



Hydraulic Fracturing Chemicals: An Overview

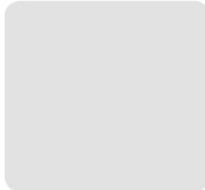
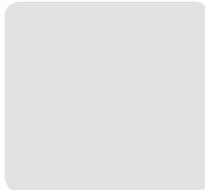
July 2, 2014

Presenter:

Jason Winegarden

District Technical Manager

Jane Lew, WV



MISSION ZERO

Nabors is committed to the safety of our employees worldwide. We strongly believe that all our global operations can and must achieve our goal of zero incidents. We expect every Nabors employee to share this commitment as a condition of employment.



Anthony G. Petrello
Chairman, President & CEO

MISSION
ZERO



Safer,
Smarter –
Incident Free

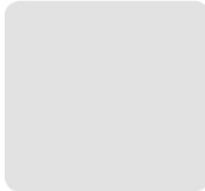
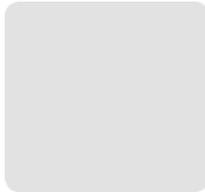
Safety Moment: Distracted Driving

- > The only thing you should be doing while you're driving is DRIVING.
- > Do not make a call, text, apply makeup, eat, or do anything other than focus on driving.
- > If any of these must be done, pull safely off the road before doing them.



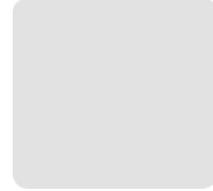
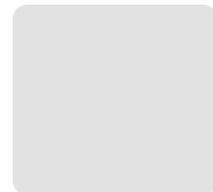
Typical Fracturing Fluid Components

- > WATER – Fresh, Produced, Flowback
- > Proppant (sand) – Holds fracture open once created
- > Acid – Dissolves minerals, helps initiate fracture
- > Corrosion Inhibitor – Protects steel components from acid corrosion
- > Viscosifier – Helps keep sand suspended during placement (guar)
- > Friction Reducer – Reduces amount of pumping “power” required (polyacrylamide)
- > Crosslinker – Additional viscosification for sand suspension (borax, boric acid)



Typical Fracturing Fluid Components (cont.)

- > Breaker – Allows for delayed breakdown of viscosifiers and friction reducers to lower viscosity over time
- > Bactericide – Disinfects water prior to being pumped
- > Clay Control – Keeps clay minerals from swelling and migrating (sodium chloride, potassium chloride, choline chloride)
- > Scale Control – Prevents scale deposition in well
- > Iron Control – Prevents solid iron deposition in well



Green Checklist

Green Screen Green Chemical Characteristics



Company Name:	<i>Nabors Completion & Production Services, Co.</i>
Product Name:	<i>WFR-3B</i>
Product Code:	<i>35-470-1300</i>
Application:	<i>Friction Reducer</i>
Manufacturer or Supplier:	<i>Nabors Completion & Production Services, Co.</i>
Dosage:	<i>0.5 to 1.5 gpt</i>
ECOTOX SUMMARY	
Biodegradable	<i>Readily biodegradable</i>
Bioaccumulation	<i>Not expected</i>
Aquatic Toxicity (fish)	<i>0 = minimal</i>
Aquatic Toxicity (crustacean)	<i>0 = minimal</i>
Aquatic Toxicity (Algae)	<i>0 = minimal</i>
Mammalian and/or human toxicity	<i>0 = None Anticipated</i>

Green Checklist



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Manufacturer or Supplier:	<i>Nabors Completion & Production Services, Co.</i>
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REGULATORY SUMMARY	
Persistent Bioaccumulative Toxic (PBT) per EPA	<i>No PTBs per EPA</i>
Safe Drinking Water Act Regulated Contaminants	<i>No SDWA contaminants</i>
Clean Water Act Priority Pollutants	<i>No CDA Priority Pollutants</i>
Hazardous Air Pollutants per EPA	<i>No HAPS</i>
Ozone Depleting Chemicals (ODCs)	<i>No ODC's</i>
Halogenated Organic Compounds (40CFR268)	<i>No Halogenated organic compounds</i>
Carcinogenic, Mutagenic or Teratogenic	<i>No known or suspected chemicals</i>
Petroleum Products per EPA Oil Pollution Act	<i>No EPA OPA products</i>
Resource Conservation Recovery Act (RCRA) "listed" waste chemicals	<i>No RCRA Listed Waste Chemicals</i>

Green Checklist



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Product Name:	<i>WFR-3B</i>
Product Code:	<i>35-470-1300</i>
Application:	<i>Friction Reducer</i>
Manufacturer or Supplier:	<i>Nabors Completion & Production Services, Co.</i>
Dosage:	<i>0.5 to 1.5 gpt</i>
REGULATORY SUMMARY	
Environmentally Hazardous Substances or Reportable Quantity (RQ) chemicals per SARA Section 304.	<i>No EHS or Section 304 RQ Chemicals</i>
SARA Section 313, Toxic Release Inventory (TRI) Chemicals	<i>No Section 313 RQ chemicals</i>
Extremely Hazardous Substances per SARA Section 302.	<i>No Section 302 substances</i>
Clean Air Act, Section 112r, Risk Management Program (RMP) Chemicals	<i>No RMP Chemicals</i>
OSHA Highly Hazardous Chemicals, Process Safety Management (PSM) Chemicals	<i>No PSM Chemicals</i>
OSHA Toxic Air Contaminant Chemicals	<i>No OSHA Air Toxic Chemicals</i>
Department of Homeland Security (DHS) Chemicals of Interest	<i>No DHS Chemicals</i>
SUSTAINABILITY SUMMARY	
Naturally-Derived and/or Renewable Ingredients	<i>Ethoxylated compounds are renewable and can be produced from animal or plant fats</i>

Material Safety Data Sheets



515 W. Greens Road,
Suite 1100
Houston, TX 77067

WFR-3B

MATERIAL SAFETY DATA SHEET

FOR EMERGENCY ASSISTANCE
CALL: INFOTRAC at 1-800-535-5053

FOR ADDITIONAL INFORMATION
CALL: 724-248-1001

SECTION 1: PRODUCT IDENTIFICATION

PRODUCT NAME: **WFR-3B**
CHEMICAL DESCRIPTION: Proprietary Blend
PRODUCT CLASS: Specialty
MSDS REVISION: 09-27-12

SECTION 2: INFORMATION ON INGREDIENTS

Chemical Name	CAS #	Weight %	OSHA PEL	ACGIH TLV
Hydrotreated light distillates (petroleum)	64742-47-8	20-50	TWA: 500 ppm	TWA: 100 ppm
Ethoxylated alcohols	68551-12-2	1-15	None established	None established
Ethoxylated oleylamine	26635-93-8	1-5	None established	None established

SECTION 3: HAZARDS IDENTIFICATION

*****EMERGENCY OVERVIEW*****

Viscous, pale off-white liquid with a hydrocarbon odor.

Warning!

May cause irritation to eyes and skin.

Harmful if ingested or inhaled.

Slippery when wet and may create a slip and fall hazard, therefore avoid contact with water.

PRIMARY ROUTES OF ENTRY: Eye contact, skin contact, absorption, ingestion, and inhalation

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing conditions of the eyes, skin, respiratory system, central nervous system, liver or kidneys may be aggravated by over exposure to this product.

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

PRODUCT: WFR-3B

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: Contact may cause eye irritation with tearing, redness, and swelling.

SKIN CONTACT: Contact may cause skin irritation. Symptoms may include itching, redness, inflammation, a burning sensation and dryness. Repeated or prolonged skin contact can cause dermatitis.

INGESTION: Ingestion of the product component, hydrotreated paraffinic solvents, may be harmful or fatal, causing irritation of the gastrointestinal tract and central nervous effects. Symptoms may include a burning sensation of the mouth and esophagus, nausea, headache, vomiting, dizziness, drowsiness, loss of consciousness, and other central nervous effects.

INHALATION: Inhalation of the vapors of hydrotreated paraffinic solvents may cause central nervous system depression with symptoms that include dizziness and euphoria leading to unconsciousness in severe cases. Vapors may irritate the respiratory tract. Symptoms may include coughing, difficult breathing, and chest pain.

SUBCHRONIC, CHRONIC: No information on this product is available. Information on the components is: Chronic exposure to hydrotreated light distillates (petroleum) may lead to central nervous system complications, and dermatitis. Animal studies have indicated the potential for liver and kidney damage. Prolonged or repeated skin contact may produce skin irritation and inflammation.

CARCINOGENICITY:

NTP: No ingredients listed in this section

IARC: No ingredients listed in this section

OSHA: No ingredients listed in this section

SECTION 4: FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eye lids occasionally to ensure complete rinsing. Seek medical attention immediately.

SKIN CONTACT: Immediately wash skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Seek medical attention if irritation occurs. Wash clothing before reuse. Thoroughly clean shoes before reuse.

INGESTION: This product may present an aspiration hazard. If swallowed, vomiting may occur spontaneously, but **DO NOT INDUCE VOMITING**. If vomiting occurs, keep head below hips to prevent aspiration into the lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

PRODUCT: WFR-3B

INHALATION: If inhaled, remove victim to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, have a trained medical person give oxygen. Seek medical attention.

SECTION 5: FIRE-FIGHTING MEASURES

FLASHPOINT: >200 °F (>93 °C), ASTM D93 Pinsky-Martens Closed Cup

FLAMMABLE LIMITS IN AIR (% by VOLUME): Not available

AUTO-IGNITION TEMPERATURE: Not available

EXTINGUISHING MEDIA: Use water fog or fine spray, carbon dioxide, dry chemical, or foam. Do not use a direct water stream. It will spread the fire.

FIRE-FIGHTING INSTRUCTIONS: Exercise caution when fighting any chemical fire. A self-contained breathing apparatus and protective clothing are essential. Keep fire exposed containers cool by spraying with water.

FIRE & EXPLOSION HAZARDS: Spills of this product produce extremely slippery surfaces. Spills of organic liquids on hot fibrous insulations may lead to lowering of the auto ignition temperatures possibly resulting in spontaneous combustion. Containers may explode when involved in a fire. Toxic gases and vapors may be released in a fire.

DECOMPOSITION PRODUCTS: Thermal decomposition or combustion may produce ammonia, carbon dioxide, carbon monoxide, and nitrogen oxides. Hydrocarbons, aldehydes and lactic, pyruvic, and acetic acids may also be formed.

NFPA CODES:

Health = 1 Flammability = 1 Reactivity = 0
Hazard Rating Scale: 0-Minimal; 1-Slight; 2-Moderate; 3-Serious; 4-Severe

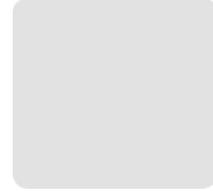
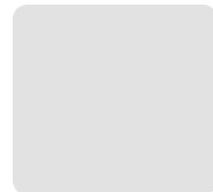
SECTION 6: ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTION: Where exposure is not known, wear self-contained breathing apparatus. Ventilate the area of the leak or spill. Wear impermeable boots, in addition to personal protective equipment specified in Section 8. Isolate the hazard area and keep unnecessary and unprotected personnel from entering the area.

METHODS FOR CLEANING SPILLS: Do not flush with water. Contain and recover the liquid when possible. Collect the liquid in an appropriate container, then absorb the residue with an inert material (e.g. vermiculite, dry sand, earth), and place the used absorbent in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to the sewer! After cleaning, flush away traces with water. If slipperiness remains, apply more dry-sweeping compound.

FracFocus 2.0 Chemical Disclosures

- > Central location for service companies and operators to disclose chemical use
- > Workflow optimized with FracFocus 2.0 such that service company can complete all forms, submit online and operating company can approve submission
- > Adds value to the process, just as many opportunities for review while minimizing opportunities for data entry error/loss while changing hands



FracFocus 2.0 Chemical Disclosures

Hydraulic Fracturing Fluid Product Component Information Disclosure

Job Start Date:	5/6/2014
Job End Date:	5/6/2014
State:	Virginia
County:	Dickenson
API Number:	45-051-12710-00-00
Operator Name:	Range Resources Corporation
Well Name and Number:	VC-530384
Longitude:	-82.24012500
Latitude:	37.07854000
Datum:	NAD83
Federal/Tribal Well:	NO
True Vertical Depth:	2,380
Total Base Water Volume (gal):	39,438
Total Base Non Water Volume:	1,647,900



Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Water	Range Resources	Base/Carrier Fluid	Water	7732-18-5	100.00000	60.60408	
Nitrogen	Nabors Completion & Production Co.	Base Fluid	Nitrogen	7727-37-9	100.00000	22.44201	
Sand	Nabors Completion & Production Co.	Propping Agent	Crystalline Silica	14808-60-7	100.00000	13.35613	
HCl	Nabors Completion and Production Co.	Acid - HCl	Water	7732-18-5	85.00000	2.47729	
			Hydrochloric Acid	7647-01-0	15.00000	0.43717	
Super Scale Control 2040	Nabors Completion & Production Co.	Scale Inhibitor	Sodium polyphosphate	88915-31-1	98.00000	0.18531	
			Tetrasodium 1-hydroxy-ethylidene-1, 1-diphosphonic acid	3794-83-0	25.00000	0.04727	
Super 100 NE	Nabors Completion & Production Services Co.	Foamer	isopropyl Alcohol	67-63-0	40.00000	0.07253	
			Methyl Alcohol	67-56-1	15.00000	0.02720	

FracFocus 2.0 Chemical Disclosures

			N-Cocoamidopropyl-N, N-dimethyl-N-2-hydrox	58139-30-0	15.00000	0.02720
			2-Butoxyethanol	111-76-2	5.00000	0.00907
Super-Flo RPM	Nabors Completion & Production Services Co.	Solvent-Surfactant				
			Proprietary Solvent	Proprietary	40.00000	0.02637
			N-Methyl Pyrrolidone	872-50-4	30.00000	0.01978
			D-Limonene	5989-27-5	20.00000	0.01318
			isopropyl Alcohol	67-63-0	20.00000	0.01318
			Nonionic Surfactant	Proprietary	20.00000	0.01318
WFR-3B	Nabors Completion & Production Co.	Friction Reducer				
			Hydrotreated light distillates (petroleum)	64742-47-8	50.00000	0.05888
			Ethoxylated alcohols	68551-12-2	15.00000	0.01768
			Ethoxylated oleylamine	26635-93-8	5.00000	0.00589
ICP-1000LT	Nabors Completion & Production Services Co.	Iron Control				
			Proprietary Mixture	Proprietary	100.00000	0.07012
ClayTreat LT	Nabors Completion & Production Services Co.	Clay Control				
			Proprietary Mixture	Proprietary	100.00000	0.06592
Breaker FR	Nabors Completion & Production Services Co.	Fluid Breaker				
			Aliphatic acid	Proprietary	20.00000	0.00369
			Ferrous Sulfate, heptahydrate	7782-63-0	20.00000	0.00369
Acid Inhibitor 2	Nabors Completion & Production Services Co.	Acid Inhibitor				
			Propargyl Alcohol	107-19-7	30.00000	0.00089
			Glycol Ether	111-76-2	30.00000	0.00089
			isopropyl Alcohol	67-63-0	30.00000	0.00089
KR-153SL	Nabors Completion & Production Services Co.	Biocide				
			Polyethylene glycol	25322-68-3	50.00000	0.00037
			2,2-Dibromo-3-Nitropropionamide	10222-01-2	20.00000	0.00015

Ingredients shown above are subject to 29 CFR 1910.1200(j) and appear on Material Safety Data Sheets (MSDS). Ingredients shown below are Non-MSDS.

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

Note: For Field Development Products (products that begin with FDP), MSDS level only information has been provided.

Ingredient information for chemicals subject to 29 CFR 1910.1200(j) and Appendix D are obtained from suppliers Material Safety Data Sheets (MSDS)