Xitech Instruments, Inc.

Free Product Recovery for Dummies

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The purpose of this document is to share our knowledge obtained through 18 years of field experience in Free Product recovery with project managers, clients, and regulators desiring site closure **without** recovery of groundwater. This document will address: the best time to apply the Xitech automatic pumping system; the best way to operate Xitech's automatic pumping systems; the basic components of a Xitech automatic pumping system; and the best way to maintain a Xitech system to minimize down time and recovery of groundwater.

The Best Time to Apply the Xitech Automatic Pumping System

The best use of Xitech technology is when you discover 1 inch or more of free product in an environmental monitoring or recovery well, and when the product is removed, the free product returns to its original thickness inside 2 or 3 days. For wells with less product or longer recovery rates of 1 or 2 weeks, a passive skimmer or monthly bailing may be more cost effective. Xitech's technology is **not** suited for open water application.

The Best Way to Operate a Xitech Automatic Pumping System

We have learned that to recover all possible recoverable Free Product in the formation you need to always maintain some Free Product in your extraction well while removing some Free Product each day from your extraction well. The easiest way to accomplish this on a long term basis is to use the Xitech ½ rule as a recovery guide. The Xitech ½ rule works like this. First let your extraction well containing Free Product rest for 24 hours. Then measure the vertical product thickness in the well. Next select a pumping time on your above ground controller that will remove only ½ of the measured thickness. Next select the number of times a day to operate the pump that will allow **full** recovery of the product thickness before the pump is turned on. Now operate the pumping systems for a few weeks. During operations, periodically (once a week) confirm that the product thickness has returned to **full** thickness right before the pump is to run. If you find less than **full** thickness right before the pump is to run. Then reduce your pumping cycles

per day. Finally, once a quarter turn off the pump for 24 hours, check the vertical thickness of product, and make that the new ½ removal amount for the next quarter. This rule is very useful for product thickness greater than 2 inches. These rules also applies when the extraction well in under low vacuum.

If you have less than 2 inches of product thickness to start with, remove all of the product down to a sheen and let it **fully** recover before you remove it again.

Note: We have observed that if you do operate a Free Product recovery pump or skimmer on a continuous basis, a donut barrier of water will form outside your recovery well isolating your extraction well from the product plume. It may take months of waiting to re-establish Free Product in the extraction well. This is why Xitech has spent 18 years perfecting pump control technology to meet a wide variety of applications.

The Basic Components of the Xitech Automatic Pumping System

Xitech has developed several pneumatic skimmers for LNAPL applications and two pneumatic submersible pumps for DNAPL applications. A selection chart that matches skimmers to applications can be found in the Free Product Recovery section of our website under "Selecting an LNAPL Recovery System" or "Selecting an DNAPL Recovery System".

Xitech's LNAPL family of skimmers satisfies the most important field requirements. Xitech has chosen pneumatic pumping technology for the safest way to remove highly flammable floating product from a well. Xitech skimmers: are deployable into 2" or greater well diameters; provide adequate skimming travel to handle water table fluctuations of up to 5 feet; are able to recover light and high viscosity floating Free Products; are able to take light LNAPLs to a sheen; and have a material compatibility selection for all floating chemicals.

Xitech's ADJ200, ADJ210, and ADJ215 skimmers fit into 2 inch diameter wells and the ADJ1000, ADJ1005, ADJ1010L, ADJ1010H, ADJ1015L, ADJ1015H skimmers all fit into 4 inch diameter or greater wells. All of these skimmers will easily fit into a PVC schedule 40 or 80 well casings. Individual specifications and photos of these skimmers can be found in the Free Product Recovery section of our website under "2" Skimmers or 4" Skimmers".

The Xitech skimmers have short or long skimmer float travels. The ADJ200(2"), ADJ210(2"), ADJ1000(4"), ADJ1010L(4"), and ADJ1010H(4") all have short skimmer float travels. These skimmers are a good match for wells with 1 to 2 feet of seasonal water level fluctuations. The ADJ215(2"), ADJ1005(4"), ADJ1015L(4"), and ADJ1015H(4") all have long skimmer float travels. These skimmers are a good match for wells near the ocean or large water ways with 1 to 5 feet of daily/weekly water level fluctuations.

Xitech skimmers have PVC and stainless steel skimmer float screens. The ADJ200(2"), ADJ1000(4"), and ADJ1005(4") all have PVC skimmer float screens. These skimmers are a good fit for Free Product that is compatible with PVC like gasoline, diesel, jet fuel, and motor oil. The ADJ210(2"), ADJ215(2"), ADJ1010L, ADJ1010H, ADJ1015L, and ADJ1015H all have stainless steel skimmer float screens. These skimmers are a good fit for chemicals that float on water or persons desiring more durable equipment.

The ADJ1010H and ADJ1015H were developed for recovery of high viscosity floating oils like #6 fuel oil, bunker sea fuel oil, PCB oil, and very old #2 fuel oil. High viscosity Free Product recovery is difficult and slow. Steaming the formation has helped move this type of product to extraction wells but with a very high cost and a lot of the Free Product ends up in the dissolved state. Xitech has attached small 75-100 watt finger heaters to the bottom of these skimmers with very good success. The finger heaters are used to heat the water in the well just below the Free Product to a temperature of about 80 degrees F. You can read more in the Free Product Recovery section of our website under "Application Note#9.

For example: The ADJ200(2") and ADJ1000(4") are the same price because they both have short skimmer float travel and both have PVC skimmer float screens. The ADJ210(2") and ADJ1010L(4") are the same price. The ADJ215(2") and ADJ1015(4") are the same.

Xitech's DNAPL submersible pumps satisfy two distinct field requirements. DNAPL pumps need to fit into 2" diameter wells or greater, and are able to recover light and high viscosity Free Products. The ADJ201 will fit into 2 inch diameter wells, and the ADJ1100 fits into 4 inch diameter or greater wells. The ADJ201 was designed for recovery of light DNAPLs like PCE solvents. The ADJ1100 was designed for light solvents, heavy coal tar, and heavy creosote sinkers.

The ADJ1100 can pump the high viscosity coal tar type DNAPLs because it has an internal return spring that pushes a diaphragm upwards creating about 25 inches of mercury vacuum at the inlet to the pump. Most pumps have the ability to push high viscosity DNAPLs to surface but very few have the ability to draw these high viscosity DNAPLs into a pumping chamber. A selection chart matching pump models with applications can be found in the Free Product Recovery section of our website under "Selecting a DNAPL Recovery System". Individual specifications and photos of these DNAPL pumps can be found in the Free Product Recovery section of our website under "DNAPL Pumps".

Xitech has developed several controllers which provide the operator with **central** control over the automatic pumping system. All of the Xitech controllers have three common features: they provide compressed air to the skimmer or pump intermittently; they shutoff the automatic pumping system when the product tank is full; and they display the total run time of the skimmer(s) or pump(s). All of these controllers can be fitted with an optional dual tank shutoff assembly that provides extra overflow protection at the holding tank and optional external switching for auto-dialer alarms.

There are two groups of controllers, single-well controllers and the multi-well controllers.

Xitech's single-well controllers are the 2500ES, 2510ES, 2550ES, REM2500ES, and the 3000ES. The "ES" means the controller includes a tank shutoff assembly. The 2500ES, 2550ES, and 3000ES require a separate compressed air source to operate the skimmer or pump. The 2510ES and the REM2500ES control stations include a controller and compressed air source. The 2550ES was specially designed for hazardous locations. This controller can be safely operated in Class I, Division 1, Groups A-F hazardous locations. All controllers are weather proof. The 2500ES, 2550ES, and 3000ES controllers can be powered by AC or DC power sources. The 3000ES controller uses a PLC programmable computer and software that enables the operator to select exactly when the skimmer or pump is to run. All of the other single well controllers use a microprocessor that provides the operator with pumping times, cycles per day, and cycles outside of a day. The REM2500ES Remote Solar Station provides a compressed air source and automatic system controls within a lockable Jobox enclosure for sites that have no AC power. The 2510ES control station is perfect for new sites that have AC power but do not have compressed air or a compound building.

Xitech's multi-well controllers are the 5000ES, REM5000ES, 5010ES, and the 5500ES. All of these controllers use a multi-channel PLC programmable computer to provide individual control over every skimmer or pump. The 5000ES, REM5000ES, and 5010ES controllers provide individual control for up to 8 skimmers or pumps. The 5500ES controller provides individual control for up to 16 skimmers or pumps. The REM5000ES and 5010ES are Joboxs containing system controls, a compressed air source for up to 8 skimmers or pumps. The REM5000ES is a solar powered system for remote sites that have no AC Power. The 5500ES can operate up to 16 skimmers or pumps but requires AC power, a large air compressor system, and a building to house the compressor and controls.

Individual specifications and photo of these controllers can be found in the Free Product Recovery section of our website under "Single Well Controllers" or "Multi Well Controllers". System drawings showing the connection of these controllers to skimmers or pumps can be found in the Free Product Recovery section of our website under "LNAPL Systems Available" or "DNAPL Systems Available". How to install and operate these controllers can be found in the Free Product Recovery section of our website under "Installation Manuals".

The Best Way to Maintain a Xitech System

The Xitech skimmers and pumps are pneumatically powered (i.e. compressed air) and require clean, dry, oil free, compressed air to operate at optimum performance. The Xitech controllers can all be exposed to direct weather, even extreme weather. We have skimming systems deployed inside the Artic Circle, Death Valley California, and a desert in the Middle East. All controllers also require clean, dry, oil free, compressed air because of their internal pneumatic switching valves.

Skimmers will need their hydrophobic filters and flexible tubing at the bottom of the skimmers replaced at least once a year. We suggest that your technicians carry a spare air logic valve with them at all times. If a skimmer or pump does stop pumping, it is usually the air logic valve. Changing the air logic valve is easy to do, prevents any down time, and is less costly to ship back to Xitech for repair. Air logic valve failures are usually caused by water moisture, dirt, or free Product getting inside.

Proper troubleshooting for our skimmers, pumps, and controllers can be found in the Free Product Recovery section of our website under

"Installation Manuals" then "Skimmer Troubleshooting" or Controller Troubleshooting.

To minimize down time we **strongly** request that your field technician call Xitech when they have any problem, and are **still in the field**. All of our controllers have a label attached with the Xitech toll free number if you need help in the field.

I hope this information has been helpful to you. If you have any questions or require site design assistance, please call the Xitech office at 505-867-0008. Our business hours are 8am to 5pm mountain time.