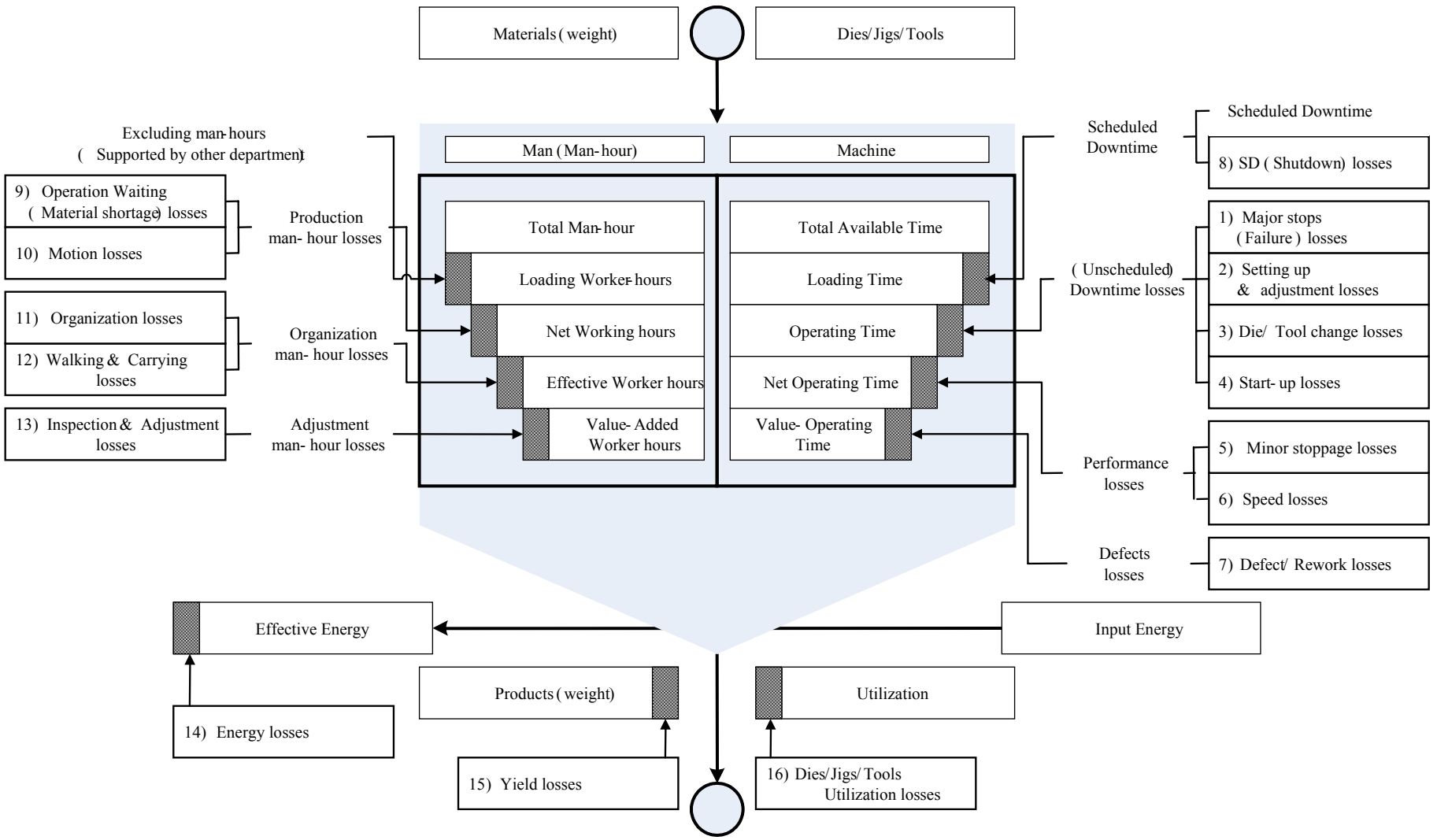
16 major production losses



Definition of equipment loss

- Equipment failure (Breakdowns) loss

  Time loss that results from sporadic (unscheduled) plant stoppage where plant or equipment ceases to function as specified.

  The failure can be classified into two types, one is the function-stoppage type and the other is the function-deterioration type. The function-stoppage type failure is the one which occurs unexpectedly, while the function-deterioration type failure is the one in which the equipment function decreases.

- Changeover (Setup & adjustment) loss

  This loss is usually caused by a stoppage due to set-up change. The set-up change time is the period during which the production is stoppage to prepare for subsequent Production. The factor which spends the most time is "adjustment".

- Cutting tools & jig change loss

  The cutting tools change loss is caused by the line stoppage for replacing the grinding wheel, cutter, bit etc. which might be broken or worn due to long service.

.

- Minor stoppage & idling loss

  The minor stoppage loss differs from failure and is the one in which temporary trouble causes the equipment to stop or idle. It might be called a "minor trouble."

  For example, idling of a line caused by a low supply of work in the chute due to clogging, and temporary line stops caused when the sensor detects a non-conforming product are examples of minor stoppage loss. These losses can be eliminated and the line returned to normal operation so long as the clogged work is removed. The losses are quite different from natural equipment failure losses.

Definition of equipment loss(cont'd)

- Speed loss

  The speed loss is the loss caused by the difference between the designed speed and the actual working speed.

  For example, when the line was operated at the designed speed. it was found that the line caused poor quality or mechanical trouble in the line. In that case, the line had to be run at a slower speed than the designed one. This loss from this situation is called a speed loss.

- Defect & rework loss

  This is the loss caused when defects are found and have to be reworked. In general, the defects are likely to be considered as waste which should be disposed of. But since even the reworked products need wasted manpower to repair them, this must be considered as the loss.

- Start-up loss

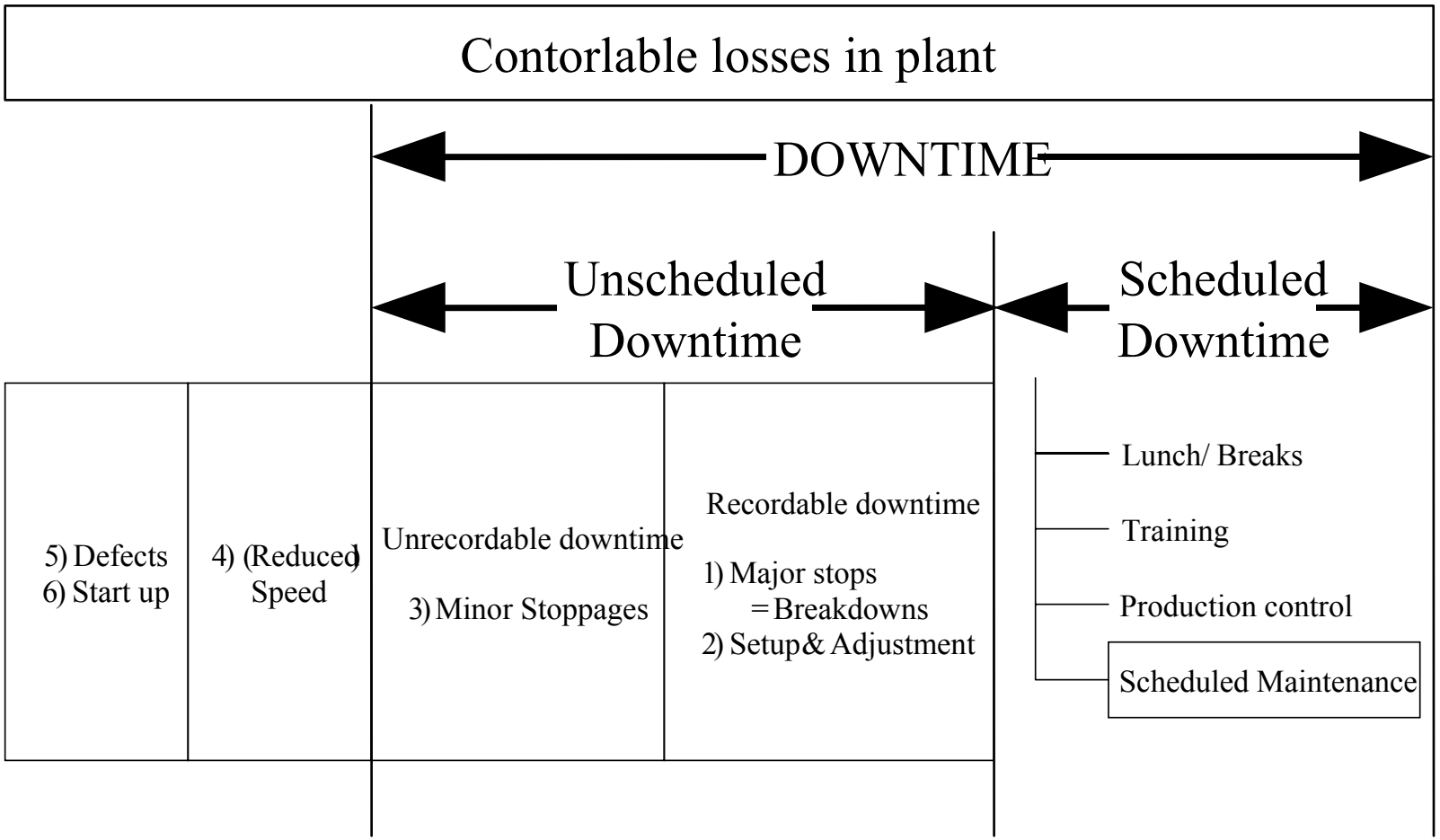
  The start-up loss is the one that occurs until the start-up, running-in and machining conditions of the equipment have been stabilized.

Scheduled downtime

- SD (shutdown) loss

  This loss is referred to as line shut-down loss, which is caused by stopping the equipment for periodical maintenance/inspection, and for scheduled shutdown for legal inspection during the production stage.

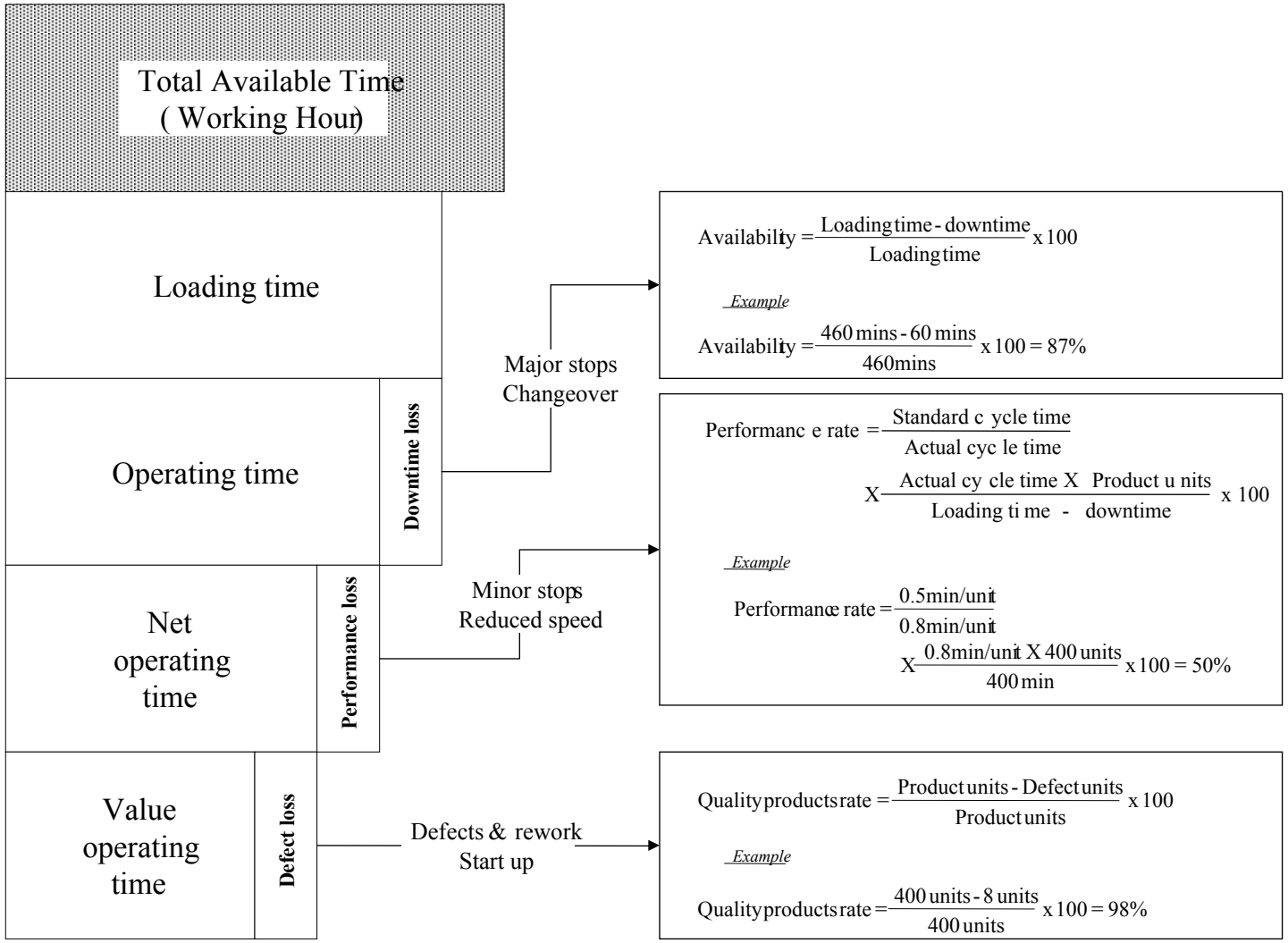
Equipment 6 major losses



Major Stops & Equipment Failures

Major stops = Unscheduled stops over 10 minutes	Equipment Failures (Breakdowns)	•Parts broken need to be replaced. •Machine function stops
	Adjustment	No need to be replaced.
	Spills	Cleaning
	Electric power stops etc.	Any utility stops
	No material	

6 major machine losses & Overall Equipment Efficiency



Example

Overall Equipment Efficiency =0.87 x 0.5 x 0.98 x 100=42.6%

Overall Equipment Efficiency

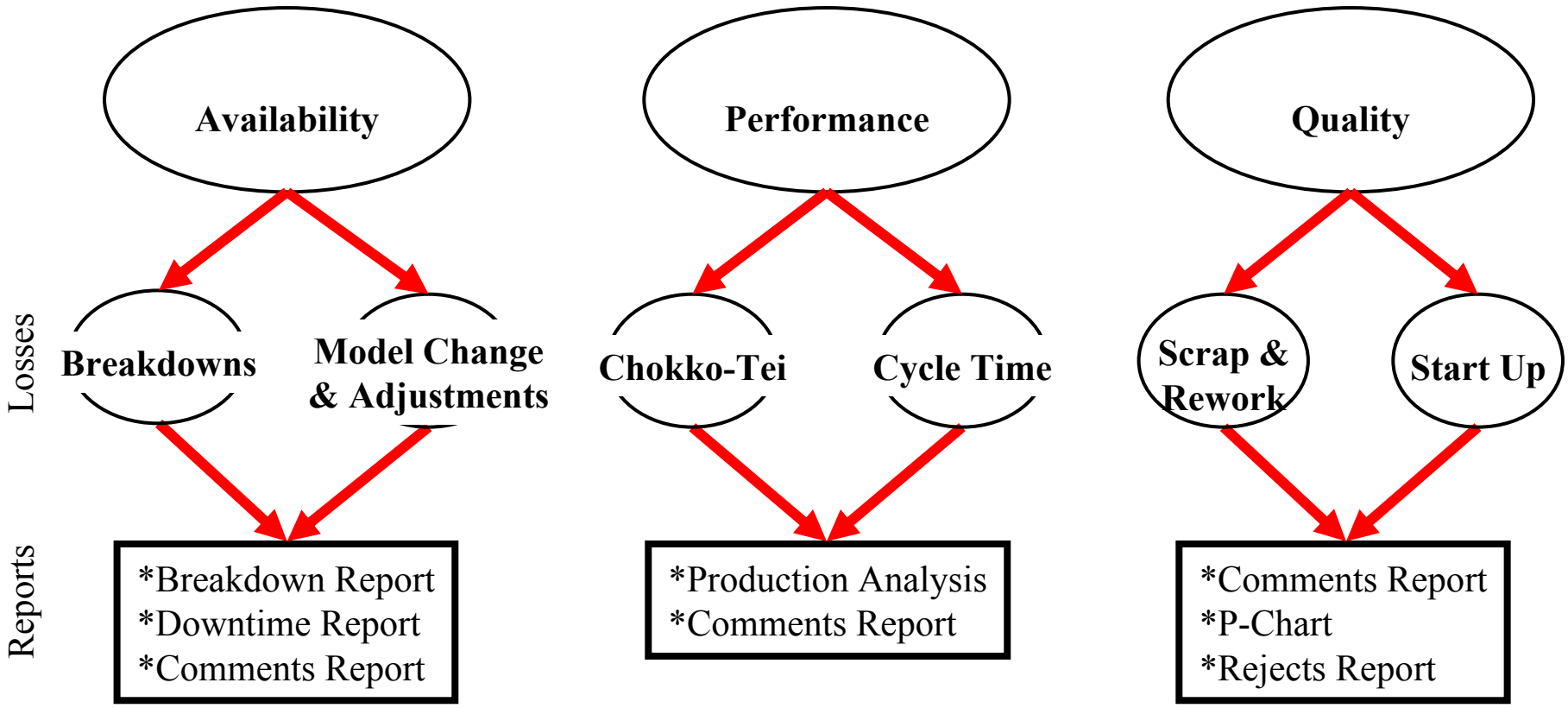
- What is OEE ?
  - To identify 6 major machine losses.
- How important is OEE data?
  - OEE is not only evaluation tool but also identify room (opportunity) to improve.
- How to use OEE ?
  - Focus on gap between 100% level and Actual level.

"Overall equipment efficiency" is used as an indicator of how well equipment (man-machine system) is used in batch / lot production.

The overall equipment efficiency is obtained in relation to losses that can impede equipment effectiveness. The magnitude of stoppage loss is expressed as availability, that of performance loss as performance rate, and that of defect loss as quality products rate ratio. The products rate ratio. The product of the three rations is called "overall equipment efficiency".

OEE(%)=Availability x Performance Rate x Quality Products Rate

OEE Analysis Flowchart & Data Source

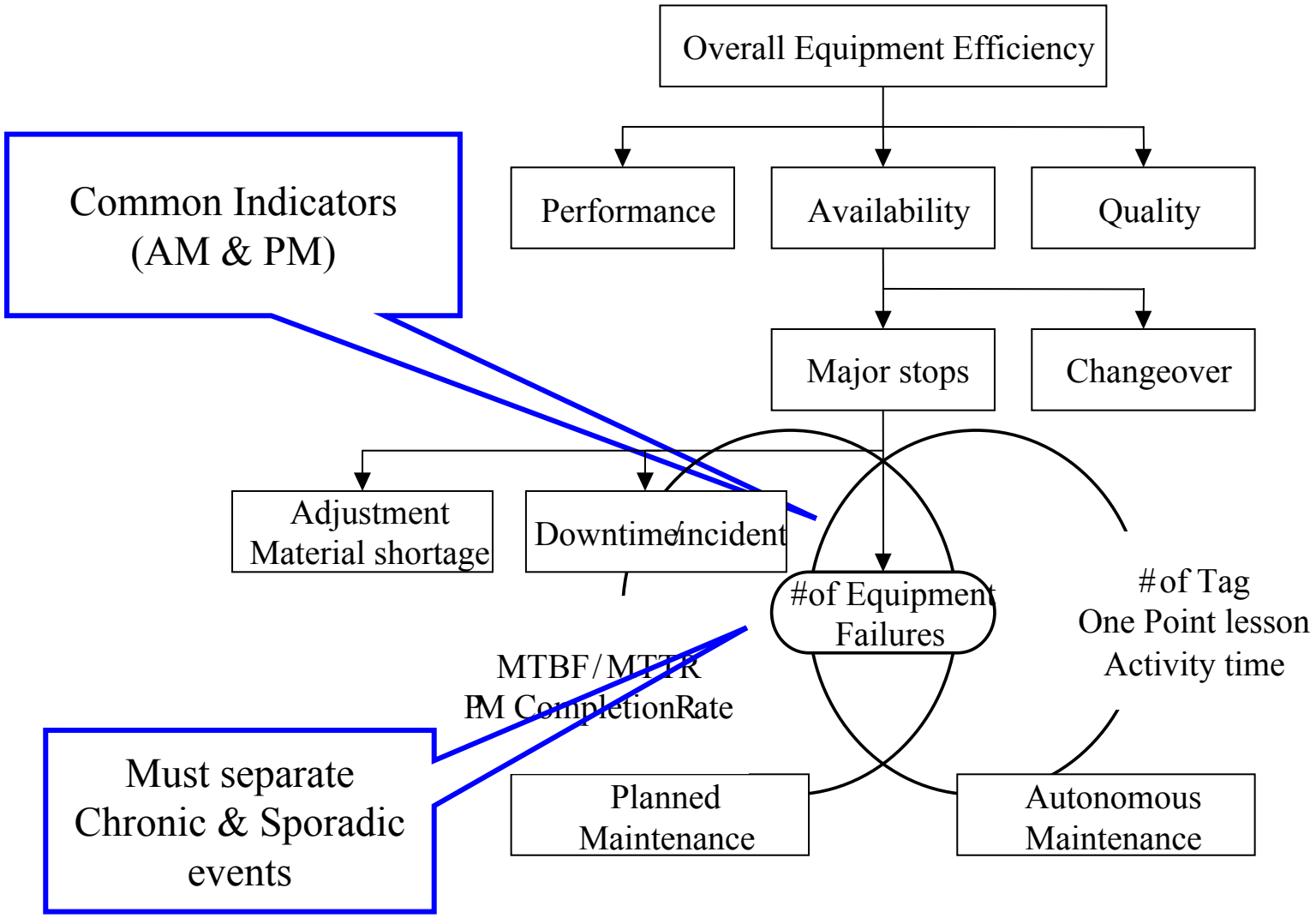


Example; MCCA,NC.

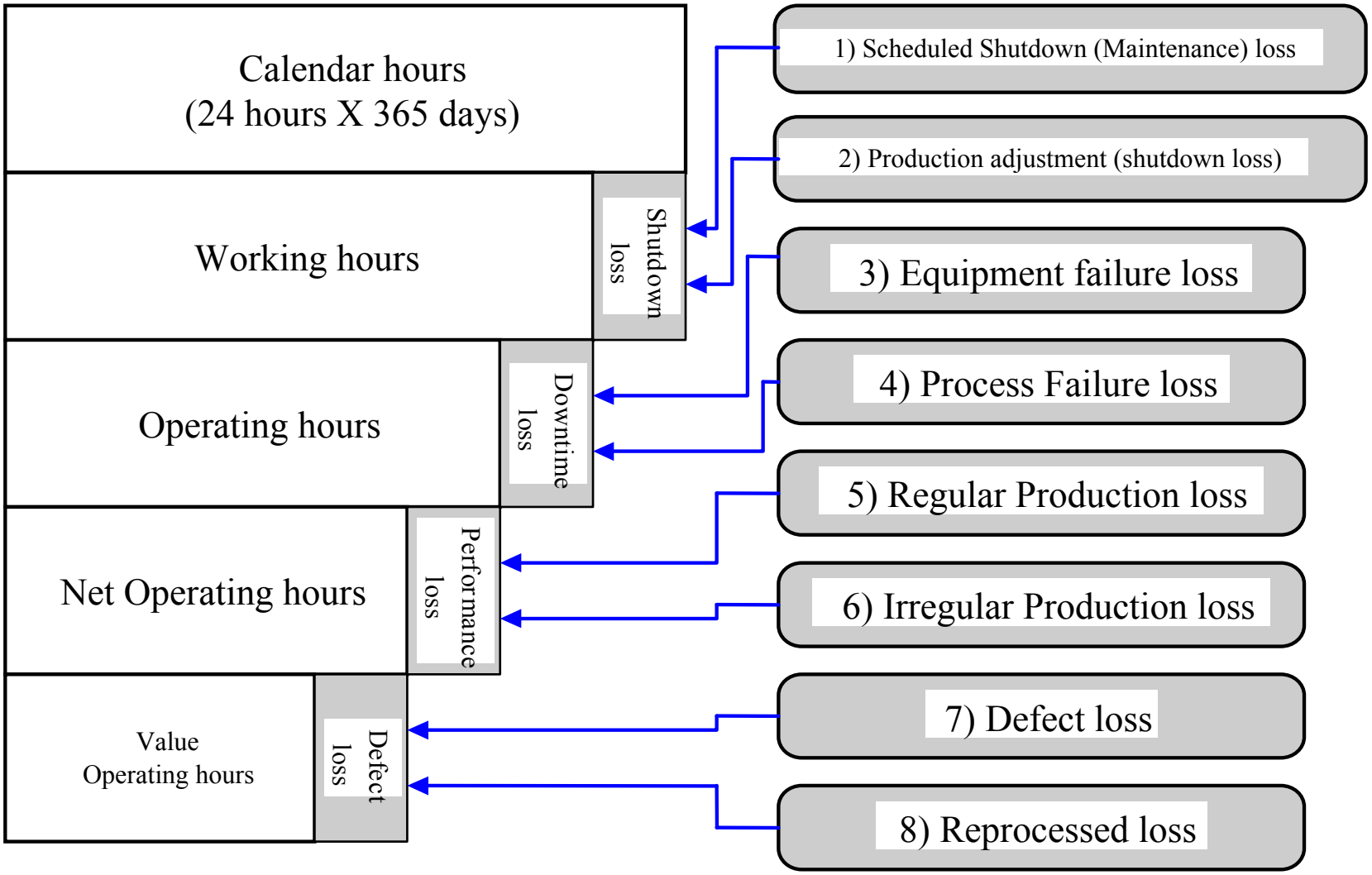
Data Source

	Data Source	Freq. Summary	Unit
Major stop & Equipment Failures	•Production Report •Maintenance log (Downtime log)	Shift & Daily	Occurrence & Time
Changeover	•Production Report	Shift & Daily	Time (Start to End)
Minor stop	•Production Report	Shift & Daily	Occurrence
Speed	•Production Report •SOP (Standard Operation Procedures)	Shift & Daily	Time (Minutes/piece)
Defects & Rework	•Quality Report (Scrap / Rework) •Production Report	Shifty & Daily	Piece %
Start up	•Production Report	Shift & Daily	Time (Start to End)

Number of Major stops – Equipment Failures



8 big losses in process plant

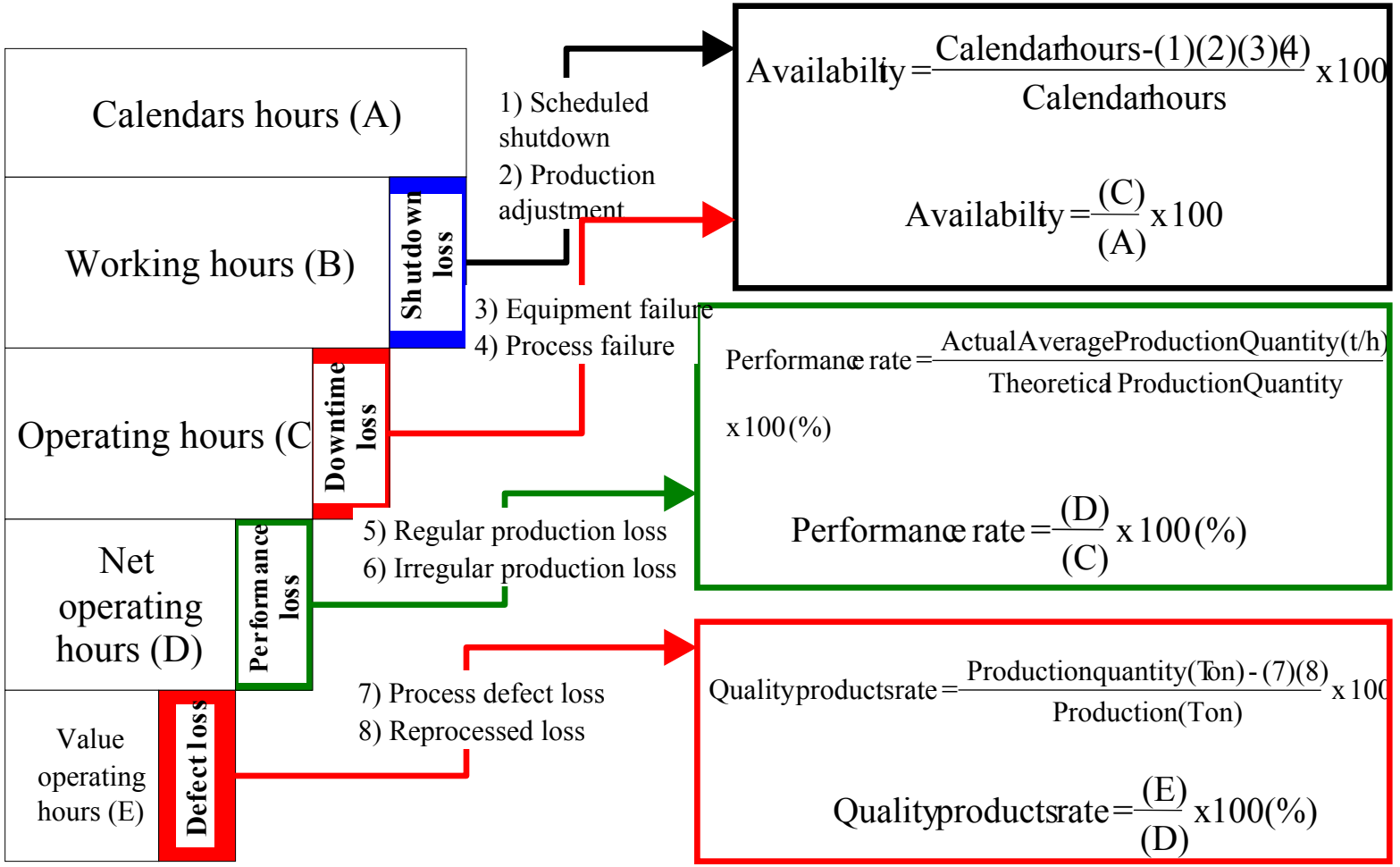


Source; TPM Encyclopedia (JIPM –2002)

Definitions and Examples of 8 big losses in process plant

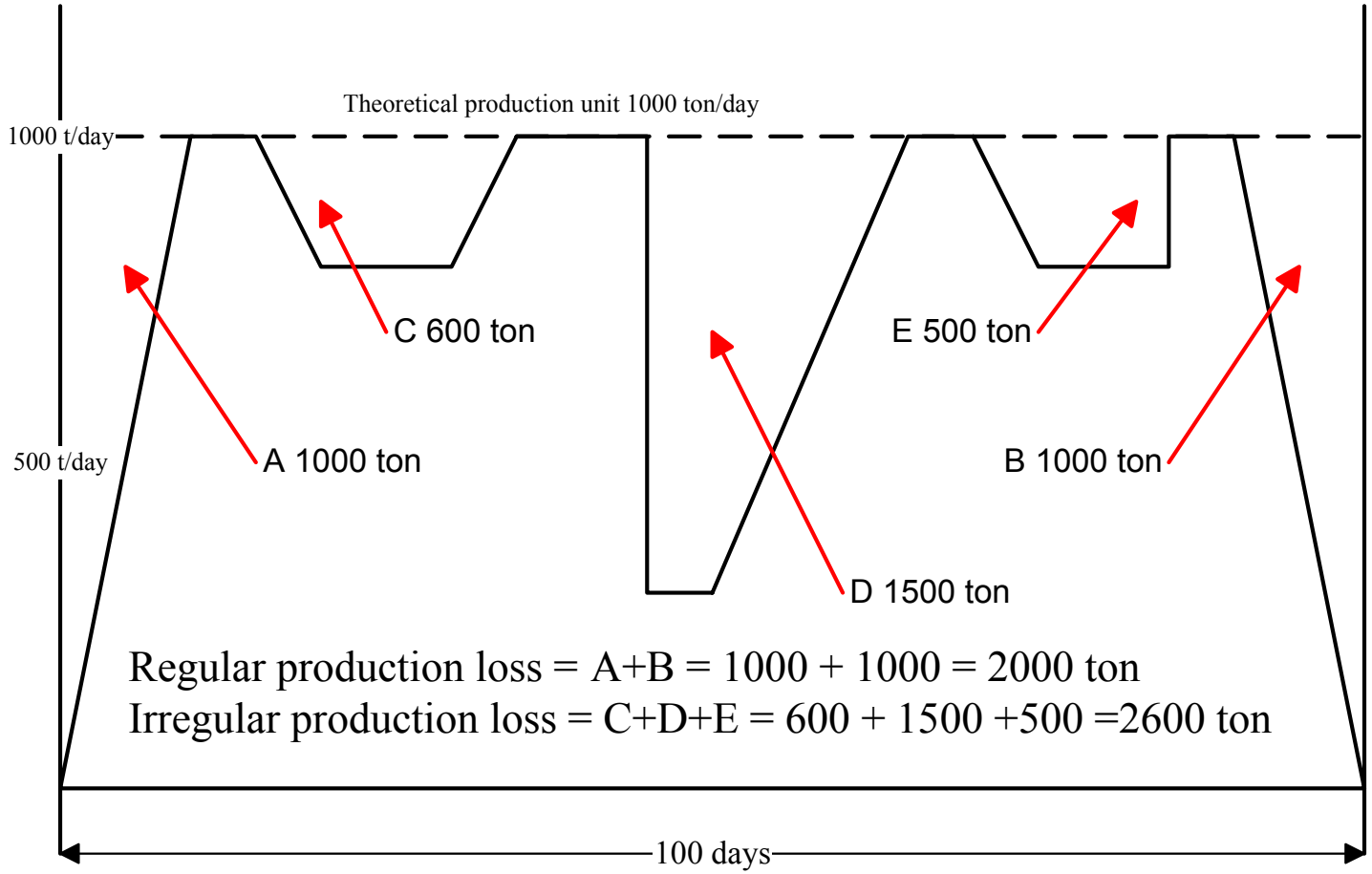
Loss	Definition	Unit	Example
1) Planed Maintenance loss	Shutdown loss which is caused by the shutdown of the plant for its planned annual maintenance and periodic plant adjustment	Hour (Day)	Shutdown works, periodic maintenance, legal inspection, autonomous inspection, general repair works and others.
2) Production Adjustment loss	Adjustment time loss which is caused by the production plan to adjust the supply and demand balance.	Hour (Day)	Shutdown for production adjustment, inventory adjustment and other reasons.
3) Equipment Failure loss	Loss which is caused by sporadic shutdown of the facility or equipment due to malfunctions.	Hour	Pump failure, motor seizure, bearing damage, shaft breakage and other causes
4) Process Failure loss	Loss which is generated in the process by plant shutdown due to improper chemical or physical properties of the substances to be handled, some other improper equipment operation or external factors.	Hour	Leak, spilling, clogging, corrosion, erosion, scattered dust and chips, operational error.
5) Regular Production loss	Loss which is caused by plant start-up, stopping and switchover.	Rate down, Hour	Start-up after starting, ending before stopping, production rate down in model change.
6) Irregular Production loss	Performance loss which is caused by reducing the production rate due to plant malfunction or abnormality.	Rate down	Low-load operation, low-speed operation, and operation below standard production rate.
7) Process Defect loss	Loss which are generated by producing defective products or imperfection. Loss which is defined as a loss deserving 2-rank down-grading.	Hour, Ton, Amount	Material and time loss caused by producing products which are off quality standard.
8) Reprocessed loss	Loss which is caused by reworking.	Hour, Ton, Amount	Defective units in final process are recycled to upstream processes for reworking to have them accepted.

Overall Production Efficiency



Overall Production Efficiency =Availability x Performance rate x Quality Defect rate x 100(%)

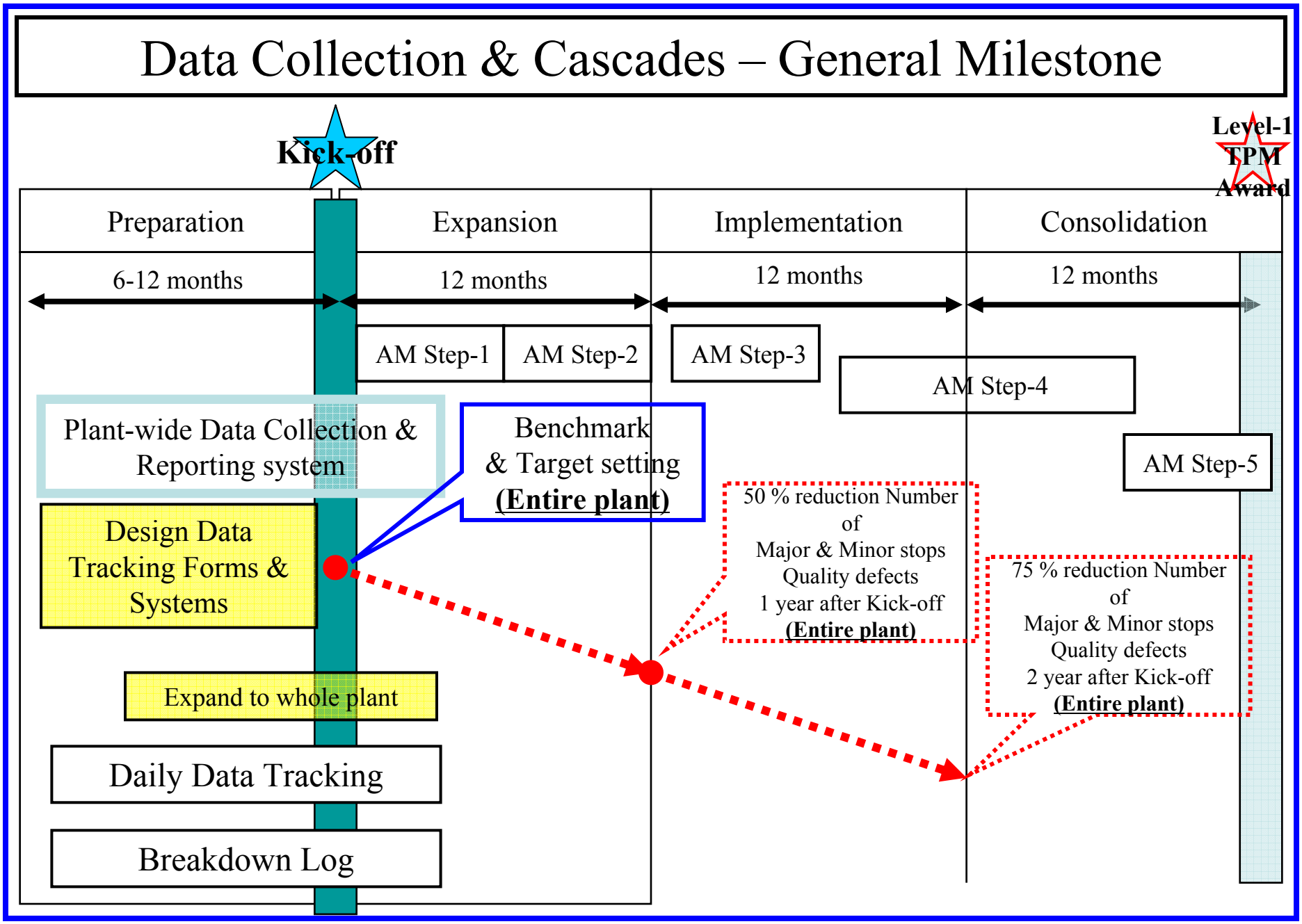
Regular production loss and Irregular production loss



Actual average production quantity = (1000 X 100 - (2000 + 2600))/ 100 days = 954 t /day

Performance rate = 954 / 1000 (t/day) = 95.4 %

Data Collection & Cascades – General Milestone



Daily Data log (Example – Form)

Data Collection Sheet

Machine # *DATE*

Time	*Products #*	*0*	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*	Cycle Time	Output	Rejects	Meeting	TPM	Material Shortage	Scheduled maintenance	Breakdown	Set up	Adjustment			
(AM) 6:00																										
7:00	Model X	■	■	■										0.5	18	2	10	5								
8:00	Model X				■	■								0.5	16	5					10					
9:00	Model X									■	■			0.5	15	3							10			
10:00	Model Y	■	■	■	■	■	■							0.5	5							30				
11:00	Model Y																									
12:00																										
(PM) 1:00																										
2:00																										
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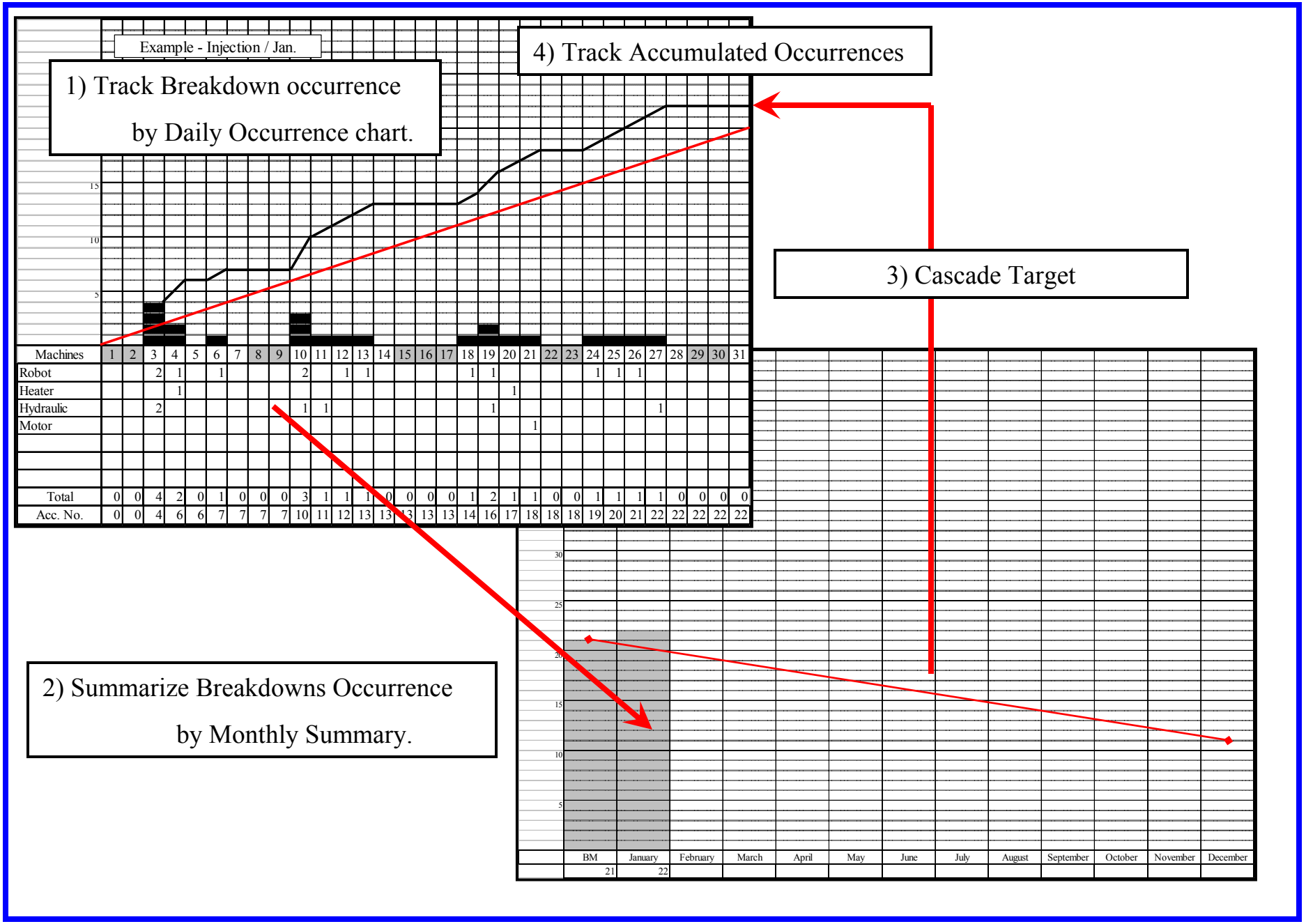
A	Loading Time = Working Hour - (Meeting , TPM, Material shortage , Scheduled maintenance)
B	Down Time = Breakdown + Set up + Adjustment
C	Availability = Loading Time - Down Time / Loading Time
D	Operating Time = Loading Time - Down Time
E	Performance Rate = Design Cycle Time X Output / Operating Time
F	Quality Product Rate = (Output - Rejects) / Output
	OEE = (C x E x F)=


Example - Injection / Jan.
1) Track Breakdown occurrence by Daily Occurrence chart.
4) Track Accumulated Occurrences
3) Cascade Target
2) Summarize Breakdowns Occurrence by Monthly Summary.
15
10
5
Machines 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Robot 2 1 1 2 1 1 1 1 1 1 1
Heater 1 1
Hydraulic 2 1 1 1 1
Motor 1
Total 0 0 4 2 0 1 0 0 0 3 1 1 1 0 0 0 0 1 2 1 1 0 0 1 1 1 1 0 0 0 0
Acc. No. 0 0 4 6 6 7 7 7 7 10 11 12 13 13 13 13 13 14 16 17 18 18 18 19 20 21 22 22 22 22 22
30
25
20
15
10
5
BM January February March April May June July August September October November December
21 22

Data Cascading