



Putting it all together: An analysis of oil and gas extraction worker fatalities, severe injuries, and illnesses

Alejandra Ramirez-Cardenas, MPH

Emily R.T. Schmick, MSPH, CIH

Sophia Ridl

National Institute for Occupational Safety and Health



Disclaimer

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Who we are

National Institute for Occupational Safety and Health (NIOSH)



*Conduct occupational safety and
health research*

NIOSH Oil and Gas Program

Established in 2007

Four Components

- Epidemiology and surveillance
- Exposure assessment
- Engineering controls
- Communications

Partner-focused

- NORA council
- OSHA Alliance
- National STEPS Network

Outline

Introduction

Fatalities from FOG

Hospitalizations and Amputations
from OSHA Severe Injury Reporting

Putting it all together: trends and
recommendations



Outline

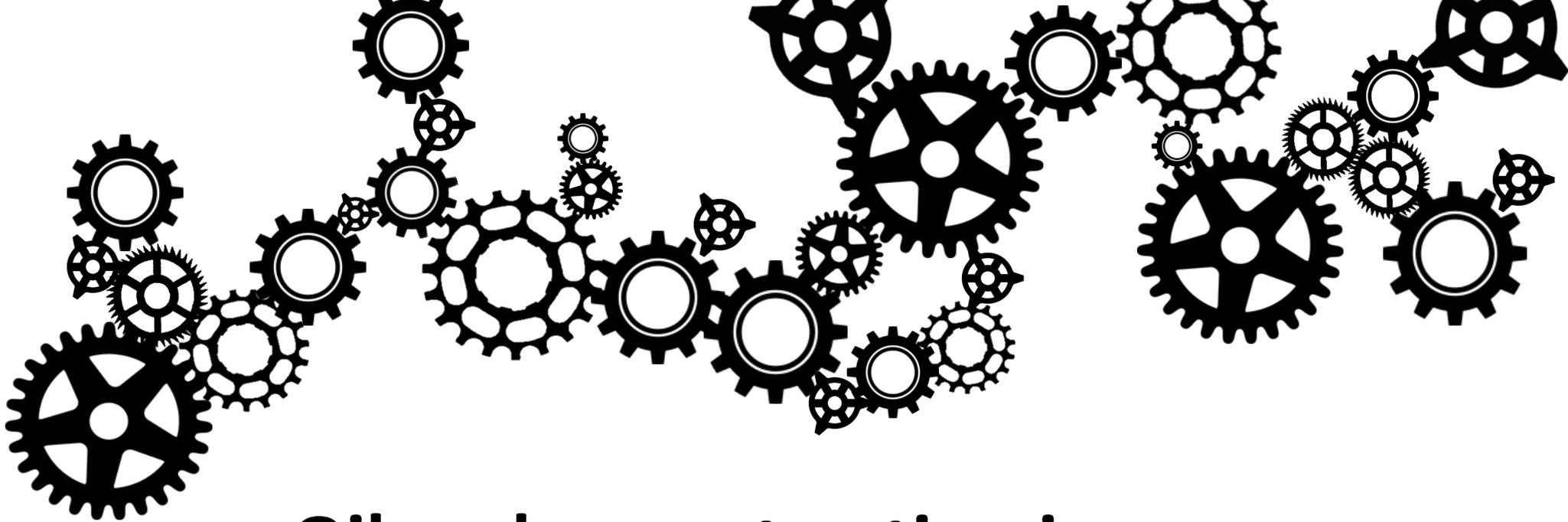
Introduction

Fatalities from FOG

Hospitalizations and Amputations
from OSHA Severe Injury Reporting

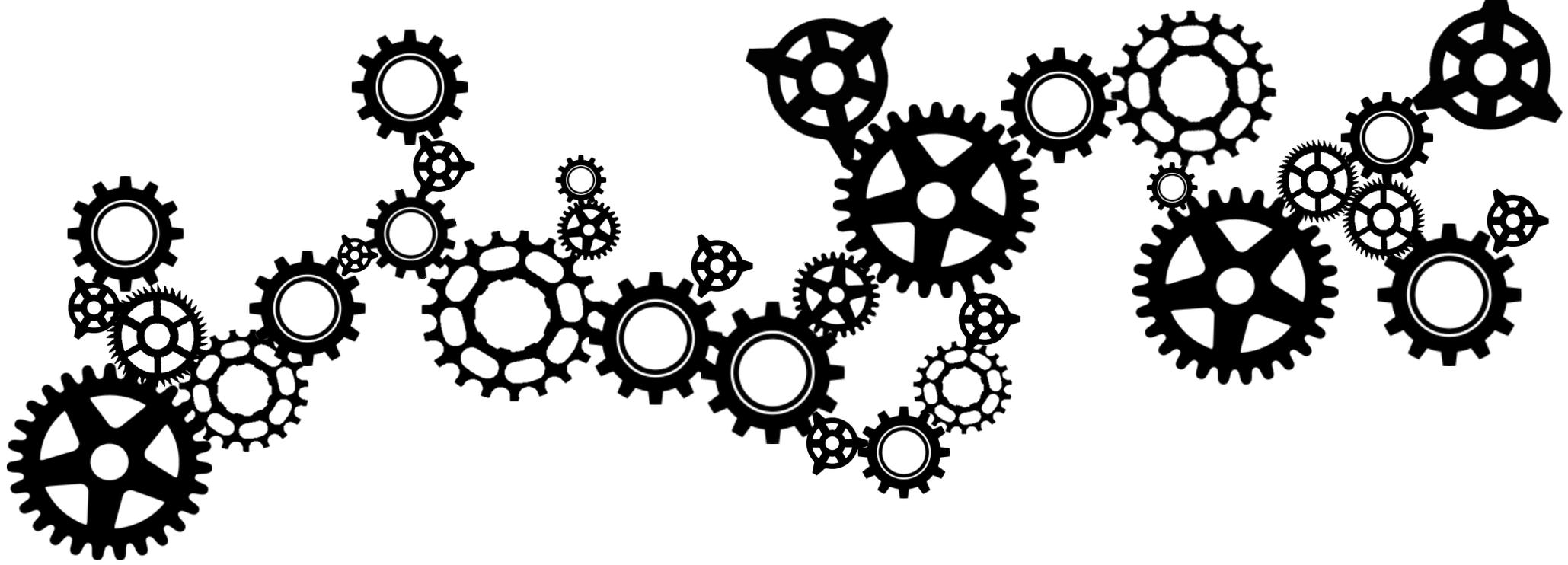
Putting it all together: trends and
recommendations



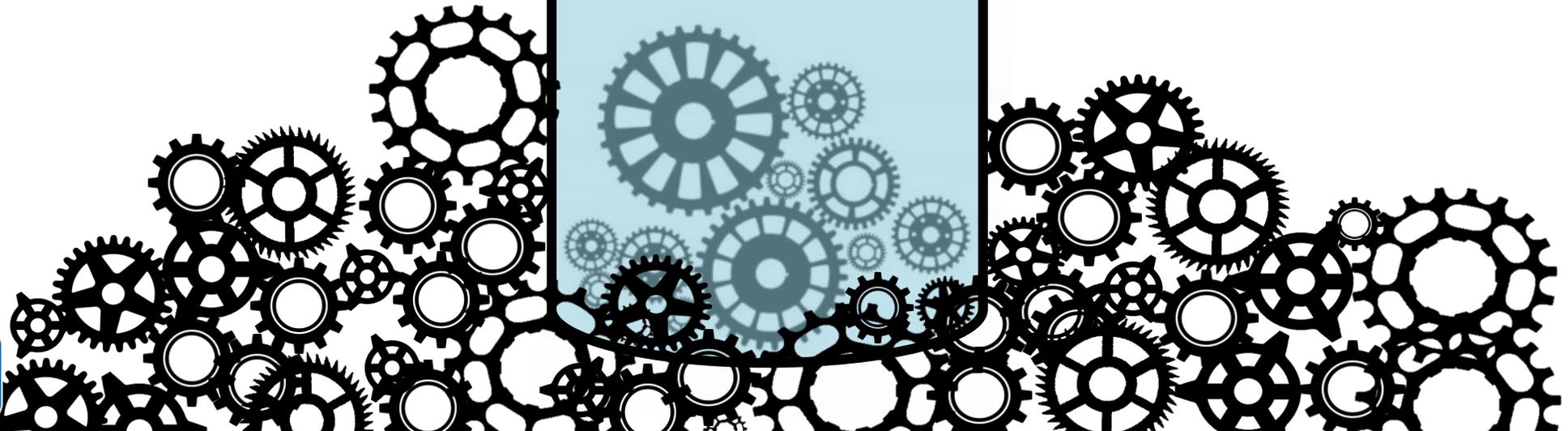
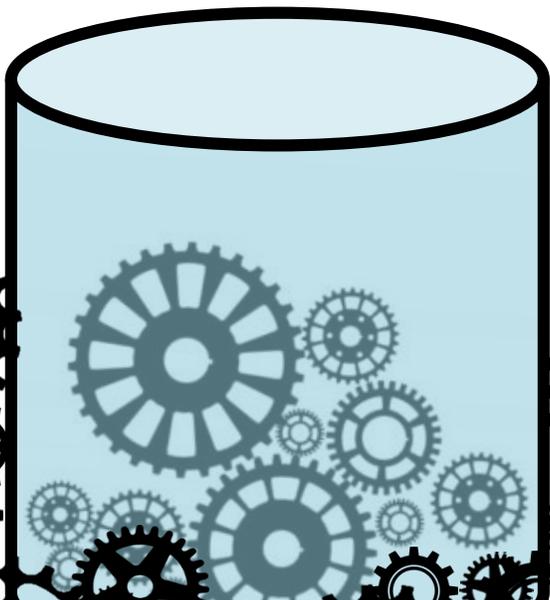
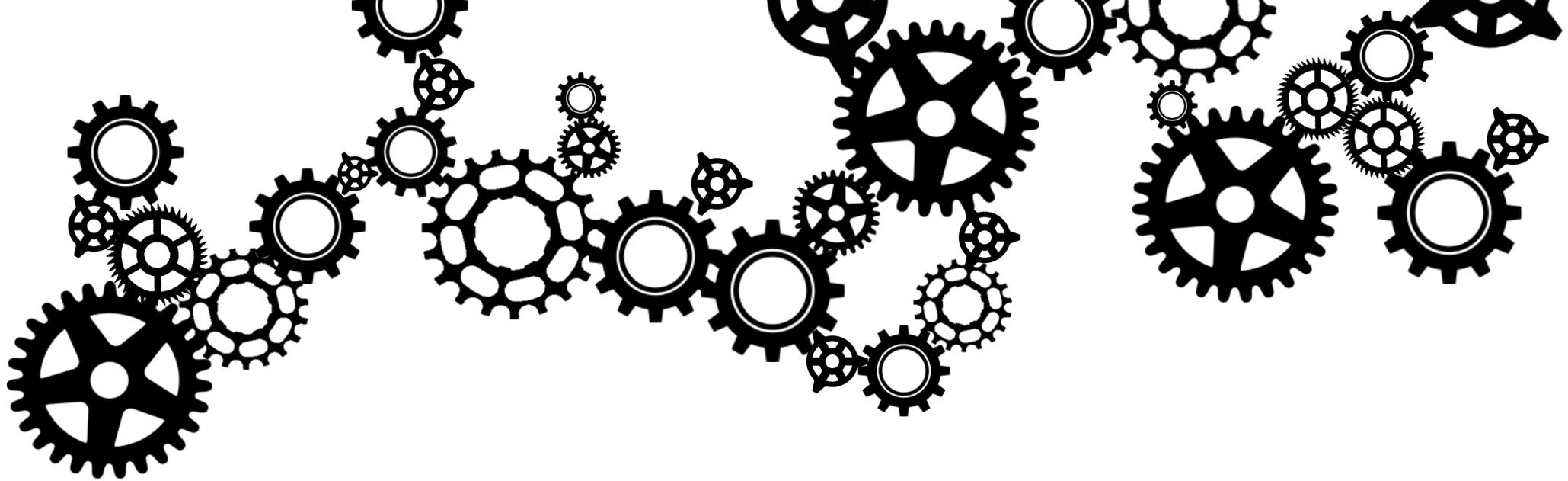


Oil and gas extraction is...

- Diverse
- Dynamic
- Specialized
- Complicated
- High hazard

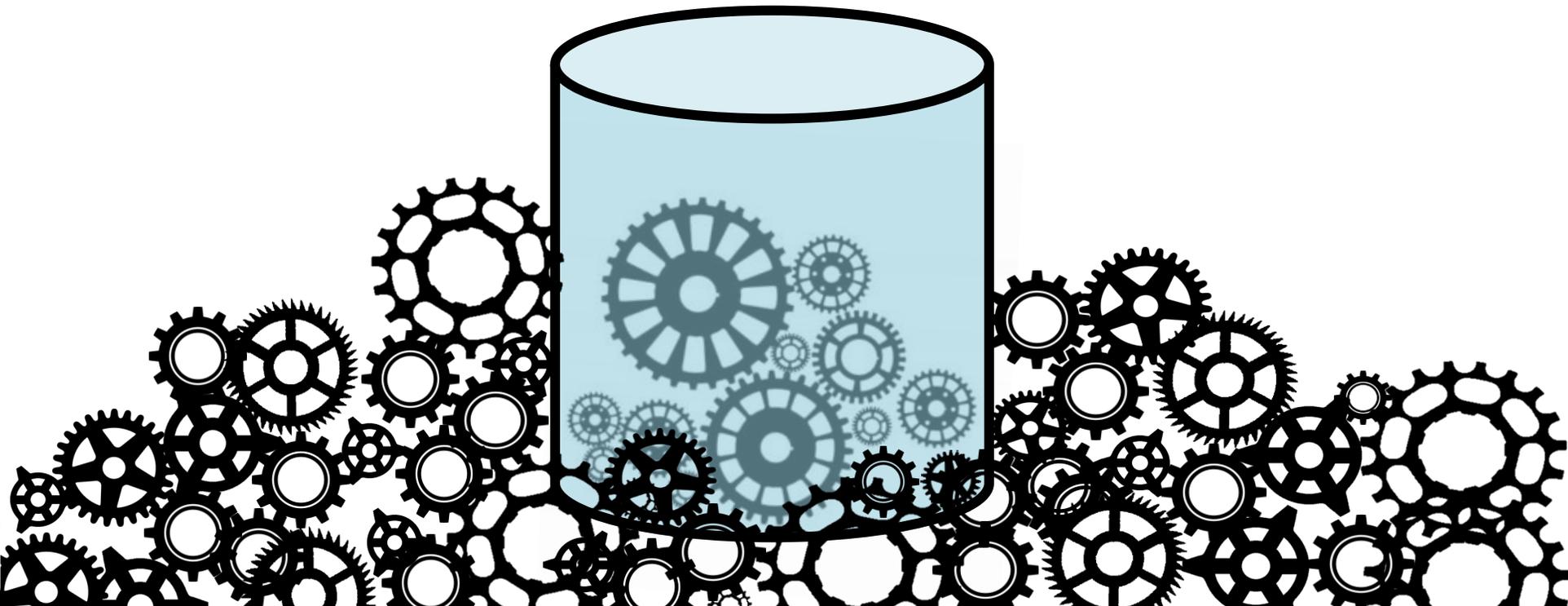


Oil and gas extraction is...
an intricate machine



The problem...

Important information was not captured in available databases.



The solution...

The Fatalities in Oil and Gas Extraction (FOG) database

A database specific to the oil and gas
extraction industry.



FOG captures what is missing



FOG captures what is missing

FOG

≠

BLS CFOI



Outline

Introduction

Fatalities from FOG

Hospitalizations and Amputations
from OSHA Severe Injury Reporting

Putting it all together: trends and
recommendations



Fatalities in Oil and Gas Database

NIOSH database that collects [detailed information](#) about oil and gas worker fatalities in the U.S.

Fatalities in Oil and Gas Database

NIOSH database that collects [detailed information](#) about oil and gas worker fatalities in the U.S.

Includes

Fatal events to U.S. oil and gas extraction workers:

- Onshore
- Offshore
- **All NAICS (O&G related)**
- Motor vehicle incidents
- **Non-traditional commuting**
- Cardiac events

Fatalities in Oil and Gas Database

NIOSH database that collects [detailed information](#) about oil and gas worker fatalities in the U.S.

Includes

Fatal events to U.S. oil and gas extraction workers:

- Onshore
- Offshore
- **All NAICS (O&G related)**
- Motor vehicle incidents
- **Non-traditional commuting**
- Cardiac events

Excludes

Midstream and downstream

Fatalities in Oil and Gas Database

NIOSH database that collects [detailed information](#) about oil and gas worker fatalities in the U.S.

Includes

Fatal events to U.S. oil and gas extraction workers:

- Onshore
- Offshore
- **All NAICS (O&G related)**
- Motor vehicle incidents
- **Non-traditional commuting**
- Cardiac events

Excludes

Midstream and downstream

Data Sources

OSHA case files, media, crash reports, autopsy reports, industry partners, state health departments

Fatalities in Oil and Gas Database

NIOSH database that collects [detailed information](#) about oil and gas worker fatalities in the U.S.

Includes

Fatal events to U.S. oil and gas extraction workers:

- Onshore
- Offshore
- **All NAICS (O&G related)**
- Motor vehicle incidents
- **Non-traditional commuting**
- Cardiac events

Excludes

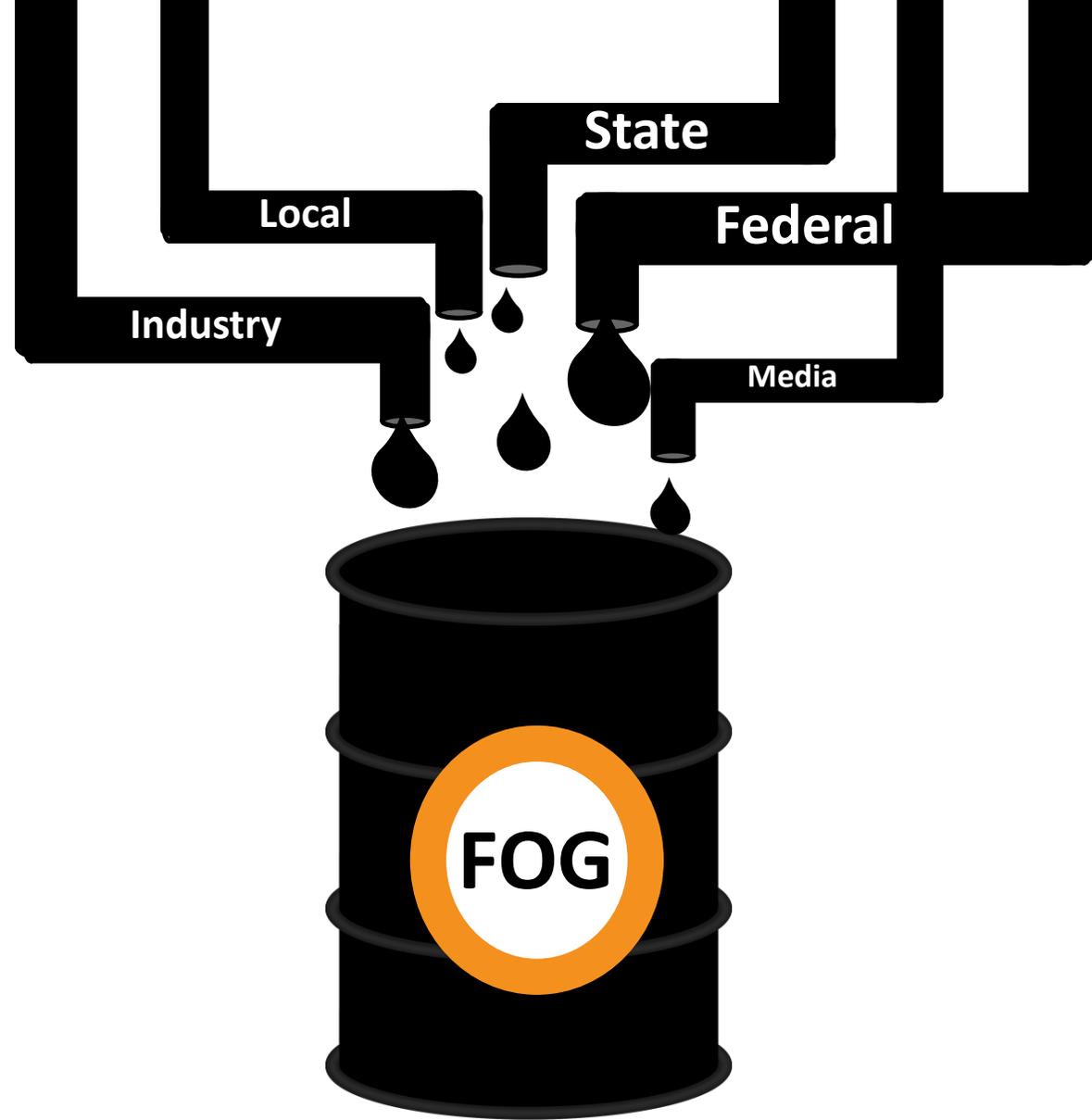
Midstream and downstream

Data Sources

OSHA case files, media, crash reports, autopsy reports, industry partners, state health departments

Limitations

Roadway motor vehicle fatalities, chronic illness



50

Variables per Incident

- ✓ Industry operations
- ✓ Industry activities
- ✓ Incident event type
- ✓ Contributing factors
(i.e. weather, equipment, etc.)



41

Variables per Worker

- ✓ Industry-specific occupations
- ✓ Years in Oilfield
- ✓ Fatigue

2015

Fatalities

63

Incidents

53

Fatalities in FOG 2015-2016

FOG

2015

2016

Fatalities

63

29

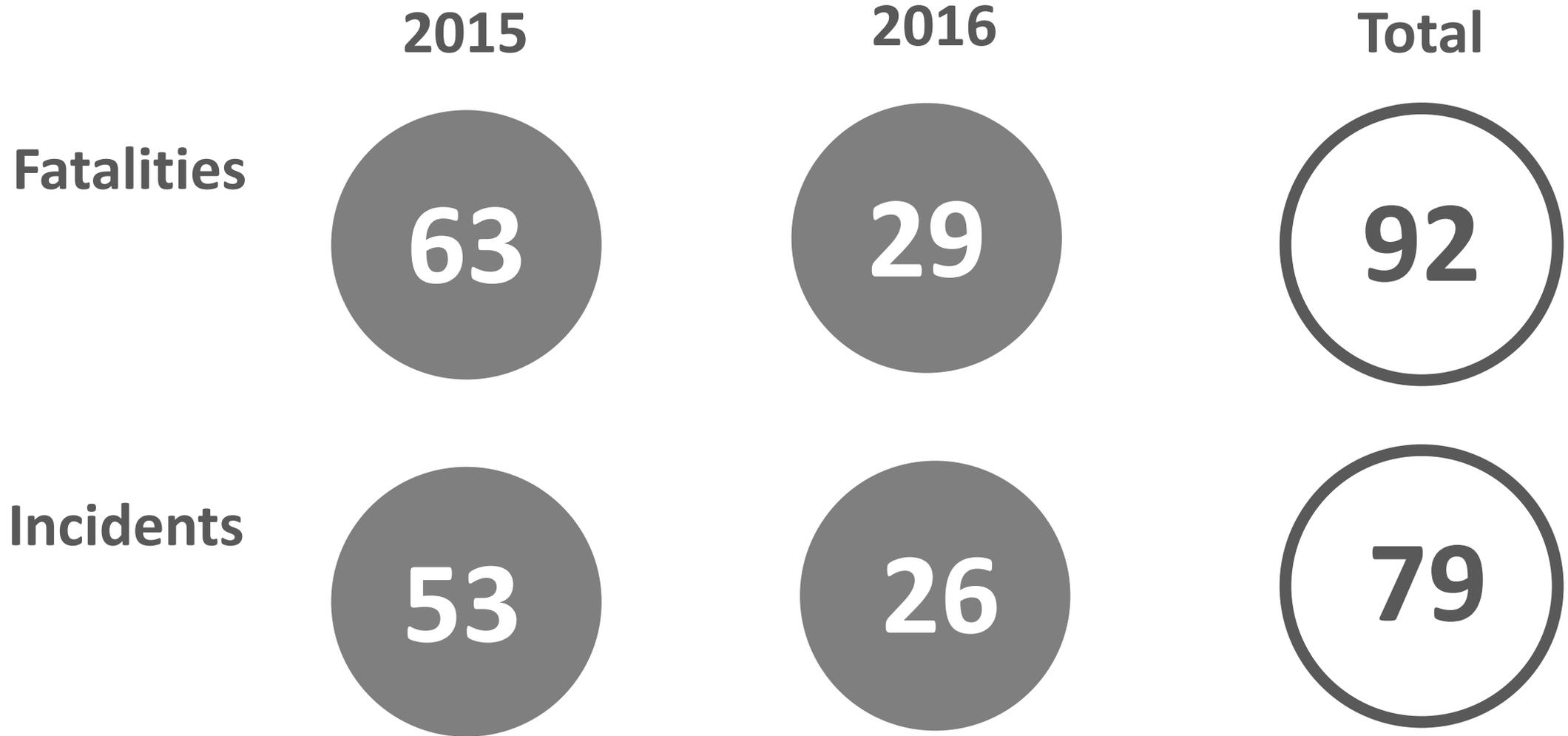
Incidents

53

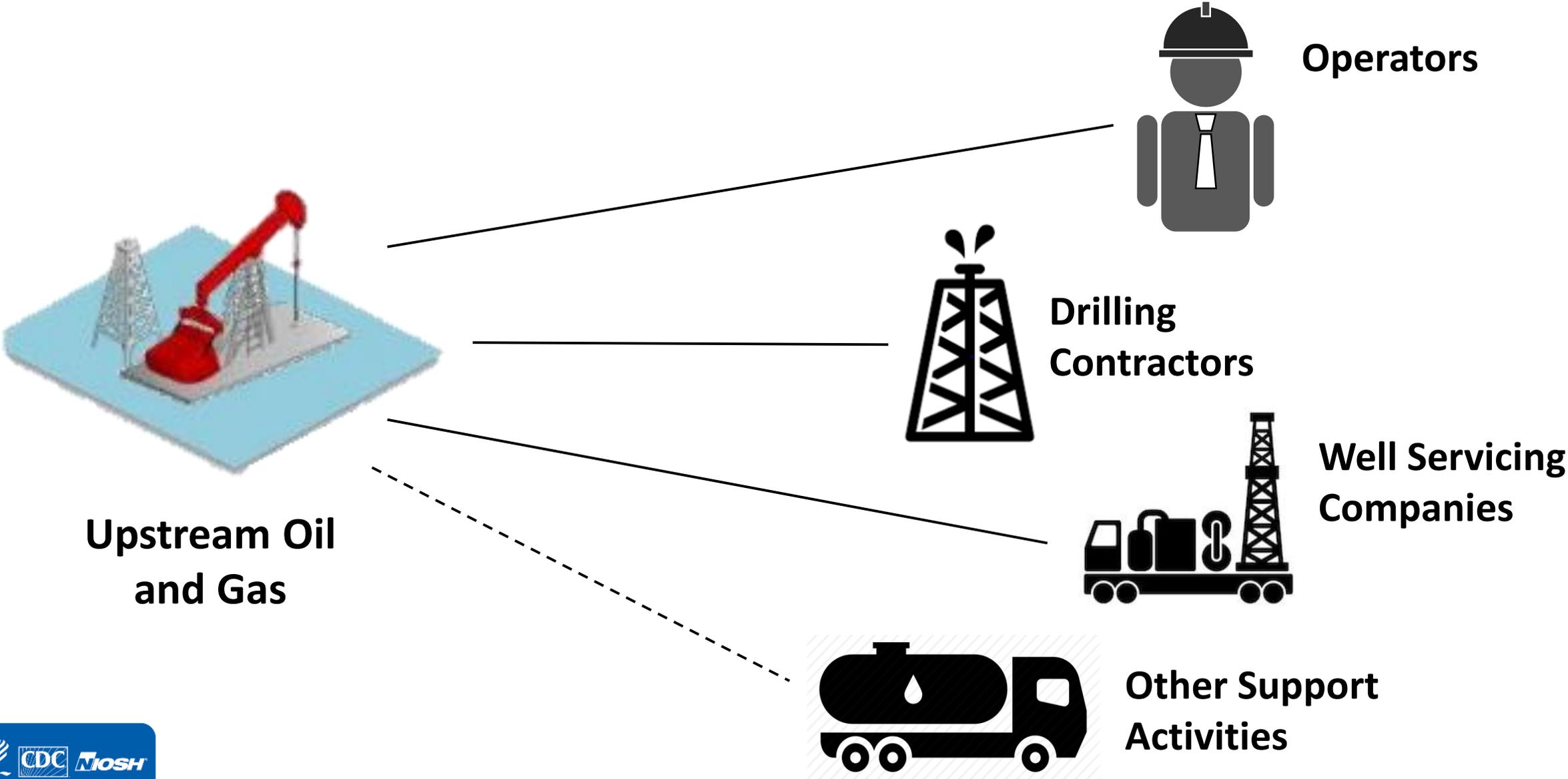
26

Fatalities in FOG 2015-2016

FOG



Upstream Oil and Gas



Industry group

- NAICS codes
- Primary business
- One per fatality

Oil and gas extraction NAICS

- 211- operators
- 213111- drilling
- 213112- support activities
- 4842- specialized freight

- ★ FOG includes all fatalities related to oil and gas extraction regardless of NAICS

Fatalities in FOG by Industry Group, 2015-2016

FOG

Industry group

- NAICS codes
- Primary business
- One per fatality

Oil and gas extraction NAICS

- 211- operators
- 213111- drilling
- 213112- support activities
- 4842- specialized freight

★ FOG includes all fatalities related to oil and gas extraction regardless of NAICS

Support activities

54

Drilling

18

Specialized Freight

6

Operator

<5*

Other industry

<5*

Unknown

10

n=92

*Values <5 are suppressed in this dataset



Fatalities in FOG by Industry Group, 2015-2016

FOG

Industry group

- NAICS codes
- Primary business
- One per fatality

Oil and gas extraction NAICS

- 211- operators
- 213111- drilling
- 213112- support activities
- 4842- specialized freight

★ FOG includes all fatalities related to oil and gas extraction regardless of NAICS

Support activities

59% of FOG identified fatalities

54

Drilling

18

Specialized Freight

6

Operator

<5*

Other industry

<5*

Unknown

10

n=92

*Values <5 are suppressed in this dataset



Operation

- Stages or distinct processes
- One per incident

Operations that Occur throughout Oil and Gas Extraction

- Vehicle repair or maintenance: <5*
- Waste fluid treatment or disposal: <5*
- Unspecified (Off-wellsite): 26
- Unspecified (Wellsite): <5*
- Offshore: 5

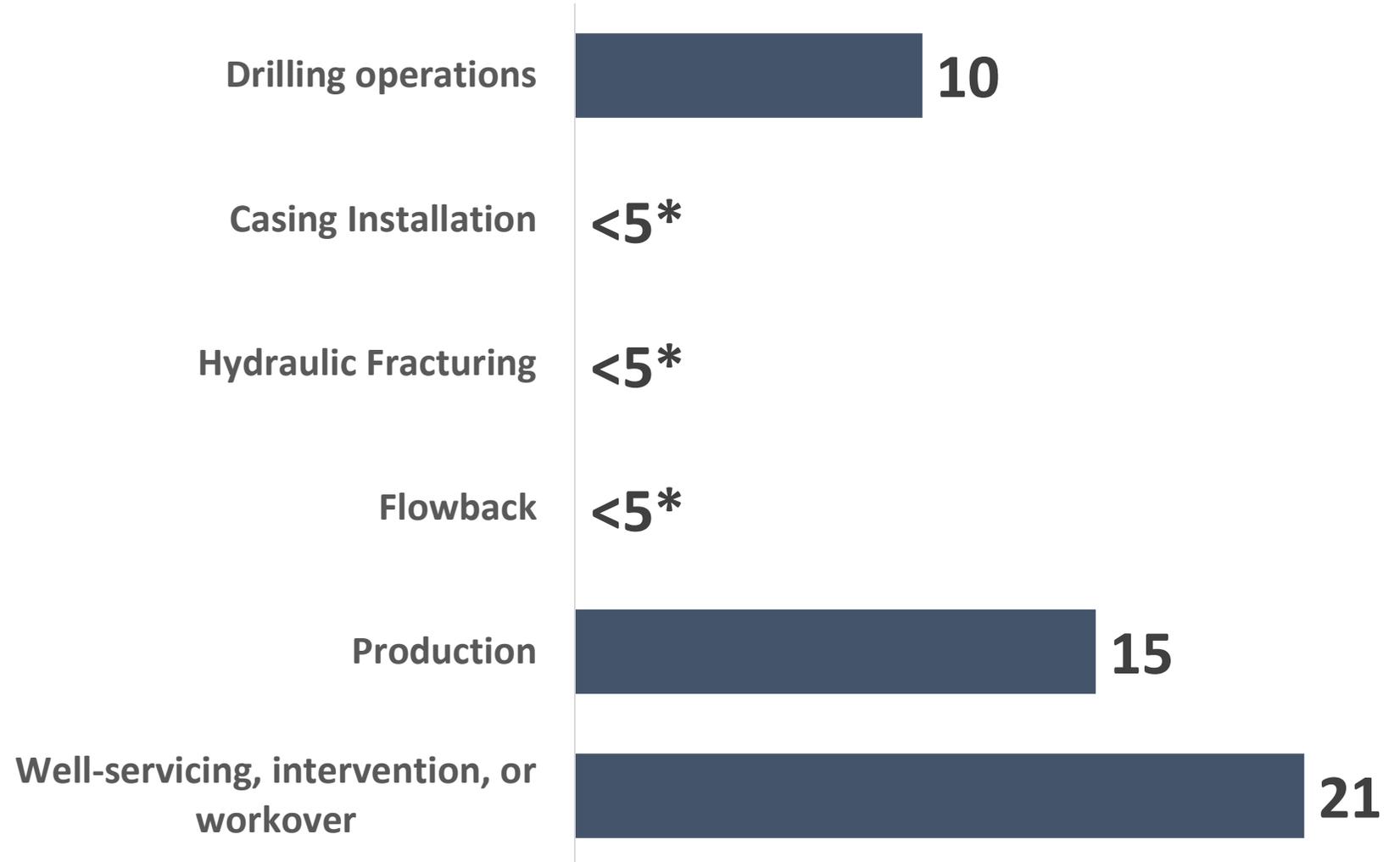
Operations by Stages of Well Development

Operation

- Stages or distinct processes
- One per incident

Operations that Occur throughout Oil and Gas Extraction

- Vehicle repair or maintenance: <5*
- Waste fluid treatment or disposal: <5*
- Unspecified (Off-wellsite): 26
- Unspecified (Wellsite): <5*
- Offshore: 5



*Values <5 are suppressed in this dataset n=92



Event type

- How fatality occurred
- FOG has its own event types
- Initial event
- One per fatality

★ 5 cardiac events with no identified work exposure are not included in these data

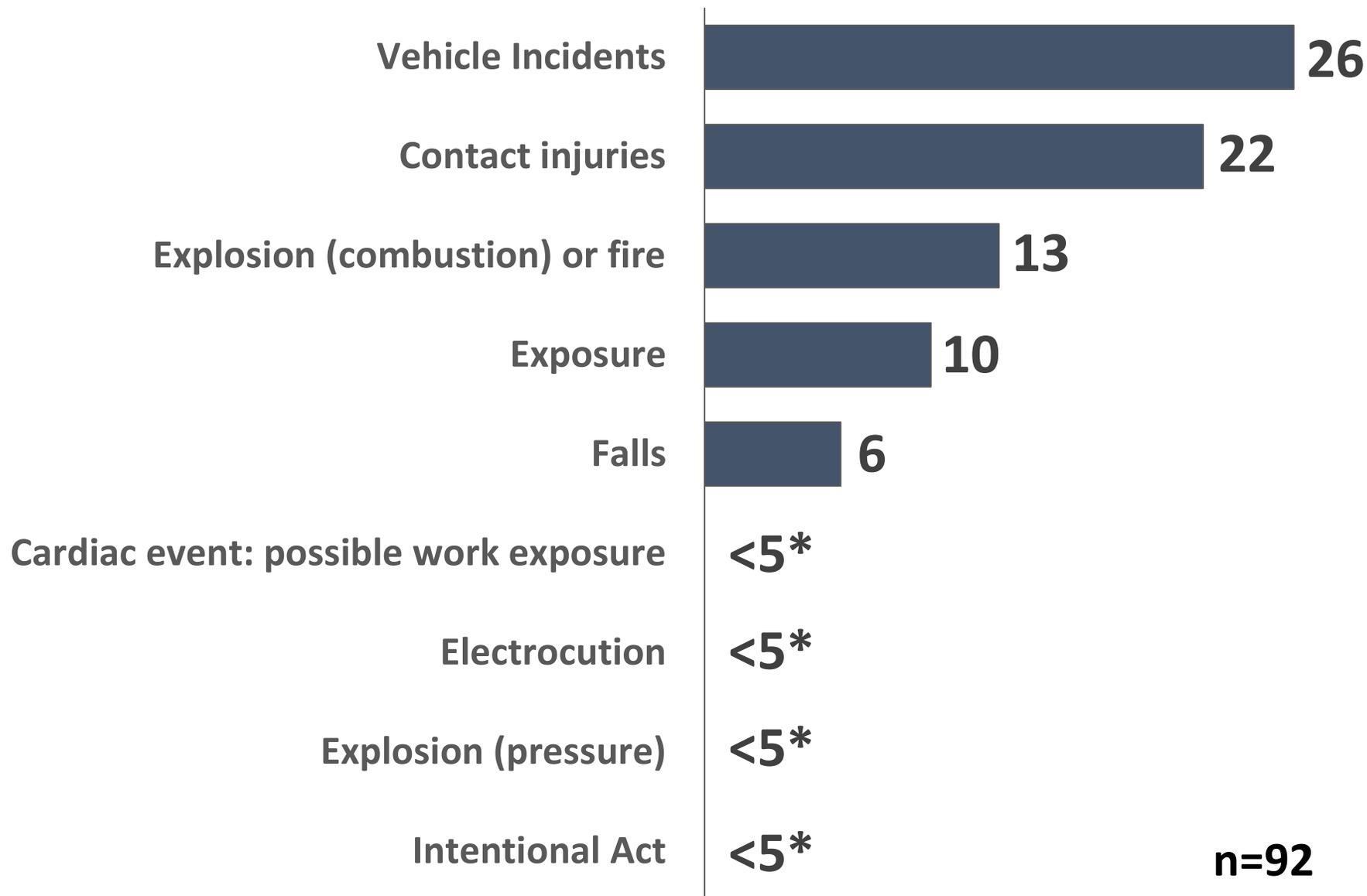
Fatalities in FOG by Event Type, 2015-2016

FOG

Event type

- How fatality occurred
- FOG has its own event types
- Initial event
- One per fatality

★ 5 cardiac events with no identified work exposure are not included in these data



*Values <5 are suppressed in this dataset

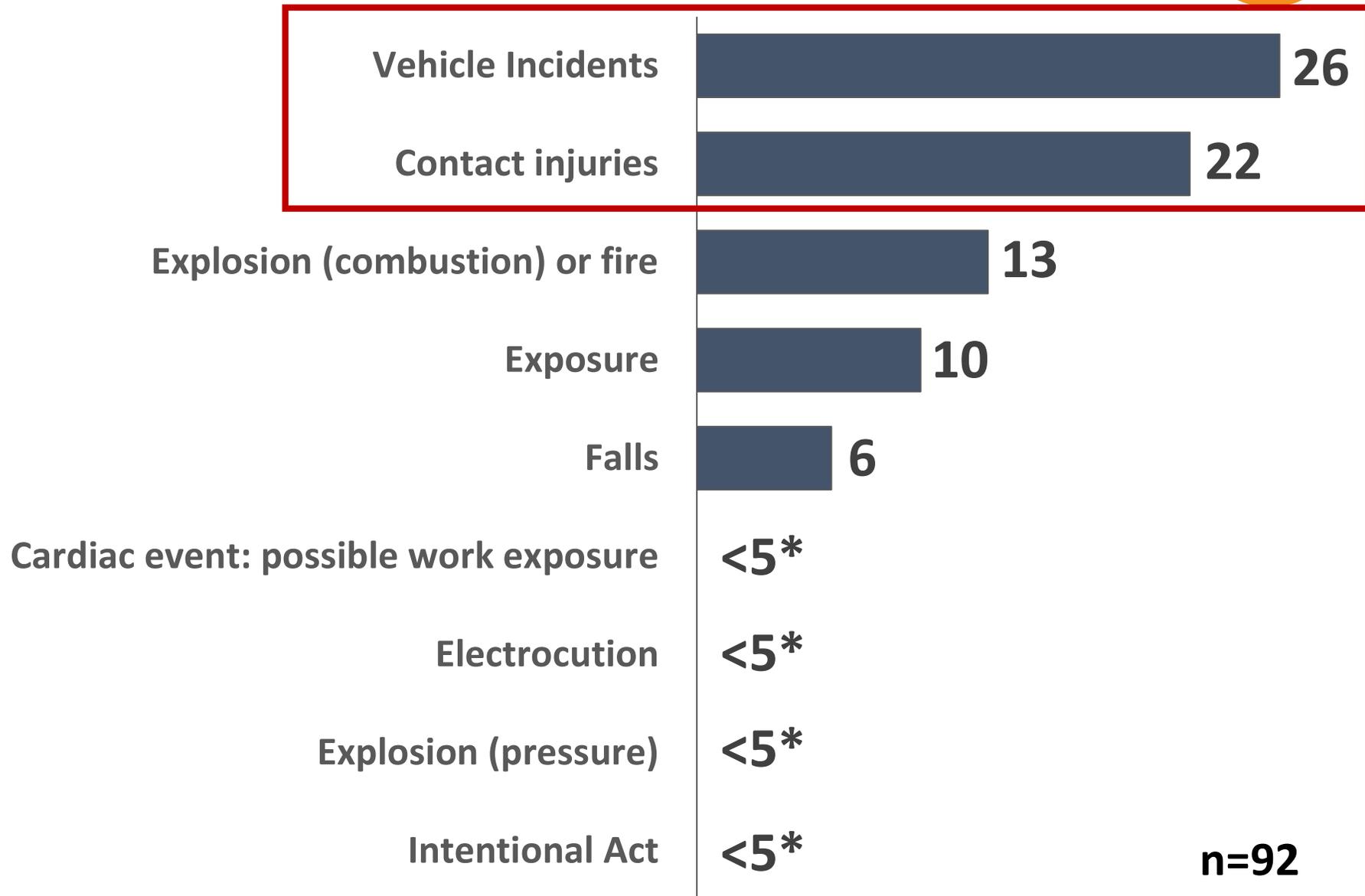
Fatalities in FOG by Event Type, 2015-2016

FOG

Event type

- How fatality occurred
- FOG has its own event types
- Initial event
- One per fatality

★ 5 cardiac events with no identified work exposure are not included in these data



*Values <5 are suppressed in this dataset

Fatalities in FOG by Event Type, 2015-2016

FOG

Event type

- How fatality occurred
- FOG has its own event types
- Initial event
- One per fatality

★ 5 cardiac events with no identified work exposure are not included in these data

→ Vehicle Incidents

→ Contact injuries

Explosion (combustion) or fire

→ Exposure

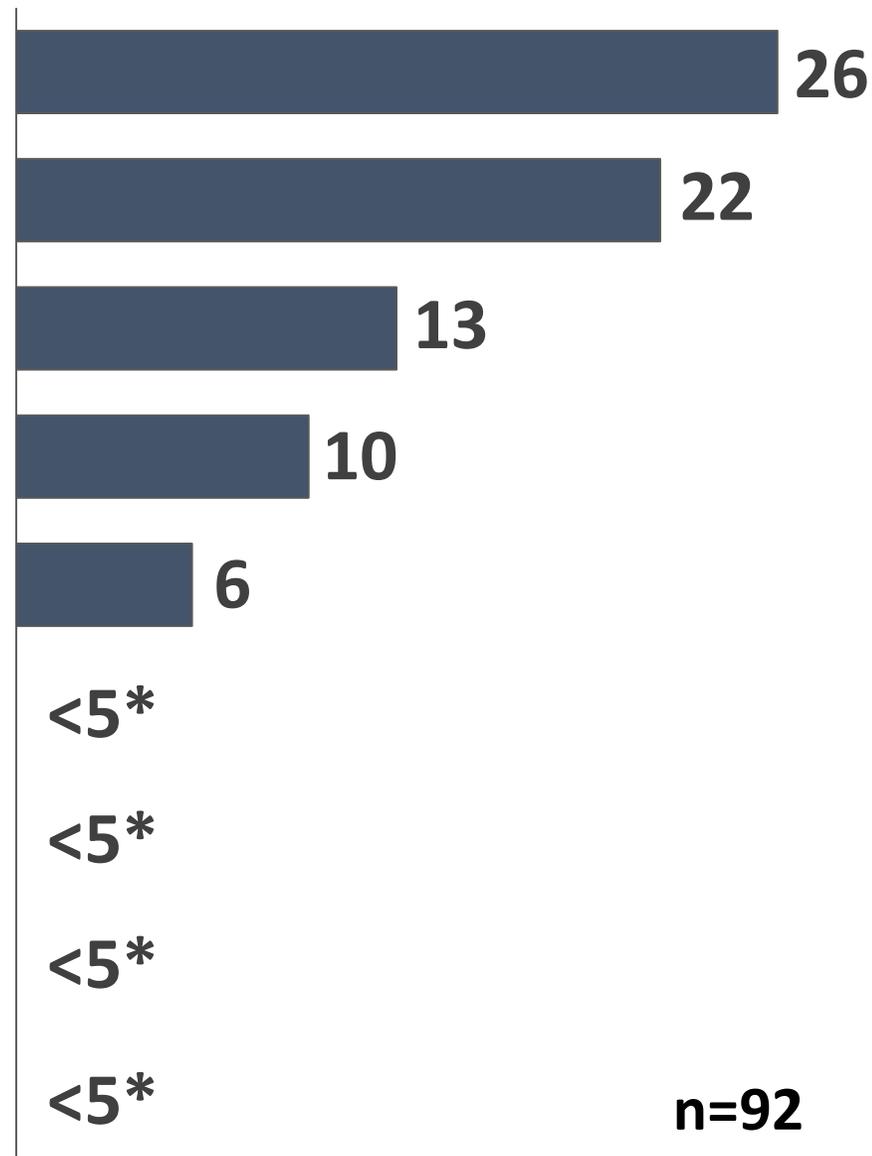
Falls

Cardiac event: possible work exposure

Electrocution

Explosion (pressure)

Intentional Act



*Values <5 are suppressed in this dataset

Vehicle Incidents



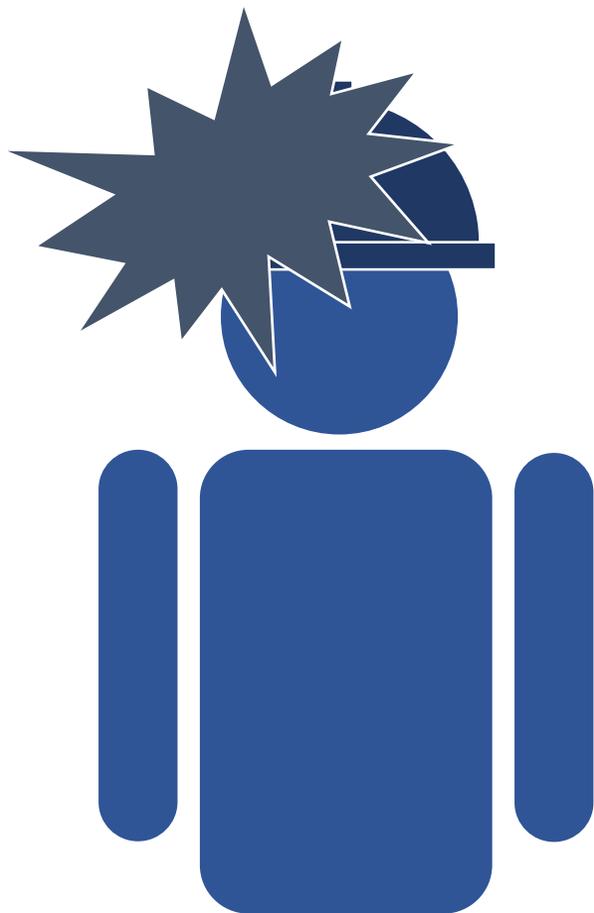
26 total fatalities

24 roadway

<5* on-site

<5* other location

Contact injuries

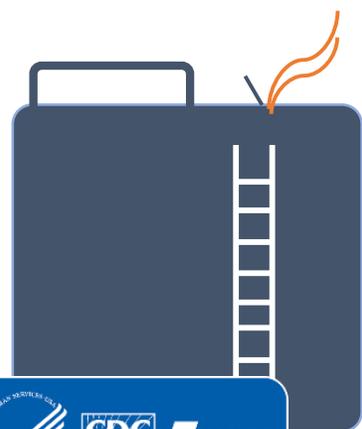
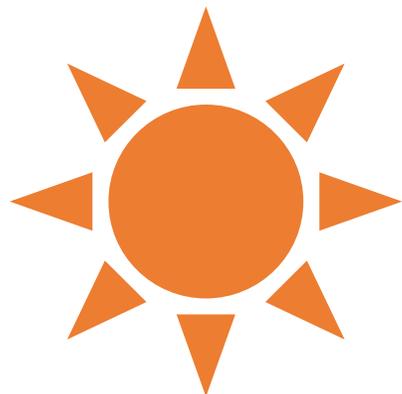


22 total fatalities

8 caught between/crushed

8 struck by

6 struck by falling object



Exposure

10 total fatalities

7 harmful substance

- H₂S
- Hydrocarbons

<5* environmental

<5* alcohol or drug poisoning

Activities

- Steps within operations
- Carried out several times
- As many as appropriate per incident

43 total activities

5

Associated with
8+ fatalities

Most common activities associated with worker fatalities

FOG



Motor vehicle travel
including non-traditional
commutes

21



Material handling:
crane, forklift, winch
truck, etc.

10



Production rig activities

10

New to task

**Pressure
related**

Drug Use

**25%
Working
alone**

**Less than 1 year
in oil field**

Outline

Introduction

Fatalities from FOG

**Hospitalizations and Amputations
from OSHA Severe Injury Reporting**

Putting it all together: trends and
recommendations

NEW!



Report a Fatality or Severe Injury

- All employers are required to notify OSHA when an employee is killed on the job or suffers a work-related hospitalization, amputation, or loss of an eye.
- A fatality must be reported within 8 hours.
- An in-patient hospitalization, amputation, or eye loss must be reported within 24 hours.



To Make a Report

- Call the nearest [OSHA office](#).
- Call the OSHA 24-hour hotline at [1-800-321-6742](tel:1-800-321-6742) (OSHA).
- [Report online](#)

Be prepared to supply: Business name; names of employees affected; location and time of the incident, brief description of the incident; contact person and phone number.

Report a Fatality or Severe Injury

- All employers are required to notify OSHA when an employee is killed on the job or suffers a work-related hospitalization, amputation, or loss of an eye.
- A fatality must be reported within 8 hours.
- An in-patient hospitalization, amputation, or eye loss must be reported within 24 hours.



To Make a Report

- Call the nearest [OSHA office](#).
- Call the OSHA 24-hour hotline at [1-800-321-6742](tel:1-800-321-6742) (OSHA).
- [Report online](#)

Be prepared to supply: Business name; names of employees affected; location and time of the incident, brief description of the incident; contact person and phone number.

Data from 2015 through 2017 is available for download...



The screenshot shows the top navigation bar of the OSHA website. It features the United States Department of Labor logo on the left, followed by the text "UNITED STATES DEPARTMENT OF LABOR". To the right are social media icons for Facebook, Twitter, Instagram, RSS, and Email, along with a search box labeled "Find". Below the navigation bar is a grey menu with the following items: "ABOUT OSHA", "WORKERS", "EMPLOYERS", "REGULATIONS", "ENFORCEMENT", "TOPICS", and "NEW".

[Data & Statistics](#) / Severe Injury Reports

Severe Injury Reports

OSHA requires employers to report all severe work-related injuries, defined as an amputation, in-patient hospitalization, or loss of an eye. The requirement began on January 1, 2015. This page provides information from those reports, including a description of the incident and the name and address of the establishment where it happened. Injuries are coded using the [Occupational Injury and Illness Classification System](#).

You can download a file of the reports below. The reports will be updated periodically and represent federal OSHA states only. They do not reflect injuries in state plans.

Please be aware the geocodes (latitude/longitude) provided were obtained through third party services based on address information provided with the injury report. The precision varies by case, and accuracy is not guaranteed.

[Download Data](#)

(Data from 1/1/2015 through 12/31/2017)

www.osha.gov/severeinjury

Data from 2015 through 2017 is available for download...



The screenshot shows the top navigation bar of the OSHA website. It features the United States Department of Labor logo on the left, followed by the text "UNITED STATES DEPARTMENT OF LABOR". To the right are social media icons for Facebook, Twitter, Instagram, RSS, and Email, along with a search box labeled "Find". Below this is a navigation menu with the following items: "ABOUT OSHA", "WORKERS", "EMPLOYERS", "REGULATIONS", "ENFORCEMENT", "TOPICS", and "NEW".

[Data & Statistics](#) / Severe Injury Reports

Severe Injury Reports

OSHA requires employers to report all severe work-related injuries, defined as an amputation, in-patient hospitalization, or loss of an eye. The requirement began on January 1, 2015. This page provides information from those reports, including a description of the incident and the name and address of the establishment where it happened. Injuries are coded using the [Occupational Injury and Illness Classification System](#).

You can download a file of the reports below. The reports will be updated periodically and represent federal OSHA states only. They do not reflect injuries in state plans.

Please be aware the geocodes (latitude/longitude) provided were obtained through third party services based on address information provided with the injury report. The precision varies by case, and accuracy is not guaranteed.

[Download Data](#)

(Data from 1/1/2015 through 12/31/2017)

www.osha.gov/severeinjury



Data from 2015 through 2017 is available for download...

...But lacks reports from State-Run Programs...



Data & Statistics / Severe Injury Reports

Severe Injury Reports

OSHA requires employers to report all severe work-related injuries, defined as an amputation, in-patient hospitalization, or loss of an eye. The requirement began on January 1, 2015. This page provides information from those reports, including a description of the incident and the name and address of the establishment where it happened. Injuries are coded using the [Occupational Injury and Illness Classification System](#).

You can download a file of the reports below. The reports will be updated periodically and represent federal OSHA states only. They do not reflect injuries in state plans.

Please be aware the geocodes (latitude/longitude) provided were obtained through third party services based on address information provided with the injury report. The precision varies by case, and accuracy is not guaranteed.

[Download Data](#)

(Data from 1/1/2015 through 12/31/2017)

www.osha.gov/severeinjury



Data from 2015 through 2017 is available for download...

...But lacks reports from State-Run Programs...

...Through OSHA-NIOSH Partnership, our team obtained OGE injury data from all 50 States!



Occupational Safety and Health Administration

ABOUT OSHA ▾ WORKERS ▾ EMPLOYERS ▾ REGULATIONS ▾ ENFORCEMENT ▾ TOPICS ▾ NEW

[Data & Statistics](#) / Severe Injury Reports

Severe Injury Reports

OSHA requires employers to report all severe work-related injuries, defined as an amputation, in-patient hospitalization, or loss of an eye. The requirement began on January 1, 2015. This page provides information from those reports, including a description of the incident and the name and address of the establishment where it happened. Injuries are coded using the [Occupational Injury and Illness Classification System](#).

You can download a file of the reports below. The reports will be updated periodically and represent federal OSHA states only. They do not reflect injuries in state plans.

Please be aware the geocodes (latitude/longitude) provided were obtained through third party services based on address information provided with the injury report. The precision varies by case, and accuracy is not guaranteed.

[Download Data](#)

(Data from 1/1/2015 through 12/31/2017)

www.osha.gov/severeinjury

All Severe Injury information is from OSHA reporting and inspections

- No OSHA jurisdiction on public roadways
- Vehicle incidents are underreported in this dataset

All Severe Injury information is from OSHA reporting and inspections

- No OSHA jurisdiction on public roadways
- Vehicle incidents are underreported in this dataset

Data provided from OSHA:

- Company NAICS Code (211(111), 213111, 213112)
- Incident Date and Location
- Counts of Hospitalizations & Amputations
- OSHA Inspection Numbers (if applicable)
- **Incident Narratives**

Some narratives were brief...

Activity:

Operation:

Event Type:

Equipment:

Hosp. or Amp:

“An employee was injured during a fire at a gas well.”

Some narratives were brief...

Activity: ???

Operation: ???

Event Type: Explosion (combustion) or fire

Equipment: ???

Hosp. or Amp: Hospitalization

“An employee was injured during a fire at a gas well.”

Activity:

Operation:

Event Type:

Equipment:

Hosp. or Amp:

...And some were very descriptive!

“Employees were running rods downhole on a servicing rig when the pump hit a tight spot causing slack on the rods. The slack resulted in the rod elevator breaking and allowing the rods to come loose. The rod struck the employee in the middle, right side of his back and knocked him to the ground.”

Activity: Pulling or running rods

Operation: Well Servicing,
Intervention, or Workover

Event Type: Struck by falling object

Equipment: Rods, Rod Elevator

Hosp. or Amp: Hospitalization

...And some were very descriptive!

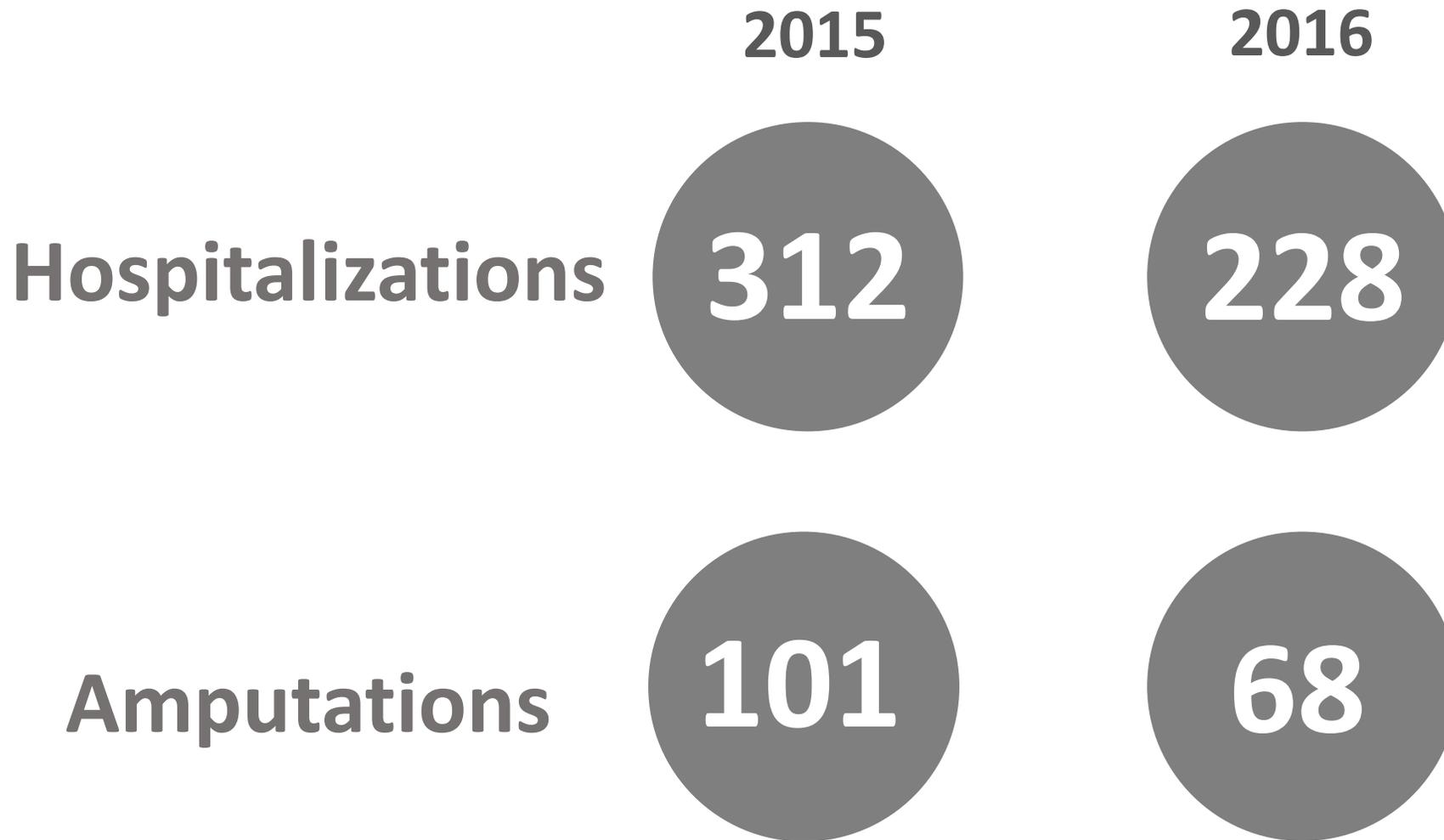
“Employees were running rods downhole on a servicing rig when the pump hit a tight spot causing slack on the rods. The slack resulted in the rod elevator breaking and allowing the rods to come loose. The rod struck the employee in the middle, right side of his back and knocked him to the ground.”

(Listed as 1 Hospitalization)

Starting point:

649

**Oil and Gas Related
incidents reported to
OSHA**



Summary of Severe Injuries 2015-2016

FOG

	2015	2016	TOTAL
Hospitalizations	312	228	540
Amputations	101	68	169



All FOG data are preliminary, unpublished, and subject to change without notice.

Severe Injuries by Operation 2015-2016

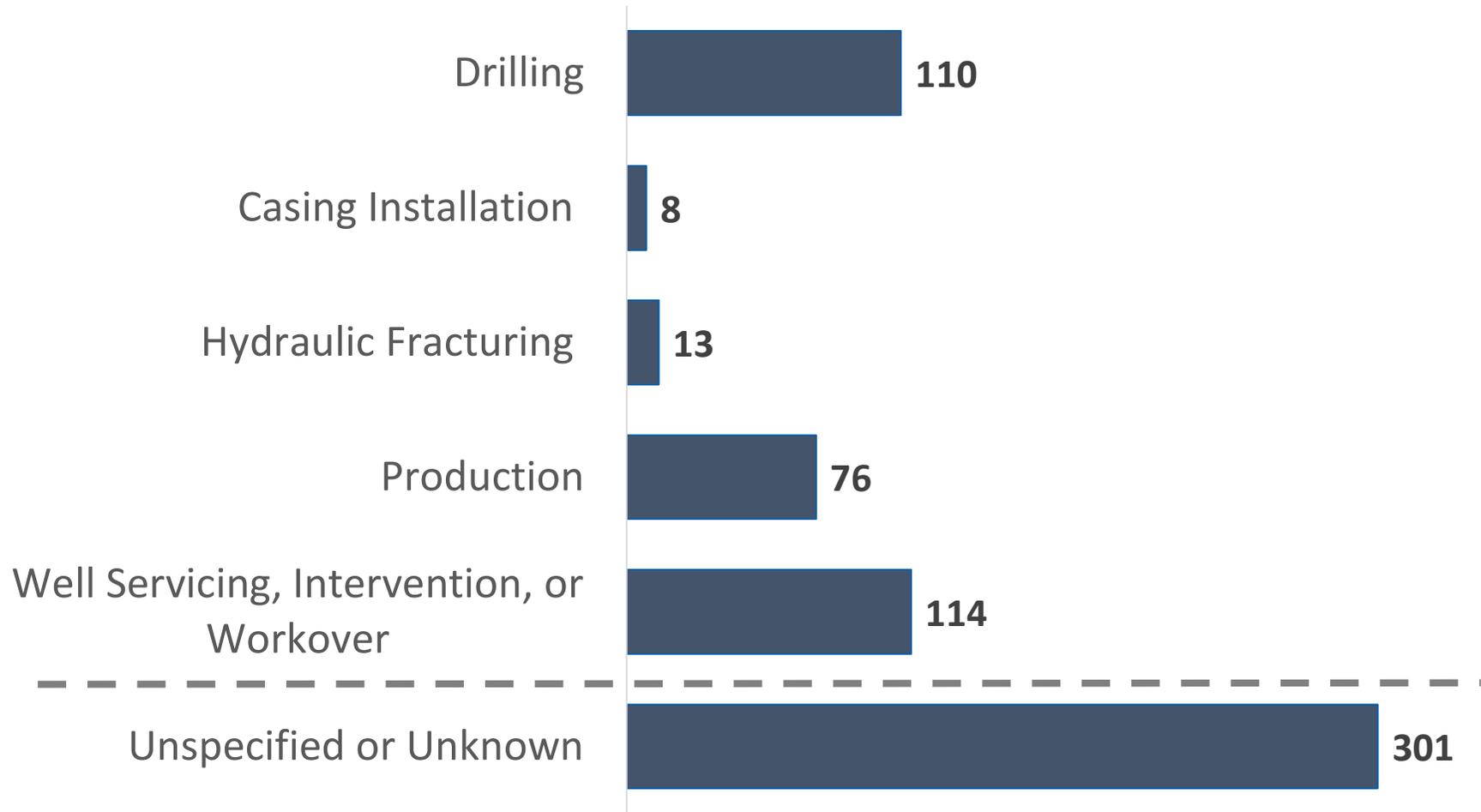
FOG

Operation

- Stages or distinct processes
- One per incident

★ Severe Injury data includes all hospitalizations and amputations related to oil and gas extraction NAICS codes

Operations by Stages of Well Development



All FOG data are preliminary, unpublished, and subject to change without notice.



Severe Injuries by Operation 2015-2016

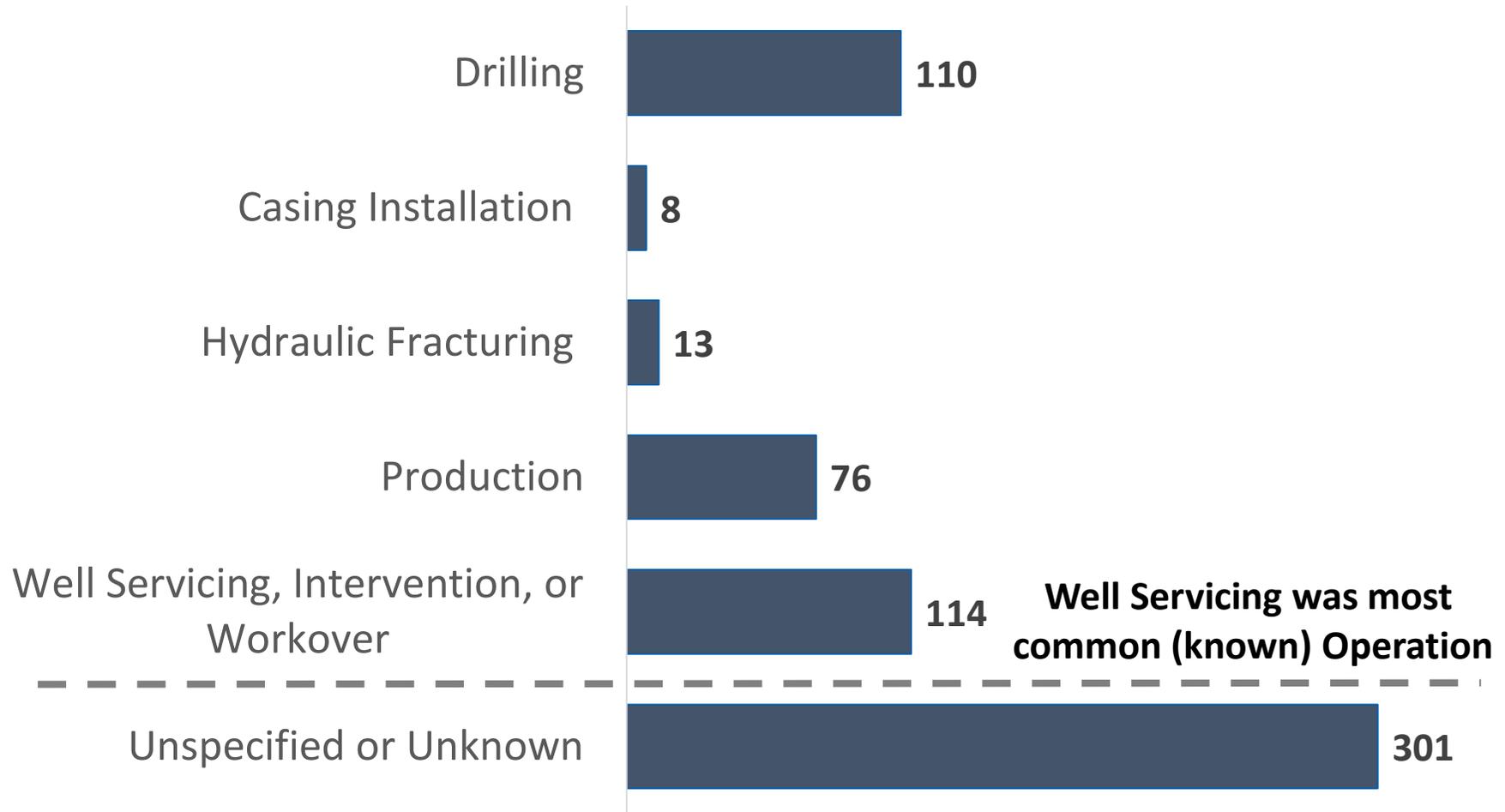
FOG

Operation

- Stages or distinct processes
- One per incident

★ Severe Injury data includes all hospitalizations and amputations related to oil and gas extraction NAICS codes

Operations by Stages of Well Development



All FOG data are preliminary, unpublished, and subject to change without notice.

Severe Injuries by Operation 2015-2016

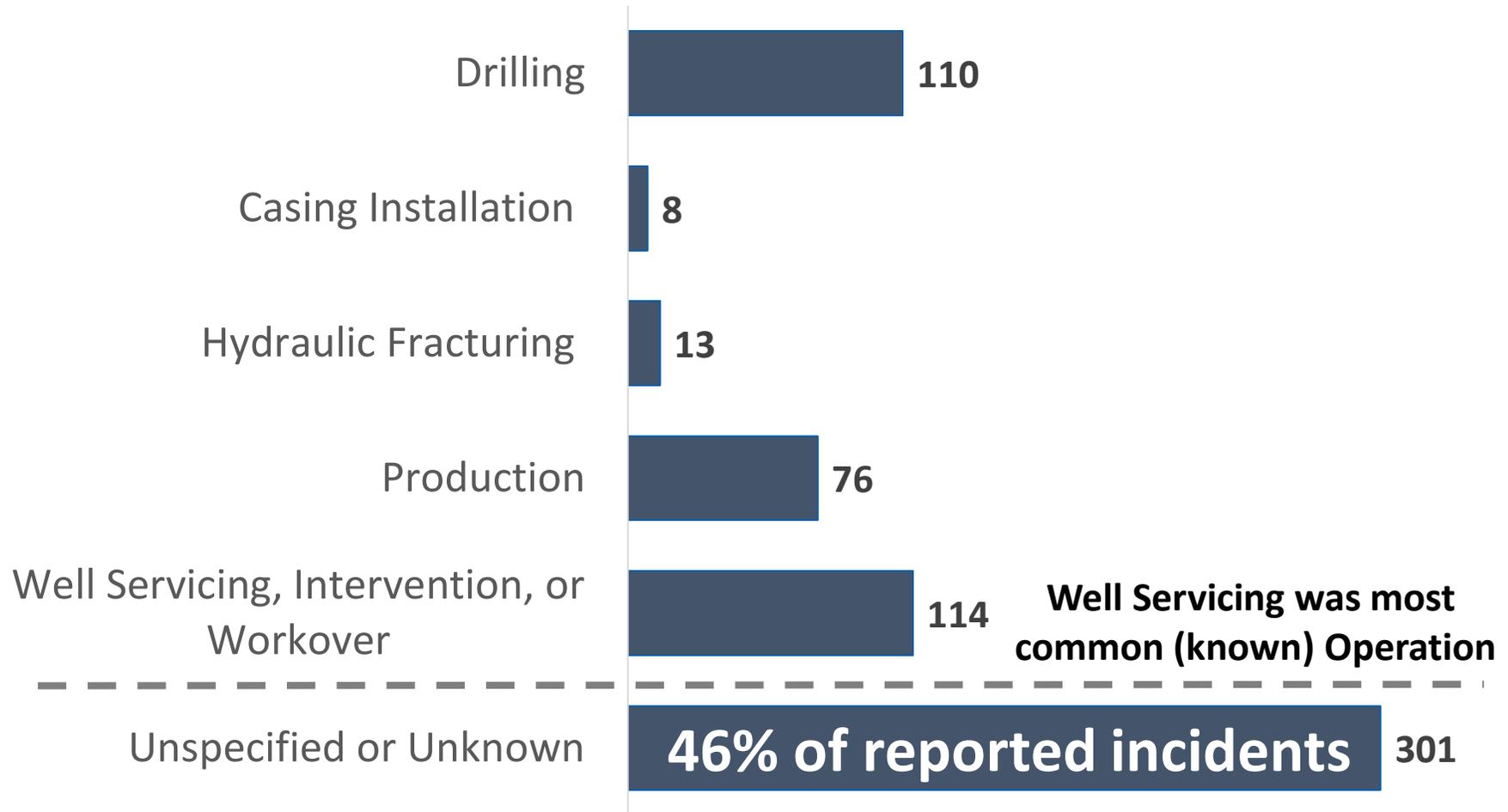
FOG

Operation

- Stages or distinct processes
- One per incident

★ Severe Injury data includes all hospitalizations and amputations related to oil and gas extraction NAICS codes

Operations by Stages of Well Development



All FOG data are preliminary, unpublished, and subject to change without notice.

Severe Injuries by Most Common Activity Type 2015-2016

FOG

of reported incidents

Activities

- Steps within operations
- Carried out several times
- As many as appropriate per incident



Rig or equipment repair or maintenance

87



Material handling: crane, forklift, winch truck, etc.

66



Make up or break out tubulars

45



Equipment install or dismantle

31



Material handling: Manual

31



Unknown Activity

144

All FOG data are preliminary, unpublished, and subject to change without notice.

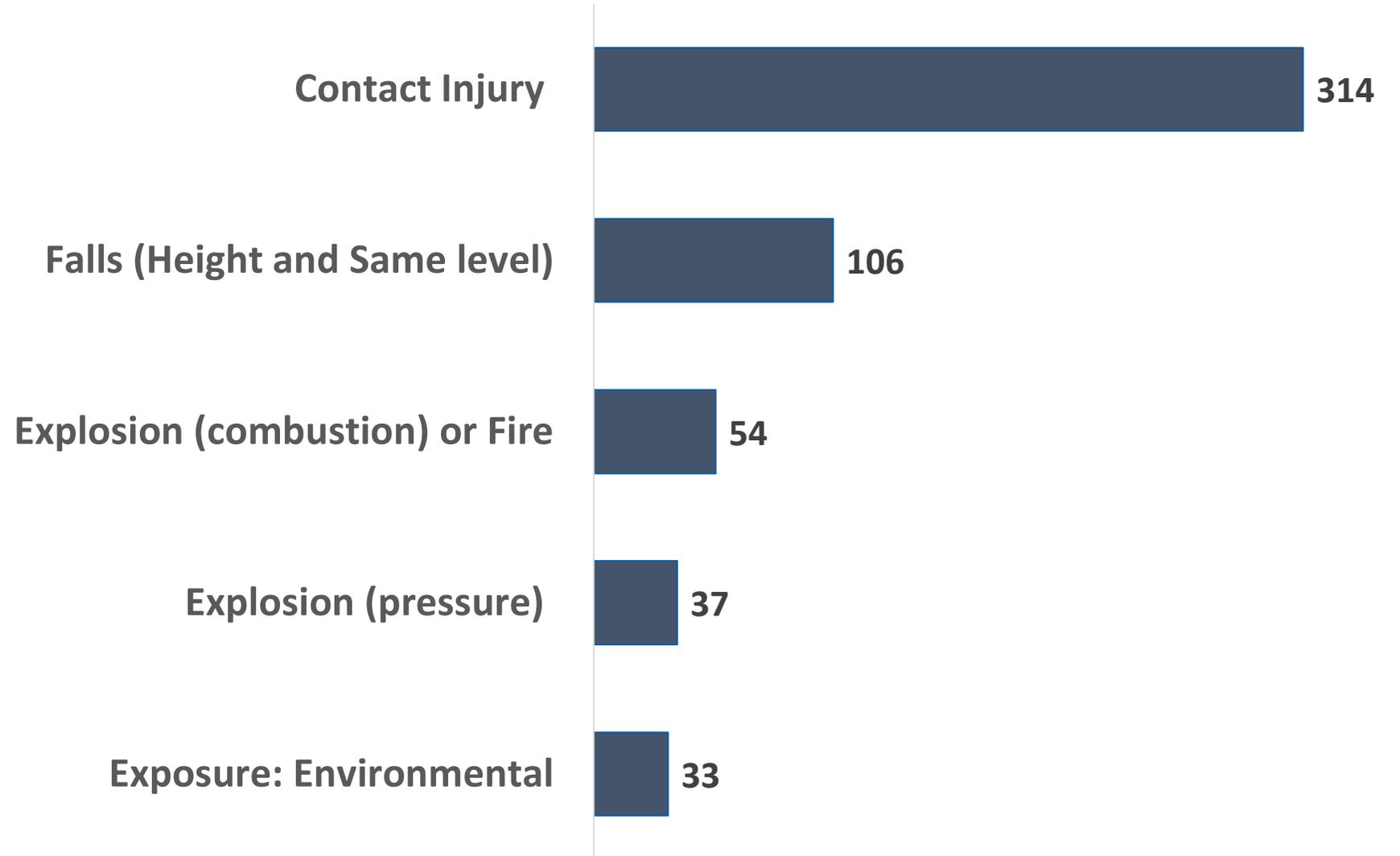
Severe Injuries by Most Common Event Type 2015-2016

FOG

Event type

- How injury occurred
- Initial event
- One per incident

★ N=649



All FOG data are preliminary, unpublished, and subject to change without notice.



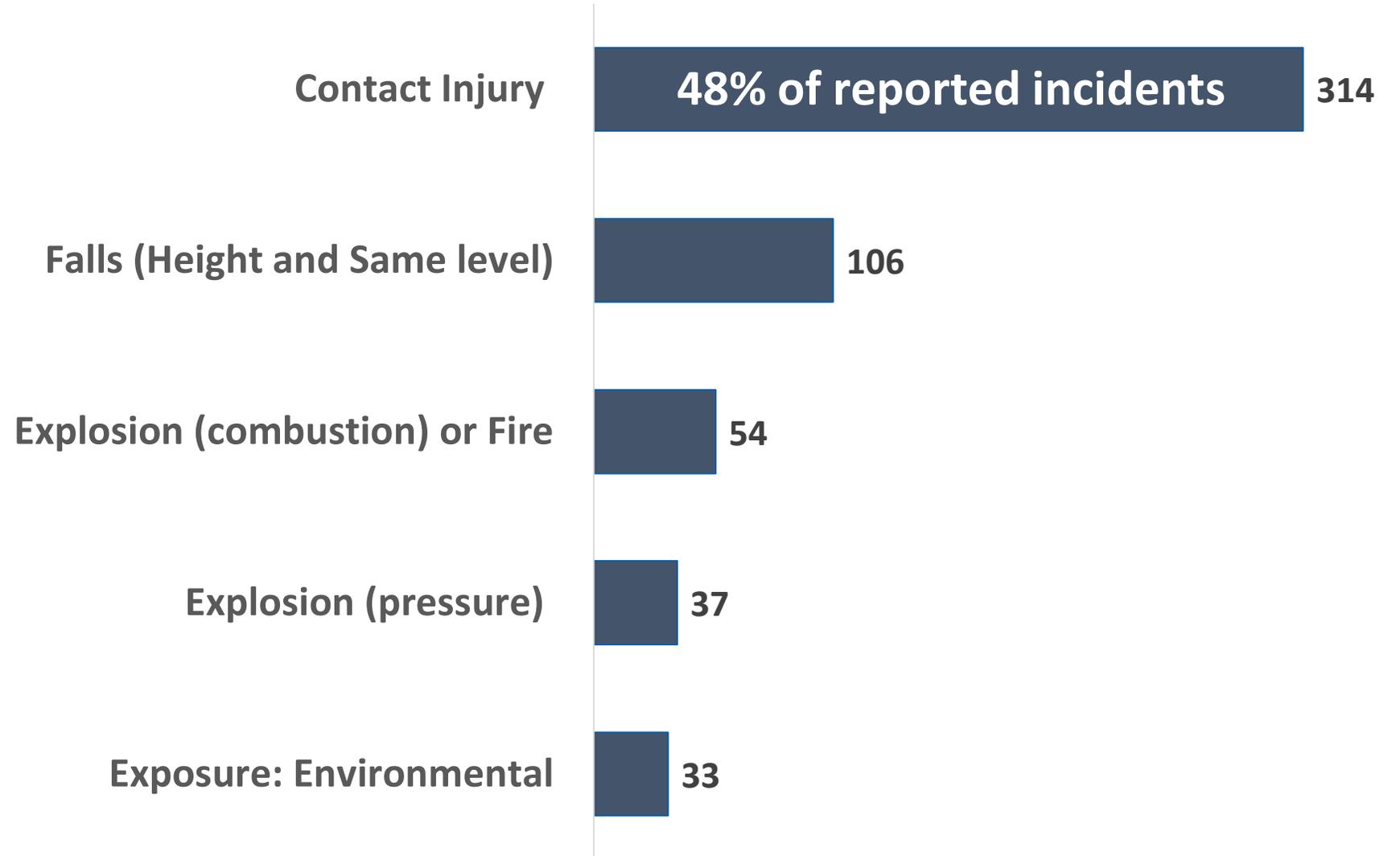
Severe Injuries by Most Common Event Type 2015-2016

FOG

Event type

- How injury occurred
- Initial event
- One per incident

★ N=649



All FOG data are preliminary, unpublished, and subject to change without notice.



Contact injuries

211 total hospitalizations

96 caught between or crushed

75 struck by

40 struck by falling object



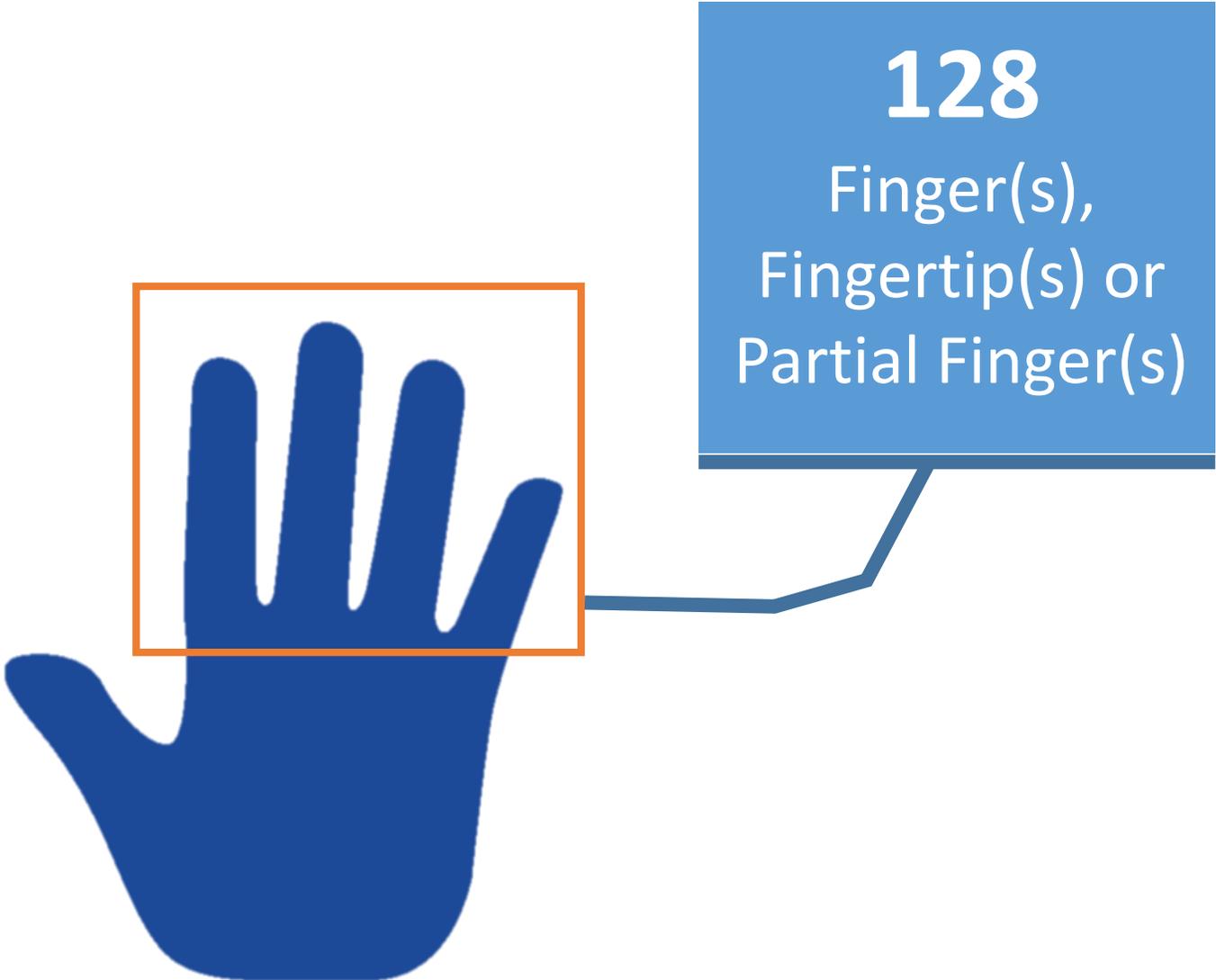
141 total amputations*

123 caught between or crushed

10 struck by

8 struck by falling object

*In some cases, amputations also involved hospitalization.



N=169

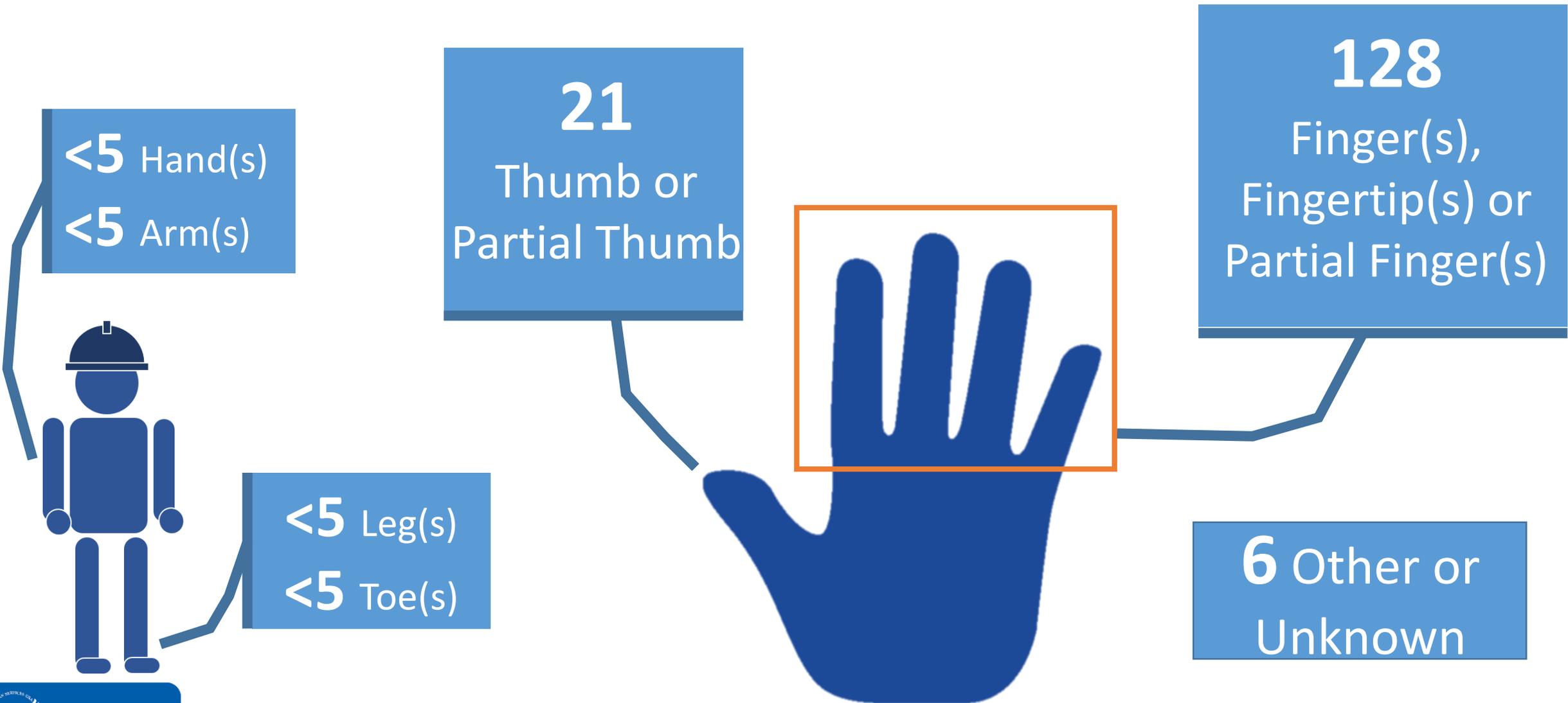
*Hand Icon created by Sasha Willins from Noun Project

21
Thumb or
Partial Thumb

128
Finger(s),
Fingertip(s) or
Partial Finger(s)



Severe Injury Amputation Events 2015-2016



N=169

*Hand Icon created by Sasha Willins from Noun Project



Forklifts

**Hand tools
(manual and powered)**

Power tongs

Pressure Washers

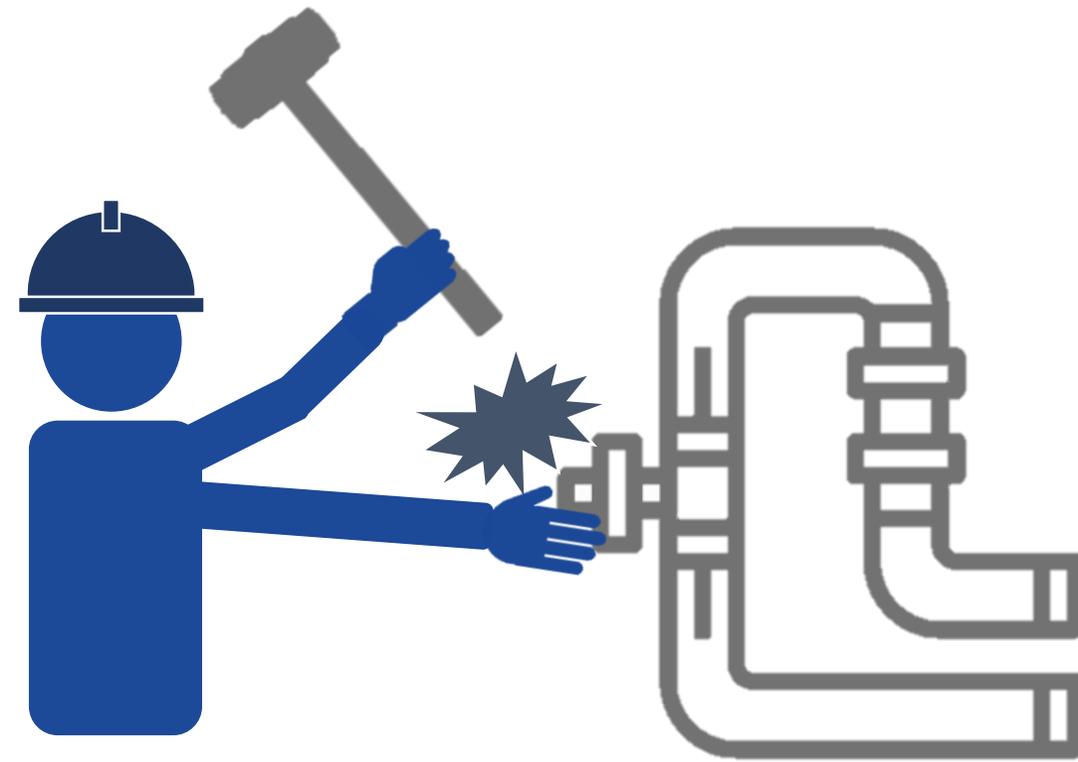
HOSES

“Employee was using a 10 lb. sledge hammer to tighten a hammer union.

The employee missed and caught his right index finger between the handle of the hammer and a valve handle.”

(Finger was amputated)

**Hand tools
(manual and powered)**



OSHA Jurisdiction does not cover:

- Incidents that occur on public streets, highways, or on normal commute¹

Trucking and Hauling related incidents may be listed on other NAICs codes

Under-reporting and reporting errors

- Estimated to be roughly 50% underreported based on workers compensation data²
- Self-reported incidents may lack crucial detail or information

OSHA Jurisdiction does not cover:

- Incidents that occur on public streets, highways, or on normal commute¹

Trucking and Hauling related incidents may be listed on other NAICs codes

Under-reporting and reporting errors

- Estimated to be roughly 50% underreported based on workers compensation data²
- Self-reported incidents may lack crucial detail or information



**I WANT YOU
TO COMPLY WITH
OSHA REPORTING
REQUIREMENTS & TO
REPORT COMPLETE
INFORMATION!**

Outline

Introduction

Fatalities from FOG

Hospitalizations and Amputations
from OSHA Severe Injury Reporting

**Putting it all together: trends and
recommendations**



Fatalities are the tip of the iceberg

High number of fatalities and severe injuries for:

- Well servicing, workover, intervention operations
- Drilling operations
- Contact injuries
- Material handling: crane, forklift, winch truck
- Pressure related events

Fatalities

Severe Injuries

Falls

6%
of fatalities

16%
of severe injuries

Hand tools

Not a major source

Major source

Manual material handling

None

5th
most common activity

Exposure: environmental

1-3%
of fatalities

5%
of severe injuries

Vehicle incidents

Some information

Very little information

Driving: The most dangerous activity for oil and gas workers

FOG

Strategies

Ensure 100% of drivers are wearing their seatbelt

Consider the implementation of In-Vehicle Monitoring System (IVMS) with coaching

Utilize journey management concepts

Address driver impairment (fatigue, distraction, substances): including during long-distance commutes

Tools/Resources

-IOGP Buckle UP

-IOGP Report 365-12

-IOGP Report 365-2

-IVMS

-Journey management

-Oil and Gas workers: How to prevent fatigued driving at work (NIOSH)

Struck by falling object

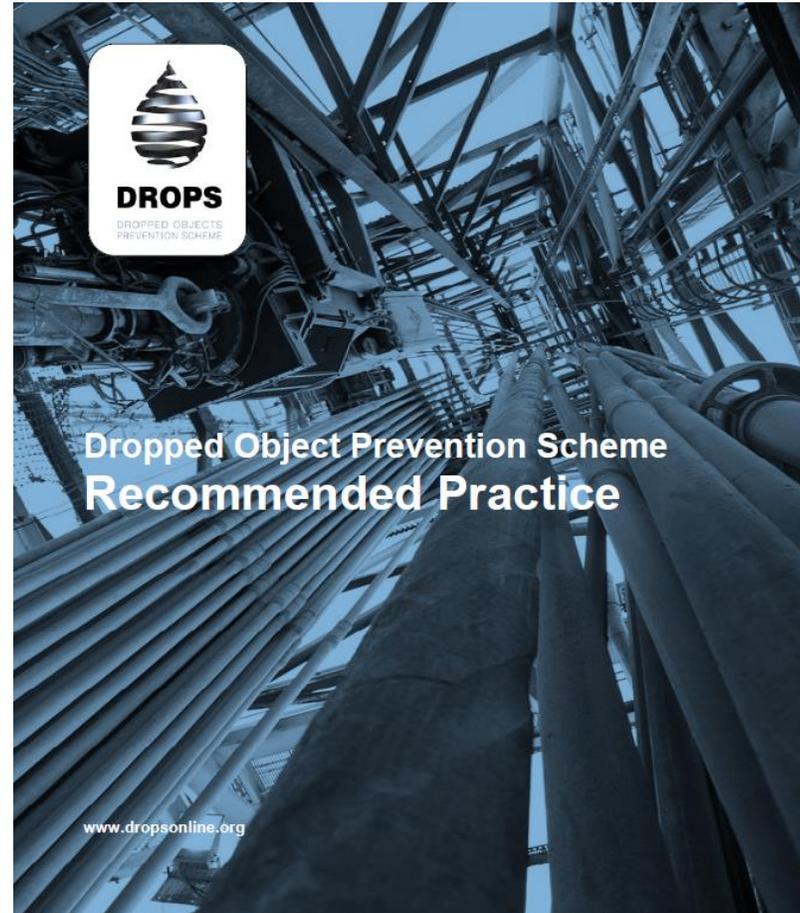
Strategies:

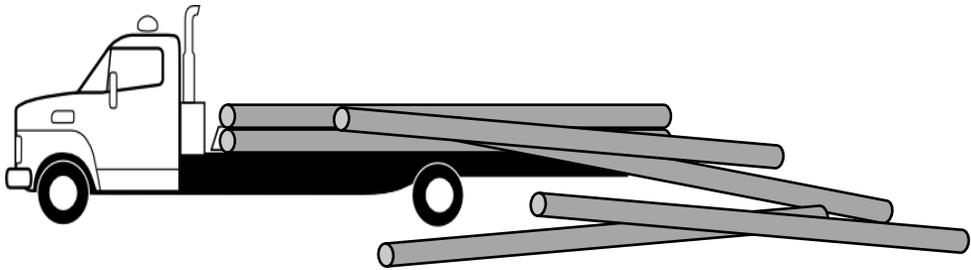
- DROPS
- Load securement (IOGP 365-18)

Caught between or crushed

Strategies:

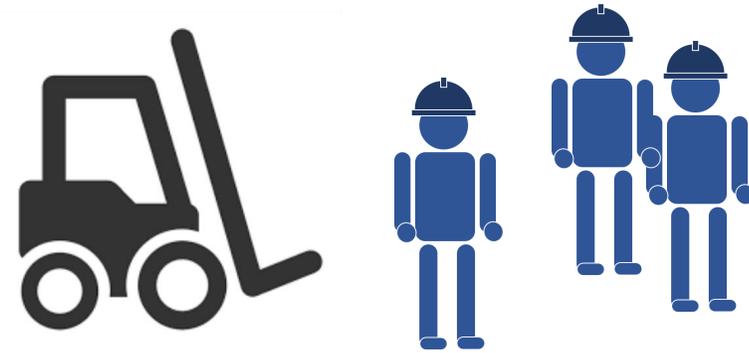
- Lock out tag out
- Machine guarding
- Reduce pinch points





Load securement

- Properly secure and unsecure loads (IOGP 365-18)
- Ensure cables and other handling equipment is properly used and inspected
- Train workers to stay out of fall zones

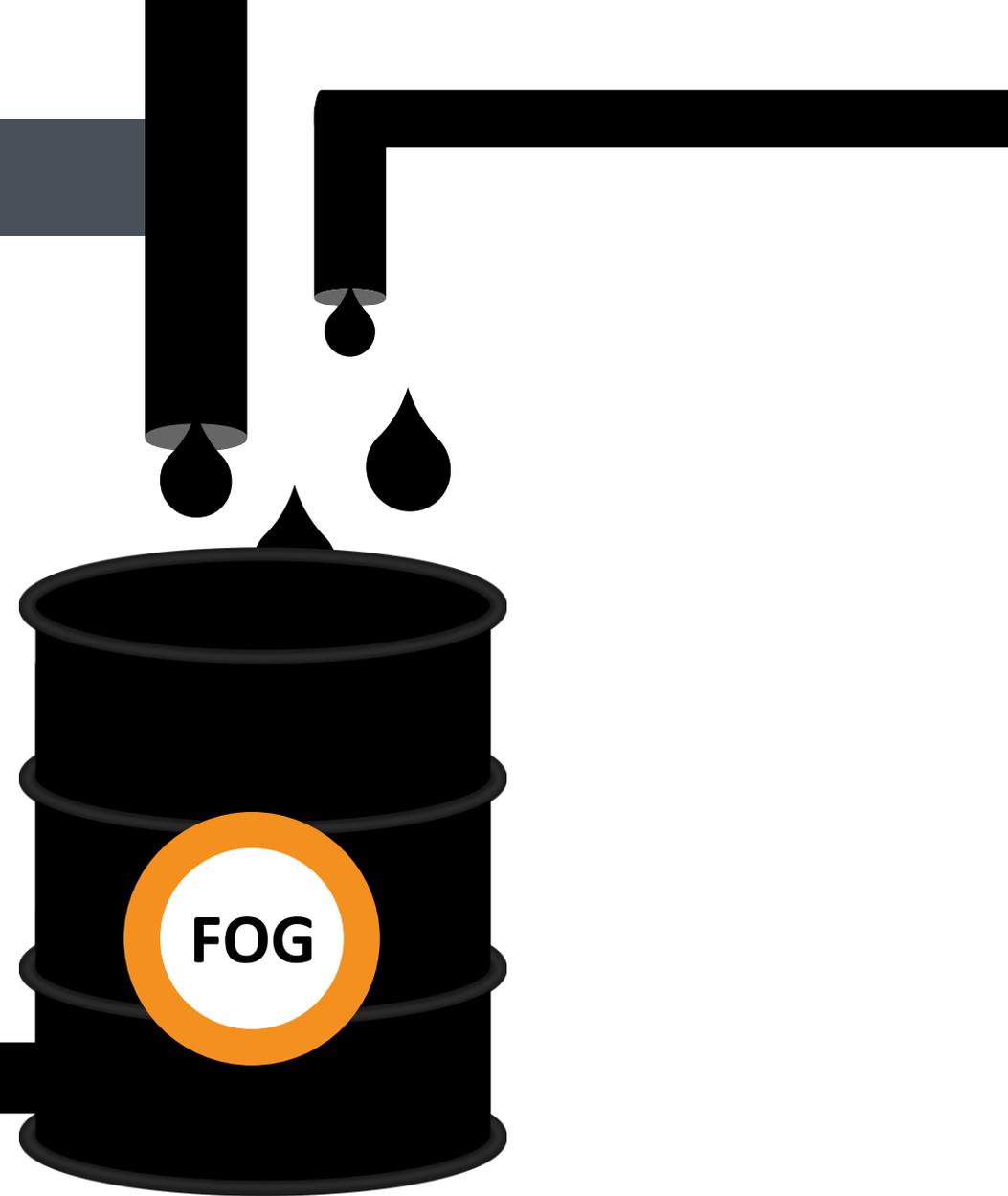


Vehicle Safety

- Use spotters
- Ensure vehicles have back-up alarms
- Improve communication on multi-employer sites

What's next

- Relaunch of updated FOG website
- FOG data tables available on-line
- 2015-2016 FOG infographics for injuries, hospitalizations, and fatalities
- Reporting of analysis for 2017 severe injuries and fatality FOG data
- **FOG 5 year report for 2014-2018 fatalities!**



Contact

Alejandra Ramirez-Cardenas
ARamirez-Cardenas@cdc.gov

www.cdc.gov/niosh/topics/fog



@NIOSHOilandGas

Resources

FOG Website

<https://www.cdc.gov/niosh/topics/fog/default.html>

OSHA Severe Injury

<https://www.osha.gov/severeinjury/index.html>

IOGP Buckle Up

<https://www.osha.gov/severeinjury/index.html>

IOGP Report 365-12

<https://www.iogp.org/bookstore/product/implementing-an-in-vehicle-monitoring-program-a-guide-for-the-oil-and-gas-extraction-industry/>

IOGP Report 365-2

<https://www.iogp.org/bookstore/product/land-transportation-safety-recommended-practice-journey-management/>

Oil and Gas workers: How to prevent fatigued driving at work

<https://www.cdc.gov/niosh/docs/2018-126/default.html>

DROPS

<http://www.dropsonline.org/>

IOGP 365-18

<https://www.iogp.org/bookstore/product/365-18-load-securement-land-transportation-safety-recommended-practice-guidance-note-18/>



Visit the NIOSH booth

**Booth
#418**

New video

Printed products

NIOSH researchers

NIOSH Breakout Sessions

Industrial Hygiene Strategies for Assessing Exposures during Onshore Drilling Activities

Bradley King, 11:30-12:15p, 355-A

A new method for assessing worker exposure to diesel-based drilling fluids

Michael Breitenstein, 2-2:45p, 355-B

