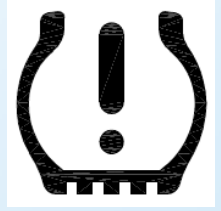


Tyre Pressure Monitoring Systems

**OICA position on
GRRF/2009/10
(proposal for a new UNECE
regulation on TPMS)**



Summary - TPMS

- **Development of draft Regulation**
- **Content of draft Regulation**
- **Comparison of warning thresholds**
- **Consequences of an eventual adoption of the draft Regulation by GRRF**
- **Conclusions**
- **Annexes**

Development of draft Regulation

To come to an official proposal for a draft text, the GRRF informal group on TPMS needed

- 4 plenary meetings (Nov 2007-Oct 2008),
- 9 additional meetings of 2 task forces,
- one special coordination meeting for finalisation.

⇒ Even if not all parties feel happy with the text proposal, more informal meetings will not lead to a solution that satisfies every stakeholder.

Content of draft Regulation (1)

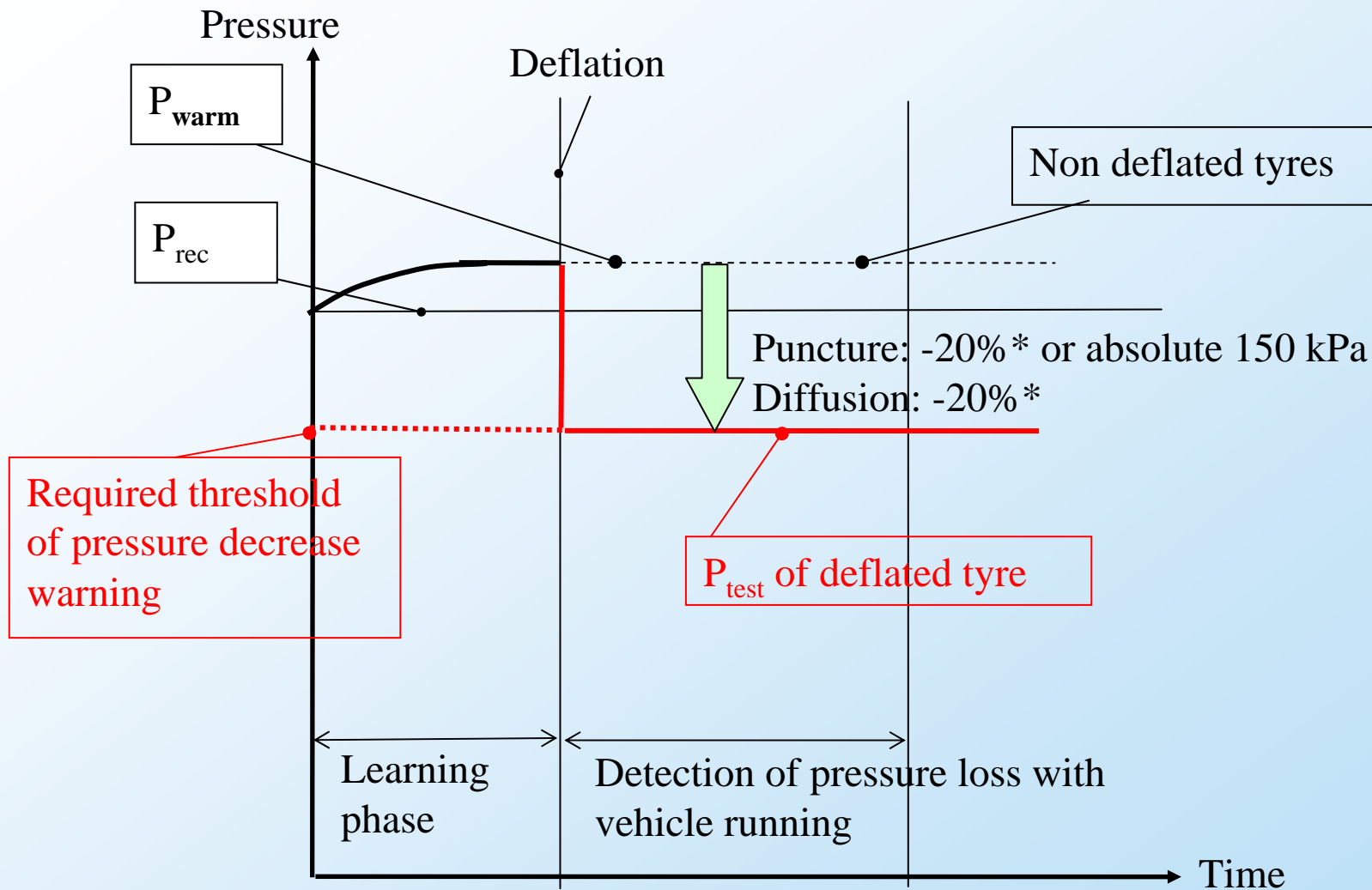
Three main requirements for type-approval:

Puncture test : Detection of an underinflation in one tyre at the latest 10 minutes after P_{warm} has decreased by 20% or to an absolute pressure of 150 kPa.

Diffusion test : Detection of an underinflation of four tyres at the latest 60 minutes after P_{warm} has decreased by 20%.

Malfunction test : Detection of a TPMS malfunction at the latest in 10 minutes.

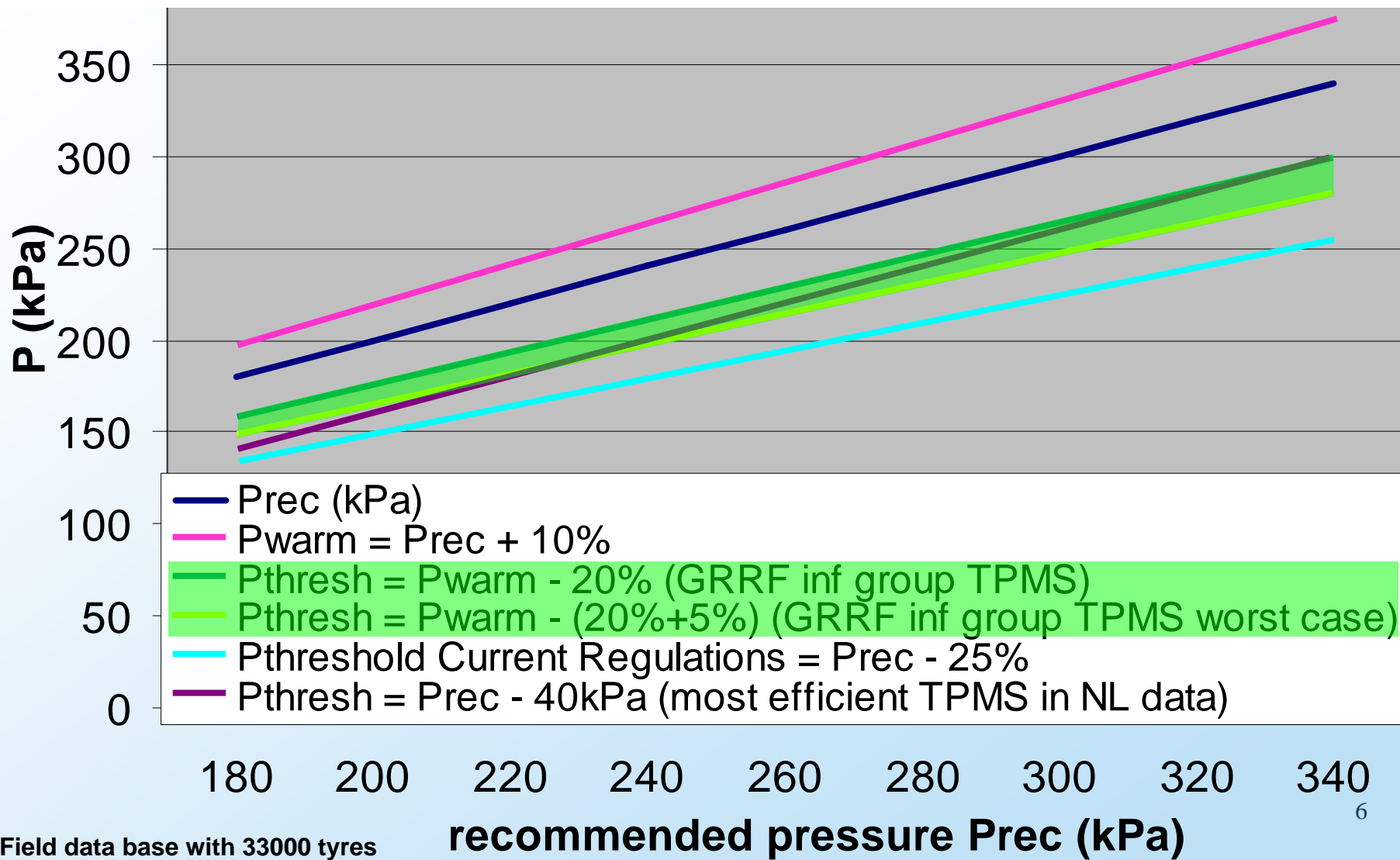
Content of draft Regulation (2)



*: A tolerance of 5% shall be added to deflation percentages for the actual test.

Comparison of warning thresholds

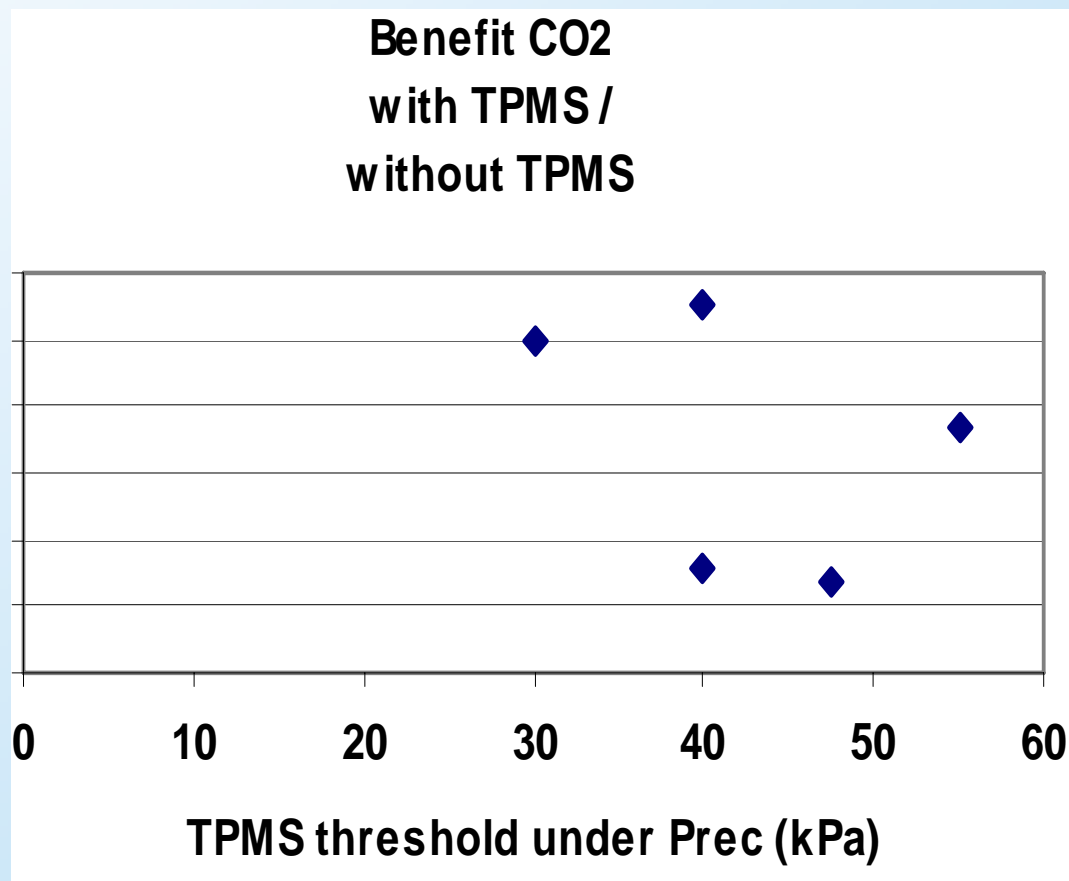
⇒ The requirements proposed by the GRRF informal group are more severe than current regulations and than the most efficient TPMS in the NL data base*.



*: Field data base with 33000 tyres

Why more severe requirements would not increase the benefit? (1)

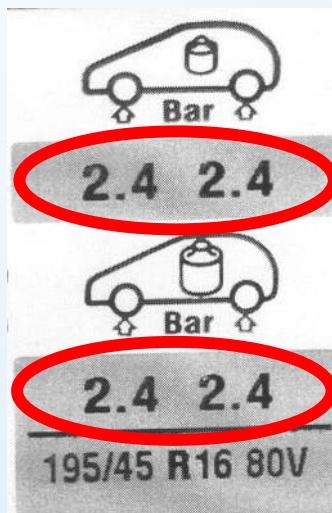
The NL field data* has shown that the real world benefit of a given TPMS system is not linear to its warning threshold.



Why more severe requirements would not improve the benefit? (2)

A tight threshold is understandable to the user in case of one unique value for P_{rec} .

However, such severity becomes nonsense if P_{rec} varies in a wide range.



Luftdruck für kalte Reifen
Tire pressure cold tires
Pression des pneus froids
Presión neumáticos fríos

Range of 90 kPa

		bar		psi	
bis up to / jusqu'à / hasta	210 km/h / 130 mph	2,0	29	2,0	29
über / over / plus de / más de	210 km/h / 130 mph	2,1	30	2,3	33
		2,4	35	2,9	42

Winterreifen: Winter tires: + 0,3 bar + 4 psi
Pneus hiver: Neumáticos de invierno: + 0,3 bar + 4 psi
Pneus échauffés: Neumáticos calientes:

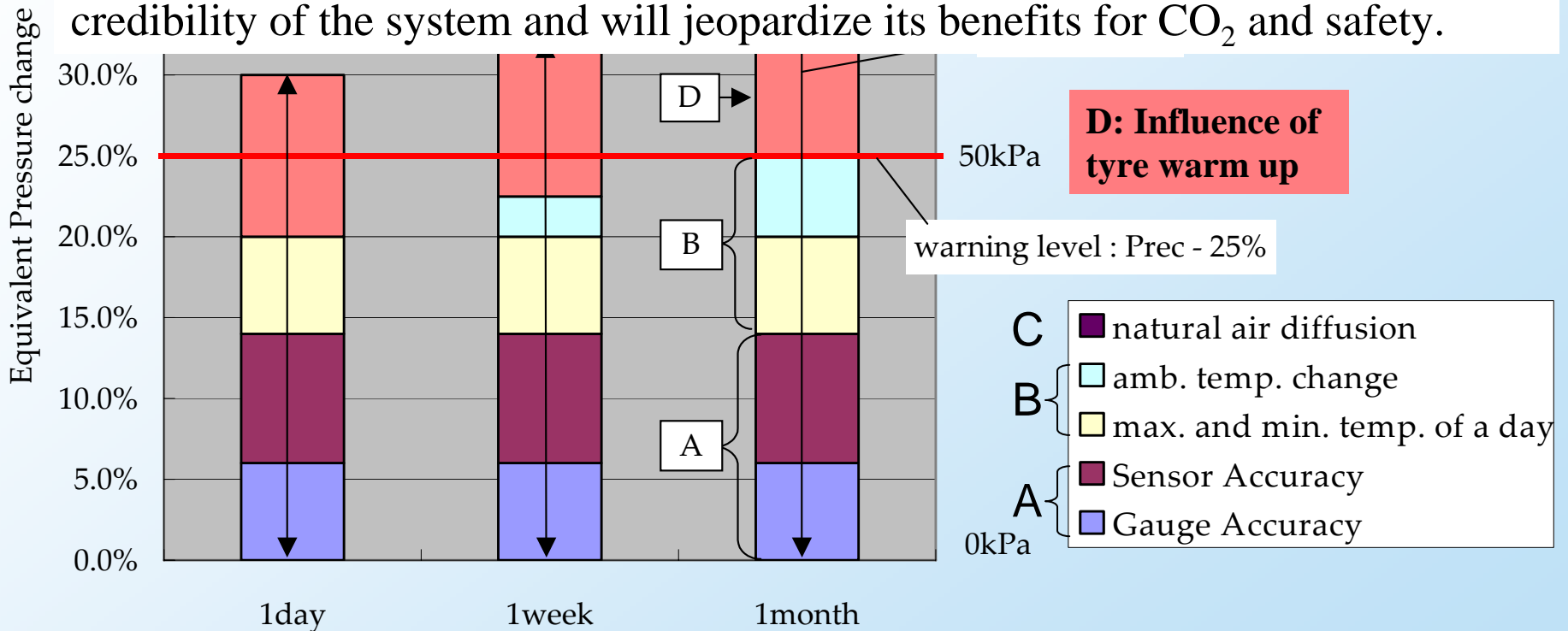
	bar/psi/kPa	
175/65 R14	1-3	4-5
195/50 R15	2,1/31/210 *	2,4/35/240
195/45 R16	2,2/32/220 *	1,8/26/180
205/40 R17		2,8/41/280
195/60 R15	2,1/31/210	2,6/37/260
*DIESEL	2,3/33/230	

Range of 140 kPa

A fine pressure adjustment according to the actual service conditions is nearly impossible. In consequence, a TPMS alert threshold which is closer to P_{rec} than 25% is not appropriate.

Why more severe requirements would not improve the benefit? (3)

In consequence, even with some degree of temperature compensation, a warning at $P_{\text{warm}} - (20\%+5\%)$ is already risky. As this may lead to false warnings (too early TPMS warning in the case of minor pressure changes), it will harm the credibility of the system and will jeopardize its benefits for CO₂ and safety.



Already within one day, especially in regions with extreme climate conditions (e.g. Scandinavia), the measured tyre inflation pressure may vary by up to 30% (without considering load changes).

Consequences of an eventual adoption of the draft Regulation by GRRF (1)

- The European Union has foreseen to require in its territory the installation of a TPMS which is conform to the future UNECE Regulation for all M1 vehicles.
- The introduction dates for the mandatory installation are actually discussed between the European Commission, the Parliament and the Council.
- Proposed dates for New Types:
01/11/2011 (Parliament), 29/10/2012 (Commission)
- Proposed dates for New Registrations:
01/11/2013 (Parliament), 29/10/2014 (Commission)

Consequences of an eventual adoption of the draft Regulation by GRRF (2)

- As for low recommended inflation pressures* even the most efficient TPMS in the NL data base does not comply with the requirements of the draft proposal for the new UNECE Regulation on TPMS,
 - Vehicle manufacturers have to start a cost and time intensive development from the day the UNECE regulation is adopted.
 - It is uncertain today whether this development will permit to meet the performance requirements, the proposed introduction dates and an acceptable level of customer acceptance.

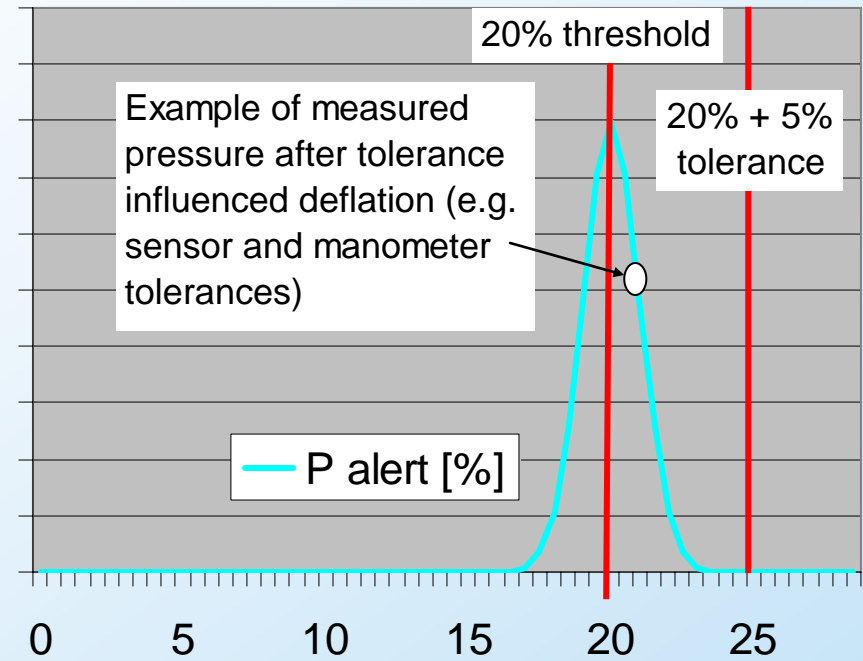
* : See Comparison of performance levels on page 6

Conclusions

- Level of severity of proposal GRRF/2009/10
 - The new UNECE Regulation would become the toughest existing regulation in force
 - Highly demanding to the manufacturers
 - Making it more demanding would
 - not be acceptable to the user
 - not be feasible with current air gauge infrastructure
 - not fit daily user situation

The draft proposal provides the maximum meaningful level of stringency for a TPMS and will result in the best achievable CO₂ and safety benefits.

Test tolerances



Tolerance to the test method:

- a. In its **internal technical specification**, the manufacturer must aim an alert at **20%** deflation to ensure approval at 25% deflation.
- b. Without this test tolerance, systems would have to be designed to detect a 15% deflation. However, this is **not acceptable for the user** and **cannot guarantee robustness** of the system during the lifetime of the vehicle.

Clarification “indirect system”

- Current TPMS focus on safety
- CO2 emission reduction is a side effect of current TPMS
- New regulation mainly aims CO2 reduction making the side effect becoming the main target
- Direct systems and second generation indirect systems (which are not yet in the NL data base) are able to detect a 4 tyre pressure loss.
- Conclusions
 - There is a need to redesign both type of TPMS direct and indirect according to this new target.
 - Current TPMS cannot be compared to future systems, for instance a simple run-flat-warning system may not bring any CO2 benefit because it has not been designed for this objective.

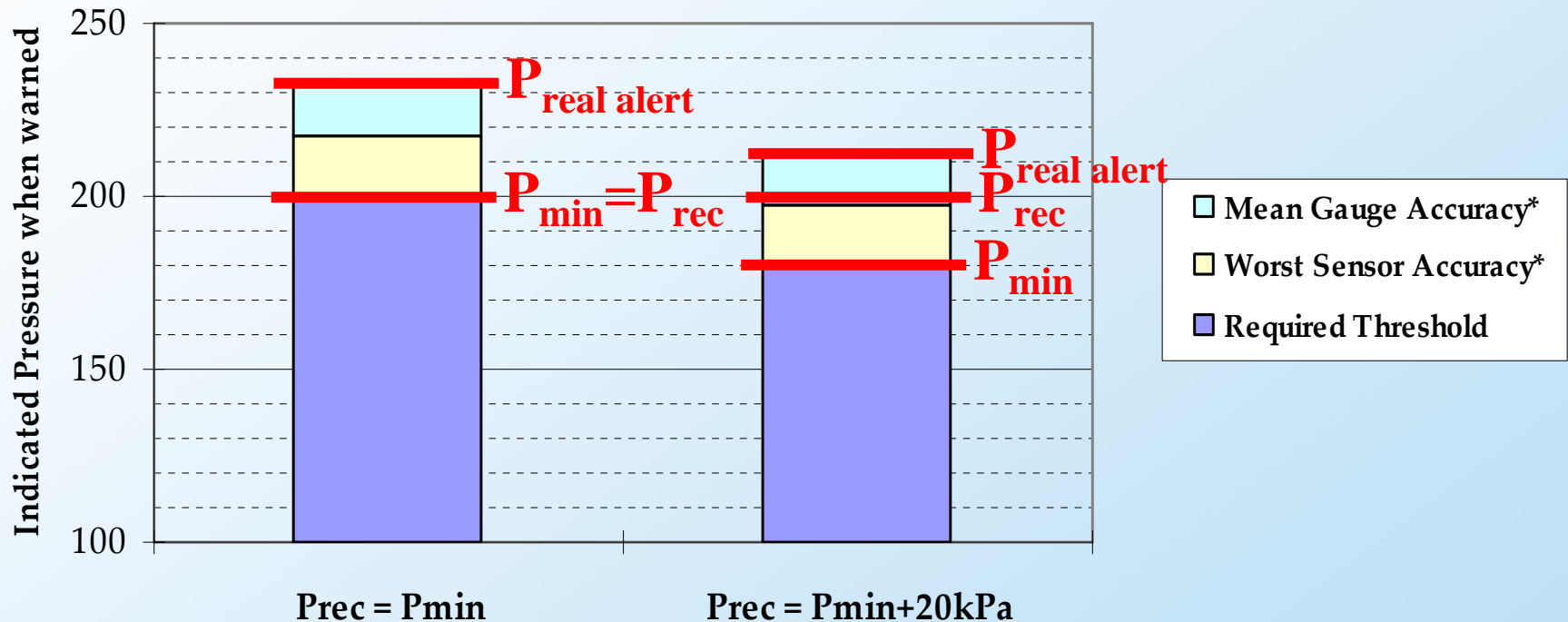
Term “indirect system” is too general and hence has to be used with differentiation between 1st and 2nd generation

Why is a regulatory alert threshold at “ P_{\min} ” unrealistic? (1)

- For decades, a lot of vehicles have been designed and put on the market with a recommended cold inflation pressure P_{rec} which is equal to P_{min} (minimum cold inflation pressure P_{min} as defined by tyre industry).
 - These vehicles - with or without TPMS - are safe and nobody, neither tyre manufacturers nor authorities, has raised any specific safety concern about this practice until now.
- Would the fitment of TPMS make these vehicles dangerous?
 - These vehicles are safe without TPMS and OICA believes that TPMS will even enhance the safety level of these vehicles.
- When defining P_{min} , tyre industry applies already a certain safety margin to prevent any legal risk even in extreme cases.
 - There is a lack of data showing that slight temporary tyre inflations under P_{min} will directly lead to accidents.
- For vehicles with $P_{\text{rec}} = P_{\text{min}}$, it is impossible to apply a TPMS alert threshold of P_{min} (see next slide).

Why is a regulatory alert threshold at “ P_{min} ” unrealistic? (2)

Example: $P_{rec} = 200\text{kPa}$; Regulatory alert threshold = P_{min}



If the alert threshold is set to P_{min} , TPMS systems have to give the alert at a higher pressure than P_{rec} . This is unacceptable for the user.

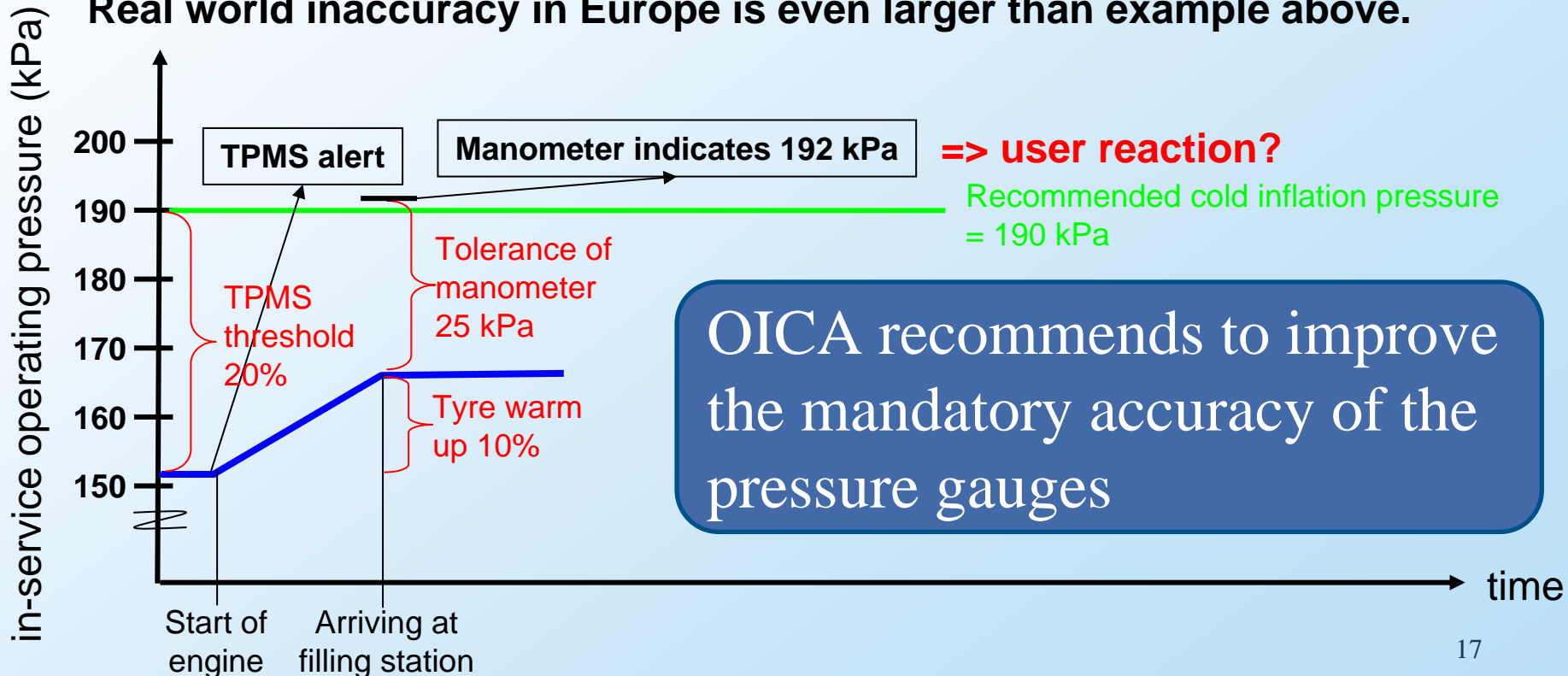
*: Mean square root method is used for addition of Sensor Accuracy and Gauge Accuracy.

Accuracy of infrastructure

Recall of legal tolerance of manometers:

According to European Directive 86/217/EEC, for tyre inflation pressures up to 400 kPa, the maximum error of a manometer shall be not greater than $\pm 8\text{kPa}$ (\Rightarrow amplitude of 16 kPa). According to national calibration laws (e.g. Germany), the error may increase up to factor 2 (\Rightarrow amplitude of 32 kPa) during the service life of a manometer.

Real world inaccuracy in Europe is even larger than example above.



Annexes

1. User acceptability
2. Daily pressure variations
3. Cost assessment

Annex 1: User acceptability

- **Why** not setting tighter warning thresholds or detection times?
Because this would lead to system warnings in situations where it is not appropriate, e.g.
- due to large changes in temperature within one day
- when the vehicle has passed from sun to dark or after car wash
- when a vehicle has been parked in a cold garage in summer
- when the outside pressure changes (short term weather changes, vehicle travels from mountain down to the valley, etc.)
- when the pressure gauge at the service station is not properly calibrated (every time the driver adjusts the pressure).

An average driver would either

- Over-inflate the tyres (loosing safety due to reduced road adhesion), or
- Disregard the TPMS warning (loosing all expected benefits)

Annex 2: Daily pressure variations

➤ The four major factors that influence the tyre pressure are:

1. The driving profile (tyre temperature)
2. The ambient temperature
3. The ambient atmosphere pressure
4. The vehicle load conditions

➤ By nature, on a vehicle in use

1. The tyre temperatures vary
2. The ambient temperatures vary according to time and place
3. The ambient pressure varies according to the altitude and weather
4. The load conditions vary

Even if it is theoretically possible to take all those factors into account, this would dramatically increase the cost of TPMS and decrease the ratio benefit/cost.

Annex 3: Cost assessment

- Use of second generation indirect systems:
 - TPMS based on software & advanced data processing
 - Uses existing ESC sensors
 - Average cost per vehicle in 2014 $\approx 8\text{€}$
 - Maintenance cost over vehicle lifetime $\approx 0\text{€}$

- Use of direct systems:
 - TPMS needs additional equipment (separate sensors, radio communication system, special wiring, etc.)
 - Need to replace the components during the lifetime of the vehicle
 - Average cost per vehicle in 2014 $\approx 52\text{€}$
 - Maintenance cost over vehicle lifetime $\approx 354\text{€}$