



**CFR**  
c h e m i c a l s

**H<sub>2</sub>S SCAVENGERS INFORMATION &  
SUPPORT SERVICES**



*Better People. Better Service.*





**StaSweat™ 6000**  
H<sub>2</sub>S Scavengers

<b>Description</b>	StaSweat™ 6000 is a proprietary liquid scavenger for use in neutralizing hydrogen sulfide (H <sub>2</sub> S), methyl, and ethyl mercaptans.
<b>Properties</b>	<ul style="list-style-type: none"> <li>• Very mild odor</li> <li>• Freeze-point greater than -40°C <u>*No ammonia or flammable freeze protection chemicals – (such as methanol) *</u></li> <li>• Non-Toxic (formulated with no formaldehyde)</li> <li>• Non-flammable, non-corrosive</li> <li>• Spent material is water miscible</li> <li>• Particle size typically less than 100µm (2µm filter will stop 97% of spent material)</li> <li>• pH of approx. 12, spent pH is approx. 9</li> </ul>
<b>Applications</b>	<p><b>StaSweat™ 6000 Neutralizes H<sub>2</sub>S and mercaptans in:</b></p> <ul style="list-style-type: none"> <li>• Truck mounted or stationary tank vent scrubbers</li> <li>• Sour gas pipeline treating (downhole and topside)</li> <li>• Sour water, oil, condensate</li> <li>• Fuel gas scrubbing</li> <li>• Storage Tanks</li> <li>• Tank, vessel and pipeline decontamination</li> <li>• Vent gas scrubbers</li> <li>• Liquid hydrocarbon pipelines</li> <li>• Gas plants and refineries (Turnarounds)</li> <li>• Many other types H<sub>2</sub>S mitigation efforts</li> </ul>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• <b>Employee Health:</b> No cancer causing formaldehyde<sup>1</sup> present, unlike competitor Triazine based H<sub>2</sub>S scavengers.</li> <li>• <b>No foul odors.</b></li> <li>• <b>Versatile:</b> Easily used in most oilfield applications.</li> <li>• <b>Environmentally Friendly:</b> spent product is non-toxic under the Environment Canada Biological test. <i>*<a href="https://www.canada.ca/en/environment-climate-change/services/wildlife-research-landscape-science/biological-test-method-publications/acute-lethality-test-daphnia-species.html">https://www.canada.ca/en/environment-climate-change/services/wildlife-research-landscape-science/biological-test-method-publications/acute-lethality-test-daphnia-species.html</a>*</i></li> </ul>
<b>Effectiveness</b>	<ul style="list-style-type: none"> <li>• <b>StaSweat™ 6000 in truck-mounted scrubbing units</b> - multiple field trials have proven to last 2-4 times longer than competitor Triazine-based scavengers.</li> <li>• <b>StaSweat™ 6000 injected directly into liquid hydrocarbons and water:</b> Recommended dosage rates to eliminate H<sub>2</sub>S: <ul style="list-style-type: none"> <li>• For application where residence time is available: 0.15 L StaSweat™ 6000/ m<sup>3</sup> liquid / 1000ppm H<sub>2</sub>S</li> <li>• For fast reaction: 0.73 L StaSweat™ 6000/ m<sup>3</sup> liquid / 1000ppm H<sub>2</sub>S</li> </ul> </li> </ul>
<b>Disposal</b>	<p>Disposal methods practiced with current spent scavenger liquids or sweetening agents should continue to be followed. In Alberta, StaSweat™ 6000 spent byproduct is <b>suitable for injection in a Class 1B disposal well</b> according to Alberta EUB Guide 51.</p> <p>Please consult with appropriate government authorities respecting proper disposal procedures to ensure compliance with all municipal, provincial, territorial, state and federal laws.</p>

<sup>1</sup> Addendum to the 12th Report on Carcinogens. Published by the U.S. Department of Health and Human Services, National Toxicology Program





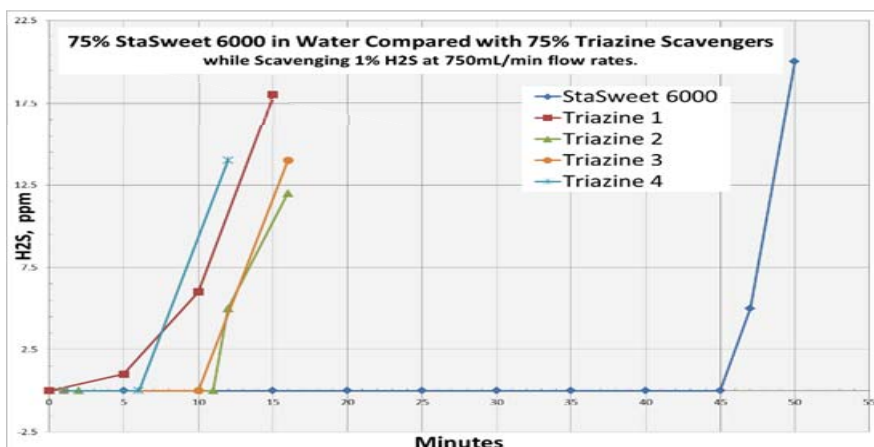
**Founded in 1996, CFR Chemicals is a privately owned Western Canadian based company. Our primary focus is the distribution of chemicals to the energy and industrial manufacturing industries, while still providing a niche market of specialty oil production chemicals.**

With a strong network of suppliers around the world and a highly experienced management team, we serve our clients and customers with pride and an unparalleled level of service. This is the reason CFR will become your first-choice chemical supplier.

## StaSweet™ 6000 Treatment Solutions

<b>Sour Condensate</b>	<ul style="list-style-type: none"> <li>A Major Oilfield Service Company treated 225m<sup>3</sup> (225,000L) of condensate with an H<sub>2</sub>S content of 8000 ppm by adding 400L of <b>StaSweet™ 6000</b> directly into the storage tank at the pump.</li> <li><b>StaSweet™ 6000</b> reduced H<sub>2</sub>S content to 0 ppm after circulating for 2 hours.</li> <li>Based on this trial the Company switched all their facilities handling H<sub>2</sub>S contaminated products to <b>StaSweet™ 6000</b> from previous formaldehyde based liquid scavengers.</li> <li>This decision was not only based on the effectiveness of <b>StaSweet™ 6000</b>, but also because it is an easier and safer alternative when being handled by their operators.</li> </ul>
<b>Sour Water</b>	<ul style="list-style-type: none"> <li>5m<sup>3</sup> of sour water with an H<sub>2</sub>S content of 10% or 100,000ppm was treated with 20L of <b>StaSweet™ 6000</b> added directly to the tanker before the sour water was pumped in.</li> <li>Upon arriving at the disposal site 1.5 hours away, the H<sub>2</sub>S content was reduced to zero in tank (vent line), and a shake test showed 100ppm H<sub>2</sub>S in the headspace.</li> </ul>
<b>Contaminated Lube Oil</b>	<ul style="list-style-type: none"> <li>1200L of lube oil contaminated with 10,000ppm of H<sub>2</sub>S was treated with <b>StaSweet™ 6000</b>.</li> <li>The company added 5L directly into the tank and hauled the load to disposal site 4 hours away.</li> <li>Upon arrival, the lube oil was accepted at the disposal site having 0 ppm H<sub>2</sub>S content.</li> </ul>
<b>Trucking and Oilfield Industry</b>	<ul style="list-style-type: none"> <li>Using <b>StaSweet™ 6000</b> in a truck mounted scrubber to eliminate H<sub>2</sub>S from the trucks venting gas is a very popular application showcasing the product's strength and longevity.</li> <li>Directly adding <b>StaSweet™ 6000</b> to sour liquid in the tank either before or after sour fluids were received can extend the life of the scavenger in truck mounted scrubbers and agitation caused by simply driving to the disposal site is sufficient to eliminate or reduce the H<sub>2</sub>S concentration to acceptable levels.</li> <li>Using <b>StaSweet™ 6000</b> in storage tanks during turnaround/cleanout can eliminate H<sub>2</sub>S levels making it safe for cleaning crews.</li> </ul>

*“superior scavenger efficiencies compared to triazine-based chemistry”*



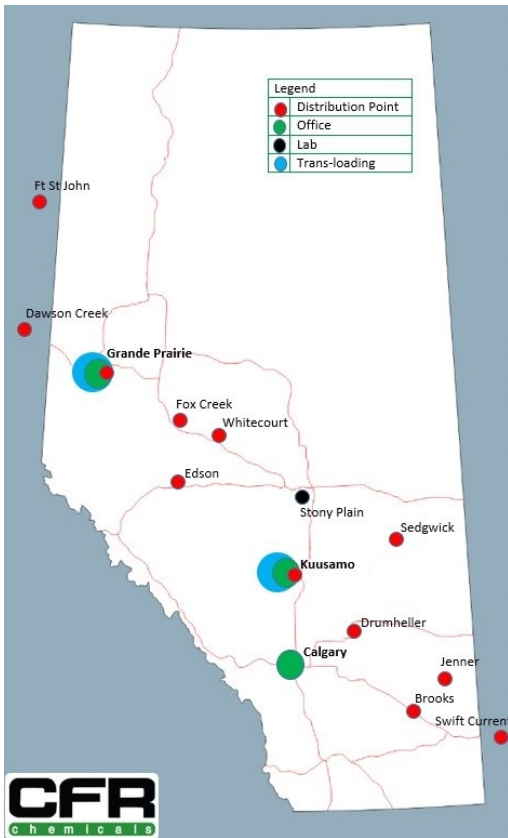
**StaSweet™**  
H<sub>2</sub>S Scavengers



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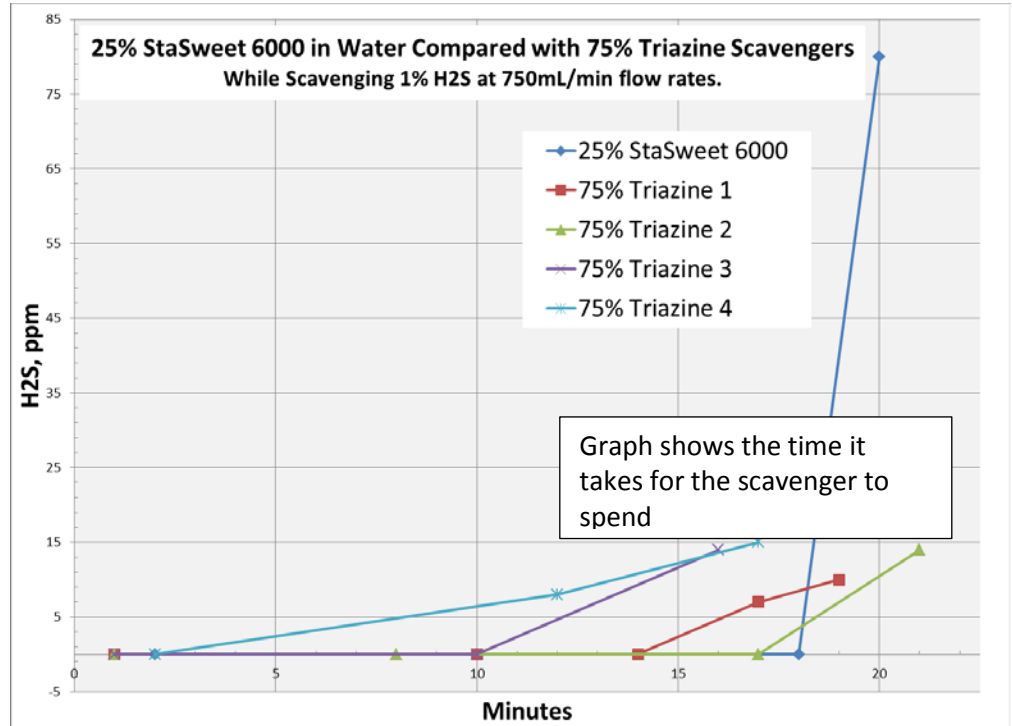
## Health & Safety

CFR is proud to have obtained an Alberta Certificate of Recognition (COR). This represents a significant achievement in our health and safety practices. We strive for continuous improvement, and to be a valued resource on best-practices within our industry. We welcome comments and suggestions from our customers – chat with us today.

We are also proud members of both ISNetworld, and Complyworks. Contact our Health and Safety manager for additional safety information, or our Corporate Development Manager for more information on our involvement with vendor management systems.

## The Research and Testing is Corroborated by the Results in the Field

*Testing indicates that 1/3 of the amount of StaSweet™ 6000 can be used versus traditional triazine alternatives, and still achieve greater scavenging results.*



### Box Scrubber TESTIMONIAL January 5, 2018 Trucking Company in West-Central Alberta

The Customer loaded CFR **StaSweet™ 6000** scavenger on October 11<sup>th</sup> 2017.

- 9 loads of full sour product 25%-35% at 40 m3 a load
- 9 sweet loads transported after each full sour load

So effectively:

- Tuesdays - 360m3 of 25%-35% full sour loads through scrubber
- Wednesdays - 360m3 of sweet water through scrubber as well
- Random Top Up - 110m3-220m3 of sour through top up loads
- After Random Top Up - 440 m3 of sweet to sweeten trailers

Conservatively:

- 1360 m3 of water was run through 160 L of **StaSweet™ 6000** in the scrubber tank
- No recorded breakthrough of H<sub>2</sub>S in the vent gas. LELs were detected and so the **StaSweet™ 6000** was changed out.
- We had since purchased a competitive Scavenger Product to test. On its first use, our truck was sent home because it was releasing an unacceptable 24ppm.
- Since going back to the CFR **StaSweet™ 6000** scavenger, we have not had an issue.

“The effectiveness of the product definitely makes up for any price difference as it ultimately saved us significant money over the life of the product.”

Adam Drysdale, Area Manager – Energetic Services

**Condensate Sweetening TESTIMONIAL** October, 2017  
**Oil Company, Grande Prairie**

During a pipeline outage this spring, C5+ was being hauled to a sweet Edmonton tank facility where H<sub>2</sub>S levels in the vapor space needed to be maintained at 200ppm or less. Untreated, values reached over 10,000ppm H<sub>2</sub>S.

“We had used a competitive scavenger in a previous haul and found CFR Chemicals to be a more cost effective solution, all things considered. A couple of test loads with **StaSweet™ 6000** were sent and we achieved the desired results. The treatment rate was higher with **StaSweet™ 6000** but it was still a cost saver for our company because of a lower cost per liter.”

The fluid being treated was sour condensate.

“**StaSweet™ 6000** was introduced directly into the truck loading lines on our tanks and the chemical pumps injected the scavenger as soon as the truck loading ESD’s would open. The trucks would load and the scavenger pump would stop when the trucker hit the stop sequence on our truck loading station. We tried to ensure the trucks kept a steady load rate of roughly 1m<sup>3</sup>/minute. **StaSweet™ 6000** feed rates were set at 3.5L/min for new tanks and 4.3L/min for old tanks.”

Plant, Lead Operator

**Sweetening of Produced Water, December 2014**  
**Oil Company, Grande Prairie**

CFR Chemicals was approached to treat sour produced water using **StaSweet™ 6000**. The goal was to eliminate approximately 613 mg/L H<sub>2</sub>S in water.

Water samples from storage tanks were recorded at 310 mg/L H<sub>2</sub>S in the water, and 1.4% (14 000 ppm) in the headspace.

20L of **StaSweet™ 6000** was loaded into a truck. Approximately 12L in a 10m<sup>3</sup> compartment, and 8L in an 18m<sup>3</sup> compartment. The truck tanks were then loaded with sour water, and allowed to sit for 5 minutes. With minimal agitation, water samples were taken and tested for aqueous and headspace H<sub>2</sub>S.

Both tanks showed 0 ppm H<sub>2</sub>S in the water phase after treatment of the 28m<sup>3</sup> of fluid. The 10m<sup>3</sup> tank tested at 0 ppm H<sub>2</sub>S in the headspace, while the 18m<sup>3</sup> tank tested at 300 ppm H<sub>2</sub>S. This was a reduction of 13,700ppm using less than 10L of **StaSweet™ 6000**.

## Box Scrubber Lifespan Calculation Using StaSweet 6000/CI 1000

$$\text{m}^3 \text{ gas before spent} = \text{L scavenger in scrubber} / (0.044 \times (\text{H}_2\text{S ppm} / 1000))$$

H <sub>2</sub> S (ppm)	Scrubber scavenger volume (L)	Gas volume before spent (m <sup>3</sup> )	Trucks before spent (based on 50m <sup>3</sup> truck displacement volume)
50	50	22727	455
50	100	45455	909
50	150	68182	1364
50	200	90909	1818
50	250	113636	2273
50	500	227273	4545
100	50	11364	227
100	100	22727	455
100	150	34091	682
100	200	45455	909
100	250	56818	1136
100	500	113636	2273
200	50	5682	114
200	100	11364	227
200	150	17045	341
200	200	22727	455
200	250	28409	568
200	500	56818	1136
500	50	2273	45
500	100	4545	91
500	150	6818	136
500	200	9091	182
500	250	11364	227
500	500	22727	455
1000	50	1136	23
1000	100	2273	45
1000	150	3409	68
1000	200	4545	91
1000	250	5682	114
1000	500	11364	227

**NOTE:** these are theoretical calculations based on Laboratory tower tests.

**RATE MAY DIFFER IN THE FIELD**

- Assuming 1m<sup>3</sup>/min gas flow rate through scrubber
- For H<sub>2</sub>S applications only. If other contaminants are present (mercaptans, CO<sub>2</sub>), then rate will increase.
- Cool wet or dry gas is ideal
- For box scrubbers without trays or packing material. Not to be used for flooded towers.

**Amount of StaSweet 6000  
to add to each m3 of sour fluid.**

Concentration of H <sub>2</sub> S in the Headspace of Sour Fluid	Low Treatment Rate*	High Treatment Rate**
	Liters of StaSweet 6000 required per m3 Fluid	Liters of StaSweet 6000 required per m3 Fluid
100 ppm	0.015	0.073
500 ppm	0.075	0.365
1000 ppm	0.15	0.73
1500 ppm	0.225	1.095
2000 ppm	0.3	1.46
2500 ppm	0.375	1.825
3000 ppm	0.45	2.19
3500 ppm	0.525	2.555
4000 ppm	0.6	2.92
4500 ppm	0.675	3.285
5000 ppm	0.75	3.65
5500 ppm	0.825	4.015
6000 ppm	0.9	4.38
6500 ppm	0.975	4.745
7000 ppm	1.05	5.11
7500 ppm	1.125	5.475
8000 ppm	1.2	5.84
8500 ppm	1.275	6.205
9000 ppm	1.35	6.57
9500 ppm	1.425	6.935
10000 ppm	1.5	7.3
* The low treatment rate can be used when at least 2 hours of mixing is possible.		
** The high treatment rate should be used when immediate removal of H <sub>2</sub> S is Required.		
Note: The values in columns 2 and 3 must be multiplied by the total number of m3 of sour fluid requiring treatment.		

**Spent Material Discharge for StaSweet Treatment Chemicals**

A Class 1b Injection well is a deep well disposal of produced water, specific common oilfield waste streams, and waste streams meeting criteria; and constructed and operated in accordance with the requirements of class 1b wells as specified by the Oil and Gas Commission.

Under 3.5.2.1 Listed Wastes, the StaSweet spent material that has been mixed with produced water or specific common oilfield waste streams appropriate for disposal in Class 1b wells and can be considered as a standard industrial practice.

The StaSweet falls under the criteria listed in section 3.5.2.1

- Amine filter backwash (e.g. MEA, DEA, MDEA).
- Acidic or alkaline solutions (neutralized) with heavy metal concentrations at or below the levels given in Schedule 1.
- Gas scrubber or absorption tower bottom liquids (neutralized) with heavy metal concentrations at or below the levels of Schedule 1.