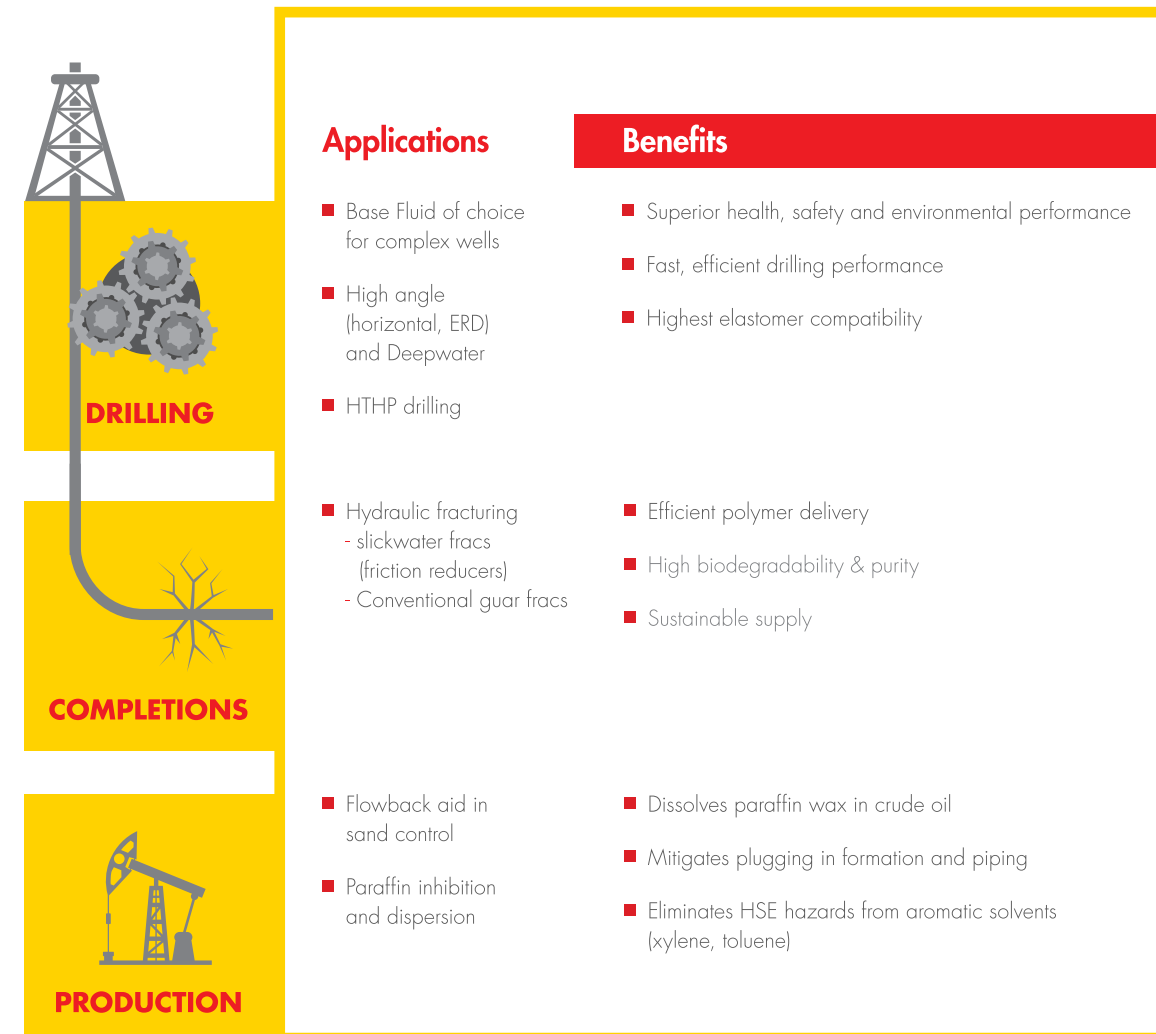


DRILLING, COMPLETIONS AND PRODUCTION BENEFITS

PURITY, SUSTAINABILITY, LEAST TOXIC, HIGHEST BIODEGRADABILITY

Shell GTL Fluid is steadily expanding into land operations following its success in offshore drilling. For over 50 years, diesel has been commonly used as a drilling base fluid in land operations. In comparison to diesel, results from a field test carried out in the United States (Permian Basin, onshore Texas) clearly showed that Shell GTL Fluid is capable of lowering **total well costs** and generating significant benefits to overall land drilling operations.¹



TOTAL WELL COSTS

GTL FLUID LOWERS TOTAL WELL COSTS ACROSS THE WELL LIFE CYCLE

¹ American Association of Drilling Engineers Comparison of GTL Synthetic versus Diesel Muds in Permian Drilling Operations

HEALTH SAFETY AND THE ENVIRONMENT

OUTSTANDING ENVIRONMENTAL PROPERTIES

Shell GTL Fluid is classified as a synthetic base fluid (SBF, Group III: low to negligible aromatic content) for Non-Aqueous Drilling Fluid (NADF) mud formulations under the definitions provided by the International Association of Oil and Gas Producers (IOGP).

PROPERTY	TEST PROTOCOL	RESULTS
Biodegradation Aerobic (freshwater) Aerobic (marine water) Aerobic (soil)	OECD 301F OECD 306 OECD 307	75% after 28d (readily biodegradable) 64% after 28d (readily biodegradable) Half-life (DT50) - 21 days (based on 1,000 mg/kg initial dose)
Water Column Toxicity Acartia tonsa Skeletonema costatum Mysidopsis bahia Pagrus auratus Daphnia magna Brachydanania rerio	PARCOM, ISO 14569 OSPAR/PARCOM US-EPA 2001 40 CFR 435 US-EPA 2003 OECD 202 OECD 203	48hr EL50: >1,000mg/L (non-toxic) 72hr EL50: >1,000mg/L (non-toxic) 96hr LC50: >1,000,000 ppm of 10% SSP (non-toxic) 7d LC50: >100,000 mg/L (non-toxic) 48hr EL50: >1,000 mg/L (non-toxic) 96hr LL50L: >1,000 mg/L (non-toxic)
Sediment Organism Toxicity Corophium Volutator	PARCOM protocol 1995 (A)	10d LC50 >20,000 mg/kg (wet basis)
Bioaccumulation Potential Octanol-water partition coefficient	OECD 117	Log Kow > 6.5 (not bioaccumulative due to poor bioavailability)



SHELL GTL FLUID IS ALSO IDEAL AS A BASE FLUID IN HYDRAULIC FRACTURING.

- The preferred health, safety and environmentally-friendly fluid for hydraulic fracturing
- No BTEX and extremely low aromatics, thus reducing harm to health and the environment
- Conductive to groundwater protection due to limited water solubility, lack of aquatic toxicity and limited soil transport
- An established carrier fluid for proppant and guar gum package in worldwide fracking operations

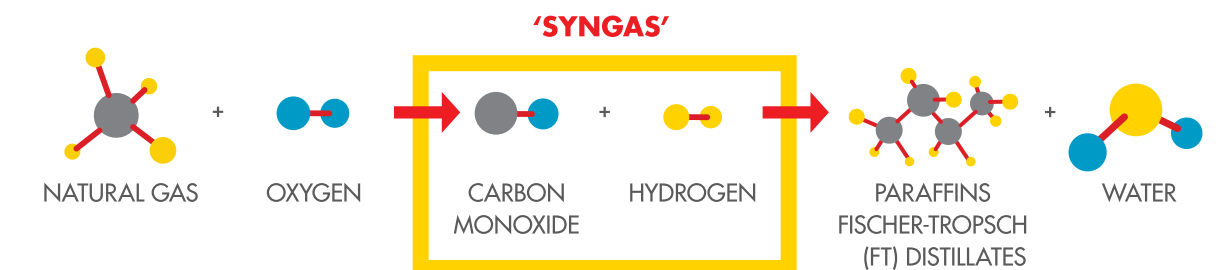
WHAT IS GTL FLUID?

Shell GTL Fluid is an innovative, non-toxic, multi-application synthetic drilling base fluid derived from natural gas. It is at the forefront in meeting drilling demands and challenges of the future in the most environmentally-friendly and safe manner - from scorching desert to subarctic temperatures, from deep water operations to high-temperature wells.

THE PROCESS

Shell pioneered the Fischer-Tropsch GTL technology in the world's first full-scale GTL plant of its kind in Bintulu, Malaysia, achieving commercial GTL production in 1993.

It is the culmination of 20 years of research into the utilisation of natural gas for the production of synthetic fuels and specialty chemicals, according to the GTL process diagram.

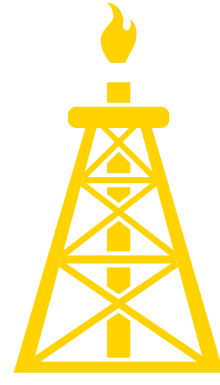


EXCELLENT DRILLING PERFORMANCE

Lower MSE for **LONGER LATERAL OPERATIONS**

GTL IMPROVES **ROP**
10-15%
over diesel

INCREASES
RIG
PERFORMANCE
IN TERMS OF
TRIPS



ENHANCED
ELASTOMER
PERFORMANCE

PERFORMANCE

SHELL GTL FLUID HAS A LOW VISCOSITY, A LOW POUR POINT AND RELATIVELY HIGH FLASH POINT, MAKING IT IDEAL FOR USE IN DRILLING IN A RANGE OF WELL CONDITIONS AND IN DIFFERENT ENVIRONMENTS.



Its low viscosity results in a better equivalent circulating density (ECD), faster rate of penetration (ROP), increased hole cleaning efficiency and lower mechanical specific energy (MSE).



It is suitable for deep water environments with mud line temperatures of 40°F or 4.4°C



Its rheological profile is relatively flat over a wide working temperature, therefore enabling better mud control while drilling with less time spent on mud conditioning, and ultimately reducing non-performing time (NPT).



It is also suitable for high-temperature high-pressure (HTHP) environments with exceptional thermal stability in borehole temperatures up to 450°F or 232°C.

GTL BASE FLUID PROPERTIES

Property	UNIT	Value	METHOD
C10-24 Paraffins	%m/m	99	GC c GC
Appearance		CSFVI ^b	Visual

Property	UNIT	Value	METHOD
Density @ 15°C	kg/m ³	781	ASTM D1298
Density @ 15°C	lbs/gal	6.52	ASTM D1298
API Gravity @ 60°F	-	50	Calculated
Flash Point, PMCC	°C	≥ 85	ASTM D93
Pour Point	°C	< -20	ASTM D97
Aniline Point	°C	95	ASTM D611
Kinematic Viscosity @ 40°C	cSt	2.9	ASTM D445
Kinematic Viscosity @ 25°C	cSt	4.0	ASTM D7042
Distillation, Initial Boiling Point	°C	200	ASTM D86
Distillation, Final Boiling Point	°C	344	ASTM D86
Vapor Pressure @ 40°C	kPa	< 0.1	Calculated
Color	Saybolt	+ 30	ASTM D156
Fractional Polarity	-	0	Calculated
Surface Tension @ 20°C	mN/m	26	-
Volatile Organic Compound (VOC)	gl	53	EPA Method 24

Property	UNIT	Value	Toxicity Classification
Biodegradation Aerobic, Marine	OECD 306 D, 28d	62%	Biodegradable
Water Column Toxicity			
Skeletonema costatum	ISO 10253, 72h EL50	> 1,000 mg/L WAF	Not toxic
Acartia tonsa	ISO T147/SC5/WG2,96h LC50	> 1,000 mg/L WAF	Not toxic
Mysidopsis bahia	US-EPA 2001 40 CFR 435 (Modified), 96h LC50	> 1,000,000 mg/L of 10% SPP	Not toxic
Terrestrial Toxicity			
Chronic Toxicity to earthworms	OECD 222, EC50	> 1,000 mg/kg	Not toxic
Terrestrial plant Test, soybean, tomato, mustard, oat, perennial ryegrass	OECD 208, EC50	990 to > 1,000 mg/kg	Not toxic
Sediment Toxicity Corophium volutator	PARCOM 10d LC50	> 49,000 mg/kg (dry)	Not toxic
Partition coefficient OECD 117	Log K _{ow}	> 6.5	May bioaccumulate
Aromatics Content PAH Content	US EPA-16 PAHs	< 1 mg/kg	

Parameters	GTL Fluid	Diesel	LTMO1	LTMO2
Total BTEX, ppm	ND	3840	ND	ND
Total Aromatics, %m	~0.02	34	~0.02	~0.03
Sulfur, ppm	~1	10-5,000	10 max	~1
OCNS Designation*	E	A	C	D

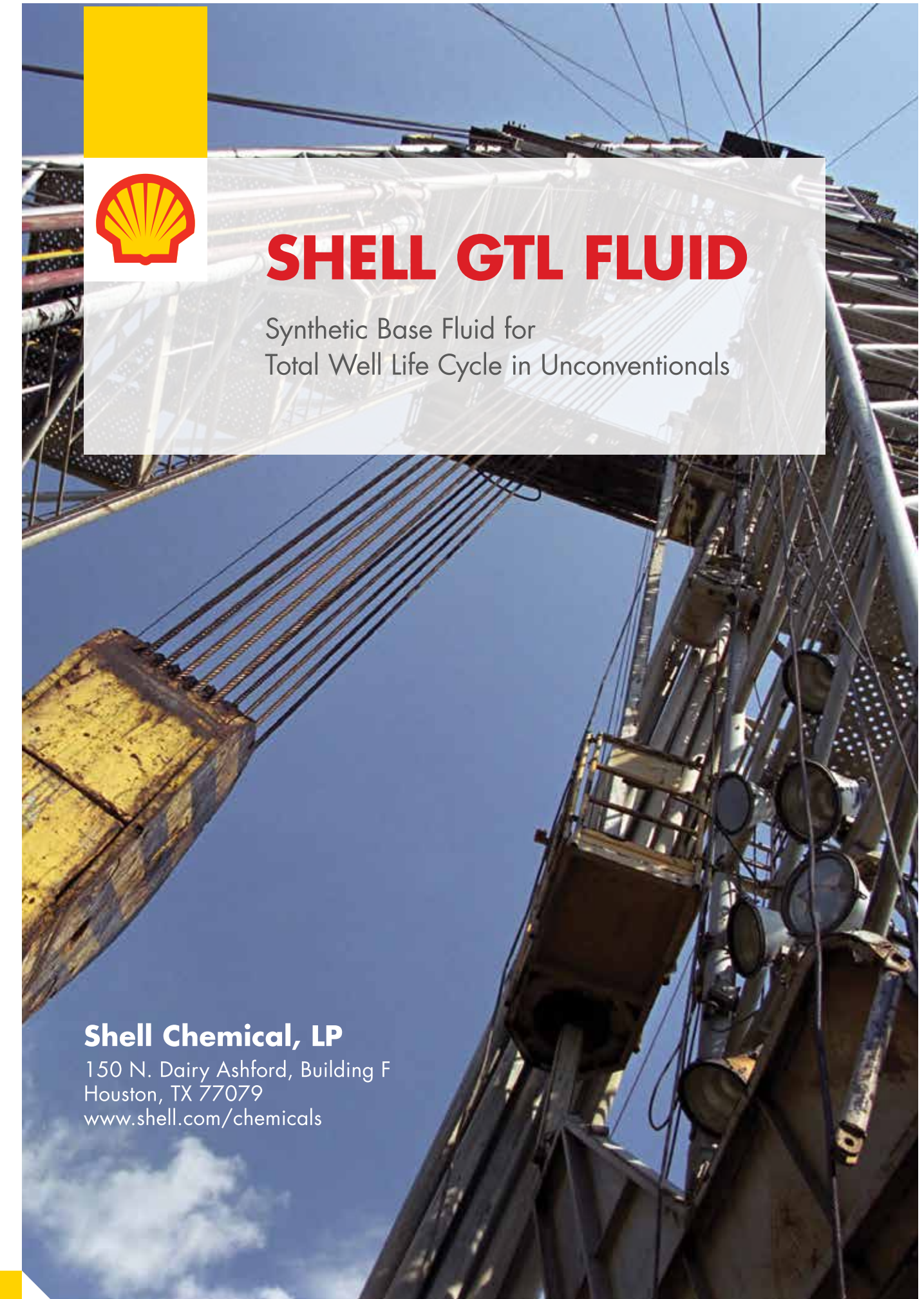
BIOREMEDIATION
When used onshore, drilled cuttings are amenable to bioremediation. Thus, the disposal of such contaminated cuttings entails less cost, and the potential for environmental liabilities is reduced due to the lack of hazardous components in the GTL drilling fluids.



LOW ECOTOXICITY
Extensive ecotoxicity tests and field trials support the view that discharge of GTL drilling fluid cuttings pose minimal environmental risk. These properties are internationally recognized, making approval for discharge permits by the regulators easier to obtain.



MINIMAL HEALTH AND SAFETY RISK
Shell GTL Fluid offers health and safety advantages based on its composition and lack of significantly hazardous components. The low mammalian toxicity (and therefore reduced health risks), reduced vapor emissions and lack of odor support the case for better industrial hygiene assessments.



SHELL GTL FLUID

Synthetic Base Fluid for
Total Well Life Cycle in Unconventionals

Shell Chemical, LP

150 N. Dairy Ashford, Building F
Houston, TX 77079
www.shell.com/chemicals