Epidemiology Perspective
Williston, ND
Hydraulic Fracturing BAKKEN SAFETY TOUR 2016

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The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the National Institute for Occupational Safety and Health.
National Institute for Occupational Safety & Health (NIOSH)

- Part of the Centers for Disease Control & Prevention (CDC)
- Research-focused
- Created an Oil and Gas Sector Program in 2007 (Epi/Surveillance, Exposure Assessment, Engineering Controls, Communications)
Outline

Fatality Trends

Motor Vehicle Safety

Targeted Surveillance-
Fatalities in Oil and Gas Database (FOG)

Conclusion: Working Together
Fatality Trends
The Oil and Gas Industry

- **Upstream Oil & Gas**
  - Exploration
  - Field Development
  - Production Operations

- **Mid Stream**
  - Transportation
  - Processing
  - Storage & Distribution

- **Downstream**
  - Manufacturing
  - Refining & Petro-Chemicals
  - Wholesale & Marketing
The Oil and Gas Industry

32% of total workers

15% of total workers

53% of total workers

Source: BLS/CFOI and BLS/QCEW. All rates calculated per 100,000 workers.
32% of total workers
Fatality Rate=22.9
per 100,000 workers

15% of total workers
Fatality Rate=4.1

53% of total workers
Fatality Rate=4.2

Source: BLS/CFOI and BLS/QCEW. All rates calculated per 100,000 workers.
The Oil and Gas Industry

32% of total workers
Fatality Rate = 22.9
Per 100,000 workers

15% of total workers
Fatality Rate = 4.1

53% of total workers
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Source: BLS/CFOI and BLS/QCEW. All rates calculated per 100,000 workers.
Number and Rate of Fatal Work Injuries

Note: Fatality counts from BLS Census of Fatal Occupational Injuries. Worker Estimates from BLS Quarterly Census of Employment and Wages (2013). Rate per 100,000 workers per year. Includes NAICS 211, 213111, 213112. *Data for 2014 are preliminary.

N=1,333
**Number and Rate of Fatal Work Injuries**  
**U.S. Oil & Gas Extraction Industry, 2003–2014**

- **Fatalities**  
- **Rate**

### Note:
Fatality counts from BLS Census of Fatal Occupational Injuries. Worker Estimates from BLS Quarterly Census of Employment and Wages (2013). Rate per 100,000 workers per year. Includes NAICS 211, 213111, 213112. *Data for 2014 are preliminary.*

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Trends in Fatality Rate by Company Type

- **Oil and Gas Operators**: 58% Fatalities Statistically Significant
- **Well Servicing Companies**: 33% Fatalities Statistically Significant
- **Drilling Contractors**: 27% Fatalities Not Statistically Significant

June 8, 2015
Most Frequent Fatal Events

- Exposure: 9% (114)
- Fires/Explosions: 14% (187)
- Falls: 8% (109)
- Contact with Objects/Equipment: 26% (340)
- Transportation: 41% (550)
- Other: 2% (33)

Total Fatalities: 1333

Data Source: BLS CFOI
Motor Vehicle Fatalities by Vehicle Type
U.S. Oil & Gas Extraction Industry, 2003-2009

- Pickup Truck: 51.5%
- Semitrailer, tractor trailer, trailer truck: 5.9%
- Unknown or other types of truck: 3.5%
- Automobile: 12.4%
- Other Types of Vehicles: 26.7%

Source: CDC-NIOSH with restricted access to BLS CFOI microdata
1. Develop a Motor Vehicle Safety Program

- Require and enforce seatbelt use
- Prohibit cell phone use
- Set limits on maximum driving distances per day/week
- Limit commute time before shift
- Include Journey Management Procedure

2. Consider Use of In-Vehicle Monitoring Systems

<table>
<thead>
<tr>
<th>Records Data</th>
<th>Measures Performance</th>
<th>Changes Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Date and Time</td>
<td>Measures driver performance against a predetermined set of parameters</td>
<td>Has shown to be effective in realizing immediate and positive effect on driver behavior.</td>
</tr>
<tr>
<td>✓ Speed</td>
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<tr>
<td>✓ Acceleration/Deceleration</td>
<td></td>
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<tr>
<td>✓ Seat Belt Use</td>
<td></td>
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Motor Vehicle Crash Rates\(^1\): 50–90%

Speeding\(^2\): 60%

Miles Driven\(^3\): 8-20%

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\(^2\) Twilhaar, 2000;  
Fatigue-Related Crash

- 3 workers killed, 4 hospitalized
- No skid marks at scene
- None of the workers were wearing their seatbelt
3. Consider Use of Fatigue Detection Technologies

- Fatigue and distraction detection systems (eye-movement)
- Smart phone sleep apps/fitness bands
- Fatigue Management Systems

http://www.sixsafetysystems.com/page/fatigue-management
Targeted Surveillance-
Fatalities in Oil and Gas Database (FOG)
Different risks for different basins?  Is distraction or fatigue a factor?

Struck by what?

Do they work where they live?

Are some vehicles more dangerous?

What are the most common ignition sources?

What are the most dangerous operations?
The details needed to answer these questions are not in available current data sources (e.g. Bureau of Labor Statistics, Census of Fatal Occupational Injuries, CFOI).
The solution...

The Fatalities in Oil and Gas Database (FOG)

A database specific to the oil and gas extraction industry.
Fatalities in Oil and Gas (FOG) Database

Internal database collecting detailed information about oil and gas worker fatalities in the U.S.
Est. 2014 (going back to 2005)

**Includes**
- Fatal events to U.S. oil and gas extraction workers
  - Land-based
  - Offshore
  - Traditional O&G industries
  - Contracted into O&G
  - Motor vehicle incidents
  - Non-traditional commutes
  - Cardiac events

**Excludes**
- Midstream, downstream, non-fatal injuries

**Data Sources**
- OSHA case files, media, crash reports, autopsy reports, industry partners, etc.
2014 Fatalities by Operation

- **Site preparation**: 2
  - Casing (5)
  - Drilling Operations (26)

- **Drilling**: 31
  - Hydraulic fracturing (8)
  - Flowback (7)

- **Well completions**: 16
  - Well completions (1)

- **Production**: 22
  - Production operations (11)
  - Site maintenance (2)
  - Well servicing, intervention or workover (9)

- **Well decommission**: 0
  - Offshore (3)
  - Vehicle repair (2)
  - Tank refurbishment and custom fabrication (2)
  - Waste fluids treatment and disposal (1)

- **Other**: 8
  - On-wellsite (10)
  - Off-wellsite (13)

- **Unspecified**: 23
  - On-wellsite (10)
  - Off-wellsite (13)
2014 Fatalities by Activity

Motor Vehicle Travel
18 fatalities

Material Handling: Crane, forklift, winch truck
13 fatalities

Rig or equipment repair or Maintenance
10 fatalities

Rigging up or down
8 fatalities

Make up and break out
8 fatalities
Emerging Issue Identified with help of FOG

Ten cardiac related fatalities working around open tank hatches.
First FOG NIOSH Numbered Publication
2014 Mid-Year Fatality Report

http://www.cdc.gov/niosh/topics/fog/
Future Plans for FOG

• Add Non-Fatal Injury and Illness Events
• Enhance data collection
• Query FOG data online
Conclusion: Working Together
A Journey of Working Together

- Ongoing in-person meetings of industry, academia, government
- Allowed us to overcome distrust
- Increased understanding about safety and health hazards
- Allowed for development of FOG and response to emerging issues (through Alliance with OSHA and National STEPS network)
Hazard Alert #1

http://www.nationalstepsnetwork.org/docs_tank_gauging/TankHazardInfographicFinal04_22_15.pdf
Hazard Alert #2

Fatalities Associated with Hot Work on Oilfield Tanks, Tankers, and other related equipment

Produced fluids, such as crude oil, produced water and produced water are brought to the surface, along with hydrocarbon repairs and grease during production operations. These fuels and gases are stored in tanks which require periodic monitoring and repair. Tank/vehicle trucks and pipelines are used to transport and/or remove these fluids from the production site.

There are flammable and toxic hazards (i.e. H2S, benzene) associated with hot work operations (burning, welding, using flammable gases to produce heat) in permanent and temporary storage and transfer structures such as tanks, vessels, trailers, trucks, and tanks/vessels on tank cars and other equipment and produce water tanks which contain hydrocarbon residues.

The most hazardous operations associated with these tanks are not following hot work practices and assuming that empty oilfield equipment does not present a fire or explosion risk to employees.

**Recognizing and understanding the job hazards and following safe work practices can prevent potential fires, explosions, and health hazards.**

**Employer Responsibilities**

- Must conduct processes and hazard assessments at the worksite and review with workers:
  - Flammable or otherwise dangerous fluids being present
  - Safety Data Sheets (SDS) on produced fluids
  - Proper use and handling of personal protection equipment (PPE), including eye, face, body, hearing, and respiratory protection, and use of PPE
- Must establish safe work practices and procedures for:
  - Hot work, confined space work, Lifting and Heavy (LOTO) work
  - Thoroughly cleaning and testing tanks to safe levels before beginning work
  - Continuously monitoring (nitrogen gas meter) for H2S, oxygen, and leaving explosive limits of H2S
  - Handling flammable, toxic, and inert:

**Worker Responsibilities**

- Your employee must establish safety procedures for your protection, including:
  - A Hazard Assessment and Work Practices
  - Follow employer's work practices and procedures
  - Use proper grounding equipment
  - Obtain appropriate hot work permits before beginning work
  - Review with the supervisor sign-off on permit and work procedures
  - Follow any additional procedures - know the contents and hazards of the tanks you will work on
  - Be aware of potential ignition sources (e.g. static, heat, spark, fire, smoke, ignition, sparks from tools or metal objects, etc.)
  - Use required PPE, air monitoring devices, and level of alarms
  - Execute and report hazards immediately

An Empty Tank Does Not Mean a Safe Tank — Check Every Tank Every Time

If you're uncertain about potential risks or have questions, STOP THE JOB AND ASK — IT COULD SAVE YOUR LIFE!
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JOINT US/EU

HYDRAULIC FRACTURING

BAKKEN SAFETY TOUR
AUGUST 31 - SEPTEMBER 2 2016

CONFERENCE ON HEALTH AND SAFETY AT WORK