

Process Safety Leading Indicator

Luc Schoonacker

Corporate Process Safety manager Europe, Asia & International

LyondellBasell Benelux BV,

A LyondellBasell Company

Implementing Process Safety LIs

To Improve HSE Performance

Cefic-Brussels

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LyondellBasell

59 plants in
18 countries

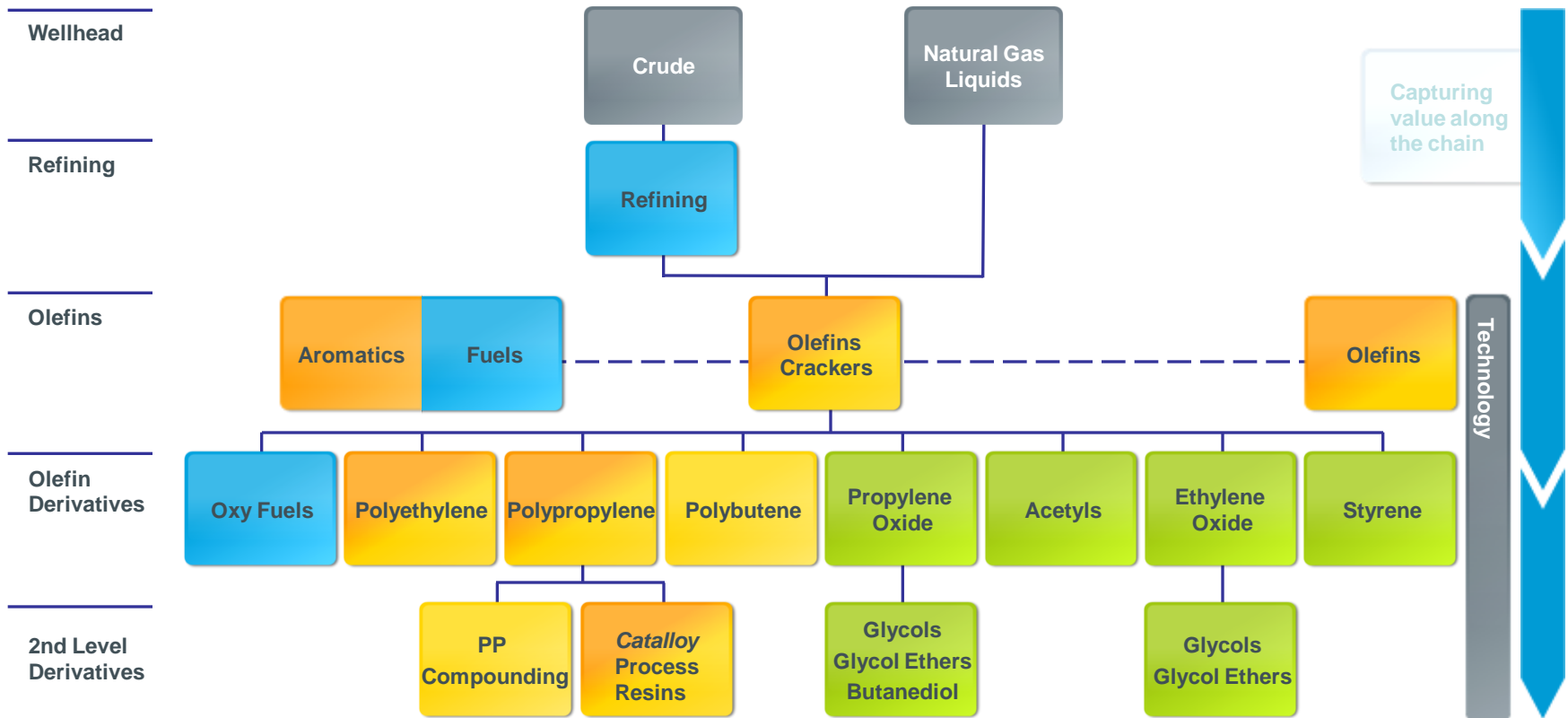
More than
14,000 employees
worldwide

Sales in
more than
100 countries



Owned and operated by LyondellBasell, its subsidiaries and/or joint ventures

Diversified & vertically integrated portfolio



Olefins & Polyolefins Americas

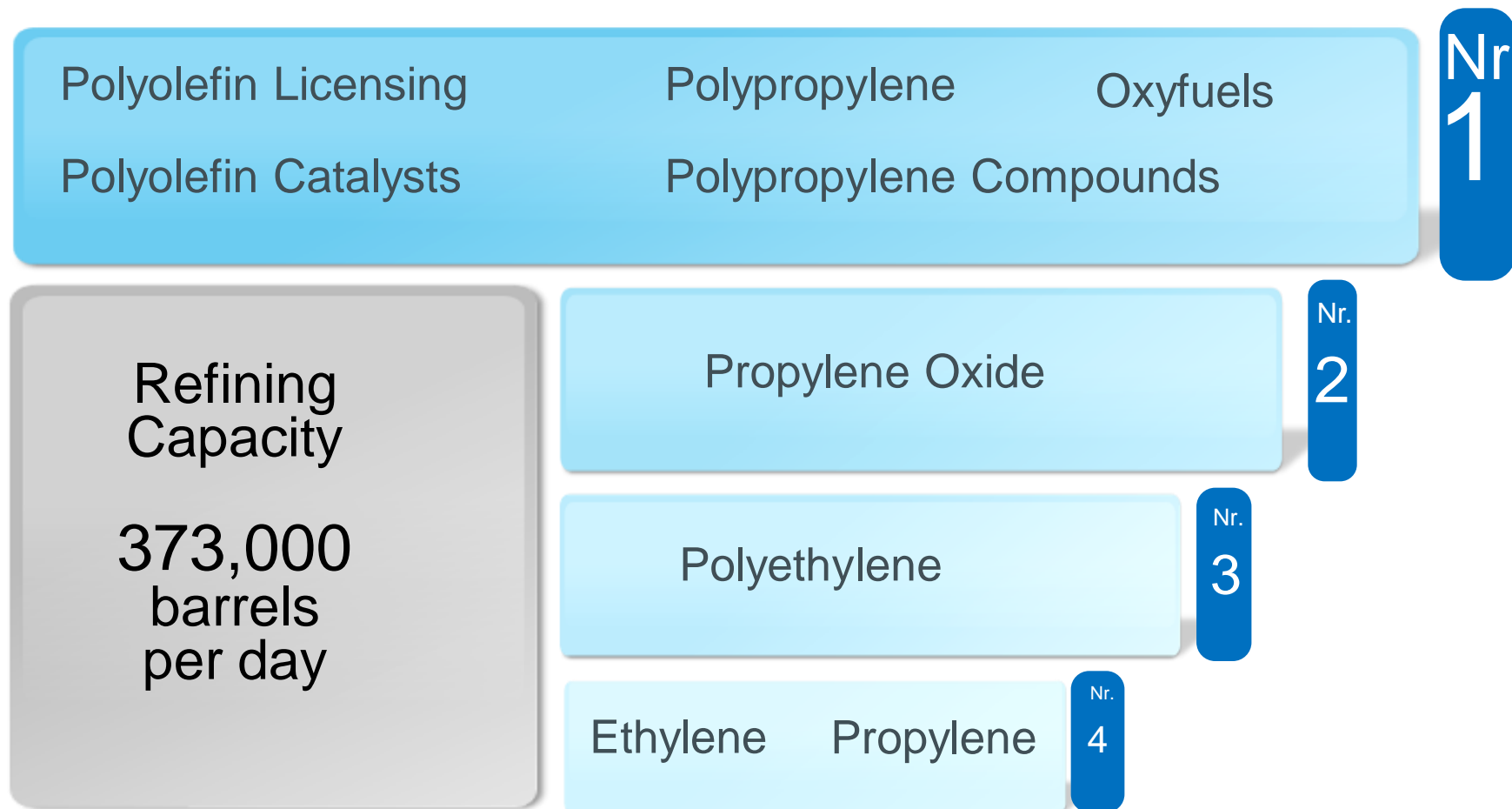
Olefins & Polyolefins Europe Asia & International

Intermediates & Derivatives

Refining & OxyFuels

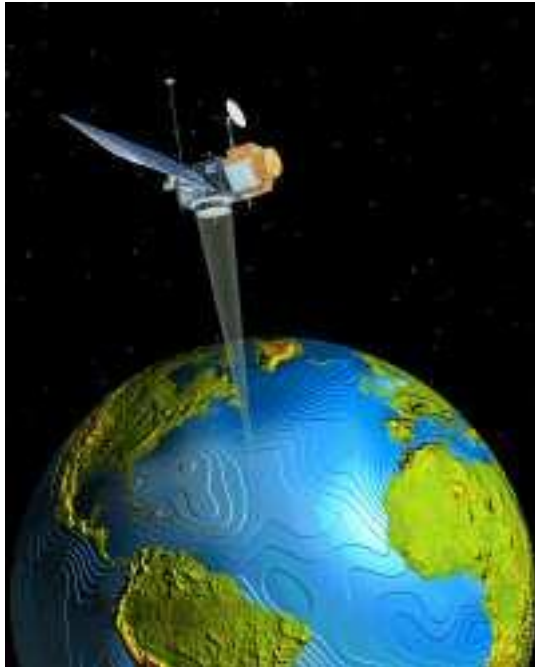
Technology

Global rated capacity rank*



*Sources: CMAI, Chemical Market Resources, DeWitt and LyondellBasell AF's internal data.

Note: Capacities and worldwide capacity position are as of December 31, 2009, except for Technology worldwide capacity position, which is as of December 31, 2008, and include our pro rata share of joint ventures.



Process Safety Performance Indicators

Navigating to HSE Success
And GoalZero

Fundamental Concept

- How well are we managing process safety.
- Why process safety performance indicators can help us manage process safety better.

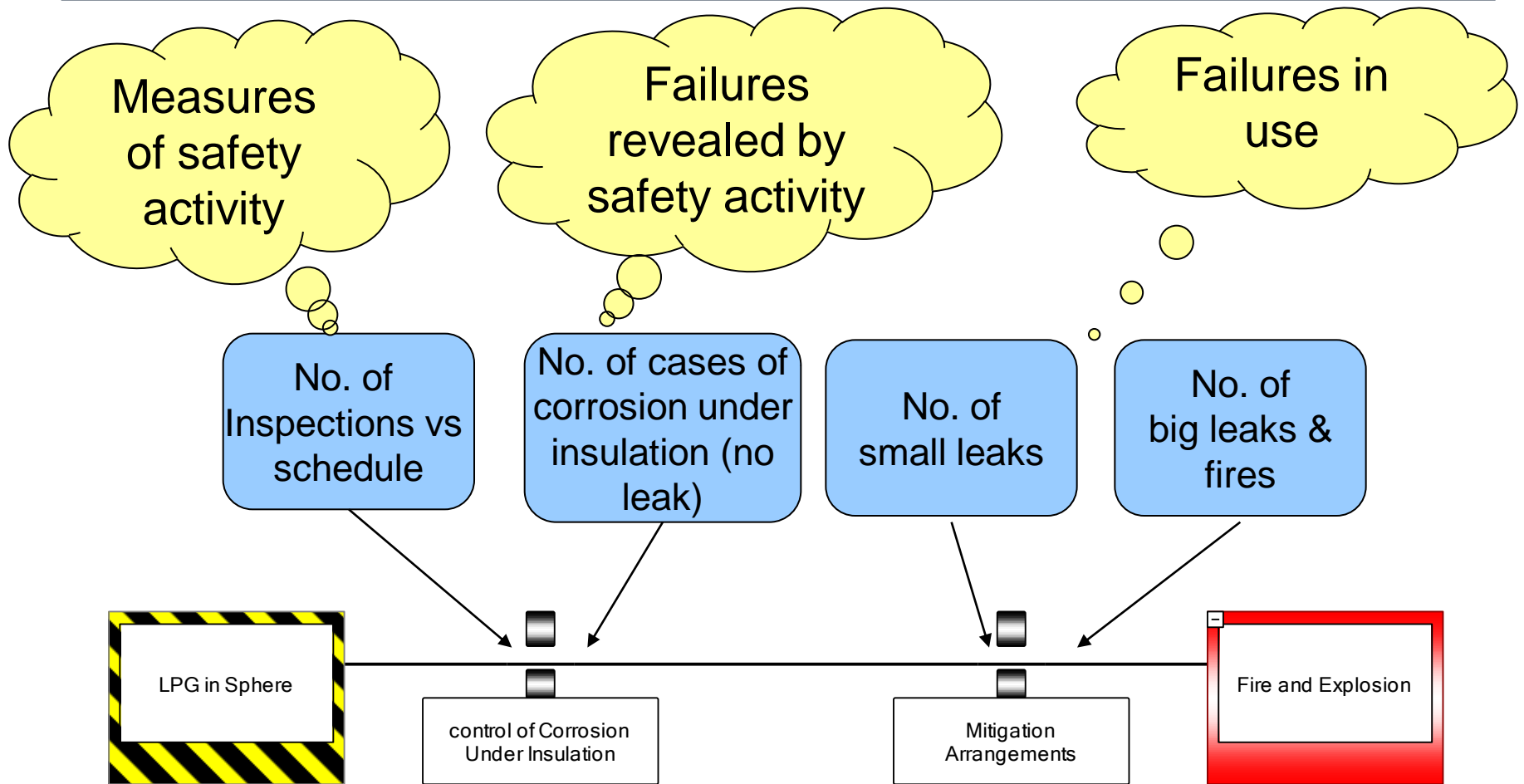
Are we managing risk adequately?

- TRR is falling
- Plant reliability is rising
- Quality performance is increasing
- and accruals for HSE bonuses have been increased
- So why should we worry?

What are the trends

- We know that incidents are happen
 - Texas City
 - ConocoPhillips Humberside
 - Buncefield
 - Etc
- But if TRR is improving, the benefits must be cascading to major accident hazards as well mustn't they?

Leading or lagging?



Hopkins A. (2009), *Thinking about process safety indicators*. Safety Science **47** 460-465

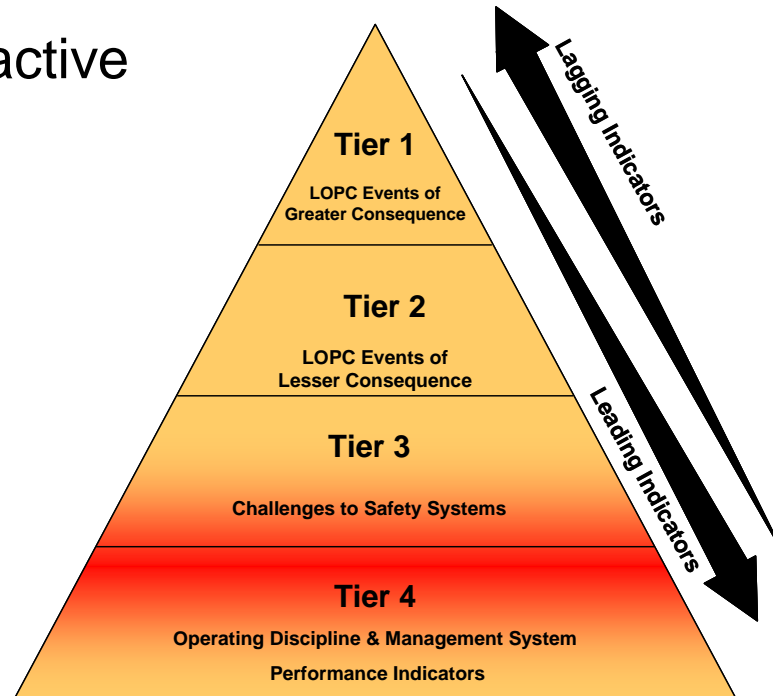
Why Process Safety ?

- Inevitable Important
- Numerous consequences when getting it wrong:
 - Asset damage
 - Business Interruption
 - Environmental impact
 - Harm to workers
 - Etc.
- A common pitfall:
 - “Seeing process safety as identical of occupational and see the latter as an indicator of General Safety”
- Most obvious measures of process safety are:
 - Loss of containment
 - Other process safety incidents

“lagging Indicators” (reactive Measure)

Why Leading Indicators ?

- To be more proactive



- To use indicators that reflect activities which are positively impacting on process safety

Why Leading Indicators (2)?

- Give confidence and assurance
 - “process safety is not only under control but also subject to continuous improvement”
- Good performance in Leading Indicators feeds forward to good performance in Lagging Indicators.
- Continuous improvement equates to continuous risk reduction

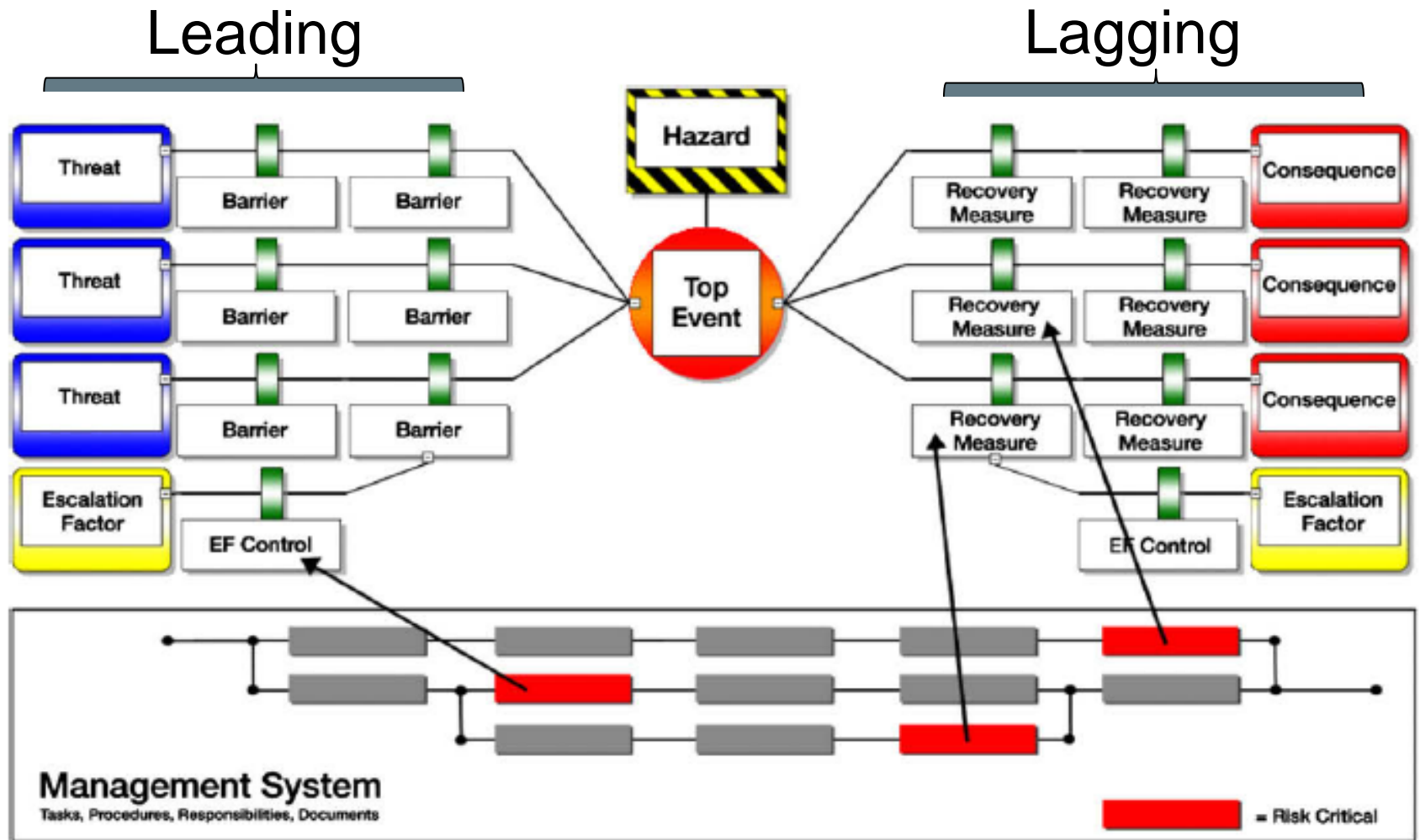
Learning By Example

- The most common found indicators are:
 - Mechanical Integrity
 - % of inspections done vs schedule
 - Action Item follow up
 - PHA actions completed
 - Audit actions completed
 - Process near misses actions completed
 - Training/Competence
 - % of people successfully trained (tests)
 - How complete roles in process safety are defined and assigned.

The Journey Towards Implementation

- Process safety indicators shall not be seen as a solely safety technical exercise
- Winning management commitment and engaging the workforce is absolutely essential
- Implementation is not an overnight activity (typically requires 3-5 year)
- It is presumed the company has policies, procedures and practices in place
- The system will need a proper level of resources, both in setting up and in data collection
- Choice between being prescriptive or allow sites to choose their own relevant Leading Indicators.

The Bow Tie



Which Indicators to Select?

- Selected indicators need to be meaningful and reflecting the true risk by identifying the hazards
- The organization should use the keywords:
 - “what could lead to a loss of containment” to identify a vulnerability profile
- Process safety risk found throughout the operations
 - Linked to measuring the function of critical safety systems or procedures. E.g. Management of Change, Process Hazardous Analysis, Permit to Work, etc.

Which Indicators to Select (2)?

- It is important to select indicators that directly show how well the systems are working in practice
- Leading indicators are typically linked to measuring the functioning of critical systems or procedures
- For generic barriers it is conceivable to consider indicators that are measuring the completeness of a program
- Data for certain indicators may be obtained by reviewing on a sample basis the execution of critical tasks
- Incident causes and which indicators could have signalled the need for timely intervention

Learning By Experience (EPSC-members)

- Don't try to measure everything: “start with a pilot”
- It's not about the quantity of indicators but about the quality of the information given by them and how you use it
- Legal compliance indicators are not recommended
- Leading indicators originate at plant level where the hazards are
- As with any reporting, it will appear that performances becoming worse before it improves. “on reporting, the submerged parts are becoming visible”
- Review the validity of leading indicators

Further Remarks

- Leading indicators are one of the key success factors to good process safety performance
- The process around leading indicators can be more valuable than the numbers themselves,
 - “No measurement without recording, no recording without analysis and no analysis without action”

Three types of process safety metrics in LyondellBasell

Locally Chosen Measures of safety activity

- Drive continual improvement
- Definitions reviewed and revised by the site to keep driving improvement

Standard Measures of safety activity

- Measure compliance with, and effectiveness of Operational Excellence Processes
- Definitions are fixed

Failures in use & Failures revealed by safety activity

- Defined in incident reporting standard
- 6 Levels defined by consequence
- Review and analysis by sites and corporate

Three types of process safety

Been applying these since 2003 with only minor adjustments

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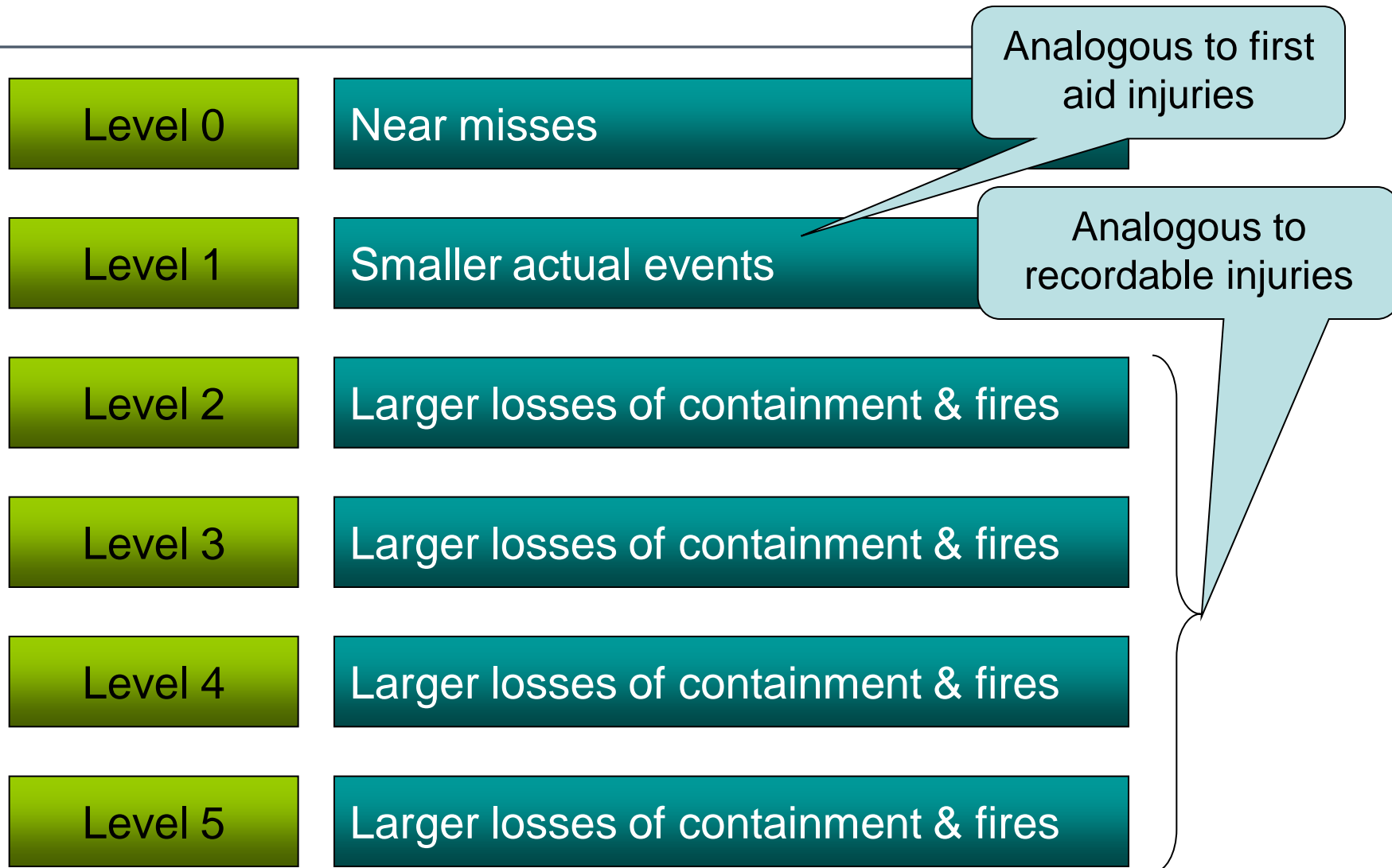
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Failures in Use and Failures Revealed by Safety Activity



Level 1 Process Safety Metrics

1. Loss of Primary Containment (LOPC) resulting in:
 - An outdoor release of 50 Kg to 500 Kg of a flammable or 2.5 Kg to 25 Kg of an acute toxic.
 - An indoor release of 5 Kg to 50 Kg of a flammable or 1 Kg to 2.5 Kg of an acute toxic.
2. Explosion or Fire with a direct cost of less than \$25,000
3. Electrical Fault
4. Safety Related Protective System Called Into Operation
5. Safety Related Protective System Found Inoperative
6. Safety Related Unplanned Shutdown by Manual Intervention
7. Safety Critical Variable Limit Exceedance
8. Auto-Refrigeration Event

Three types of process safety metric

Work in progress

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Standard measures of safety activity

Operational Excellence Processes

Contractor Safety Relationship
Work Permitting
Operation Certification and Recertification
Asset Integrity - Deficiency Management
Asset Integrity - Preventative Maintenance and Inspection Compliance
Safety Critical Variables and Equipment
Environmental Management
PHA and Process Risk Management
Facility and Building Siting
Emergency Response
Management of Change
Incident Reporting and Classification
Investigation
Alarm and Controller Management
Self assessment

Each process has metrics defined, for example ...

Overdue A and B Priority Risks
Past Due Scheduled PHAs
Past Due PHA Action Items
A Priority Risk Count
B Priority Risk Count

Count of Controllers in Manual
Alarms/Hour/Operator
Standing Alarms/Operator
Peak Alarm Rate/10 min/Operator

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Locally Chosen measures of safety activity

- Each site required to select 5 of their own
- Required attributes of the metrics:
 - Support continual improvement
 - Drive appropriate behaviour
 - Emphasise achievements rather than failures
 - Be precise and accurate
 - Be difficult to manipulate
 - Be owned and accepted by the people involved in related work activities and those using the metrics
 - Be easily understood
 - Be cost-effective in terms of data collection
- Monitoring arrangements in the site need to be defined
- Sites should periodically review and revise

All these things are auditable.

Conclusions

It's not about measuring. It's about managing.

A successful PSPI programme is one which creates a simple tool
that senior managers use
to constructively engage in process safety.

Thank you.

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