



## **Saskatchewan Hydraulic Fracturing Fluids and Propping Agents Containment and Disposal Guidelines**

**Information Guideline GL 2000-01  
Saskatchewan Energy and Mines  
Petroleum Development Branch  
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## **INTRODUCTION**

**Although Saskatchewan Energy and Mines has exercised all reasonable care in the compilation, interpretation and production of this document, it is not possible to ensure total accuracy, and all persons who rely on the information contained herein do so at their own risk. Saskatchewan Energy and Mines and the Government of Saskatchewan do not accept liability for any errors, omissions or inaccuracies that may be included in, or derived from, the use of this document.**

### **Background**

Saskatchewan Energy and Mines (SEM) firmly believes that frac fluids and sands must be managed to protect the environment from adverse impacts. SEM maintains the position that operators must continue to work on methods to minimize the impacts of frac fluids and sands on the environment. In this regard, such things as selecting environmentally friendly additives, using no-leak containment devices, minimizing the volume of frac fluids used, re-using and recycling sands, and selecting the best disposal option should be an integral part of well stimulation programs.

This guideline outlines comprehensive methods and criteria for the handling and disposal of frac fluids and sands in Saskatchewan. The intent of this guideline is to ensure environmentally safe and responsible management of frac fluids and sands. Operators using disposal methods other than the recommended methods described in these guidelines do so at their own risk. Ultimately, the operators are responsible for the proper disposal of their own wastes.

This guideline replaces all previous Saskatchewan Energy and Mines guidelines pertaining to the disposal of frac fluids and sands produced by the upstream petroleum industry.

## Section 1: General Requirements

### 1.1 Frac Fluid System Classifications

- **Water-based frac fluids** are natural or synthetic polymer gels of water or hydrochloric acid. Gels typically consist of cellulose, guar, guar derivatives or polysaccharides. They include both linear gel and/or crosslinked gel systems. Water-based frac fluids may include the addition of thickening derivatives and stabilizers (i.e. isopropanol, potassium chloride, ammonium nitrate, glycol and acids) to enhance the performance. Water-based frac fluids must have total extractable hydrocarbon concentrations of less than 0.5%.
- **Foams** are normally classed as water-based fluids. Nitrogen gas is dispersed in a liquid to create a foam. Surfactant is used as a foaming agent to initiate the dispersion. Stabilizers may be used to enhance the performance. Foam is designed primarily for low-permeability or low pressure gas wells. Water-based frac fluids must have total extractable hydrocarbon concentrations of less than 0.5%.
- **Mix-based frac fluids** are oil in water dispersion or emulsions that serve as highly efficient fracturing fluids.
  - **Crosslinked hydrocarbon gel** consists of crosslinked water (95%) with an oil phase (5%) dispersed throughout the mixture. Gel functions to provide a high viscosity in the fluid.
  - **Polyemulsion** (viscous emulsion) is viscous water-outside-phase emulsion containing two parts oil (crude or refined) and one part water or brine. Polyemulsion is designed to provide high viscosity fracturing fluids at temperatures up to 175°C. It is seldom used because of fire hazards and high cost.
- **Oil-based frac fluids** in the past, refined oils, crude oils and soap-type gels of crude, kerosene or diesel were used. Due to safety considerations, lack of temperature stability and cost, these materials are seldom used.
- **The operators are required to submit Form A-2: Notification Of Flowback Fluid And Frac Sand Disposal no later than 48 hours after the disposal of the flowback fluid and/or frac sand.**

The operators are prohibited from using disposal method(s) described in this guideline to dispose of any material(s) regulated by Atomic Energy Control Board (AECB). The material(s) regulated by AECB shall be disposed in accordance with AECB's requirements. This guideline does not apply to AECB regulated material(s).

Please note, certain frac fluids and sands may be classified as waste dangerous goods, please refer to the *Waste Management Guidelines for the Saskatchewan Petroleum Upstream Oil and Gas Industry*, SPIGEC, February 1996 for detailed information.

## 1.2 Containment of Flowback Fluids and Sands

- Flowback fluids and frac sand shall be contained in a tank.
- Tanks receiving flowback fluids and frac sand from water-based, foam and cross-linked hydrocarbon frac fluid systems shall be placed 23 metres away from the well head unless otherwise approved by Saskatchewan Energy and Mines.
- Tanks receiving flowback fluids and frac sand from polyemulsion, oil-based frac fluid systems or flowback fluids containing any amount of appreciable flammable gas, liquid or solid shall be placed 45 metres away from the well head unless otherwise approved by Saskatchewan Energy and Mines.
- Flowback fluids and frac sands must be contained in such a manner so that they do not constitute a hazard to the environment.
- Blowing flowback fluids and sands into a pit, sump or on the surface of the lease is expressly prohibited. Flowback fluids and sands should be disposed of in a timely manner (no longer than 90 days, unless otherwise approved).
- Placing hazardous wastes, waste dangerous goods (e.g. used lubricating oil, solvents and antifreeze) or garbage in flowback storage tanks is prohibited. Please refer to the *Waste Management Guidelines for the Upstream Oil and Gas Industry*, SPIGEC, February 1996.

## 1.3 Disposal of Flowback Fluids

- All flowback fluids shall be disposed of at an approved waste processing facility with an approved disposal well, unless it is permitted by other methods described in this guideline or the operator receives written permission from Saskatchewan Energy and Mines. Approved waste processing facilities are assigned a WPF number from Saskatchewan Energy and Mines. No additional tests are required other than the tests requested by the waste processing facility operator.
- Flowback fluids from water-based frac fluids and foams may be disposed of at an approved disposal well owned by the operator.
- Flowback fluids from water-based frac fluids and foams may also be disposed of at an approved disposal well owned by a third party operator, who does not have a waste processing facility approval. Prior to disposal, the flowback fluid shall be tested and meet the following criteria:

Parameter	Criteria
pH	greater than 2 and less than 12.5
Closed Cup Flashpoint	greater than 61°C

- Written approval from Saskatchewan Energy and Mines is required prior to implementing new treatment or disposal methods for flowback fluids.
- Discharge of flowback fluids on surface land, surface water or into the environment is strictly prohibited. This restriction applies to natural and man-made features, including but not limited to: agricultural lands, alkaline sloughs, drilling sumps, flare pits, gravel pits, landfarms, landfills, pipeline right-of-ways, oil and gas surface leases and access roads, remote sumps, seismic lines, sewer systems, tailing ponds, tailing piles and vegetated lands (forest, crops, or native grass).
- The operator is responsible to comply with all other relevant regulatory requirements, for example: requirements specified in *The Transportation of Dangerous Goods Regulations*.

#### 1.4 Disposal of Frac Sand

- All frac sand can be disposed of at an approved waste processing facility. Approved waste processing facilities are assigned a WPF number from Saskatchewan Energy and Mines. No additional tests are required other than the tests requested by the waste processing facility operator.
- Operators are encouraged to reuse or recycle frac sand whenever possible. Commercial recycling facilities and service providers shall make a written application to the SEM head office to operate in Saskatchewan.
- Management Level 1 Frac Sand (ML1): refers to frac sand generated from water based and foam frac fluid systems that meet all of the criteria listed in the table 1 column ML1. Chemical analysis specified in table 1 column ML1 must be conducted and submitted to SEM by completing **Form A-2: Notification Of Flowback Fluid And Frac Sand Disposal**. ML1 frac sand may be disposed in:
  - ➔ municipal landfills
  - ➔ non-SEM approved commercial landfarms
  - ➔ commercial/industrial use (construction materials, fill, building materials)
  - ➔ other methods approved by SEM (written approval is required)
  - ➔ other methods specified in section 1.4 (i.e. WPF, reuse/recycle or ML2)

The operator will be required to obtain permission from the authorized personnel of the disposal facility (i.e. municipal landfill operator), prior to disposal. The operator must comply with any relevant regulatory requirements specified by other regulatory agencies.

- Management Level 2 Frac Sand (ML2): refers to frac sand generated from water based, foam, and cross-linked hydrocarbon frac fluid systems that meet all of the criteria listed in the ML2 column in table 1. Chemical analysis specified in table 1 column ML2 must be conducted and submitted to SEM by completing **Form A-2:**

**Notification Of Flowback Fluid And Frac Sand Disposal.** ML2 frac sand may be disposed in:

- SEM approved commercial landfarms
- commercial landfills (must receive prior written approval from SEM)
- reuse and recycle (must receive prior written approval from SEM)
- water based frac fluid system may be disposed in accordance with the Section 3.2 Residual Solids Disposal (RSD) Methods in Information Guideline GL 99-01, Saskatchewan Drilling Waste Management Guidelines. Disposal of all other frac fluid systems are prohibited from RSD disposal method. Written landowner consent must be obtained prior to disposal, whether RSD is on-lease or off-lease.



**Table 1. Management Level Frac Sand Criteria**

Criteria for Frac Sand and Fluid Management Category			
Management Level Classifications		ML1	ML2
pH		6 to 8	as per specific approval <sup>2</sup>
Electrical Conductivity (dS/m)		≤2	as per specific approval <sup>2</sup>
Sodium Adsorption Ratio <sup>1</sup>		≤5	as per specific approval <sup>2</sup>
flash point (°C)		≤61	≤61
total extractable hydrocarbons soxhlet extraction - GC/FID	C <sub>11</sub> -C <sub>60</sub>	≤1000 mg/kg	as per specific approval <sup>2</sup>
Microtox® <sup>3</sup>		pass	not required

**Legend:**

- <sup>1</sup> Sodium Adsorption Ratio analysis is not required if the total sodium ion concentration is less than or equal to 500 mg/L and E.C. is less than or equal to 2 dS/m.
- <sup>2</sup> Specific disposal method described in ML2 have specific waste acceptance or disposal criteria prescribed by Saskatchewan Energy and Mines.
- <sup>3</sup> Microtox bioassay pass means Microtox EC50(15) ≥ 75%.

# FORM A-2: NOTIFICATION OF FLOWBACK FLUID AND FRAC SAND DISPOSAL

1. WELL INFORMATION										
OWNER NAME							Well Licence Number:			
Well Licensee:										
Surface Location:	LX	LSD	SEC	TWP	RGE	MER	Disposal Date:	DATE	MONTH	YEAR
2. COMPANY INFORMATION										
OPERATOR CONTACT							CHOOSE THE APPROPRIATE SEM FIELD OFFICE TO SUBMIT FORM			
							<input type="checkbox"/> AREA 1 LLOYDMINSTER			
COMPANY NAME							<input type="checkbox"/> AREA 2 KINDERSLEY			
							<input type="checkbox"/> AREA 3 SWIFT CURRENT			
PHONE NUMBER							<input type="checkbox"/> AREA 4 ESTEVAN FAX			
EMAIL ADDRESS										
3. FRAC FLUID SYSTEM INFORMATION										
FRAC FLUID SYSTEM TYPE			ADDITIVE INFORMATION				CONTAINMENT FEATURES			
<input type="checkbox"/> WATER BASED			<input type="checkbox"/> OIL				<input type="checkbox"/> OPEN TOP TANK			
<input type="checkbox"/> FOAM			<input type="checkbox"/> ACID				<input type="checkbox"/> ENCLOSED TANK			
<input type="checkbox"/> MIXED-BASED			<input type="checkbox"/> METALS				TANK SPACING			
<input type="checkbox"/> CROSSLINKED			<input type="checkbox"/> TDGR DANGEROUS GOODS				<input type="checkbox"/> 23 METRES FROM WELL HEAD			
<input type="checkbox"/> POLYEMULSION			<input type="checkbox"/> AECB REGULATED MATERIAL				<input type="checkbox"/> 45 METRES FROM WELL HEAD			
<input type="checkbox"/> OIL BASED										
4. FLOWBACK FLUID DISPOSAL INFORMATION					5. FRAC SAND DISPOSAL INFORMATION					
TOTAL FLUIDS VOLUME					TOTAL FRAC SAND VOLUME					
$m^3$					$m^3$					
DISPOSAL METHOD			WPF/MRO		DISPOSAL METHOD			WPF/MRO		
<input type="checkbox"/> WASTE PROCESSING FACILITY					<input type="checkbox"/> WASTE PROCESSING FACILITY					
<input type="checkbox"/> COMPANY OWNED DISPOSAL WELL					<input type="checkbox"/> ML1 DISPOSAL					
SPECIFY LOCATION & MRO NO.:					<input type="checkbox"/> MUNICIPAL LANDFILL (SPECIFY MUNICIPALITY)					
					<input type="checkbox"/> NON-SEM APPROVED LANDFARM (SPECIFY COMPANY)					
					<input type="checkbox"/> OTHER METHOD (SPECIFY)					
					SPECIFY: _____					
<input type="checkbox"/> 3RD PARTY DISPOSAL WELL					<input type="checkbox"/> ML2 DISPOSAL					
pH: _____					<input type="checkbox"/> COMMERCIAL LANDFILL (COMPANY AND LOACTION)					
FLASH POINT: _____ °C					<input type="checkbox"/> SEM APPROVED LANDFARM (SPECIFY WPF NO.)					
SPECIFY LOCATION & MRO NO.:					<input type="checkbox"/> RSD METHOD (SUBMIT FORM A-1)					
					<input type="checkbox"/> OTHER METHOD (SPECIFY)					
					SPECIFY: _____					
6. FRAC SAND ANALYTICAL INFORMATION FOR ML1 AND ML2 DISPOSAL METHOD										
pH			SODIUM ADSORPTION RATIO			TOTAL EXTRACTABLE HYDROCARBON				
						$mg/kg$				
ELECTRICAL CONDUCTIVITY			FLASH POINT			MICROTOX				
$dS/m$			$^{\circ}C$			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL				
7. CERTIFICATION INFORMATION										
The operator shall submit this form within 30 days of completion of the frac operation as part of the frac report.										
I hereby certify that I am authorized to represent the above mentioned well licensee and I certify that the information submitted herein application is correct and accurate to the best of my knowledge. I understand that if the flowback fluid and/or frac sand is/are disposed incorrectly (disposed in a manner contrary to this guideline, other applicable waste management guidelines or applicable regulatory/legislative requirements) the well licensee will be responsible to implement mitigative measures prescribed by Saskatchewan Energy and Mines.										
NAME (PRINT):					SIGNATURE:					