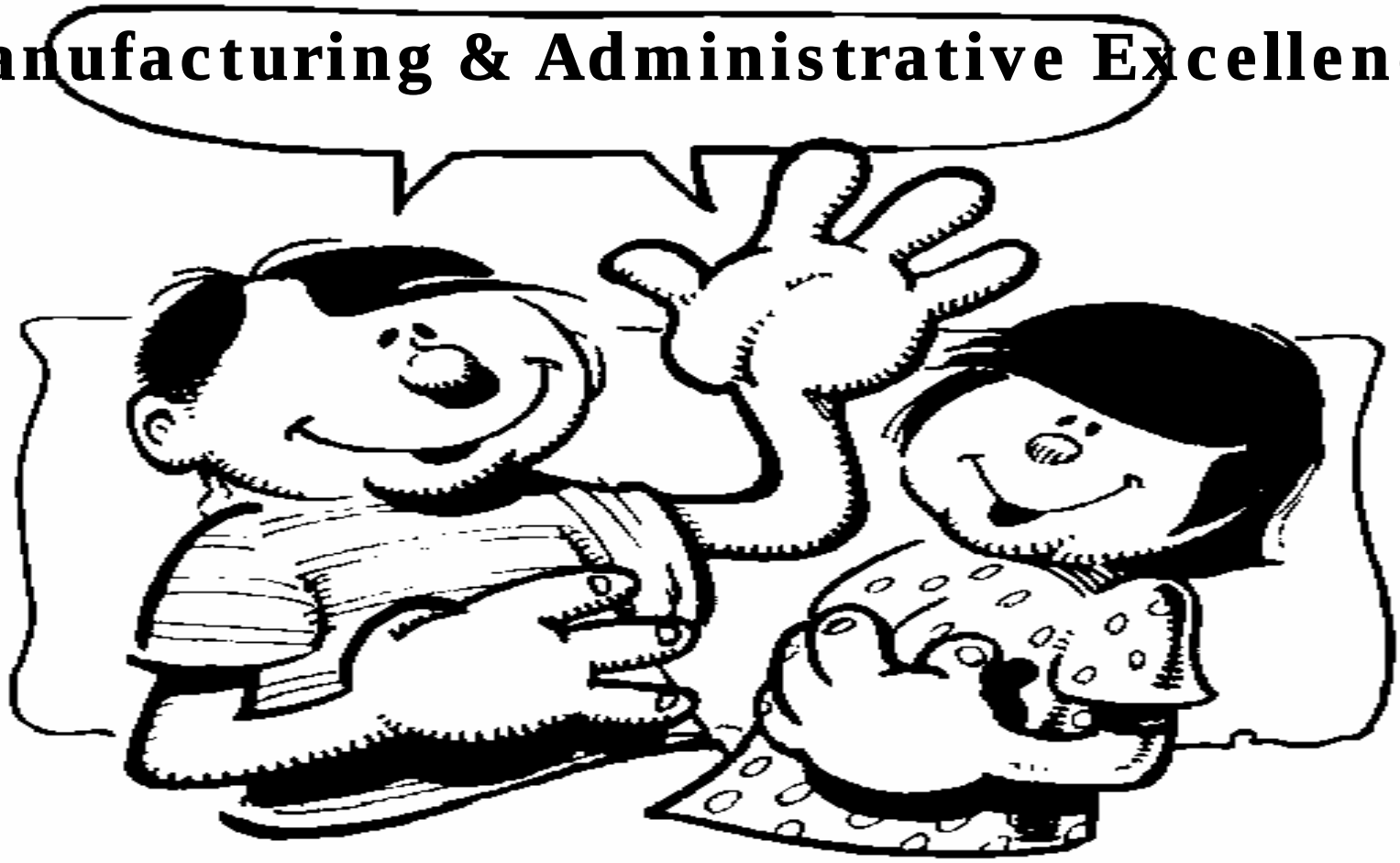
TPM OVERVIEW

Manufacturing & Administrative Excellence.



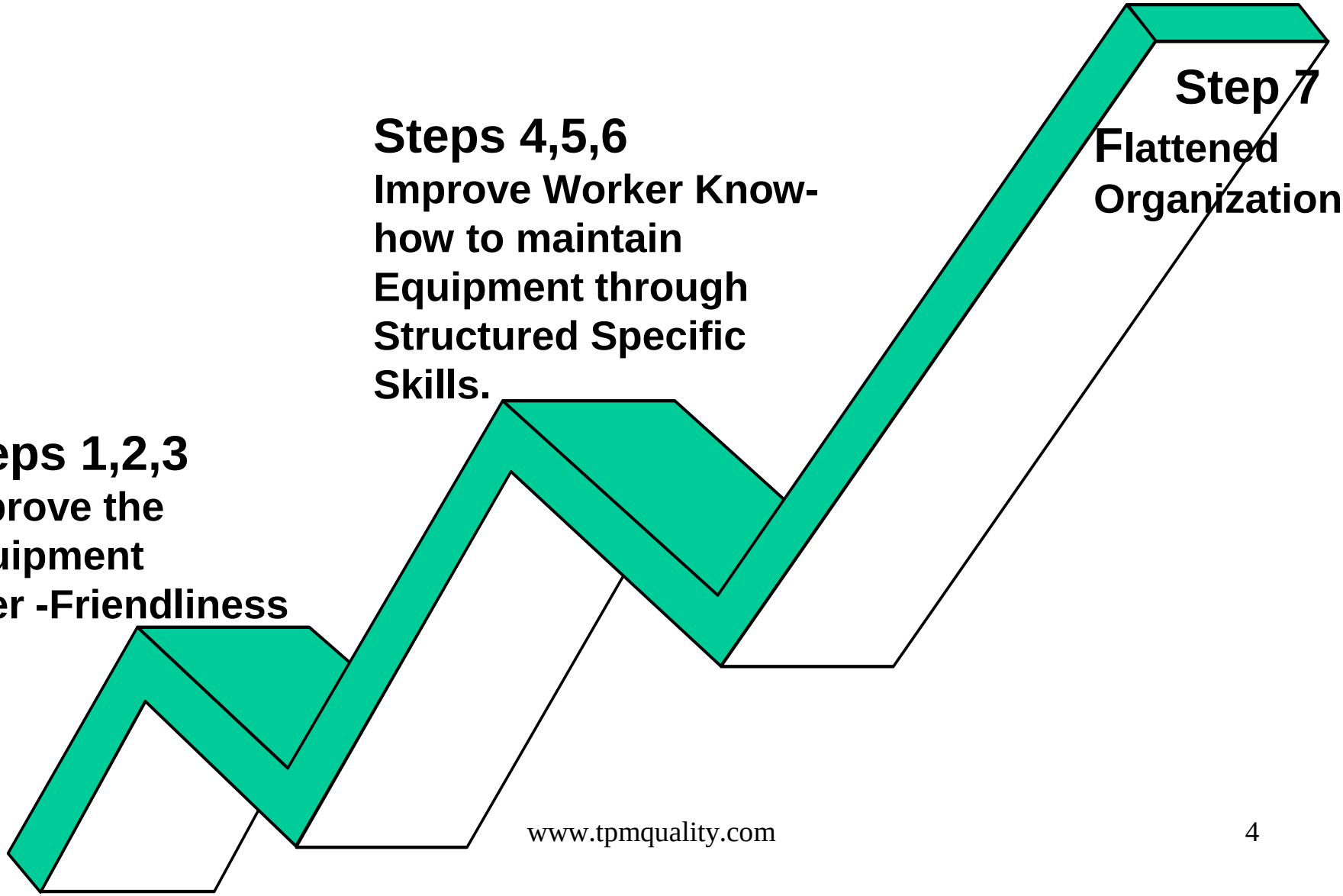
Background of TPM

- **Main manufacturing excellence approach of Toyota and other excellent Japanese companies since the 70's.**
- **TPM is foundation for JIT, FA, Poka Yoke, Lean Manufacturing, Zero Defects.**
- **TPM Reference Standard - JIPM (Japan Institute of Plant Maintenance)**
- **Comes from the best of Japanese Industrial Excellence and evolved from the heat of the continuing Energy Crisis and Globalization challenges to achieve More with Less.**

Executive Overview Of

1. Autonomous Maintenance
2. Equipment Improvement
3. Planned Maintenance
4. Quality Maintenance
5. Office TPM

Logic of AM Steps

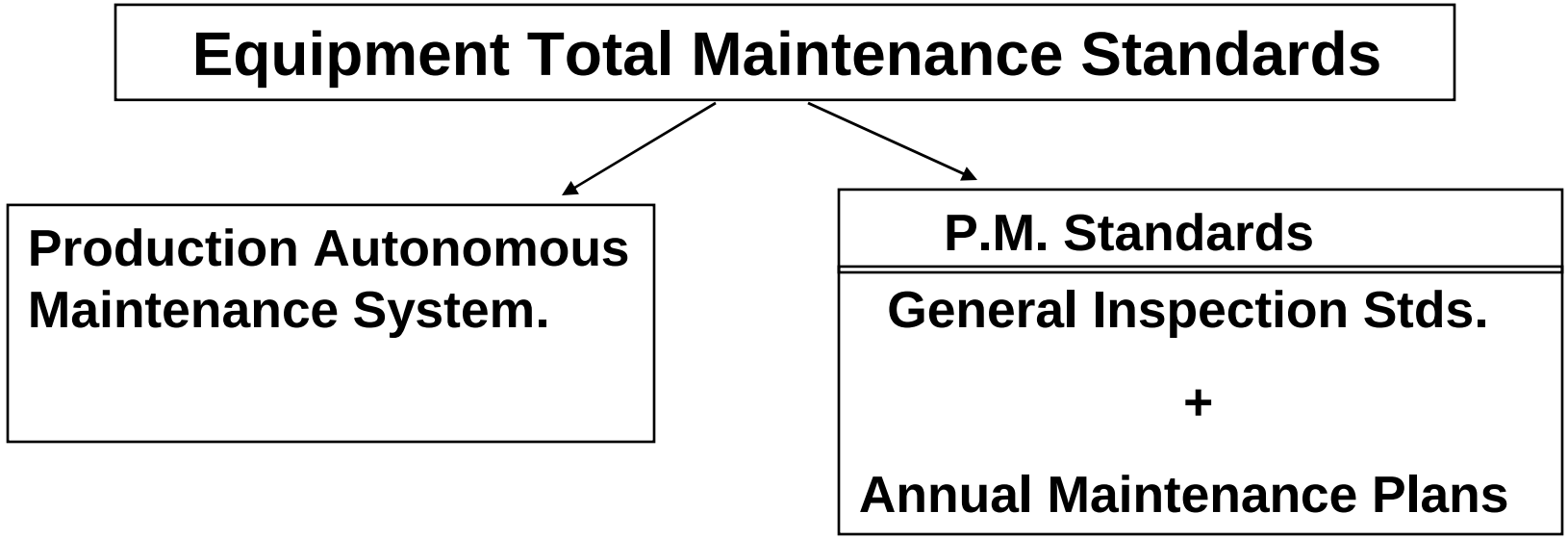


AM STANDARDS

Step #	Step Goal	Standards
Step 1	Restoration	**=> 85% repair rate**
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**

Goal of Planned Maintenance.

Achieve "ZERO EQUIPMENT BREAKDOWNS" by implementing systems of "parts replacement before failure" through TBM and CBM.



Planned Maintenance Activities:

- Support Autonomous Maintenance Activities by technical support, breakdown analysis and demarcation between Production & P.M. Systems.
- P-M Analysis for chronic breakdowns.
- Time Based Maintenance items
- Condition Based Maintenance items.
- Spares Mgtm & Maintenance Day Practice.

Role of Plant EI Team

Achieve systematic breakthroughs in equipments' 6 BIG LOSSES and establish Standards for Basic Machine Conditions.

The Basic Machine Conditions are:

1. **Cleaning Standards.**
2. **Lubrication Standards.**
3. **Bolt-tightening Standards.**

Equipment 6 Big Losses

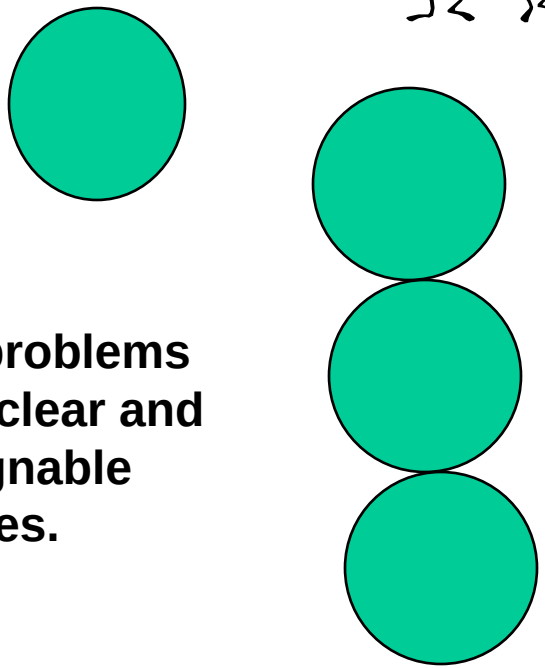
(Focus is at the Bottleneck processes.)

1. **Breakdown Losses**
2. **Speed Losses.**
3. **Setup Losses.**
4. **Defect Losses.**
5. **Start-up or Yield Losses**
6. **Minor Stoppages Losses**

LOSSES / Maint LEVEL	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1.Breakdown losses	• Have chronic B/Ds • B/d Repair time PM time. • >20% deviation of service life range. • Root-cause s of breakdown not clear.	• Only spontaneous breakdowns. • B/d Repair time = PM time. • Within parts service life span. • Root-causes of B/Ds are clear and addressed.	• Time-based component maint. system. • D/Trepair time < PM time • B/d downtime < 1% • Service life of components => upper range of specs.	• Condition-based maint system • Maint staff do only PM. • AM do D/T repairs < at 0.1% of DT level. • Clear improvement in MTBF
2.Setup Losses	• Incomplete setup documentation. • Setup times variation >30%.	• Complete set-up documentation • On-line and off-line setups are defined. • SetupTime variation < 15%	• Successful efforts to convert on-line to off-line setups • All adjustments are fully clarified and standardized.	• Optimal set-ups under 10 mins. • 1st time set-up produce good parts. No need to adjust any further.
3.Minor Stoppages	• No awareness/data.	• Data on frequency, location of minor stoppages.	Reduced 1/20th of current • Root-causes of minor stoppages are clear and countermeasures in place.	• Zero minor stoppages.
4.Speed Losses	• Equipment specs not clear. • No settings documented by different packages/ machine models & types.	• Root-causes are clear • Settings documented by package / machine type. • < 5% variation between same type machines	• Countermeasures for root-causes of speed losses implemented. • Revised settings with notes on quality and accuracy impact. • < 2% speed loss.	• Operates at designed speed or above. • Zero Speed losses
5. Defect & Startup Losses	• Nothing done about chronic losses. • No results from previous actions	• Chronic defects are quantified by type, frequency and volume. • Root causes for problems are identified and understood.	• Countermeasures implemented effective for early in-process detection of defects. • Q-components identified and effects on quality are clear.	• M-Q relationship established. • Regular audit of Q-components • Loss due to quality defects is < 0.1%

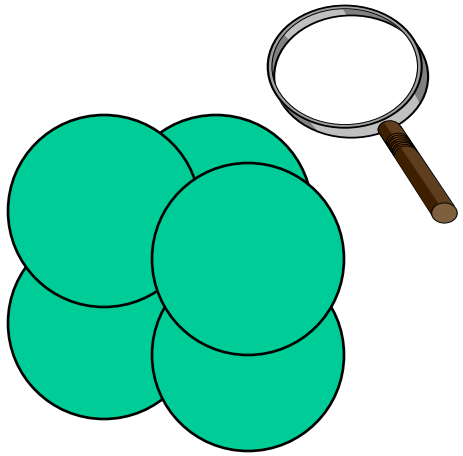
Sporadic & Chronic Problems

Why-Why Analysis.



For problems with clear and assignable causes.

P-M Analysis.



For problems with clear causes & no effective counter-measures

Why-Why Analysis & P-M Analysis

- Used with other data analysis or data collection tools.
- Emphasize on logical reasoning to fully understand the whole chain of cause-effects so as to devise holistic multiple solutions.
- All defects, breakdowns, accidents and work – problems are result of an error by Man which is the Root Cause.
- Problems are traced to all the 4Ms
- Solution Sustained by linked to the TPM systems.

Quality Maintenance:

is activities to set **equipment conditions,** based on the basic concept of maintaining perfect equipment to maintain perfect quality of processed goods. The machine conditions **(Q-Components)** are checked and measured in time-series to verify that measured values are within standard values to prevent defects. The transition of measured values is watched to **predict possibilities of defects** occurring and to take countermeasures beforehand.

Role of Plant TPM-QM

Achieve "ZERO DEFECT" by identifying all the upstream factors of Equipment causes of defects and implementing fool-proofing techniques to eliminate man and materials-caused defects.

1. **Identify all the Q-components**
2. **Implement fool-proofing techniques to prevent man and materials-caused defects.**
3. **Eliminate all Chronic defects.**

ABOUT OFFICE TPM

- **Is a structured 5S program using Why-Why Analysis as a problem-solving tool.**
- **Has similar Autonomous Maintenance 5 Steps**
- **Improves "CRITICAL FUNCTIONS" of Ware-house, Storage Place, administrative areas' through work-flow studies.**
- **Areas contributing to OEE losses are selected for Kai'zen activities.**

The 5S step-by-step program.

1 - Cleaning & Restoration.	**Thoroughly restore & clean.** **Motivation through participation.**
2 - Eliminate Stains, Mixed, Contamination.	**Study Root Causes of Dirt, Mixing,** **Loss, damage and take actions.**
3 - Improve Accessibility.	**Achieve 1 minute accessibility time for documents + parts. Implement stock-management-at 1 glance.**
4 – Standardization & Control of Work.	**Achieve a problem-free work flow in stock inventory, data availability.**
5 - Self Management	**Self Managing Work Teams.**