



## PPI water disposal facility **Doubles oil recovery**

### at a glance

**Unit Type**—3-in. Separation Enhancer

**Application**—Water disposal well

**End User**—Petroleum Processors Inc. (PPI), a company that provides produced water disposal services in Northwestern Alberta and is headquartered in Edmonton, Alberta.

**Reason for Installation**—The facility had been operating about two years before unit installation. The primary goal of the installation was to increase volumes of skim oil recovered and decrease associated water cut.

**Results**—The unit performance exceeded expectations. The skim oil recovery doubled and the water cut dropped below the level needed to meet Canadian pipeline specifications. In addition, lines and tanks became cleaner with significantly less sludge buildup and water disposal injection rate increased.

### contact distributor

### Site Description

Located about 30 miles (48 km) from Swan Hills, the PPI facility separates out the recoverable oil and injects the remaining water down a disposal well and into the Wabamun formation. According to the PPI president, Allan Szybunka, the formation at this location is about 37 ft (11.3 m), making the injection zone significantly thicker than the 3–7 ft (0.9–2.1 m) more commonly found at similar sites. As is typical for water disposal sites, both the amount and the nature of loads received over any given time period can vary widely.

For example, the number of loads could be 30 a day or 30 a month depending on market conditions. Reflecting the production source, the water–oil ratio of incoming fluid could be 10:1 or 100:1. The oil gravity could be 14°API (density 971 kg/m<sup>3</sup>) or 40°API (density 823 kg/m<sup>3</sup>). Whatever the nature of the incoming fluids, the treatment must yield a skim oil with properties that can meet Canadian pipeline specifications, one of which is that skim oil contain no more than 0.5% water. Before the Separation Enhancer was installed, the basic sediment and water (BS&W) for skim oil was typically 5%–30%, which meant extra expense to remove enough water to meet the specification. In fact, one of the primary motivations cited by Szybunka for trying the Separation Enhancer was to find a better way to dry out the skim oil.





## Installation Notes

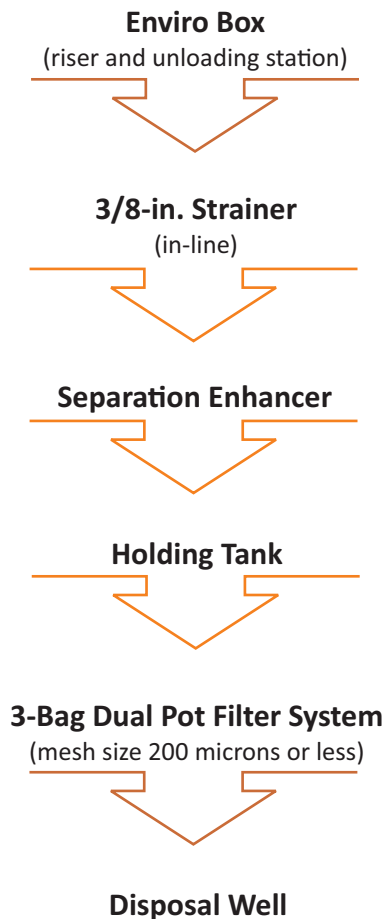
“Operationally, the Separation Enhancer was pretty easy to install,” notes Szybunka. As seen in the process flow diagram, the unit is hard-lined (3-in. line size) inside of the filter room just before fluids enter the storage tanks. The treatment system is ideal for examining the effects of the Separation Enhancer because it is relatively simple, relying on separation through gravity segregation. The facility has never used heat or chemicals in the processing.

As a general practice, Szybunka recommends incorporating a recycle line

to better manage fluctuations in the amount of produced water received for treatment. A recycle line can help maintain steady flow rates through the Separation Enhancer and ensure that the ionization remains effective through as widespread a zone as possible.

“The current installation does not include a recycle line,” he explains. “As a result, we have noticed that, if the site goes for three days without receiving new loads, the fluids show a noticeable drop in the level of ionization. At some point when conditions warrant, we would like to place a recycle line just before the fluid stream goes down the well.”

## Process Flow Diagram



## Results

“After installing the Separation Enhancer, it only took about three days to start seeing positive differences,” remarks Szybunka. One of the first changes noticed was a drop in the water cut of the skim oil. By the time the unit had been in for a month, other benefits became apparent as well.

**Increased Oil Recovery**—With the introduction of the Separation Enhancer, the amount of skim oil recovered doubled from 1% to at least 2% for similar loads of produced water. The monthly oil recovery without the unit was about 180 bbl (28.6 m<sup>3</sup>) compared to about 360 bbl (57.2 m<sup>3</sup>) with the unit. This increase reflects the fact that ionization causes more thorough separation of the fluid constituents according to specific gravity.

**Decreased BS&W**—Besides increasing the amount of oil recovered, the ionization process ensures that there are fewer impurities within that separated oil—an important consideration given that one of the goals for installing the Separation Enhancer was to dry the oil out. After unit installation, the typical BS&W for the skim oil dropped from 5%–30% to about 0.1%–0.2%, thereby eliminating the need for additional processing to meet the Canadian pipeline specification of 0.5%.

## Site Characteristics Before and After Installation of Separation Enhancer

Characteristic	Before Installation	After Installation
Monthly Skim Oil Production	180 bbl (28.6 m <sup>3</sup> )	360 bbl (57.2 m <sup>3</sup> )
Percent Monthly Oil	1%	2%
BS&W	5%–30%	0.1%–0.2% (meets pipeline spec of 0.5% without need for further treatment)
Sludge Generation	Plugged skim oil line; sides and bottoms of tanks coated with heavy sludge	After 3 days, oil line clear; sides of tanks clean; loose sludge on tank bottoms
Water Injection Rate (under vacuum)	10–12 m <sup>3</sup> /hr (62.9–75.5 bbl/hr) or 240–288 m <sup>3</sup> /d (1,510–1,811 bbl/d)	15 m <sup>3</sup> /hr (94.3 bbl/hr) or 360 m <sup>3</sup> /d (2,264 bbl/d)

“When the doors were removed, we were amazed to see that the sides of the tanks were shining. In all my 20 years of doing door pulls, the sides have never been shiny.”

—Allan Szybunka, PPI president

### Actual Oil Sales Report



NOTE: Achieved with Separation Enhancer only; no heat or chemicals used.

**Reduced Sludge Generation**—Sludge is an ever-present operational challenge at water disposal facilities. Szybunka remembers that, just before installing the Separation Enhancer, the skim oil line was clogged with sludge even though the line was located half way up the tank, and so had some head pressure on it. PPI thought that it would be necessary to do a door pull, which is a procedure to empty the tank, pull the door off, and manually clean out the sludge. The sludge typically coats the tank walls and is very thick on the bottom, so much so that workers have to step into the tank and use shovels to scoop the thick, viscous sludge towards a vacuum hose for removal. The procedure is very expensive. Since it is not practical to do door pulls every three to six months, Szybunka speculates that PPI would have probably started looking at introducing chemicals into the process had it not tried the Separation Enhancer first.

Given the level of sludge buildup already in place, this installation was well suited to test the effect of ionization on sludge. After only about three days with the Separation Enhancer, the skim oil line was flowing freely.

About a month later, PPI had striking evidence of just how effective the Separation Enhancer had been in dealing with the problem. As part of an experiment for an oil company, PPI did a door pull on two of its 1,000-bbl (159-m<sup>3</sup>) tanks. “When the doors were removed, we were amazed to see that the sides of the tanks were shining,” Szybunka relates. “In all of my 20 years of doing door pulls, the sides have never been shiny. The oil usually clings to the sides. Then it turned out that the work crew didn't even have to go inside the tanks to remove the bottom sludge. When the vacuum hose was put in, the sludge was thin enough to move to the hose without additional help from the workers. We have never had this happen to us before.”

**Increased Injection Rate**—Another benefit of the Separation Enhancer is that it allows for an increased injection rate down the well. At the PPI facility, the well is somewhat unique in that it is on a 22-psi vacuum. Because it takes a while to obtain the vacuum and get the pumping started, it can be difficult to quantify the improvement in injection rate. Even so, PPI records show that the injection rate increased from about 10–12 m<sup>3</sup>/hr (62.9–75.5 bbl/hr) to about 15 m<sup>3</sup>/hr (94.3 bbl/hr).