System Safety for the O&G Industry

What will it take?

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April 19, 2012

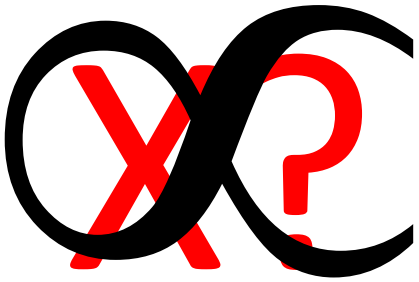
By the way, regarding shear rams: They do work sometimes...

Behavior Safety::Process Safety

Concepts that may have outlived their usefulness

Lesson learned from BP Texas City ?

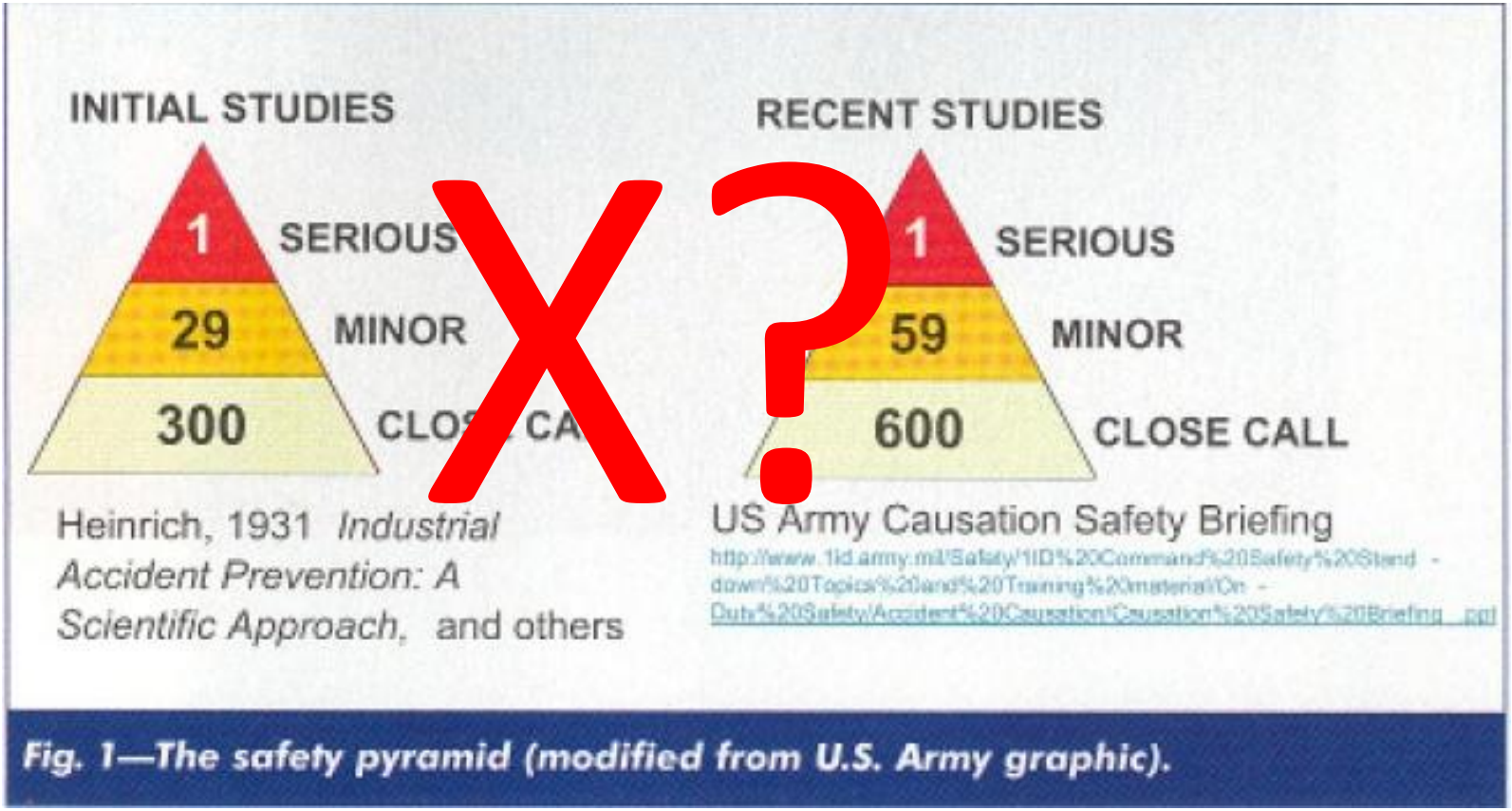
Slips, trips, falls



Process incidents

Safety Pyramid

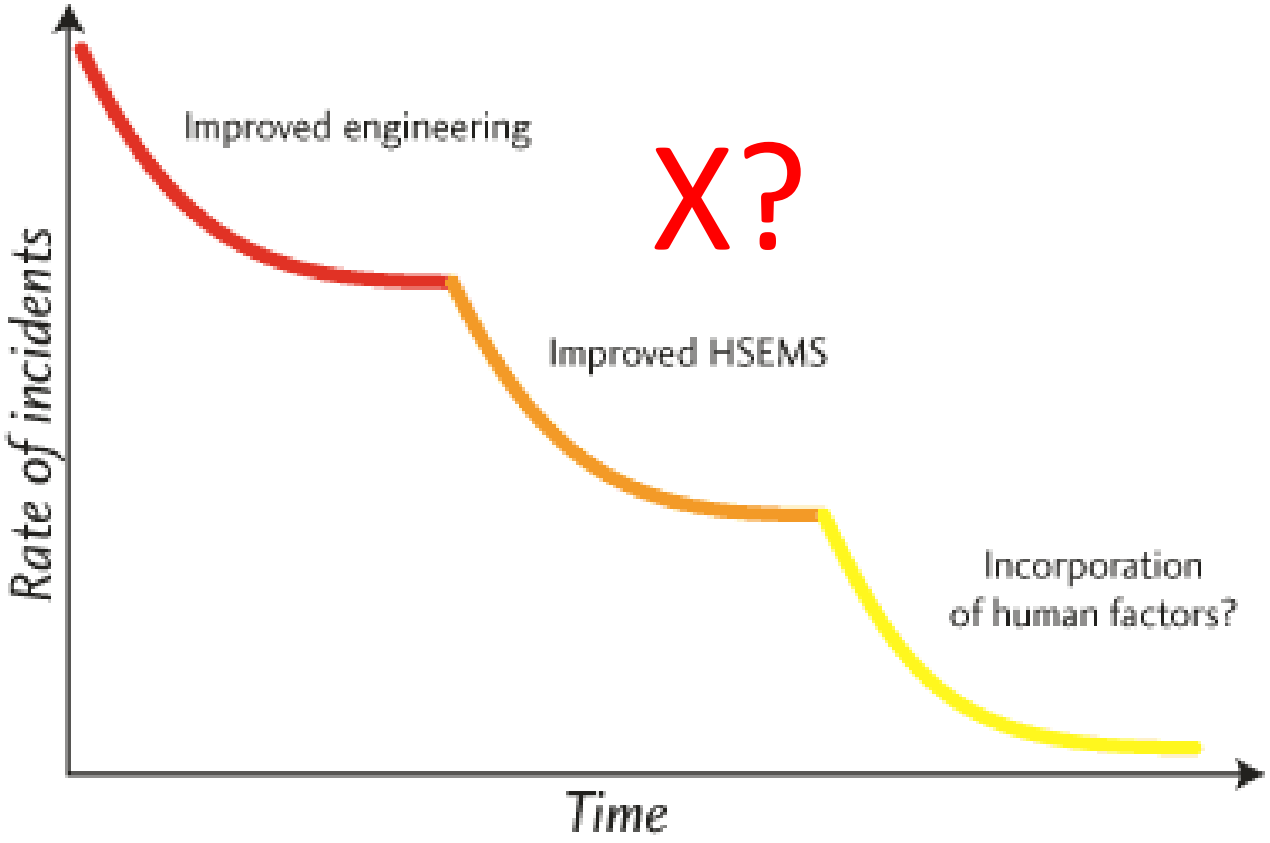
Concepts that have outlived their usefulness



SPE JPT April, 2004

Another well entrenched concept that needs to be disposed of?

Concepts that may have outlived their usefulness



Confusion between occupational safety and system safety

Personal safety focuses on

- Changing individual behavior
- Controlling injuries to employees on the job

Process (system) safety focuses on

- Design of system in which behavior occurs
- Preventing major losses

Result: Managing to the wrong feedback

Example: Using “days off from work” as a measure of system safety between occupational safety and system safety

Dr. Leveson, http://www.ioconf.no/2011/video

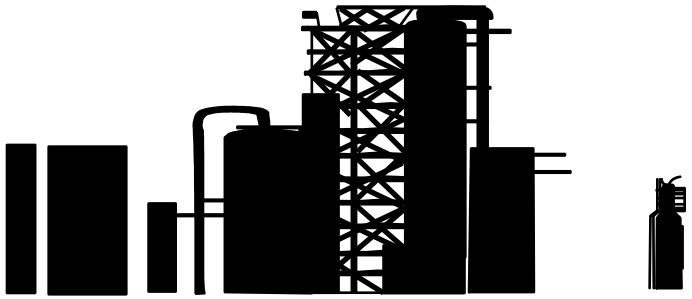
Caution: In O&G Industry

Process Safety =X? System Safety

What is PSM?

Comprehensive, Systematic Management Approach that Integrates:

Engineering Controls & Technologies
Safe Work Practices
Training
Management Practices



And...

There are 14 Elements in the Process Safety Management regulation:

1) Process Technology
2) Process Hazards Analysis
3) Operating Procedures and Safe Work Practices
4) Management of Change - Technology
5) Personnel Training and Performance
6) Contractor Safety and Performance
7) Management of Change - Personnel
8) Incident Investigation and Communication
9) Emergency Planning and Response
10) Auditing
11) Quality Assurance
12) Mechanical Integrity
13) Pre-Startup Safety Reviews
14) Management of "Subtle" Changes

But, PSM is not:

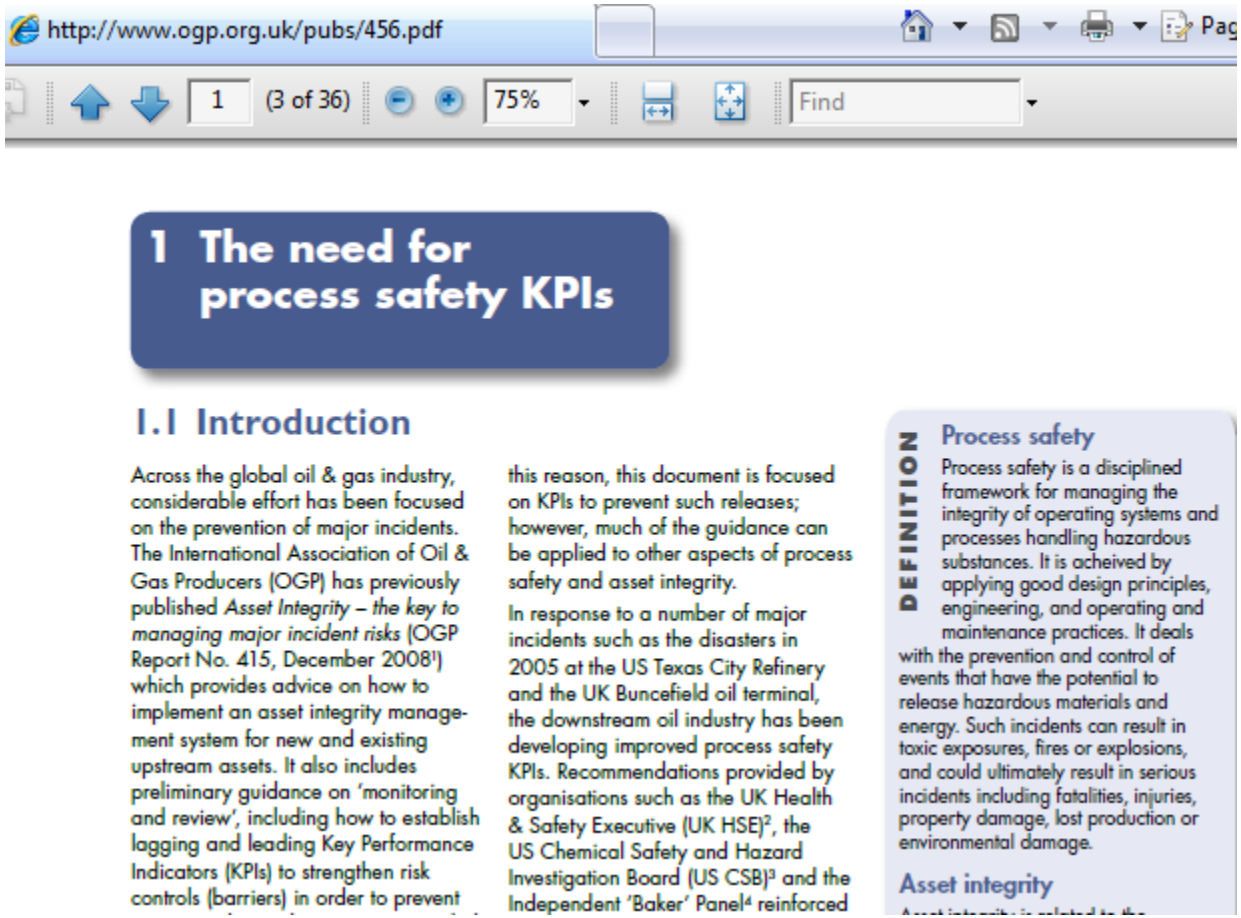
- Exceptions

- Hydrocarbon fuels used solely for workplace consumption as a fuel
- Flammable liquids stored in atmospheric storage tanks
- Retail facilities
- Oil & gas drilling or servicing operations
- Normally unoccupied remote facilities

Perhaps...

this has changed under new rules? It has for some companies.

Process Safety in the Oil Industry



Swiss Cheese KPIs = Process Safety?

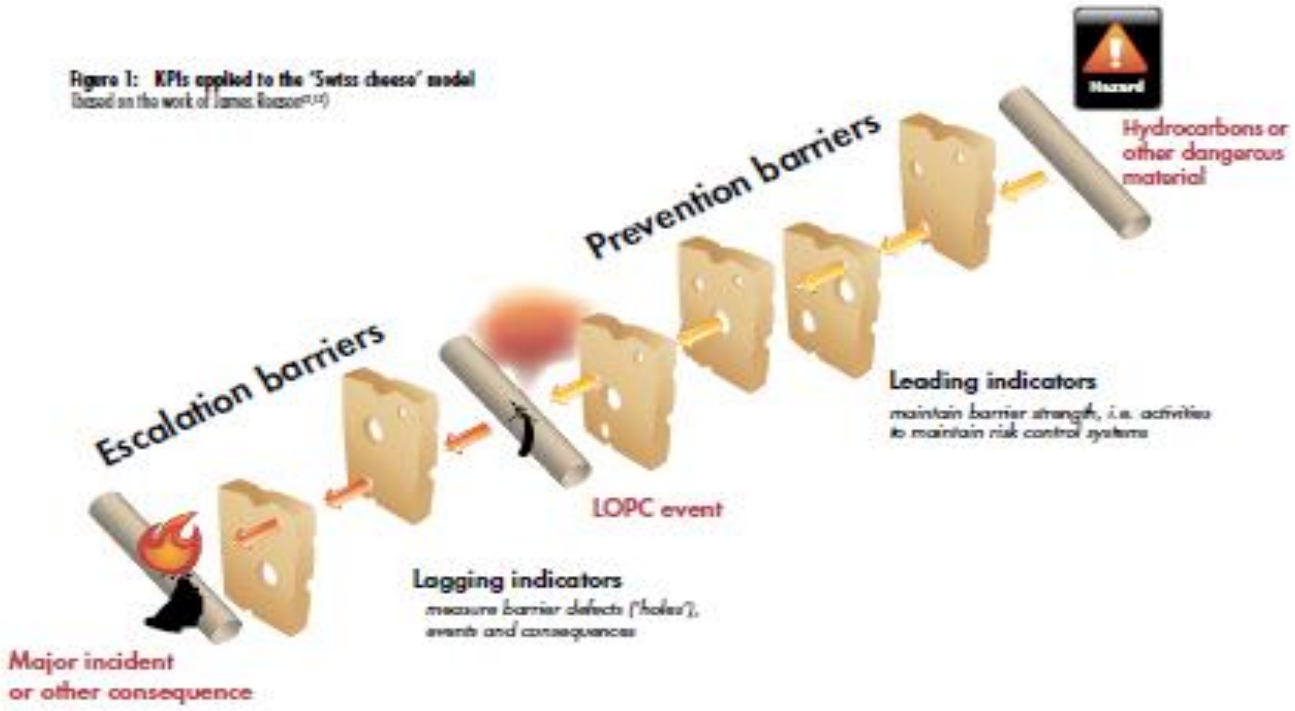
in Figure 1 using the 'Swiss cheese model' (after James Reason, 1990[12] and 1997[13]). The same principles underpin other similar approaches such as the 'bow tie' model or 'layers of protection analysis' (LOPA).

Hazards are contained by multiple protective 'barriers' or 'risk control systems'. The barriers – represented here by individual 'slices of Swiss

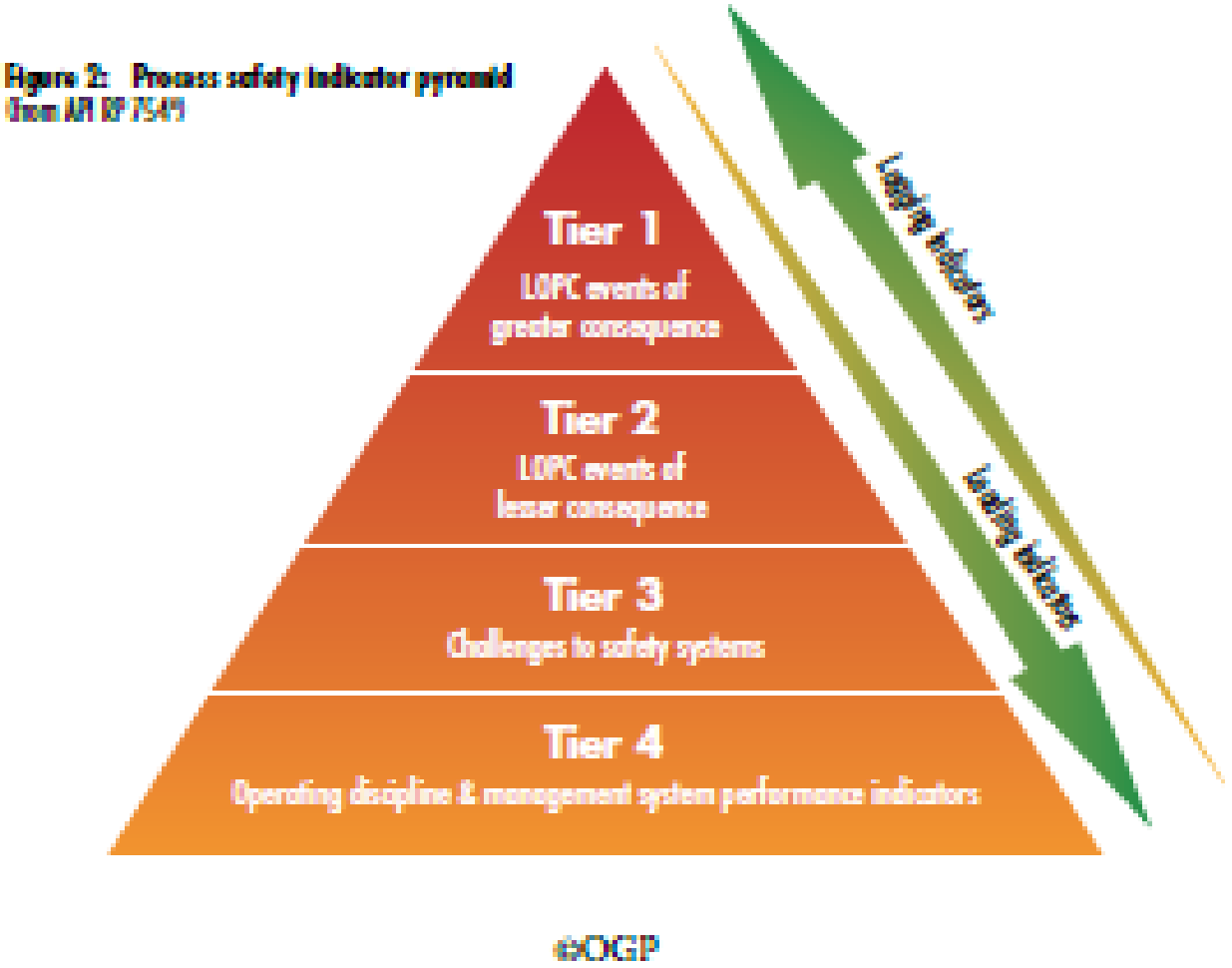
which is the predominant cause of major process safety incidents in our industry. Barriers can have weaknesses, depicted as 'holes' in the Swiss cheese. The alignment of holes in the

harm can result from a fire, explosion or other destructive incident.

Figure 1: KPIs applied to the 'Swiss cheese' model
Based on the work of James Reason[12,13]



New Triangle?



API RP 754 – Are we on the same page?

Table 1 – process safety event definitions, reproduced from API RP 754

Tier 1 Indicator Definition and Consequences

A Tier 1 Process Safety Event (PSE) is a loss of primary containment (LOPC) with the greatest consequence. A Tier 1 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g. steam, hot condensate, nitrogen, compressed CO_2 or compressed air), from a process that results in one or more of the consequences listed below:

- An employee, contractor or subcontractor 'days away from work' injury and/or fatality;
- A hospital admission and/or fatality of a third-party
- An officially declared community evacuation or community shelter-in-place
- A fire or explosion resulting in greater than or equal to $25,000 of direct cost to the Company
- A pressure relief device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:
  - liquid carryover
  - discharge to a potentially unsafe location
  - an onsite shelter-in-place
  - public protective measures (e.g., road closure)

  and a PRD discharge quantity greater than the threshold quantities in Appendix B in any one-hour
- A release of material greater than the threshold quantities described in Appendix B in any one-hour period

Tier 2 Indicator Definition and Consequences

A Tier 2 Process Safety Event (PSE) is an LOPC with lesser consequence. A Tier 2 PSE is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials (e.g. steam, hot condensate, nitrogen, compressed CO_2 or compressed air), from a process that results in one or more of the consequences listed below and is not reported in Tier 1:

- An employee, contractor or subcontractor recordable injury;
- A fire or explosion resulting in greater than or equal to $2,500 of direct cost to the Company;
- A pressure relief device (PRD) discharge to atmosphere whether directly or via a downstream destructive device that results in one or more of the following four consequences:
  - liquid carryover
  - discharge to a potentially unsafe location
  - an onsite shelter-in-place
  - public protective measures (e.g., road closure)

  and a PRD discharge quantity greater than the threshold quantities in Appendix B in any one-hour period
- A release of material greater than the threshold quantities described in Appendix B in any one-hour period

Note: Non-toxic and non-flammable materials (e.g., steam, hot water, nitrogen, compressed CO_2 or compressed air) have no threshold quantities and are only included in this definition as a result of their potential to result in one of the other consequences.

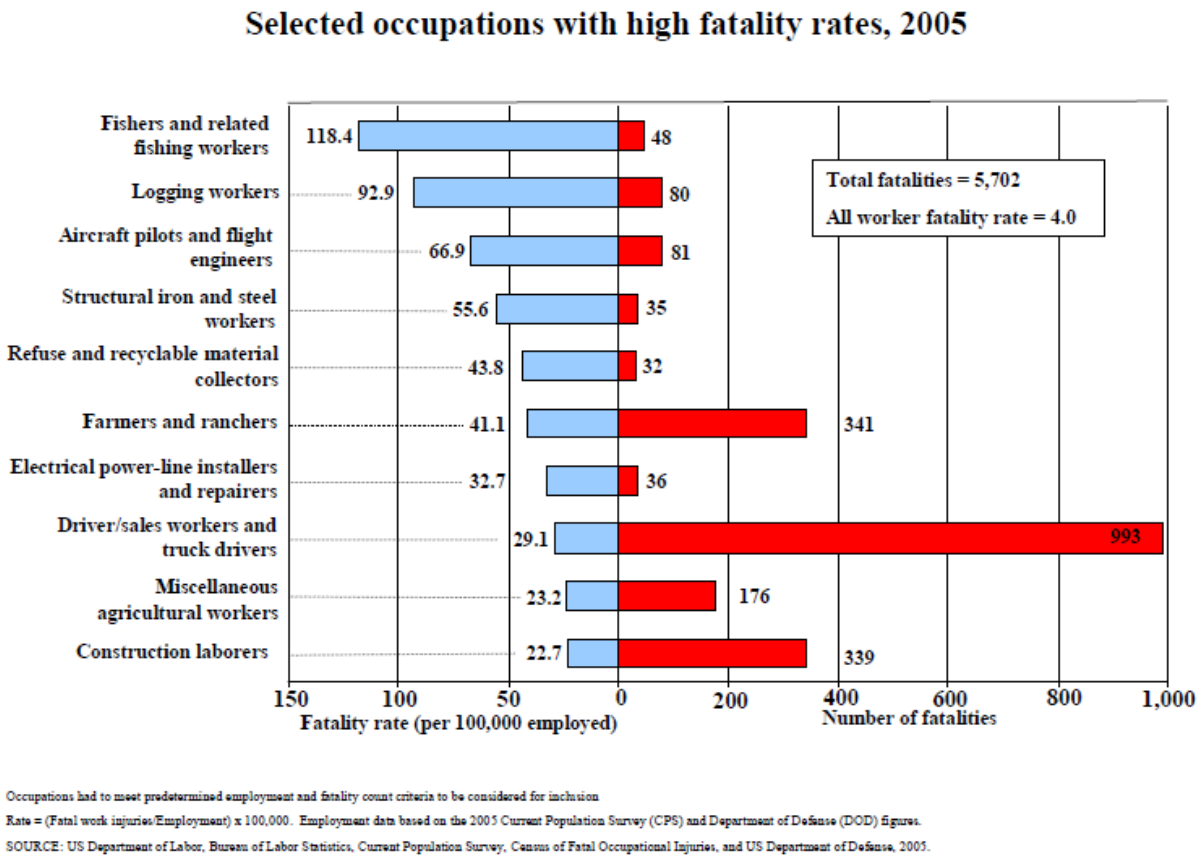
Behavioral or Process?

A nod to ”Environmental”?

Perhaps ”System Integrity” to include System Safety, Process Safety, HSE?

Behavioral or Process?
How about System Integrity?

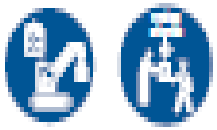
Behavioral or Process?



Transportation and material moving occupations accounted for the highest number of fatalities of any major occupational group (1,543 fatalities, up 2 percent from 2004). Fatalities among motor vehicle operators accounted for 71 percent of all fatal work injuries in this

Life Saving Rules

The OGP Life-Saving Rules can be grouped into four broad categories.

OGP Core Life-Saving Rules		OGP Supplemental Life-Saving Rules
	Personal safety	
	Driving	
	Site safety	
	Control of work	

Lately (last ~15years) I hear more talk about....

- Risk
- Recordables
- Forward looking
- Lagging, Leading indicators
- High Potential near misses
- Symptoms
- Values
- PMT – Performance Management
- PE – Production Excellence

...but not much about Process Safety (except in chemicals divisions)

...only most recently from SPE, API, OGP

Conclusion

System Safety/Process Safety/System Integrity has made it to the agenda. But there is a long way to go to implement it in the Upstream Oil and Gas Industry