



HYDRAULIC FRACTURING

BAKKEN SAFETY TOUR | 2016
AUGUST 31 - SEPTEMBER 2

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Epidemiology Perspective

Williston, ND

Hydraulic Fracturing BAKKEN SAFETY TOUR 2016

Kyla Retzer, MPH

National Institute for Occupational Safety and Health



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)



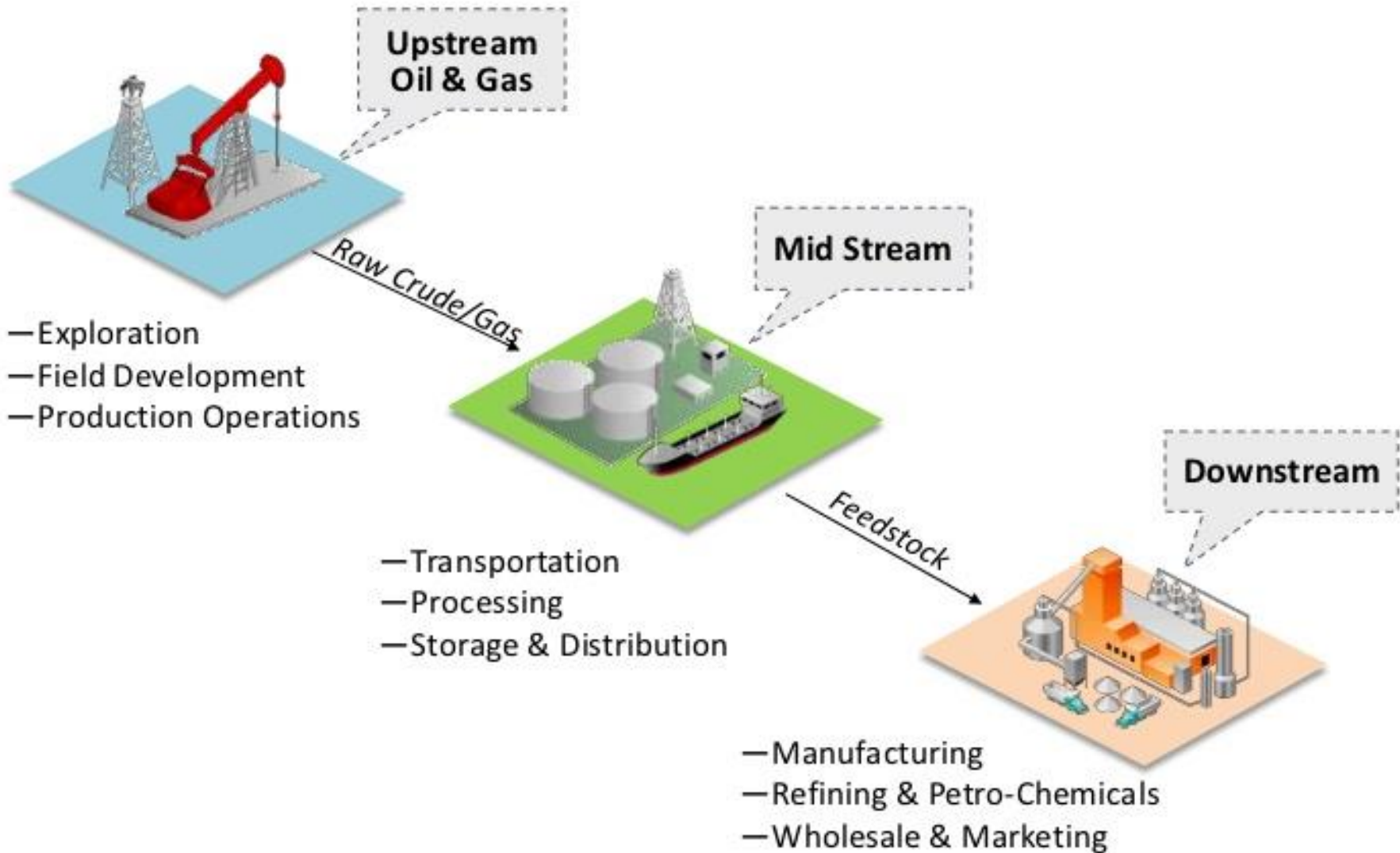
Conclusion: Working Together

Outline

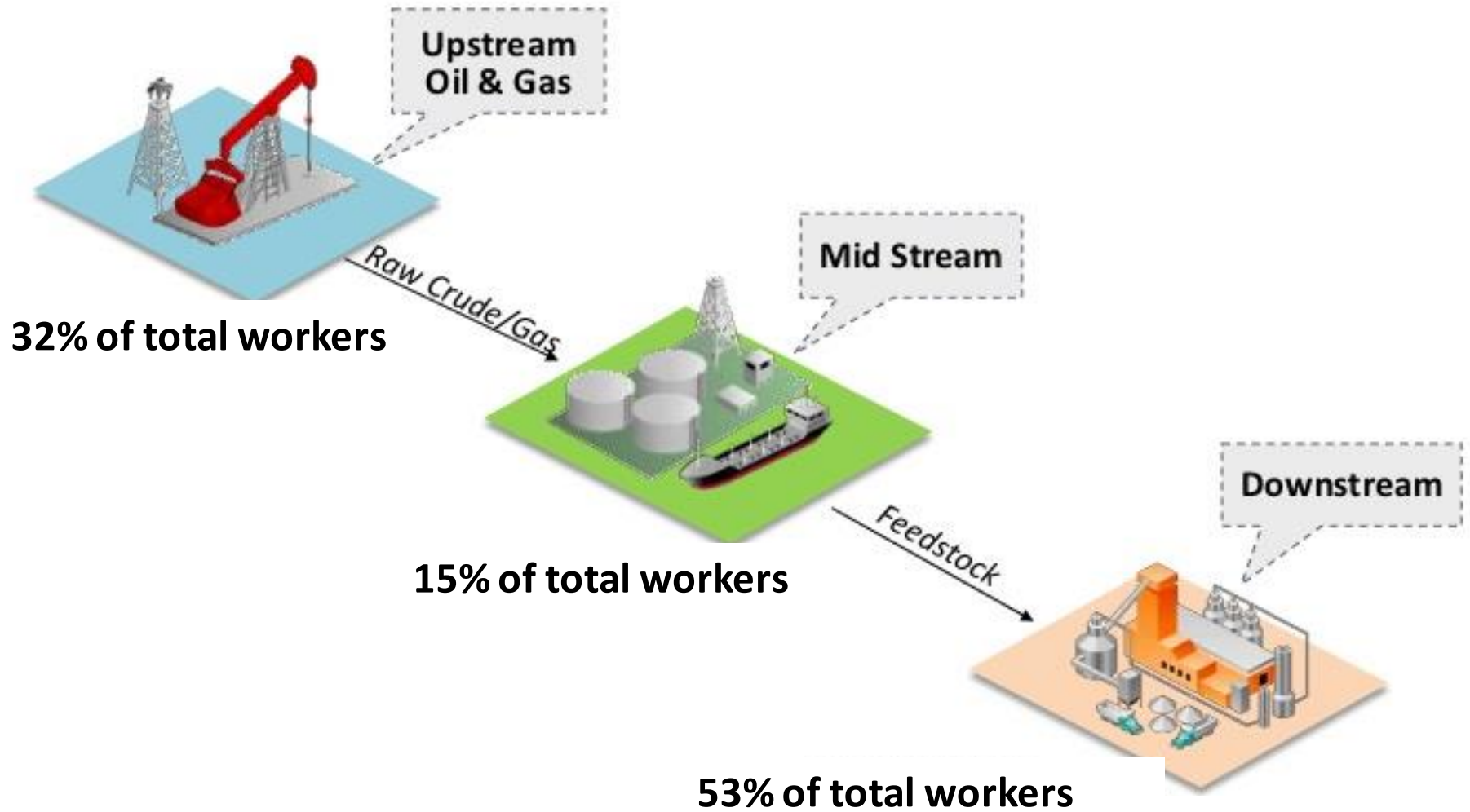


Fatality Trends

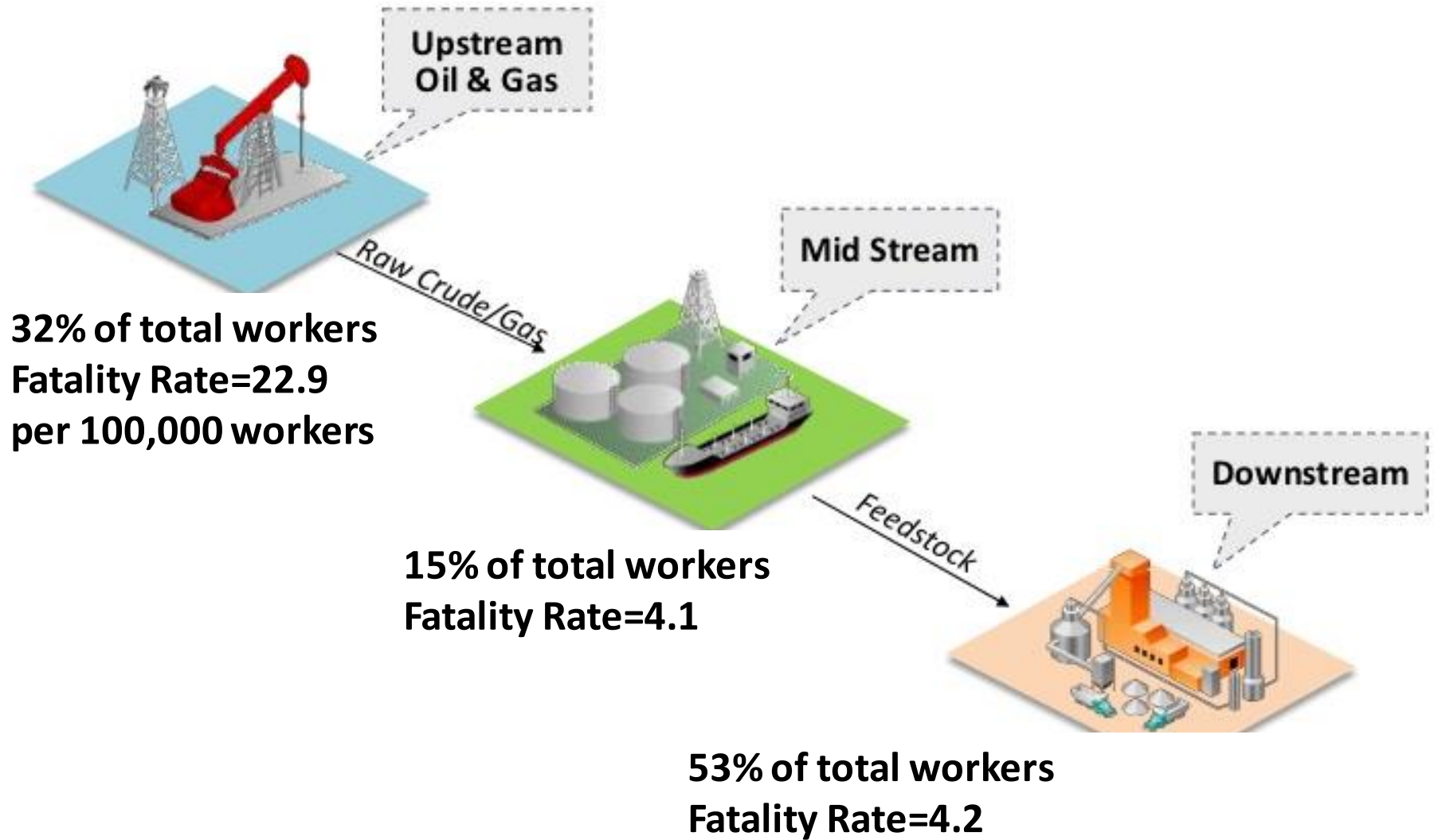
The Oil and Gas Industry



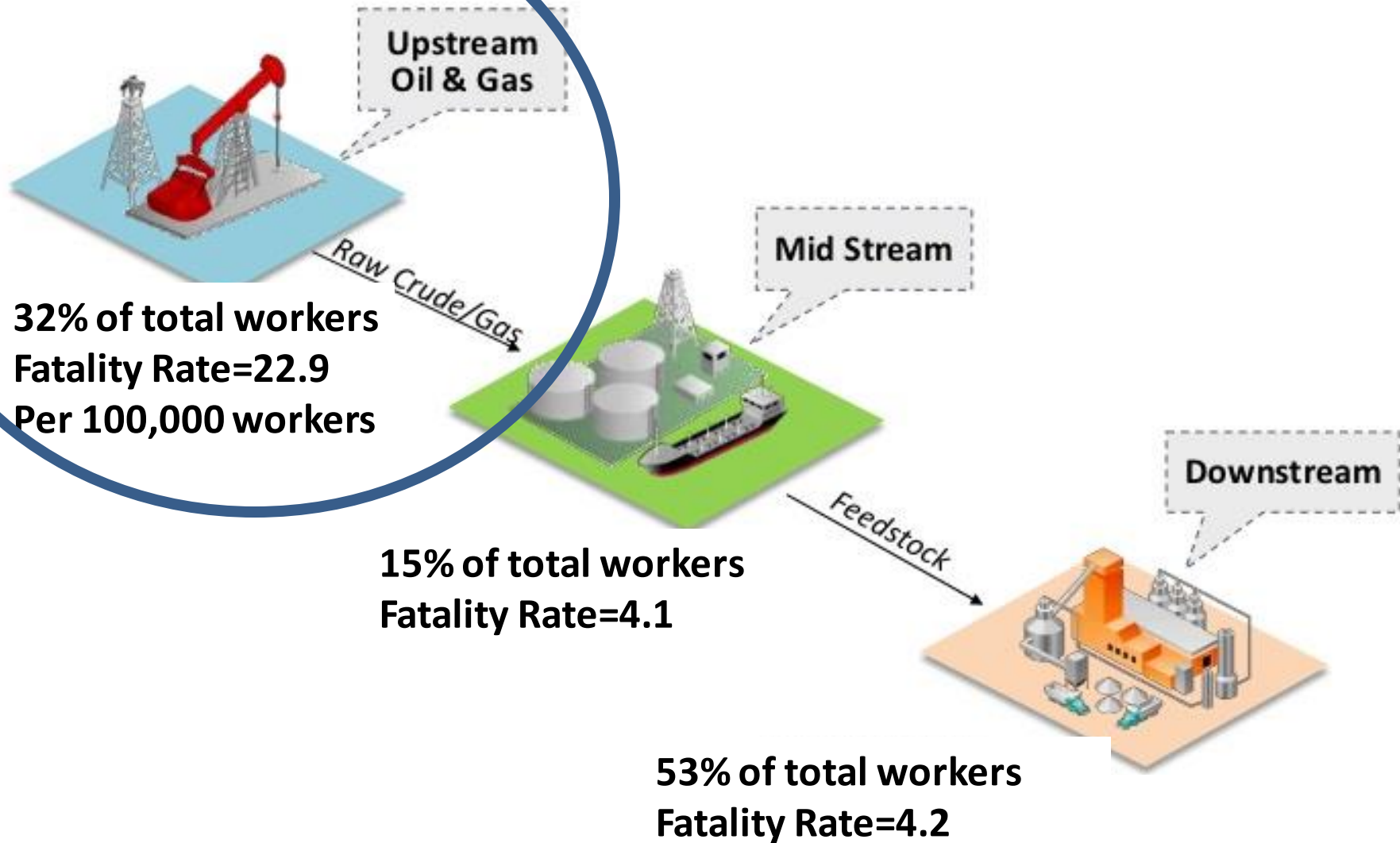
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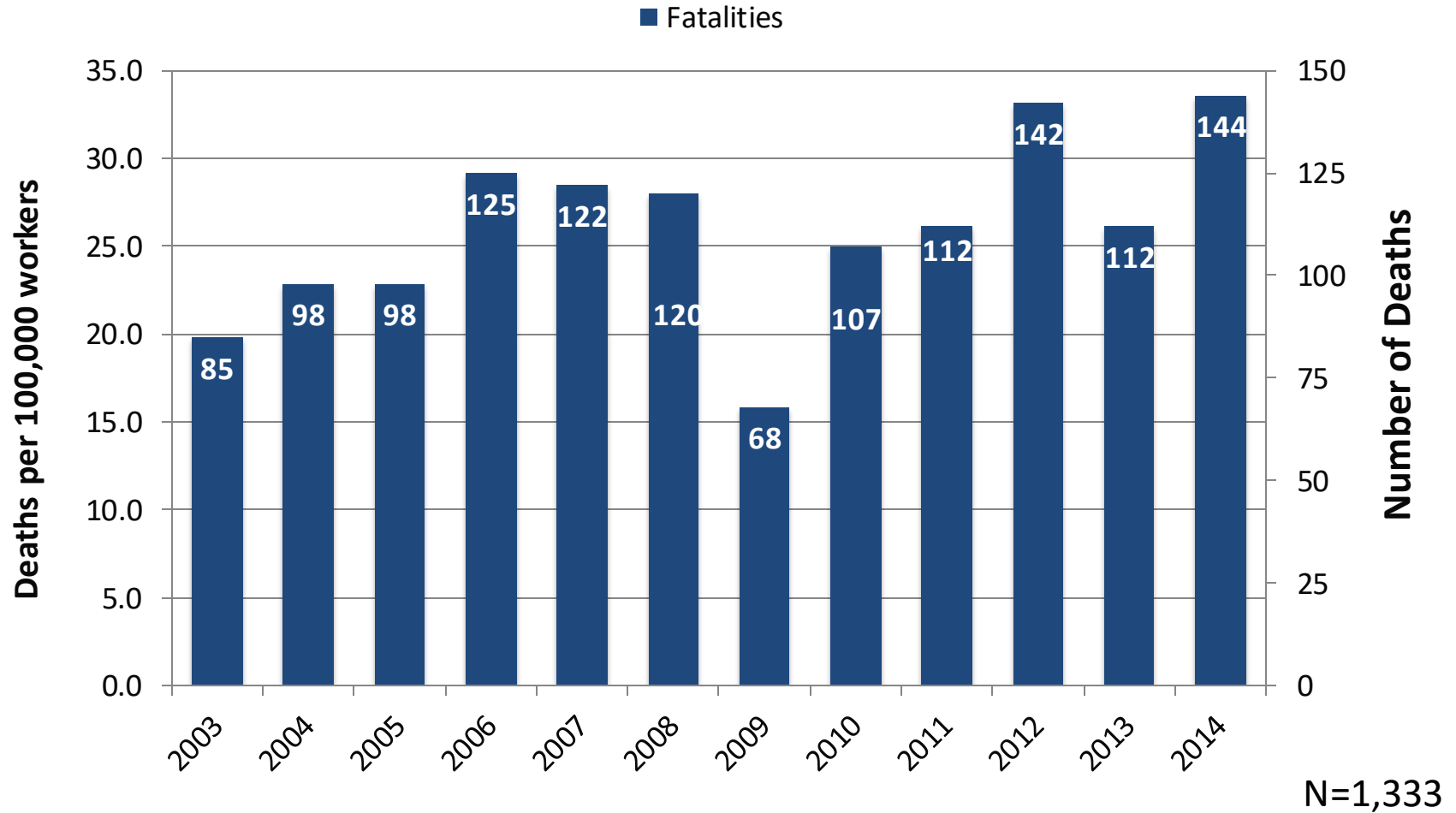
The Oil and Gas Industry



The Oil and Gas Industry

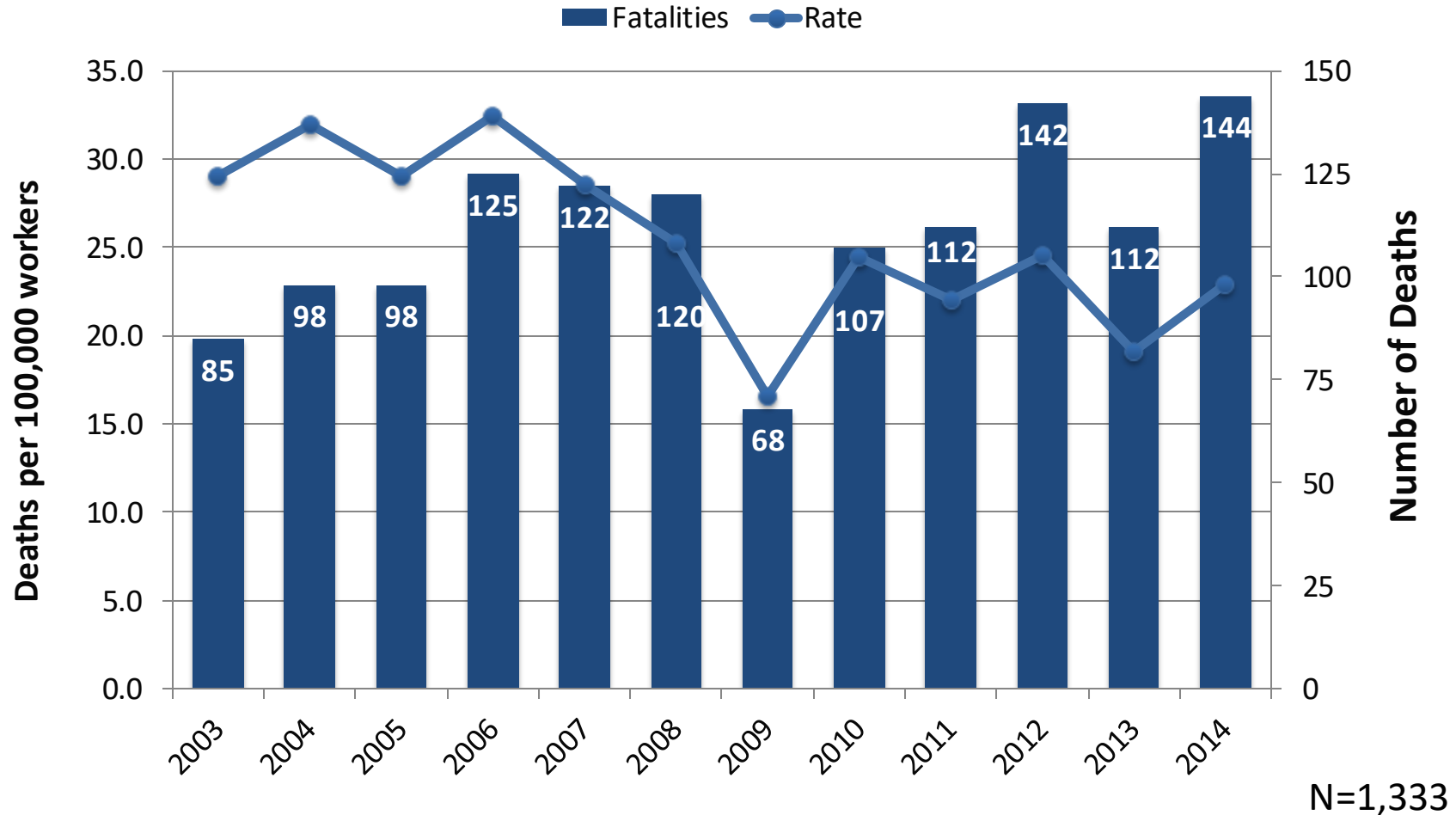


Number and Rate of Fatal Work Injuries U.S. Oil & Gas Extraction Industry, 2003–2014



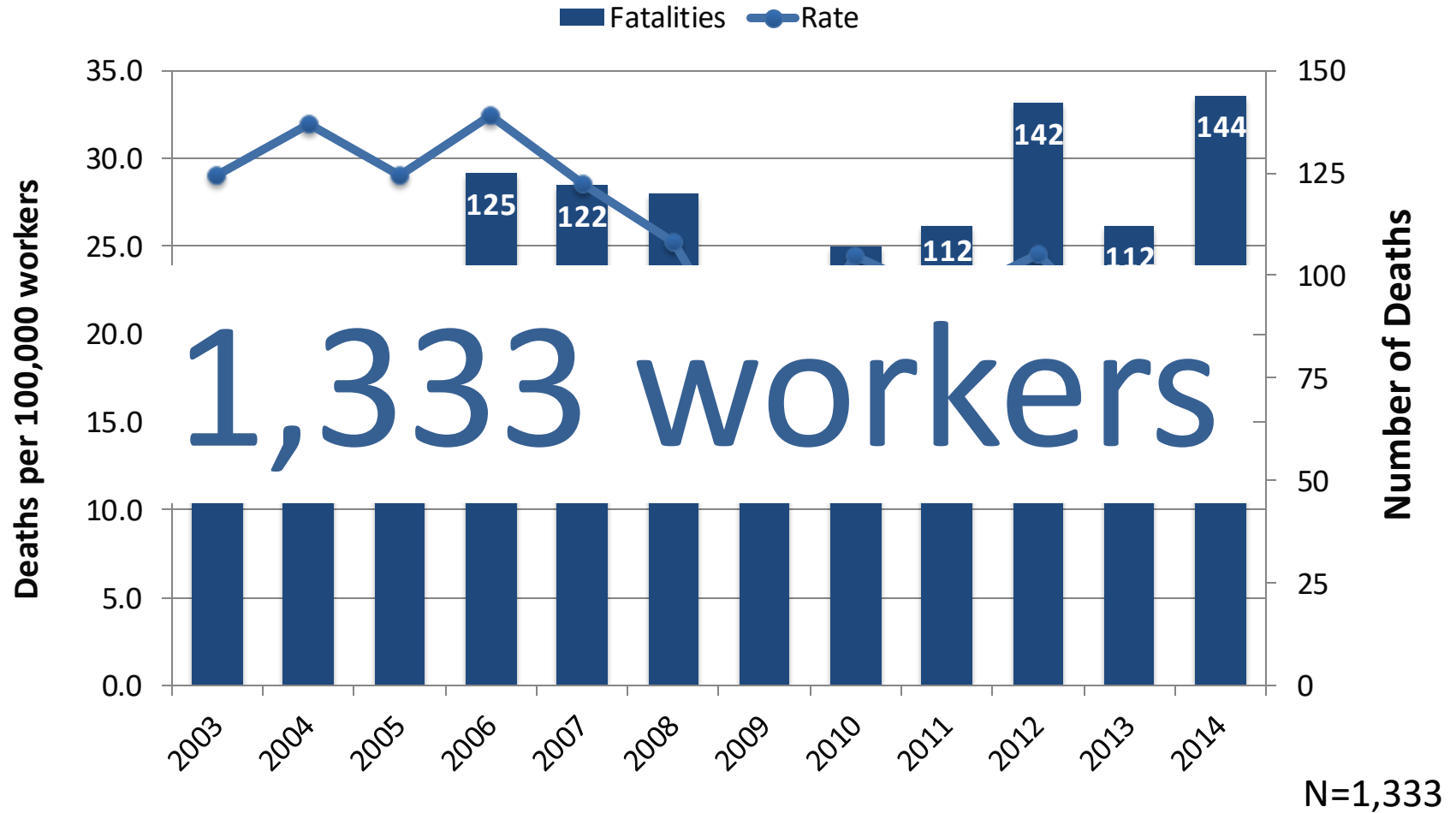
Note: Fatality counts from BLS Census of Fatal Occupational Injuries. Worker Estimates from BLS Quarterly Census of Employment and Wages (2013). Rate per 100,000 workers per year. Includes NAICS 211, 213111, 213112. *Data for 2014 are preliminary.

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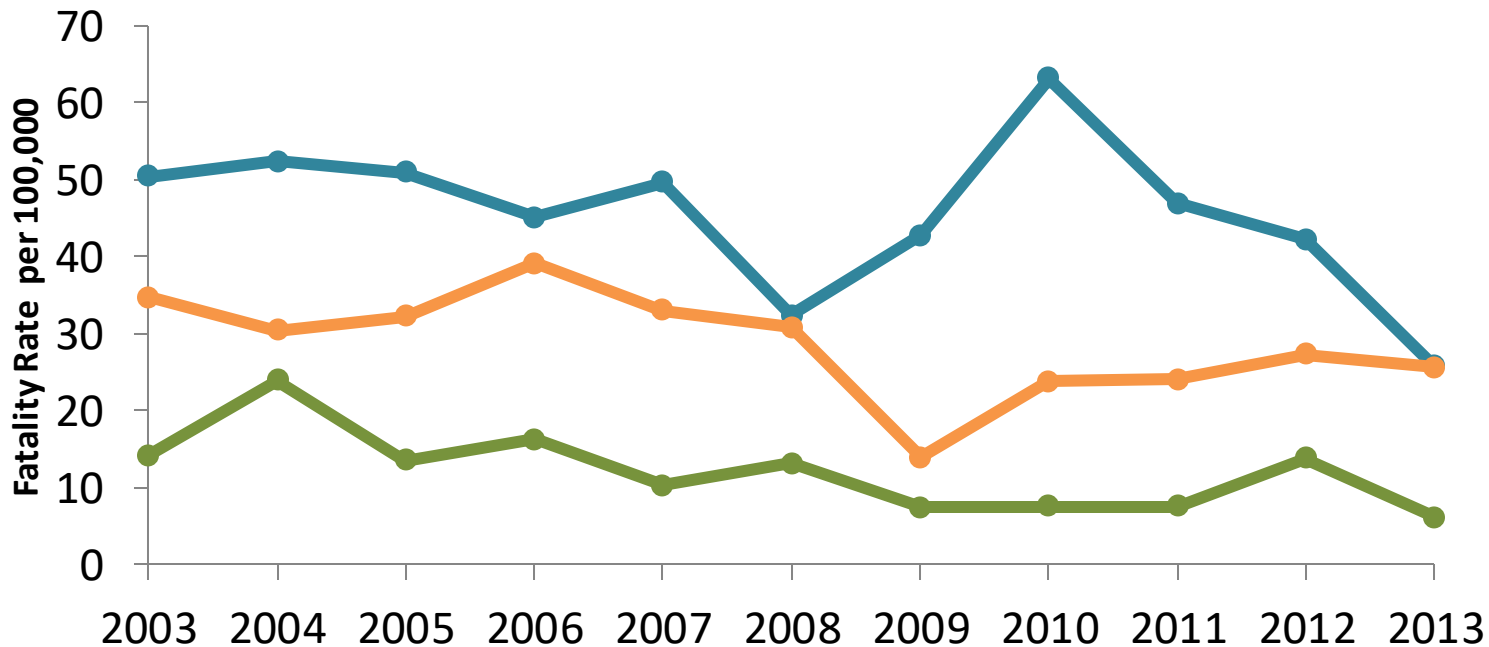
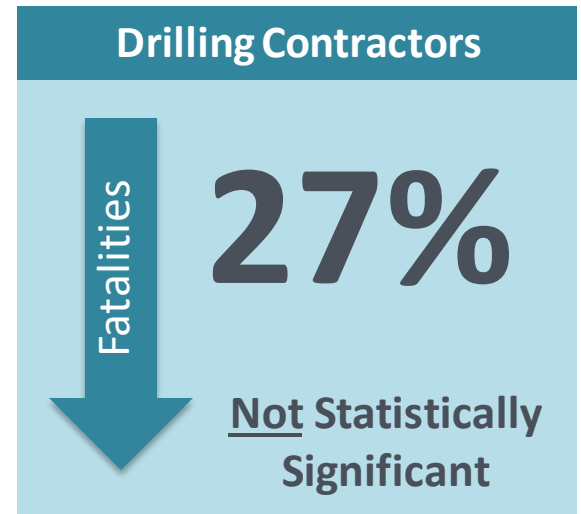
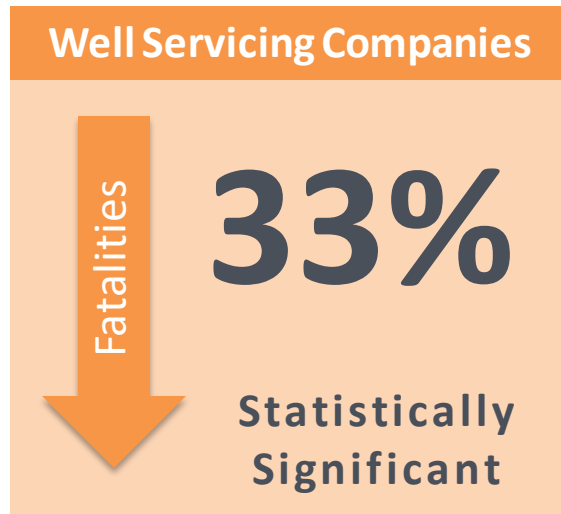
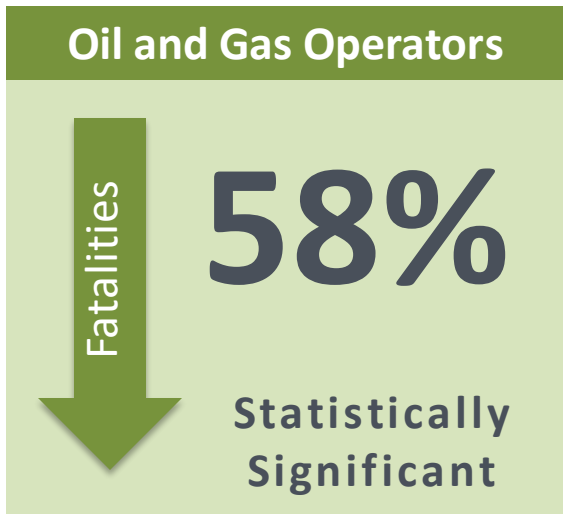
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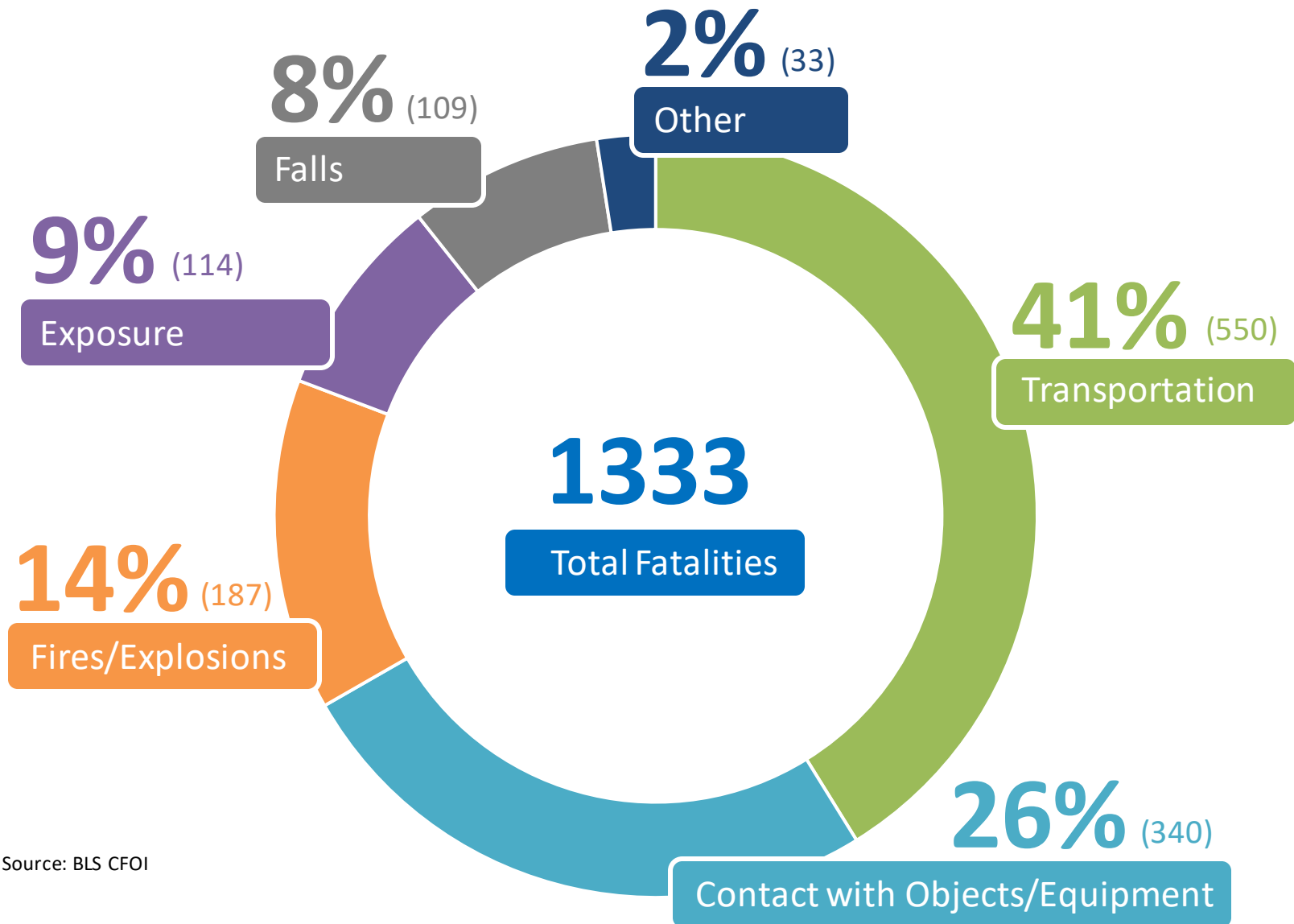
Trends in Fatality Rate by Company Type



June 8, 2015

Most Frequent Fatal Events

U.S. Oil & Gas Extraction Industry, 2003–2014



Data Source: BLS CFOI

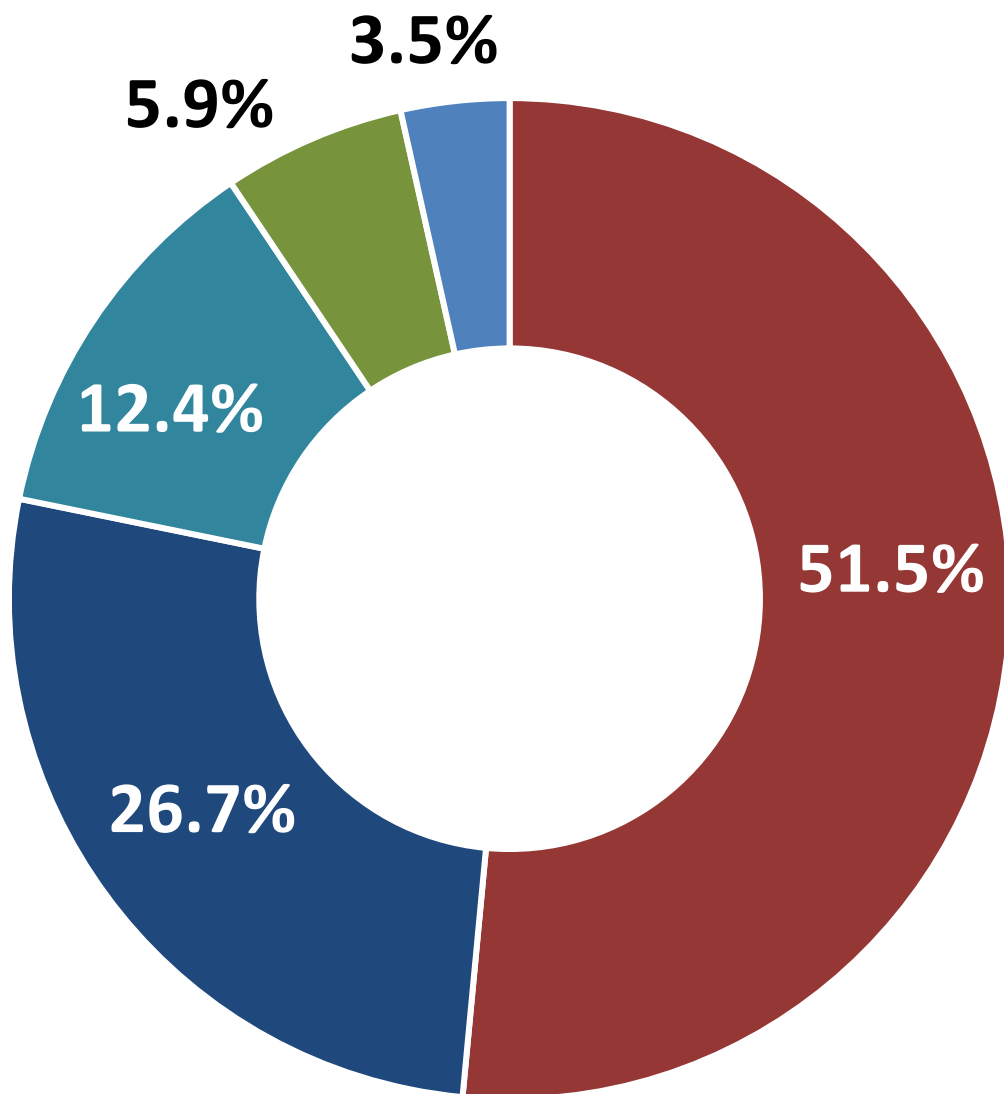
Outline



Motor Vehicle Safety

Motor Vehicle Fatalities by Vehicle Type

U.S. Oil & Gas Extraction Industry, 2003-2009



Pickup Truck

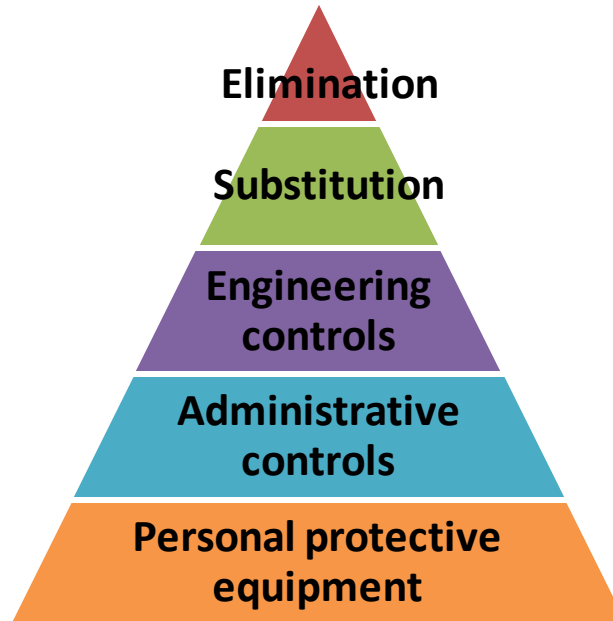
Semitrailer, tractor trailer, trailer truck

Unknown or other types of truck

Automobile

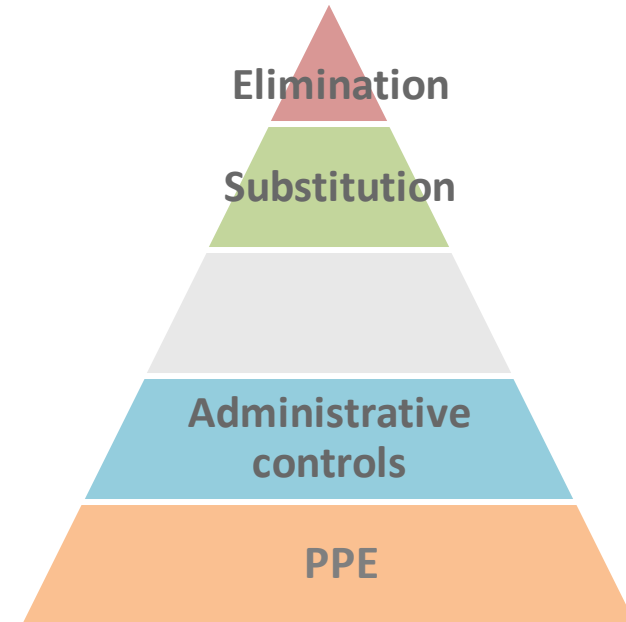
Other Types of Vehicles

Motor Vehicle Safety Program



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



More information: OGP Land Transport Safety Recommended Practice, Journey Management:
www.ogp.org.uk/pubs/365-2.pdf; SPE 168566.

2. Consider Use of In-Vehicle Monitoring Systems

Records Data

- ✓ Date and Time
- ✓ Speed
- ✓ Acceleration/Deceleration
- ✓ Seat Belt Use

Measures Performance

Measures driver performance against a predetermined set of parameters

Changes Behavior

Has shown to be effective in realizing immediate and positive effect on driver behavior.



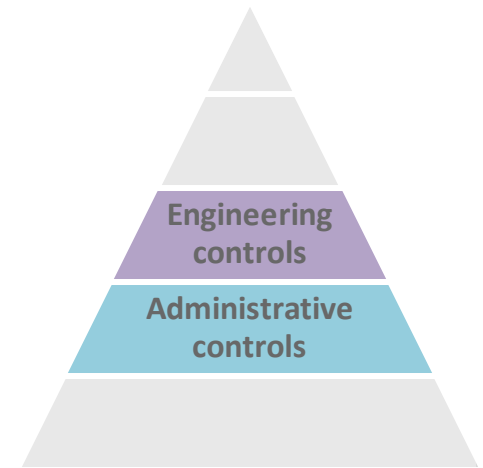
**Motor Vehicle
Crash Rates¹**
50–90%



Speeding²
60%



Miles Driven³
8-20%



¹Gale et. al, 2012, Mora et. al, 2010, Velasquez, et. al, 2010, Matusalen, et. al, 2006, Ballard et. al, 2004, Jutten et. al, 2002, Cocianni & Taviansky, 1998); ²Twilhaar, 2000; ³Lopez, 2006, Twiilar, 2000.

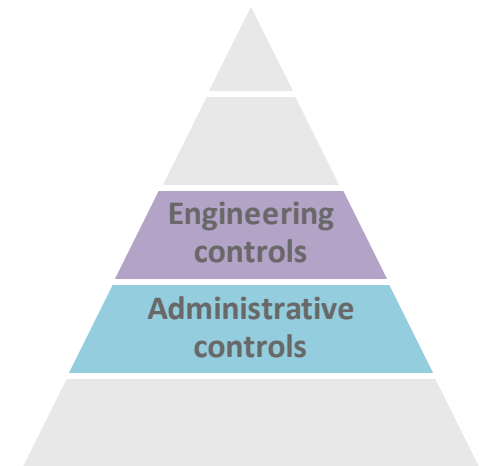
Fatigue-Related Crash



- **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>

Outline



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?

Different risks for different basins? Is distraction or fatigue a factor?

Struck by what?

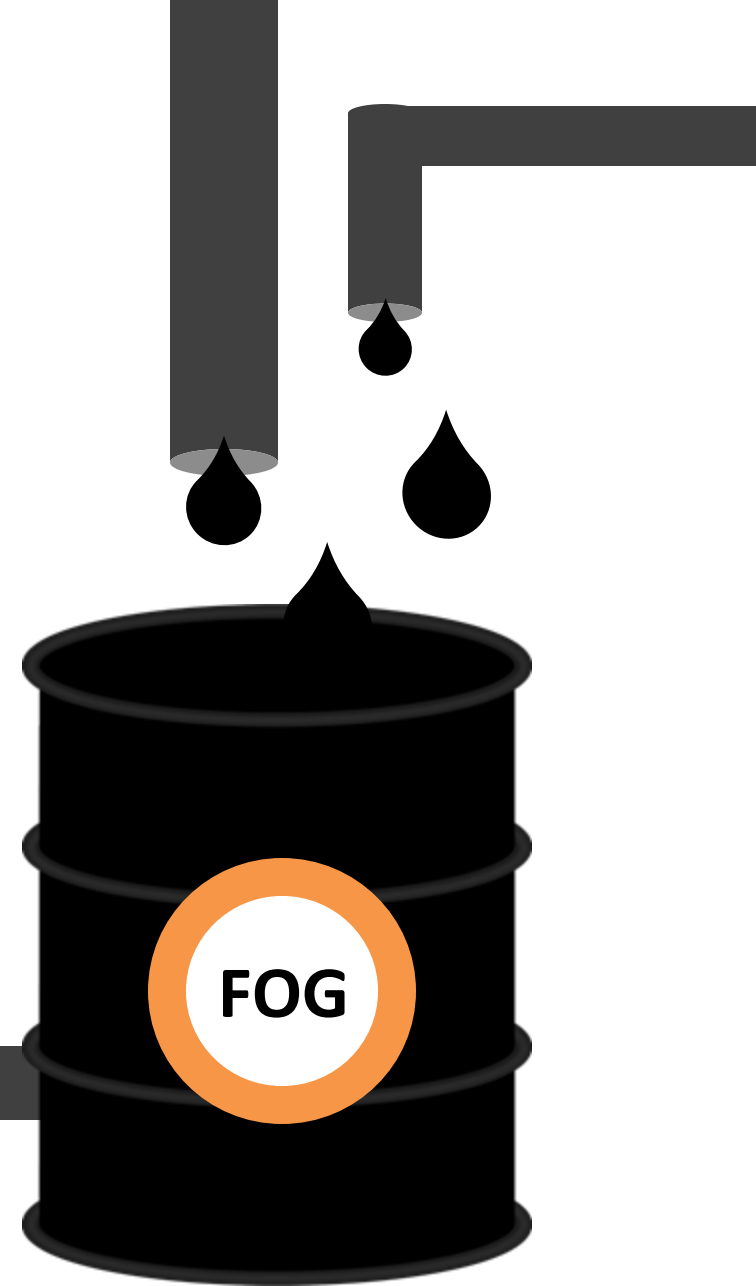
Do they...
Are some...
The details needed to answer these questions are not in available current data sources

(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

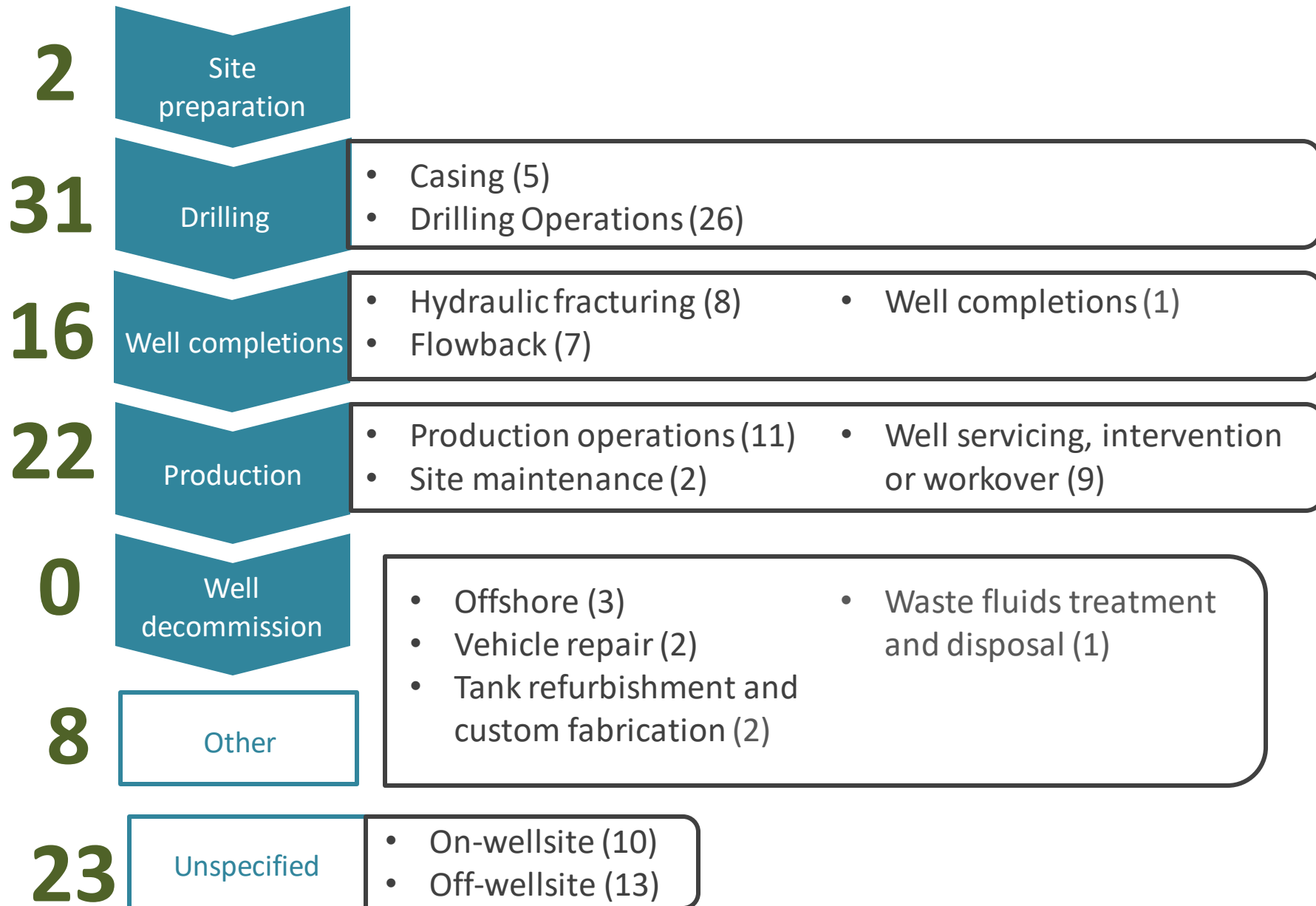
Excludes

Midstream, downstream, non-fatal injuries

Data Sources

OSHA case files, media, crash reports, autopsy reports, industry partners, etc.

2014 Fatalities by Operation



2014 Fatalities by Activity



Motor Vehicle Travel

18 fatalities



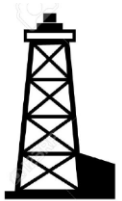
Material Handling: Crane, forklift, winch truck

13 fatalities



Rig or equipment repair or Maintenance

10 fatalities



Rigging up or down

8 fatalities



Make up and break out

8 fatalities

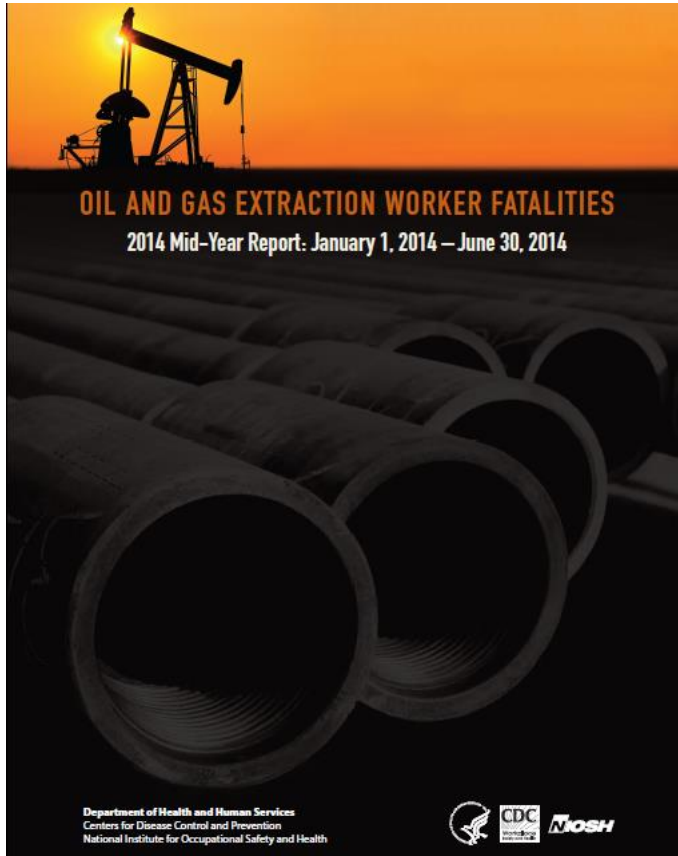


Emerging Issue Identified with help of FOG

Ten cardiac related fatalities working around open tank hatches.



First FOG NIOSH Numbered Publication 2014 Mid-Year Fatality Report



Maps

Fatalities
by
Operation



Descriptive
Statistics

Narratives

Up/down*	9
Specified operation	5
Non-traditional commuting	4
General well servicing	4
Rig/equipment repair or maintenance	3
Coiled tubing operations	2
Back operations	2

<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



Outline



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

TANK HAZARD ALERT

gauging • thieving • fluid handling
how to recognize and avoid hazards

Opening thief hatches of storage tanks can lead to the rapid release of high concentrations of hydrocarbon gases and vapors. Those may result in very low oxygen levels and toxic and flammable conditions around and over the hatch. Recent reports have documented fires or explosions, and described workers experiencing dizziness, fainting, headache, nausea, and, in some cases, death while gauging tanks, collecting samples, or transferring fluids. Tank gauging, thieving, and fluid handling can be performed safely with proper precautions.



hazards
that workers can encounter

- oxygen deficiency
- fires & explosions
- chemical toxicity
hydrocarbon vapors
propane
butane
benzene
hydrogen sulfide (H₂S)

potential effects of exposure

- death
- chronic illness
- flash fire burns
- dizziness
- irregular heartbeat
- irregular breathing
- respiratory irritation
- fatigue
- nausea
- eye irritation
- headache

EMPLOYERS:

Must Conduct Exposure and Hazard Assessments at Worksites to determine needs for:

- Engineering Controls
- Respiratory Protection
- PPE
- Monitoring Device such as:
 - ▶ Multi-gas meter
 - ▶ Other direct-reading toxic gas meter (benzene)

Must Provide Training to Workers:

- Hazard Communication
- Lone Worker Policy
- Proper use of PPE and respiratory protection
- Types, use, and limits of respiratory protection equipment as appropriate
- Recognizing ignition sources
- Tank Gauging work practices/procedures
- Emergency Response Plan
 - ▶ Procedures for alarm response and site re-entry
- Use and limits of toxic- or multi-gas meter for O₂, H₂S, LEL, and CO

Should Implement Engineering Controls such as:

- Remote Gauging
- Closed Loop Systems
- Auto Gauging
- Sight Glasses/Gauges
- Remote Venting

Verify sub-contractors are following work practices/procedures

PPE protect your



WORKERS:

Your employer has established safety procedures for your protection including a Hazard Assessment and Work Practices/Procedures

Follow your employer's Hazard Assessment and Established Work Practices/Procedures

- Use toxic- or multi-gas meter provided by your employer as per your training
- Heed all alarms
- Stop flow into tanks prior to gauging, when possible
- Minimize leaning over open hatches – stand away/upwind/crosswind when possible
- ▶ Inversion/high humidity/lack of wind could increase danger
- Follow your employer's "lone worker" policy
- Allow tanks to ventilate after opening thief hatches
- Evacuate unsafe work areas and report immediately
- Know the limits of your respiratory protection as provided during employer training
- Immediately report any health symptoms

Wear PPE as required/provided

Attend Hazard Communication Training

Be Aware of Potential Ignition Sources:

- Static
- Cell phones
- Sparks from tools or metal objects
- Open flames
- Non-approved electrical equipment/devices
- Ensure proper grounding/bonding

If you are not sure, STOP the job and ask!

Everyone has the right to STOP work that is unsafe.

Through the OSHA National Steps Alliance, this Tank Gauging Hazard Alert is for informational purposes only. It does not necessarily reflect the official views of OSHA or the U.S. Department of Labor, March, 2015

Under the Occupational Safety and Health Act, employers are responsible for providing a safe and healthy workplace and workers have rights. OSHA can help answer questions or concerns from employers and workers. OSHA's On-site Consultation Program (www.osha.gov/consultation) offers free and confidential advice to small and medium-sized businesses, with priority given to high-hazard worksites. For more information, contact your regional or area OSHA office (www.osha.gov/html/RAmap.html), call 1-800-321-OSHA (6742), or visit www.osha.gov.



YOUR LIFE can change in a **SINGLE BREATH** or with **ONE SPARK.**

Hazard Alert #2

FINAL
DRAFT

Alert Hazard Alert Hazard Alert Hazard Alert Hazard Alert Haza

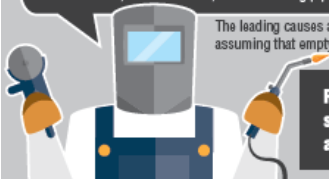
Between 2005 and 2015
85
DEATHS due to fires or explosions
including **28**
hot work deaths

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

Produced fluids, such as crude oil, flowback water and produced water are brought to the surface, along with hydrocarbon vapors and gases during production operations. These fluids are separated and stored on the production site in tanks which require periodic monitoring and repair. Tanker/vacuum 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 fire-or-spark producing tools) on permanent and temporary storage and tanker/vacuum truck tanks and other equipment such as heater/treaters, flowback tanks, interconnecting pipes, and produced water tankers which contain hydrocarbon residues.

The leading causes associated with these fatalities 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 exposure and hazard assessments at the worksite and review with workers:

- Hazards of possible flammable/toxic hydrocarbons being present
- Safety Data Sheets (SDSs) on produced fluids
- Proper use and limitations of personal protection equipment (PPE), including eye, face, skin, hearing, and respiratory protection, and fire retardant clothing (FRC)

Must establish safe work practices and procedures for:

- Hot work, confined space work, Lockout/Tagout (LOTO) work
- Thoroughly cleaning and venting tanks to safe areas before beginning work
- Continuously monitoring (multi-gas meter) for H₂S, oxygen, and lower explosive limits (LELs)
- Thawing frozen valves, hoses, and lines

Must implement and train workers on additional hazard control measures, including:

- Hot work permits and other safe work practices (i.e. confined space, LOTO)
- Recognize and eliminate ignition sources (e.g. ground and bond equipment, intrinsically safe tools)
- Air monitoring devices and procedures
- Emergency Action Plan

Must verify sub-contractors are following work practices/procedures

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

Worker Responsibilities

Your employer has established safety procedures for your protection, including a Hazard Assessment and Work Practices/Procedures

- Follow employer's work practices and procedures
- Use proper grounding/bonding
- Obtain appropriate hot work permits before beginning work
 - Review with and have supervisors sign off on permit/audit work procedures
- Attend hazard communication training – know the contents and hazards of the tanks you work on
- Be aware of potential ignition sources (e.g. static, cell phones, open flames, cigarettes, sparks from tools or metal objects, etc.)
- Use required PPE, air monitoring devices, and heed all alarms
- Evacuate and report hazards immediately



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

Through the OSHA/NIOSH National Safety Alliance, this Hazard Alert is for informational purposes only. It does not necessarily reflect the official views of OSHA or the U.S. Department of Labor. August, 2015



Contact Info and Acknowledgements

Contact Info:

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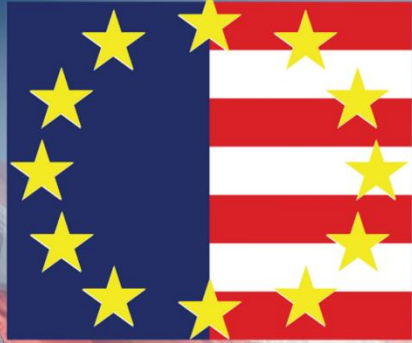
kgz7@cdc.gov , 303-236-5934

Acknowledgements:

Sophia Ridl, NIOSH, Western States Division



JOINT US/EU



**CONFERENCE ON HEALTH
AND SAFETY AT WORK**

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