

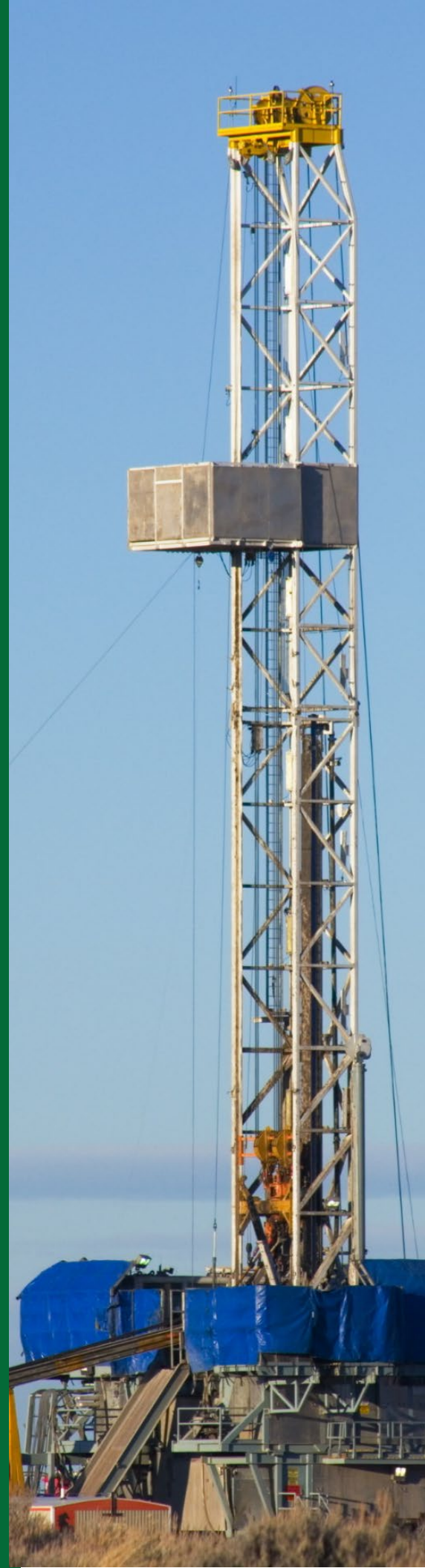


# REAL TIME FLUID MANAGEMENT

Enhancing fluid containment in drilling operations to improve rig safety,  
increase operational efficiency, and reduce remediation costs.

WHITE PAPER

[www.katchkan.com](http://www.katchkan.com)



## Centralized Containment System

Few industries have influenced our perspective as profoundly as the energy industry. This industry has undergone a significant transformation, partly due to misconceptions and negative connotations associated with it. One of the most pressing issues is oil pollution, which, while devastating, is also preventable. Most oil spills occur due to the presence of improper or lack of proven containment equipment.

As the energy industry evolves and faces new workforce challenges, the petroleum sector is making strides in improving environmental impact and workplace safety through containment regulations. This transition presents complex challenges for both contractors and operators, who must adapt to new, cost-effective containment sources. Historically, solutions often emerged from makeshift approaches, such as in-house manufactured containment systems. Despite efforts to create these systems, issues such as fluid spills in back wells and inadequate containment from the drill floor persist. Implementing effective closed-loop systems can address these persisting issues of not only proper fluid containment, but rig floor safety.

Standards play a crucial role in helping industry professionals enhance operational efficiency, cost-effectiveness, product consistency, and compliance with legislative remediation and reclamation requirements. In the U.S. it is required by legislation, in accordance with the Environmental Protection Agency (EPA), to maintain a Spill Prevention Control and Counter Measure (SPCC) on all types of drilling rigs.<sup>1</sup> The Katch Kan™ Central Containment System is an environmentally proven technology that allows for accurate control and counter measure. It is a best fit global practice to enact legislation that requires responsible environmental management.

For many years, Katch Kan™ has been dedicated to developing comprehensive systems that effectively address and mitigate risks in fluid containment and recovery. Their innovations in rig floor and central containment systems not only prevent environmental releases but also enhance worker safety and generate substantial financial savings. Proper controls are essential to maintain these risks at acceptable levels.

## Real-time Equipment Operation

The Central Containment System is a two-part system that works in tandem to mitigate safety and environmental risks. These two components consist of the Rig Safety System™ and the Zero Spill System™.

I. **Rig Safety System™ (RSS):** The RSS™ is designed for use on the rig floor of the drilling rig to re-direct fluid to the ZSS™, prevent employee contact with fluids, and improve operating environments through mitigated safety hazards. The components specific to the RSS™ make up the following:

- The Kelly Kan™ allows for control and fluid redirection back into the annulus.
- The Splash Guard™ is a fully encompassing flexible guard that contains drilling fluid. It supports the fluid re-direction of the Kelly Kan™ and protects workers from getting caught in slip handles.
- The Katch Mat collects and retains drilling fluid released to the floor of the rig while optimizing the floor traction.

II. **Zero Spill System™ (ZSS):** The ZSS™ is mounted on the blowout preventer (BOP) in the substructure and consists of containment structures that are placed under the floor of the drilling rig. The ZSS™ is installed and sealed with clamps and latches to the upper section of the BOP and includes the following components:

- The 2<sup>nd</sup> Stage Low Profile Katch Kan collecting fluids from the rig floor and discharging them to a containment system.
- The Adjustable Containment Enclosure™ (ACE™) prevents all fluid redirected from the rig floor from being released into the environment when being collected in the 2<sup>nd</sup> Stage Low Pro Katch Kan.

A system designed as a response to industry feedback, regulatory concerns, and environmental stewardship. Industry demanded a more efficient and safe way to contain production and drilling fluids from releasing on-site, the Zero Spill System™ delivers cost savings to any rig.



## Fluid Hazards

The hazards of fluid contact fall into two primary areas. The first is chemical contact, which is a known hazard to personnel. The containment equipment used within the Rig Safety System™ and Zero Spill System™ protect the worker from any exposure to chemicals found in the fluids, either hydrocarbon or water-based, from not getting on the employee to be further ingested, absorbed, or injected (if the hydraulic pressure is strong enough). Occupational Disease has increased in notoriety within industries on a global level. The U.S. Bureau of Labor Statistics reported on November 8, 2023, that illness reporting by private industry employers in the United States had increased by twenty-six percent (26%) compared to the last report from 2022.<sup>5</sup> This increase is not related to fluid release in the oil and gas industry, but indicates that society recognizes the relationship between chemical exposure and occupational illness.

The second area of fluid hazards is among slips and trips. Based on the IADC ISP 2023 report, slip and fall events account for ten percent (10%) of all reported incidents on drilling and service rigs.<sup>2</sup> The simple prevention of released fluid on the working area dramatically reduces these slip hazards. Introducing an engineered solution goes a long way to creating the proper work environment and removing this hazard. In this case, the engineered solution is the Katch Kan™ Mat system, which assists in directing fluid away from the workers and redirected to the containment system below. The Katch Mat System is configured in a modular fashion, simultaneously allowing fluid to run under the workers footing yet increasing overall grip and traction within their setting. Overall, improving the working environment among the rig floor through fluid hazard mitigation.

## Material Composition

Each product within the Katch Kan™ Central Containment system is built with a patent protected polymer composition. This super polymer is built specifically to withstand and uphold the harsh environments of the oil and gas industry. It is a custom lightweight polyurethane composition with high tensile properties, chemical resistant, and innately durable. This customized polyurethane is a versatile elastomer used to maximize the capabilities and operations for the harsh impacts seen within drilling operations.

### I. Lightweight

Traditionally, polymers are of lightweight composition. However, traditional equipment in the petroleum sector is far from this. For example, traditional mud bucket systems required mechanical assistance, such as a cable hang or tugger, as they weighed 185 lbs./84 kg or more.

This possesses serious snag risk hazard potential in the mast with the cable. With the Kelly Kan™, one worker is able to perform an installation on the tubular break, due to its lightweight characteristic of 21 to 54 lbs. Proving the Kelly Kan™ to be founded as lightweight yet chemical resistant and a highly durable product.

## II. Temperature Resistant

The temperature resistance of the Katch Kan™ Central Containment System products is in due to the super polymer composition. A composition seen in the Kelly Kan™, 2<sup>nd</sup> Stage Low Pro, and Katch Mat System. This polyurethane makeup allows the following products to remain flexible in low temperature conditions. This is an important factor for the products to maintain an accurate shape to perform their intended operational purpose. If the Katch Mat was to shrink due a cold climate, it would not be able to optimize the traction capability needed on the rigs working platform.

Temperature resistance is also seen among the the Kelly Kan™ Seals. These seals were established to allow for the Kelly Kan™ to fit all sizes of drill pipe. These seals were not only configured to allow for an accurate fit on the drill pipe but capable of remaining flexible in a wide range of temperatures. The Kelly Kan™ Seals were built to uphold varying temperatures from -75°C (-103°F) to 190°C (374°F).

## III. Durability

One of the main components of the Rig Safety System™, the Katch Mat, has been proven to be a durable containment solution with a warranty of up to 15 years. This warranty proves the Katch Mat's capability to withstand the conditions on an oil and gas drilling rig.

Additionally found on the rig floor is the Katch Kan™ Stab Mat. This product is also a part of the Rig Safety System™. The Stab Mat is designed to protect threads and channel drilling fluids while racking tubing/drill pipe. The Katch Kan™ Stab Mat was



evaluated in accordance with ASTM D695-15 to determine the maximum force that can be withstood. The Katch Kan™ Stab Mat was proven to withstand up to 74,400 pounds per square inch (psi). A super polymer product proven to be extremely durable.

Both Rig Safety System™ Katch Kan™ products are being utilized on more than 95 rigs globally. Some of the current Katch Mat Systems have been on a rig for over 25 years. A product proven in the field to improve the workers safety, increase containment, and stand the test of time.



## Case Study:

### Zero Spill Performance Report by Sumimsa



Katch Kan and Sumimsa have formed an exclusive partnership to expand operations in Mexico, demonstrating their commitment to advancing fluid containment and recovery systems. To validate the effectiveness of the Katch Kan™ Zero Spill System™, Sumimsa conducted a comprehensive performance report. This assessment highlighted the system's exceptional fluid capture capabilities and cost effectiveness, emphasizing the partnership's dedication to high-value products and minimizing remediation and reclamation risks among drilling operations.

As part of their strategy to deliver comprehensive services and generate value for clients, Sumimsa emphasizes sustainability and social responsibility. They are committed to meeting established quality standards while ensuring operational safety and efficiency.

In a recent case study involving the installation of Katch Kan™'s Zero Spill System™ on the IXACHI 89 well, the system demonstrated outstanding performance. The Zero Spill System™ achieved a remarkable 99.99% recovery rate of the drilling fluid. This success translated into a significant 93% cost saving on the total oil base mud recovered in the working dams.

Historically, drilling operations have faced challenges with fluid spills into the back well, primarily due to the use of locally manufactured trays that inadequately contain fluids from the drilling floor. These spills lead to volume losses during tubing trips, with additional costs incurred for treating and disposing of contaminated wastewater.

Overall, the Zero Spill System™ has proven to be an environmentally safe solution that significantly enhances worker safety, prevents contamination hazards, and offers substantial economic benefits through efficient fluid recovery and reduced cleaning costs.

## Operational Efficiency

Efficient drilling operations are crucial for maximizing productivity, reducing costs, and ensuring a safe and sustainable environment. The adoption of an appropriate containment system is a strategic way to offer a cleaner and more efficient way of optimizing drilling rig operations. The Katch Kan™ Central Containment System is a system that is able to maximize performance while minimizing human exposure and environmental impact. An industry leading environmentally verified technology that improves the overall productivity of oil extraction.

Enhancing drilling efficiency using a reliable containment system directly impacts project timelines and associated costs. By implementing strategies that minimize non-productive time, operators can effectively reduce operational expenses and maximize profitability.

A two-part study done for an international operator evaluated the time and monetary savings related to system installation, dismantling, and the fluid recuperation capability.

The findings indicated that over a five-month period the operator had saved a total of \$78,540 (USD) in 2002, simply through replacing their conventional steel trays. In terms of fluid recuperation, the operator saved \$483,740 (USD) as the system displayed full capability when an unforeseen kick occurred. The Zero Spill System™ resulted in maximizing personnel safety, fluid recapture, and the capability to get the well back under control.

## The Recapture Process

Fluid release, which occurs when tubular connections break, poses significant environmental and financial risks. These risks can be mitigated with the appropriate recapture process. Now, recovery systems or clean-up methods retain the fluid, most do not retain it at a confirmed 99.99%. If clean-up methods are used, the fluid must traditionally be retreated prior to being reused in the circulating system.

Utilizing the Katch Kan™ Central Containment System the recapture process starts from the rig floor and mediates down to the BOP area, where it is then recaptured in a holding tank (Figure 1). Due to this fluid re-capture little to no drilling fluids are released into the environment. In addition, the drilling fluid can be re-captured and re-used, thus there is reduced maintenance required to maintain volume levels for circulation. Traditionally, this retreatment has a cost associated with getting the fluid back to specifications for practical use.

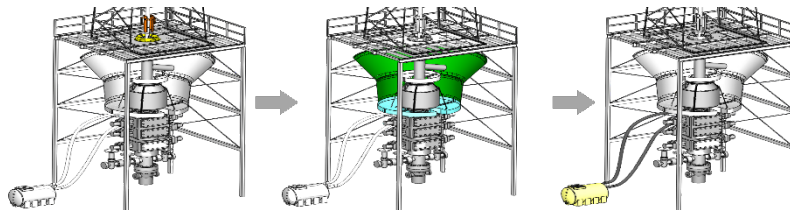


Figure 1. The Katch Kan™ Central Containment Fluid management and recapture process.



## Financial Impact

The economic benefit of fluid containment and recovery is a simple mathematical equation. The average 90-foot stand, of 5-inch drill pipe, will contain roughly 50.46 gallons of fluid, estimated at \$5.56 per US gallon of hydrocarbon drilling fluid. A total loss of 50.46 US gallons per stand is \$280.56. Not all fluid is lost during trips or connections, but that potential exists if it is not adequately contained. Even a ten percent (10%) loss during a trip or connection equates to \$28.06 per stand (Table 1).

Now expand that to the average well depth in the Permian Basin, which is an 18,000-foot well. In a wet trip, there are roughly 190 stands of tubular that require to be broken and drained. That is approximately 12,350 gallons of fluid per trip. Therefore, even a 10 percent (10%) loss of 1,235 gallons costs \$6,866.60.

Stand Size	Weight (lb./ft)	Capacity (bbl./ft)	Total Cost per 90 ft Stand	Ten percent Loss/ Stand
4 ½"	16.60	0.0143	\$225.41	\$22.54
5"	19.5	0.0178	\$280.57	\$28.06
5 ½"	24.70	0.0213	\$335.74	\$33.57

Table 1. API Drill Pipe Capacity and Displacement.<sup>4</sup> The 10 percent (%) loss per stand is a nominal amount that has not been proven as average, however is reflective of potential impact.

These numbers can be applied to water-based systems with a cost range of \$50.46 to \$0.05 per US gallon, depending on the system's complexity. Using the same parameters on an 18,000-foot trip with a 10 percent (%) loss of fluid per trip can equate to 1,235 US gallons loss at \$10.00 per US Barrel, results in a total loss of \$390 per trip.

The economic impact on a company is more straightforward and practical to measure concerning risk reduction with increased data, specifically related to using the system versus not using the system. The reduction in hazards to the worksite is by far more intuitive and knowledgeable based on years of experience in the industry. No formal studies precisely measure the reduction in ergonomic injuries due to handling a mud bucket, slips and falls on the working floor due to spilled fluid, or an increase in occupational illness from chemical contact. Those potential hazards are all something that an experienced professional will recognize the rig floor safety system, reducing to a reasonable and practical risk level.

## Case Study:

# Fluid Recovery and Environmental Technology Verification

The Katch Kan™ Zero Spill System™ Technology was subjected to verification through GLOBE Performance Solutions. Testing was conducted by the WSP Canada Inc., and the Edmonton Waste Management Centre of Excellence (EWMCE) in order to verify the Katch Kan™ System's technologies performance; considering the principles and requirements of ISO 14034:2016.<sup>3</sup>



The objective of the Environmental Technology Verification (ETV) was to provide credible, reliable, and independent verification of the performance for the environmental technology. To verify the Katch Kan™ Zero Spill System™ the amount of drilling fluids released during tripping operations versus the amount of fluids that can be collected and recovered were observed.



Figure 1. Verification Process.

The Katch Kan™ Zero Spill System™ technology was installed on the Akita 41E rig. When installed on the following drilling rig, in accordance with the manufactures recommendations, the Katch Kan™ System was proven to enable the collection and retention of drilling fluids released from the drill pipe during tripping operations. At a 95% confidence level, the Katch Kan™ system was proven to collect 99.99% of drilling fluids during four (4) tripping operations.

In conclusion, this resulted in substantial savings on drilling fluids and cleanup costs during and after production. Proving the fluid containment system is a proactive and sustainable solution for the upstream oil and gas industry.

## Conclusion

The wellbores are becoming more complicated, with the one (1) mile lateral being pushed to three (3) miles. The usual kick-off point in the Permian Basin is in the 8,000-to-10,000-foot range, which means that with a three (3) mile lateral section, there are roughly 15,000-foot of tubular to back ream or pump out of the horizontal section. This extension of the horizontal wellbore requires a focus on fluid containment and recovery far more than historically required for vertical wells. Operators can control the vertical well's fluid loss while tripping, which can be controlled by pumping a weighted pill and pulling out of the hole dry. Horizontal sections of the wellbores are usually pulled out wet due to back reaming and thus require fluid containment on every stand broken and racked back.

The Katch Kan™ Central Containment System is an effective system for creating safe working conditions and fluid containment. By effectively addressing the dual challenges of environmental protection and worker safety, the system offers a comprehensive solution to a critical industry issue. A proactive system that not only brings a positive light to the petroleum sector but exceeds legislative and industry standards. With proven effectiveness through multiple studies and international certification, the Katch Kan™ System is a testament to innovation in drilling safety technology.

## References

- [1] Environmental Protection Agency. (2000, June 30). *General requirements for spill prevention, Control, and Countermeasure Plans*. The Electronic Code of Federal Regulations. <https://www.ecfr.gov/current/title-40/part-112/section-112.7>.
- [2] International Association of Drilling Contractors. (2024, March). IADC ISP Report 2023. <https://iadc.org/wp-content/uploads/2024/03/IADC-ISP-Report-2023.pdf>
- [3] ISO. (2016). ISO 14034:2016 Environmental management — Environmental technology verification (ETV).
- [4] Mack, A. (2018, September 23). *Drill pipe capacity and displacement*. Engineering Solutions. <https://confluence.external-share.com/content/fb0bc715-ed4b-44d6-9669-e0b2c9ce106f/598149704/598182686/598149720>
- [5] U.S. Bureau of Labor Statistics. (2023, November 8). Employer-Reported Workplace Injuries and Illnesses – 2022. <https://www.bls.gov/news.release/osh.nr0.htm>
- [6] U.S. Energy Information Administration. (2022, June 7). Horizontal drilling drives trends in U.S. oil and natural gas production. <https://www.eia.gov/todayinenergy/detail.php?id=52138>

## About the Author



### Tim Dibben

Vice President - HR/HSE/QAQC

Tim has thirty-two plus years directly involved in drilling operations, seventeen years working on the front line from floor hand to rig manager, and fifteen years of experience among high level management of HSE, risk assessment, and hazard control. He has focused here at Katch Kan on optimizing quality standards and exceeding industry levels of containment within drilling operations.