WILD WELL CONTROL



# GLOBAL SERVICES BRIEF

2022

V. 07

wildwell.com

# LOCATIONS

## Corporate Office

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

## Regional Response Locations

**UNITED STATES**

Houston, Texas
Odessa, Texas
Greeley, Colorado
Roaring Branch, Pennsylvania

**INTERNATIONAL**

Aberdeen, Scotland
Dammam, Kingdom of Saudi Arabia
Dubai, UAE
Kuala Lumpur, Malaysia
Port Harcourt, Nigeria
Stavanger, Norway
Singapore

## Well Control Training Centers

**UNITED STATES**

Houston, 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, 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 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Blowout with Fire | 2 | 2 | 4 | 0 | 2 |
| Blowout | 36 | 36 | 31 | 23 | 24 |
| Pressure Control | 32 | 36 | 25 | 19 | 24 |
| Unconventional Intervention | 59 | 74 | 106 | 71 | 79 |
| Engineering Services | 234 | 221 | 275 | 231 | 222 |
| **Total** | **363** | **369** | **441** | **344** | **351** |

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 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 16 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
- Odessa, Texas
- Roaring Branch, Pennsylvania
- Dubai, UAE
- Port Harcourt, Nigeria

**Special Service Equipment Packages are maintained in:**

- Houston, Texas
- Bakersfield, California
- Greeley, Colorado
- Odessa, Texas
- Al Khobar, KSA
- Dubai, UAE
- Neuquén, Argentina
- Port Harcourt, Nigeria
- Singapore

Also included in the specialized well control equipment are two complete subsea capping/containment systems. Each WellCONTAINED subsea capping stack system includes a modular 18 3/4-in., 15K subsea capping stack. Both systems have a choke and valve manifold that will facilitate flow back to the surface, if required. In addition, each system has a set of large-scale hydraulic shears for debris removal along with the necessary equipment required to inject dispersant into the uncontrolled flow.

**WellCONTAINED Subsea Capping Equipment Packages are maintained in:**

- Aberdeen, Scotland
- Singapore

## 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 to 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.

In 2015, Wild Well completed a nine-well campaign off the west coast of Africa using a newly designed, Riserless subsea plug and abandonment tool. Since that time, Wild Well completed other multi-well projects, and received the 2017 Offshore Technology Conference Spotlight on New Technology Award for its Riserless P&A technology. In 2019 after selling the Subsea Riserless intervention business group to Baker Hughes, Wild Well continues to provide alternative P&A technology with the DeepRange system to Subsea Intervention providers and technical planning support to the SRI industry globally.

## 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.

WILD WELL CONTROL

# 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

## 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 $H_2S$ environments
- Pressure control in HPHT wells



# 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 can calculate 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 consist 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 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

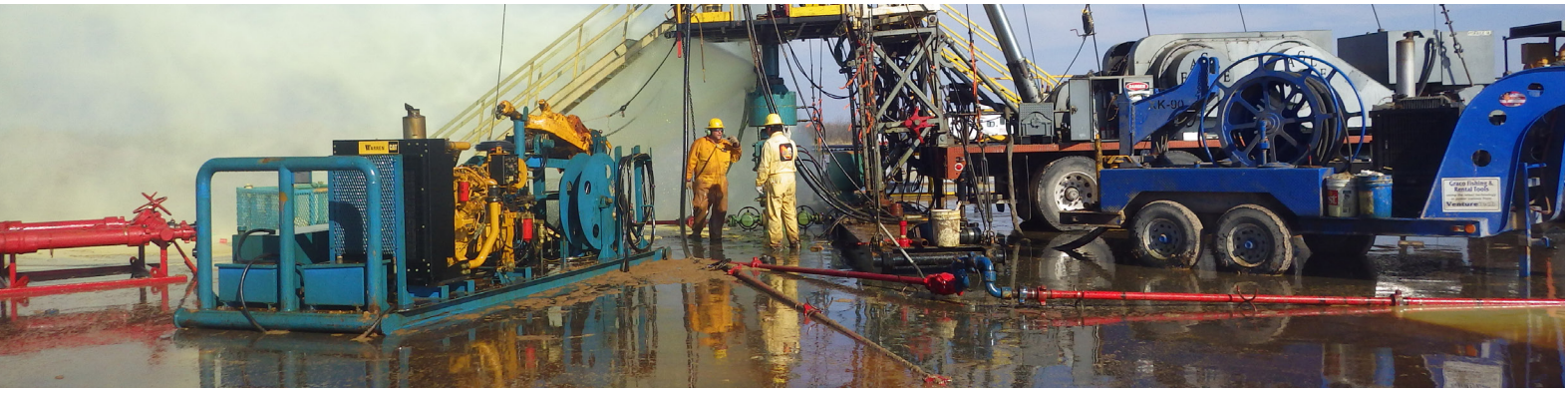
During well kill operations, thermal expansion of the drilling fluid is suspected in masking the correct shut-in pressure values. To address this, Wild Well performs multiphase simulation-based analyses to determine the potential for thermal expansion issues for a given well.

## 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.



# 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

Wild Well provides Relief Well Operations services to intercept and kill a blowout well when surface intervention or capping requires an extended period of time, and/or when such efforts may not succeed. These services include:

**Project Engineering & Design**

With the world's foremost team of Relief Well Experts, Wild Well offers unparalleled Project Engineering and Design services to ensure proper planning and oversight for the safe and successful execution of the Relief Well Operation.

**Relief Well Intersection Management**

Provide on-site management of:

- Relief Well Intersection Process
- Intercept depth(s)
- Constraints on relief well surface location(s)
- Target and adjacent well position uncertainties
- Hydraulic communication method(s)
- Target ranging strategy
- Subsurface drilling and well control hazards
- Relief well(s) trajectories
- Casing design
- Drilling program
- Kill program integration

**Hydraulic Kill Management**

Provides on-site management of:

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

**Wellsite Supervision**

Supervision of Drilling, Testing and Completion Operations for relief well intersections including the on-site management of:

- Operator and service company technical support personnel
- Directional drilling and Measuring while drilling (MWD) personnel and equipment
- Borehole surveying personnel and equipment
- Homing-in (electromagnetic 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 & Abandonment Using a Relief Well

When there is no surface access, plug and abandonment of blowout wells has become a more prominent use of relief wells.

## Ranging Services

Ranging services use passive-magnetics or active-electromagnetic ranging, which both depend on steel, such as casing or drillstring, in the target well. Wellbore positioning is critical in reducing risk and increasing value in well construction. It impacts the entire life cycle of the well, including the ability to efficiently plan and execute a relief well. An understanding of the full cycle of wellbore positioning activities is critical for intercepting geological targets, avoiding adjacent wells and geological hazards, planning relief well trajectories, and managing trajectory positional uncertainty to improve subsurface modelling correlations. It's important to verify that grid, magnetic declination, and convergence are correct by surveying surface locations directly.

## Relief Well Workshops

Wild Well's Relief Well Workshops introduce the fundamentals of relief wells. In addition to covering the fundamentals, these workshops can also be customized for a specific well to enhance context.

Examples include:

- Relief Well Plans
  - As a subset of Incident Emergency Response Plans
  - Well/Platform-specific planning
- Complexity Assessments
- Complexity Mitigation
- Secondary Relief Well Mitigation Plans
- Relief Well Execution
  - Relief Well Intersection – Management
  - Kill Operations – Management
- The various phases of a successful relief well:
  - Planning
  - Drilling
  - Intercept
  - Kill
  - Plug and Abandonment

Attendees will also participate in hands on exercises where they'll work in teams to frame a Relief Well solution and will apply lessons learned from the workshop.

# ENGINEERING ANALYSIS

## Subsea Dispersion (Plume) Analysis

Subsea dispersion (plume) analysis simulations model the behavior of oil and gas as they rise from the wellhead to the sea surface during a subsea blowout. The hydrocarbon plume is modeled along with current and local metocean conditions using computational fluid dynamics (CFD) techniques. Results from this analysis can be used to determine the surface arrival point and concentration of hydrocarbons at the surface. An atmospheric gas dispersion study may follow a subsea dispersion analysis to track the gas once it reaches the surface. Wild Well is a member of the SURE joint industry project which has conducted large scale offshore experiments to validate the industry leading CFD simulations.

## 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.

## Multiphase Flow Analysis

Multiphase flow analysis includes a simulation of any complex 3D fluid flow involving liquids, gases, and solids as well as any combination of these using CFD. Examples include predicting erosion, separation behavior, e.g., mud-gas separator performance or subsea plume analysis. Virtually any fluid dynamics problem can be solved in this way.

## Erosion Analysis

Erosion analysis uses CFD to predict the erosion rates in pipework and equipment carrying particle laden fluids to assess the integrity of the system. This can be applied to production pipework and equipment, but also to well control equipment for incident response planning (e.g., erosion during well kill & diverter system integrity checks).

## Cryo-Freeze & Heat Transfer Analysis

Cryo-freeze and heat transfer analysis are a detailed thermal analysis using CFD to solve complex heat transfer problems not readily solvable with other means. It can be applied across a wide spectrum of problem types, e.g., calculation of freeze time and ice plug size and shape during well freeze operations or heat up or cooldown of subsea hardware during startup and shut in.

## Structural Engineering: Strength, Fatigue & Fracture

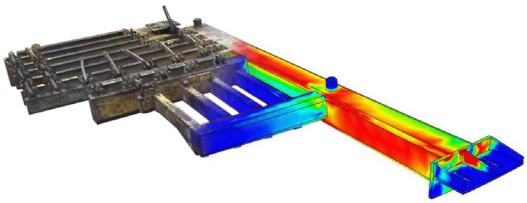
Our structural team comprises licensed professionals who perform structural assessments through a combination of calculation and analysis. Wild Well is the expert in using finite element analysis (FEA) to solve the most challenging structural and mechanical engineering problems; applicable for any type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

## 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.

## Dropped Objects Risk Assessments

Wild Well can provide a dropped object risk assessment to satisfy the latest BSEE requirements. Wild Well offers a 4-tier approach to the risk assessment where the engineering complexity is progressively enhanced based on initial findings. Tier 1 is a probability-based approach as per DNV recommended practice. This can then be supplemented by three additional tiers using FEA and CFD to more precisely quantify the risk if the first-tier findings show the risk is unacceptable.



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

## Forensic Studies

All of the above capabilities can be applied during the planning and design phases of a project but can also be utilized to investigate post-event if something has not worked as planned. By performing a variety of engineering studies, lessons may be learned, and operating practices or designs improved.

## Design to Industry Standards

Wild Well experts use both classical methods and FEA to deliver the design of structures and equipment to API, AISC, ASME, DNV, NORSOK and other Industry Standards.

## Fitness for Purpose Assessment

If there is a structural problem, Wild Well's Advanced Engineering team has the capability to solve it – whether it is designing equipment and skids to meet DNV rules or determining whether a design is fit for purpose.

# 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 give 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.

## Source Control Response Plans

Source control response plans provide access to Wild Well expertise in regard to client-specific Source Control needs. They are based upon the general guidelines for Source Control response (operational overviews to include SIMOPS, Site Survey, BOP Intervention, Subsea Dispersants, Debris Removal, Capping, Flowback/Surface Containment, Relief Well, Well Kill, Engineering Services, and Decontamination/Demobilization). The plans provide an overview of Well Containment equipment used for source control operations, and includes emergency response guidance checklists/task lists, and procedures for use in an actual response. The plans also cover components of well control emergency response when developed for floating operations.

## Source Control Response Exercises & Drills

Source control response exercises and drills focus on the individual or entire Source Control Emergency Response Organization to allow each group, unit, and/or branch (within Source Control Org) to use tools within the Source Control Emergency Response Plan (SCERP). Exercises are focused on testing and improving an organization's subsea well containment response (source control) capabilities in addition to using procedures and bridging existing plans (Crisis Management, Oil Spill Response Plans, etc.).

## Source Control Response Training

This training provides a strategic response management overview for an incident involving an uncontrolled subsea well control event. The training will also review the Source Control Emergency Response Plan and Logistics Plan to guide attendees in using these plans as management tools. Reference is also given to the WellCONTAINED System operational guidance procedures, which can be customized to a specific well control event using the data embedded in the documents. The training will also provide timeline guidelines and logistics considerations to guide attendees during a well control event as well.

## Logistics Plans for Well Control / Containment Equipment

The purpose of this plan is to provide a detailed document for mobilizing a Capping & Containment System in an emergency dealing with a subsea well control event from the system's point of rest to drilling locations globally. The plan will include current status of the equipment, ongoing maintenance, mobilization preparations, origin operations, mode of transportation and destination operations (to include handover of responsibilities).

# 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.

## Freeze

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 and offshore (above or below the water line) 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 offshore/subsea/land well due to surface equipment failure
- Damaged offshore well platform inspections and securing of wells
- Damaged and/or inoperable well intervention
  - Surface (offshore or land)
  - Subsea
  - Surface wellhead that is now subsea (vessel damage, hurricane damage, or another catastrophic event)
- Utilizing rigless P&A methods
- Project Management/Engineering/Planning/Execution for Unconventional Intervention and P&A operations

## Damaged Platform Structural Survey

The Damaged Platform Structural Survey includes a thorough review of the as-built platform, accommodations, equipment, and wellhead/wellbores both above sea level and below. This is compared to the actual condition of the platform after damage (through pictures and measurements) to model the damaged platform for developing platform removal modelling, planning safe access, and all future intervention planning.



*Example of debris removal to lighten the topside loading on a damaged wellhead platform*

## Collapsed Platform Removal Modeling

Collapsed Platform Removal Modeling is used to develop a full 3D model of the damaged platform both above sea level and below, which is updated as debris is removed, and wellbores are accessed. This becomes a valuable planning tool for all debris removal, wellbore access, and intervention planning and allows the full project team to understand the condition of the damage work area as work progresses.

## Unconventional Well Intervention

Unconventional Well Intervention is based on the type of damage and the final disposition of the facility, and then the most effective intervention method is selected. This can include subsea hot tap, direct wellhead intervention, subsea re-installation of a new wellhead, and can also involve conventional equipment such as pumping, wireline, coiled tubing and snubbing.

## Unconventional Plug & Abandonment

For severely damaged wells with no feasible workover options or for damaged wells near the end of their life, permanent plug and abandonment may be the best option. Achieving the plug and abandonment will include Unconventional Well Intervention and conventional well servicing equipment.

**Subsea Intervention Technology – DeepRange P&A Tool**

DeepRange is a highly effective riserless P&A tooling and methodology that is used to bring subsea wellbores from TA through P&A by isolating outer annuli. The patented technology perforates and circulates plugging material into outer annuli.

# Well**CONTAINED**™ SERVICES

## Capping Stack Interface Check

The Capping Stack Interface Check analyzes customer-supplied drawings to verify connector type and check for interference with guide funnels, guidepost, and frames, If any issues are identified, the plan will include mitigation recommendations.

## Capping Stack Deployment Plans

Wild Well offers the following types of Capping Stack Installation Plans:

**Well-Specific**

This provides a detailed plan once the Capping Stack enters the water until the landing out of the Capping Stack on a well, the connector has been locked on the mandrel, and the stack has been disconnected from the deployment vessel while in the 'Flow to Sea' configuration.

**MODU-Specific**

Following Wild Well personnel's completion of a Rig Site Survey and related data gathering activities, a Capping Stack Deployment Assessment for the Drillship or MODU surveyed is developed to cover:

- Logistics of getting the capping stack equipment on board the drilling rig
- Feasibility assessment of assembly of the capping stack on board the drilling rig
- Detailed list of equipment needed for stack-up and testing in BOP cart on drillship
- Detailed stack-up plan and testing procedure in drillship BOP carts
- Review of customer provided bathymetry and subsea soil data (if desired) to determine possible locations for setting subsea mud mats or suction piles for wet parking of capping stack
- Evaluation of methods to keel haul the capping stack to get it under the rig

The final report will include recommendations for the best method for running the capping stack from the drilling rig, loading diagrams, layout drawings, and logistics from dock to rig.

## Capping Stack Shut-in Plans

Capping Stack Shut-in Plans cover the period after the Capping Stack downward looking connector has been locked. The plan will also include the closing of the BOPs, chokes, and outlet valves, as well as installation of the tertiary cap, if needed.

*NOTE: The provided shut-in plans cover only operation of the equipment in order to shut in on the well and does not consider well conditions or well monitoring. Those additional details would be provided by the Well Control Group during an incident based upon the actual well data.*

## Sea Fastening Plans

Sea Fastening Plans include detailed engineering drawings and calculations for sea fastening the capping stack, shears, or dispersant equipment onto a specific deployment vessel. Deliverables will be detailed enough to provide to a shipyard or welding crew to perform the required work.

## Capping Stack Deployment Plans Shallow Water

These plans cover the necessary preparations and methodologies for deploying a capping stack in 1,500 ft of water or less and includes plume analysis to determine the probable location and concentration of surface gas clouds. It also covers deployment vessel selection and deployment methodologies based upon the site-specific surface conditions.

## Subsea Well Control Equipment

Wild Well provides Subsea Capping and Containment Equipment access to clients through several membership options. Membership is subject to the terms and conditions of a separate Equipment Access Agreement.

Members receive access to the following equipment:

- Subsea Capping Stacks
- Subsea Dispersant Equipment Packages
- Subsea Debris Removal Equipment Packages





*WellCONTAINED is a comprehensive solution to global deepwater well control incident prevention and response.*

# WELL CONTROL TRAINING SERVICES

## WellSHARP LIVE Instructor-Led Well Control Training

Wild Well offers IADC WellSharp Live as a distance learning solution for well control training. WellSharp Live allows the industry to continue training personnel in a safe manner that does not sacrifice quality. The distance learning solution, incorporates live instruction over a digital platform as well as cloud-based simulations.

**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 (Driller)**

The IADC WellSharp Driller level course offers basic, fundamental well control knowledge for crew members involved in day-to-day drilling operations including kick detection, well shut-in procedures, calculations, standard well control methods, and barrier equipment

**Drilling Surface (Supervisor)**

The IADC WellSharp Supervisor level course provides students with the tools for developing practical problem-solving tactics and strategies when confronted with a well control incident; focuses on kick detection, shut-in procedures, calculations, standard well control methods, and completing killsheets

**Drilling-Surface with Subsea Supplement**

Subsea Supplement covers well control methods and techniques for surface and deepwater subsea environment. It is designed to familiarize the student with surface well control as well as subsea choke line friction pressure (CLFP) using various sized choke lines, kick detection, circulating gas through long choke/kill lines, and special subsea applications of 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 Workover versus Drilling. 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

**Advanced Subsea**

The Advanced Subsea Well Control curriculum is taught as part of the IADC program. It uses a methodological discovery process to improve critical thinking and problem-solving skills in subsea well control. Real-world subsea well control scenarios are used in a realistic team-based approach to help students develop the technical and nontechnical skills essential for improving drilling and safety performance. The team-based training enhances situational awareness, communication, leadership and decision making skills. The course encourages participation among the different levels of decision makers from multiple companies – from rig personnel to engineering staff to management – which promotes the sharing of comparable ideas, perspectives and experiences.

## 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.

**1 day Ballooning seminar**

This 1 day course covers the geology of formations most likely to balloon, why ballooning occurs and how it affects the well and drilling operations, the methods used to monitor for ballooning and proper response when ballooning is suspected during various rig operations.