Learning's from Major Process Safety Incidents

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Objective

To share Learning's from Major Process Safety Incidents and how the application of a Operations Risk Management Model can significantly reduce the probability of and consequence from such an incident

My background

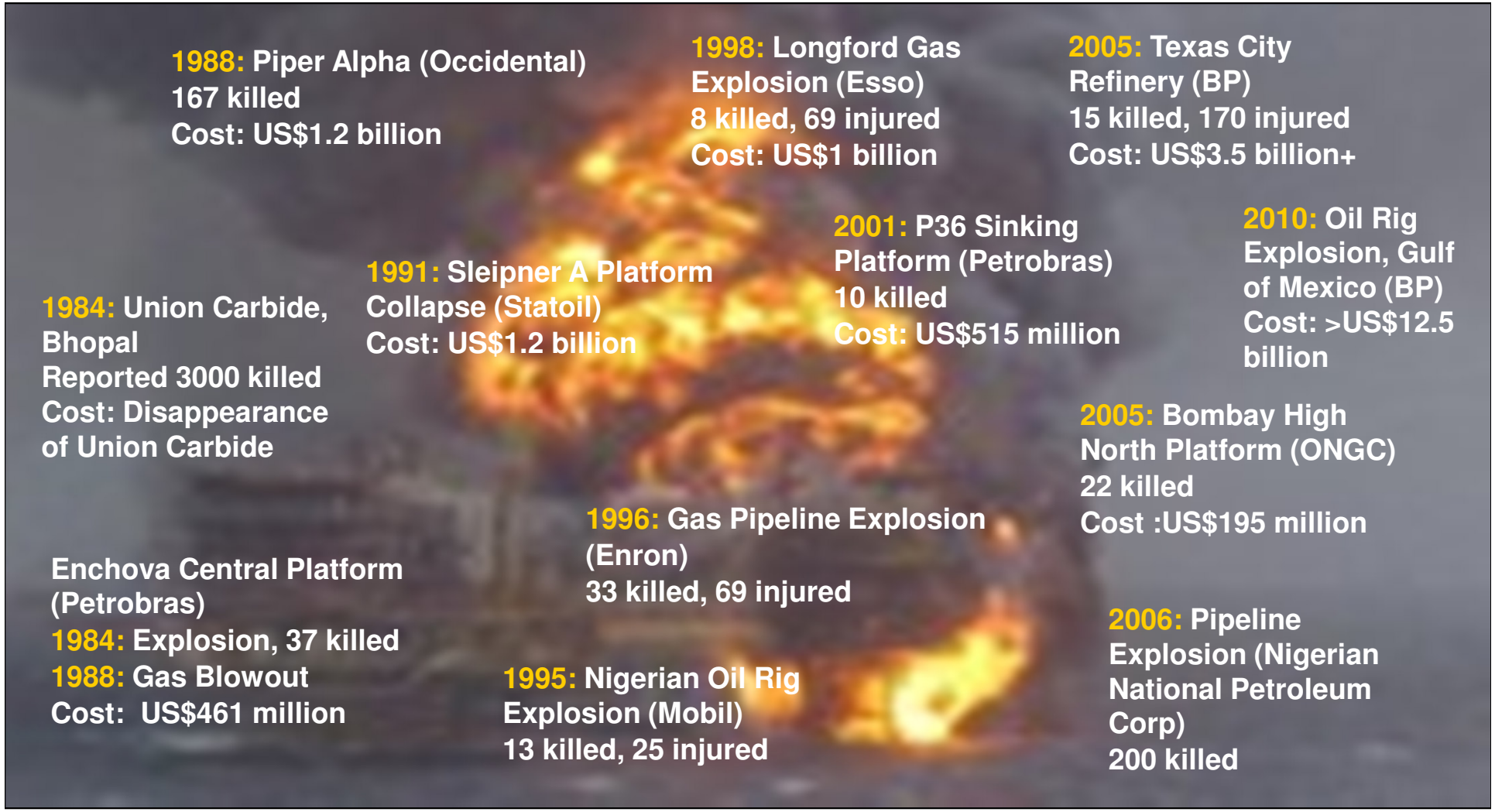
- I am a Chemical Engineer by training and an experienced operations leader
- I am currently the Global PSM Practice Leader for DuPont Sustainable Solutions
- I am committed to helping organizations and facilities achieve zero process safety incidents while improving viability and sustainability

"We preach what we practice"

Safety is a DuPont Core Value

- **Core values: Safety, ethics and respect for people and the environment**
- **$32 Billion revenue, 13 business units from electronics to plastics, paints and agricultural chemicals. Sustainable Solutions is the services oriented business unit**
- **Over 175 facilities around the world**
- **Worldwide reputation for safety**
- **DuPont applies a single Operational Risk Management system worldwide**

Major Industrial Incidents



Defining Risk

- **Risk** is the potential for loss, calculated by combining possible or foreseeable **consequences** with realistic **probability (or frequency)** of occurrence.
- **Operational risk** is a portion of a business's total risk profile, specifically the operations or process related aspects—potential losses resulting directly from the business's operations.

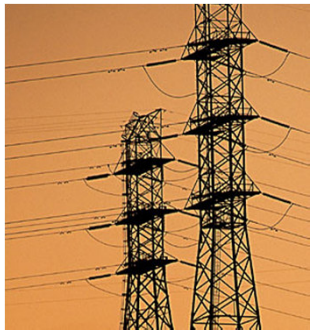
Typical Operational Risks

- Employee / Public Health and Safety
- Environmental Damage
- Physical Assets
- Business Interruption

- Regulatory Compliance
- Reputation, Public Support and Right to Operate
- Employee Retention / Morale
- Product Liability
- Business Value / Market Capitalization
- Community Economic Impact

Top Operational Risk Factors

- Inadequate identification / evaluation of operational risks
- Integrity of facilities
- Competing priorities, i.e., production, quality, costs
- Insufficient resources, both quantity and capabilities
- Inadequate management of change
- Weak compliance-to-procedures culture
- Failure to manage process safety risks differently from workplace safety
- Weak audit function
- Ineffective leadership



What Is Operational Risk Management?

An **integrated management system** that identifies, evaluates, and controls a manufacturing process' operational risks in a way that catastrophic incidents are prevented that could impact:

- People **– the public, employees and contractors**
- The Environment **– local community / work sites**
- Business **– lost assets, business opportunities, loss of customers, loss of shareholders**

DuPont Operational Risk Management Model

Why the Model Works for Successful Companies

- Management leadership and commitment is in the center of the wheel. Core Value
- A robust Managing System that identifies, evaluates and mitigates process risks at all stages of a facility's life cycle
- Operational Discipline encircles all the technical elements
- A single governance process
- Integrated into all business processes
- Flexible and adaptable to many industries

Learning's from Major PSI's

1. **Every element of the Operational Risk Management Model is important**

A Typical Incident RCFA

PSM Elements Analysis	Performance (vs. system)	System deficient
Management Leadership and Commitment	☒	☒
Technology		
Process Technology	☒	☒
Process Hazards Analysis	☒	☐
Operating Procedures and Safe Work Practices	☒	☒
Management of Change – Technology	☐	☐
Facilities		
Quality Assurance	☐	☐
Pre-Startup Safety Reviews (PSSRs)	☐	☐
Mechanical Integrity	☒	☒
Management of Change – Facilities	☐	☐
Personnel		
Training and Performance	☐	☒
Contractor Safety and Performance	☐	☐
Incident Investigation and Communication	☐	☐
Management of Change – Personnel	☒	☒
Emergency Planning and Response	☐	☐
Auditing	☒	☐

DuPont 1H2011 PSM Trends – PSM Elements

PSM Technical Elements

Mechanical Integrity	30%
Operating Procedures/SWP's	18%
Training and Performance	17%
Process Technology	13%
Quality Assurance	5%
MOC- Technology	4%

Top 4 for past 5+ years

Most Frequent NEP PSM Citations

1910.119(x)(x)

- (f)(1) Operating procedures……..49
- (d)(3) PSI pertaining to equipment ……47
- (e)(3) PHA specific criteria……..40
- (j)(4) MI Inspection & Testing ……32
- (e)(5) PHA recommendation F/U ……..16
- (j)(5) Deficient Equipment……16
- (l)(1) MOC implementation ……..15

OSHA adds value to business, work and life

Learning's from Major PSI's

1. **Every element of the Operational Risk Management Model is important**
2. **Every element requires a managing system**
   - **Ownership and accountability (who)**

Table of Contents

   - **Standard of expectations / subject matter expertise (what, when, where)**

PSI Standard

   - **Metrics, Audits and Continuous Improvement (how and why)**

2010 Site Metrics

First Party Audits

   - **Data management (how)**

Learning's from Major PSI's

1. **Every element of the Operational Risk Management Model is important**
2. **Every element requires a managing system**
   - **Ownership and accountability (who)**
   - **Standard of expectations / subject matter expertise (what, when, where)**
   - **Data management (how)**
   - **Metrics, Audits and Continuous Improvement (why)**
3. **Every element is dependent on other elements, creating the need for a holistic, interdependent and integrated complete managing system**

Baker Panel Recommendations

The Panel was charged with making recommendations to improve BP's corporate safety culture, corporate oversight of process safety, and process safety management systems.

RECOMMENDATION #2 – INTEGRATED AND COMPREHENSIVE PROCESS SAFETY MANAGEMENT SYSTEM

BP should establish and implement an integrated and comprehensive process safety management system that systematically and continuously identifies, reduces, and manages process safety risks at its U.S. refineries.

Baker Panel Recommendation #2

RECOMMENDATION #2 – INTEGRATED AND COMPREHENSIVE PROCESS SAFETY MANAGEMENT SYSTEM

From the Commentary on Recommendations:

(1) *"integrated and comprehensive management system"*—In order to be effective, a management system for process safety must be comprehensive; a weak or fragmented system will not address all of the numerous process safety risks that exist in BP's U.S. refineries. Among other things, this comprehensive management system should

(b) utilize an integrated set of leading and lagging performance indicators for process safety as described in Recommendation #7

Example. A minor incident investigation

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DuPont Process Safety Management Model

DuPont Process Safety Management Model

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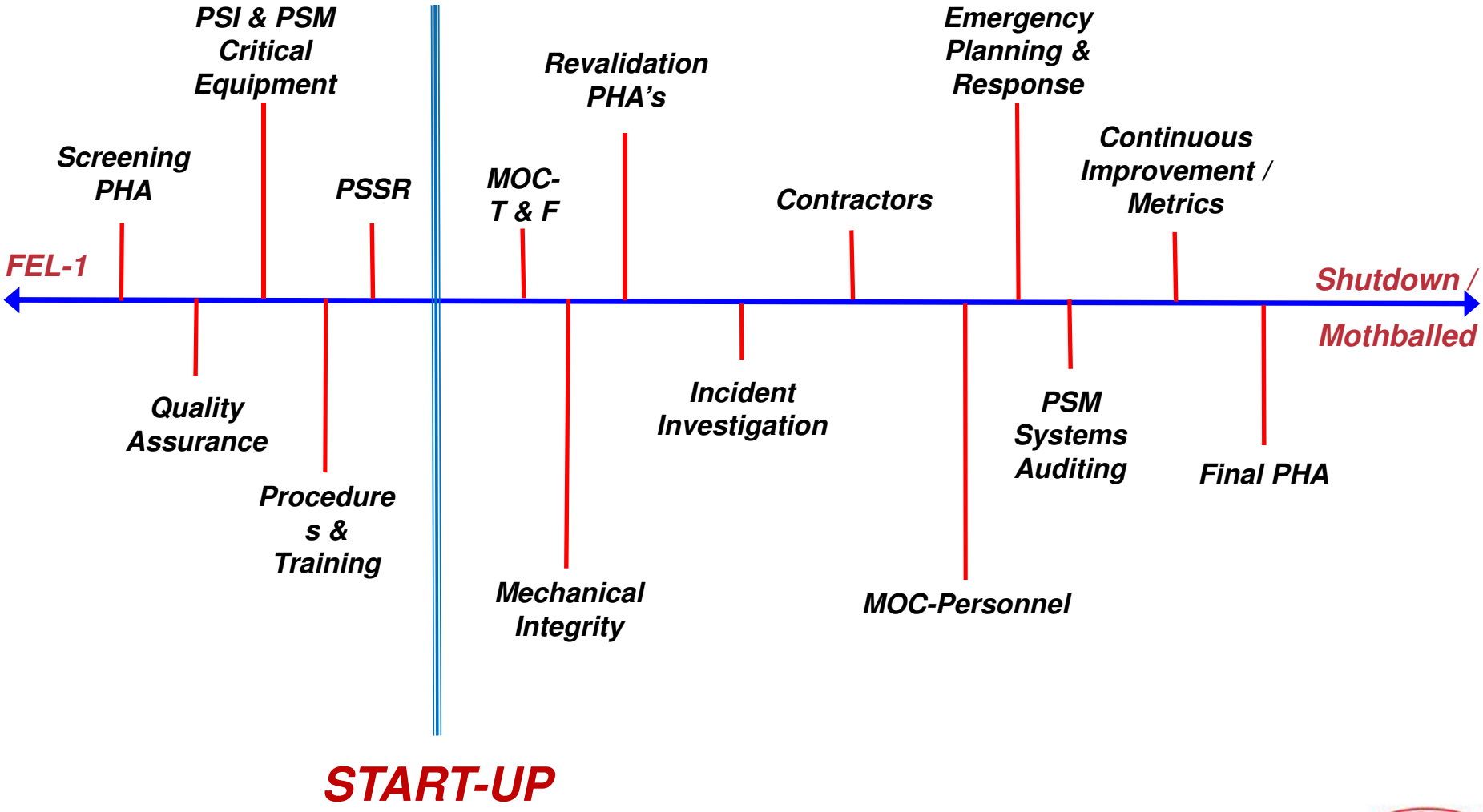
Learning's from Major PSI's

1. Every element of the Operational Risk Management Model is important
2. Every element requires a managing system
   - Ownership and accountability (who)
   - Standard of expectations / subject matter expertise (what, when, where)
   - Data management (how)
   - Metrics, Audits and Continuous Improvement (why)
3. Every element is dependent on other elements, creating the need for a holistic, interdependent and integrated overall managing system
4. Process Safety Management must be applied from early conceptual design through mothballing/shutdown if all Major PSI's are to be prevented

Risk Management from Beginning to End



Risk Management Program Benefits

- Avoidance of catastrophic events that injure people, facilities, business and the environment
- Improved sustainability performance
- Improved productivity and reduced costs through reduced downtime; fewer incidents
- Sustained “right to operate,” as granted by the community, governments and other stakeholders
- Improved employee morale
- Improved credibility in the investment community

Conclusion

Successful leaders identify, evaluate and mitigate operational risks by:

- **Implementing comprehensive, integrated management systems**
- **Fostering a positive, trusting and open culture**
- **Pursuing and achieving the goal of zero significant operational incidents**

"It is imperative that leadership set the 'tone at the top' of the organization and establish appropriate expectations regarding process safety performance."

Baker Panel Report (January 2007)