



UNDERGROUND STORAGE SERVICES DIRECTORY

wildwell.com

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LOCATIONS

Corporate Office

Drilling Technology Center
2202 Oil Center Court
Houston, Texas 77073 USA

Regional Response Locations

UNITED STATES

Odessa, Texas
Greeley, Colorado
Roaring Branch, Pennsylvania

INTERNATIONAL

Aberdeen, Scotland
Dammam, Kingdom of Saudi Arabia
Dubai, UAE
Kuala Lumpur, Malaysia
Moscow, Russia
Stavanger, Norway

Well Control Training Centers

UNITED STATES

Houston, Texas
Corpus Christi, Texas
Odessa, Texas
Tyler, Texas
Lafayette, Louisiana
Oklahoma City, Oklahoma
Casper, Wyoming
Williston, North Dakota
Canonsburg, Pennsylvania



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CORPORATE OVERVIEW

Founded in 1975, Wild Well Control is the world's leading provider of onshore and offshore well control emergency response, pressure control, relief well planning, engineering, environmental, and training services. Headquartered in Houston, Texas, and with offices in eight other major cities, Wild Well provides its services on a global basis, and responds to an estimated 80% of the global well control response market.

Wild Well's personnel and strategically located specialized well control equipment continue to position the company as a leading global provider of well control and related services.

Experience

It is the experience that Wild Well has gained over the past four decades in business that has placed it as the market leader in well control services. Personnel resources, specialized well control equipment resources, diverse well control services, a high-level safety culture, and new technology all deliver unmatched support in Wild Well's position as a global leader in well control. However, it is the experience of responding to hundreds of well control emergencies around the world that prepares and qualifies Wild Well as the market leader.

Well Control Response	2015	2016	2017	2018	2019
Blowout with Fire	3	3	2	2	4
Blowout	12	17	36	36	31
Pressure Control	34	25	32	36	25
Unconventional Intervention	37	48	59	74	106
Total	86	93	126	148	166

Wild Well's personnel are unmatched when it comes to field experience and well control engineering support. This did not just happen overnight. It takes years of dedication to a singular pursuit, such as well control, to produce a team of professionals and a line-up of specialized well control equipment designed to provide world-class well control solutions. The culture at Wild Well fosters the development of the best well control personnel, the best specialized equipment, and the best engineered solution in the safest manner.

Personnel Resources

On a global basis, Wild Well has the largest number of dedicated well control personnel. Wild Well's personnel are full-time employees dedicated to well control work entirely each and every day.

Typically mobilized in groups of two, well control specialist teams will include as many as six to eight for a response to a major blowout. Wild Well's well control engineering staff provides continuous support to the well control specialists.

Wild Well's Engineering Department includes a diverse range of engineering disciplines:

- Petroleum
- Mechanical
- Relief Well
- Structural
- Civil
- Computational Fluid Dynamics
- Cementing
- Subsea
- Marine



This diversity of engineering disciplines allows Wild Well to review, plan, and provide the best engineered solution for the pressure control or well problem. Wild Well's engineers have engineering experience working for operators around the world. With open access to such a vast knowledge and experience base, Wild Well analyzes scenarios from different perspectives to ensure a well control problem is addressed in the most efficient and safest manner possible.

Wild Well's Training Department has a total of 22 certified well control instructors. Accredited by both International Well Control Forum (IWCF) and International Association of Drilling Contractors (IADC), Wild Well is the worldwide leading provider of well control training. Well control courses are developed in-house, and incorporate real-life well control incidents and their related causes into the well control curriculum and training.

Specialized Well Control Equipment Resources

Wild Well maintains the largest inventory of well control, firefighting, and special services equipment in the industry. Wild Well houses a majority of the specialized well control equipment at its Houston Headquarters where in only a matter of hours the equipment can be mobilized to any part of the world. In addition, Wild Well stores and maintains specialized well control equipment at other locations in the US and internationally.

Because Wild Well designs, engineers, and fabricates a majority of the specialized well control equipment itself, the history of all of the equipment movements and maintenance have been tracked through an electronic inventory system; ensuring that it is ready at all times for shipment to remote areas in response to a well control emergency.

Inventoried items include 2,500 to 6,000 GPM Wild Well fire pumps (several rated for Arctic use), hydraulic and conventional Athey Wagons and accessories, fully stocked hose and monitor containers, hot tap tools, gate valve drilling units, and cryogenic freeze packages. Wild Well also possesses the largest inventory of abrasive jet cutters in the industry, which Wild Well designed, engineered, and fabricated.

Emergency Well Control / Firefighting Equipment maintained in:

- | | | |
|------------------|--------------------------------|--------------------------|
| ■ Houston, Texas | ■ Greeley, Colorado | ■ Dubai, UAE |
| ■ Odessa, Texas | ■ Roaring Branch, Pennsylvania | ■ Port Harcourt, Nigeria |

Special Service Equipment Packages are maintained in:

- | | | |
|---------------------|---------------------------|--------------------------|
| ■ Houston, Texas | ■ Bakersfield, California | ■ Cairo, Egypt |
| ■ Odessa, Texas | ■ Dubai, UAE | ■ Singapore |
| ■ Greeley, Colorado | ■ Al Khobar, KSA | ■ Port Harcourt, Nigeria |

Services

Through its years in the well control industry, Wild Well has developed and offered many services, all related to well control. While Wild Well's core business pertains to responding to a well control emergency in the field, there are many other services provided in support of those field services. These emergency response services are provided on a daily basis around the world in a variety of environments: onshore, inland waters, offshore, and in deep water.

In recent years, Wild Well developed several services that assist the operator and drilling contractor in managing the risks associated with the drilling, completion, production, and plug and abandonment of oil and gas wells. Wild Well also worked with several insurance underwriters to develop specialty Risk Management Services to help reduce the inherent risks associated with oil and gas wells.

Quality

Wild Well follows an extremely aggressive quality management system that provides structure to our services and our various processes, including Quality, Safety, and Environmental. The following quality certifications are maintained by Wild Well:

- ISO 9001:2015 Quality Management System Certificate
- ISO 14001:2015 Environmental Management System Certificate
- OHSAS 18001: 2007 Occupational Health and Safety Management System Certificate

New Technology

Wild Well continuously explores and implements new technology in its lineup to improve its services so that customers have up-to-date access to the latest in well control response and well control engineering advancements. In recent years, Wild Well worked with Texas A&M University in finalizing the use of cryogenic freezing as a means of installing a temporary barrier inside the wellbore. Today, cryogenic freezing is an important service line within our Special Services Department, because it provides a means to isolate the well through the temporary placement of an ice plug in the wellbore. This service proves invaluable in many instances by allowing the operator/contractor to continue with its drilling or completion operations in a relatively short period of time.

A Worldwide Service of Excellence

Whether in terms of personnel, specialized well control equipment, emergency well control response services, engineering services, training services, safety, quality, new technology, or well control experience, Wild Well is the best in the well control industry.



Products & Services

EMERGENCY RESPONSE SERVICES

Blowout & Well Control Response

Catastrophic well control incidents occur unexpectedly and necessitate immediate emergency response, regardless of time or day. With the world's largest and most experienced staff of Well Control Specialists, Wild Well maintains Blowout & Well Control Response teams on standby at all times – 24 hours a day, 7 days a week, 365 days a year – thus ensuring rapid response to the site of the incident to mitigate uncontrolled fires, well flows, etc., and restore control of the well.

- Well capping
- Well re-heading
- Well-related fire suppression
- Deluge systems

Pressure Control

Wild Well provides specialist assistance – available in-office and/or on location in the field – to resolve well control complexities to regain hydrostatic control of a given well. In complex wells, the margin between fracture gradient and pore pressure gradient is narrow, which makes formation breakdown always a possibility.

Wild Well possesses the necessary expertise and skills to help clients return to normal operations after encountering well control issues such as:

- High-volume kicks
- High-pressure kicks
- Underground blowouts
- Kicks with lost circulation
- Kicks with no pipe in the hole
- Kicks in oil-based drilling fluids
- Kicks with drillstring off bottom
- Pressure control in H₂S environments
- Pressure control in HPHT wells



RISK MANAGEMENT SERVICES

Well Control Emergency Response Plans

Well control emergency response plans provide a process for responding to and safely managing well control emergencies. The objective of this process is to provide a framework for the response and management of a range of well control incidents, with various tasks and guidelines defined to ensure that all aspects of the response are given adequate consideration. This includes the organizational structure of the client's response team, and subsequent interface with the Wild Well response team.

Emergency Response Plan Rollout

The training will also review the Well Control/Source Control Emergency Response Plan and Logistics Plan to guide attendees in using these plans as management tools. Training will integrate well control response operations and procedures, which can be customized to specific well control event scenarios using the client specific data. The training will also provide timeline guidelines and logistics considerations to guide attendees during a well control event. Modules for this can include:

- Well Control/Source Control Management Overview
- Logistics Planning Considerations
- Logistics Plan Overview
- WCERP/SCERP Plan Overview
- Well Control Equipment/Other Equipment Overview

Emergency Response Training, Drills & Exercises

Emergency response training, drills, and exercises reinforce incident response preparedness by working through a specific scenario. The scenario and exercise gives companies an opportunity to practice effective implementation of their Emergency Response Plan. Wild Well facilitators direct and evaluate the response, and additionally conduct an after-action review, to capture any lessons learned that could be included in the Emergency Response Plan. Through participation in the Table-Top exercise, companies are able to validate the effectiveness of their response, identify areas for improvement and ensure the preparedness of its personnel.

Well Control Response Cards

The primary objective of the Well Control Response Card (WCRC) is to be a quick reference tool for critical information that personnel on location or in the operations center can access and utilize quickly. The WCRC typically includes the information required to determine the appropriate response level and corresponding immediate actions, as well as client specific call out notification protocol, site access routes, and predetermined areas for staging of firefighting and other well control equipment. Also included are site-specific response considerations that identify potential risks unique to the well site and adjacent areas. The WCRC is meant to supplement a Well Control Emergency Response Plan and provide a quick reference and a streamlined process to field personnel in the event of a well control incident.

Well Control Equipment Survey

The Well Control Equipment Survey consists of a visual, external inspection of well control equipment after all equipment has been rigged up and tested, and after the surface or intermediate casing has been set, and before or immediately after the shoe has been drilled out. Upon survey completion, all findings, immediate concerns, recommendations, suggestions, and comments are compiled in a formal report and presented to the client. The report is fully documented with photographs taken on location during the site visit.

Rig Site Crew Competency Assessment through Kick Drills

The Rig Site Crew Competency Assessment through Kick Drills is conducted on location at the rig site. Wild Well's kick drill assessments are a quantitative and qualitative measurement of a rig crew's knowledge to detect and properly respond to a kick event.

Well Integrity (WI) Services

Each operator is in a different place on their well integrity journey. Some have embraced the most stringent regulations globally, while others are just investigating the path forward. Wild Well will tailor our well integrity offering to meet the specific needs and unique aspects of the targeted area of operations.

Risk Assessment for Gas Storage Operations

A risk matrix will be developed to address Table 1 from API Standard 1171 Functional Integrity in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs specific to a gas storage operator's field and wells. Wild Well will offer a template risk matrix that can address the elements of Table 1 as well as any supplemental threats and hazards that may impact specific operators. Development of the risk matrix will include 1 Risk Management response specialist and 1 Risk Management Technician on-site for up to 5 days to review and collect client's relevant data and operations. Wild Well personnel will evaluate and assist in prioritizing the initial population of the risk matrix alongside Company personnel utilizing the methodology outlined in Section 8.5.2 of API 1171.

Wellhead Integrity Survey With Field Operator Training (WISFOT)

The Wellhead Integrity Survey with Field Operator Training will identify all wellhead components and instruct operators on proper maintenance procedures. Intended service for natural gas storage operator personnel who operate and maintain wellheads.

The survey will begin with Wild Well personnel assisting in identifying all wellhead components within the operator's storage field. Original equipment manufacturers maintenance procedures will be referenced to develop specific procedures for each wellhead component in a client's inventory.

Upon identification of components and procedures, Wild Well personnel will accompany the client's operators and advise on wellhead component maintenance and testing.

Deliverables

- Valve maintenance procedure(s)
- Differential pressure checks and procedure.
- Updated (New) Wellhead Schematic
- Certificate of Completion
- Address requirements of API 1171 – to include sections 9.3.1 Well Integrity Evaluation, 9.3.2 Well Integrity Monitoring, 11.3 Operations and Maintenance and 11.12 Training
- Report to recommend full-diameter entry to well bore if necessary (API 1171 6.2.2)

Client Prep

- Pre-select wells to be evaluated ensuring access to well location and well records.
- Provide equipment necessary for maintenance including calibrated gauges, appropriate grease gun, grease & associated fittings

Sample Agenda For Three Day Training

Sample Agenda for 3 Day Wellhead Integrity Survey with Field Operator Training	
DAY1	
0800-1100	Introductions and identify equipment manuals
1100-1400	Identify and visit each well to be targeted
1400-1600	Develop procedures and confirm equipment for field day
DAY 2	
0800-1600	Field Work – wellhead integrity survey and field operator training
DAY 3	
0800-1400	Continue Field Work
1400-1600	Office debrief – update procedures as necessary

First Responder Well Control Incident Management

Municipal agencies responding to an oilfield emergency must deal with a unique set of safety factors, each with the potential to catastrophically escalate if initial response is inaccurate and resources are ineffectively assigned. This course is intended to provide first responder's with a brief orientation of common oilfield and wellsite equipment, tactics for those first on-scene, Wild Well's methodology of a response, and the basic Wild Well equipment.

Deliverables Formatting

- The training will be facilitated via a visual presentation (PowerPoint) and contain visuals that include animations and images. An end of course evaluation will be administered to gauge the student's level of understanding as well as reinforce class concepts. A Certificate of Completion will be received upon request for all participants.

Audience

- Training is intended for fire departments, Hazmat Teams, Public Safety and Emergency Management Personnel.

Sample Agenda For Training

Sample Agenda for First Responder Well Control Incident Management Training	
0800-0830	Sign – In and Introductions
0830-0930	Common Oilfield Equipment including Rigs and their components and wellpad equipment
0930-1030	Tactics for first on scene
1030-1130	Response methodology FAQs
1130-1230	Firefighting and well control equipment
1230-1330	Blowout Intervention & Kahoot Quiz
1330-1400	Feedback and Course Wrap Up

ENGINEERING ANALYSIS

Atmospheric Dispersion Analysis

Atmospheric dispersion analysis uses calculations and/or simulations to predict the propagation of gas clouds from a blowout, leak, or flare. Gaussian plume analysis or computational fluid dynamics are used to determine the concentration of flammable or toxic gases from the source as gas is dispersed by wind and atmospheric turbulence. Wind speed, temperature, humidity, and atmospheric stability are accounted for in the analysis as is the presence of terrain and surrounding structure, if required. Results from the analysis can be used in planning of safe zones and exclusion zones for well control operations, relief well operations, and overall risk of exposing the surrounding areas to the gas cloud.

Radiant Heat Analysis

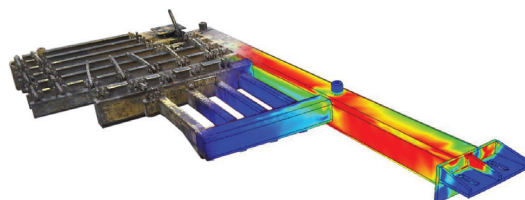
Radiant heat analysis uses calculations and/or simulations to determine the magnitude of radiant heat energy generated by a fire. Results of this analysis can be used to determine the level of risk to personnel and/or equipment that are in proximity to a well fire or flare. This analysis is often followed up by an assessment of the effects of the fire on surrounding equipment and structure to examine the potential for an event to escalate.

Explosion Analysis

Explosion analysis offers studies of explosion severity should a gas cloud ignite. It is aimed at quantifying risk to personnel, equipment, and infrastructure. Explosion analysis can include both high level assessments as well as detailed CFD analysis. This analysis is often followed up by an assessment of the effects of explosion on surrounding structure. This could be to support a voluntary ignition plan or other safety case assessments.

Structural Engineering: Strength, Fatigue & Fracture

Our structural team comprises licensed professionals who perform structural assessments through a combination of calculation and analysis. Wild Well is the expert in using finite element analysis (FEA) to solve the most challenging structural and mechanical engineering problems; applicable for any type of structure, equipment or material, both onshore and offshore.



Finite element analysis identifies strength, fatigue, and fracture issues.

Structural Response to Explosion & Fire

Structural response to explosion and fire offers a structural analysis specific to an explosion or fire event to determine the potential levels of escalation and risk to personnel and equipment following a loss of hydrocarbon containment or loss of well control.

UNCONVENTIONAL INTERVENTION SERVICES

Hot Tapping

Hot tap equipment is used to safely determine if pressure exists in oilfield equipment when conventional methods to check for pressure is not possible. Typical equipment where hot taps are performed include casing, production tubing, drill pipe, coiled tubing, valves, flanges and bull plugs. When access is achieved through a hot tap, the pressure can safely be contained for monitoring, bleed off or kill operations. Our equipment is rated for 0-15,000psi.

Valve Milling

The process of milling a full bore opening in a valve gate that has become inoperable or is in a closed/partially closed position. The unit is capable of milling through gate, ball and plug valves, T/A Caps, BPVs and Dual Check Valves. This process is performed under pressure up to 15,000psi and can be used in H₂S environments.

Freezing

Freeze services are used to place a temporary pressure barrier (ice) in a well casing, annular space, tubing, drill pipe, spool, valve or other wellhead pressure containing component, when the use of conventional barrier options is not possible. In its simplest form, a freeze involves bringing a wellhead component to a very low temperature in order to transform the existing fluid within the wellbore component into ice, and this ice is utilized as a testable pressure barrier.

Abrasive Jet Cutting

Abrasive Jet Cutting is a well intervention tool normally used during a blowout where damaged surface equipment must be removed while the well is flowing uncontrolled. The system uses high pressure water and sand as a cutting medium.

Mechanical Cutting

Wild Well has a range of mechanical cutting equipment suited for various applications. Hydraulically supplied shears are used for cutting debris on land to allow safe access to the well to perform intervention activities. For use in re-heading a well, we have Diamond Wire for initial full casing cut, Clamshell cutters and Rail mills for preparing the casing for wellhead installation. During the fishing of damaged coiled tubing we offer our Coiled Tubing cutter that is designed to deal with the stored energy encountered when cutting coiled tubing.



Unconventional Well Intervention & Abandonment

Wells that have been damaged by an unplanned event or have succumbed to loss of integrity due to lack of maintenance or simply extensive operational life, will require specialized methods to regain safe access. The solution can be a combination of our Unconventional Intervention Services and other typical conventional well servicing methods.

For severely damaged wells with no feasible workover options or for damaged wells near the end of their life, permanent plug and abandonment (P&A) may be the best option to secure the well. Achieving the plug and abandonment may require the combination of Unconventional Well Intervention and conventional well servicing equipment.

Examples include;

- Valve and annuli access to determine pressure for monitoring, and decision making on further well intervention activities
- A previous P&A was not completed successfully, the well is leaking at the surface and will require re-entered and re-abounded
- Re-head operations due to surface equipment failure
- Utilizing rigless P&A methods
- Project Management/Engineering/Planning/Execution for Unconventional Intervention and P&A operations





WELL CONTROL TRAINING SERVICES

WellSHARP® Well Control Training

Wild Well offers the following IADC accredited training courses:

Introductory

The introductory IADC-recommended curriculum covers basic skills for floorhands, roustabouts, unit assistants, and new employees over a two-day class. The course focuses on crew awareness of well control equipment and procedures. This course is available at our training center or your location.

Drilling -Surface Only (Driller & Supervisor)

The Drilling Course provides students with the tools for developing practical problem-solving tactics and strategies when confronted with a well control incident; focus on kick detection, shut-in procedures, calculations, and standard well control methods.

Service Company Rig Operator Workover

The Workover Course reviews types of complications that can occur during workover operations. The course covers workover fundamentals with a focus on understanding well control in relation to Drilling versus Workover. The class covers workover essentials such as barriers, equipment, and relevant well control methods; it also includes an in-depth review of Bullheading and Reverse Circulation techniques.

Oil and Gas Operator Representative

The Oil and Gas Operator Representative Course reviews types of well control complications that can occur during workover, coiled tubing, snubbing, and wireline operations. The course covers well control fundamentals with a focus on understanding well control in relation to well servicing. Well Servicing essentials such as barriers, equipment, and relevant well control methods are taught as well as specific difficulties with working both dead and live wells

Well Control Course Modules

In addition to offering the certified courses listed above, Wild Well also offers the following non-certified Well Control Course Modules focusing on specific disciplines:

Air Drilling

This course covers the basics of air drilling equipment, the types of air drilling, differences between mud and air drilling, how to apply well control principles to air drilling operations, and sets aside time for the discussion of specialized equipment that allows the operator to drill much faster with air than with water or other fluids.

Stuck Pipe

Stuck Pipe provides a review of the fundamentals, including differential sticking, mechanical sticking, and packoff and bridging. Students gain an understanding of wellbore geometry and the significance of geologic formations when handling stuck pipe operations.

WELL CONTROL ENGINEERING SERVICES

Blowout Rate Modeling (Worst Case Discharge Analysis)

Blowout rate modeling uses multiphase simulations to calculate the maximum expected flow rate from producible reservoirs or target formations for a given well and reservoir configuration. The software used for these simulations is a well performance, design and optimization program suited for modeling most types of well configurations found worldwide in the oil and gas industry today. By modelling each component from the reservoir fluid, the reservoir flow potential and the pressure losses in the well, the software is capable of calculating the maximum flow rate that a reservoir or a series of reservoirs could produce in case of a blowout.

Dynamic Kill Analysis

Dynamic kill analysis offers a dynamic simulation of blowouts as well as operating parameters for the necessary kill process. It involves the latest technology in transient multiphase simulation, and provides the following unique features: blowout rate, kill rate, wellbore pressure profiles, volumes, fluid density, hydraulic horsepower, and other dynamic kill parameters needed to restore control. Operational parameters, such as pump rate and fluid density, can be changed in response to developing well conditions, just as in an actual kill operation. Wellbore response to such changes are visualized immediately in the live graphics.

Broaching Simulation & Analysis

Broaching simulation and analysis consists of the evaluation of a shut-in well's behavior once pressure at the casing shoe exceeds the fracture gradient of the surrounding formation. The transient simulation technology analyzes fracturing of the formation, upward propagation of the fractures, charging up of any exposed formation above the casing shoe, and eventual broaching to the surface.

Bullheading Analysis

Bullheading analysis consists of multiphase simulation and analysis of the well control parameters (e.g., pressure, density, pump rate, etc.) required to successfully bullhead a well. Modeling addresses risks during bullheading (e.g., injectivity of the exposed zones, charging zones, effects on downhole activity such as well flow and formation pressure and "ballooning" or underbalance, potential broaching of shallow casing shoe, etc.). The incorrect application of bullheading methods can lead to a range of undesirable outcomes including influx remaining in the wellbore, inadvertent breakdown of the casing shoe, underground blowout, etc.

Dynamic Temperature Modeling

Dynamic temperature modeling provides a simulation of the dynamic temperatures that a rig's well control systems could potentially encounter during kick circulation to determine whether or not the temperature rating for each component is sufficient to safely handle kicks encountered while drilling. The modeling also addresses the considerable temperature variations in the well during normal HPHT and deepwater drilling operations and impact of thermal expansion on well control operations.

Shut-in Analysis

When considering shutting in the well with a capping stack, this analysis determines the maximum expected pressure at the relevant casing shoe(s) by simulating the dynamic pressures and temperatures that a rig's well control systems could potentially encounter during capping operations. The analysis helps address and mitigate the risks of hard vs. soft shut-in methods.

Real-Time Support for Critical Well Operations

Working from the office or on-site as part of the drilling team, Well Control Engineers are available to provide real-time well control expertise and engineering support during critical well operations. Support activities include reviewing daily drilling reports (DDR) to evaluate well control parameters (e.g., kick tolerance, Emergency Shutdown (ESD), Equivalent Circulating Density, gas readings, hole behavior, connection and trip behavior, etc.) and keeping watch for developing trends to ensure relevant pressure management and/or well control issues are proactively addressed.

Surge / Swab Modeling

In HPHT wells where there are small margins, it is critical it is to maintain circulation during swabbing operations to avoid underbalanced conditions. Wild Well provides hydraulic simulations to analyze wellbore pressures, ECD, return rate & max string movement throughout the wellbore. Simulations are also done to evaluate at the pressure changes effects during drilling, tripping, or cementing operations. Wild Well uses the Drillbench dynamic drilling simulation software as a tool for performing steady state computations of hydraulic parameters in an oil or gas well during drilling operations.

Thermal Expansion Modeling

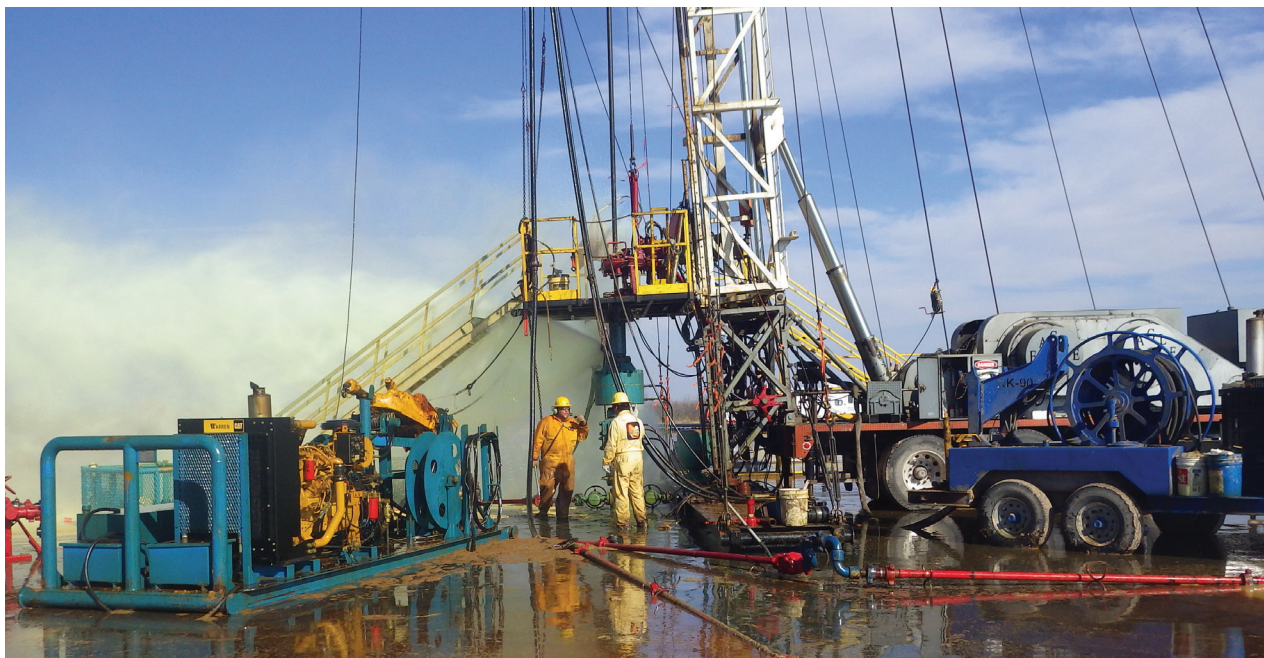
During well kill operations, thermal expansion of the drilling fluid is suspected in masking the correct shut-in pressure values. To address this, Wild Well performs multiphase simulation-based analyses to determine the potential for thermal expansion issues for a given well.

Well Control (Kick) Modeling

Wild Well uses Drillbench Rigsite Kick software to generate integrated, time-transient, multiphase flow simulations to examine the full, dynamic behavior of the wellbore and its contents from time of influx, through flow check, shut-in and subsequent kill operations. In addition to deriving standard kill methods, the full effects of special kill procedures (e.g., extended shut-in, mud weight or pump rate changes, etc.) are further analyzed for their impact on well bore integrity. Data from these simulations can also be used to evaluate casing design and surface well control equipment.

Well Control Risk Assessment

The well control risk assessment process involves the identification, evaluation, and ranking of well control risks associated with drilling and intervention operations. Risks identified during the assessment are ranked according to their probability and impact, and for all risk events ranked as high or medium, common mitigation practices and contingency plans are provided. Results are summarized in a series of figures and tables, based on different phases of well operations, for final presentation. The collective risk assessment process is conducted by Wild Well's experienced engineering and operations teams.



Advanced Crew Awareness Training

Advanced Crew Awareness Training is based on well-specific computer kick simulations that show how a kick will act in the hole for a given well. These simulation-based training sessions help crews understand the impact and dynamics of well control considerations such as detection limitation, gas migration, BOP closure time, and response time delay. The training aims to improve crew awareness and prepare them to make proper decisions during operations if and when kicks are encountered.

SPECIALIZED TRAINING SERVICES

Training to Reduce Unscheduled Events (TRUE)

TRUE was developed to educate the rig team in a collaborative environment on the early identification of events, their causes and the potential actions to mitigate their impact. TRUE requires the personnel to pull together and use teamwork to confront the problem. The training is typically conducted in 3-day concentrated sessions where the team is immersed. Many operators conduct the training during mobilization, commissioning, or offsite so that they have the undivided attention of the crew

Crew Awareness Orientation

Lasting approximately 45-60 minutes per session and delivered to each tour crew, these orientations are conducted on-site and are directed at all rig personnel – from the Roustabout to Tool Pusher. Crew Awareness Orientations focus on enhancing a rig crew's understanding of blowouts and how they occur/evolve, and also emphasizes the importance of early kick detection and proper shut-in procedures and response.

Ideally, this service would be delivered in association with a survey of the rig's well control equipment once the BOP has been nipped up and tested on the surface casing.

Well Control Incident Management Training

Our courses prepare companies, regulators, and first responders with the skills necessary to respond to and manage a well control emergency. Case studies and best practices are reviewed to ensure participants have the necessary skills to coordinate a prolonged response and work collaboratively with well control specialists in order to achieve successful outcomes to oil and gas emergencies.

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PROJECT TECHNICAL SUPPORT SERVICES

Dedicated Technical Support

Dedicated Technical Support from Wild Well includes dedicated engineer(s) to provide technical expertise and support for drilling, completion, workover, and intervention operations with a primary focus on well control. Working as a member of the client's project team, the technical support personnel will embed within the project's day-to-day operations. This provides the client continuous well control support by an engineer who is well versed in their activity and has an established trusted relationship with their personnel. Depending on need, several types of support assignments are available, such as:

Rig-based: Personnel located at the rig site to assist with pressure control and well control-related activity. This can be dedicated to a single rig or a shared resource between a few rigs that are located on the rig drilling critical sections.

Client Office-based: These "Well Control Desk Engineers" are embedded in the client's engineering and operational teams to provide well control technical support which may include, but are not limited to:

- Evaluate well control risks for all operations
- Support client well control drills
- Analyze ongoing operations to identify possible operational improvements to reduce the frequency, severity, and duration of well control incidents.
- Review well control equipment specifications
- Critical hole section monitoring
- Gap analysis of client well control documents
- Lead relevant discussions on various well control topics with client engineering staff
- Conduct well control studies
- Conduct data gathering for WCERP, WCERP updates, and modeling work
- Provide office support for well control events

Client Office-based & First Responders: These personnel are also embedded in the client's engineering and operational teams to provide well control office and field technical support, which may include, but are not limited to:

- Act as technical liaison between field operations, Wild Well main office and client office personnel
- Support field operations with forward planning and project memos
- Review well control equipment specifications
- Conduct well control studies
- Conduct data gathering for WCERP, WCERP updates, and modelling work
- Conduct well control equipment audits as needed
- Well control support for client organizations as needed
- Participate in risk assessments

Wild Well Office-based: These personnel are located in Wild Well's office and can provide support for in the client's engineering and operational teams, which may include, but are not limited to:

- Critical hole section monitoring
- Well Control Modeling
- Engineering studies on possible barrier failure mode and mitigations
- Gap analysis of client well control documents
- Provide technical well control advice and review to client engineering projects

Field Abandonment: Advisory

Engineers will provide technical support for abandonment operations ranging from team member to project manager. Activities shall include, but are not limited to, well control risk assessment, review of client provided procedures, and operational well control support.

Drill the Well On Paper (DWOP)

Wild Well provides full-service DWOP workshop Subject Matter Experts (SME) to participate in pre-spud workshops to address the particular requirements of a drilling project from a well control aspect. Workshop participants perform an in-depth review and analysis of the well control aspects of drilling a well including kick tolerance, casing shoe depths, shut-in analysis, dynamic kill analysis, relief well plans and blowout preventer equipment (BOPE) configuration.



RELIEF WELL SERVICES

Relief Well Plans

Wild Well offers full-service relief well design and delivery process planning and development, including site selection, rig selection, well construction, wellhead design, casing design, hydraulics design, intercept coordination and tool design, well kill design, blowout well pressure recording, and integrity status.

Integration in Emergency Response Plans

A Relief Well Plan is specific to an operating area. It is a subset of all incident emergency response plans (ERP) and the Source Control Emergency Response Plan (SCERP) and has the following hierarchy:

- Relief Well Plan
- General Relief Well Response Plan
- Specific Relief Well Complexity Assessments
- General Blowout Rate and HSE consequence assessment
- Operational Complexity
- Well Intersection and Hydraulic Kill Complexity
- Blowout Plug and Abandonment Complexity

Well/Platform-Specific Relief Well Plans

Well/Platform-Specific Relief Well Plans address specific operational concerns for each of the following topics/areas:

- Operational, Logistics & Equipment Requirements
- Intersection & Ranging
- Hydraulic Communication & Kill
- Plug & Abandonment via Relief Well

Complexity Assessment

Wild Well analyzes the subject well, set of wells and/or platform structure, identifies the complexity of a relief well operation (i.e., degree of difficulty based on key variables), and estimates the time to construct a relief well and regain control following a blowout. The results of this assessment are categorized for the operator's consideration.

Complexity Mitigation

Once the operator has finished considering the results of the complexity assessment and finalized their drilling plans, Wild Well's Relief Well Experts complete the Relief Well Plan with a focus on mitigating the remaining complexities of the anticipated relief well operation, should such need arise

Relief Well Operations for Blowout Control

With the world's foremost team of Relief Well Experts, Wild Well offers unparalleled relief well engineering, management, and design services to ensure proper planning and oversight for the safe and successful execution of the Relief Well Operation. These services include:

Relief Well Intersection Management

Provide in-office and on-site management of:

- Relief Well trajectory planning and well construction
- Relief well surface location selection
- Intersection strategy
- Target well and adjacent well position uncertainty derivation
- Hydraulic communication and kill strategy
- Ranging strategy (active, passive and other methods)

Dynamic Kill Management

Provide in-office and on-site management of:

- Blowout and kill simulation specialists and software equipment
- High-pressure pumping personnel and equipment
- Kill fluid storage and transfer personnel and
- Mud plant and kill fluid personnel and equipment
- Specialty reactive kill fluids and polymers

Wellsite Supervision

Provide on-site management for special services:

- Non-routine service company technical support personnel
- Directional Drilling and Measuring While Drilling (MWD) personnel and equipment
- Borehole surveying and advanced survey management
- personnel and equipment
- Ranging and wireline personnel and equipment
- Milling and perforating (to gain hydraulic communication) personnel and equipment
- Daily and final reports for specialty intersection services

Plug and Abandonment using a Relief Well

A relief well intervention project is often thought to occur primarily for blowout events that take place during drilling operations; however, relief wells are more often used to perform complex P&A's where conventional access through the wellhead / tubulars has been lost and conventional P&A methods cannot be used. Wild Well's experienced team of personnel provide top-quality engineering and project management services to assist in the successful execution of any relief well P&A project.

Relief Well Planning

Wild Well's relief well planning provides a complexity assessment and list of mitigation techniques to help simplify relief well operations should they arise. Deliverables include evaluation of the intersection objective, surface location selection, detailed trajectory design following industry best practices for relief well intersections, ranging feasibility and technology selection, as well as recommendations for minimizing the positional uncertainty. When coupled with dynamic kill modeling, the proposed relief well trajectories are used in the transient multiphase simulations to calculate the required kill rate, mud weight, volumes, and surface pressures to regain control of the well for the given scenario.

Relief Well Surface Location Modeling

Identifying potential relief well spud locations before an event occurs can help reduce the planning cycle during relief well operations and potentially shorten the overall time to regain control of the blowout well. Improper surface placement may have devastating effects that could increase the complexity of the relief well or yield a trajectory that fails to intersect the target well. Wild Well utilizes custom software to simulate thousands of relief well trajectory profiles abiding by a set of design constraints to analyze the feasibility for relief well placement. These models can be used for single or multiple intersection scenarios or congested well scenarios in a field or platform where a single relief well location may be suitable for multiple wells. The results of the analysis provide a map of regions that are acceptable for relief well placement based

on the design criteria and applicable exclusion requirements.

Casing Magnetization

Casing Magnetization is recommended as a relief well contingency for blowout scenarios where active ranging systems have limited capability, and passive ranging becomes the primary ranging technology. Depending on the installation configuration and size of pipe, the increase in pole strength from magnetization will increase the detection range significantly. If a blowout occurs, the increased detection range is highly desirable as it will reduce the time frame for the relief well to locate and kill the well by potentially days or weeks. Wild Well's magnetization systems can be deployed globally, accommodating casing sizes up to 22". Along with the magnetization service, Wild Well has developed finite element modeling software that can simulate the expected detection range capability and optimize the installation arrangement to best suit the proposed relief well trajectory profile.

Magnetic Ranging Modeling

For Active Magnetic Ranging, Wild Well uses advanced 3D electrostatic finite element software to simulate and predict the behavior of both downhole and surface injected electrical current. These models can be configured to any well geometry allowing for a detailed evaluation of ranging complexity and feasibility of complicated ranging situations such as breaks in casing, nearby wells, end-of-pipe effects, as well as multi-layered formation resistivity.

For Passive Magnetic Ranging, Wild Well uses custom finite element software capable of deriving a distance and direction to a target wellbore using raw accelerometer and magnetometer data such as that obtained using MWD or similar surveying instruments. These models can also be used for well intersection applications or to provide an estimate of another well's proximity for anti-collision purposes. These models also allow for the identification of the magnetic pole positions (casing collars, etc.) along the target well. This identification is of particular use during high precision intersections, since it allows the relief well to identify the relative position along the target well casing/tubing tally and ensure the appropriate intersection point is achieved.

Relief Well Workshops

Wild Well's Relief Well Workshops provide an introduction to the fundamentals of relief wells operations. In addition to covering the fundamentals, the workshops can also be customized for a specific well to enhance context. Attendees will also participate in hands-on exercises where they work in teams to frame a relief well solution, and will apply lessons learned from the workshop.

