Mechanical struck up in CCRD.
- Control cable short.
- JB problem near centre pit.
- Pendulam cam limit switch problem.

Step-4

Problem Analysis

(Data collection from log book)

"SEQUENCE" problems	
Year	No of 'Sequence problems'
2012	145
2013	149
2014	138
2015	142
2016	151
total	725

Problems in the period From Jan 2017 to Mar 2017	
Description	No of complaints
Problems in CCRD	**37**
Problems Slip Ring	**08**
Problem in Control cable	**07**
Problem in Centre pit JB	**06**
Problem in Aux. contact	**05**
Other problems	**05**
Total	**68**

CCRD Problem is **54.41%**

Step - 4

Analysis of Problem

DATA COLLECTION SHEET
(Based on log book : from Jan-2017 to Mar-2017)

Topic:Frequent Sequence problems in 'conveyor-4A to Reclaimer-A'

Sl.no	Reclaimer-A machine "Sequence" Related problems	Failure of equipments	No. of times	Total
1.	Problems in CCRD	Guide roller unit	10	37
		Drive motor	6	
		Rotor resistance	8	
		Drive chain	6	
		Pendulum limit switch	7	
2	Problems in Slip Ring	Damages of brushes	5	8
		Failure of fixing unit	3	
3	Problem in Control cable	Cable cut	4	7
		Cable core open	3	
4	Problem in Centre pit JB	Terminal wire loosen	4	6
		Terminal connector broken	2	
5	Problem in Aux. contact	Failure of coil	5	5
6	Other problems	Auxilary equipments	5	5
		Total no. of failure		68

Step-4

ANALYSIS OF PROBLEM

(Data For pareto diagram)

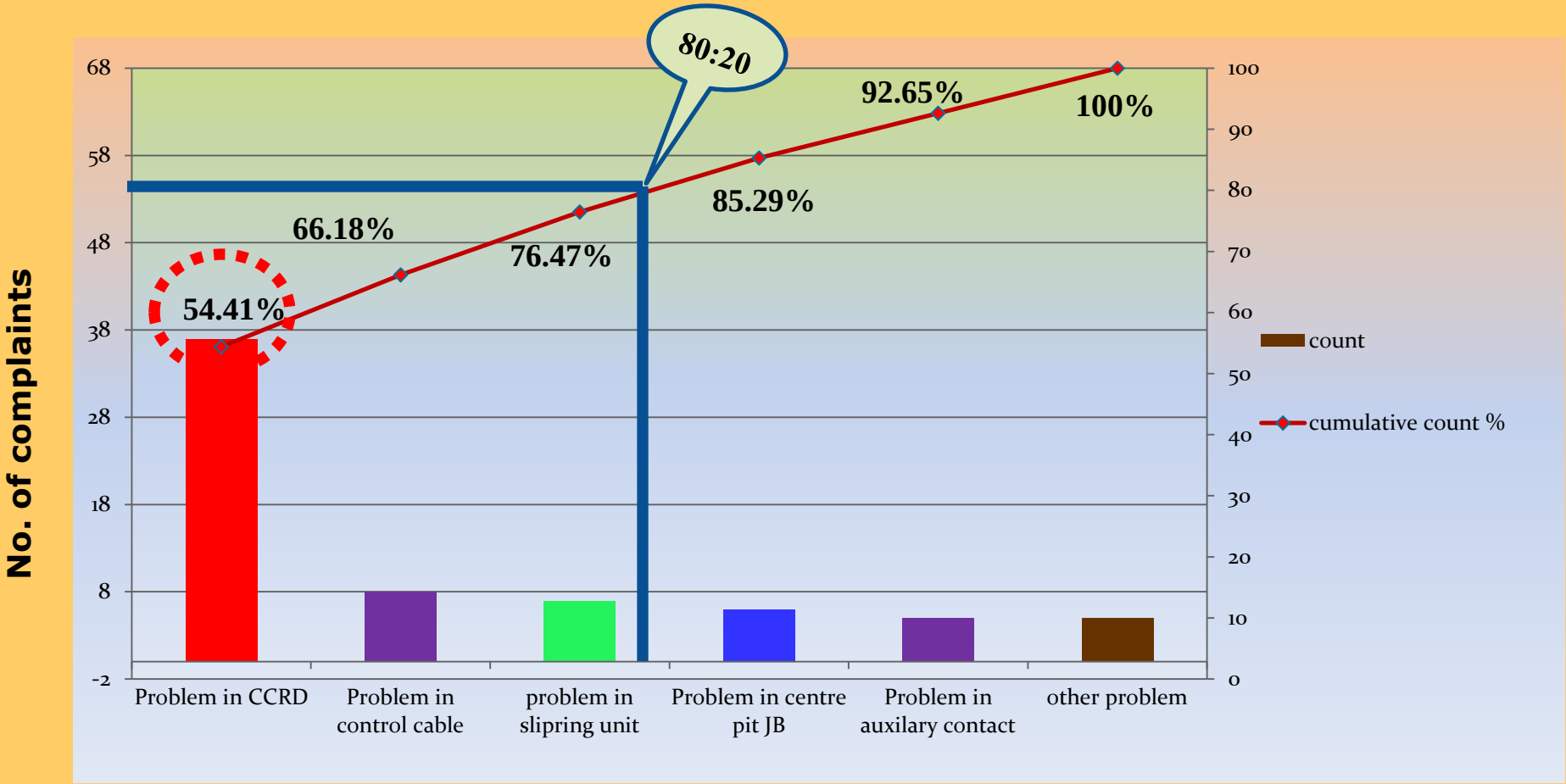
Sl.no.	Type of problem	No of occurrences	No of occurrences in %	Cumulative percentage
1.	Problems in CCRD	37	54.41	54.41
2	Problems Slip Ring	8	11.76	66.18
3	Problem in Control cable	7	10.29	76.49
4	Problem in Centre pit JB	6	8.82	85.29
5	Problem in Aux. contact	5	7.35	92.65
6	Other problems	5	7.35	100
	Total	68	100%	

Step-4

Pareto Chart

Logic controller

Data collection from JAN to MAR- 2017



Nature of complaints

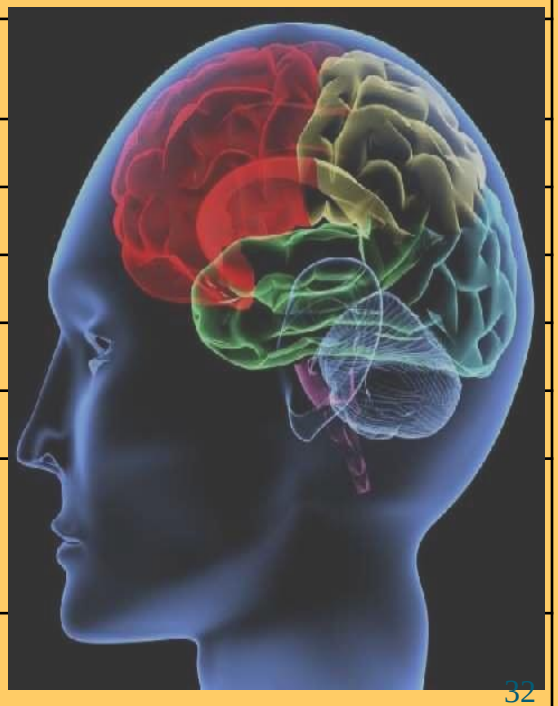
The CCRD,CONTROL CABLE & SLIPRING accounts for 80% of the problems

Step - 5

Finding out the Causes

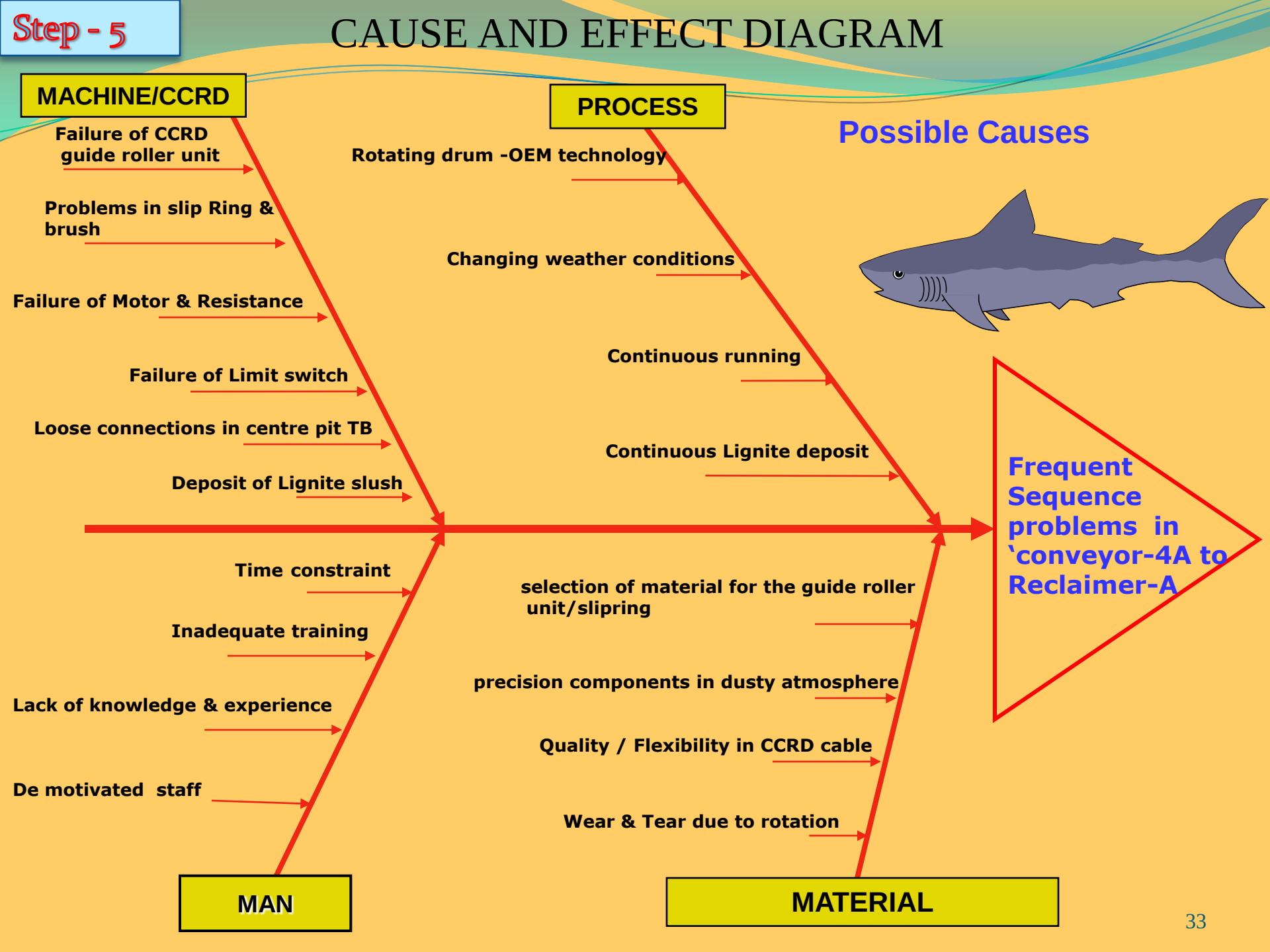
GEMBA OBSERVATIONS - Brain Storming

Sl. no	Possible causes	Sl.no	Possible causes
1	Failure of Motor & Resistance	15	Precision components in dusty atmosphere
2	Failure of Limit switch	16	Quality/Flexibility in CCRD cable
3	Loose connection in centre pit JB	17	Wear & Tear due to rotation
4	Deposit of Lignite slush	18	Failure of CCRD
5	Time constraint		
6	Inadequate training		
7	Lack of knowledge & experience		
8	De motivated staff		
9	Rotating drum-OEM technology		
10	Changing weather conditions		
11	Continuous running		
12	Continuous Lignite deposit		
13	Selection of material for the guide roller Unit/slipring		
14	Water enter in the centre pit JB		



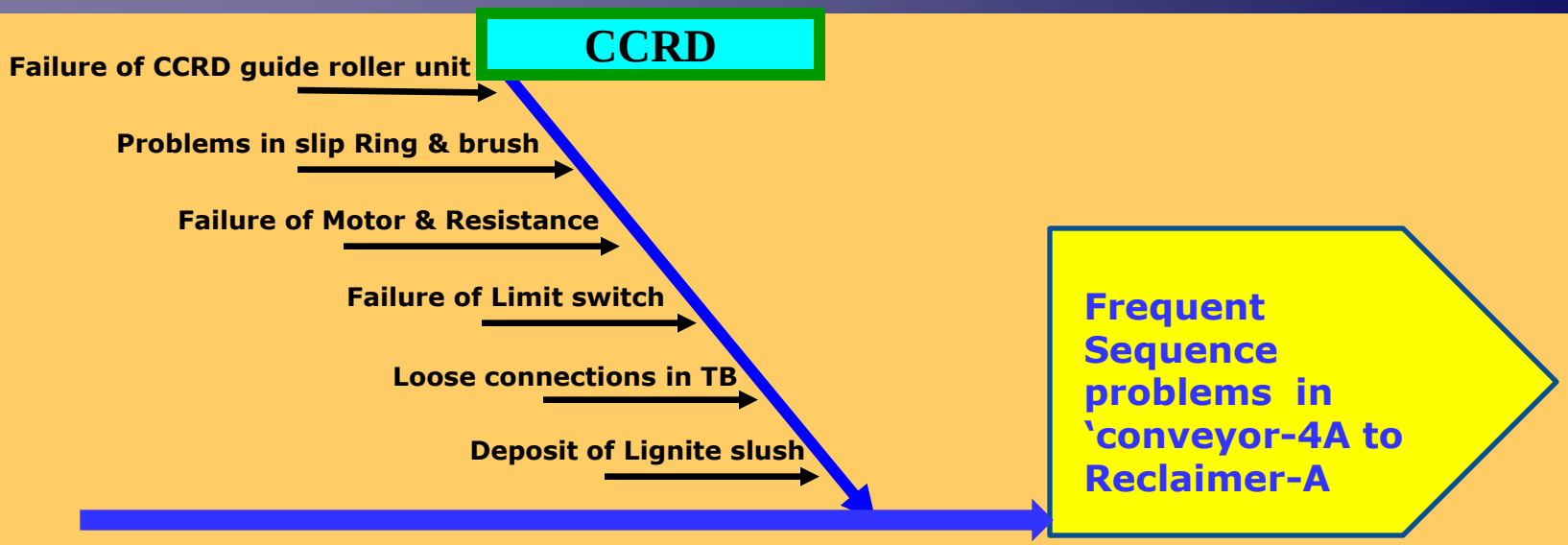
Step - 5

CAUSE AND EFFECT DIAGRAM



Step - 5

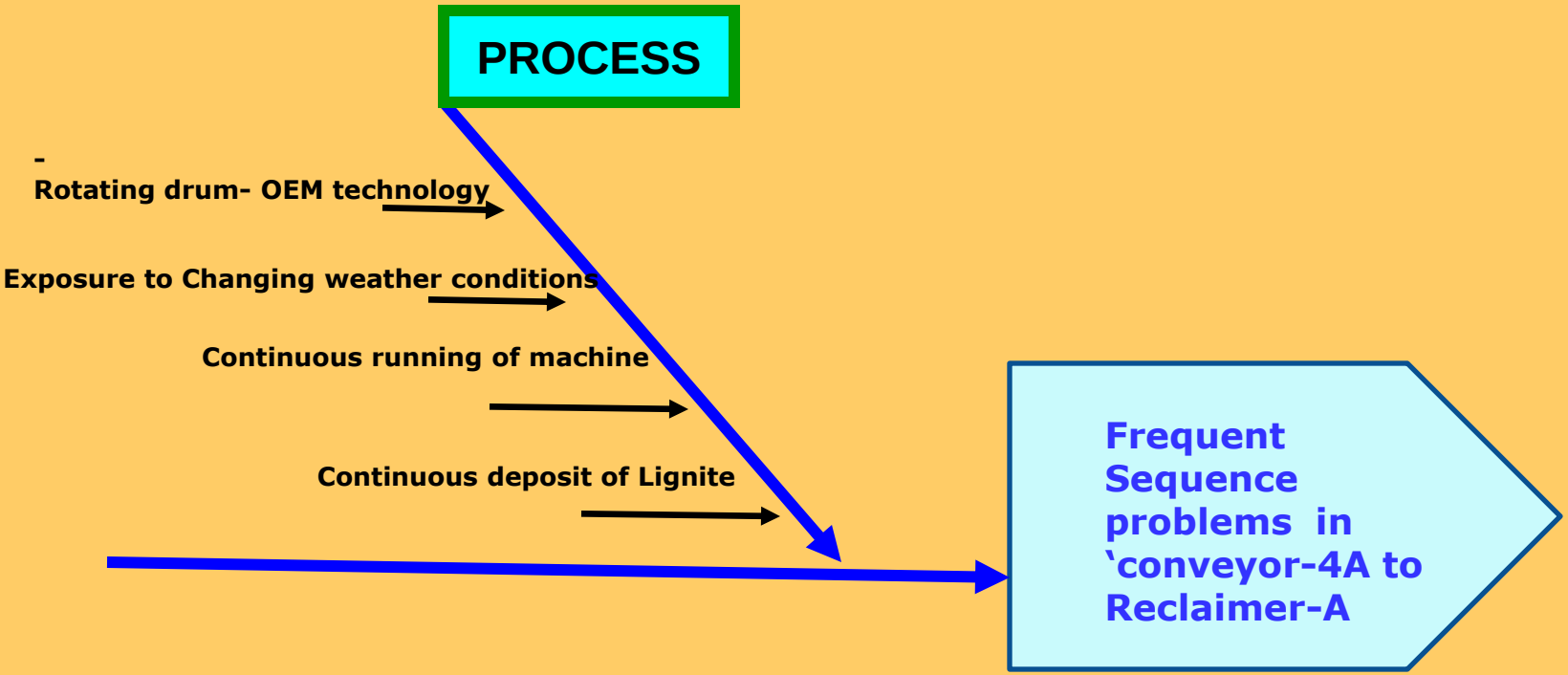
VALIDATION OF CAUSE AND EFFECT DIAGRAM



POINT TO CHECK	VALIDATION	RESULT	REMARKS
Failure of CCRD guide roller unit	Data collection	Valid	Significant
Problems in Slip ring & brush	Data collection	Valid	Significant
Failure of Motor & Resistance	Observation	Within the limit	Not Significant
Failure of Rotary cam Limit Switch	Data collection	Valid	Significant
Loose connections in terminal block	Tested	OK	Not Significant
Deposit of Lignite slush	Data collection	Valid	Significant

Step - 5

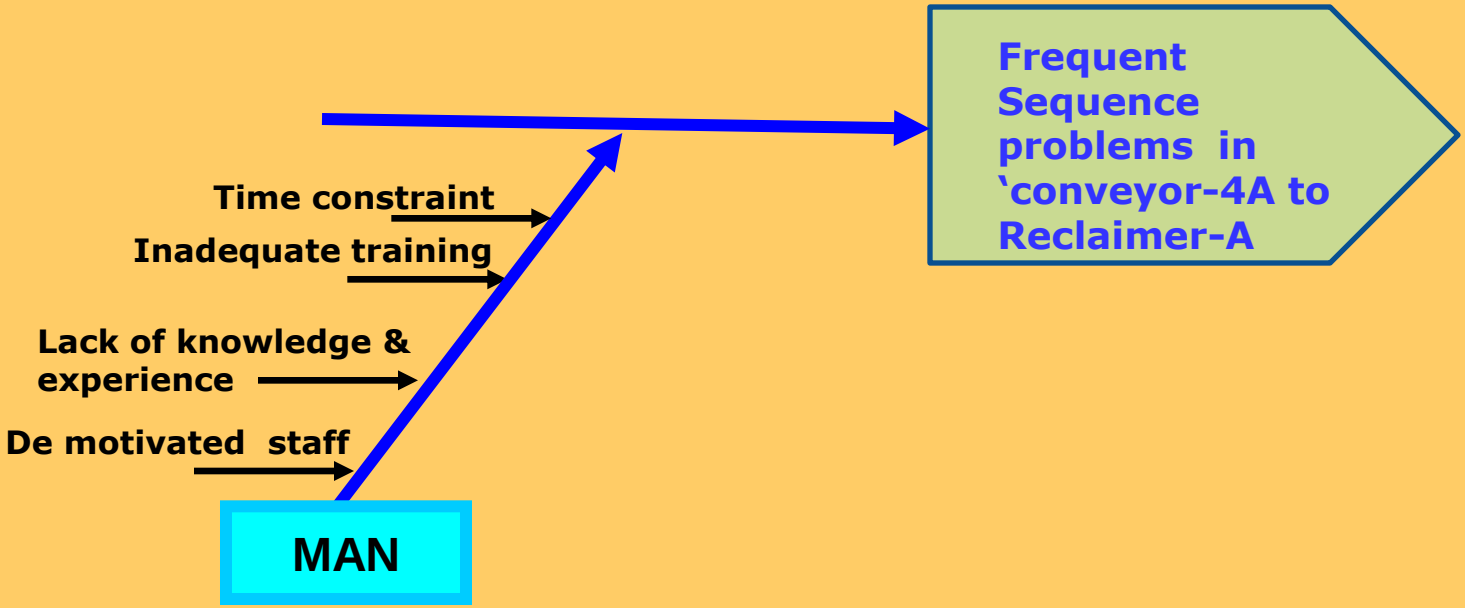
VALIDATION OF CAUSE AND EFFECT DIAGRAM



POINT TO CHECK	VALIDATION	RESULT	REMARKS
Rotating drum- OEM technology	observation	Valid	Significant
Changing weather conditions	observation	Valid	Significant
Continuous running of machine	Observation	Valid	Significant
Continuous deposit of Lignite	Data collection	Valid	Significant

Step - 5

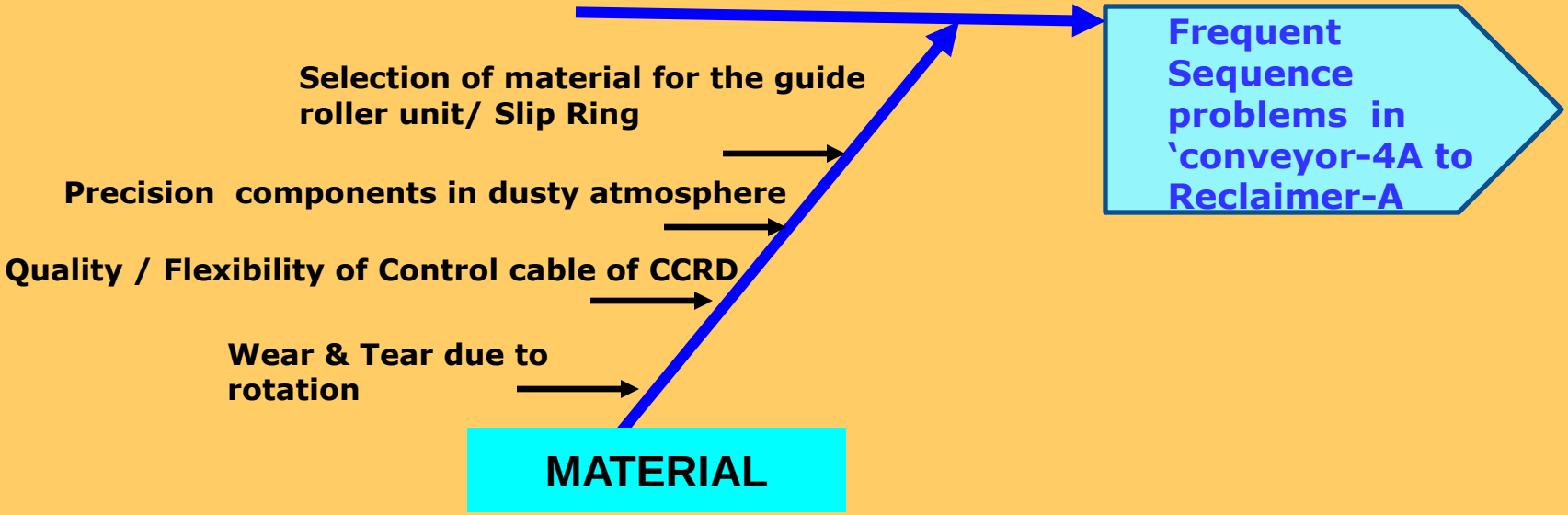
VALIDATION OF CAUSE AND EFFECT DIAGRAM



POINT TO CHECK	VALIDATION	RESULT	REMARKS
Time constraint	Test and trial	valid	Significant
Inadequate training	Trained person	OK	Not Significant
Lack of knowledge & experience	Test and trial	OK	Not Significant
De motivated staff	Test and trial	OK	Not Significant

Step - 5

VALIDATION OF CAUSE AND EFFECT DIAGRAM

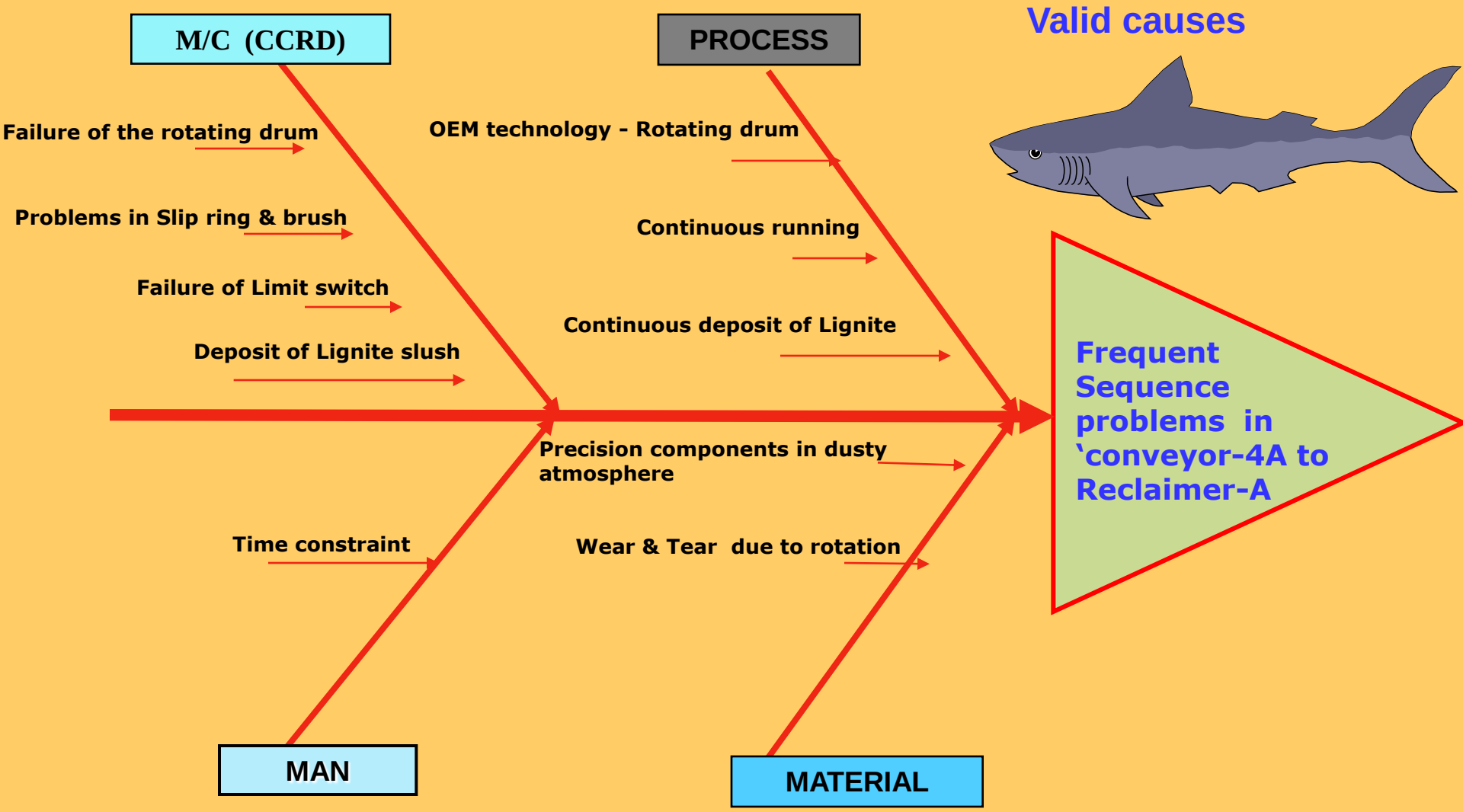


POINT TO CHECK	VALIDATION	RESULT	REMARKS
Selection of material for the guide roller unit/ Slip Ring	manual	OK	Not Significant
Precision components in dusty atmosphere	Data collection	Valid	Significant
Quality / Flexibility of Control cable of CCRD	Test & Trial	OK	Not Significant
Wear & Tear due to rotation	Test & Trial	Valid	Significant

Step -5

Finding out the Causes

(Revised C&E Diagram based on significant causes)



Step -6

Root Cause Analysis (By Brain storming)

	Probable Causes	Validation
MAN	Time constraint	Operational requirement
PROCESS	**Rotating drum OEM technology**	Needs further analysis
	Continuous running	Operational requirement
	Continuous deposit of Lignite	Needs further analysis
MATERIAL	**Selection of material for the switch**	Stringent Specification adopted
	Precision components in dusty atmosphere	Needs further analysis
	Wear & Tear due to rotation	Needs further analysis

Step -6

Root Cause Analysis (By Brain storming)

	Probable Causes	Validation
CCRD	**Failure of CCRD guide roller unit**	Needs Further analysis
	Problems in Slip ring & brush	Needs Further analysis
	Failure of Limit Switch	Needs Further analysis
	Deposit of Lignite slush	Needs Further analysis

Step -6

Route cause analysis

Why Why Analysis 1

Failure of Rotating Drum

Failure of Limit switch

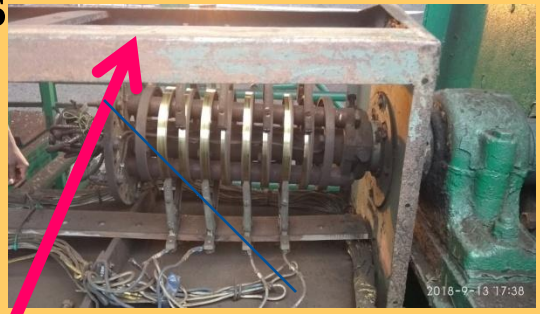
Failure of CCRD guide roller

Failure of slipring and brushes

Wear & Tear in Precision components

WHY ?

Because of Continuous rotation



WHY ?

That was the technology available

ROOT CAUSE- Methodology – Rotation

Step -6

Why Why Analysis - 2

Continuous deposit of Lignite
Precision components in dusty atmosphere
Deposit of Lignite slush

WHY ?

Due to location of the machine in the Dusty atmosphere

(machine in the stock piles)

WHY ?

Due to Operational Requirement

ROOT CAUSE- **Location of the CCRD / Slipring in the Lignite yard**

Step -6

Root Causes and Countermeasures

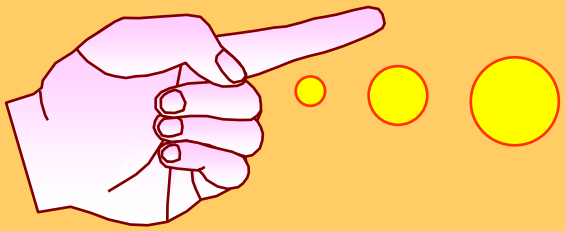
(By Brain storming)

1. Methodology – Rotating componets

Countermeasure

CCRD should be removed and a ‘non contact type device’ should be introduced in the sequence circuit

2. Location of the Machine



Due to heavy dust and rough atmospherical conditions, the ‘sensing device’ should be fixed at dust free location

Countermeasure

Step -7

DATA ANALYSIS FOR IMPLEMENTATION

Suggestions of Our team (Brain storming)

- Replace the CCRD & Rotary cam Limit switch periodically- **REJECTED**
- Connect Machine and Control Room with Wireless equipment – **REJECTED**
- Change CCRD with Energy chain – **REJECTED**
- Replace ALL COMPONENTS periodically– **NOT POSSIBLE**
- Change the design with NON CONTACT TYPE equipments – **ACCEPTED**
- Change the location of equipments to non dusty atmosphere- **ACCEPTED**

Step -8

Development of solution

ACCEPTED SOLUTION for deriving "SEQUENCE"

- Proximity sensor is fixed in the non moving part of the impact roller of a machine RA.
- For sensor sensing purpose small size of metal plate welded in the top surface of the impact roller. It is termed as striker plate.
- Speed monitor unit(D100) and off delay timer(0-60sec) are fixed in the electrical house interlocking panel.
- Necessary control wiring works are completed between proximity sensor and speed monitor unit.
- when conveyor-4A is started, impact roller also rotate corresponds to belt speed, striker plate cuts the sensor signals these status reflected in to the speed monitor as pulses.
- By using speed monitor unit we can able to fix the range and set the setting to energize auxiliary relay.
- The output of the auxiliary relay used to energize off delay timer and the out put of timer is to energize sequence contactor.

Step -8

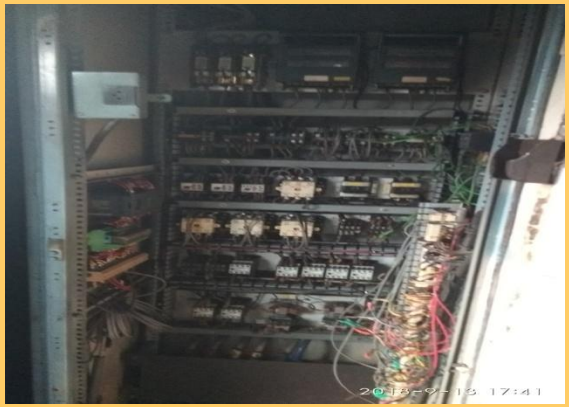
Development of solution

ACCEPTED SOLUTION DEVELOPMENT

speed sensor and striker arrangement → speed monitor & off delay Timer → existing sequence contactor

Impact roller and sensor with striker arrangements

off delay timer and speed monitor units



Existing control panel

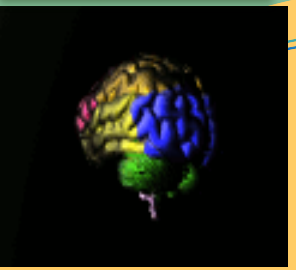
Step -8

Development of solution

ACTION PLAN (*5W + 1 H*)

SL NO	WHAT	WHY	WHO	WHERE	WHEN	HOW
1	Mounting of sensor ,speed monitor unit and wiring works.	To get sensor feed back	S.Gnanam J.Selvapandian G.Iyyappan	Impact roller and and electrical house panel	2017-Dec-15 Dec-21 Dec-26	Drilling, fixing , wiring and logic checking
2	Welding striker plate in the impact roller	To eliminate/ reduce breakdowns	K.G.Rajendrakumar S.Gnanam	At machine	Dec-17 Dec-24 Dec-30	Drilling, fixing wiring and logic checking
3	Fore seeing probable resistance, Trial Checking & standardization	To see the suitability	K.G.Rajendrakumar S.Kumar	In LHS	Jan to Mar-2018	Brain storming, Data collection meeting with experts and modifying datasheets and procedures
4	Working Model	For presentation	K.G.Rajendrakumar S.Gnanam J.Selvapandian G.Iyyappan	Site at Our office	Feb-20 to Feb-25 of 2018	Welding , fabrication and implementation
5	Meeting organizing and Communication	Over all Co-ordination	S.Kumar	Among members at Neyveli	Through the Project	Over Phone and in person

Step -9



FORESEEING RESISTANCE - BRAIN STORMING

ACTIVITY	PROBABLE RESISTANCE	RESISTANCE FROM	ACTION TAKEN TO OVERCOME RESISTANCE
Providing Electronic circuit for Sensing Signals.	Electronic circuits may not be reliable	OPERATION TEAM	Educated and convinced sensor(imported make) is a trouble free and proven technology
	Will it be sensitive and safe?	OPERATION SERVICES	Trial run taken and found to be safe
CCRD will not be in service	Wireless phone has to be used by Operators	SME OPERATORS	Operators are apprised of advantages
Defeat sequence when con run in local mode.	Will it be ensure when con Run in local mode.	Our division staff	Reclaimer ON command interlock with con local starting circuit.

Step - 10

TRIAL IMPLEMENTATION

Trial Implementation on 05/01/2018 in Reclaimer-A

The following modifications were done.

- Proximity sensor and striker are fixed in the impact rollers.
- Speed monitor (D100) unit and off delay timer are fixed in the electrical house panel no-9
- We measured 360 impulse/min from D100 unit. As per our management we set 280 impulse/min with 3 sec delay from off delay timer for tripping the system if the impulse count falls below the set value.
- This system was taken into service on 05.01.2018
- Necessary modifications in the Control drawing were done and informed to the other related departments.

Step -10

THE TRIAL IMPLEMENTATION

Logic controller

What we did ?.....

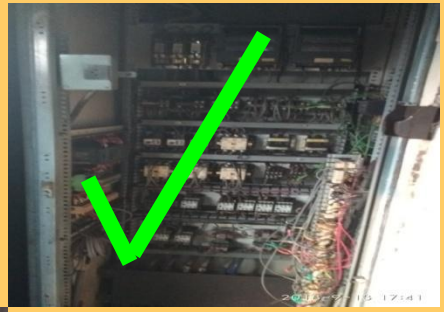
CCRD , SLIPRING UNIT AND CONTROL CABLE REMOVED.

RPM SENSING DIVICE FIXED IN THE EXISTING MECHANICAL ARRANGEMENTS

Sensor and striker plate in existing impact roller

Dusty location

EASY accessible location



Existing control panel

CCRD,Cable,slipring

Timer and speed monitor units

Motor, Rotor resistance

Step -10

What we did ?.....

Conveyor-4A Ele.cont.panel

Control Room Ele.cont.pnl.

Centre pit JB

CCRD Control Cable

CCRD Pendulem unit

Slip ring and brush unit

Reclaimer Ele house cont.pnl

Rotating components in dusty atmosphere

Before QC

After QC

speed sensor and striker arrangement

speed monitor & off delay Timer

Reclaimer Ele house cont.pnl

Non-Contacts components in dust free atmosphere

Step -10

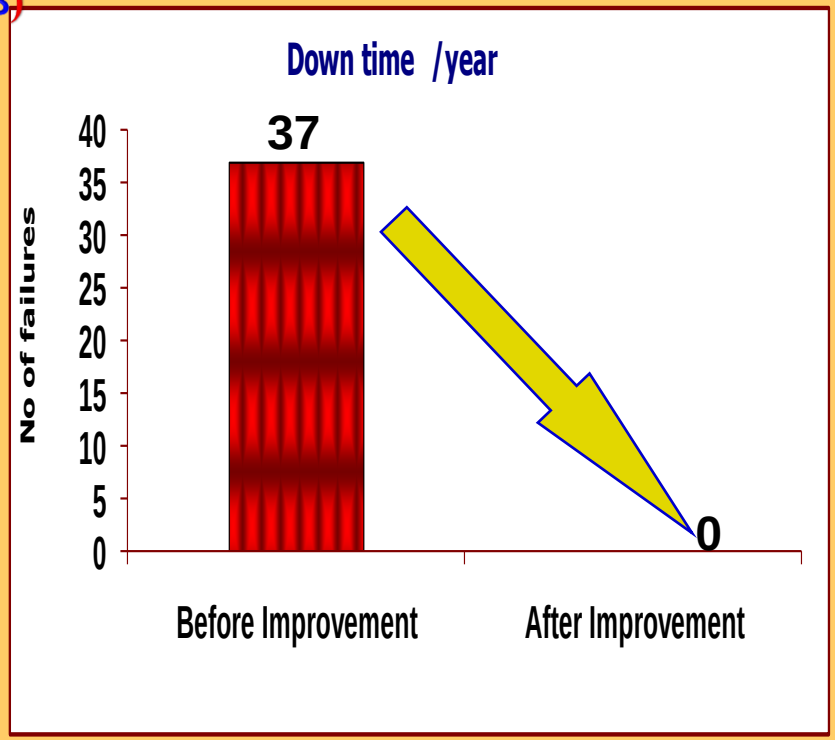
TRIAL IMPLEMENTATION

P
Q
C
D
S
W E

PERFORMANCE CHECK & ANALYSIS AFTER IMPLEMANTATION

(Data collection From Jan-2018 to July-2018)

Description	No of complaints
Problems in CCRD	**0**
Problems Slip Ring	**0**
Problem in Control cable	**0**
Problem in Centre pit TB	**0**
Problem in Aux. contact	**5**
Other problem	**5**
Total	**10**



The follow-up & data collection shown the best performance of non contact device .

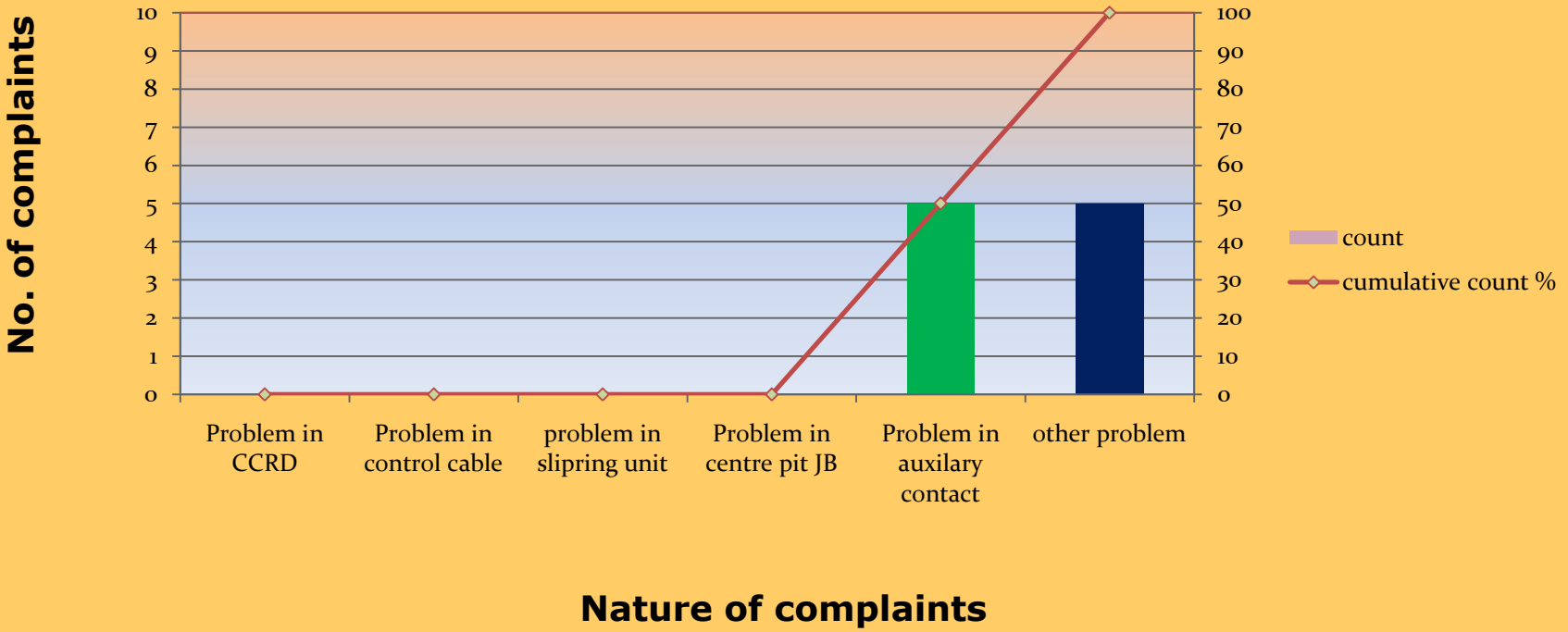
Step -10

TRIAL IMPLEMENTATION

Revised Pareto Chart

PERFORMANCE CHECK & ANALYSIS AFTER IMPLEMANTATION

Data collection from JAN to JULY- 2018

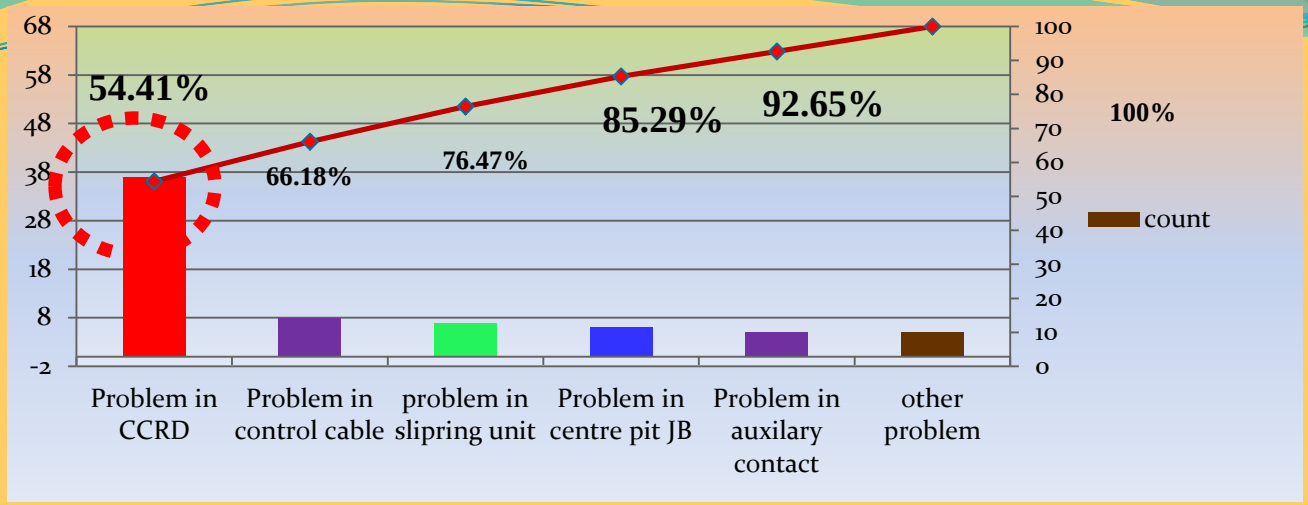


80% of the problem related to CCRD,CONTROL CABLE & SLIPRING fully eliminated

Step - 10

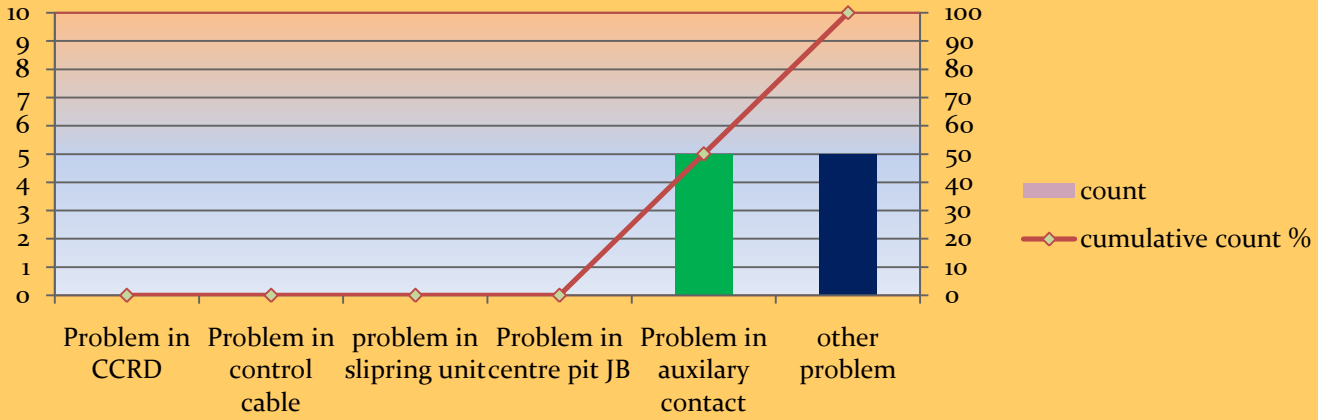
Comparative pareto charts

Logic controller



Before QC

The CCRD,CONTROL CABLE & SLIPRING accounts for 80% of the problems



After QC

80% of the problem related to CCRD,CONTROL CABLE & SLIPRING fully eliminated

NIL breakdown of Transferring system by "SEQUENCE "problem.

The follow-up & data collection shows the best performance of non contact device.

Step -11

REGULAR IMPLEMENTATION

Logic controller

Data comparison Before & After Modification

"Sequence "related complaints

Description	No. of complaints			
	Before QC (2017) From JAN-2017 to MAR-2017	After QC (2018)		
		From Jan-March-2018 (Trail follow-up)	From April to July-2018 Follow-up after regular implementation	From Jan-2018 to July-2018
Problems in CCRD	37	0	0	0
Problems Slip Ring	8	0	0	0
Problem in Control cable	7	0	0	0
Problem in Centre pit TB	6	0	0	0
Problem in Aux. contact	5	3	2	5
Other problems	5	4	1	5
Total	68	7	3	10

Based On Logbook Reports

Step -11

REGULAR IMPLEMENTATION

Logic controller

DATE OF REGULAR IMPLEMENTATION : 23. 03. 2018

1. **Approved Circuit Diagram was included in Machine Drawing.**
2. **Modification details were informed to Operation In-charges.**
3. **Existing electrical components and fixtures were dismantled.**

Follow-up review were carried out.

Step -11

Analysis After Regular Implementation

Logic controller

Data collection From Jan-2018 to July-2018

Data source : Log book

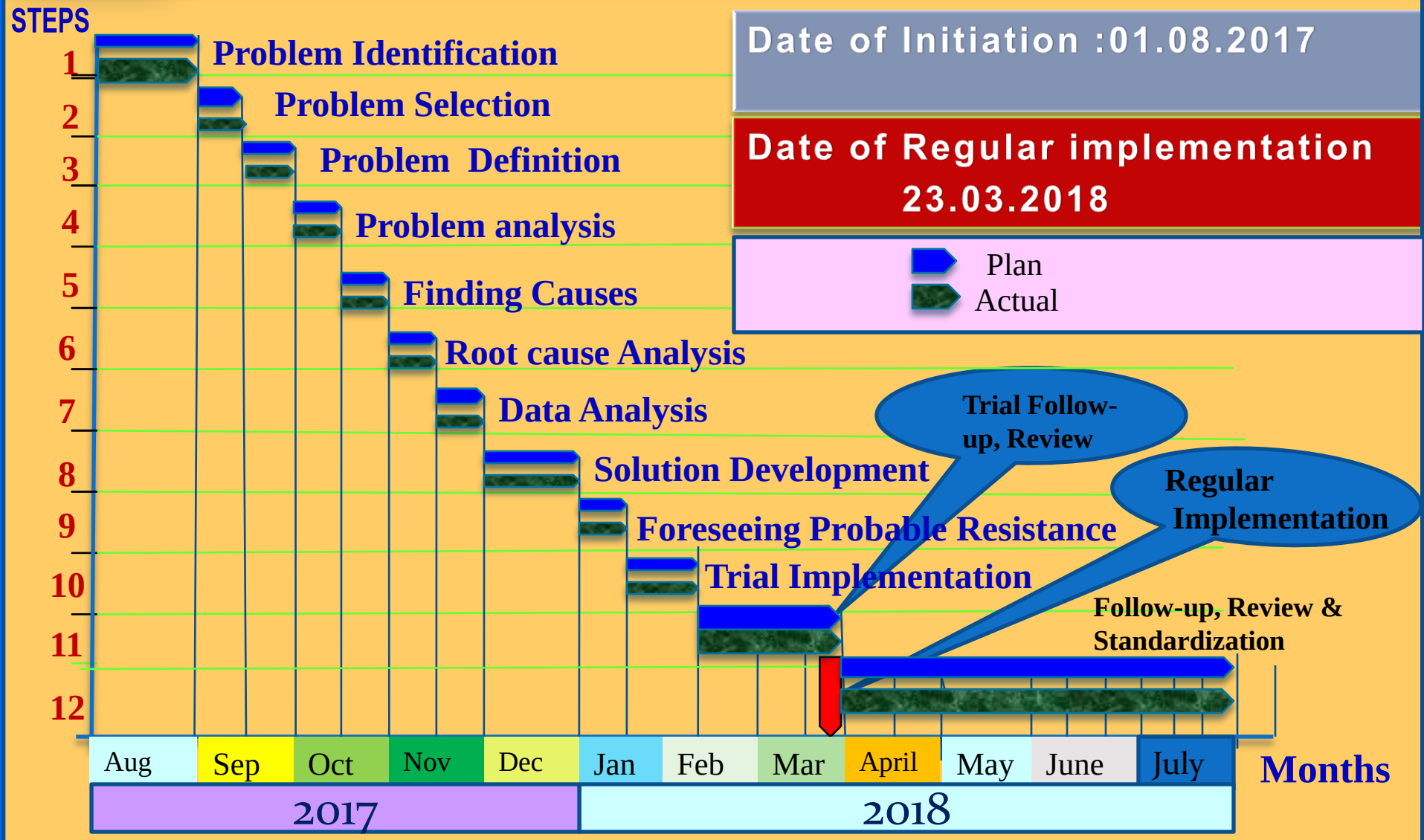
Description	No of complaints
Problems in CCRD	0
Problems Slip Ring	0
Problem in Control cable	0
Problem in Centre pit TB	0
Problem in Aux. contact	5
Other problems	5
Total	10

- **Working without complaint till date.**
- **Encouraging feedback from SME operators and Operation In-charges.**

Step -11

Milestone Chart of this Case Study

Logic controller



Step -12

FOLLOWUP REVIEW

Logic controller

1. **Training session was conducted to Operation crew and maintenance crew.**
2. **Follow up & Oral data collection were done till date . No abnormality found.**

AKNOWLEDGEMENT FROM OTHERS

SL.NO.	Department	Work involved	Acknowledgement
1	Civil Maintenance	Cleaning	Very good
2	Mechanical Maintenance	Maintenance	Very good
3	Operation In charges / PMs	Operation	Very good
4	SME Operators	Operation	Very good
5	Our Head of Department & Engineers	Maintenance	Very good

Step -12

Logic controller

FOLLOWUP & REVIEW

AA Chart

AIM

1. Frequent failure of conveyor 4-A to Reclaimer-A **"sequence"** should be avoided.
2. To minimize the Maintenance time.
3. To minimize the Maintenance & Spares cost.
4. To ensure Safety of the Men & machine.

ACHIEVED

1. Sequence failure is Eliminated by means of non-contact device installed at clean atmosphere
2. The Maintenance time due to this problem eliminated.
3. The Maintenance and spares cost reduced.
4. Safety of Men & machine ensured.

Step -12

Cost Benefit Analysis

Logic controller

Modification cost

- IFM make Sensor cost: Rs 2500 ; Cable (15m)& TB cost: Rs 500 ; off delay timer cost: Rs.800/-
- IFM make speed monitor: Rs 1250 Total cost: Rs. **5050/-**

Maintenance cost

Spares required for maintaining the old system per annum:

24 core control cable 150m x 500 = Rs 75000 (Replacement once in 5 years)
Slip ring & brushes = Rs 50000 (Replacement once in 3 years)
Rotary cam Limit switch = Rs 50000 (Replacement once in 6 years)
Rotor Resistance = Rs 4000 (Replacement once in 3 years)
Special torque motor = Rs 33000 (Replacement once in 3 years)
Other Electrical components = Rs 25000
For Mechanical components = Rs 100000
(CCRD ,Guide roller, Pendulum unit, Chain & gear box)
Total cost for maintenance p.a = Rs.3,37,000

Savings

Savings in the first year: 337000 – 5050 = **Rs. 3,31,950**

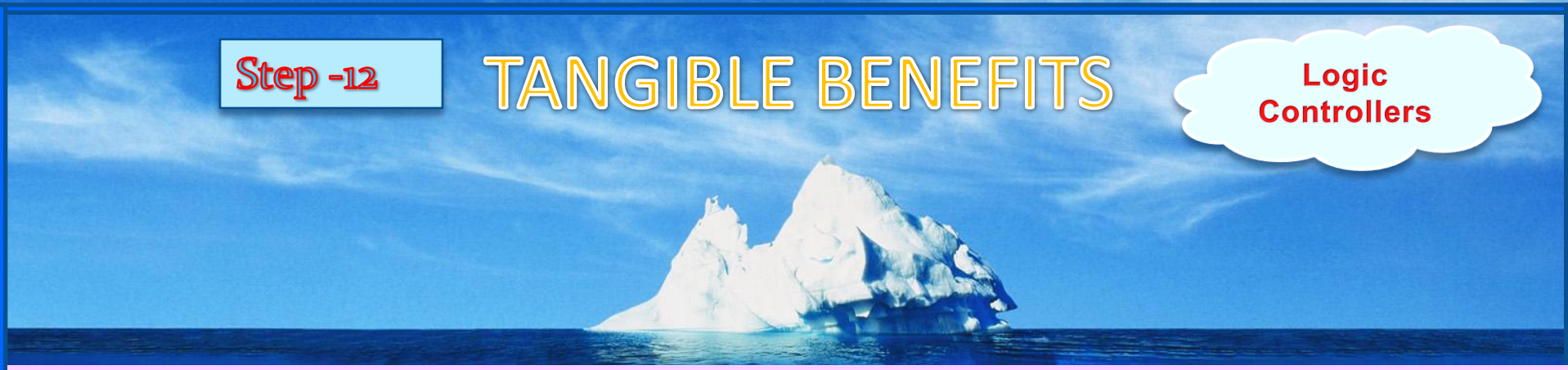
From II year onwards: 337000 - 600 = **Rs 3,37,100**

Replacement of IFM make sensor & D100 units : once in 2 yrs, timer: once in 2 yrs)

Step -12

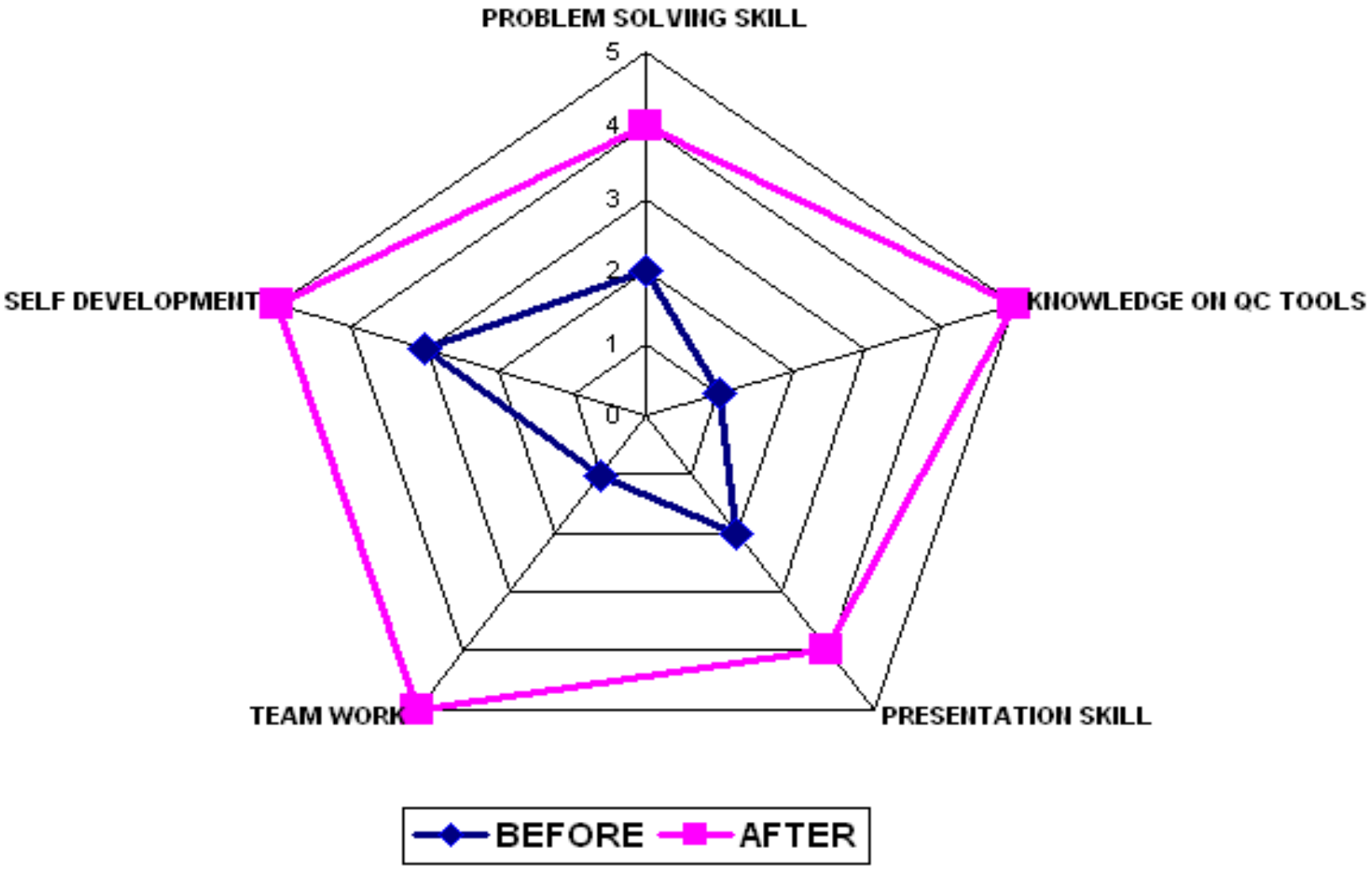
TANGIBLE BENEFITS

Logic Controllers

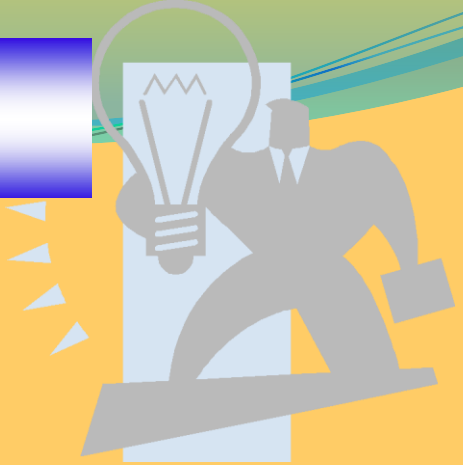


1. Cost saving for the 1st year Rs.3,31,950/-
2. Cost saving for the next year Rs.3,37,100/-
3. The Maintenance time due to this problem eliminated.

Intangible Gains



QC TOOLS & TECHNIQUES USED



1. ABC ANALYSIS
2. PRIORITY RANKING
3. PROCESS FLOW DIAGRAM
4. GANTT CHART
5. A A CHART
6. PARETO DIAGRAM
7. BRAIN STORMING
8. CAUSE & EFFECT DIAGRAM
9. WHY-WHY ANALYSIS
10. RADAR CHART

Logic Controllers

Our next QC case study.

Our next projects:

- Encoder based soft limit switch for Shuttle conveyors
- Non contact back up limit for SME machine Slewing circuit
- Display of Conveyor status /running current in Intranet

OUR SINCERE THANKS TO

- QCFI
- JUDGE PANEL
- OUR MANAGEMENT
- ALL PARTICIPANTS
  &
  AUDIENCE