TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

TOC Strategic Solutions

How to combine replenishing to MTA buffers with working on weekly production plans

Jelena Fedurko
TOC Strategic Solutions

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

Jelena Fedurko

Jelena has 14 years of TOC experience as a trainer and consultant providing support in TOC implementations in the areas of production, supply chain, project management, sales, marketing and people management.

Jelena has worked in Japan, Poland, Turkey, Italy, Russia, Ukraine, India, China, Chile, Colombia, Mexico and other countries throughout the world.

Jelena is the author of the books *Behind the Cloud – Enhancing logical thinking* and *Through Clouds to Solutions.* The books present new developments in the area of working with assumptions and UDE Clouds.

Together with Oded Cohen, Jelena has co-authored the book Theory of Constraints Fundamentals.

She has authored numerous articles on TOC concepts and implementation, has written several chapters in TOC books and has edited a number of TOC books and publications.

Jelena is International Director of TOC Strategic Solutions Ltd and Founder and Co-President of TOCPA.

jelenafedurko.gs@gmail.com

www.toc-strategicsolutions.com

www.tocpractice.com

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOCPA
Theory Of Constraints Practitioners Alliance

SHARING EXPERIENCE

TOC Strategic Solutions

TOC Solution for MTA

Tactics: Production and Material Management are on the TOC Replenishment system

Mindset
Produce to ensure availability
Injection 1

Immediate improvement in availability
Injections 2-5

Continuous improvement
POOGI
Process of Ongoing Improvement
Injections 6-8

Injection 1

Management is committed to availability with no excess inventory at the Plant (Central) Warehouse, with the P(C)W as the major regulator of the whole replenishment system

Injection 2

Stock Buffers in the Plant (Central) Warehouse are maintained to ensure 100% availability, with Production Work Orders (WO) released according to the consumption from the P(C)W Buffers

Injection 3

Open Work Orders (WO) are prioritized according to the status of their corresponding buffers in the Plant (Central) Warehouse
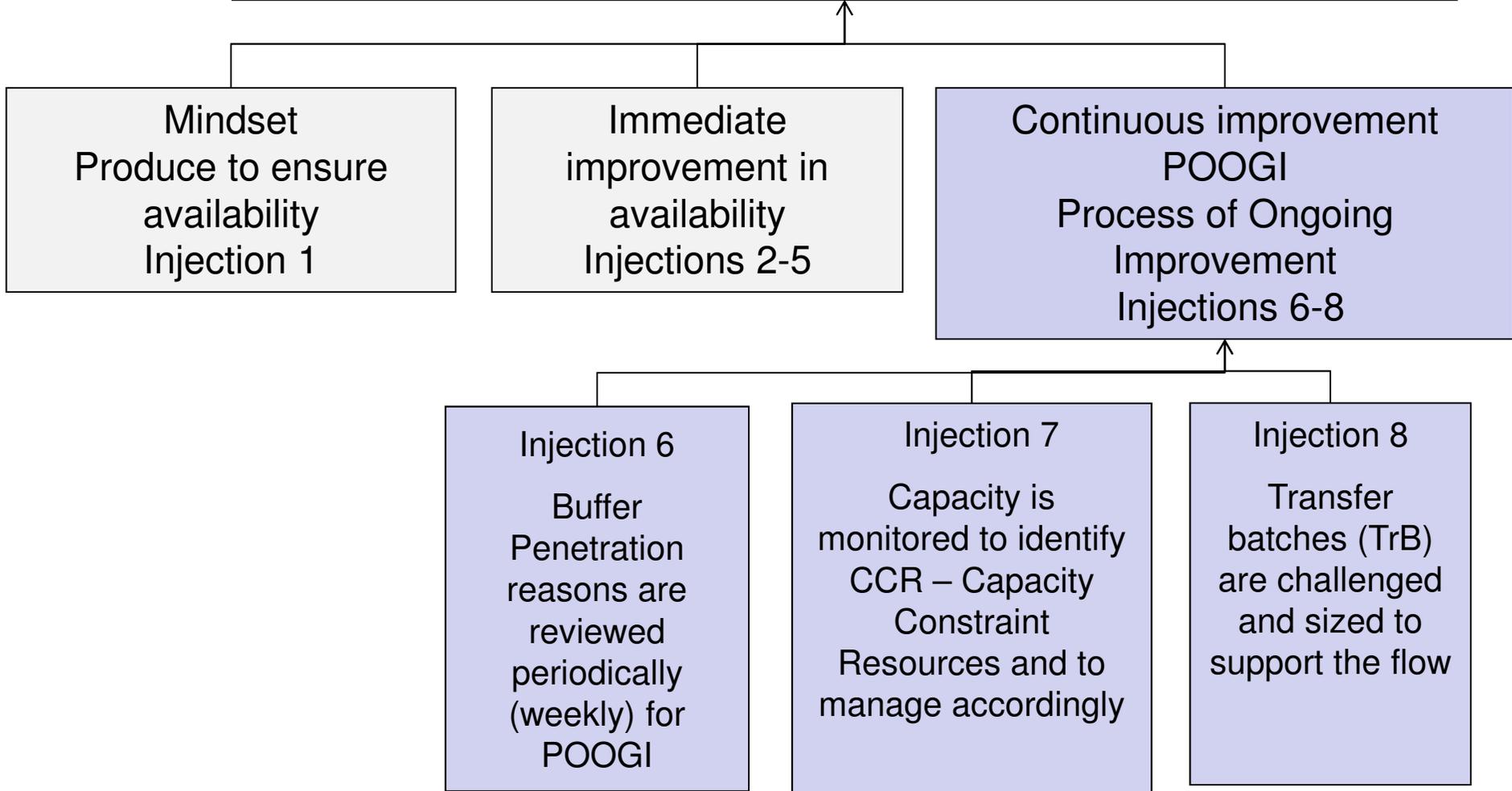
Injection 4

Buffer Management for recovery actions is in place

Injection 5

Availability of Raw Materials and components is monitored and managed

TOC Solution for MTA

Tactics: Production and Material Management are on the TOC Replenishment system

Mindset
Produce to ensure availability
Injection 1

Immediate improvement in availability
Injections 2-5

Continuous improvement
POOGI
Process of Ongoing Improvement
Injections 6-8

Injection 6

Buffer Penetration reasons are reviewed periodically (weekly) for POOGI

Injection 7

Capacity is monitored to identify CCR – Capacity Constraint Resources and to manage accordingly

Injection 8

Transfer batches (TrB) are challenged and sized to support the flow

Replenishment mechanics within MTA –

Make to Availability

1. The concept of Stock Buffer

2. The concept of replenishment driven by consumption

3. Determining inventory target levels – buffer size

4. Mechanics of calculating replenishment WO buffer status

1. The concept of Stock Buffer as a managing mechanism

Stock buffer – is set for each SKU in each location.

Measured in physical units (or in weight units – tons, kilograms, etc. when there are no identifiable physical units).

0-33%

34-67%

68-100%
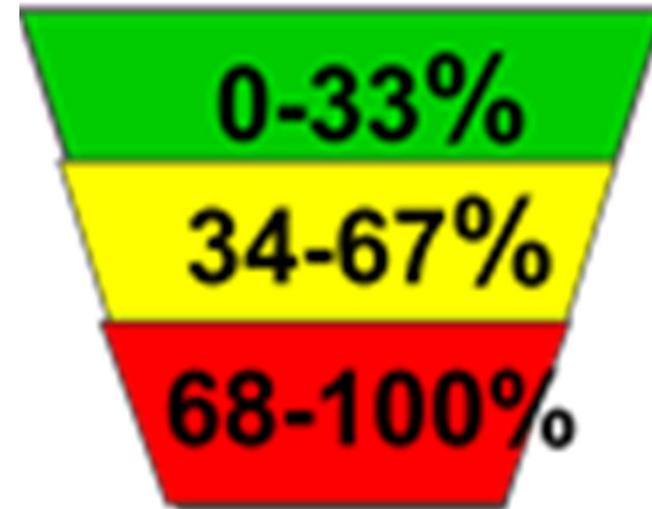
1. The concept of Buffer as a managing mechanism

Buffer Management – continuous receiving of information from the Buffer, and the basis of which managers take actions to ensure the required progressing of the order in the flow so that they system cold meets its primary measurements.

The mechanism of Buffer Management is a part of every logistical solution of TOC. Buffer Management requires tight monitoring of the buffer status and is used for:

1. Recovery actions to ensure that the penetration in the buffer will not exceed 100%;

2. Determining the correct size of the buffer;

3. Identifying and removing problematic areas in the flow.

Buffer management is always oriented in the future.

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

2. The concept of replenishment driven by consumption the TOC way

Replenishment driven by consumption the TOC way – quick and frequent replenishment of those SKU quantities that were consumed from the buffer; consumption data is reported daily, replenishment is done as frequent as possible and sensible.

ВАЖНО: The replenishing link replenishes "as frequent as possible and sensible".
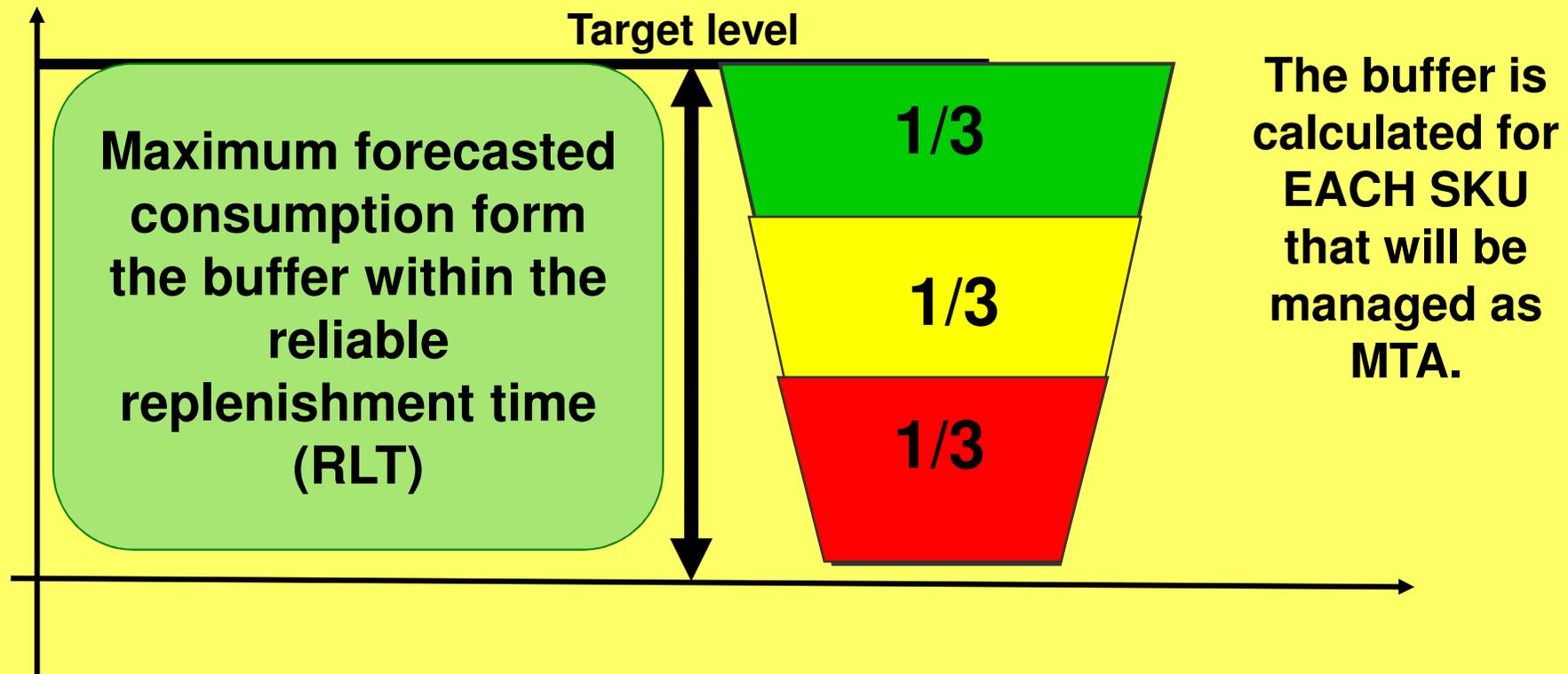
«SENSIBLE» means NOT FROM THE POINT OF VIEW OF CONVENIENCE TO PRODUCTION,

BUT PROCEEDING FROM THE COMMITMENT NOT TO HAVE STOCKOUTS in the stock buffer.

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints Practitioners Alliance

SHARING EXPERIENCE

3. Determining inventory target levels – buffer size

The Target Level for each SKU in each location includes quantities (1) on hand in the warehouse; (2) on the way; (3) in the replenishment orders.

Target level

Maximum forecasted consumption form the buffer within the reliable replenishment time (RLT)

1/3

1/3

1/3

The buffer is calculated for EACH SKU that will be managed as MTA.

4. Mechanics of calculating the same SKU replenishment WO buffer status

Every new consumption from the on-hand stock in the Assembly Warehouse not only triggers the release of a corresponding WO to replenish the consumed amount, but also changes the buffer status of ALL earlier WOs for this SKU in production.

The buffer status is calculated for EACH WO in the production based on the formula:

$$\frac{\text{(target level minus on-hand minus earlier production orders)}*100}{\text{target level}}$$

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING EXPERIENCE

4. Mechanics of calculating the same SKU replenishment WO buffer status

(target level minus on-hand minus earlier production orders)*100
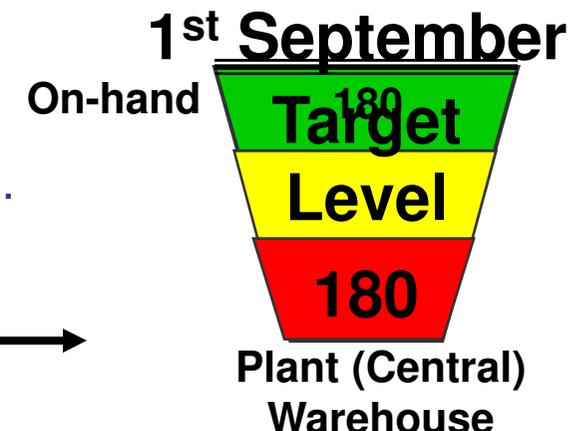**target level**

EXAMPLE:

Production cycle for this type of SKU is 5 days.

The target level [buffer size] for this type of SKU is set to be total 180 units (on-hand in P(C)W plus open Work Orders as WIP or waiting to be released in Production).

Even though the stock buffer cover ALL system under consideration, for practical reasons we place the icon for the Stock Buffer with the colored zones at the P(C)W.

On 1st September all 180 units resided at the P(C)W (=on-hand). There was no consumption from the P(C)W for a while, therefore on 1st September there were no open Work Orders for this SKU in production.
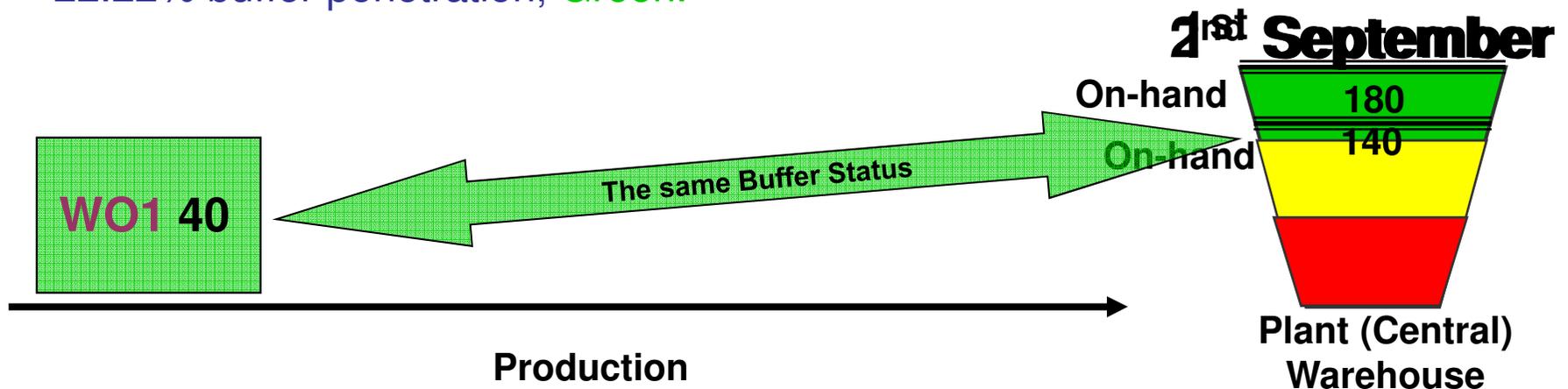
Production →

1st September

On-hand

180

Target
Level

180

Plant (Central)
Warehouse

4. Mechanics of calculating the same SKU replenishment WO buffer status

> **(target level minus on-hand minus earlier production orders)*100**
> **target level**

On 2nd September 40 units of this SKU were consumed from P(C)W. On-hand 140 units.

The request to release WO1 for 40 units was passed to production.

Calculating buffer status for WO1: (180 minus 140 on-hand minus 0 earlier WOs)*100/180= 22.22%, Green. Production released WO1 for 40 units with 22.22% buffer penetration, Green.

1st September

2nd September

On-hand 180

On-hand 140

WO1 40

The same Buffer Status

Production

Plant (Central) Warehouse

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

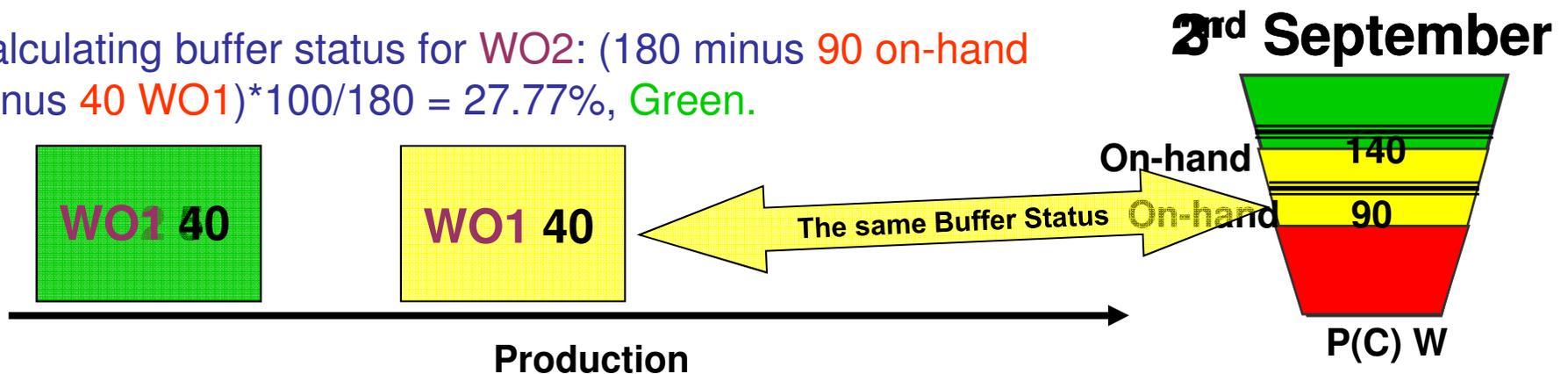# 4. Mechanics of calculating the same SKU replenishment WO buffer status

(target level minus on-hand minus earlier production orders)*100
target level

On 3rd September 50 more units of this SKU consumed from P(C)W.
   WO1 still in production.
   On-hand 90 units.
The request to release WO2 for 50 units was passed to production.

Calculating NEW buffer status for WO1: (180 minus 90 on-hand minus 0 earlier
   WOs)*100/180 = 50%, Yellow

Calculating buffer status for WO2: (180 minus 90 on-hand
minus 40 WO1)*100/180 = 27.77%, Green.

3rd September

WO1 40

WO1 40

The same Buffer Status

On-hand 140

On-hand 90

Production

P(C) W

How to use MTA

when working on the basis of weekly production plans

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

How to do MTA replenishment use MTA when working on the basis of weekly production plans

We calculate the initial stock buffer size in units!

Target level

WHAT IS «RELIABLE REPLENISHMENT TIME» WHEN WORKING ON THE BASIS OF WEEKLY PRODUCTION PLANS?

1/3

1/3

1/3
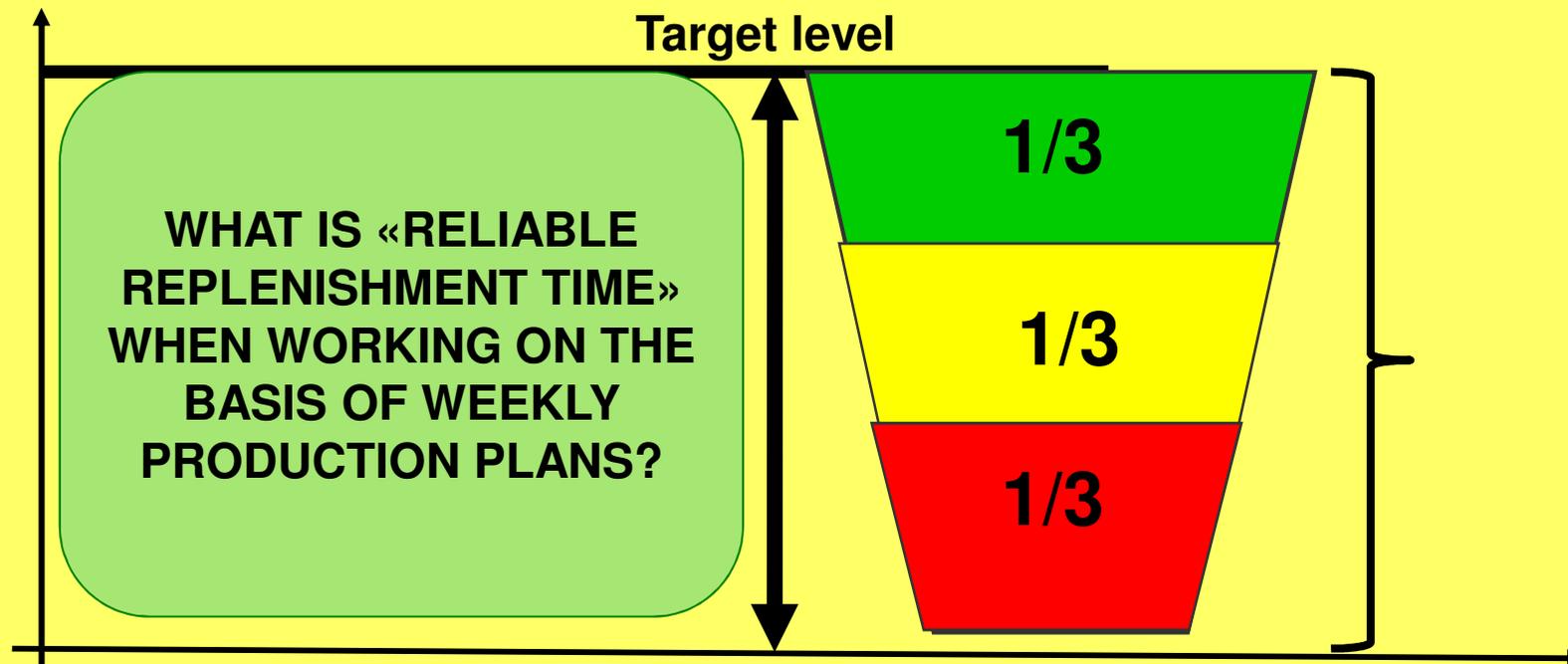
The replenishment time is calculated from the moment a unit of SKU was consumed form the buffer to the moment its "replacement" arrives.
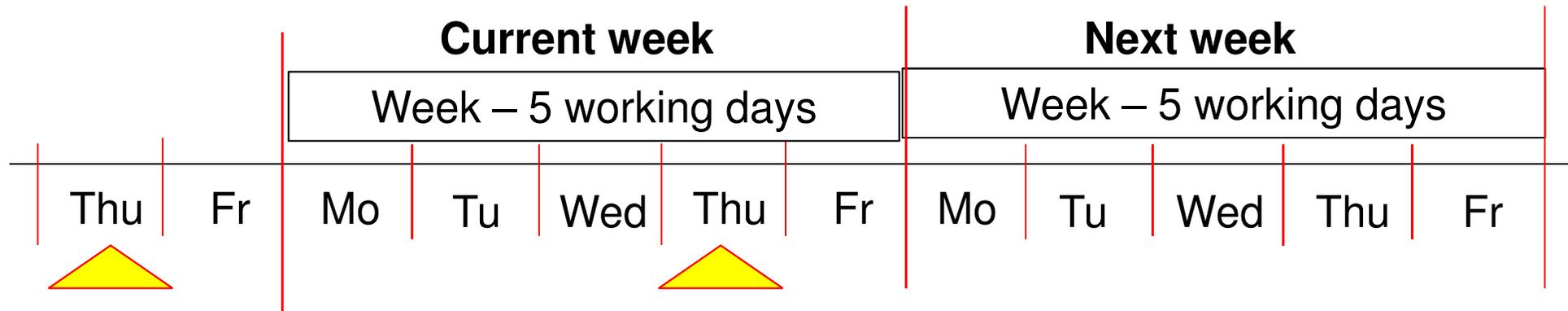
www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints Practitioners Alliance

SHARING EXPERIENCE

The concept of TOC Replenishment when production in managed by weekly production plans

III

To include in production plan for the next wee (when you work on weekly plans)

Daily consumption form the buffer

WOs released to production and included in the production plan for this week – the days and quantities determined

Production

Buffer target level

I

On hand

II

On the way to the buffer
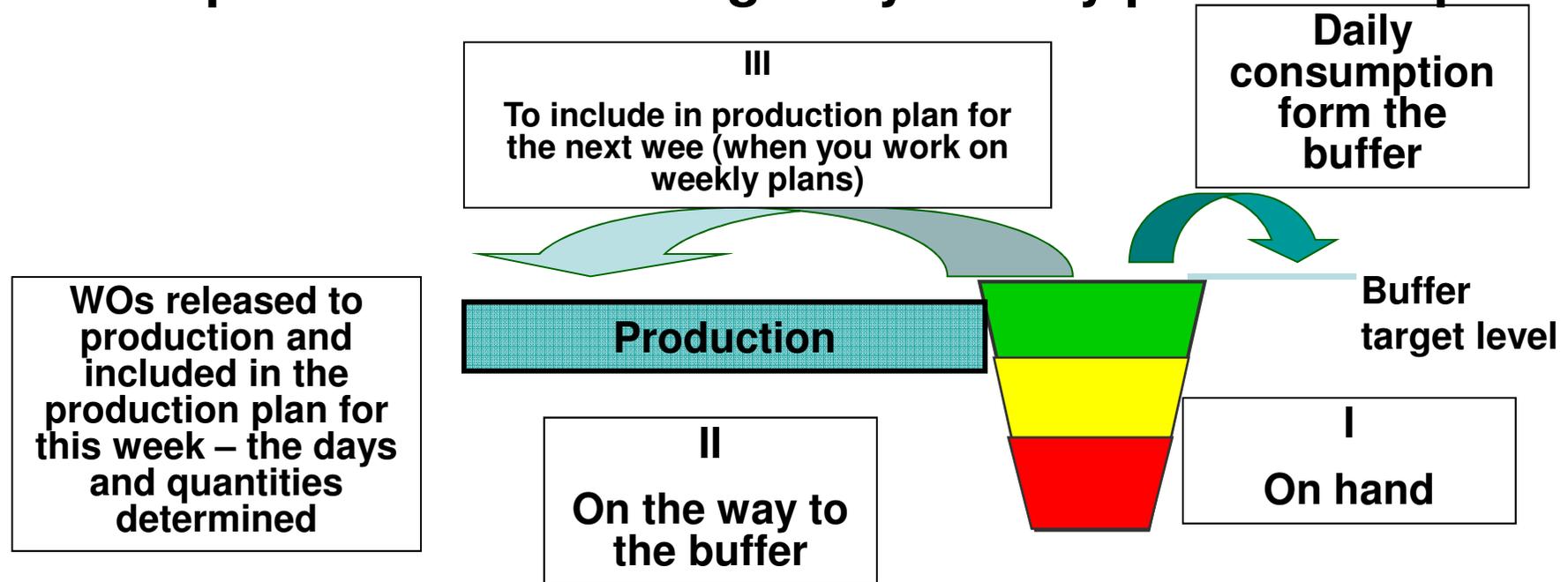
Target level = I + II + III = On hand + On the way to the buffer + To include in produciton plan

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints Practitioners Alliance

SHARING EXPERIENCE

What is the duration of Reliable Replenishment Time (RRT)?

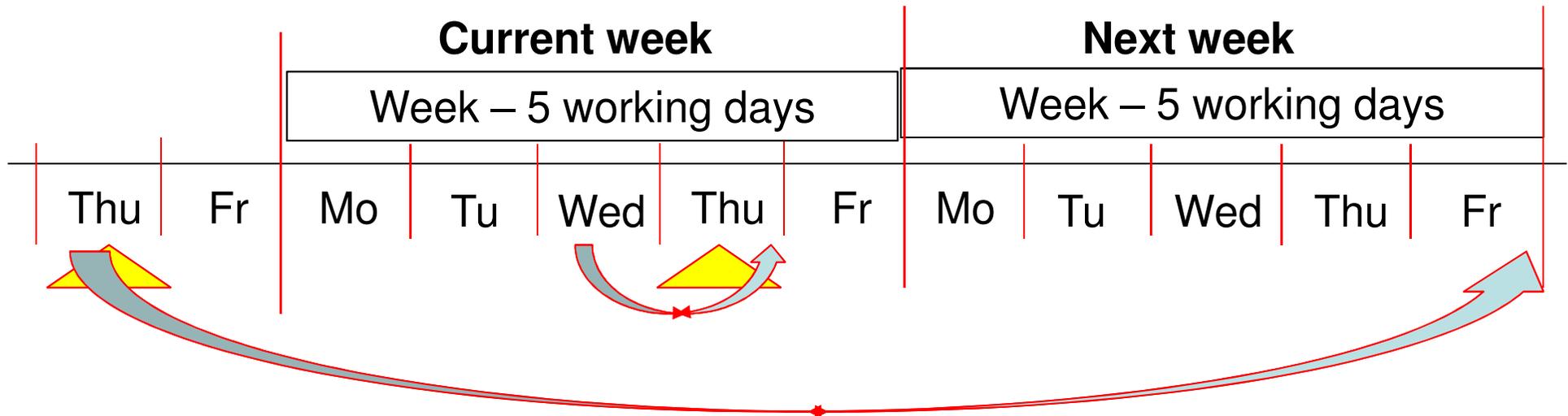|		**Current week**					**Next week**				
		Week – 5 working days					Week – 5 working days				
Thu	Fr	Mo	Tu	Wed	Thu	Fr	Mo	Tu	Wed	Thu	Fr

- On Thursday morning the production department receives from the planning department the SKU titles and QUANTITIES that need to be produced during the next week.

- The task of the production planner is to put all quantities into the production plan for the NEXT week – make a daily plan of plan which SKUs to produce and what quantities. This work must be finished by Thursday end of first shift.

- If there is something very urgent and production has capacity – the planner can make changes to the CURRENT week plan and make additions to the plan for the second shift on Thursday or for Friday.

- Everything that is planned for production for one workday, is released to production and completed within the same day.

What is the duration of the replenishment time?

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

What is the duration of Reliable Replenishment Time (RRT)?

	Current week				Next week				
	Week – 5 working days				Week – 5 working days				

| Thu | Fr | Mo | Tu | Wed | Thu | Fr | Mo | Tu | Wed | Thu | Fr |

What is the duration of the replenishment time?

Minimum – 1 workday

Maximum – 11 workdays, and this is
IF PRODUCTION HAS ALL MATERIALS AND CAPACITY!

AND – if this SKU IS put in the production plan at all!

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

If we cannot immediately release the production replenishment order on the basis of consumption from the buffer – does it make sense to go for MTA?

Yes, if the MTA file is the basis for dynamic daily production management.

When there are buffers:

• Each SKU buffer status changes daily.

• When the planning department passes over to the production department the quantities that need to be produced in the following week – both departments see the buffer status of each SKU as of Thursday morning.

• The responsibility of the production planner is to build such a weekly plan that it will ensure no stockouts in the buffers.

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

TOC Strategic Solutions

How to plan for the next week on the basis of the current buffer status?

How to plan for the next week on the basis of the current buffer status? – With the help of VIRTUAL BUFFER.

Virtual Buffer "After Replenishment"– shows the projected buffer status after the replenishment from production has arrived.

On Thursday morning the production planner sees the current buffer status. When the planner inserts the quantities into the daily slots of the production plan, the projection is made to determine what will be the buffer status at the end of the next week. This is VIRTUAL BUFFER.

Since the file with the data is updated daily with the adjustments to consumption from the buffer and replenishment to the buffer that happened in the previous day, then at a certain time point daily we see the actual amount of units in the buffer and the projected amount at the end of the week with account of the amounts that are in the production plan to be produced until the end of the week.

On Thursdays, the objective of the production planner is to build "the basis" for the production plan for the following week. and then EVERY DAY to do the necessary changes to respond to the actual changes in the buffers.

KEEP IM MIND THAT THE BUFFER STATUS (hence, urgency of production orders) IS DETERMINED ONLY BY THE STATUS ON HAND – the quantities available for sale.

So far we have only looked at the projection of the buffer status after the arrival of the replenished quantities during the next week.

However, during the next week there may also be the consumption from the buffer (or may not).

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING
EXPERIENCE

TOC Strategic Solutions

How to plan for the next week on the basis of the current buffer status?

Virtual Buffer "After Replenishment with deduction of average daily sales"– shows the projected buffer status after the replenishment from production has arrived with deduction of average daily sales.

The calculation is made on the basis of Virtual Buffer After Replenishment. For every day of the next week we project the consumption from the buffer in the amount of average daily sales for this period (with account of growing or decreasing trend), and the difference is calculated between the replenishment quantities arriving in the buffer from production, and the quantities calculated as "consumed" by the moment the buffer was replenished

It is important to remember that this projected "consumption" form buffer may actually not take place. However, the replenishment to the buffer WILL take place as the quantities have already been put in the plan,

Therefore the virtual buffer **"After Replenishment with deduction of average daily sales"** only has the informative value.

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING EXPERIENCE

This is how the next week production plan looks on 23 March - Saturday

0	0	0	0	0	0	0		581
0	0	0	0	0	0	0		69
4000	0	0	0	0	0	0		16916
100	0	0	0	0	0	0		113
1500	2500	2000	0	0	0	0		13463
0	0	0	0	0	0	0		111
0	0	1000	0	0	0	0		1021
0	0	500	0	0	0	0		-34
0	0	0	0	0	0	0		1237
500	0	0	0	0	0	0		1706
0	0	0	0	0	0	0		335
0	0	0	0	0	0	0		94
0	0	0	0	0	0	0		11
0	0	0	0	0	0	0		410
0	500	0	0	0	0	0		891
0	0	0	0	0	0	0		36
0	0	0	0	0	0	0		181
0	0	100	0	0	0	0		69

Changes in the plan as response to the buffer status (and more) on 25 March - Monday

0	0	0	0	0	0	0		604
0	0	0	0	500	0	0		569
4000	0	0	0	0	0	0		19606
100	0	0	0	200	0	0		326
1500	2500	2000	0	0	0	0		13394
0	0	0	0	0	0	0		111
0	0	1000	0	0	0	0		991
0	0	500	0	500	0	0		946
0	0	0	0	0	0	0		1237
500	0	0	0	0	0	0		1706
0	0	0	0	0	0	0		335
0	0	0	0	0	0	0		94
0	0	0	0	0	0	0		11
0	0	0	0	0	0	0		410
0	500	0	0	0	0	0		891
0	0	0	0	0	0	0		36
0	0	0	0	0	0	0		181
0	0	100	0	0	0	0		69

The objective of planning

The objective of planning – is NOT to endanger availability in stock buffers.

www.tocpractice.com

Sixth International TOCPA Conference

18-19 May, 2013, Moscow, Russia

TOC Strategic Solutions

TOCPA
Theory Of Constraints
Practitioners Alliance

SHARING EXPERIENCE

Response to buffer status – as of 16 May

On hand	Buf sta tus	-	Today	Today +1	Today +2	Today +3	Today +4	Today +5	Today +6		Virtual Buffer end of 7 day period	Gra de	Virtual Buffer with deducting average daily sales – end of 7 day period
18	98%		800	0	0	0	0	0	0		818	5	555
-153	115%		700	0	0	0	0	0	1000		1547	5	1265
-27	100%		3000	0	5200	0	2000	2800	0		12973	3	5764
2,168	76%		0	1000	0	4000	2000	0	0		9168	4	5621
23	99%		1000	0	0	0	0	0	1000		2023	5	1308
1,010	50%		180	0	0	0	0	0	1000		2190	5	1044
757	47%		0	0	0	0	0	0	500		1257	5	256
106	95%		0	0	0	0	0	0	2000		2106	0	503
611	43%		0	0	0	0	0	0	0		611	5	-145
1,630	-31%		0	0	0	0	0	0	1000		2630	5	1762
976	0%		0	0	0	0	0	0	507		1483	5	797
51	80%		0	0	150	0	0	0	0		201	3	144
-102	168%		0	0	250	0	0	0	0		148	3	84
532	38%		0	0	0	0	200	0	0		732	5	130
1,238	16%		0	0	0	0	0	0	0		1238	5	6
958	20%		0	0	0	0	0	0	0		958	5	118
365	61%		0	0	300	0	0	0	0		665	5	14
1,521	-52%		0	0	0	0	0	0	0		1521	5	1371
1.276	15%		0	0	0	0	0	0	0		1276	5	902

Level of availability