The Case for Change

Fatality Trend
Dow Global, Employees & Contractors

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatality Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
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<td>2012</td>
<td>2</td>
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<tr>
<td>2013</td>
<td>3</td>
</tr>
</tbody>
</table>
Fatality Count and Injury Trend Comparison

- Fatality Count/year, 5-year avg.
- I/I Rate, 5-year avg.
By Hazard Type

Fatalities by Hazard Type
Dow Chemical Company
Global, Employees & Contractors

Hazard Categories
Process
- Explosion/Overpressure
- Exposure
- Fire
- Pipe/Vessel Rupture

Non-process
- Asphyxiation
- Caught in Equipment
- Electrical
- Fall
- Falling Object
- Hydroblasting
- Other
- Struck by Object
- Vehicular Impact
- Workplace Violence

Transportation
- Airplane
- Vehicle

Fatality Count

<table>
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<tr>
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</tr>
</thead>
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<tr>
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<td>18</td>
<td>15</td>
<td>27</td>
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<td>10</td>
<td>31</td>
<td>13</td>
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<tr>
<td>Transportation</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>
What Do We Have to Do Differently?

- Old Paradigm - addressing root causes for all events to realize an equal reduction in all parts of the injury pyramid with more recent focus on RWC, DAWC and fatalities (serious injuries)
- Enhanced Paradigm – focus on injuries and near misses that caused or had the potential to result in life-altering injuries or fatalities
LIFE and pLIFE

Applied to Safety Pyramid

LIFE Incidents
LIFE or pLIFE Incidents

pLIFE Incidents

• Fatality
• DAWC
• RWC
• RMTC
• FAC
• Precautionary
• Near Miss

LIFE Incidents (actual + potential)
LIFE Terminology

• **LIFE Incidents** = an actual Life-changing Injury or Fatality Event

• **LIFE potentials (pLIFE)** = a potential LIFE incident is any incident which could have resulted in a LIFE Incident had circumstances been slightly different. This includes reportable injuries less severe than a LIFE Incident and non-injury near misses.

• **LIFE recordable incidents** = Includes all LIFE Incidents and a subset of pLIFE. The pLIFE subset includes only the **recordable** incidents.

• **Non-Injury pLIFE** = Any unplanned event that did not cause a reportable injury, but reasonably could have caused a LIFE type injury.

Note - Recordable incidents include RMTC+RWC+DAWC and fatality.
Note - Reportable incidents include Precautionary + First Aid Visits + RMTC+RWC+DAWC and fatality.
Company Trend – LIFE Events

LIFE Event Count
Dow Global, Employees & Contractors

- pLIFE First Aid & Precautionary Visit
- pLIFE Recordable
- LIFE Incident

Data is not available for 2011 and 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Count</th>
</tr>
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<tbody>
<tr>
<td>2011</td>
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<td>2012</td>
<td>34</td>
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<tr>
<td>2013</td>
<td>69</td>
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<tr>
<td>2014</td>
<td>65</td>
</tr>
<tr>
<td>9-2015 YTD</td>
<td>24</td>
</tr>
<tr>
<td>9-2015 YTD</td>
<td>22</td>
</tr>
</tbody>
</table>

Annualized

9-2015 YTD Annualized

- 2011: 2
- 2012: 5
- 2013: 5
- 2014: 1
- 9-2015 YTD: 3
- 9-2015 YTD: 4
Company Trend – LIFE Recordables

LIFE Recordable Incidents
Dow Global, Employees & Contractors

LIFE Recordables
LIFE Recordables as % of Recordable Injuries

LIFE Recordable Incident Count


13% 19% 16% 22% 20% 0%

0 10 20 30 40 50 60 70 80

0% 5% 10% 15% 20% 25%

LIFE Recordables by LCS Gap Relation
Dow Global, Employees & Contractors

- LIFE Recordable Incident, but NOT Related to LCS Gaps
- LIFE Recordable Incidents Related to LCS Gaps

<table>
<thead>
<tr>
<th>Year</th>
<th>LIFE Recordable Incident, but NOT Related to LCS Gaps</th>
<th>LIFE Recordable Incidents Related to LCS Gaps</th>
<th>Total</th>
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</thead>
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<td>15</td>
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<tr>
<td>2013</td>
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<td>31</td>
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<tr>
<td>2014</td>
<td>13</td>
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<tr>
<td>8-2015 YTD</td>
<td>6</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>8-2015 YTD Annualized</td>
<td>9</td>
<td>29</td>
<td>38</td>
</tr>
</tbody>
</table>

Number of LIFE Recordable Injuries
Injuries related to LCS Gaps?

Recordable Injuries by LCS Relation
Dow Global, Employees & Contractors, 2015

- LCS Related: 37%
- Not LCS Related: 63%
What about Severe Injuries (SIF)?

SIF Recordables by LCS Relation
Dow Global, Employees & Contractors, 2015

- LCS Related: 72%
- Not LCS Related: 28%
LCS Gaps (w/o SWP) Related to Injuries
Dow Global, Employees & Contractors, 2014 to 2015

- Isolation of Energy: 46%
- Elevated Work: 28%
- Line & Equipment Opening: 18%
- Confined Space Entry: 2%
- Electrical Work: 2%
- Hot Work: 2%
- Hydroblasting: 2%

Which Standards had the most Gaps?
Error Type Results?

Injuries related to LCS Gaps w/o SWP by Error Type

Error Types

- **Specification**
  - Errors in applying specific requirements of the standard

- **Performance**
  - Errors in body mechanics performance that are not associated with any specific requirement

- **Fundamental**
  - Errors in applying the basic principles of the standard
Alignment with Audits and Assessments?

**Error Types**
- **Specification**
  - Errors in applying specific requirements of the standard
- **Performance**
  - Errors in body mechanics performance that are not associated with any specific requirement
- **Fundamental**
  - Errors in applying the basic principles of the standard

---

**Injuries & Assessments related to LCS Gaps w/o SWP by Error Type**

- **Injuries**
  - Specification: 90%
  - Performance: 10%
  - Fundamental: 0%

- **Assessments**
  - Specification: 100%
  - Performance: 0%
  - Fundamental: 0%
By Contact Type

Non-Injury pLIFEs by Contact Type

Number of Entries

Fall - EW
Object Falling
Chemical
Line of Fire
Asphyxiation
Electrical
MVA
Fire/Explosion
Overpressure

1Q-2016
2Q-2016
3Q-2016
4Q-2016
1Q-2017
2Q-2017
Non-Injury pLIFEs by LCS Gap

* The Crane Standard/Guidance is not an LCS Standard, but is being tracked

Number of Entries

- Elevated Work
- IOE
- CSE
- Hot Work
- Crane*
- Electrical
- LEO
- Hydroblasting

Legend:
- 1Q-2016
- 2Q-2016
- 3Q-2016
- 4Q-2016
- 1Q-2017
- 2Q-2017
Results by Standard?

LCS Gaps (w/o SWP) Associated with Injuries

<table>
<thead>
<tr>
<th>Year</th>
<th>IOE</th>
<th>Elevated Work</th>
<th>LEO</th>
<th>Electrical</th>
<th>Hot Work</th>
<th>Hydroblasting</th>
<th>CSE</th>
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<td>7</td>
<td>5</td>
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<tr>
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<td>2</td>
<td>2</td>
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</table>
Fatality Count and Injury Trend Comparison
Summary

• This data analysis has led us to a deeper understanding about what is driving our severe injuries and fatalities.

• This is still very much a work in progress, but we are starting to see improvement in our Life Critical Standard gaps associated with injuries, particularly on IOES, Elev Work, and line and equipment openings where we have been focusing our efforts.

• We are also starting to see a decline in our pLIFE Recordable injuries, those recordable injuries with high potential to have been much more severe.

• We are hopeful that our severe injuries and fatalities will also decline and eventually reach zero and stay there.

• This is our journey. Yours must start with your data and where it leads you.
SERIOUS INJURY AND FATALITY PREVENTION

The Human Element
SIF PREVENTION

CAN WE IMPROVE HUMAN RELIABILITY?

DONALD K. MARTIN MPH CSP
SENIOR VICE-PRESIDENT
DEKRA/BST
## Nine Interventions That Really Matter

<table>
<thead>
<tr>
<th>Life Saving Safety Rules</th>
<th>Field Verification Critical Controls</th>
<th>Pre-Task Risk Assessments</th>
<th>Pause Work &amp; Near Miss Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Handling Systems</td>
<td>Incident Data and Analytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractors</td>
<td>Over Road MV</td>
<td>Understanding &amp; Influencing Human Behavior</td>
<td></td>
</tr>
</tbody>
</table>
THREE PREVAILING FATAL FACTORS

Normalization of deviation

Uncalibrated risk perception/tolerance

Decisions with safety consequences not grounded in data

Monitor your organization for these catastrophic risk indicators
Three Types of Behavior

- Enabled
- Difficult
- Non-enabled
The Most Powerful Consequences

Soon / Certain / Positive
Oh Those Humans......!!

Recognizing weak signals as precursors to normalization of deviation

Field improvisation
Procedures optional/inconsistently interpreted
Granting variances/exception management

Better approaches to improve human reliability
Recognizing safety critical decision pathways in the moment...fast brain/slow brain
Alignment on accuracy of risk perception and organizational/individual risk tolerance
Operations reliability helps human reliability
Practical Solution 1 – Alert the Brain

With properly designed...
Pre-Task Risk Assessments – Job Safety Briefs
Pause-Work Authority
Near-Hit Reporting

Support these people-centric activities with
Proper designs
Feedback
SC+ Consequences
Pre-Task Risk Assessments

“What’s the next thing that’s going to kill me?”

A mantra for all pilots and astronauts.

Chris Hadfield
An Astronaut’s Guide to Life on Earth

- Collaborative
- Accurately predicts exposures and control measures
- In-field check
- Last-minute/field-level risk assessment
- Mid-job check
- Provisions for exposure change
- Triggers for pause/stop
- Post-job debrief
Practical Solution 2 – Enable SIF Safe Behavior

Life-Saving Rule Processes

Process Design
Prevention through design
Inherently safer design

Rigor Around Safety Hierarchy of Controls
# Life-Saving Safety Rules

## Design Integrity
- Clear, concise, accurate
- Truly protective
- Aligned with SIF exposures

## Behavioral Reliability
- Easy to understand
- Accurately and consistently interpreted
- Conformance 100% enabled
- Very few with zero tolerance
<table>
<thead>
<tr>
<th>Hierarchy of Controls</th>
<th>Description</th>
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<tbody>
<tr>
<td>Elimination</td>
<td>Exposure eliminated.</td>
</tr>
<tr>
<td>Substitution</td>
<td>Exposure significantly reduced.</td>
</tr>
<tr>
<td>Engineering Controls/Isolation</td>
<td>Exposure controlled during normal ops; still possible during maintenance operations or emergencies.</td>
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<tr>
<td>Administrative Controls</td>
<td>Exposure controlled IF employees rigorously comply and IF culture supports compliance and IF leadership maintains commitment to verification and oversight.</td>
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<tr>
<td>Personal Protective Equipment</td>
<td>Last layer of defense; unreliable for full protection; does not mitigate risk or exposure, only extent of possible injury; primarily used when hazard is unpredictable or pervasive; use is dependent on too many variables.</td>
</tr>
<tr>
<td>Gimmicks; incentives; hollow threats</td>
<td>Worker seen as the cause of exposure and simply requires motivation; no change in exposure.</td>
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**Safety depends LEAST On employee Behavior**

<table>
<thead>
<tr>
<th>15%</th>
<th>85%</th>
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<tr>
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<tr>
<td><strong>LEAST</strong></td>
<td><strong>MOST</strong></td>
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<tr>
<td>On employee Behavior</td>
<td>On employee behavior</td>
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</tbody>
</table>

**What if N=100 cases?**

<table>
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Practical Solution 3 – Verify SIF Controls

Verify the presence and effectiveness of critical SIF controls

- Behaviors
- Conditions

Use checklists

Observe, discover, correct in the moment

Understand why critical control not followed, missing, ineffective

Provide enterprise data analysis and feedback

Continuous improvement loop
Checklist for Field Verification of Critical SIF Controls

- Enabling More Pause/Stop Work
- When momentum is building to complete the task, the temptation to take risk, or accept higher levels of risk, is very strong.
How Many of These Require Human Involvement?

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<tr>
<td>Oversight Retention</td>
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SERIOUS INJURY AND FATALITY PREVENTION

The Human Element
JOHN HORNE &
LARRY SIMMONS

PotashCorp
History and Background
PotashCorp SIF Summary & Intervention Strategy

- 2010 Start with BST® & 6 other companies
- Initially Reactive SIF based on events that occurred
- Leader education
- SIF Exposure visibility
- Determined our precursors
  - Mine your data
  - Discover thru observation and interview
• Interventions integrated into existing SHE systems
  o Injury/Incident reporting
  o Pause work climate – Stop Work Obligation (SWO)
  o Pre-task risk assessments (RA/JSA)
  o Life Saving Rules – quality, integrity, and reliability

• Accident handling system and incident investigation quality
Quick Successes

• Identified SIF Potential by site in order for each site to develop its own intervention strategies that will improve existing management or safety systems

• Standardized Categories and Precursors
Challenges

• Recognized the need for a very concrete definition and decision matrix for determining SIF Potential

• Limited resources to investigate SIF potential incidents due to the existing requirements for investigating all recordable incidents regardless of their SIF potential

• Consistently determining SIF potential across sites

• Reactive SIF is important but there is more…….
Serious Injury and Fatality Prevention Redefined
Serious Injury and Fatality Prevention Redefined

A Holistic Approach To SIF Prevention
## PotashCorp Serious Injury and Fatality Prevention

### Reactive
- Promotion of reporting all SIF incidents
- Systematic incident analysis looking for SIF Potential
- Thorough investigation of SIF incidents
- Ensuring strong preventative remedial actions are put in place
- Drive all aspects of process down to worker level
- Involve all workers in incident analysis for SIF potential.

### Proactive
- Looking for “SIF in the Routine”
- Systematic process to observe complete tasks
- Training to weaken “Cultural Blindness” and the “Normalization of Deviation”
- Compile SIF exposures inherent in routine work
- Includes remediation and tracking process
- Involve all workers through the selection of audit teams

### Integration
Saturating a ‘SIF prevention thinking’ throughout the entire organization

- EBS
- OHC
- JHA
- Pausing
- Safety Meetings
- Investigations
- Audits and Assurance
- Area Inspections
Proactive Serious Injury and Fatality Prevention
Things that are obvious to outsiders are invisible to those on the inside

Water? What water?

SIF potential? What SIF potential?
Key SIF Processes

The rearview mirror is important, but we need to be looking through the windshield

Serious Injury & Fatality Prevention – **Reactive**
At each site, all incidents will be evaluated for SIF potential. Incidents determined to have SIF potential, regardless of the severity outcome, will be investigated.

Serious Injury & Fatality Prevention – **Proactive**
Cross functional teams will be developed and these teams will be trained in SIF theory and audit routine tasks. The objective is to mitigate situations prior to a SIF event.
SIF in The Routine Process

- SIF Steering Team
- SIF Audit Working Group
- SIF Audit Team

Intake Tasks

Form teams and schedule audit

Analyze & determine appropriate follow-up

Complete SIF Audit

Reviews SIF Audit results

Communicate follow up information

Follow-up and monitor success
Integration
Incorporating a Serious Injury and Fatality Prevention Focus in all we do

Promoting safety leadership by all workers and ensuring they engage daily in our safety processes

Maintaining focus on removing complication

“If I would have had more time I would have written a shorter letter” - Pascal
EVERY MOMENT MATTERS
QUESTION & ANSWER
Discussion Questions

1. What is your organization’s overall approach to SIF prevention? Have you not started, just on the way, more mature? What have been your biggest successes and barriers?

2. What human performance elements does your organization consider related to SIF exposure or potential? Have you identified any common human-oriented root causes in SIF cases? If so, what are they?

3. Has your organization investigated any recent thinking in high reliability/high performance organizational science, neuroscience, visual science, or other fields? If so, what sort of thinking are you exploring?
2018 SYMPOSIUM
Create Change for the Future of EHS

FEBRUARY 20-21, 2018
Charlotte, North Carolina
thecampbellinstitute.org/symposium
PLEASE COMPLETE YOUR FEEDBACK CARDS