Executive TPM Introduction & Overview

1. Why Is TPM Important and Relevant?
2. How and Why TPM Works?
3. How To Implement TPM Effectively And Quickly And Achieve Bottom-line ROI?
4. Q & A

Welcome !!
Executive TPM Briefing Notes

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Contact Us For A No-Obligations Top Management Briefing.

A Word About Moses. . . . .

Moses Tan is the Principal consultant of ZenPower International, an experienced TPM expert since 1996. He greatly **emphasizes on implementation** details and methods. With an extended 20 years of experience, Moses was previously a TPM Training Manager with a Japanese-owned semiconductor manufacturer, Silicon Systems, a wholly-owned subsidiary of TDK Corporation, Japan. TDK is an advanced TPM Practitioner and a recipient of the prestigious World-Class TPM award from the JIPM.

As TPM manager, he led in hands-on TPM Implementation and conducted TPM Training, 5S, Kai'zen employee suggestion system and other TPM-related technical skills training. His large clientele includes NEC electronics, Carsem Semiconductor, Hitachi, SCI Manufacturing, NEC Seminconductor, Siemens, Sony Display Devices, Sumitomo bakelite, Infineon, Malaysian Newsprint Industries, Yamaha Motors, Hong Leong, Hitachi-Nippon Steel, Taiko Electronics, Showa Denki, Guocera Tiles Industries and the list goes on (see next page)

He has consulted for both the **discrete and process** industries and consistently improved their ROI. His focus of expertise includes **all** the TPM Pillars – Autonomous Maintenance, Planned maintenance, Focused Improvements, Quality Maintenance, Poka Yoke, Office, Administrative and Warehouse TPM, 5S, Kai'zen Suggestion System, Why-Why Analysis and P-M Analysis with Design of Experiments. He also successfully prepared a major Client for the JIPM PM Award and has conducted numerous public and in-house seminars which were always graded **extremely well.** He is also the **Inventor** of the **LEAN ScoreBoard™** which enables any Manufacturer to convert his Process/machine indices in LEAN, TPM, 6-Sigma Programs to be **quantified into COSTs and vice-versa**.

He occasionally contributes TPM articles to the Productivity and Services Board, Singapore. He has also received professional recognitions through awards like the 1989 National Training Awards for the Manufacturing Sector, Singapore; the 1992 & 1994 National Training Commendation Awards, Singapore; 1995 Essay Prize from the Singapore Quality Association for his published article on "TQM Implementation In Singapore MNCs".

Moses holds a Diploma in Education (Technical); a Diploma in Electronics Engineering from the Singapore Polytechnic; a Bachelor's in Information Technology from University of southern Queensland; and a MSc In Training (major in TQM) from the University of Leicester, UK.

OUR GROWING LIST OF TPM CLIENTS WHO HAD ENGAGED OUR PROFESSIONAL CONSULTING, IN-HOUSE AND PUBLIC TRAINING SERVICES – 1996 TO 2006

CARSEM SEMICONDUTOR SDN BHD; CARSEM SEMICONDUCTOR MALAYSI SDN BHD; SCI MANUFACTURING SINGAPORE PTE LTD; SINGAPORE MITSUBISHI BELTING PTE LTD; NEC SEMICONDUTOR PTE LTD; DISPLAY DEVICE (Spore) PTE LTD; .SHOWA DENKO HD; SUMITOMO BAKELITE PTE LTD SINGAPORE, SIEMENS COMPONENTS PTE LTD; MALAYSIA NEWSPRINT INDUSTRIES SDN BHD; GUOCERA TILES INDUSTRIES (Kluang) SDN BHD; YAMAHA MOTORS HONG LEONG SDN BHD; HITACHI-NIPPON STEEL PTE LTD SINGAPORE; TAIKO DENKI SDN BHD, SENAI; MALAYSIA NEWSPRINT SDN BHD; TATA MOTORS LIMITED; BHARAT HEAVY ELECTRICALS LIMITED; INDIAN OIL CORPORATION LIMITED; HMT MACHINE TOOLS LIMITED; HEG LIMITED; ITC LIMITED; MOSER BAER INDIA LTD; NTPC LIMITED; NORTH DELHI POWER LIMITED; THE TATA IRON AND STEEL COMPANY LIMITED; TRIDENT AUTO COMPONENTS PVT LTD; HALLA CLIMATE CONTROL (THAILAND) CO LTD;KIRLOSKAR FERROUS INDUSTRIES LIMITED; TIMKEN INDIA LIMITED; SULZER INDIA LIMITED; KIRLOSKAR COPELAND LIMITED; CAPTIVE POWER PLANT; ALLIED NIPPON LIMITED; UNICHEM LABORATORIES LTD; NATIONAL ALUMINIUM COMPANY LTD; KIRLOSKAR BROTHERS LIMITED; SANDVIK ASIA LTD; TATA CHEMICALS LTD; NALCO; TATA POWER LTD; DR REDDY'S LABS, BALDA THONG-FOOK SOLUTIONS, SIAM-CEMENT; SANDVIK ASIA; UNICHEM;SAMSUMG ELECTRONICS;BHARAT HEAVY ELECTRICAL LTDNATIONAL ALUMINIUMS COMPANY LTD; KIRLOSKAR BROTHERS LTD; MOSER BAER INDIA LTD;INDIAN OIL CORPORATION LTD; HTM MACHINE TOOLS LTD; HEG LIMITED;ITC LIMITED;NTPC LIMITED; NORTH DELHI POWER LIMITED; TATA IRON AND STEEL COMPANY LTDTRIDENT AUTO COMPONENETS PVT LTD;KIRLOSKAR FERROUS INDUSTRIES LIMITED; SULZER INDIA LTD;KIRLOSKAR COPELAND LIMITED.

*References can be supplied upon request.

Background Of TPM

- Championed by the JIPM organization in Japan.
- Mandatory participation – Corporate Policy.
- T = Total, P = Productive, M = Maintenance.
- T = Total, P = Production, M = Management.
- T = Total, P = Perfect, M = Management.
- Evolved in Japan since 70s from Toyota for Companies who desperately want to WIN in today's competition.

1. Why Is TPM Important and Relevant?

a. Emphasizes Equipment Excellence as backbone of Manufacturing Excellence.

b. Integrates Whole Factory's Improvement Program into ONE.

c. Major Improvement Systems, Measurements & Tools to achieve Zero Defects, Zero Breakdowns, Delivery and Cost-Down Goals.

TPM Focus On Equipment:

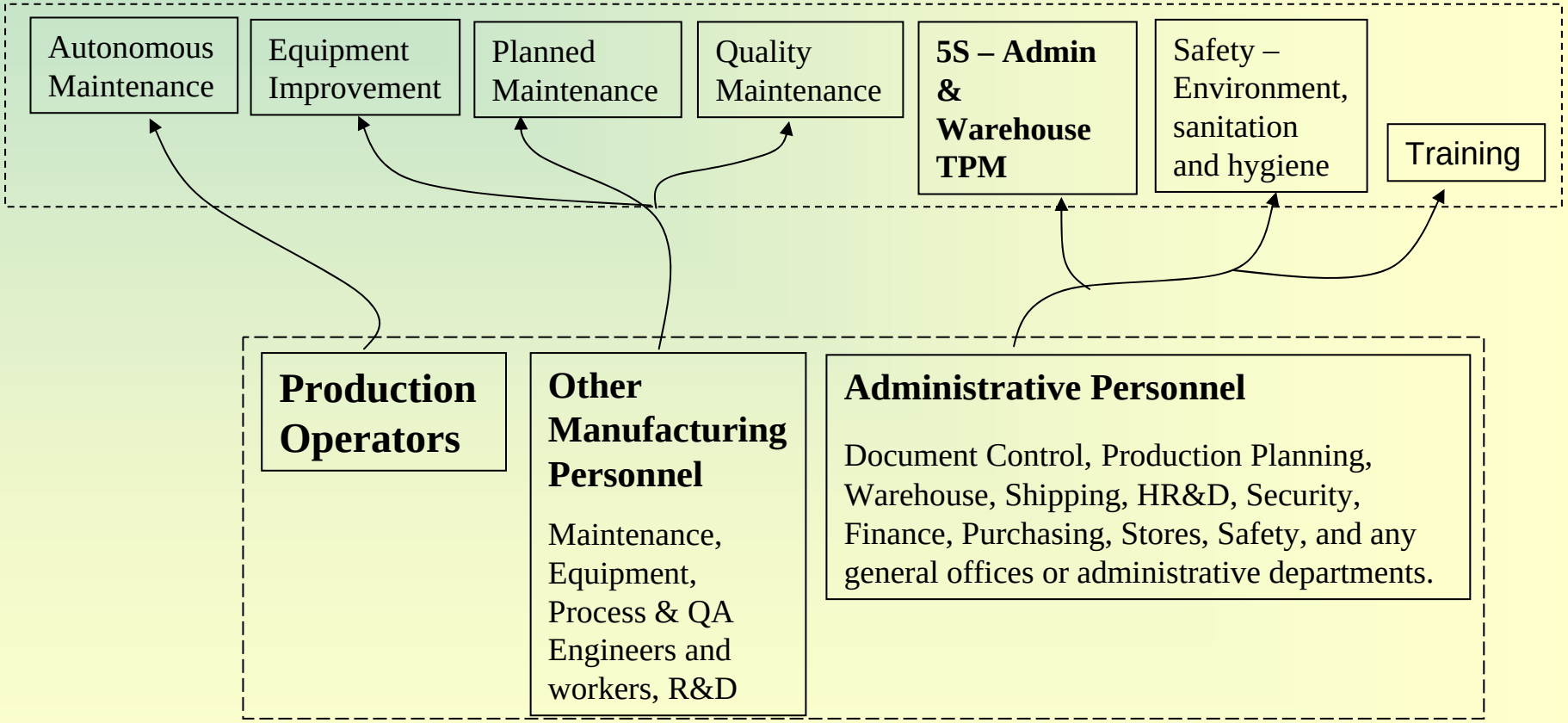
- Every breakdown and defect is due to a deviation from the required Basic Machine Conditions.
- Adhering To The Basic Machine Conditions keeps Manufacturing Equipment From Breaking Down or Generating Defects.
- The Basic Conditions Are: 1) Cleaning 2) Lubrication, 3) Bolt-Retightening. These are enforced with Equipment Inspection & Precision Checks by Operators, Prod Techs and Maint. Techs.

Concept of Forced Deterioration

- Equipment deterioration is natural. But neglect cause a much faster and greater amount of deterioration resulting in expensive breakdowns and defects.
- Main culprits are faulty lubrication, dust, dirt, loose parts, missing, loose or over-tightened bolts and nuts, mis-operation, faulty repairs.
- TPM aims to achieve Prevention, Early Detection and Restoration of deterioration.

TPM Unites Whole Company In Single Program

Major Pillars in TPM Implementation.



Total Involvement Needed: Eg: When A Production Machine Breaks down, various losses are incurred such as:

1. Time taken to report the breakdown.
2. Time taken to locate the technician.
3. Time taken to verify the breakdown.
4. Time to get tools.
5. Time to get spare parts.
6. Actual Time to repair the machine.
7. Time to buyoff the machine after repair.

Except for #6, the other losses are management or administrative or supervisory related losses.

The Pillars of JIPM-TPM Are:

Each Pillar represents one activity-type of TPM focus.

1. Equipment-Improvement Pillar.
2. Production Autonomous Maintenance Pillar.
3. Planned Maintenance Pillar.
4. Education & Training Pillar.
5. Initial New Equipment & Products Control Pillar (MP)
6. Quality Maintenance Pillar.
7. Warehouse & Administrative TPM Pillar.
8. Safety, Hygiene & Work Environment Pillar.

Two other important activities deserve to be emphasized here:

9. Target setting and Measurement
10. TPM Section/Department.

Source: JIPM

2. How & Why TPM Works?

a. Overall Design Logic Of TPM.

b. 7 Steps and 4 Stages Of Autonomous Maintenance.

c. The Initial Stage Of TPM Sustainability.

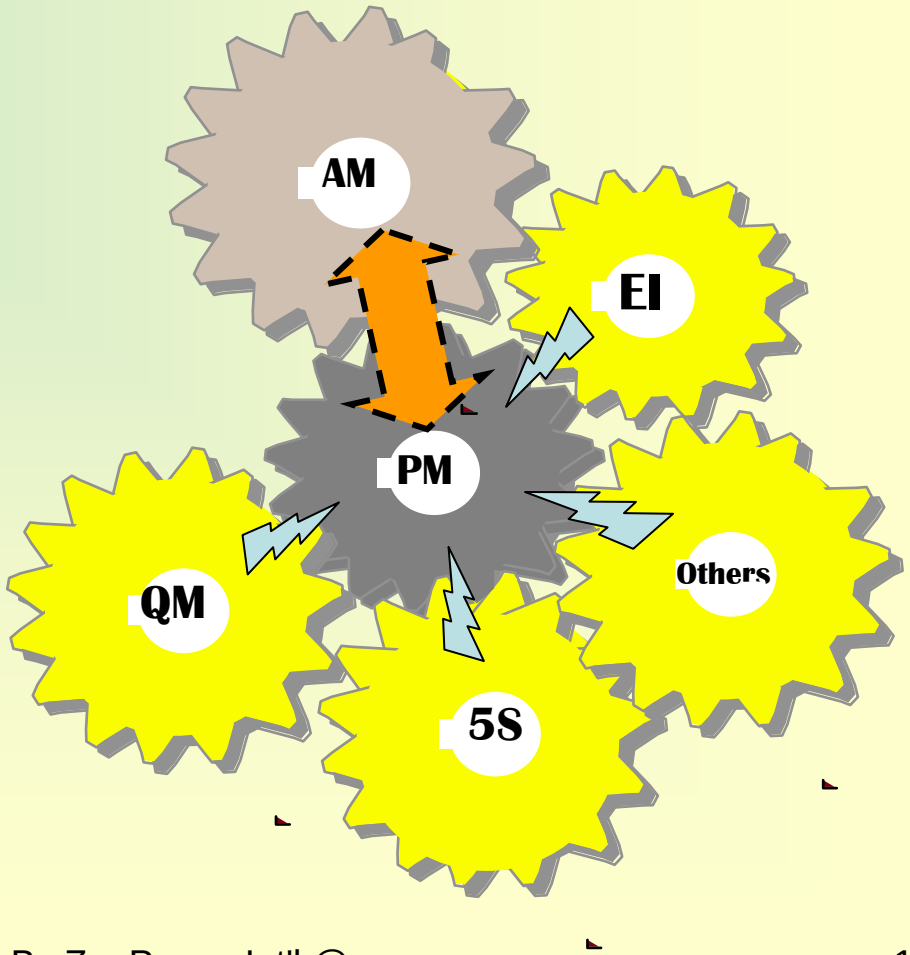
d. Developing Advanced Stages of TPM.

- Focused Equipment Improvement
- Quality Maintenance & Poka Yoke
- Chronic Defects
- Self Managing Work Teams

Overall Design Logic / Relationship Between TPM Pillars

CORE Pillars Are

- Autonomous Maintenance
- Planned Maintenance

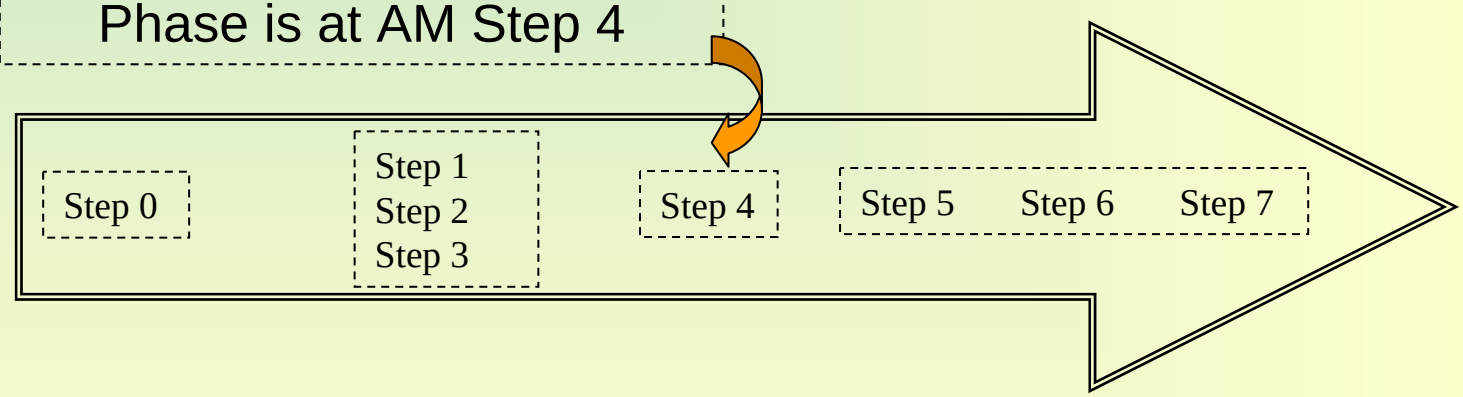


Design of Autonomous Maintenance.

(Approach to changing worker mindset, Improve Worker-Skills & workplace culture)

Advanced AM Steps 5,6,7 heavily rely on Planned Maintenance, EI, QM, Solving Chronic Problems.

Sustainable Foundational Phase is at AM Step 4



Motivation
Eyes-opened.

Improve the Equipment

Improve the Operators

Improve
Organization. Culture.

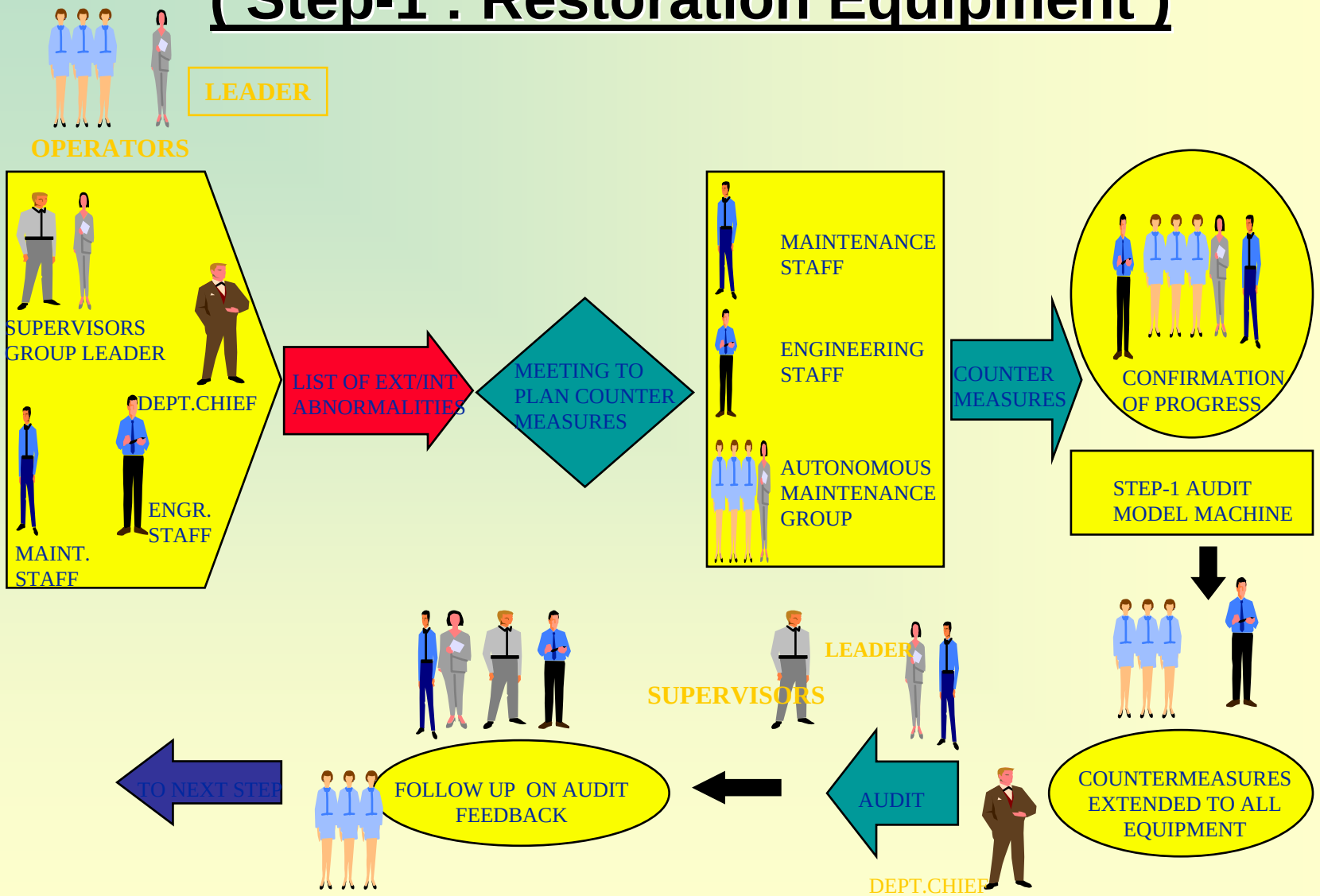
We Take A Very Quick Look At CORE PILLAR - Autonomous Maintenance.

- They Are Structured.
- They Are Sequentially Implemented
- They Are Led By Production Supervisors But Technically Supported By Maintenance Group.

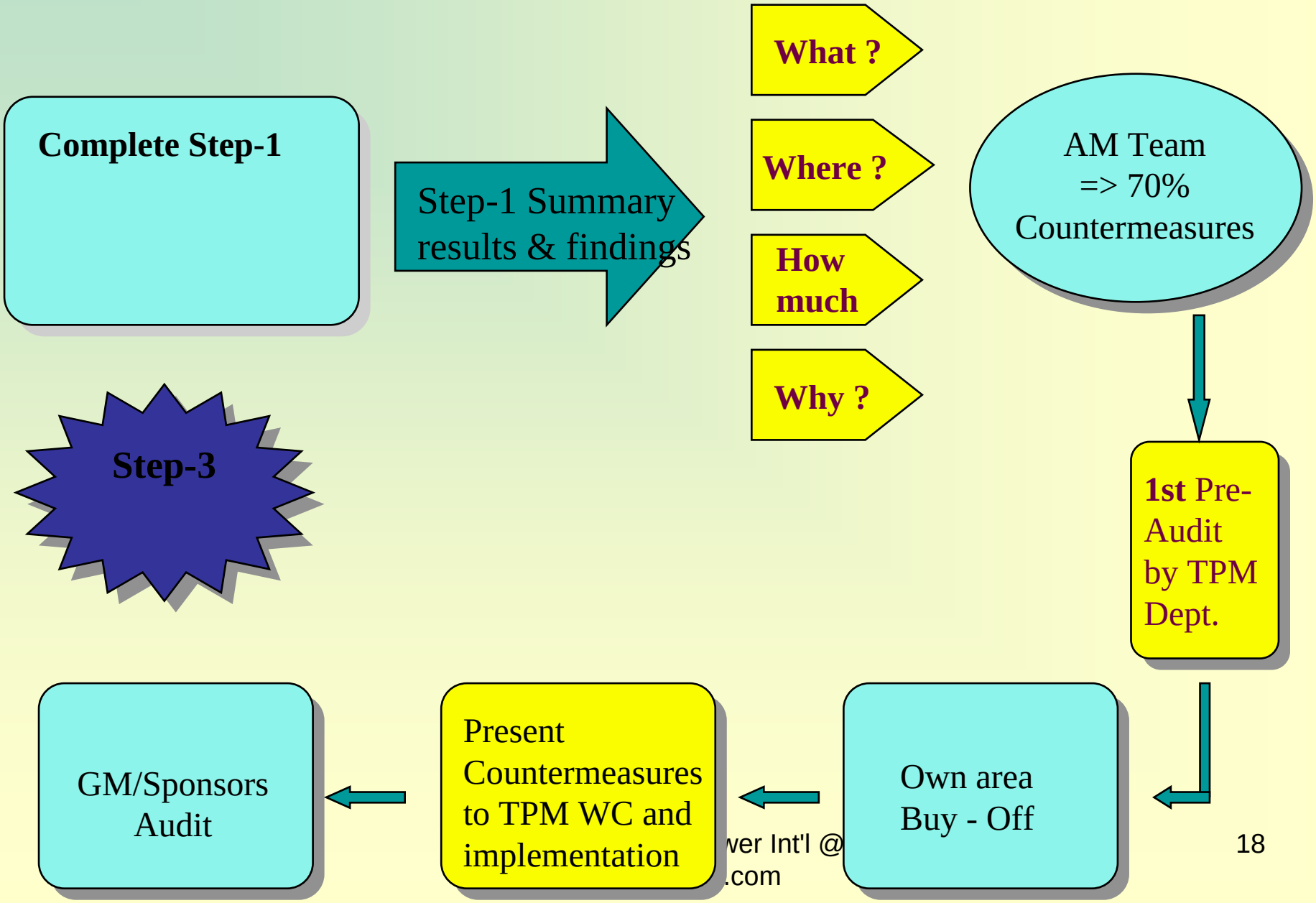
AM STANDARDS

Step #	Step Goal	Standards
Step 1	Restoration	**=> 85%**
Step 2	Eliminate Sources of Contamination	**=> 70% successful effort**
Step 3	Improve Equipment Accessibility	**=> 70% successful effort**
Step 4	Initial Maintenance Standards	**>50% sudden b/d reduction**
Step 5	General Inspection Skills	**> 90% sudden b/d reduction**
Step 6	Autonomous Inspection	**>95% sudden b/d reduction**
Step 7	Organise and manage workplace	**TBD by management**

(Step-1 : Restoration Equipment)



(Step-2 : Eliminate Contamination & Stains on Area & Parts)



(STEP 3 : IMPROVE EQUIPMENT ACCESSIBILITY).

Model m/c Passed Step 2

Areas difficult or inaccessible for cleaning checking & lubricating

- Inaccessible
- No Place To Stand
- Wiring or piping obstruct
- Cannot see easily
- Time Consuming to clean

Product Manager

AM Leader

Operator Leader/ Operators

Supervisor

Pre-Audit by TPM Dept.

Own Area Buy Off

W/C Buy Off

GM Audit

Model Machine Goes To Step 4

(Step 4 : Initial Maintenance Standards)

Model m/c passed Step 3

Initial maintenance standard

Hard to lubricate

Hard to check oil level

Abnormality in lubrication equipment

Abnormality in circulation of lubrication

Equipment gets dirty during oiling

Product Manager

AM Leader

Operator

Leader/operator

Counter measure for cleaning and checking

Supervisor

Draft standards for cleaning, inspection & lubrication

Engineer & Maintenance

Trial Period

Attach identification label

Confirm standard for cleaning, inspect & lubrication

TPM dept. Pre-audit

iefing

GM audit

Power Int'l @

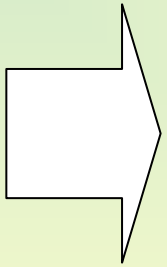
lity

Proliferation of Step 4

AM Step 4 Initial Maintenance Standards

Information Collected From:

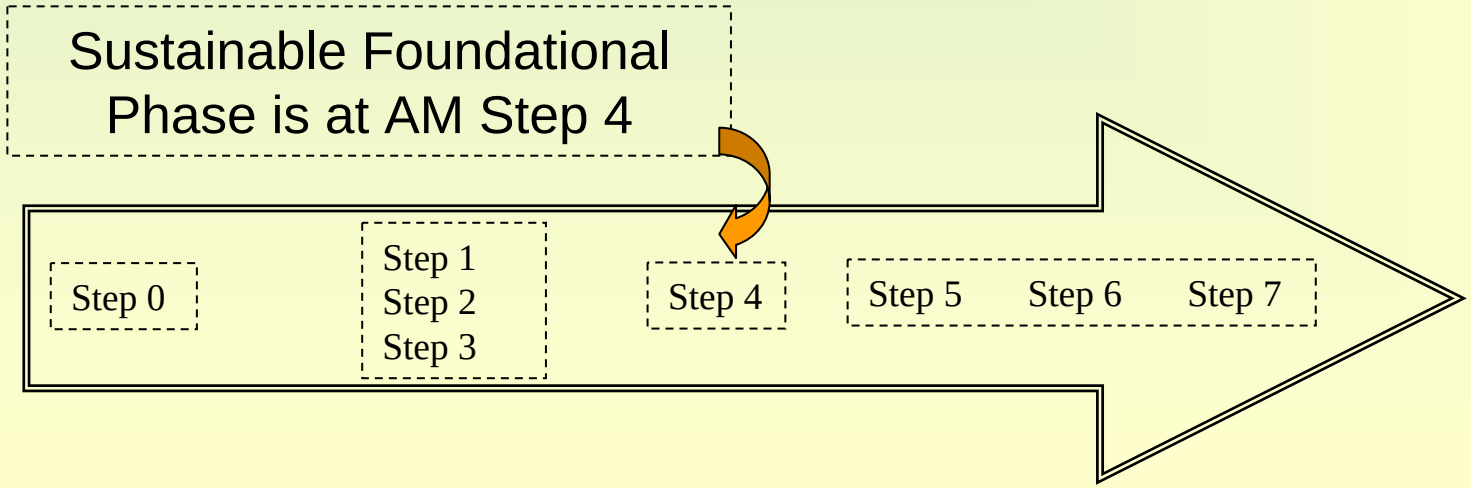
- AM Steps 1-3
- Lubrication Study Program.
- Bolt-tightening Study Program
- Why-Why Analysis of Equipment Sporadic Breakdowns.



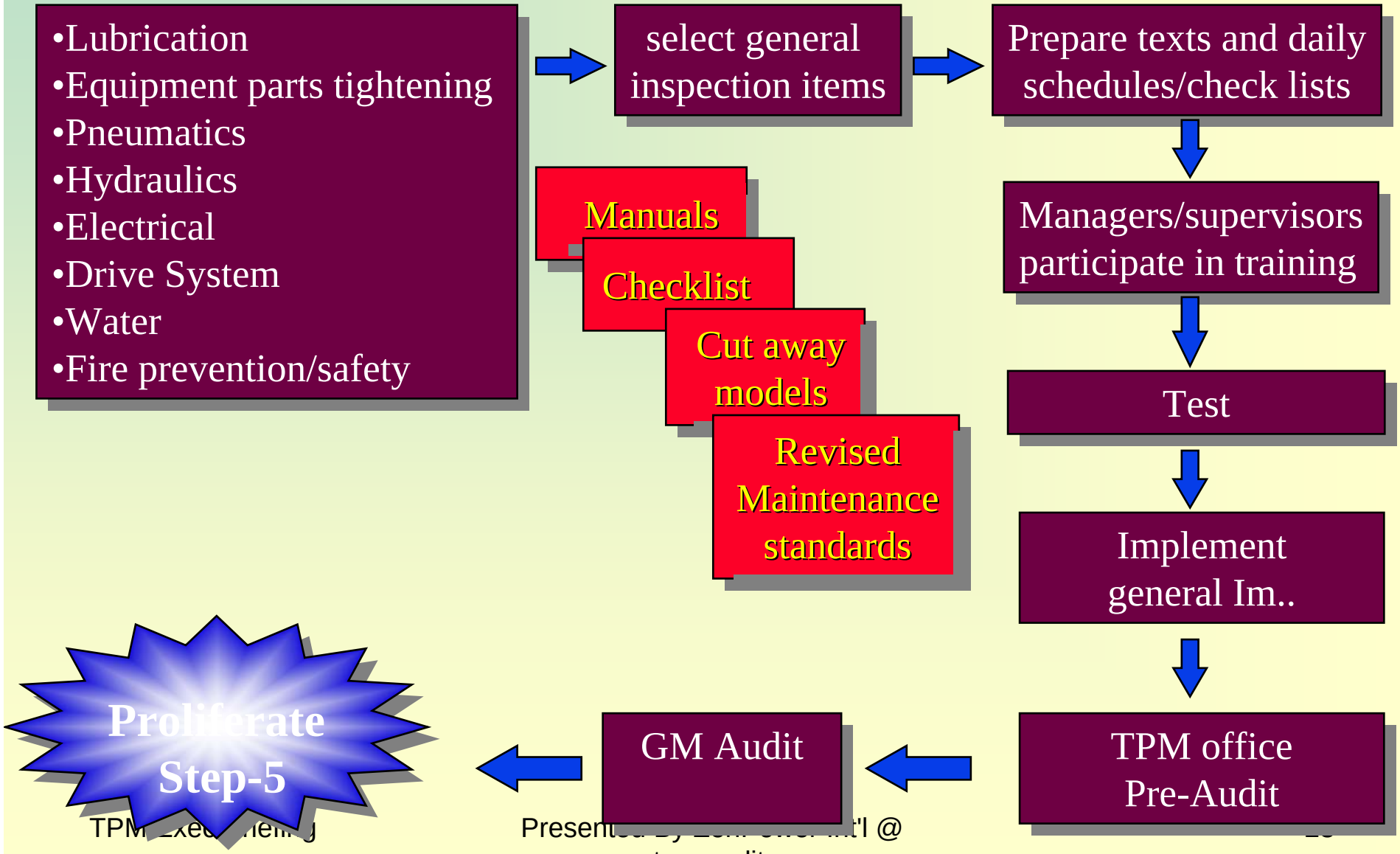
- Equipment Cleaning Standards.
- Equipment Lubrication Standards.
- Equipment Inspection Standards

A Strategic Implementation Plan Sees AM Steps 0-4 As A Single Stage.

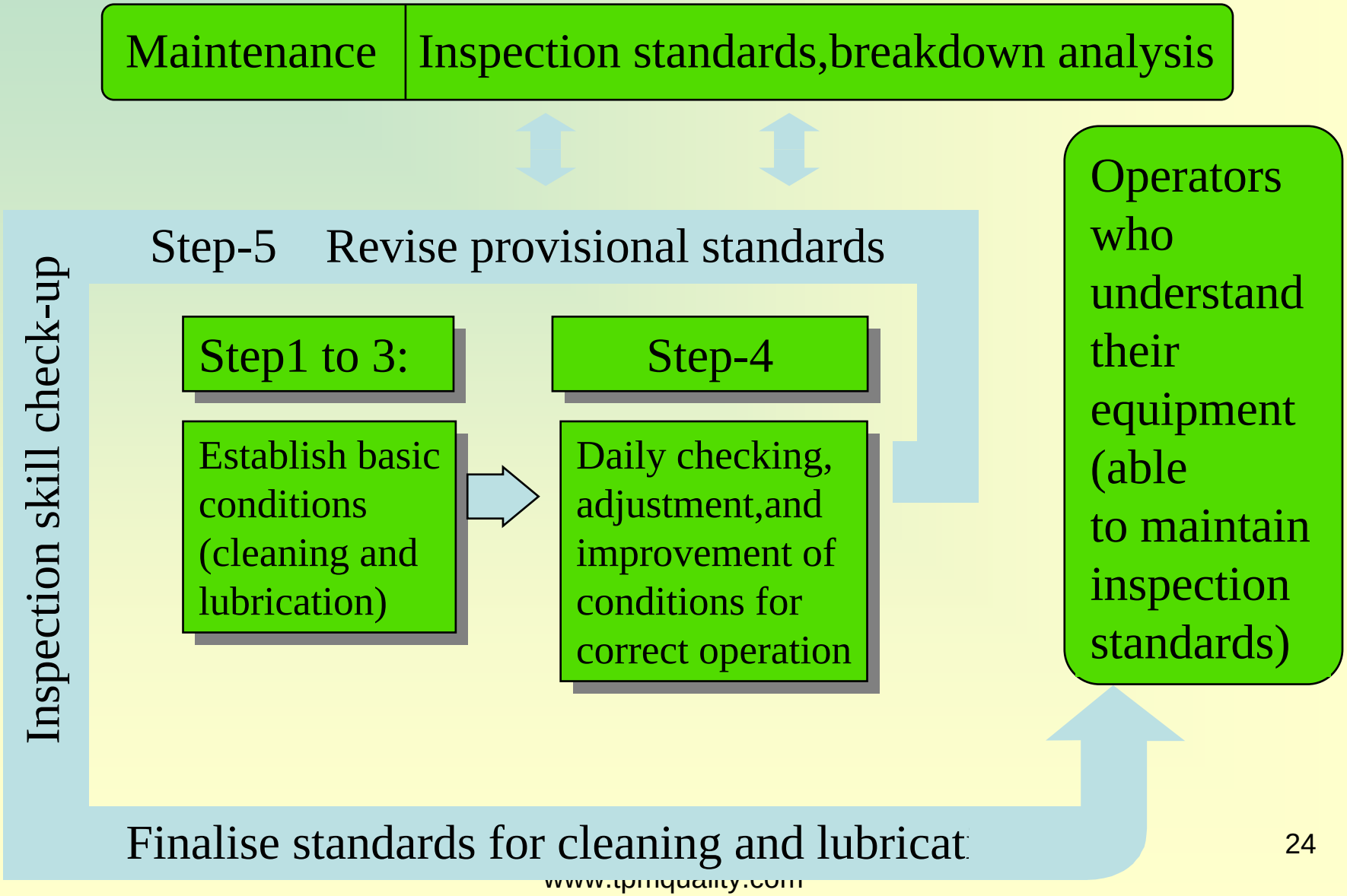
- Resource Allocation.
- Implementation Strategies & focus.
- Delay Advanced Planned Maint., EI, QM till Foundation is laid.



(Step 5 : General Inspection skills)



(Step-6 : Autonomous Inspection)



Step-7 : Organise and Manage Workplace

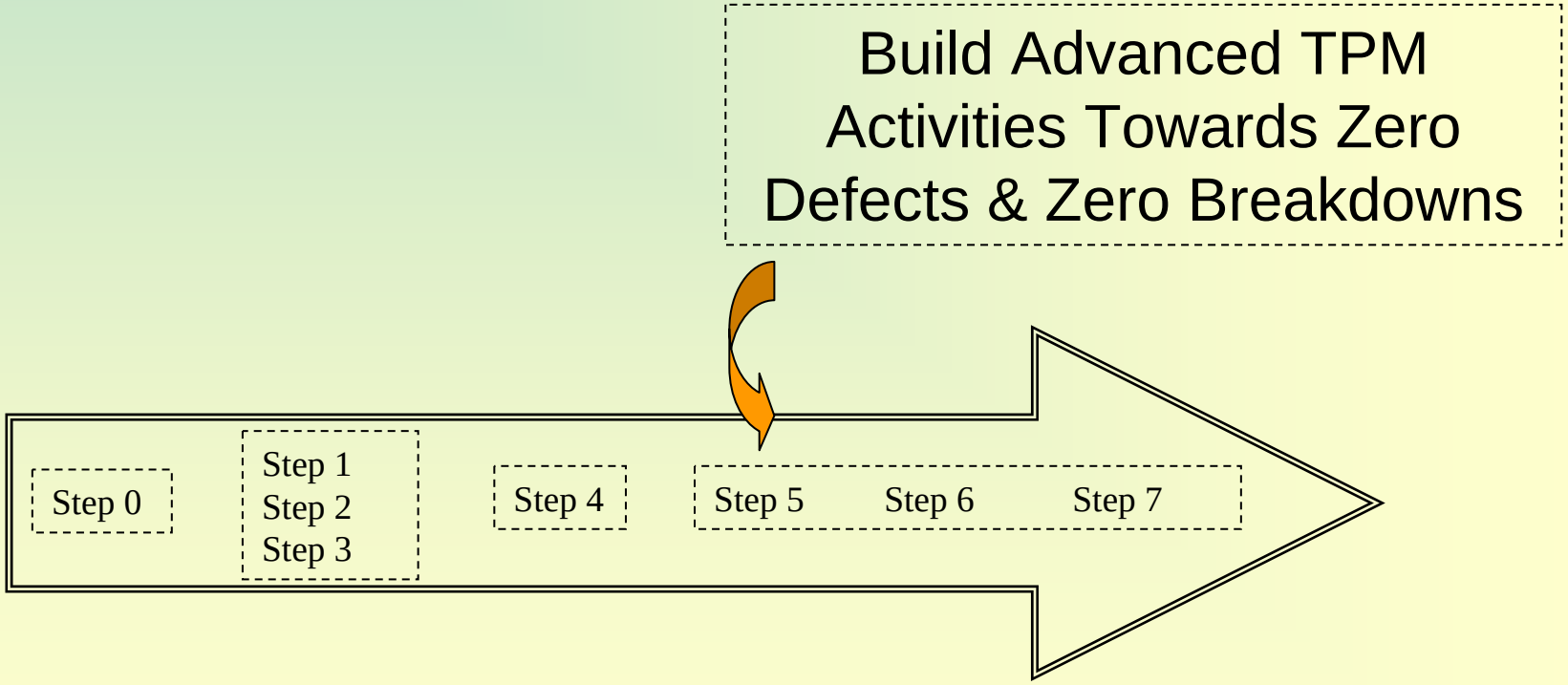
Organise and set standards for :

EQUIPMENT PRECISION INSPECTION ITEMS

STANDARDS FOR INDIVIDUAL WORK RESPONSIBILITIES

TOOLS AND MATERIALS FLOW AND STORAGE

After TPM Foundation AM Step 4
Then Other Advanced Pillars



We Take A Very BRIEF Look At CORE PILLAR - Planned Maintenance.

- They Are Structured.
- They Accumulates ALL Maintenance Knowledge relating to prevention of breakdowns and defects for both Autonomous Maintenance & Maintenance Department.
- They receive inputs from All Pillars and Problem Solving Teams.

Building The Maintenance Competence

Developed By: **Date:** **Pg 1/10**

Reviewed By: **Date:**

Preventive Maintenance Standards

Machine: Press

Legend: * need 1-point lessons

System level Assy	Assy overall function	Assy symptoms (functional + WIP quality)	*Breakdown parts of System level assembly	Repair Class- Minor /Major	TBM change, calibrate	Cleaning			Lubrication			*Inspection				Check	
						Agent	Tool	Stds	Type	Tools	Qty	Stds		See	Feel	Hear	Stds	Tool
Drive System																		
1) Gravity powder assembly	To feed powder into charger grid	1.1 hopper box powder not full (F)	1.1.1 Mesh, elephant trunk and powder distributor blocked by powder lumps.	Minor		??	??	No lumps stuck										
2) Charger assembly	To feed powder into the mould cavity and	2.1 Green tiles below compactness delta range (Q)	2.1.1 Setting of Charger and table plate not level.	Minor	Calibrate every setup.												??	Flat bar

WHY-WHY Analysis Case 1: Cylinder operation is jerky.		
Question (Hint: Ask questions to point out Man's eror)	**Answer**	**Actions** (Restorative & Preventive)
1. Why is cylinder operation jerky?	The oil strainer is clogged.	Clean the strainer.
2. Why is the oil strainer clogged?	The oil is dirty.	Drain oil, clean and replace.
3. Why is the oil dirty?	Dirt has entered the tank.	Prevent surrounding dirt from scattering.
4. Why did dirt get into the tank?	Upper plate of tank has a hole.	Plug the hole
5. Why is the hole there?	It was a repair error by Maintenance.	Standardize future repairs.

Every problem solved such as by Why-Why Analysis is "captured" or "standardized" permanently.

PREVENTIVE MAINTENANCE RESPONSIBILITY MASTER LIST

Type of Machine :	**FUJI PICK AND PLACE**	**Number of Machine :**	**13**
Model of Machine :	**FCP642E**	**Last Update :**	**13/02/2001**

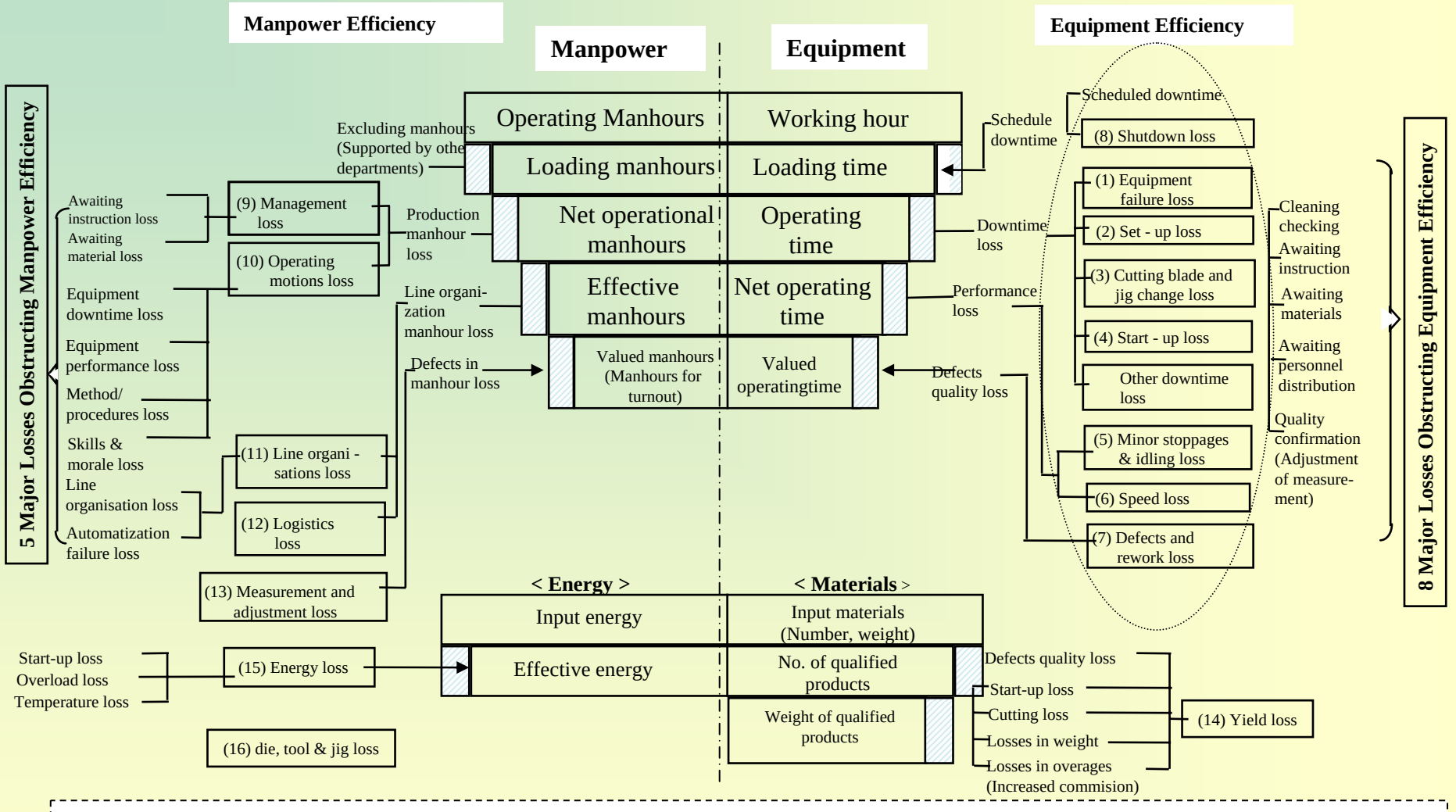
(Section A) - Cleaning Checklist						
S/N	**Sub-Assembly**	**Cleaning Item**	**Operator**	**Maint.**	**DM/PM/Prod.**	**Remarks**
1	Conveyor cover	Top cover	O		Prod	1 Day
2	XY Table	Top Surface	O		Prod	1 Week
3	Device Table	Top Surface	O		Prod	1 Week
4	M/C Top cover	Top cover	O		Prod	2 Week
5	Servo Control Box	Door Panel and Air Filter	O		Prod	1 Month
6	In and Out Conveyor	Railing and Belts	O		Prod	1 Month
7	Prism Surface	Glass surface		O	PM	3 Month
8	Nozzle Filter	Filter Element		O	PM	3 Month
9	Nozzle	Nozzle Tip and Reflecting Sticker		O	PM	3 Month
10	Filter Regulator	Filter Element		O	PM	3 Month
11	Nozzle Clutch	Clutch Surface		O	PM	3 Month
12	Cam Box	All Cam Bearing and Turret		O	PM	3 Month
Use same format to demark Lub / Inspect / Precision Check / ….						

We Take A Very BRIEF Look At Equipment Focused Improvement

(Linked Back to Pl. Maintenance)

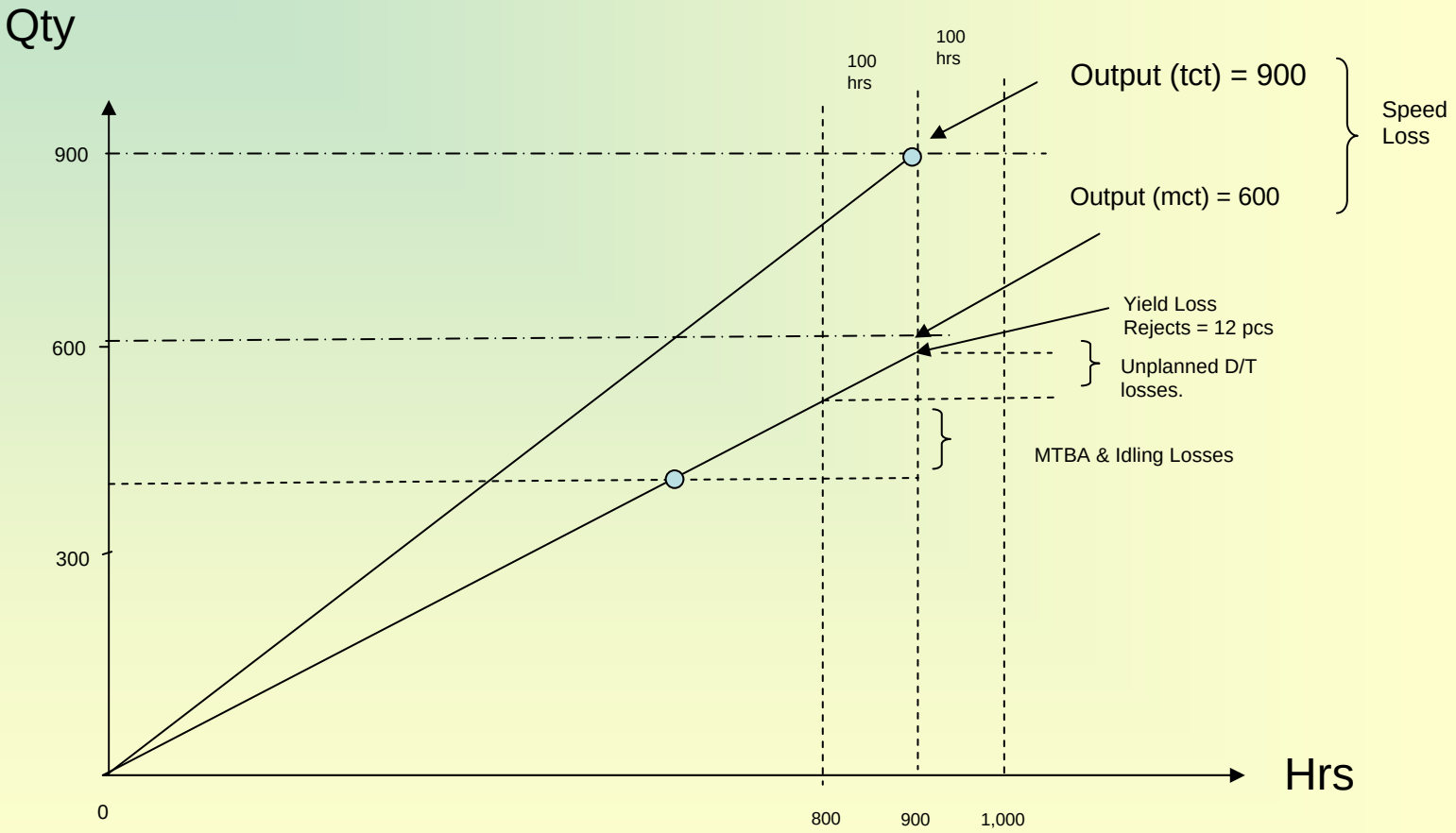
- From OEE Loss-Chart Analysis, all 16 losses known can be measured.
- Each type of Loss such as MTBA, MTBF, Defects, Speed losses and Logistics Losses need different methodologies.

Loss Structure Of Manufacturing Activities (16 Major Losses)



The 6 Big Equipment Losses are (1) Equipment failure or Breakdown Loss (2) Setup Loss (3) Startup Loss(4) Minor stoppages and Idling Loss (5) Speed Loss and (6) Defect & Rework Loss. The other two (7) Shutdown or Preventive Maintenance Loss and (8) Cutting Blade and jig change loss may also be considered if significant.

Model answer: OEE Graphical Analysis Of Losses.

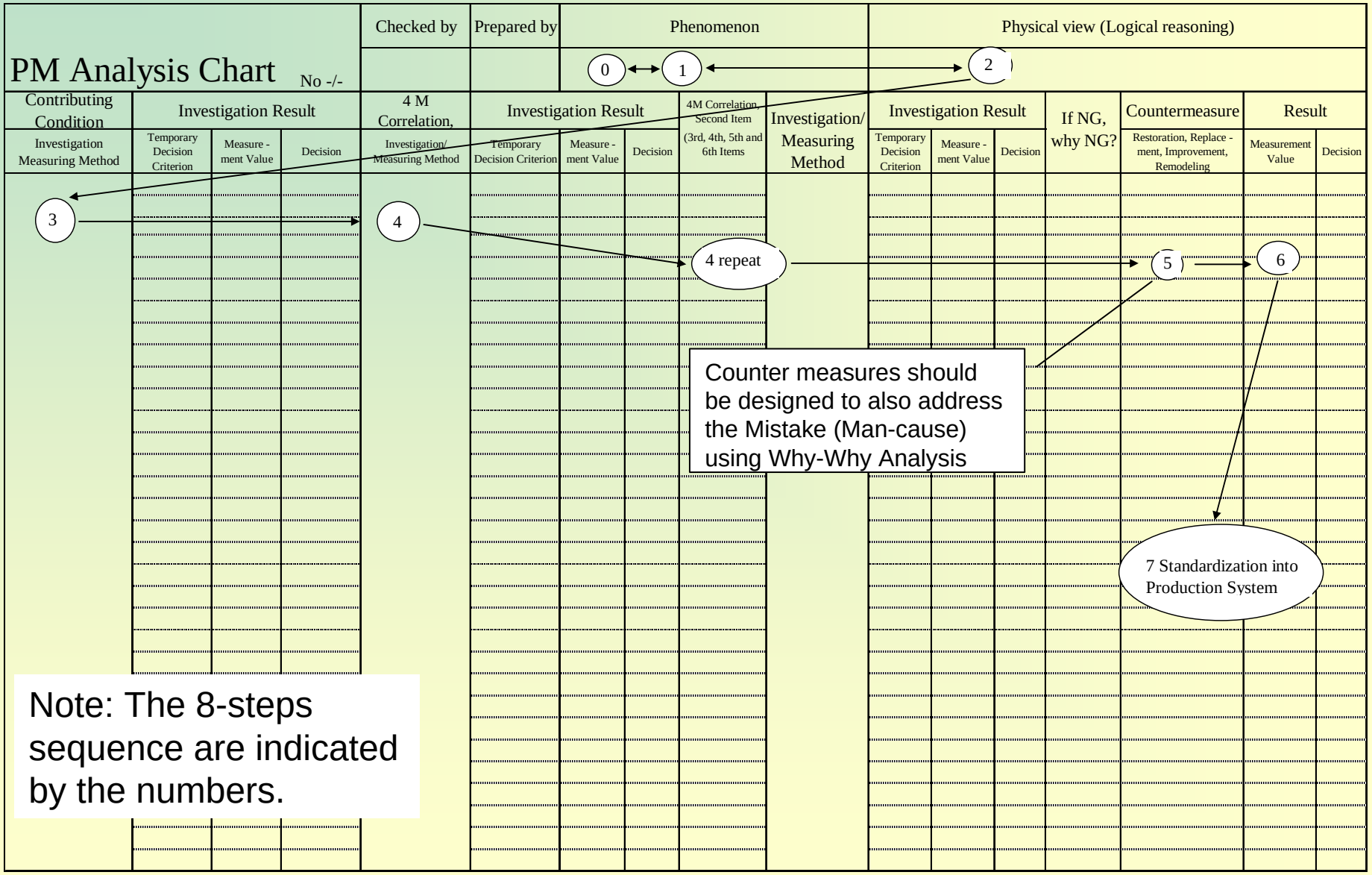


We Take A Very BRIEF Look At Quality Maintenance (Poka Yoke)

(Linked Back To Pl. Maintenance)

- Two Major Reasoning Tools: Why-Why Analysis and P-M Analysis (with DoE or Taguchi Methods)
- All Breakdowns & Defects have 4Ms Causes BUT always started by a Man-Mistake which is the true Root Cause.
- Poka Yoke Design starts with Process Defects to find Man Mistakes for Mistake Proofing counter-measures.

The Standardized P-M Analysis Worksheet



P-M ANALYSIS WORKSHOP

2-DAY WORKSHOP + *1-DAY PROJECT-BASED

* Optional, recommended for Project teams

METHODOLOGY BASED ON JIPM-MODEL

(An Advanced Toyota Production System Problem-Solving Tool)

Poka-Yoke DESIGN

advanced *3-day workshop

(*3+1 For In-House Training)

Poka Yoke Design is able to prevent Man's inadvertent (un-intended) mistakes in any Process based on the concept that all defects are Man-caused.

3. How To Do TPM Effectively, Quickly & Get Bottom-line ROI?

a. A 3½ -Day Management and Leaders' TPM Implementation Workshop. (Separate Asia & Europe)

b. Followed by ½ Day TPM Implementation Planning.

c. Use Proven FAST-Track TPM Methodology reaches AM Step 4 in under 1 ½ years. Results guaranteed.

d. Expert Hand-Holding with various Pillar Leaders. Individual Site activities + Combined Europe and Asia + AIM Group Consulting.

Six Reasons To Choose Fast-Track© TPM Implementation

1. **Complete foundational AM Step 4 in 9 to 20 months with Expert Hand-Holding for your TPM facilitators and Pillar Leaders.**
2. **Achieved sustainability at this Step 5.**
3. **Significant %** reduction in sporadic and chronic Quality defects.
4. **Measurable Capacity** improvement.
5. **Significant Savings** In Implementation Costs, Efforts, Resources.
6. ***Assured Success** – Deliverables at every AM Steps 1-4.

* Provided Client co-operates fully with the Fast-Track Program requirements.

A 12-Month Fast-Track TPM Milestone

© ZenPower International's Fast-Track TPM Utilizing about *24 Consultant-days for AM 0,1,2,3,4.	1	2	3	4 M	5 O	6 N	7 T	8 H	9	1 0	1 1	1 2
1. Select Implementation Area and identify Model Machines. (1/2)	—											
2. Appoint Fast-Track TPM Project Team and identify the baselines for measuring before/after results (11/2 Consultant-day)	—											
3. Do Fast-Track AM Step-1 on Model M/C (1 Consultant-day)		—										
4. Do Fast-Track AM Step-2 on 1st Model M/C with proto-types of countermeasures. (1 Consultant-day)		—										
5. Do Fast-Track AM Step-3 on 1st Model M/C with prototypes of countermeasures. Rationalize with Item (4). (1 Consultant-day)			—									
6. Meeting with Fast-Track Project Team to finalize actual implementation of countermeasures (1 Consultant-day)			—									
7. Repeat 3-6 with other Model M/Cs. (4 Consultant-days)				——								
9. Setup Fast-Track AM-4 Initial Maintenance Stds for 5 Model M/cs with the Fast-Track Project Team and SMEs. (5 Consultant-days)					———	—						
10 Conduct 1-Month Trial on Model M/Cs. Monitor indices and results (1 Consultant-day)						—						
11 Fine-tune and finalize the Initial Maintenance Standards. (1Consultant-day)							—					
12 Proliferate countermeasures to all machines in 2 months (2 Consultant days)								—				
13 Training of all operators, supervisors and technicians. (2 Consultant-days)										—		
14 Post-launching follow-up (3 Consultant days)											——	——

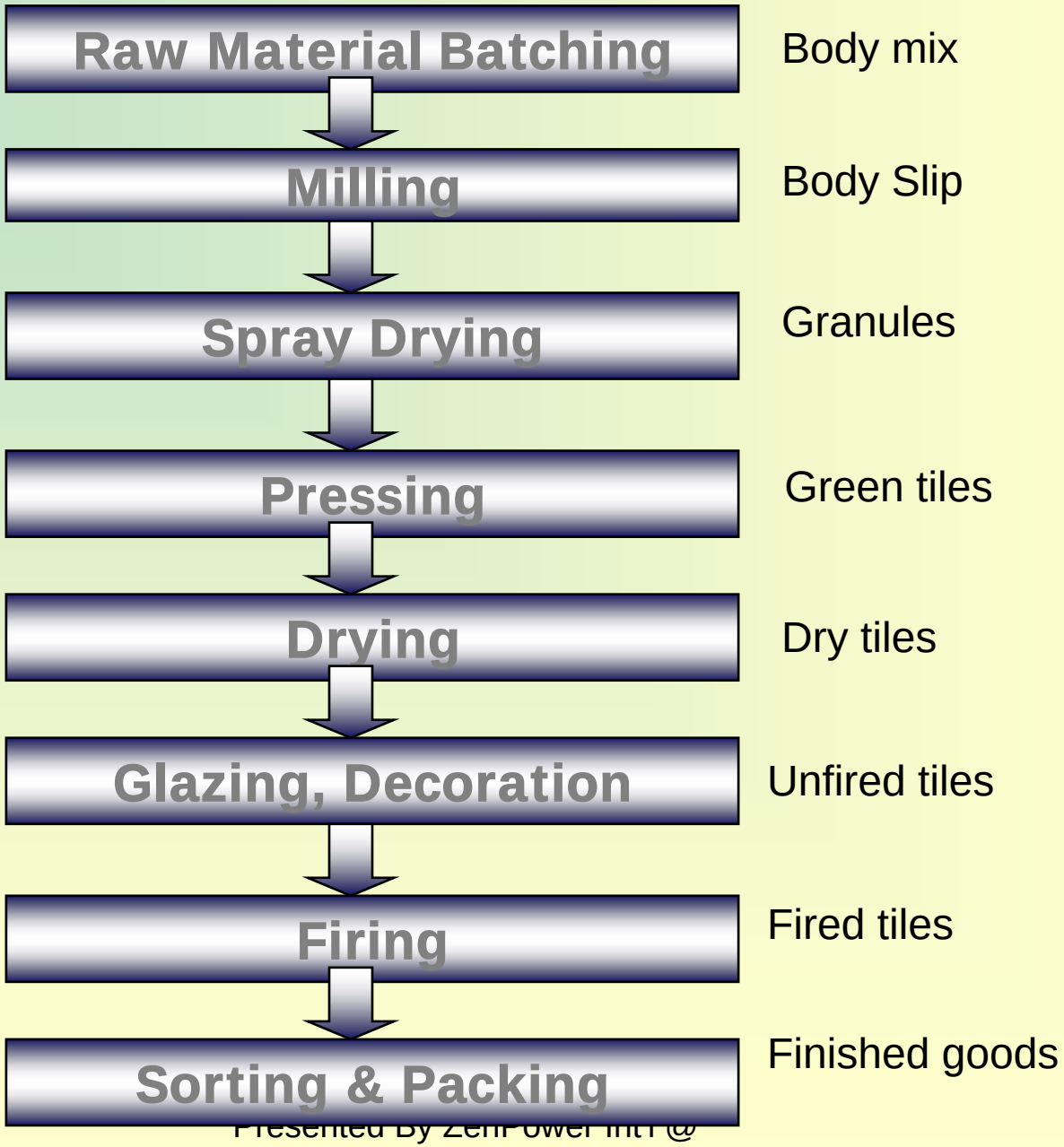
Typical Expected ROI

On Installation Of AM Step 4

Initial Production System

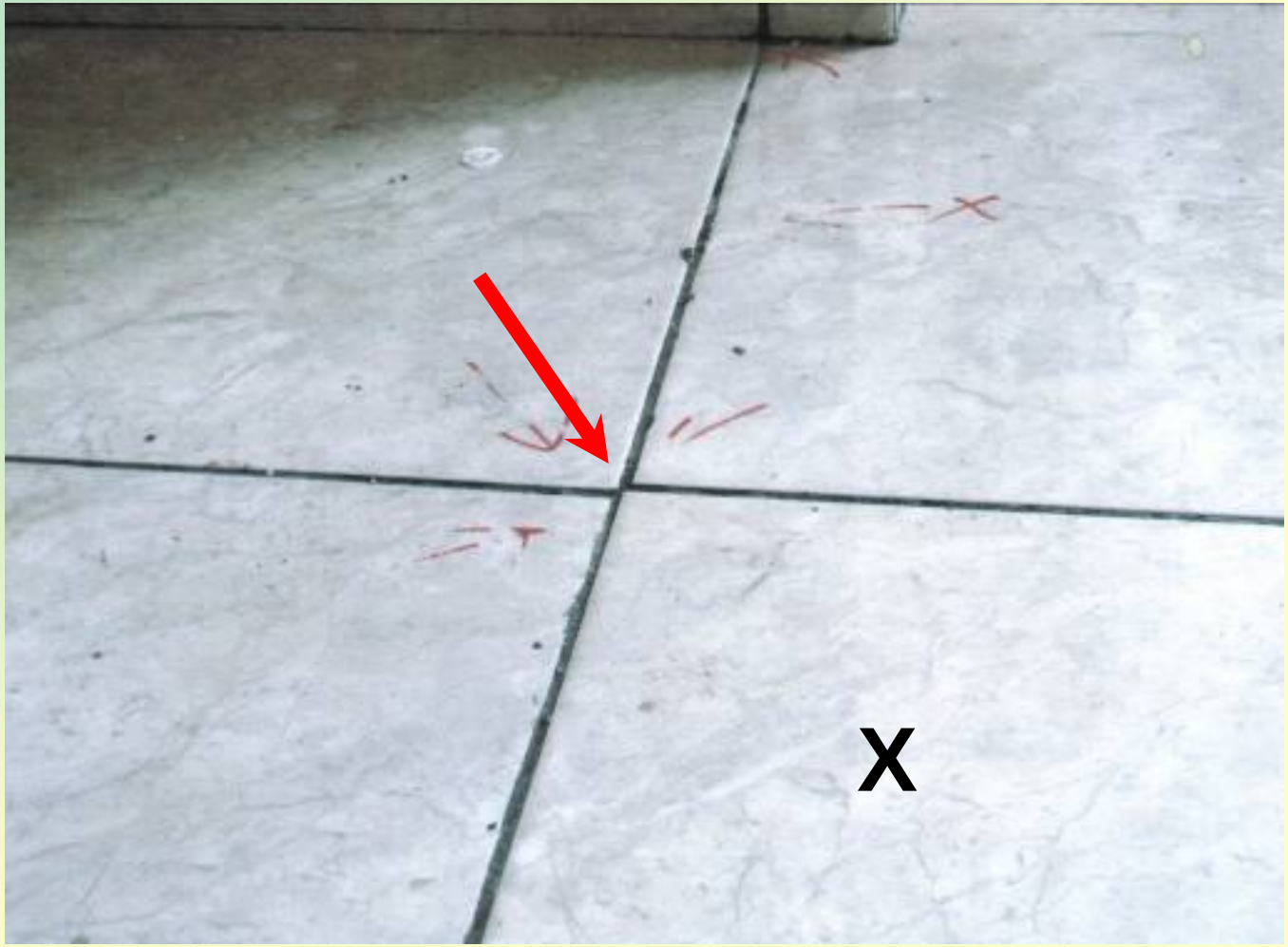
Production System through TPM

- Process Overview.
- Business results achieved through TPM Implementation.


Raw Material Batching
Body mix
Milling
Body Slip
Spray Drying
Granules
Pressing
Green tiles
Drying
Dry tiles
Glazing, Decoration
Unfired tiles
Firing
Fired tiles
Sorting & Packing
Finished goods

Examples Of Common Defects of Ceramic Tiles

COMPLAINT ON SIZE VARIATION

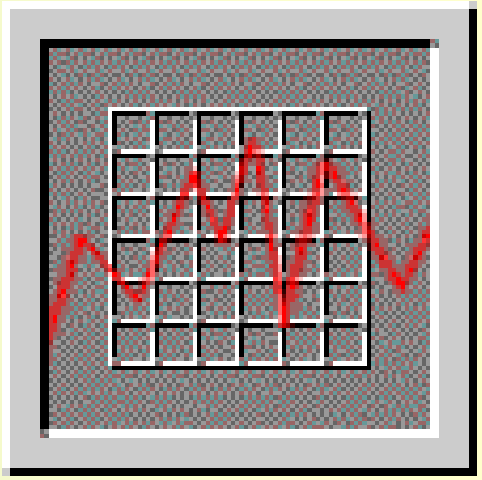


45x45cm floor tiles laid with the recommended 4mm gaps but still show poor uniformity in size. Tile X was found to be 2.5mm bigger than the rest of the tiles. Therefore, this tile was packed into the carton by mistake.

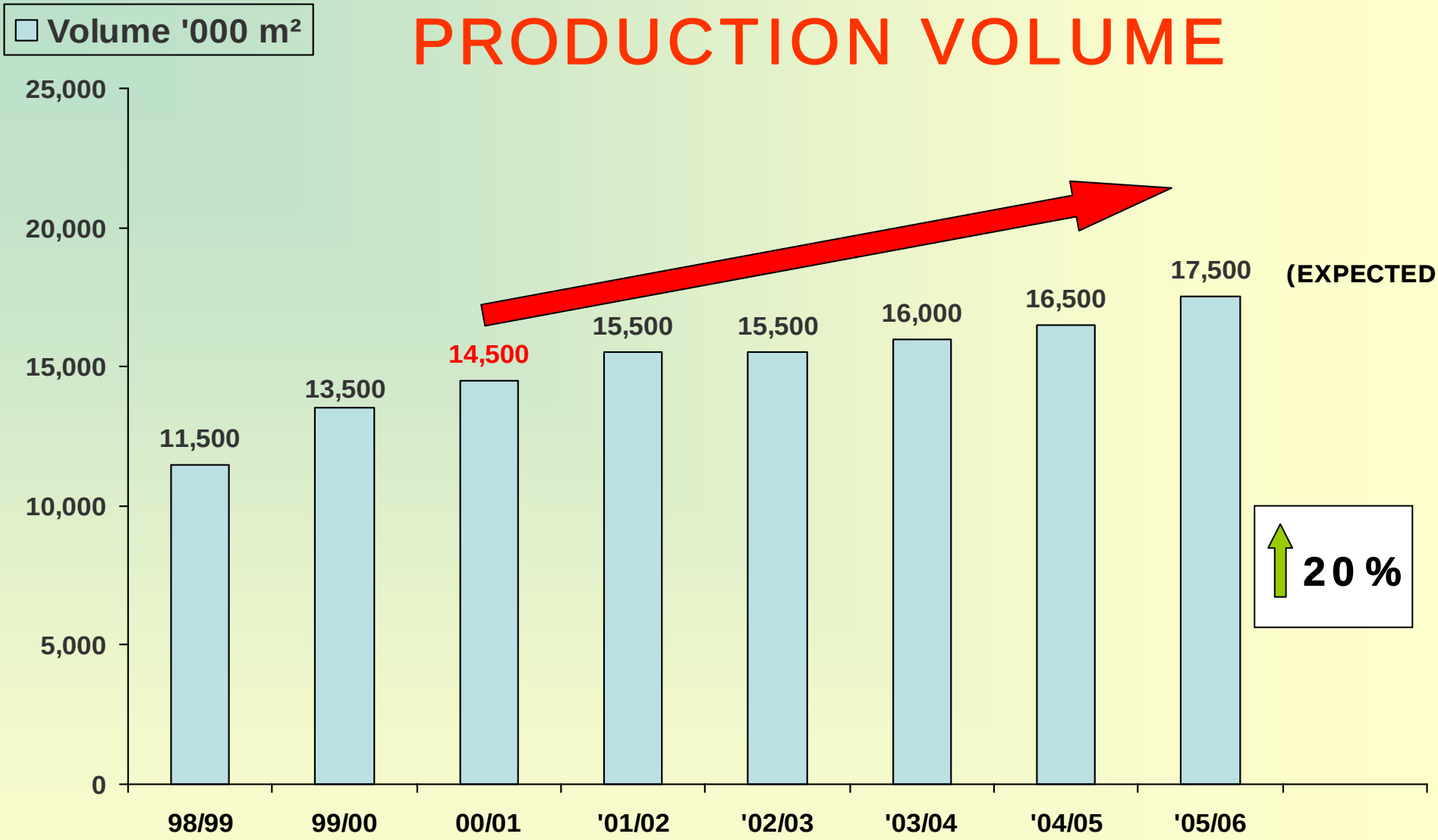
MORE EXAMPLES OF WATER SEEPAGE

In this picture, the gel-like substance has penetrate the tile body through a spot hole on the glaze.

TPM BUSINESS RESULT



PRODUCTION VOLUME



(TPM STEP 0)

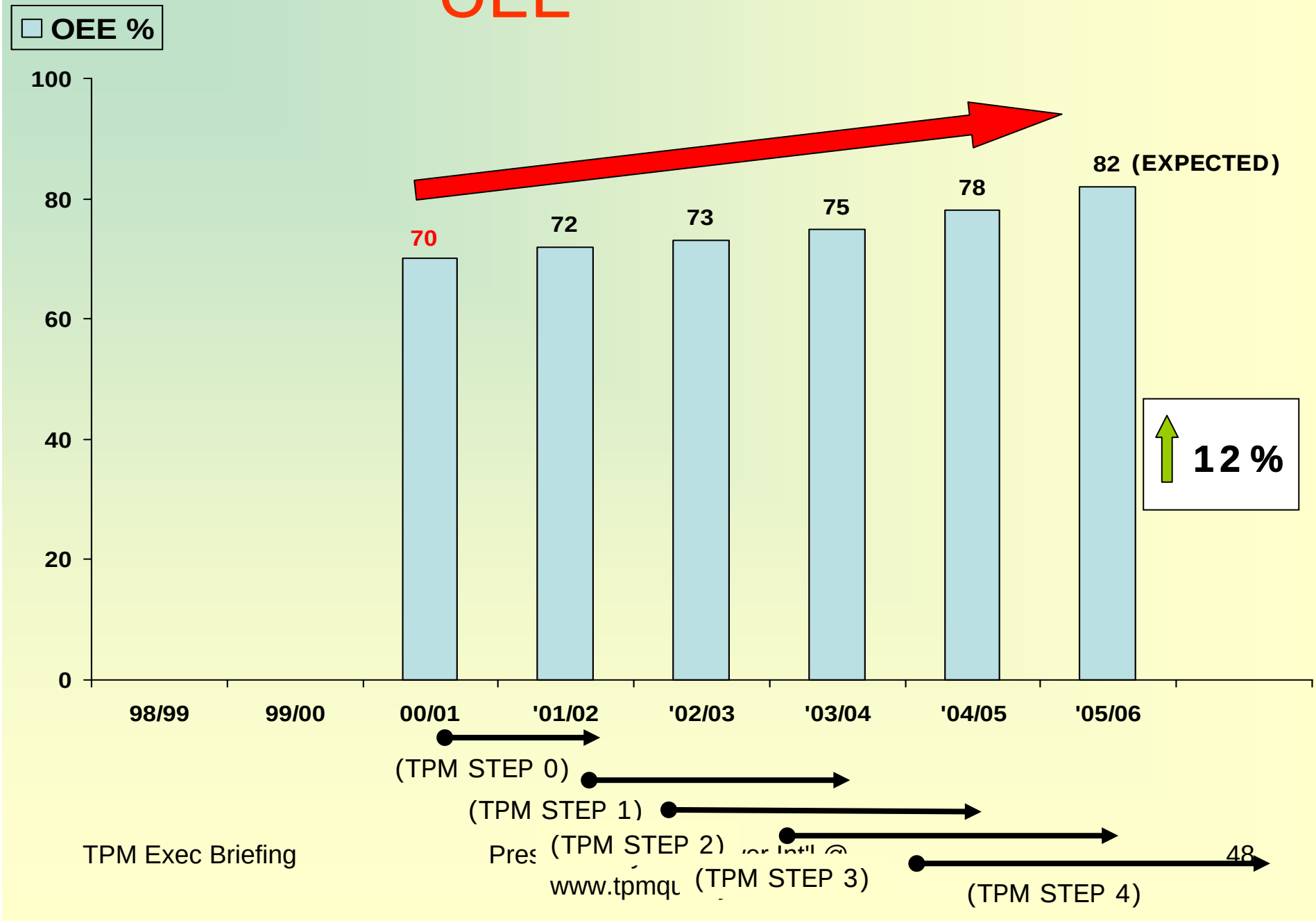
(TPM STEP 1)

(TPM STEP 2)

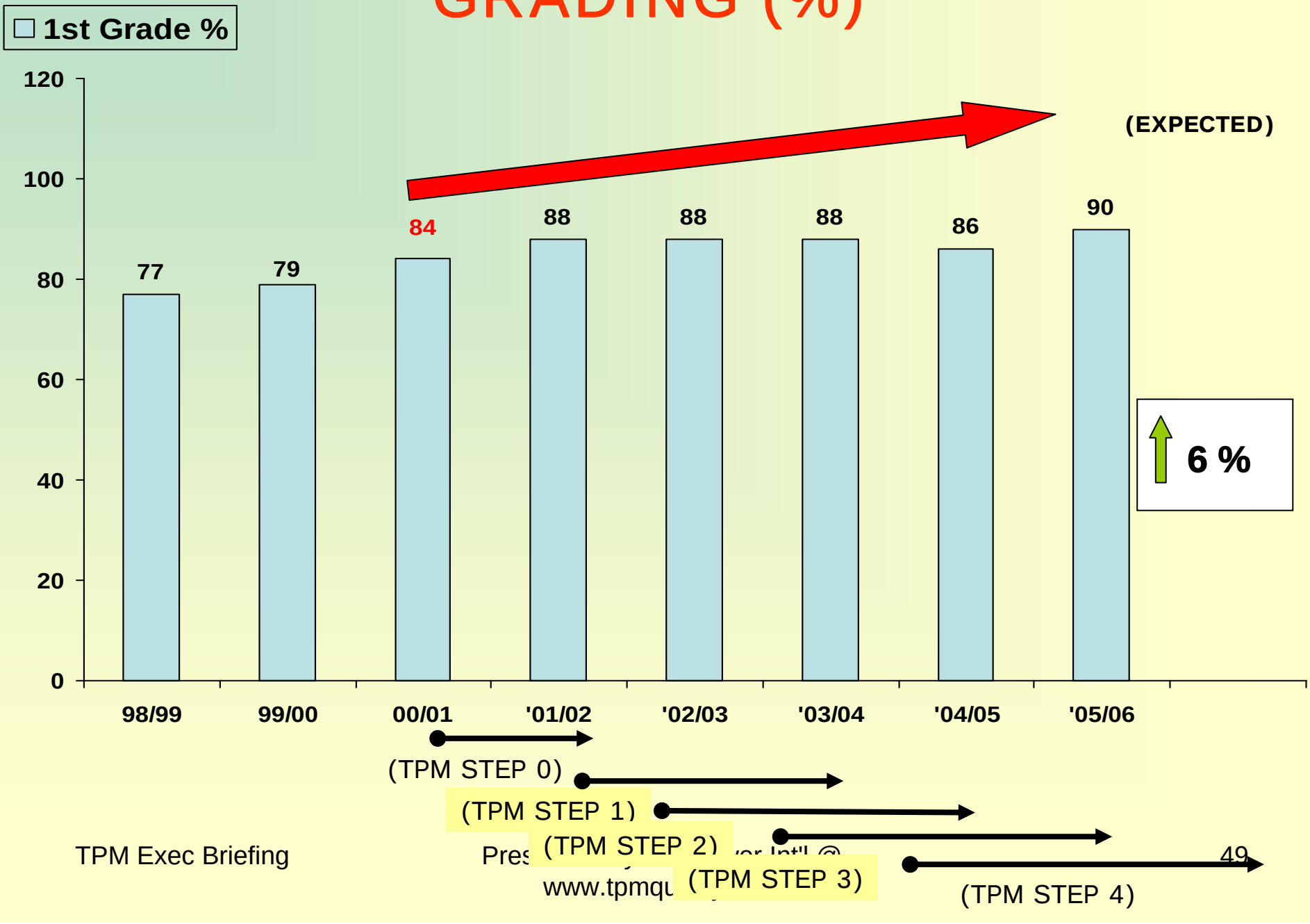
(TPM STEP 3)

(TPM STEP 4)

OEE

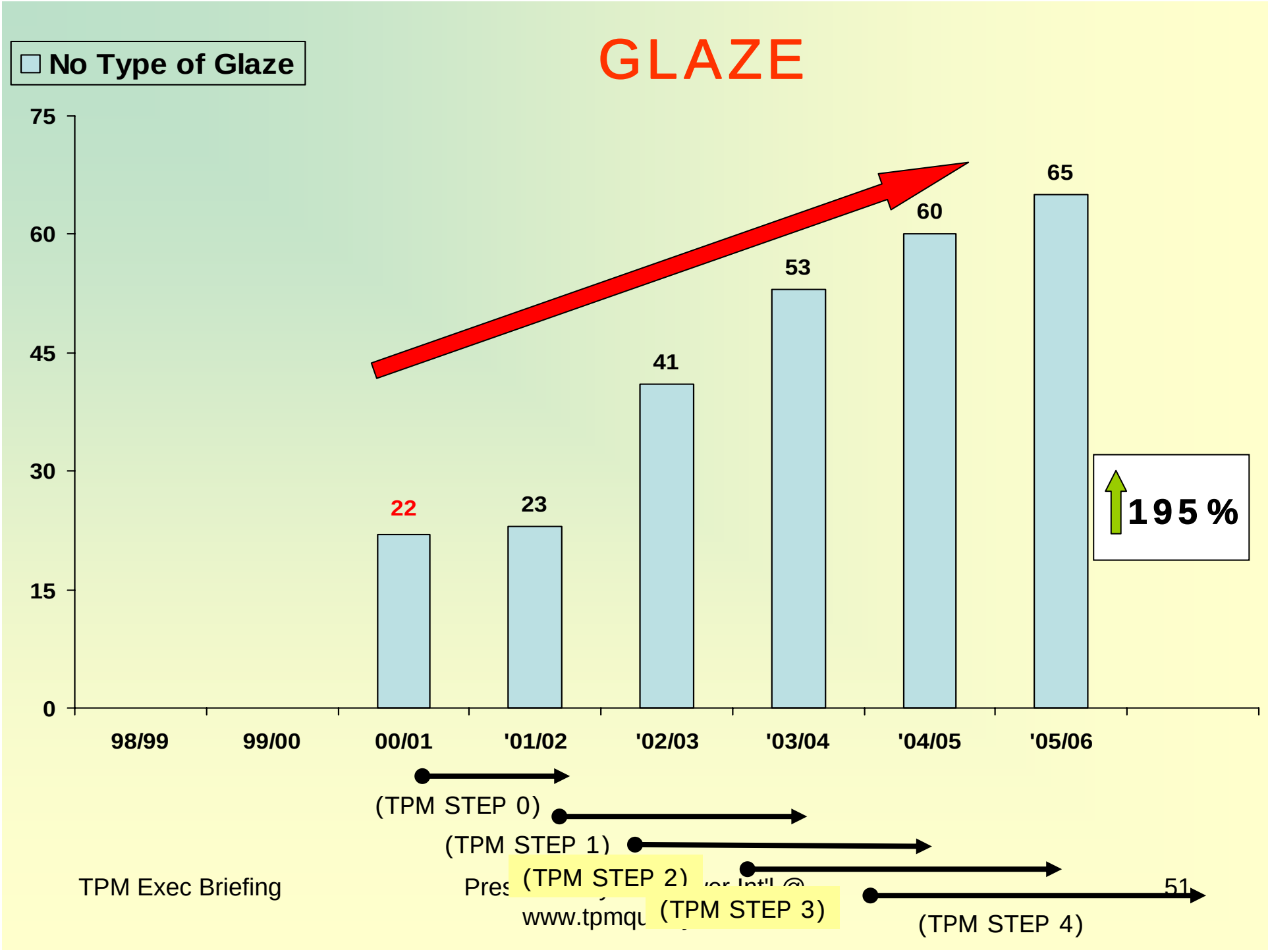

OEE %
100
80
60
40
20
0
70
72
73
75
78
82 (EXPECTED)
12 %
98/99
99/00
00/01
'01/02
'02/03
'03/04
'04/05
'05/06
(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)

GRADING (%)

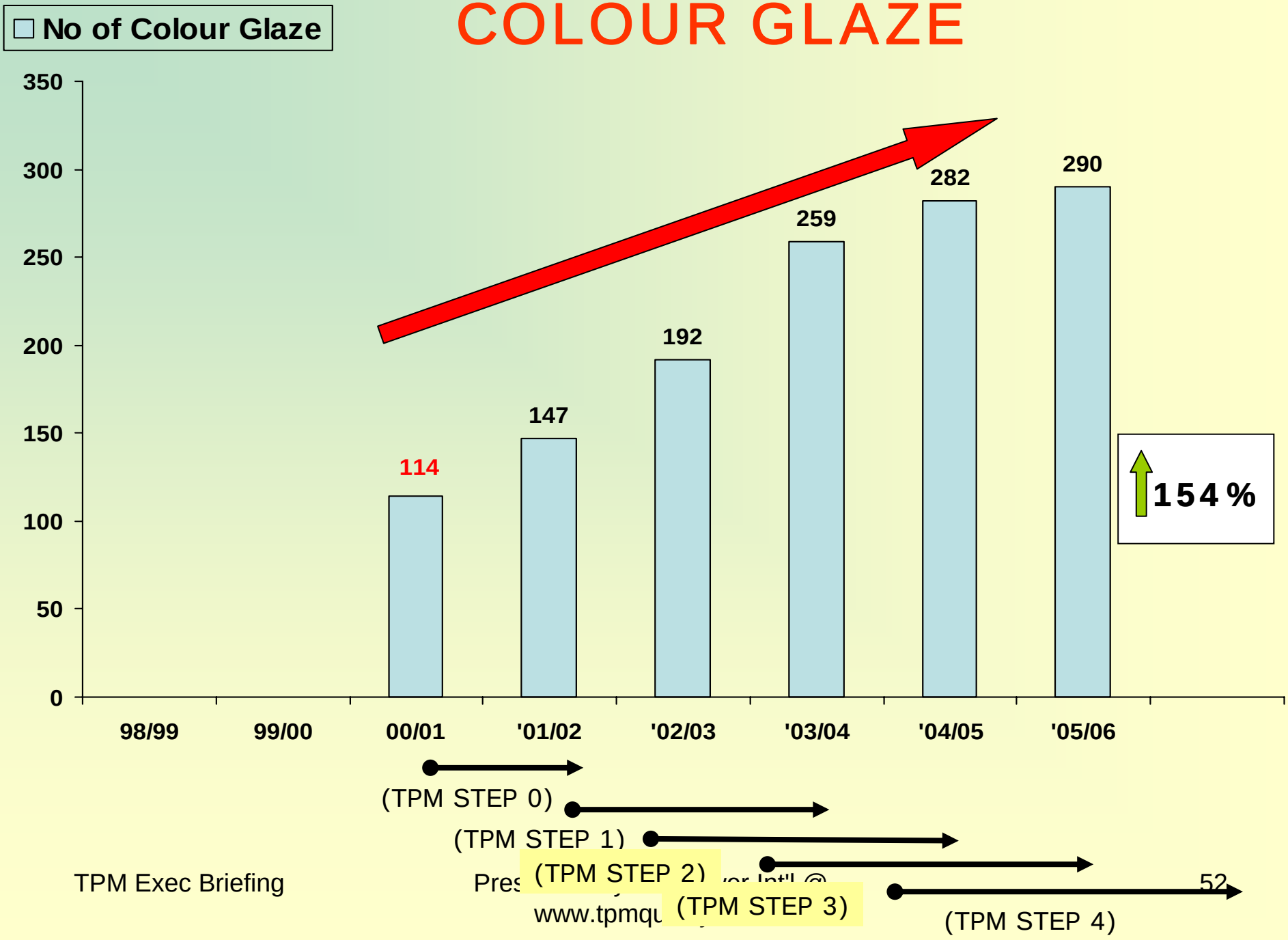

1st Grade %
120
100
80
60
40
20
0
(EXPECTED)
77
79
84
88
88
88
86
90
6 %
98/99
99/00
00/01
'01/02
'02/03
'03/04
'04/05
'05/06
(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)

COSTING

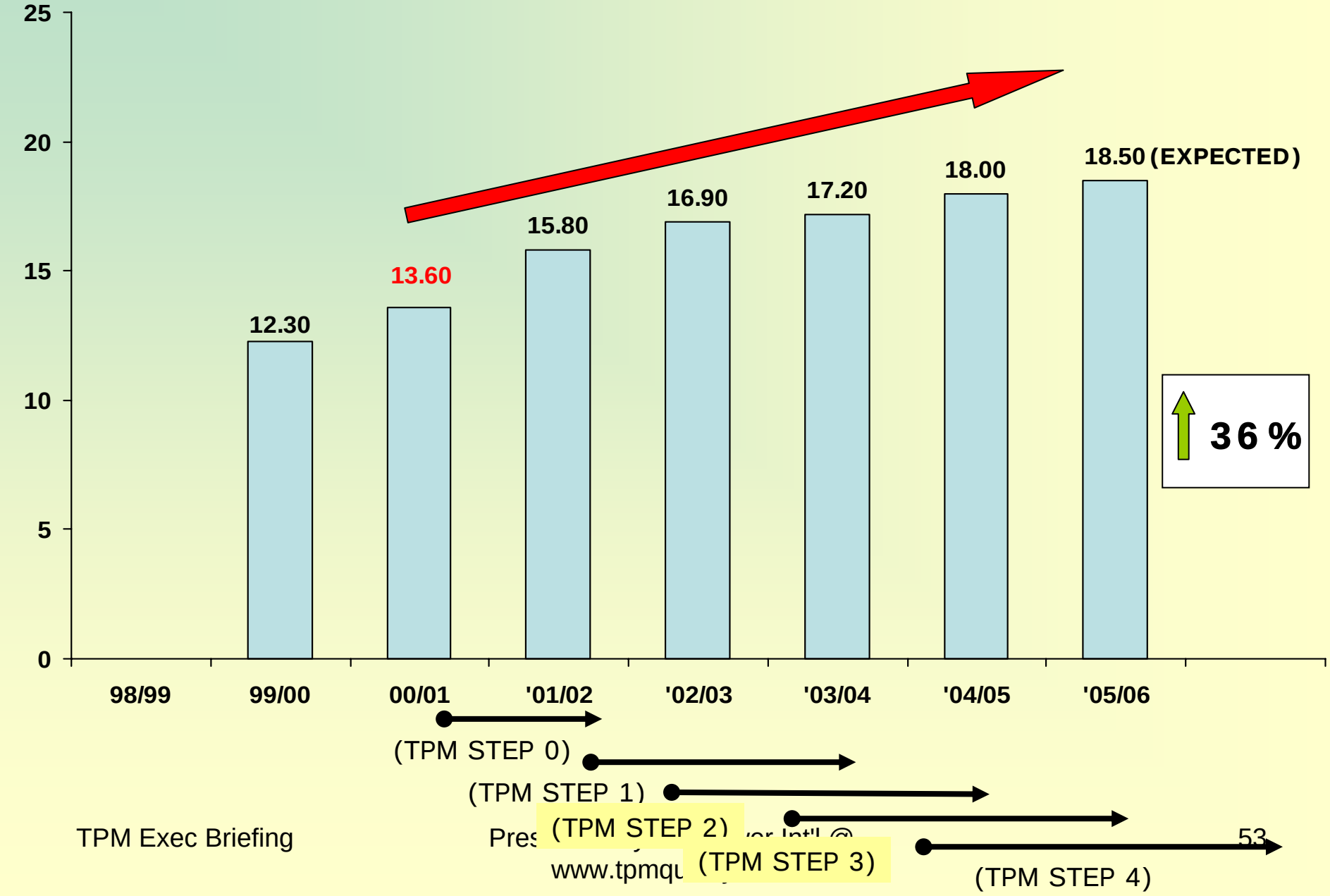

Cost
120
100
80
60
40
20
0
106
107
100
91
87
86
90
87
(EXPECTED)
13 %
98/99
99/00
00/01
'01/02
'02/03
'03/04
'04/05
'05/06
(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)
50


No Type of Glaze
GLAZE
75
60
45
30
15
0
22
23
41
53
60
65
195%
98/99
99/00
00/01
'01/02
'02/03
'03/04
'04/05
'05/06
(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)
TPM Exec Briefing
51

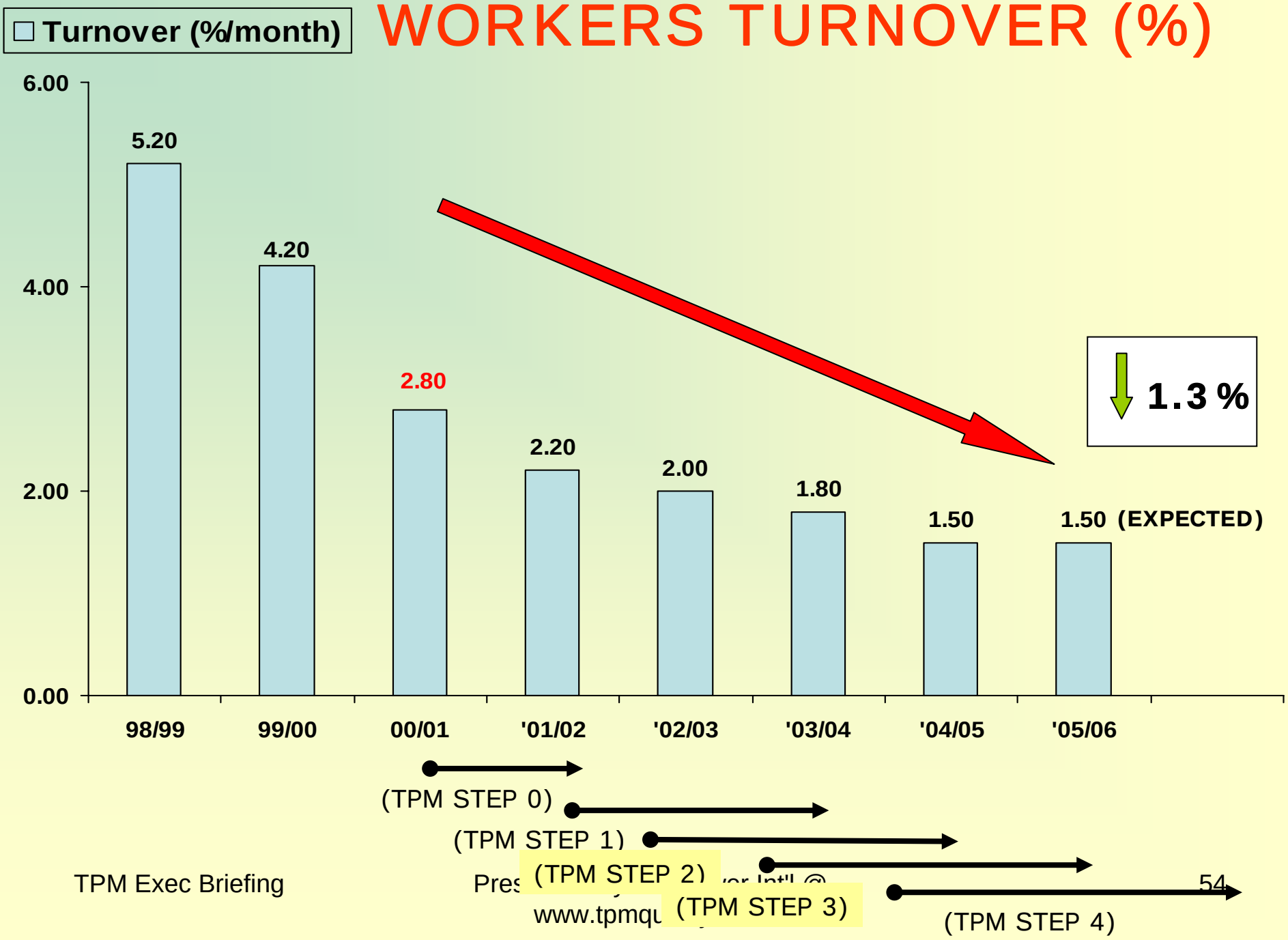
COLOUR GLAZE

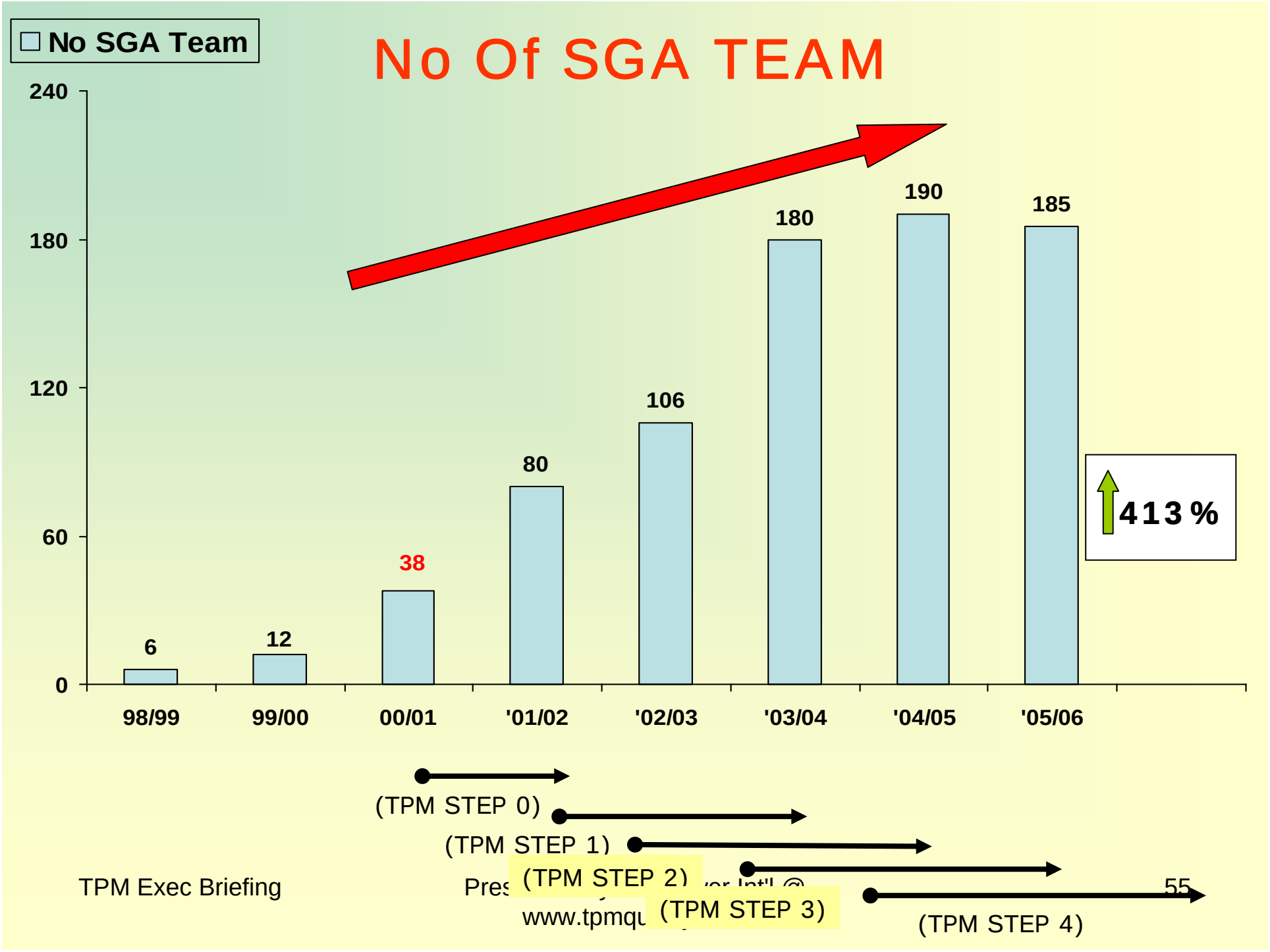


PRODUCTIVITY (m²/MAN/YEAR)



WORKERS TURNOVER (%)




No SGA Team
No Of SGA TEAM
240
180
120
60
0
6
12
38
80
106
180
190
185
413%
98/99
99/00
00/01
'01/02
'02/03
'03/04
'04/05
'05/06
(TPM STEP 0)
(TPM STEP 1)
(TPM STEP 2)
(TPM STEP 3)
(TPM STEP 4)
TPM Exec Briefing
55