

  
**Chilworth Technology**  
*A Professional Process Safety Firm*

**BP North American Refineries Independent Safety Panel**  
*Overview of Process, Findings, and Recommendations*

**Presented to the Community Advisory Council to Flint Hills Resources' Pine Bend Refinery**

  
Rosemount, MN  
February 24, 2008  
**Dennis C. Hendershot**  
Principal Process Safety Specialist  
Member of the BP North American Refineries Independent Safety Panel  
**Chilworth Technology, Inc.**  
250 Plainsboro Road  
Plainsboro, NJ 08536  
Tel: 609-799-4449  
<http://www.chilworth.com>  
e-mail: [dhendershot@chilworth.com](mailto:dhendershot@chilworth.com)

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**Texas City, Texas, March 23, 2005**



15 fatalities, 180 injuries, billions of dollars of economic loss, a significant impact on BP's corporate image, stock price, and management (in conjunction with other contemporaneous events)

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**What Happened?**



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### Panel Formation

- ❑ In response to an “urgent recommendation” from the United States Chemical Safety and Hazard Investigation Board (CSB) to BP’s Global Executive Board of Directors, August 17, 2005
- ❑ Recommendation based on initial results of CSB’s investigation of the Texas City incident, and other significant incidents at Texas City
- ❑ Not an OSHA or CSB investigation

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### US CSB Concerns

- ❑ Effectiveness of process safety management system at BP Texas City
- ❑ Effectiveness of BP North America’s corporate safety oversight of refining operations
- ❑ Corporate safety culture which may have tolerated serious and longstanding deviations from good safety practice

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### Panel Charter

- ❑ Independent assessment of effectiveness of BP corporate process safety management systems at US refineries
- ❑ Examination of corporate safety culture and process safety management systems as they impact the refineries
- ❑ **Specifically excluded** – investigation of causes of and responsibility for the March 2005 Texas City explosion

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## Panel Membership

- Secretary James A. Baker III , Chair
- Admiral Skip Bowman, former Director of Naval Nuclear Propulsion and president of the Nuclear Energy Institute.
- Glen Erwin, United Steelworkers
- Former United States Senator Slade Gorton, state of Washington
- Dennis C. Hendershot, Chilworth Technology, AIChE/CCPS
- Dr. Nancy Leveson, MIT, Professor of Engineering Systems
- Sharon Priest, former Secretary of State for the state of Arkansas
- Dr. Isadore "Irv" Rosenthal, Wharton School of the University of Pennsylvania and former member of the US CSB
- Dr. Paul V. Tebo, retired Vice President, DuPont
- Dr. Douglas Wiegmann, Mayo Clinic, former investigator for NTSB
- Duane Wilson, retired Vice President of Refining, ConocoPhillips

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## What do we mean by "safety culture" and "process safety"?

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## What is a Safety Culture?

- The British Health and Safety Executive defines Safety Culture as "the product of the individual and group values, attitudes, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety programs."

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## What Is “Process Safety Culture”?

CCPS Definition:

**“What you do when nobody is watching.”**

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## Process Safety

- Chemical industry term for “system safety” in a more broad technology context
- Focus on the safety of the technology of chemical manufacture
- “Personal safety”, “industrial safety”, “workplace safety” still important
  - But, the activities to manage these risks are very different
  - Good personal safety performance does not ensure good process safety performance

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## Workplace Safety

- Slips, trips, falls, moving equipment, “struck by” accidents, etc.
- These are important, and must not be neglected
- In my experience at Rohm and Haas Company, these represented more than half of reportable incidents, including more than half of fatalities
  - Little or nothing to do with the fact that the company was engaged in chemical processing
  - Traffic accidents, fall from roof, electrocution in switch room, terrorist activity
- Prevention activities may be very different from process safety management systems

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### Personal Safety Management

- Hazard recognition by workers
  - Many of the hazards are such that they can be readily recognized without specialized knowledge and expertise
- Personal protective equipment
- Procedures and training
- “Behavior based safety” programs

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### Chemical Process Safety

- Major incidents involving the release of hazardous materials or energy
  - Consequences can be safety (fires, explosions, toxic material exposure), environmental damage, or major economic losses

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### Chemical Process Safety

- Incidents can have catastrophic impacts
  - Multiple injuries or fatalities
  - Major economic, property, environmental, and corporate image damage
  - Impact public outside facilities

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## Chemical Process Safety

- Prevention
  - Design and engineering of facilities
    - Design to minimize human error, make equipment error tolerant
  - Mechanical integrity and maintenance
  - Control, training, procedures, hazard identification, management of change, technical risk management.

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## Hazard Recognition – Personal Safety Compared to Process Safety

- Personal safety
  - Working at elevation, slipping and tripping hazards, moving equipment hazards
  - Do not require special knowledge to recognize
    - But does require training and awareness to understand significance and take required actions

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## Hazard Recognition – Personal Safety Compared to Process Safety

- Process safety
  - Reactivity hazards, equipment overpressure hazards, flammability, toxicity, etc.
  - Requires specialized knowledge and training
  - In some cases the knowledge may be beyond what can realistically be expected from non-technical personnel
    - For example – is the relief valve on the reactor big enough to protect against a runaway reaction? Is the emergency relief collection and treatment system designed adequately to prevent generation of a flammable gas cloud at a location where ignition is possible? Is the emergency relief discharge system adequate to prevent exposure of personnel to hazardous vapor concentrations?

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## How is Process Safety Addressed?

- Engineering Design Practices and Standards
- Management Systems
  - Procedures (R&D, Engineering, Design, Construction, Startup, Operating, Maintenance, Change, etc.)
  - Safety reviews
  - Operating Procedures
  - Training
  - Equipment Inspections/ Mechanical Integrity
  - Contractor process safety program
  - Near Miss/ Incident Investigations
  - Performance Management / Goals
  - Audits/ Site inspections

How well an organization does these procedures and practices defines its process safety culture

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## Panel Focus on Process Safety

- Concern about major incidents involving the release of hazardous materials or energy
- Can have catastrophic impacts
  - Multiple injuries or fatalities
  - Major economic, property, environmental, and corporate image damage
- Can impact public outside facilities
- Prevention focuses on the design and engineering of facilities, mechanical integrity and maintenance, effective control, effective operations, training, and procedures, and continuing hazard identification and management.

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## Panel Activities

- Refinery visits by the Panel and its staff
- Public meetings in communities where the refineries are located
- Interviews with BP personnel at all levels, from contractors and line workers to the CEO
- Process safety audits by the Panel's consultants for all five refineries
- Process safety culture survey for the workforce in BP North American refining
- BP management briefings
- Review of documents, policies, and procedures
- Meetings with other companies

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### Panel Refinery Visits

- One day visits by panel
- High level focus on management systems and site culture
- Site tours and informal interviews with personnel

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### Public Meetings

- Evening meetings lasting 2-3 hours at a local public meeting place
- Advertised ahead of time in newspapers
- Opportunity for neighbors and other local interested parties make statements to provide input to the Panel
- Panel questions

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### Interviews

- Panel staff interviewed more than 700 people
  - Hourly workers
  - Staff
  - Management
  - Other personnel including contractors
- BP Corporate managers in Houston, Chicago, and London (at least one Panel member present, with staff)
- Retired executives from BP and BP heritage companies
- Representatives of regulatory agencies

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## Process Safety Audits

- ❑ "Conventional" PSM/RMP Technical Areas
  - ❑ Employee participation, process safety information, process hazard analysis, operating procedures, training, contractors, pre-startup safety review, mechanical integrity, safe work practices (for example, hot work permits), management of change, incident investigation, emergency planning and response, compliance audits, trade secrets, risk management program compliance
- ❑ Additional Areas
  - ❑ Management leadership, authority, accountability; process safety measurement; risk based decision making; conformance with selected industry codes and standards (safety instrumented systems, area electrical classification, fired heaters); management of block valves under relief valves; facility siting

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## Process Safety Audits

- ❑ Guidelines and Requirements
  - US OSHA PSM standard
  - US EPA RMP rule
  - BP internal standards, policies, procedures
  - Consensus codes and standards
  - Process safety guidelines from CCPS and other relevant external organizations (for example, ACC, API)

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## Process Safety Audits

- ❑ Panel technical consultants – ABS Consulting and JLM Consulting
- ❑ Four refineries
  - 2 week on-site audit by 5-6 member team covering all areas of expertise
  - Document reviews, walk around inspections, observation of work activities, employee interviews, review of records of PSM activities
- ❑ Texas City
  - Review of independent consultant (AcuTech) audit of Texas City (required by OSHA Settlement)
  - Panel technical consultant review of additional items "beyond compliance" not covered by independent Texas City consultant

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### Process Safety Audits

- ❑ Not a “wall to wall” audit of everything
- ❑ Sampling of all areas to understand process safety performance
- ❑ Did not attempt to specifically identify all process safety issues at each site
- ❑ Focus on sufficient review to understand the effectiveness of process safety management systems

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### Culture Survey

- ❑ Panel subcommittee developed survey and supervised implementation
- ❑ Survey administered by International Survey Research, L. C. (ISR)
  - Survey administration
  - Response compilation
  - Statistical analysis of survey results
- ❑ ~7500 BP employees and contractors participated65 statements related to process safety culture
- ❑ Paper or computer based, English and Spanish
- ❑ 72% response (range 65% to 74%)

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### BP Management Meetings

- ❑ Topics selected by Panel
- ❑ Organizational structure
- ❑ Management policies and procedures
- ❑ Process safety management systems
  - Evolving in wake of Texas City

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### Document Review

- Panel and staff reviewed ~344,000 pages of documents provided by BP or from other sources
  - Audits, reviews, investigations, action tracking, inspections, policies and procedures (corporate and site), etc.
- Mostly reviewed by staff, who screened documents to be reviewed by the entire panel

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### Meetings with Other Companies

- Oil and gas
- Chemical and other processing
- Nuclear power

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### The Results

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## Panel Findings

**Corporate Safety Culture**

- Process safety leadership
- Employee empowerment
- Resources for process safety
- Role of process safety in corporate decision making
- Lack of common process safety culture at the North American refineries

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## Panel Findings

**Process Safety Management Systems**

- Risk assessment
- Compliance with internal standards
- Implementation of external standards and good engineering practices
- Process safety knowledge
- Effectiveness of process safety management systems
- Notable practices
  - Process safety minimum expectations
  - Engineering authority at each refinery
  - Many refinery specific programs

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## Panel Findings

**Performance and Oversight**

- Measuring process safety performance
- Incident investigation
- Process safety auditing
- Correction of deficiencies and follow up on actions
- Corporate oversight – executive management and board level

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## Panel Recommendations

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## Panel Recommendations

1. **Process safety leadership**
  - Demonstrated commitment
  - Clear message
  - Articulated goals
  - Match action to words
2. **Integrated Process Safety Management system**
3. **Process Safety knowledge and expertise**
  - Executive management
  - Line management
  - All refinery personnel

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## Panel Recommendations

4. **Process safety culture**
5. **Defined process safety expectations and accountability**
6. **Line management support**
7. **Process safety performance indicators**
  - Leading indicators
  - Lagging indicators
8. **Process safety audits**

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## Panel Recommendations

**9. Board of Directors monitoring**

- Implementation of panel recommendations
- Independent monitor (5 years)
- Public reporting of implementation and process safety performance

**10. Become an industry leader in process safety**

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## Personal Thoughts on the Baker Panel Report

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“We are under no illusion that the deficiencies we have identified are unique to BP. If other refining and chemical companies consider our recommendations and apply them, we believe that those workplaces will be safer and that future tragedies like the Texas City accident can be avoided.”

– Secretary James Baker  
January 16, 2007

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### Challenge to the Panel

- Informal communication from US CSB hoping for “profound recommendations”
- Is anything in the previous slides which is new or profound to process safety professionals?
- So, what is the key lesson?

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### Improving Process Safety Performance in the Future

- We don't need new tools
  - Tools can get better, and should be enhanced and developed (particularly Process Safety measurement tools), but this is not what is stopping us from getting better.
- We don't need new technology or skills

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### Improving Process Safety Performance in the Future

- We need to actually do what we already know how to do!
  - All of the time, everywhere!
  - 90%, 99% excellent practice isn't good enough in process safety
  - The old management “80/20 rule” (80% of the benefit from 20% of the work) does not apply to process safety
    - “If you follow this rule, which 20% of the major accidents are you willing to have?” - Art Dowell, Rohm and Haas Company

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### Old News

- ❑ Walt Howard (Monsanto), paper at the 17<sup>th</sup> American Institute of Chemical Engineers (AIChE) Loss Prevention Symposium in Denver, Colorado, August, 1983
- ❑ Paper Title:
  - "Efficient Time Use to Achieve Safety of Processes"
- ❑ Sub-title – the *real* title:
  - "We ain't farmin' as good as we know how now."

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### For industry to think about

- Process safety leadership
- Process safety knowledge and expertise
- Variable process safety culture
  - Mergers, acquisitions, divestures, asset sales, and other restructuring
- Process safety management system
- Process safety audits
- Measurement of process safety performance
  - Injury rates are not a good indicator
  - Feedback to management on PSM activity performance
  - New CCPS recommendations on metrics
- Process safety goals

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### Thank you for your attention!

### Questions or Comments?

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