



## **“SpiroFlo for Marsh and Wetlands Cleanup”**

Colin McKay Miller  
Marketing Manager, SpiroFlo Holdings, Inc.  
Colin@spiroflo.com  
www.spiroflo.com

### **ABSTRACT**

The SpiroFlo solution can be most easily described as creating a “tornado in a pipe.”

When placed on the end of a pipeline attached to an air source (pressure or vacuum), the SpiroFlo device can be used by an operator to specifically target and remove oil floating on top of the ocean. SpiroFlo’s patented device sets up a spinning flow that separates the oil from the water (based on differing mass/viscosities), causing the oil to travel slowly around the outer part of the pipe before being captured and removed. Meanwhile, the water—now free from most (80% or more) of the oil—travels on through a smaller pipe inside the original pipeline, and when combined with an eductor (jet) pump, a second SpiroFlo aerates the cleaned water before returning it to the ocean, all without any additional oxygen source. This process is particularly beneficial for inland waterways such as wetlands and marshes, where many oil cleanup solutions can’t go, yet several fragile life forms (and correlating industries) depend on clean, oxygenated water.

Since the SpiroFlo solution requires no additional power source outside of the air source, energy costs are kept low, and with no moving parts, there is nothing to wear out. SpiroFlo is also environmentally neutral with no chemicals involved. Users can easily operate the system with little training and no required protective gear, encouraging local employment. Since mostly oil is being collected and the cleaned water is returning to the ocean, a recovery vessel can stay on location longer.

The SpiroFlo solution\* is a proven, value-added process that is commercially available (with over 1,400 tools sold into the oil and gas industry) and available for immediate deployment.

*\*The SpiroFlo solution is owned by SpiroFlo Holdings, Inc., a Colorado corporation, and is the subject of eight U.S. patents with additional U.S. and overseas patents pending.*

## The Need

The Deepwater Horizon oil spill is the largest offshore spill in U.S. history. As people have mobilized to clean up hundreds of millions of gallons of oil from the ocean, there are several contaminated areas being overlooked. One of these key areas is that of marshes and wetlands.

Louisianans have complained about the need for coastline restoration for years, and while there was initial hope that April 20, 2010 oil spill might finally force a response, by May 2010, vocal critics expressed their disappointment over the government and BP's lack of response to the needs of the wetlands; especially with what was construed as the federal government's obstruction of local cleanup efforts. "This is our worst nightmare," said Plaquemines Parish president Billy Nungesser. He continued, "The oil is getting into our inner wetlands, killing wildlife and decimating breeding grounds. There's no sense of urgency, and we're just reacting. We're begging someone to step up to the plate and do the right thing, to throw the kitchen sink at this and do whatever we can."<sup>1</sup> Louisiana political commentator James Carville also gave a blunt statement aimed at the President: "(Y)ou got to get down here and take control of this! Put somebody in charge of this thing and get this moving! We're about to die down here!"<sup>2</sup>

While local politicians, state politicians and stakeholders—including commercial fishers, tourism managers and the oil and gas sector—focused on the prevention of the oil reaching the marshes, barrier islands and inland waterways, the efforts were stymied by federal regulations. Though there was an initial blockade of containment booms (floating barriers that stop the oil from crossing a certain point in the ocean)—180,000 feet worth as of April 30, 2010, with another 300,000+ feet on the way<sup>3</sup>—"high winds and rough waves [soon rendered these] oil-catching booms largely ineffective."<sup>4</sup> Since that time, the oil has spread to the marshes and wetlands, threatening several industries, including those that rely upon shrimp, crab and oyster beds. This threat is large enough that Chef Susan Spicer filed a class-action lawsuit against BP for damaging the dwindling seafood sources for Gulf Coast restaurants.<sup>5</sup>

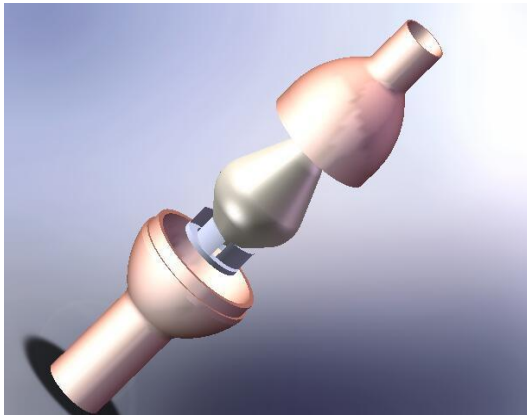
In addition to the frustration of not having a timely response to the disaster, there aren't many technology solutions that can address the sensitive needs of the wetlands and marshes, leaving many technology companies pursuing the 'billion-dollar rainbow' in the Gulf with marked up prices. One example of a commercial fishing area being negatively affected is that of oyster beds. Oyster can't move; they attach and grow where they are, so the oil needs to be removed from their location. Otherwise, oysters become coated with oil and/or the sheen on top of the water blocks the necessary sun rays from penetrating the water, halting the photosynthetic process and the life cycle it sustains. With Thad Allen stating "that it would take years to mitigate the impact of the spill on the marshes, beaches and wildlife on the Gulf Coast,"<sup>6</sup> the potential for commercial fishing to be crippled for years to come remains probable, but few solutions can remove the oil from the wetlands and marshes without causing additional ecosystem damage.

According to Chris Craft, a wetlands expert in Indiana University's School of Public and Environmental Affairs and past president of the Society of Wetland Scientists, some of the

current cleanup techniques may be worse for the wetlands and marshes than the oil spill itself: “[S]ome of the techniques they use are pretty harsh, like high-pressure washing. On rocks or sandy shores, it’s still pretty harsh. But imagine trying to use some of these techniques on vegetative marshes. The plants just cannot handle it. [Also] a lot of people will be out on the marsh sopping up oil. People end up trampling the vegetation. I’m not saying they shouldn’t try to clean it up. But [with] some of the techniques they use, they almost sterilize the soil and kill the vegetation in the process of removing the oil.”<sup>7</sup> There are also concerns regarding the harmful results of chemical treatments and high-end technologies that essentially put ‘dead’ (oxygen-free) water back into the ocean.

With the lack of response and technologies that can clean up the wetlands and marshes without causing greater ecosystem damage, there is a clear need for low disturbance, efficient technologies.

### The SpiroFlo Solution



The SpiroFlo is a patented, proven, commercially available device for environmentally neutral oil-water separation and cleanup.

When placed at the end of a pipeline attached to an air source, the SpiroFlo device (exploded diagram pictured left) allows an operator to specifically target the oil for removal. Since the oil floats on top of the water, a heavy oil mix of contaminated water will be going through the SpiroFlo device, permitting both a targeted and efficient cleanup.

As the incoming turbulent flow passes through the SpiroFlo device, it is shaped into an organized spinning flow. This stable flow separates liquids of differing viscosities/mass. In the case of an oil-water mix, the air (the lightest component) will quickly travel as a rope in the center, whereas the oil (the most viscous component) snakes slowly around the boundary layer of the pipe (pictured right). Finally, the water travels between the air and the oil.

Since the separation is predictable and the air, oil and water will consistently travel in the same places in the pipeline, the slow-moving oil is collected in a series of containers, whereas the air and water—now free from most (80% or more) of the oil contamination—continues on through a smaller pipe set inside the original pipeline. As the cleaned water then goes through a second SpiroFlo device attached



to an educator (jet) pump, air is pulled in through the venturi, re-oxygenating the flow as it returns to the ocean. This educator pump (preferred model shown below) can be easily adjusted for both surface level and deep aeration.



Since the air pump (vacuum or pressure) is the only source of power, energy costs are kept low (as opposed to alternatives using 20xGs worth of energy to generate a vortex). With no moving parts, the SpiroFlo device allows nature itself—as seen with tornados, black holes, etc.—to create this powerful vortex inside the pipe, meaning there is little maintenance and no parts to wear out. The SpiroFlo solution offers low operational costs, low barrier to entry, and the process can be easily adapted to fit on any boat available for the cleanup of marshes/wetlands. Though the SpiroFlo solution is designed for handheld use with  $\frac{3}{4}$ " tools, larger SpiroFlo devices can be made for larger volume applications without sacrificing product efficiency.

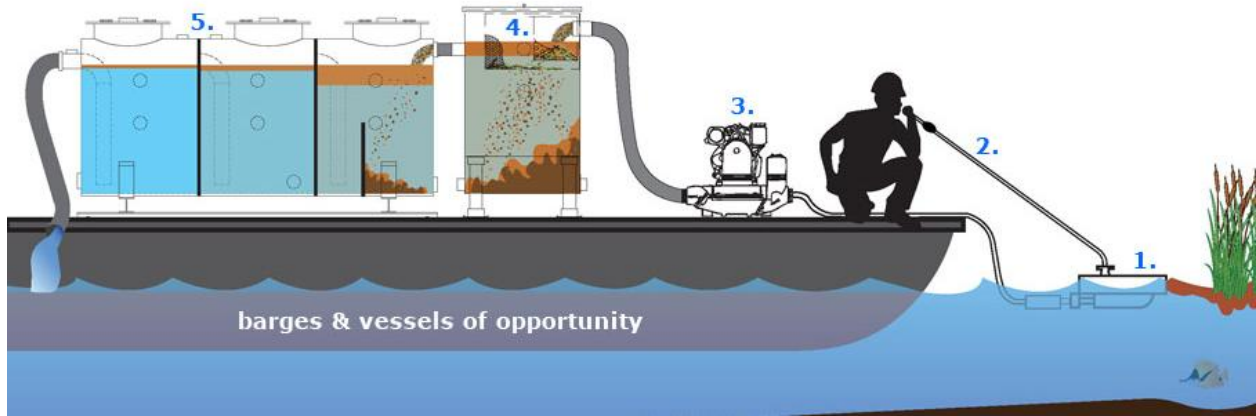
Additionally, there are no harmful chemicals, meaning that the device is environmentally neutral and therefore requires no special safety gear. Finally, since the equipment is easy to learn to operate and requires no special skills/degree, there is no need to bring in outside experts to help with marsh and wetlands cleanup. Locals can work this solution with as little as a small ship, a vacuum, tubing, a set of SpiroFlo devices, collection containers and an educator pump.

A typical system is expected to consist of the following:

1. A method of collecting contaminated water
2. A control wand and suction valve
3. A pump to lift the collected oil/water mix
4. A tank arrangement to knockout the solids, capture oil, decant and separate water
5. A pump to return the "clean" water

In addition, the equipment needs to be housed on a boat or other vessel.

The below schematic from Skim Oil, Inc. shows the layout of the typical, portable skimmer. Skim Oil, Inc. has a floating weir-head skimmer which is being considered for the recovery of larger areas of contaminated water in the marshes.

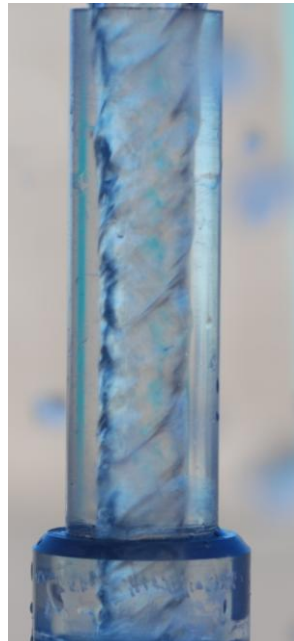
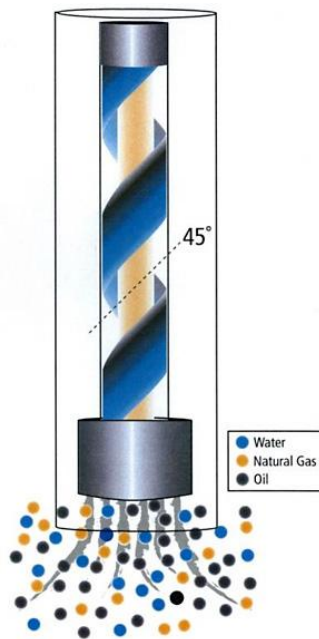


Possible Layout Image: Courtesy of Skim Oil, Inc.<sup>8</sup>

Over 1,400 SpiroFlo tools are already deployed in the oil and gas industry (under the oil and gas license of SpiroFlo's sister company, Vortex Tools, LLC) for use in declining wells / constricted surface flowlines. These SpiroFlo-eductor combination systems are available for immediate deployment, can be modified for specific project needs, and are not marked up to 'disaster recovery pricing.'

### *How the SpiroFlo Device Works*

In simple terms, the patented SpiroFlo device is a "tornado in a pipe." The SpiroFlo device shapes turbulent liquid flow into an organized spiraling flow with very stable characteristics and operational efficiencies.



As fluids (liquids and/or gases) are introduced to the SpiroFlo device, the flow undergoes a rotational shift of 90-degrees from the inlet. Fluid then traverses around a series of helical-shaped "turbines" which causes the fluid to spin and accelerate as it passes across the proprietary device. Any air particles present in the fluid are separated and pulled toward the center of the tornado-like vortex as the flow develops.

Once the flow is fully organized, liquids travel around the pipe in a 45-degree spiraling flow and the gases concentrate and travel in a spinning rope-shaped flow in the center of the vortex (pictured left).

SpiroFlo in-line designs have significant benefits for single-phase liquids and multi-phase (liquid and gas) flows. This exciting process offers the potential to use the technology for continuous mixing, as well as the separation of liquid/gas flows during piping transfer.

In a two-phase liquid-gas mix, bubbles of gas are drawn to the center of the vortex and travel inside the spinning envelope in a stable and organized flow, essentially separate from the spiraling liquids. In single-phase liquid applications, the fluids travel through the pipeline in a spiral flow, reducing drop-out and residue build-up.



By adding an eductor pump onto the end of the SpiroFlo device, the discharge (pictured left), is tightened into a more powerful jet stream of water aerated with oxygen. With the oxygen being pulled in through the venturi of the eductor pump and the fine spray of the spinning flow of the SpiroFlo device, millions of tiny particles of clean water are infused with the necessary oxygen to sustain marine life in the ocean. It is only the combination of these technologies that creates this efficient aeration, all without using any additional oxygen source.

## Conclusion

With the Deep Horizon oil spill as the largest offshore spill in U.S. history, many contaminated areas are being overlooked, including those of wetlands and marshes, where several current solutions can't or won't go, and if they can, may cause greater ecological damage than the spill itself. The SpiroFlo solution, however, provides an environmentally neutral solution that can target mostly oil on the surface of the water for removal, all without harmful chemicals or protective gear. With no specialized training or skills, there is no need to bring in experts from out of state; locals can soon learn to operate this simple solution that separates the oil from the water for collection, thereby off-setting the costs of the cleanup and supporting local employment efforts. With the cleaned water being aerated as it passes through the second SpiroFlo-eductor (jet) pump combination, the delicate marshes and wetlands are rejuvenated with the clean, re-oxygenated water they need to support commercial fishing industries. With no moving parts and no special pricing for Gulf cleanup applications, the SpiroFlo solution is cost-effective as well as efficient.

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## Contact Information

Colin McKay Miller  
Marketing Manager, SpiroFlo Holdings, Inc.  
[colin@spiroflo.com](mailto:colin@spiroflo.com)  
[www.spiroflo.com](http://www.spiroflo.com)

4131 S. Natches Ct.  
Unit E.  
Englewood CO 80110

303.761.7010  
303.761.7011 (fax)

## Additional Information

Additional information on the SpiroFlo device can be found at [www.spiroflo.com](http://www.spiroflo.com) and [www.youtube.com/spiroflodevice](http://www.youtube.com/spiroflodevice).

Additional information on Vortex Tools can be found at [www.vortextools.com](http://www.vortextools.com) and [www.youtube.com/vortextools](http://www.youtube.com/vortextools).

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