“Using the Last Several Years of QHSE Data to Improve the Next Several Years of QHSE Performance”

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Overview

- Background
  - Large global data set from risk reduction processes
  - A customer example of the goal
    - To improve Process Safety with “leading” management KPI’s

- Our Ongoing Journey
  1. Identify TOP from BOTTOM lagging performers (i.e. loss rates)
  2. LEADING metrics from execution of risk reduction processes
  3. Statistical process to find unique “factors” of TOP PERFORMERS
  4. Apply factors as leading management KPI’s to continuously improve
  5. Iterate annually
Background
Common Data Model ➔ Large Data Set

Over 740,000 Users in 1000’s of Sites
Over 100 Countries and 24 Languages

Millions of rows of leading and lagging risk event data!
# Data Set of Risk Reduction Processes

## LAGGING EVENTS:
Incident-based Processes

<table>
<thead>
<tr>
<th>Process Safety Incidents</th>
<th>Injuries / Illnesses</th>
<th>Releases / Spills</th>
<th>Security</th>
<th>Asset Damage</th>
<th>Equipment Failure</th>
<th>Reputation Damage</th>
<th>Other “kinds” of loss events........</th>
</tr>
</thead>
</table>

## LEADING EVENTS:
Assessment-based Processes

<table>
<thead>
<tr>
<th>Behavioral Safety Observations</th>
<th>QHSE Management System Audits</th>
<th>Risk Assessments / PHA</th>
<th>Management of Change (MOC)</th>
<th>Site-level Inspections</th>
<th>ISO 9000 Certification Assessment</th>
<th>Corporate Audits</th>
<th>Hundreds of other processes....</th>
</tr>
</thead>
</table>

**Over a Million Incident and Near Miss events**

**Action Item Management**

Millions of Action Items (from all above processes)

Average of over 50 “event” processes per company in data set.
(for companies with > 2 years of usage)
A Customer Example: Improve Process Safety Performance with “Leading” Management KPI’s
# Example Process Safety KPI Dashboard

<table>
<thead>
<tr>
<th>Lagging PSI Rate</th>
<th>6 “Leading” Management KPI’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>Inspections</td>
</tr>
<tr>
<td>Site 2</td>
<td>Good</td>
</tr>
<tr>
<td>Site 3</td>
<td>Fair</td>
</tr>
<tr>
<td>Site 4</td>
<td>Poor</td>
</tr>
<tr>
<td>Site 5</td>
<td>Good</td>
</tr>
<tr>
<td>Site 6</td>
<td>Fair</td>
</tr>
<tr>
<td>Site 7</td>
<td>Poor</td>
</tr>
<tr>
<td>Site 8</td>
<td>Good</td>
</tr>
</tbody>
</table>

* Measured on monthly basis, reviewed by Top Operations Executives…

**Legend**
- Poor
- Fair
- Good

Dozens of metrics Roll-up to each Management KPI…

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*Slide # 7  jstough@syntexsolutions.com*
Sampling of Inspection Metrics

1.3.1 - API 510 Vessels # Internal Inspections Past Due
1.3.10 - Critical Safety Analyzer (CAC) % Past Due (H2S and LEL)
1.3.11 - Deluge systems % past due
1.3.12 - Sprinkler systems % past due
1.3.13 - PIV's % past due
1.3.14 - Fire pump tests % past due
1.3.15 - Inspection Work Orders % Past Due
1.3.16 Temporary Repairs # in place (not included as green, yellow or red dot)
1.3.2 - API 510 Vessels # External Inspections Past Due
1.3.3 - API 653 Tanks # Internal Inspections Past Due
1.3.4 - API 653 Tanks # External Inspections Past Due
1.3.5 - API 570 Class 1 Piping % TML's Past Due
1.3.6 - API 570 Class 2/3 Piping % TML's Past Due
1.3.7 - API 570 Piping Estimated % Not Yet Classified
1.3.8 - API 521 Relief Valve/Rupture Disk # Past Due
1.3.9 - Critical Intrument (CIC) % Past Due

Dozens of metrics Roll-up to each Management KPI…
Our Ongoing Journey

1. Identify TOP and BOTTOM performers (i.e. loss rates)
2. Leading metrics from execution of risk reduction processes
3. Statistical process to find unique “factors” of TOP PERFORMERS
4. Apply factors as leading management KPI’s
5. Iterate Annually (go to Step 1)
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Identifying the Top Performers

- Example lagging metrics (from incident events)
  - Process Safety Incidents (per API)
  - Total Recordable Injuries (per OSHA)
  - Loss Rates from Environmental, Security, Quality, etc...
  - Mechanical Availability, etc. from Solomon (for Refining)

- World-class Performers
  - Maintain low “mean” rates of loss
  - Consistency ➔ low variability over time
World Class Performers: What is their Secret?

THE PROBLEM:
What are the World Class performers doing differently?

What are the unique “leading” factors that create World Class “lagging” performance.

World class performers per Energy data set from world leaders in QHSE performance. (IMPACT customers)
Making the BEST Performance Repeatable

THE SOLUTION:

Find the “measurable” differences
- Leading metrics from QHSE processes
- Apply STATISTICAL MODEL
- Factors unique to the top performers

Monitor and improve
- Calculate monthly KPI’s
- Apply to management scorecards

Iterate Annually
- Benchmark internally / externally
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Data from Risk Reduction Process “Software”

Risk Exposure

- First Report, Assessment Wizard
  - Workforce Engagement
  - Risk Reduction Cycle
    - Obtain / Review Data
    - Measure Potential Risk
      - Identify Failed Controls
      - Implement / Repair Controls
      - Incident Module
    - Assessment Module
  - Risk Matrix
  - Investigations
  - Findings / Checklist
  - Action Items Module

Business Process Automation (BPA)
- the **backbone** of the solution “design philosophy”
- system for process execution **measurement and control**
"Measurable" Data from Risk Reduction Processes

1. Reporting Culture

Total Event Reporting:
Worker reporting at bottom of pyramid.
Rate and distribution of proactive involvement.

Risk Reduction Cycle Processes

Front-line Responsiveness:
Front-line "management" responsiveness.
Mean-time between worker “reported” and leader “response”.

Risk Control Process:
Rate of causation and / or risk scoring.
Consistency in execution of investigations.

Leadership Commitment:
Review / approve causal factors, findings.
Rate of participation in "non-mandatory" events.

Follow-up Sponsorship:
Review, authorize execution of action items.
Mean-time to follow-up action initiation.

2. Action Item Execution

Action Management:
Percent of actions complete on-time.
Risk-weighted on-time completion rate.
Rate and timeliness of past-due action items.

3. Leadership and Process

Risk Reduction Cycle Processes

Total Event Reporting:
Worker reporting at bottom of pyramid.
Rate and distribution of proactive involvement.

“Balanced Pyramid”

Reported

Reduced

Incident / Assessment

Risk Matrix

Root Cause / Findings

Action Items

Reported

Reduced

Risk Reduction Cycle Processes

Sources of Exposure

Iterate Where Applicable

Hi

Med

Low

No Injury

Exposure to Injury

Hi

Med

Low

No Loss

Exposure to Loss

"Balanced Pyramid"
Producing these Leading Metrics....

- **Action Item Effectiveness Theme**
  - Rate of Action Follow-up (12 metrics)
  - Percent On-time (11 metrics)
  - Raw Timeliness (7 metrics)

- **Leadership and Process Theme**
  - Leadership Involvement (11 metrics)
  - Organizational Discipline (12 metrics)
  - Process Execution (13 metrics)
  - Process/Usage (17 metrics)
  - Risk-based Process (12 metrics)

- **Reporting Culture Theme**
  - Pyramid Ratios (9 metrics)
  - Employee Participation (16 metrics)
  - Employee Reporting (8 metrics)
  - Proactive Activity (11 metrics)
  - Distribution of Involvement (11 metrics)
  - Feedback / Communication (3 metrics)
4. Critical Risk Reduction Process Execution

Critical Risk Reduction “Systems”

- Activity
  - BBS events as % of total events
  - Human factor causes as % of total
  - Management system improvement events as % of total
  - Process safety events as % of total
    - PHA, MOC, etc.
  - Events with risk assess as % of total
  - Total risk control process improvement events as % of total

- Participation
  - Rate of total risk control events per employee count
  - % of employees participating in risk control process improvement events
Summary of Data Set

- Millions of events drawing data from
  - Both outcomes
  - And business process execution

- External sources
  - Other Benchmarking Data (e.g. Solomon)
  - Site-level applications
    - Training
    - Driver certification
    - Facility maintenance

- Collectively hundreds of Metrics
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Applying the 6 Sigma Framework (DMAIC)

- **Define – IMPACT Math 101**
  - Work with consortium of current customer SME’s to identify potential X’s
    - Define means of calculating X’s from multi-business data set

- **Measure – IMPACT Math 201**
  - **Factor Analysis:** create indices as stronger, practical metrics
    - SME’s select and name indices (e.g. reporting culture, leadership, etc.)

- **Analyze – IMPACT Math 202**
  - **Correlation:** identify indices with strong association to Y (losses)

Company-specific internal execution steps:

- **Improve** – Apply indices as Early Warning KPI’s for leaders
- **Control** – Use SPC to control X’s and Y’s
Find the Unique Factors of Best Performers

For Example: Best performers have better...

-- Risk Reduction Process Execution
-- Leadership Engagement
-- Reporting Culture
-- Action Timeliness
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## Pursuing KPI’s to Drive Improvement

### Continuous measure and improve...

<table>
<thead>
<tr>
<th></th>
<th>PSI Rate</th>
<th>Leadership Index</th>
<th>Action Index</th>
<th>Reporting Culture Index</th>
<th>Risk Reduction Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
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</tr>
</tbody>
</table>

### Site 6 Management Response to RED scores:
1. Increase leadership involvement in Process Safety practices.
2. Compel workers to openly report mistakes, un-safe conditions.
3. Improve execution of critical risk reduction programs...

### Legend
- ◆ Poor
- ▼ Good

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*Slide # 24*  
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12/15/2008
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Benchmarking Program

- Annual Benchmarking Report
  - Study of leading metrics across participating companies
  - Study of leading metrics within sites of customer
  - High-level recommendations for improvement

- Value Improvement Workshop
  - In-person one-day workshop to review report
  - Identification of key areas of improvement
  - Assistance with planning execution

- Data Analysis Tools
  - Data extraction routines (for horizontal metrics)
  - Templates for reporting of resulting KPI’s
Executing the Strategy

Bottom 20% (Challenged Sites)

Annually Apply to Challenged Sites: KPI’s to drive improved performance

Top 20% (World-class Performers)

Monitor Performance Gain: Improvements in leading KPI’s yield gains in performance.
Questions?