

Supplementary Table 1
Fatalities in Oil and Gas Extraction (FOG) Database Data Dictionary

Variable Name	Description of Variable	Plausible Values
Incident ID	Unique identifier for each incident. Comprised of year incident occurred followed by incident number, beginning with 001.	YYYY-###
Injuries to Multiple People	Displays either "Y" indicating that yes, more than one worker was injured in the incident or "N" indicating that no, only one worker was injured	- Y-Yes - N-No - U-Unknown
# of Oil and Gas Extraction (OGE) Fatalities	Number of fatally injured workers	1+
# of OGE Hospitalizations	Number of workers that were seriously injured and transferred to a hospital	0+
Year	Year the incident occurred	YYYY
Date	Date the incident occurred	MM/DD/YYYY
Time	Time the incident occurred	Time 24-hour system
Emergency Medical Services (EMS) Response Time	Time it took first responders to arrive	Free text [Number of minutes]
State	State where the incident occurred	State abbreviation
City	City where the incident occurred	Free text [City name]
Address	Address of where the incident occurred	Free text [Street number; Street name]
Latitude	Exact or estimated latitude of where the incident occurred	Free text [Decimal degrees] Unknown
Longitude	Exact or estimated longitude of where the incident occurred	Free text [Decimal degrees] Unknown
Longitude/Latitude Accuracy	Determination of whether the latitude and longitude were reported in the investigation report or if they were estimated by the FOG research team based on the geographic (city, state, address) information	- Estimate - Non-Estimate - Unknown
Basin	Basin where the incident occurred based on geographic (city, state) information and the FracTracker basin map	- Anadarko - Appalachian - Ardmore - Arkoma - Bighorn - Black Warrior - Cherokee Platform - Denver - Forest City - Fort Worth - Greater Green River - Illinois - Los Angeles - Marfa - Marietta - Michigan - Montana Thrust Belt - North Park - Palo Duro - Paradox - Permian - Powder River - Raton - San Joaquin - San Juan

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		<ul style="list-style-type: none"> - Santa Maria - TX-LA-MS Salt - Uinta-Piceance - Valley and Ridge - Ventura - Western Gulf - Williston - N/A - Unknown Basin
Operator Name	Name of the company who owns or leases the wellsite	Free text
Operator # of Employees	Number of workers employed by the company who own or leases the wellsite	Free text [Numeric]
Operator Size	Size of the company who owns or leases the wellsite	<ul style="list-style-type: none"> - Large, 99+ - Medium, 20-99 - Small, <20
Phase of Operation	The distinct stage or processes of well development that was taking place when the incident occurred	<ul style="list-style-type: none"> - Casing Installation - Drilling Operations - Emergency Operations - Exploration - Plug and Abandon Well - Production - Site Preparation and Construction - Unknown - Unspecified: Off-Wellsite - Unspecified: Roadway - Unspecified: Wellsite - Waste Fluids Treatment and Disposal - Well Completion: Flowback - Well Completion: Hydraulic Fracturing - Well Completion: Other - Well Servicing, Intervention, or Workover - Yard Operations
Activity 1	The task or step within an operation that was taking place when the incident occurred. Each incident is assigned as many activities as appropriate to adequately characterize the event. It is possible for an incident to not have any assigned activities.	<ul style="list-style-type: none"> - Break or Rest - Cementing - Chemical handling - Coiled tubing activities - Drilling during workover activities - Drilling fluid mixing and pumping - Drilling, pulling or running tubulars: <ul style="list-style-type: none"> - Lay down or pick-up - Makeup or break-out - Racking back - Other - Unspecified activity - Equipment assembly or dismantle - Fishing - Hot oiling - Hotwork and welding - Housekeeping and cleaning: <ul style="list-style-type: none"> - Equipment - Rig - Tanks or other vessels - Other

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		<ul style="list-style-type: none"> - Unspecified - Lease operation - Material handling: <ul style="list-style-type: none"> - Powered equipment - Manual - Office and administrative activities - Perforating - Plug drill out - Pressure pumping - Pressure testing - Production rig activities - Repair or maintenance: <ul style="list-style-type: none"> - Equipment - Flowlines - Rig - Separation equipment - Tanks - Tubulars - Vehicle - Rigging up or down - Setting packers or plugs - Snubbing - Spotting - Swabbing - Tank opening, gauging, or sampling - Tank refurbishment and custom fabrication - Training - Transport: <ul style="list-style-type: none"> - (And transfer) of fluids - Equipment, proppant, or supplies hauling - Other types of cargo - Unspecified cargo - Travel: <ul style="list-style-type: none"> - Aircraft - Light duty vehicle (commuting, non-traditional) - Light duty vehicle (on-duty) - Light duty vehicle (unknown) - Other (rail, bike, animal, etc.) - Water vehicle - Well cleanout - Well control equipment activities - Wellhead or pumping unit activities - Well kill - Wellsite construction or upkeep - Well testing or logging - Wireline and slickline activities
Activity 2	Same as Activity 1. This variable is only used if more than 1 activity is needed.	[See Activity 1]
Activity 3	Same as Activity 1. This variable is only used if more than 2 activities are needed.	[See Activity 1]

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Activity 4	Same as Activity 1. This variable is only used if more than 3 activities are needed.	[See Activity 1]
Location on Rig	Location on the wellsite where the incident occurred	<ul style="list-style-type: none"> - Catwalk/V-Door - Cherry picker/Crane - Derrick/Mast (Crown Monkey/Stabbing board, A-frame) - Engine room/Generator room - Forklift - Fuel/Water storage tanks - Jacking house - Living/Camp areas/Accommodations - Mud pump room - Off location - Mud mixing tank/area - Mud pits/tanks - Pipe rack/deck - Rig floor - SCR/Electrical room - Shale shaker - Stairs/ladders - Substructures - Tank battery - Well control (BOP) stack/Wellhead/Tree area - Well pad - Winch truck - Work room (Change house, Storage house) - Other - Unknown
Fatigue Related	Denotes whether worker fatigue was listed as a contributing factor in the investigation report	<ul style="list-style-type: none"> - Y-Yes - N-No
Pressure Related	Denotes whether high pressure was listed as a contributing factor in the investigation report	<ul style="list-style-type: none"> - Y-Yes - N-No
Permit Required Confined Space	Denotes whether a permit confined space contributed to the incident	<ul style="list-style-type: none"> - Y-Yes - N-No
Fluid Type	Completed if the incident involved the transport or transport of a fluid by a hauler	<ul style="list-style-type: none"> - Condensate - Crude oil - Flowback - Fresh water - Produced water (waste water, salt water, etc.) - Tank bottoms, solids, waste - Unspecified
Vehicle Related	Denotes whether the incident occurred in a moving vehicle	<ul style="list-style-type: none"> - Y-Yes - N-No
Crash Type	Completed only if Vehicle Related=Y. Denotes the type of crash as reported in the crash report.	<ul style="list-style-type: none"> - Collision with object other than vehicle - Collision with other vehicle - Non-collision incident - Pedestrian vehicular incident
Vehicle Type	Completed only if Vehicle Related=Y. Denotes the vehicle the fatally injured worker was driving or riding in when the incident occurred.	<ul style="list-style-type: none"> - ATV - Automobile - Bus - Crane

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		<ul style="list-style-type: none"> - Forklift - Helicopter - Motorcycle - Other offroad vehicle - Other powered industrial vehicle - Other semitrailer/Tractor trailer/Trailer truck - Pickup truck - Sand hauler - Tractor - Truck, other/unspecified - Water hauler - Unknown
Road Type	Completed only if Vehicle Related=Y. Denotes the type of road as reported in the crash report.	<ul style="list-style-type: none"> - At the wellsite - Lease road - Local road or street - Parking lot - Rural highway (2 lane) - Rural highway (>2 lane) - Urban interstate - Yard - Other unpaved road - Unknown
O&G Vehicle at Fault	Completed only if Vehicle Related=Y. Denotes whether the vehicle that the fatally injured worker was driving or riding in was at fault as reported in the crash report.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Occupation of Driver	Completed only if Vehicle Related=Y. Occupation of the fatally injured worker if they were driving the vehicle involved in the incident or the occupation of the driver of the vehicle the fatally injured worker was riding in.	<ul style="list-style-type: none"> - Area/Region Manager (Well Servicing) - Coiled Tubing Assistant - Coiled Tubing Operator - Company Man - Construction Worker – Facilities - Construction Worker – Pipeline/Flow line - Construction Worker – Well Site - Crane Operator - Derrickman - District Manager (Well Servicing) - Driller - Electrician (Drilling) - Electronics Tech (Well Servicing) - Engineer (Drilling) - Engineer (Well Servicing) - Engineer – Field (Well Servicing) - Environmental Manager/Technician (Production) - Floorhand - Health and Safety Manager (Well Servicing) - Hot Oiler Helper/Asst. - Hot Oiler Truck Operator/Driver - Hydraulic Fracturing Equipment Operator - Hydraulic Fracturing Field Coordinator

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		<ul style="list-style-type: none"> - Hydraulic Fracturing Operations Manager/Asst. - Hydraulic Fracturing Service Leader - I.T./Metering/SCADA/Automation Technician (Production) - Kill Truck Operator/Driver - Maintenance Manager (Well Servicing) - Maintenance Supervisor (Drilling) - Mechanic/Repair Tech (Drilling) - Medic (Drilling) - Motorman - Pressure Control Specialist - Procedures Analyst - Professional Driver-Shuttle/Van/Bus - Pumper/Operator/Field Technician - QA/QC Technician - Rig Helper - Rigger - Roustabout - Service Manager - Shop Foreman - Snubbing Assistant - Snubbing Specialist - Supervisor (Well Servicing) - Swab Truck Assistant - Swab Truck Operator - Tank Gauger - Tool/Fishing Operator - Toolpusher/Drilling Supervisor - Truck Driver – Crude Oil Tank - Truck Driver – Flatbed Driver - Truck Driver – Fluid Hauler - Truck Driver – Other - Truck Driver – Proppant Hauler - Truck Driver – Sand Hauler - Truck Driver – Straight Stick Transport Driver (Deliveries, etc.) - Truck Driver – Unspecified - Truck Driver – Water Hauler - Truck Driver – Welding Truck - Truck Helper/Swamper (Drilling) - Vacuum Truck Operator/Driver - Welder (Drilling) - Welder (Well Servicing) - Well Servicing Operator - Wireline Operator - Wireline Technician - Wireline Gun Loader - Other Occupation - Unknown Occupation - N/A
Speeding	Completed only if Vehicle Related=Y. Denotes whether speeding was listed as a contributing factor or potential	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown

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	contributing factor to the crash as reported on the crash report.	- N/A
MPH over Speed Limit	Completed only if Vehicle Related=Y AND Speeding=Y. Number of miles per hour over the speed limit as reported on the crash report.	Free text [Number of miles per hour]
Distraction	Completed only if Vehicle Related=Y. Denotes whether a distraction was listed as a contributing factor or potential contributing factor to the crash as reported on the crash report.	- Y-Yes - N-No - U-Unknown - N/A
Distraction Type	Completed only if Vehicle Related=Y AND Distraction=Y. Type of distraction as reported on the crash report.	Free text
Fatigue/Drowsiness	Completed only if Vehicle Related=Y. Denotes whether fatigue or drowsiness were listed as contributing factors or potential contributing factors to the crash as reported on the crash report.	- Y-Yes - N-No - U-Unknown - N/A
Alcohol Involvement	Completed only if Vehicle Related=Y. Denotes whether alcohol was listed as a contributing factor or potential contributing factor to the crash as reported on the crash report.	- Y-Yes - N-No - U-Unknown - N/A
Drug Involvement	Completed only if Vehicle Related=Y. Denotes whether drugs were listed as a contributing factor or potential contributing factor to the crash as reported on the crash report	- Y-Yes - N-No - U-Unknown - N/A
Weather Related	Denotes whether weather was a contributing factor to the incident	- Y-Yes - N-No
Environmental Factor 1	Completed only if Weather Related=Y. Denotes the specific environmental factor that contributed to the incident.	- Fog - Hail - High Temperatures - High Winds - Ice - Low Temperatures - Rain - Snow
Environmental Factor 2	Completed only if Weather Related=Y. Denotes a secondary specific environmental factor that contributed to the incident.	- Fog - Hail - High Temperatures - High Winds - Ice - Low Temperatures - Rain - Snow
Other Environmental Factor	Completed only if Weather Related=Y. Denotes an environmental factor that is not listed as an option for Env. Factor 1 or Env. Factor 2.	Free text
Offshore	Denotes whether the incident occurred on an offshore platform	- Y-Yes - N-No
Wave Height (ft)	Completed only if Offshore=Y. If a wave contributed to the incident, the wave's height in feet is captured.	Free text
Distance from Shore (mi)	Completed only if Offshore=Y. Distance in miles from the nearest shoreline to location where incident occurred. May be approximated if exact location is not known.	Free text

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Wind Speed (kts)	Completed only if Offshore=Y. Wind speeds in knots at the time of the incident, as reported in the investigation report.	Free text
Water Temperature (°F)	Completed only if Offshore=Y. Water temperature in degrees Fahrenheit at the time of the incident, as reported in the investigation report.	Free text
Water Depth (ft)	Completed only if Offshore=Y. Depth of water at the location of the incident, as reported in the investigation report.	Free text
USCG Investigation #	Completed only if Offshore=Y. Inspection number if the United States Coast Guard investigated the incident.	Free text
BSEE Lease #	Completed only if Offshore=Y. The number assigned to a lease by the Bureau of Safety and Environmental Enforcement, who has jurisdiction over mineral activity in the territory where the lease is located.	Free text
NTSB Investigation #	Completed only if Offshore=Y. Inspection number if the National Transportation Safety Board investigated the incident.	Free text
OSHA Investigation #	Incident investigation number if the Occupational Safety and Health Administration (OSHA) investigated the incident	Free text
OSHA Fatal Facts #	OSHA Fatal Facts number if identified in OSHA Fatal Facts report	Free text
NIOSH FACE Investigation #	National Institute for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) Program number if identified in NIOSH FACE report	Free text
Case Identification	Primary source of case identification	<ul style="list-style-type: none"> - BSEE - Media – Google Alert - Media – OSHA or NIOSH Clips - Media – Other - Newsletter - OSHA Direct Notification - OSHA Fat/Cat - OSHA Preliminary Report Data - OSHA Weekly Reports - Professional Contact - State OSHA Website - TX DOT - USCG IIR - USCG Search - Other - N/A
NIOSH Incident Description	Incident description from source documents	Free text
NIOSH Additional Information	Additional notes describing incident	Free text
OSHA Incident Descriptions	Incident description from OSHA case file if investigated by OSHA	Free text
Worker ID	Unique identifier for each fatally injured worker. Comprised of Incident ID followed by worker number, beginning with 1.	YYYY-###-#
Age	Age of the fatally injured worker	Free text

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Sex	Sex of the fatally injured worker	<ul style="list-style-type: none"> - Female - Male
Race	Race of the fatally injured worker	<ul style="list-style-type: none"> - American Indian/Alaska Native - Asian - Black or African American - Hispanic or Latino - White - Other - Unknown
State of Residence	State of residence of the fatally injured worker	State abbreviation
ESL	Denotes whether the fatally injured worker spoke English as a second language	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown
Occupation	Occupation of the fatally injured worker	<ul style="list-style-type: none"> - Area/Region Manager (Well Servicing) - Coiled Tubing Assistant - Coiled Tubing Operator - Company Man - Construction Worker – Facilities - Construction Worker – Pipeline/Flow line - Construction Worker – Well Site - Crane Operator - Derrickman - District Manager (Well Servicing) - Driller - Electrician (Drilling) - Electronics Tech (Well Servicing) - Engineer (Drilling) - Engineer (Well Servicing) - Engineer – Field (Well Servicing) - Environmental Manager/Technician (Production) - Floorhand - Health and Safety Manager (Well Servicing) - Hot Oiler Helper/Asst. - Hot Oiler Truck Operator/Driver - Hydraulic Fracturing Equipment Operator - Hydraulic Fracturing Field Coordinator - Hydraulic Fracturing Operations Manager/Asst. - Hydraulic Fracturing Service Leader - I.T./Metering/SCADA/Automation Technician (Production) - Kill Truck Operator/Driver - Maintenance Manager (Well Servicing) - Maintenance Supervisor (Drilling) - Mechanic/Repair Tech (Drilling) - Medic (Drilling) - Motorman - Pressure Control Specialist - Procedures Analyst - Professional Driver-Shuttle/Van/Bus

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		<ul style="list-style-type: none"> - Pumper/Operator/Field Technician - QA/QC Technician - Rig Helper - Rigger - Roustabout - Service Manager - Shop Foreman - Snubbing Assistant - Snubbing Specialist - Supervisor (Well Servicing) - Swab Truck Assistant - Swab Truck Operator - Tank Gauger - Tool/Fishing Operator - Toolpusher/Drilling Supervisor - Truck Driver – Crude Oil Tank - Truck Driver – Flatbed Driver - Truck Driver – Fluid Hauler - Truck Driver – Other - Truck Driver – Proppant Hauler - Truck Driver – Sand Hauler - Truck Driver – Straight Stick Transport Driver (Deliveries, etc.) - Truck Driver – Unspecified - Truck Driver – Water Hauler - Truck Driver – Welding Truck - Truck Helper/Swamper (Drilling) - Vacuum Truck Operator/Driver - Welder (Drilling) - Welder (Well Servicing) - Well Servicing Operator - Wireline Operator - Wireline Technician - Wireline Gun Loader - Other Occupation - Unknown Occupation - N/A
Years in Oil Field	Number of known years of experience the fatally injured worker had in the oil and gas extraction industry	Free text
Contractor	Name of the company that worker was employed by	Free text
Contractor # of Employees	Number of workers employed by the company that worker was employed by	Free text
Contractor Size	Size of the company that worker was employed by	<ul style="list-style-type: none"> - Large, 99+ - Medium, 20-99 - Small, <20 - Unknown
NAICS Code	North American Industry Classification System (NAICS) code indicating the industry group of the employer	<ul style="list-style-type: none"> - 211- Operator - 213111- Drilling Operations - 213112- Well Servicing - 238910- Site Preparation and Construction for Oil and Gas - 4842- Specialized Freight - 541360- Geophysical Surveying and Mapping

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		<ul style="list-style-type: none"> - Other - Unknown
Lone Worker	Denotes whether the worker was fatally injured without any other worker or person present at the worksite or in the vehicle	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown
Working Unobserved	Denotes whether the worker was fatally injured while working independently and unobserved by other workers on-site	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
NIOSH Event Type	How the fatal injury or illness occurred. In instances where two or more events occur to a single victim, precedence is given to the initial event type.	<ul style="list-style-type: none"> - Cardiac Event: No Known Work Exposure - Contact Injury: <ul style="list-style-type: none"> - Caught Between or Crushed - Struck Against - Struck By - Struck By Falling Object - Electrocution - Explosion (combustion) or fire - Explosion (pressure) - Exposure: <ul style="list-style-type: none"> - Alcohol or Drug Overdose - Cardiac Event: Possible Work Exposure - Environmental - Hot or Cold Objects - Harmful Substance - Undetermined: Possible Work Exposure - Fall: <ul style="list-style-type: none"> - From Height - Same Level - Intentional Act - Overexertion - Vehicle Incident: <ul style="list-style-type: none"> - On-Site - Other Location - Roadway - Unspecified Location - Undetermined: No Known Work Exposure - Unknown
Injury Event Code	The manner in which the injury or illness was produced or inflicted by the source of injury or illness as coded by the Occupational Injury and Illness Classification System (OIICS)	Free text See OIICS Manual for Coding Scheme
Nature of Injury	Principal physical characteristic(s) of the work related injury or illness as coded by OIICS	Free text See OIICS Manual for Coding Scheme
Body Part Injured	Part of the body directly affected by the previously identified nature of injury or illness as coded by OIICS	Free text See OIICS Manual for Coding Scheme
Source of Injury	Object, substance, equipment, or other factor that was responsible for the injury or illness incurred by the worker or that precipitated the event or exposure as coded by OIICS	Free text See OIICS Manual for Coding Scheme

Fatalities in Oil and Gas Extraction (FOG) Database Data Dictionary

Secondary Source	Object, substance, equipment, or other factor that was responsible for the injury or illness incurred by the worker or that precipitated the event or exposure as coded by OIICS	Free text See OIICS Manual for Coding Scheme
Task	Primary task performed by the fatally injured worker at the time of the incident	Free text
Other Task	Other task performed by the fatally injured worker at the time of the incident	Free text
Human Factor 1	Primary human factor that contributed to the incident	<ul style="list-style-type: none"> - Alcohol Consumption - Defective Equipment: Knowingly Used - Distracting Actions by Others - Drug Use - Equipment in Use Not Appropriate for Operation or Process - Fatigue - Inexperience - Insufficient or Lack of Engineering Controls - Insufficient or Lack of Exposure or Biological Monitoring - Insufficient or Lack of Housekeeping Program - Insufficient or Lack of Protective Work Clothing and Equipment - Insufficient or Lack of Respiratory Protection - Insufficient or Lack of Written Work Practices Program - Malfunction of Neuro-Muscular System - Malfunction of Perception System with Respect to Task Environment - Malfunction of Procedure for Securing Operation or Warning of Hazardous Situation - Malfunction of Procedure for Lock-Out or Tag-Out - Misjudgment of Hazardous Situation - Operational Position Not Appropriate - Procedure for Handling Materials Not Appropriate for Task - Safety Devices Removed or Inoperative - Under Suspended Load Unnecessarily
Human Factor 2	Additional human factor that contributed to the incident	<ul style="list-style-type: none"> - Alcohol Consumption - Defective Equipment: Knowingly Used - Distracting Actions by Others - Drug Use - Equipment in Use Not Appropriate for Operation or Process - Fatigue - Inexperience - Insufficient or Lack of Engineering Controls - Insufficient or Lack of Exposure or Biological Monitoring

Fatalities in Oil and Gas Extraction (FOG) Database Data Dictionary

		<ul style="list-style-type: none"> - Insufficient or Lack of Housekeeping Program - Insufficient or Lack of Protective Work Clothing and Equipment - Insufficient or Lack of Respiratory Protection - Insufficient or Lack of Written Work Practices Program - Malfunction of Neuro-Muscular System - Malfunction of Perception System with Respect to Task Environment - Malfunction of Procedure for Securing Operation or Warning of Hazardous Situation - Malfunction of Procedure for Lock-Out or Tag-Out - Misjudgment of Hazardous Situation - Operational Position Not Appropriate - Procedure for Handling Materials Not Appropriate for Task - Safety Devices Removed or Inoperative - Under Suspended Load Unnecessarily
Other Human Factor	Other human factor that contributed to the incident or additional details describing the previously identified human factors	Free text
Contact Injury	Completed only if NIOSH Event Type=Contact Injury OR if a contact injured occurred during the incident. Denotes whether the incident involved a contact injury.	<ul style="list-style-type: none"> - Y-Yes - N-No
Equipment	Completed only if Contact Injury=Y. Equipment that produced or inflicted the injury or illness.	<ul style="list-style-type: none"> - Anchor Chains, Cables, Winches - Boards/Baskets - BOP Stack - Chemicals - Chemicals (sack, drum, pail, bulk hopper) - Christmas Tree - Coiled Tubing - Crane - Decks (grating, walkway) - Drawworks/Hoists/Winch (cathead) - Elevators - Engines/Pumps/Machinery/Compressor - Forklift - Hand Tools (manual) - Hand Tools (power) - Hardline/Softline - Heater Treater - Iron Roughneck, Pipe Spinner, Power Tongs - Kelly Bushings (master bushings) - Ladder - Manual Tongs - Pipes, Collars, Tubulars - Pressure Hoses/Lines - Pump Unit

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		<ul style="list-style-type: none"> - Rig Floor Winch - Rotary - Sand Separator - Slings (wire rope, cable, chain, web) - Slips - Spinning Chain - Stairs - Tank/Vessels - Top Drive (blocks, swivel, Kelly) - Truck- Semi, Long-Haul, Short-Haul - Truck- Vacuum - Truck- Winch - Vehicles - Welding, Cutting, Grinding Equipment - Other Equipment
Other Equipment	Completed only if Contact Injury=Y. Other equipment that contributed to injury or illness.	Free text
Pipe Handling	Completed only if Contact Injury=Y. Denotes whether pipe handling occurred during incident.	<ul style="list-style-type: none"> - Y-Yes - N-No
Fall	Completed only if NIOSH Event Type=Fall OR if a fall occurred during the incident. Denotes whether the incident involved a fall.	<ul style="list-style-type: none"> - Y-Yes - N-No
Fall Height (ft)	Completed only if Fall=Y. Height of the fall.	Free text
Harness Used	Completed only if Fall=Y. Denotes whether fall protection equipment, such as a harness, was worn by the fatally injured worker.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Harness Sized Correctly	Completed only if Fall=Y AND Harness Used=Y. Denotes whether the harness was sized correctly for the fatally injured worker.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Tied Off Correctly	Completed only if Fall=Y AND Harness Used=Y. Denotes whether the harness was tied off correctly.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
System Failure	Completed only if Fall=Y AND Harness Used=Y. Denotes whether a harness system failure occurred.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Transport Accident	Denotes whether the incident was related to transportation.	<ul style="list-style-type: none"> - Y-Yes - N-No
Commuting	Completed only if Transport Accident=Y. Denotes whether the fatally injured worker was commuting to or from work.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Ejected	Completed only if Transport Accident=Y. Denotes whether the fatally injured worker was ejected from the vehicle.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A
Seatbelt Used	Completed only if Transport Accident=Y. Denotes whether the fatally injured worker was wearing a seat belt.	<ul style="list-style-type: none"> - Y-Yes - N-No - U-Unknown - N/A

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Fires and Explosions	Completed only if NIOSH Event Type= Explosion (combustion) or fire OR Explosion (pressure) OR if a fire or explosion occurred during the incident. Denotes whether the incident involved a fire or explosion.	<ul style="list-style-type: none"> - Y-Yes - N-No
Equipment	Completed only if Fires and Explosions=Y. Equipment that was involved in the fire or explosion.	<ul style="list-style-type: none"> - Anchor Chains, Cables, Winches - Boards/Baskets - BOP Stack - Chemicals - Chemicals (sack, drum, pail, bulk hopper) - Christmas Tree - Coiled Tubing - Crane - Decks (grating, walkway) - Drawworks/Hoists/Winch (cathead) - Elevators - Engines/Pumps/Machinery/Compressor - Forklift - Hand Tools (manual) - Hand Tools (power) - Hardline/Softline - Heater Treater - Iron Roughneck, Pipe Spinner, Power Tongs - Kelly Bushings (master bushings) - Ladder - Manual Tongs - Pipes, Collars, Tubulars - Pressure Hoses/Lines - Pump Unit - Rig Floor Winch - Rotary - Sand Separator - Slings (wire rope, cable, chain, web) - Slips - Spinning Chain - Stairs - Tank/Vessels - Top Drive (blocks, swivel, Kelly) - Truck- Semi, Long-Haul, Short-Haul - Truck- Vacuum - Truck- Winch - Vehicles - Welding, Cutting, Grinding Equipment - Other Equipment
Other Equipment	Completed only if Fires and Explosions=Y. Other equipment that was involved in the fire or explosion.	Free text
Ignition Source	Completed only if Fires and Explosions=Y. Ignition source that produced the fire or explosion.	Free text
Flammable Material Source	Completed only if Fires and Explosions=Y. Source of flammable material involved in the fire or explosion.	Free text

Supplementary Table 2
Fatalities in Oil and Gas Extraction (FOG) Database

Variable Changes from FOG 1.0 to FOG 2.0

The FOG variables Phase of Operation, Activity, and Event Type were reviewed and updated by NIOSH oil and gas researchers to better reflect the OGE circumstances of fatalities identified during 2014–2017. An updated “FOG 2.0” set of variable codes were used to code fatalities during 2018–2019 and were also used to update codes for fatalities during 2014–2017. The following tables display the original FOG 1.0 values for each variable and the updated FOG 2.0 values. Values highlighted in red in FOG 1.0 were removed if the corresponding FOG 2.0 cell is blank. Values highlighted in red in FOG 1.0 were renamed, combined, or modified in some way if the corresponding FOG 2.0 cell is highlighted in green. Values highlighted in green in FOG 2.0 where the corresponding FOG 1.0 cell is blank were new values.

Phase of Operation:

FOG 1.0	FOG 2.0
Casing installation	Casing installation
Drilling operations	Drilling operations
Emergency operations	Emergency operations
	Exploration
Flowback	
Hydraulic fracturing	
Offshore	
Plug and abandon well	Plug and abandon well
Production	Production
Site preparation	Site preparation and construction
Tank refurbishment and custom fabrication	
	Unknown
Unspecified: Off-wellsite	Unspecified: Off-wellsite
	Unspecified: Roadway
Unspecified: Wellsite	Unspecified: Wellsite
Vehicle repair or maintenance operations	
Waste fluids treatment and disposal	Waste fluids treatment and disposal
Well completion	Well completion: Flowback
	Well completion: Hydraulic fracturing
	Well completion: Other
Well servicing, intervention, or workover	Well servicing, intervention, or workover
	Yard operations

Activity:

FOG 1.0		FOG 2.0	
Break or rest		Break or rest	
Casing repair or maintenance			
Cementing		Cementing	
		Chemical handling	
Coiled tubing activities		Coiled tubing activities	
Downhole tool and equipment activities			
Drilling activities		Drilling during workover activities	
Drilling fluid mixing and pumping		Drilling fluid mixing and pumping	
Laydown or pickup tubulars		Drilling, pulling or running tubulars:	Lay down or pick-up
Makeup or breakout tubulars			Makeup or break-out
Racking back tubulars			Racking back
Making connection			Other
Pulling or running rods			Unspecified activity
Pulling or running tubing			
Equipment install or dismantle		Equipment install or dismantle	
Fishing		Fishing	
Hot oiling		Hot oiling	
Hotwork and welding		Hotwork and welding	
		Housekeeping and cleaning:	Equipment
			Rig
			Tanks or other vessels
			Other
			Unspecified
Production monitoring		Lease operation	
Material handling:	Crane, forklift, winch truck	Material handling:	Powered equipment
	Manual		Manual
	Rig floor hoisting equipment		
		Office and administrative activities	
Nitrogen pumping			
Paraffin removal			
Perforating		Perforating	
Plug drill out		Plug drill out	
Pressure pumping		Pressure pumping	
		Pressure testing	
Produced and waste fluids storage			
Production rig activities		Production rig activities	
		Repair or maintenance:	Equipment
Rig or equipment repair or maintenance			Flowlines
Rod repair or maintenance			Rig
Tank cleaning or maintenance			Separation equipment

Production tubing repair or maintenance		Tanks
Vehicle repair or maintenance		Tubulars
Production tubing installation		Vehicle
Rigging up or down	Rigging up or down	
Running casing		
Separation equipment activities		
	Setting packers or plugs	
Snubbing	Snubbing	
Spotting	Spotting	
Swabbing	Swabbing	
Tank gauging or sampling	Tank opening, gauging, or sampling	
	Tank refurbishment and custom fabrication	
Training	Training	
Tripping pipe in or out		
Truck transport:	Crude oil hauling	(And transfer) of fluids
	Equipment or supplies hauling	Equipment, proppant, or supplies hauling
	Other types of cargo	
	Produced or waste water hauling	Other types of cargo
	Unspecified cargo	Unspecified cargo
	Water hauling	
Commuting: Nontraditional	Travel:	Aircraft
		Light duty vehicle (commuting, non-traditional)
Motor vehicle travel		Light duty vehicle (on-duty)
Nonmotor vehicle travel		Light duty vehicle (unknown)
		Other (rail, bike, animal, etc.)
		Water vehicle
Vacuum truck activities		
Well cleanout	Well cleanout	
Well control equipment activities	Well control equipment activities	
Wellhead or pumping unit activities	Wellhead or pumping unit activities	
Well kill	Well kill	
Wellsite maintenance or construction	Wellsite construction and upkeep	
Well testing or logging	Well testing or logging	
Wireline and slickline activities	Wireline and slickline activities	

Event Type:

FOG 1.0		FOG 2.0	
Contact Injuries	Caught between or crushed	Contact Injuries	Caught between or crushed
			Struck against
	Struck by		Struck by
	Struck by falling object		Struck by falling object
Electrocutions		Electrocutions	
Explosion (combustion) or fire		Explosion (combustion) or fire	
Explosion (pressure)		Explosion (pressure)	
Exposure	Alcohol or drug poisoning	Exposure	Alcohol or drug overdose
	Cardiac event: possible work exposure		Cardiac event: possible work exposure
	Environmental		Environmental
			Hot or cold objects
	Harmful substance		Harmful substance
	Undetermined: possible work exposure		Undetermined: possible work exposure
Fall	Fall from height	Fall	From height
	Same level (slip or trip)		Same level (slip or trip)
Intentional Acts		Intentional Acts	
		Overexertion	
Vehicle Incident	On site	Vehicle Incident	On-site
	Other location		Other location
	Roadway		Roadway
	Unspecified location		Unspecified location
Events with No Known Work Exposure	Cardiac event: no known work exposure	Events with No Known Work Exposure	Cardiac event: no known work exposure
	Undetermined: no known work exposure		
		Unknown	

Supplementary Table 3
Oil and gas extraction worker fatalities by phase of operation – Fatalities in Oil and Gas Extraction
(FOG) Database, 2014-2019

Phase of Operation	Total FOG fatalities No. (%)
Production	83 (17.7)
Unspecified: roadway	76 (16.2)
Well servicing, intervention, or workover	67 (14.3)
Drilling operations	66 (14.0)
Well completion	39 (8.3)
Yard operations	31 (6.6)
Unspecified: wellsite	23 (4.9)
Waste fluids treatment and disposal	11 (2.3)
Casing installation	10 (2.1)
Site preparation and construction	7 (1.5)
Unspecified: off-wellsite	6 (1.3)
Plug and abandon well	2 (0.4)
Exploration	1 (0.2)
Unknown	48 (10.2)
Total	470

Supplementary Appendix 1

Fatality Information Form

Fatalities in Oil and Gas Extraction (FOG) Database

Fatality Information Form

Fatalities in Oil and Gas Extraction (FOG)

Incident ID: **YYYY-###**

Last Updated:

Required Incident Information

Date:	Select Date (MM/DD/YYYY)	Multiple Injuries:	Select Answer
Time:	Type Time (Military time)	# of Fatalities:	Select #
EMS Response Time:	Type Minutes	# of Hospitalizations:	Select #
State:	Select State		
City:	Type City		
Address:	Type Address		
Latitude:	Type Coordinate or Select Unknown		
Longitude:	Type Coordinate or Select Unknown		
Long./Lat. Accuracy:	Select Answer		
Basin:	Select Basin		
Operator Name:	Type Operator Name		
# of Employees:	Type Operator # of Employees		
Size:	Select Operator Size		
Phase of operation:	Click here to enter text		
Activities:	Type activities separated by a semicolon		
Location on Rig:	Select Location		

Fatigue Related:	<input type="checkbox"/>		
Pressure Related:	<input type="checkbox"/>		
Permit required confined space:	<input type="checkbox"/>		
Fluid Type:	Choose an item		
Vehicle Related:	<input type="checkbox"/>		
Crash type:	Choose an item		
Vehicle Type:	Select Vehicle Type		
Road Type:	Select Road Type		
O&G Vehicle at Fault	Select Answer		
Occupation of Driver	Select Occupation		
Speeding	Select Answer		
MPH over speed limit:	Click here to enter text		
Distraction	Select Answer		
Distraction Type:	Click here to enter text		
Fatigue/Drowsiness	Select Answer		
Alcohol Involvement	Select Answer		
Drug Involvement	Select Answer		
Weather Related:	<input type="checkbox"/>		
Env. Factor 1:	Select Env. Factor		
Env. Factor 2:	Select Env. Factor		
Other Env. Factor:	Click here to enter text		
Offshore:	<input type="checkbox"/>		
Wave Height (ft):	Type Wave Height	Distance from Shore (mi):	Type Distance from Shore
Wind Speed (kts):	Type Wind Speed	Water Temperature (°F):	Type Water Temperature
Water Depth (ft):	Type Water Depth	USCG Investigation #:	Type USCG Investigation #
BSEE Lease #:	Type BSEE Lease #	NTSB Investigation #:	Type NTSB Investigation #

Fatality Information Form

Fatalities in Oil and Gas Extraction (FOG)

Incident ID: **YYYY-###**

Last Updated:

Incident Descriptions

OSHA Investigation #:	Type # or Select N/A
OSHA Fatal Facts #:	Type # or Select N/A
NIOSH FACE Investigation #:	Type # or Select N/A
Case Identification:	Type/Select Source
Source Document Tracking Form:	Hyperlink or Paste Pathname

NIOSH Oil and Gas Description of Incident (includes all de-identified relevant information from all sources):

Type NIOSH description of Incident

NIOSH Oil and Gas Additional Information

Type description

OSHA Preliminary Report Descriptions of Incident:

Type OSHA description of Incident

Fatality Information Form

Fatalities in Oil and Gas Extraction (FOG)

Incident ID: **YYYY-###**

Last Updated: Date

Employee Information

Worker ID: IncidentID-#

Age:	Type Age
Sex:	Select Sex
Race:	Select Race
State of Residence:	Select State
ESL	Select answer
Occupation:	Select Occupation or Click here to enter text
Years in Oil Field:	Type Years in Oil Field
Contractor:	Type Contractor Name
# of Employees	Type Contractor # of Employees
Size:	Select Contractor Size
NAICS Code:	Select NAICS Code

Lone worker:	Select Answer
Working unobserved:	Select Answer
NIOSH Event Type:	Select Event Type
Injury Event Code:	####
Nature of Injury:	####
Body Part Injured:	####
Source of Injury:	####
Secondary Source:	####
Task:	Type Task
Other Task:	Type Other Task
Human Factor 1:	Select Human Factor
Human Factor 2:	Select Human Factor
Other Human Factor:	Type Other Human Factor

0- Contact Injury:	<input type="checkbox"/>
Equipment:	Select Equipment
Other Equipment:	Type Other Equipment
Pipe Handling:	<input type="checkbox"/>
1- Fall:	<input type="checkbox"/>
Fall Height (ft):	Type Fall Height
Harness Used	Select Answer
Harness Sized Correctly	Select Answer
Tied Off Correctly	Select Answer
System Failure	Select Answer
4- Transport. Accident:	<input type="checkbox"/>
Commuting	Select Answer
Ejected	Select Answer
Seatbelt Used	Select Answer
5- Fires and Explosions:	<input type="checkbox"/>
Equipment:	Select Equipment
Other Equipment:	Type Other Equipment
Ignition Source:	Type Ignition Source
Flammable Material Source:	Type Flammable Material Source

Supplementary Appendix 2

Contributions of Fatalities in Oil and Gas Extraction (FOG) data to oil and gas extraction research

Exposures to hydrocarbon gases and vapors

- NIOSH Special Topic Report: Suspected Inhalation Fatalities Involving Workers during Manual Tank Gauging, Sampling, and Fluid Transfer Operations on Oil and Gas Well Sites, 2010—2014. 2015. <https://www.cdc.gov/niosh/topics/fog/SpecialTopic2015.html>.
- NIOSH Science Blog: Update: Reports of Worker Fatalities during Manual Tank Gauging and Sampling in the Oil and Gas Extraction Industry. 2015. <https://blogs.cdc.gov/niosh-science-blog/2015/04/10/flowback-3/>.
- MMWR Article: Sudden Deaths Among Oil and Gas Extraction Workers Resulting from Oxygen Deficiency and Inhalation of Hydrocarbon Gases and Vapors — United States, January 2010–March 2015. 2016. <https://www.cdc.gov/mmwr/volumes/65/wr/mm6501a2.htm>.
- NIOSH-OSHA Hazard Alert: Health and Safety Risks for Workers Involved in Manual Tank Gauging and Sampling at Oil and Gas Extraction Sites. 2016. NIOSH Publication No. 2016-108. <https://www.cdc.gov/niosh/docs/2016-108/default.html>.
- NIOSH Story of Impact: NIOSH and Partners Work to Prevent Worker Deaths from Exposures to Hydrocarbon Gases and Vapors at Oil and Gas Wellsites. 2016. NIOSH Publication No. 2017-110. <https://www.cdc.gov/niosh/docs/2017-110/default.html>.
- Video: Protecting Oil and Gas Workers from Hydrocarbon Gases and Vapors. 2017. NIOSH Publication No. 2017-158D. <https://www.cdc.gov/niosh/docs/video/2017-158d/>.
- NIOSH Special Topic Report: Fatalities and Hospitalizations Related to the Ignition, Inhalation, or Suspected Inhalation of Hazardous Gases and Vapors While Handling Fluids at Oil and Gas Sites: 2015—2016. 2018. <https://www.cdc.gov/niosh/topics/fog/SpecialTopic2018.html>.
- NIOSH Science Blog: Gases and Vapors Continue to Pose Hazards on Oil and Gas Well Sites During Gauging, Fluid Transfer, and Disposal. 2018. <https://blogs.cdc.gov/niosh-science-blog/2018/08/24/oil-and-gas-vapors/>.
- OSHA-National STEPS Network-NIOSH Hazard Alert: Minimizing Risk During Fluids Transfer. 2021. <https://www.nationalstepsnetwork.com/hazard-alerts/2020/10/15/fluid-transfer-transport-hazard-alert>.
- Video: You've Got This! Understanding Hazards, Risks, and Controls for Safer Fluid Transfers in Oil and Gas Extraction. 2023. NIOSH Publication No. 2023-122. <https://www.cdc.gov/niosh/docs/video/2023-122/>.

Periodic publications

- Oil and Gas Extraction Worker Fatalities, 2014 Mid-Year Report: January 1, 2014–June 30, 2014. 2015. NIOSH Publication No. 2015-239. <https://www.cdc.gov/niosh/docs/2015-239/>.
- Oil and Gas Extraction Worker Fatalities 2014; NIOSH Fatalities in Oil and Gas Extraction (FOG) Database. 2017. NIOSH Publication No. 2017-193. <https://www.cdc.gov/niosh/docs/2017-193/default.html>.

Hazard alerts and fact sheets

- Tank Gauging: OSHA-National STEPS Network-NIOSH Alliance Product. 2015. <https://www.nationalstepsnetwork.com/hazard-alerts/2015/3/31/tank-gauging-hazard-alert>.
- Hot Work: OSHA-National STEPS Network-NIOSH Alliance Product. 2016. <https://www.nationalstepsnetwork.com/hazard-alerts/2016/9/28/hot-work-hazard-alert>.

Fatalities in Oil and Gas Extraction (FOG) Database Data Dictionary

- Mobile Engine: OSHA-National STEPS Network-NIOSH Alliance Product. 2017.
<https://www.nationalstepsnetwork.com/hazard-alerts/2017/5/31/mobile-engine-hazard-alert>.
- Multi-Gas Monitors: OSHA-National STEPS Network-NIOSH Alliance Product. 2017.
<https://www.nationalstepsnetwork.com/hazard-alerts/2017/11/30/limitations-of-monitors-hazard-alert>.
- Fatigued Driving for OGE Workers: NIOSH Publication No. 2018-126. 2018.
<https://www.cdc.gov/niosh/docs/2018-126/>.
- Fatigued Driving for OGE Employers: NIOSH Publication No. 2018-125. 2018.
<https://www.cdc.gov/niosh/docs/2018-125/>.
- Sudden Pressure Release: OSHA-National STEPS Network-NIOSH Alliance Product. 2020.
<https://www.nationalstepsnetwork.com/hazard-alerts/2020/07/28/sudden-uncontrolled-pressure-release-hazard-alert>.

Scientific Publications

- Working Alone and/or in Remote Locations: Opportunities to Prevent the Risk of Fatality from Cardiovascular Events in Oil and Gas Extraction Workers. 2023. Journal of Occupational and Environmental Medicine.
- Fatalities Involving Substance Use Among U.S. Oil and Gas Extraction Workers Identified Through an Industry Specific Surveillance System (2014–2019). 2023. Journal of Occupational and Environmental Medicine.
- Risk Factors for Heat-Related Illness Resulting in Death or Hospitalization in the Oil and Gas Extraction Industry. 2023. Submitted for publication.