

BUSINESS UNIT  
**CHEMICALS FOR DRILLING  
AND RECOVERY**



**CATALOG OF CHEMICALS  
FOR OIL RECOVERY**



**MIRRICO**  
GROUP OF COMPANIES



**ABOUT COMPANY**

Chemicals for Drilling and Recovery Business Unit (CDR BU) deals with synthesis, customized selection, and supply of a wide spectrum of complex chemicals with high engineering content for well construction and oil recovery.

The main types of our services

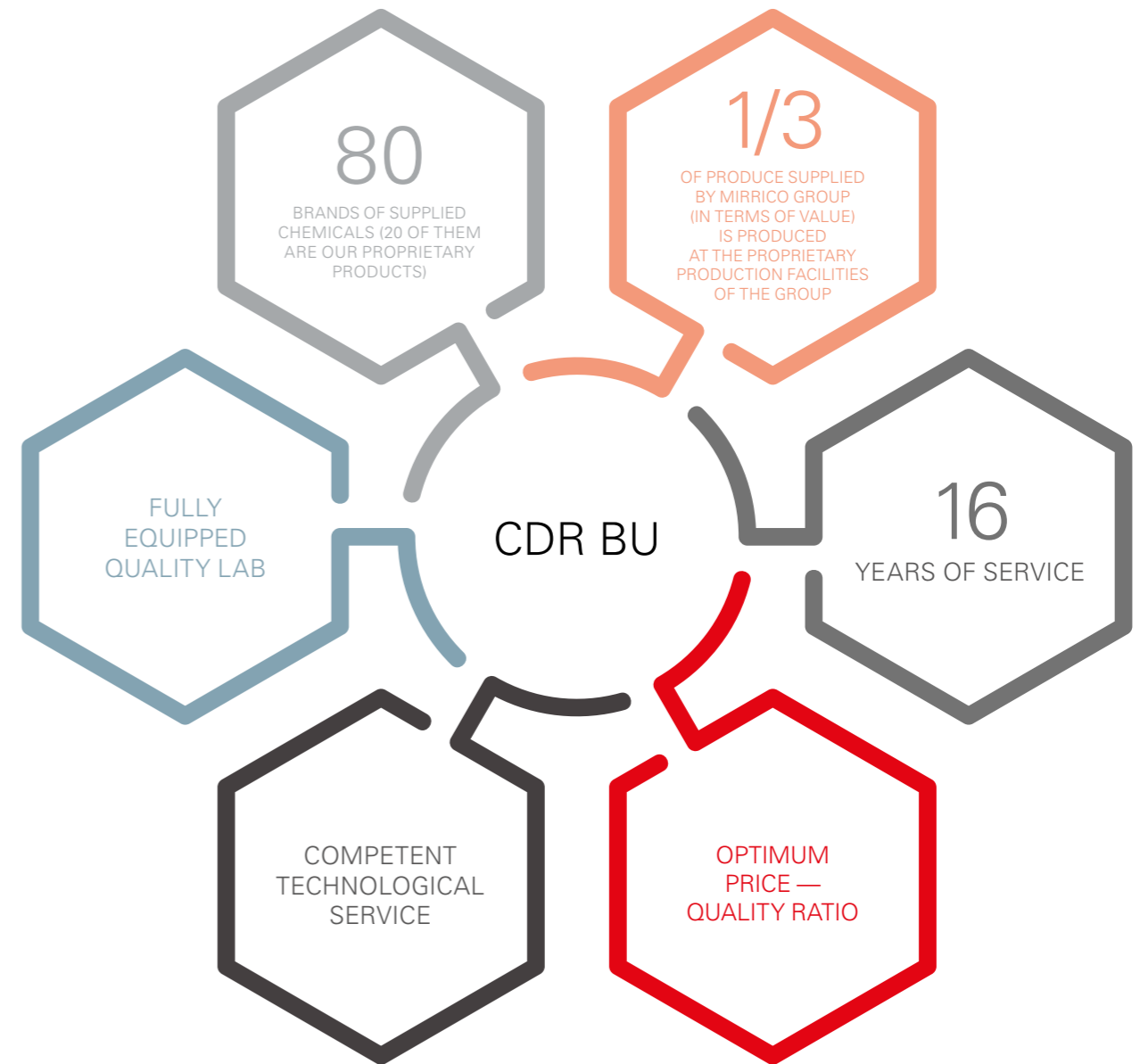
**Trading —**

selection and supply of chemicals for drilling, cementing and oil recovery of our own produce and produced by other vendors customized for the client's specific geo-technical issues and with consideration of the specific drilling conditions in Russia and the CIS countries.

**Engineering —**

designing the chemicals and process fluids for oil recovery and hydraulic fracturing, as well as technical support by the qualified process engineers who supervise the implementation of the designed chemical solution.

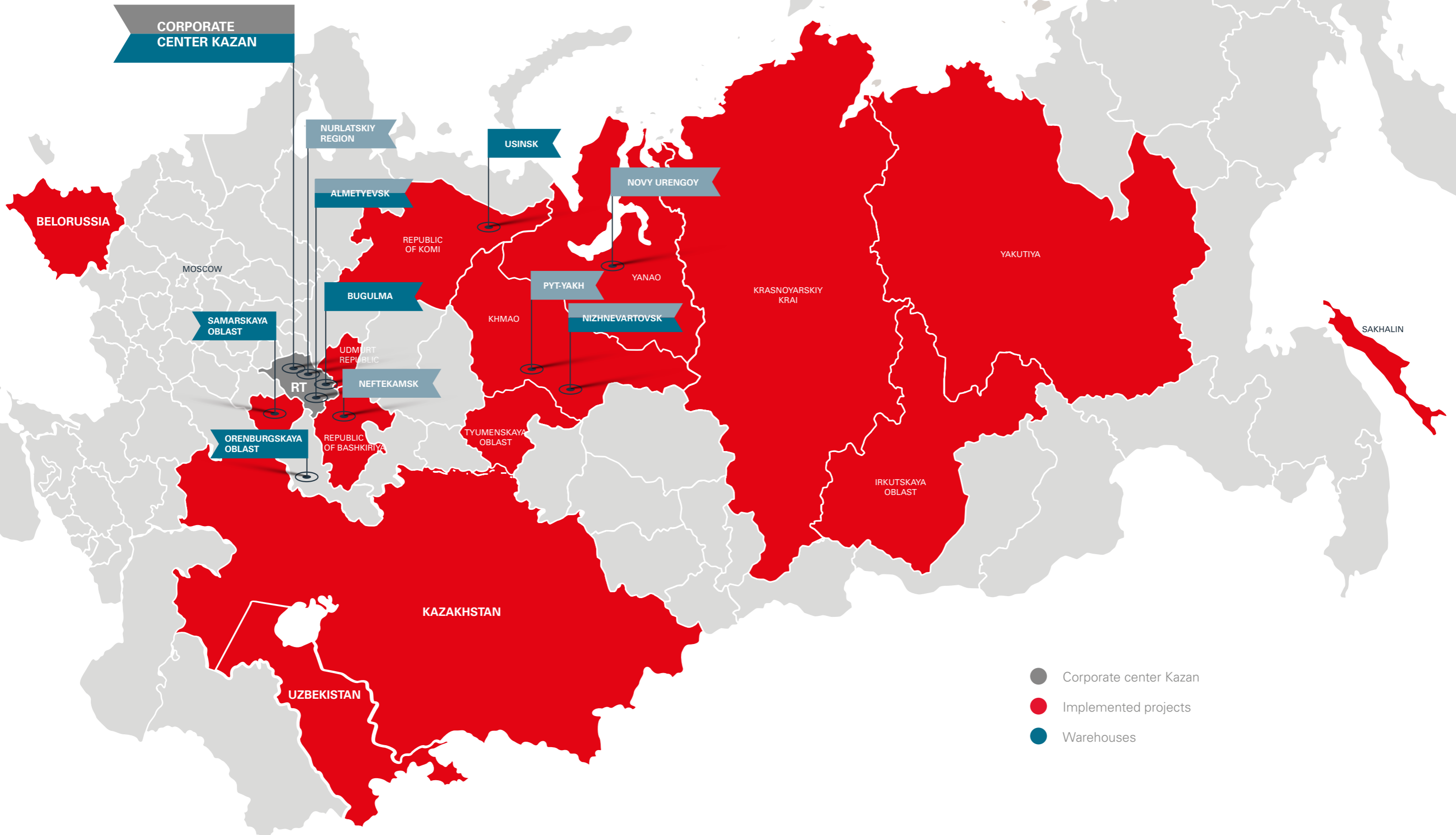
CDR BU actively develops and implements generic chemical solutions for oil recovery technologies as well as new solutions in the field of water control and high-viscosity oil recovery.



Interdisciplinary collaboration within business-areas of Mirrico Group allows to develop and offer tailored chemical solutions to our clients, as well as to adapt and to improve the efficiency of client's technological processes based on our proprietary chemical solutions.

Our network of production and storage facilities and standing stock of chemicals allow us building optimal delivery schemes and to deliver on time.

Geography of business



## Structure

### CHEMICALS FOR DRILLING AND RECOVERY BUSINESS UNIT

DEPARTMENT OF SALES OF CHEMICALS FOR WELL CONSTRUCTION (DRILLING, CEMENTING)

DEPARTMENT OF SALES OF CHEMICALS FOR OIL RECOVERY

TECHNOLOGICAL SERVICE UNIT

RESEARCH AND DEVELOPMENT LABORATORY

CONTRACTS DEPARTMENT

TECHNOLOGICAL SERVICE UNIT

## Own production facility and R&D lab



Wide range of chemicals



Modern equipment for the most up-to-date research



Quality assurance of ISO 9001:2008 standard

## Quality Management System

Quality management system of Chemicals for Drilling and Recovery Business Unit is certified according to the requirements of ISO 9001:2008 international standard.

The transition of Chemicals for Drilling and Recovery Business Unit to ISO 9001:2015 international standard is planned for the nearest future.

## Our clients



NK Rosneft' PAO



RussNeft PJSC



Regionserviceneft LLC



Scientific-Production Union Geliy



Surgutneftegaz OJSC



Eriell Group



Schlumberger Company



LUKOIL PJSC

## CHEMICALS FOR ENHANCED OIL RECOVERY (EOR)

### Polyacrylamide SEURVEY of brands R1 and R3

**Description:** powdered modified polyacrylamide with high molecular weight and medium anionic charge density.

**Usage:** during oil and gas wells construction and operation, for EOR technologies, during water shut-off operations, injection profile conformance control, in flow deviation technologies during polymer flooding. It is produced in two brands R1 and R3 depending on the usage conditions. Polyacrylamide of Seurvey R3 brand is featured by increased thermostability (up to 120°C) and salt resistance.

**Specific features:**

- The composition of Seurvey R™ provides for minimization of the polymer destruction during injection, thus improving the efficiency of its application.
- Based on used technological process it can be applied separately from cross-linking agents and together with them.

**Recommended consumption:** average concentration at injection 0.3–0.5%.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Powdery substance of white to light-yellow color
Moisture content, %	not more than 12
Bulk density at 20 °C, g/cm <sup>3</sup>	0.6–0.9
Insoluble residue, %	not more than 3.5

### Polyacrylamide DP9-8177

**Description:** powder of modified polyacrylamide with high molecular weight and low anionic charge density.

**Usage:** in technological operations of enhanced oil recovery, for injection wells profile conformance control, for modification of permeability of a porous reservoir.

**Specific features:**

- Enables to increase reservoir sweep, oil recovery efficiency, reduces the water cut in the recovered product

**Physical and chemical properties**

Indicator	Standard value
Appearance at 20 °C	Granular powder of white to light-yellow color
Base substance content, not less than %	not less than 85
Bulk density, g/cm <sup>3</sup>	0.6–0.9

### Polyacrylamide PDA-1004

**Description:** powder of modified polyacrylamide with high molecular weight and low anionic charge density.

**Usage:** in technological operations of enhanced oil recovery, for injection wells profile conformance control, for modification of permeability of a porous reservoir.

**Specific features:**

- Enables to increase reservoir sweep, oil recovery efficiency, reduces the water cut in the recovered product.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Powdery substance from white to cream in color
Molecular mass, * 10 <sup>6</sup> dalton	10–11
Base substance content, not less than %	90.0
Inherent viscosity, deciliter/gram	10.0–11.0
Bulk density, g/cm <sup>3</sup>	0.55 – 0.65

### Polyacrylamide SOFTPUSHER of NP, LP, TP brands

**Description:** Polyacrylamide SOFTPUSHER of NP brand is a high-molecular and partially hydrolyzed polyacrylamide.

Polyacrylamide SoftPusher of LP brand is a modified medium-molecular and partially hydrolyzed polyacrylamide. Polyacrylamide SoftPusher of TP brand is a medium-molecular and partially hydrolyzed polyacrylamide with increased thermostability and salt resistance.

**Specific features:**

- Very soluble. If dissolved forms viscous gels, that can cross-link with various cross-linking agents.
- Effectively blocks the flooded part of the reservoir redirecting the filtration flows.

**Usage:** Polyacrylamide SoftPusher is designed for industrial usage in oil production industry, in the enhanced oil recovery processes, aimed to reduce water cut in the recovered product within polymer flooding technology.

**Physical and chemical properties**

Indicator	Standard value		
	NP	LP	TP
Appearance at 22+3 °C	Powder of white to light-yellow color		
Moisture content, % max	12	10	12
Dynamic viscosity, cPs, min	150	120	120

## Liquid xanthan biopolymer (LXB)

**Description:** a water-based complex colloid system consisting of xanthan biopolymer, surfactant, and biocide.

**Usage:** during technological operations, aimed on enhanced oil recovery, water cut reduction, injection wells profile conformance control. Used for creation of stable blocks of xanthan biopolymer in the water saturated part of the reservoir. It is pumped into the injection wells where it blocks the flooded areas of the reservoir thus improving the reservoir sweep.

**Specific features:**

- Can be used in fresh and highly mineralized environments.
- It is a ready-to-use concentrate, which does not require dispersing of the polymer in the medium.
- Biologically degradable without forming harmful substances.

**Physical and chemical properties**

Parameter	Values for LXB-1
Appearance	Semitransparent liquid from white to pale yellow in color
Solution density at 20 °C, g/cm <sup>3</sup>	0.999–0.997
pH value of the solution	6–8
Solution dynamic viscosity, MPa*sec	4–8
Product homogeneity	Absence of undissolved particles of the polymer

## Water solution of chrome acetate

**Description:** 50% water solution of chrome acetate.

**Usage:** used as cross-linker of water-polymer systems based on polyacrylamides and natural polysaccharides, enhanced oil recovery, remedial cementing, injection wells profile conformance control.

**Specific features:**

- Compatible with the majority of commonly used gelling compounds (based on polyacrylamides and polysaccharides).
- Facilitates formation of stable elastic gels.
- Speed and dynamics of the cross-linking process can be managed by varying the concentration.

**Recommended consumption:** batch up into the injected process liquid in concentrations of 0.01-0.1%.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Liquid of dark green color
Mass fraction of chrome (III), %	11.2–11.8
Mass fraction of chrome acetate (III), %	49.3–51.9
Hydrogen ions activity, pH, within the range	3–4

## Multifunctional surfactant ATREN-SA

**Description:** compositions of non-ionic surfactants and stabilizing additives.

**Usage:** within process liquids for drilling-in and completion of the producing layer. Atren SA functions in a wide range of formation conditions, it is also resistant to poly-mineral aggression.

**Specific features:**

- Effectively reduces boundary tension between the phases, has good washing effect.
- Enables to increase the return production rate of the reservoirs.
- Compatible with a wide range of formation conditions and mud compositions for drilling-in the producing layers.

**Recommended consumption:** the concentration of the chemical is determined based on lab and industrial testing, but on the average, it ranges between 0.5 and 5 kg/m<sup>3</sup>.

**Physical and chemical properties**

Parameter	Standard value	
	for SA-1 brand	for SA-2 brand
Appearance	Transparent colorless liquid	
Density at the temperature of 20 °C	1.06–1.11	
Solidification temperature, °C max	-30	-15
pH value	6–10	
Cinematic viscosity at 20 °C, mm <sup>2</sup> /sec max.	36–47	

## Emulsifier CLEAVE of C and R brands

**Description:** a composition of non-ionic surfactants with an organic solvent.

**Usage:** for preparation of inverted emulsions, that are used for injection wells treatment during conformance control operations as well as for preparation of well-killing fluid. Produced in the form of concentrate (brand C) or in the form of hydrocarbon-based solution (brand R).

**Specific features:**

- Forms stable (even at high temperatures) emulsions that can be applied in various EOR technologies.

**Recommended consumption:** to prepare the emulsion, CLEAVE™ of C brand needs to be mixed with hydrocarbon phase and treated water should be added to the mixture while stirring or water should be added to CLEAVE™ of R brand. The dosage depends on the specific conditions of the process. For the additional increase of inverse emulsion stability, it is recommended to add calcium chloride to the water phase.

**Physical and chemical properties**

Parameter	Standard value	
	for C brand	for R brand
Appearance at 20 °C	Homogeneous oily viscous liquid from light brown to brown in color	
Density at the temperature of 20 °C	0.85–1.10	0,80–1.02
Solidification temperature, °C, max	-10	-30
Acid value, mg KOH/g, min	40.0	20.0

## CHEMICALS FOR WATER SHUT-OFF

### SEURVEY RPM relative permeability modifier

**Description:** a polymer gel on hydro-alcoholic base.

**Usage:** used in oil industry for reduction of the water cut in the product recovered from producing wells: due to absorption on the surface of channels in the porous reservoir blocks influx of hydrophilic fluid (water) and does not block the influx of oil.

**Specific features:**

- Causes selective impact on the reservoir rock, interreacting only with water bearing part without impact on the oil saturated part of the reservoir rocks.
- Reduces water relative permeability of the reservoir rocks.
- Effective in a wide range of temperatures (up to 120°C).
- Easy-to-use during water shut-off operations.
- Compatible with chemicals for hydraulic fracturing, reduces the risk of water cut increase when used in hydraulic fracturing operations.

**Recommended consumption:** 5–12% depending on usage conditions.

#### Physical and chemical properties

Parameter	Standard value	
	for W brand	for S brand
Appearance	Opalescent homogeneous liquid, from colorless to yellow in color	
Solidification temperature, °C, max	-15	-5
Density at 20 °C, g/cm <sup>3</sup>	1.00–1.12	1.02–1.16

### Water-swellaable polymer SEURVEY R2

**Description:** partially cross-linked polyacrylamide able to increase its volume multifold due to water binding.

**Usage:** to prepare hydrocarbon based water-absorbing compositions that are used for controlling severe circulation loss zones, to tackle water shows during remedial cementing and drilling operations. Insulating compositions based on SEURVEY R2™ absorb water or water solutions and hold them within their structure even at high pressures. During interreaction of the chemical with water the polymer particles gain volume and thus they stay within the pores blocking them.

**Recommended consumption:** in the compositions for controlling the circulation losses — 20–30%, depending on conditions. Diesel fuel can be used as a carrier fluid.

#### Physical and chemical properties

Parameter	Standard value
Appearance	Crystalline matter from white to light yellow in color with medium to big size of crystals
Moisture content, % max.	12
Bulk density, g/cm <sup>3</sup>	0.7–1.0
Unloaded absorptive capacity, 'water/'chemical, min	150.0

### Gelling agent ATREN WSO

**Description:** multicomponent polymer based product with addition of surfactants in hydrocarbon thinner.

**Usage:** in selective water shut-off technologies in flooded oil producing wells. At interreaction with formation water, a stagnant, resin-like mass is formed which blocks further filtering of water to the wellbore. It is also used in the technologies of injection profile conformance control. The effect of the chemical is based on ability to form stable gels with adjustable viscosity in the water solutions, that selectively block the flooded highly permeable interlayers, thus improving the reservoir sweep.

**Specific features:**

- Selective treatment of the producing interval during the remedial cementing operations without use of mechanic insulation systems.
- Rapid and complete solubility of the gelling agent in the injected water flow of any mineralization.
- Additional input of cross-linking components into the system is not required.
- Resistivity of the formed polymer system to the mechanical impact.
- Easy breaking of the cross-linked polymer system. If necessary, the produced gel can be broken by the water solutions of chlorine hydride.

**Recommended consumption:** in the technologies water shut-off: mixing of ATREN WSO chemical with hydrocarbon based thinner in 1:1 ratio. In conformance control technologies 10–25 l. ATREN WSO on 1 m<sup>3</sup> of process water.

#### Physical and chemical properties

Parameter	Standard value
Appearance at 22 °C	Suspension from light brown to dark brown in color. Allowable stratification is not more than 10% of the total volume.
Density at 20 °C	0.9–1.2
Brookfield viscosity at 20 rpm, 25 °C, cPs, min	2,000

### Chemical for selective water shut-off SEURVEY EM

**Description:** partially hydrated high-molecular polymer dispersed in organic thinner.

**Usage:** used in water shut-off technology for reduction of water cut in the produced oil. The function principle of the chemical is based on ability to form stable viscoelastic system at contact with formation water.

**Specific features:**

- Thermostable, thins down at contact with oil.
- Low consumption of the chemical per 1 m<sup>3</sup> of formation water.
- Can be degraded by standard breakers.

#### Physical and chemical properties

Parameter	Standard value
Appearance	Liquid from white to pale greenish in color
Base substance content	39–41%
Density	1.03–1.06 g/cm <sup>3</sup>
pH	6–9.6
Congelation temperature	Above – 20 °C
Viscosity at 10 rpm (flow meter Brookfield DV-II +PRO)	1,000–1,500 cPs

## Chemical for selective water shut-off AQUALOCK of S brand

**Description:** composition of surfactants in the hydrocarbon based thinner.

**Usage:** used in selective water shut-off technologies in oil producing wells. The chemical selectively impacts the oil saturated part of the reservoir bed, lowering water cut in the recovered products. The effect of AQUALOCK is based on the spontaneous formation of stable highly viscous composition in water saturated areas of the reservoir layer which blocks the further influx of water into the well.

**Specific features:**

- Does not require additional materials for preparation of the process solution.
- Does not cause any negative impact on the oil-saturated part of the producing layer.

**Recommended consumption:** mixing of AQUALOCK with diesel fuel is done in 1:1 ratio and further mixing with formation water (with density 1.09 g/cm<sup>3</sup>) or with 25% water solution of calcium chloride in 1:1. The composition is injected into the formation and kept under pressure for 16–24 hours. After shut-in period the well is set to production mode.

**Physical and chemical properties**

Parameter	Standard value
Appearance	Homogeneous transparent liquid from light to dark brown in color
Bulk density, g/cm <sup>3</sup>	0.87±0.05
Solidification temperature, °C max	-5



## Production casing leaks curing system AQUASCREEN of BASE and LINK brands

**Description:** two-component composition: basic component — AQUASCREEN BASE is an oligomer for polycondensation of phenol and formaldehyde and AQUASCREEN solidifying agent LINK — a mixture of organic acids.

**Usage:** used in oil producing and gas producing industries, in well workover operations, during remedial cementing operations in order to cure leaking production casing which occurs during the well operation.

**Specific features:**

- Product solidification speed: the product gains strength during the period of 8–10 hours (at the downhole temperature starting from 50 °C) up to 24 hours (at the 20 °C temperature).
- The solidified product exhibits very high values of breaking strength.
- The solidified product is resistant to the impact of aggressive environments.
- The system easily adaptable to various temperature conditions.

**Recommended consumption:** the composition of AQUASCREEN BASE in mixture from 74 to 88%, AQUASCREEN LINK — from 12 to 26%. Exact component content in the mixture is determined by the well temperature for every particular use case.

**Physical and chemical properties**

Parameter	Standard value	
	BASE	LINK
Appearance at 20°±2 °C	Homogeneous liquid from red brown to cherry in color	Homogeneous liquid from light yellow to dark brown in color
Density at the temperature of 20 °C, g/cm <sup>3</sup>	1,200±0.020	
Dry residue, %, min	64	Not required
Mass fraction of alkali, %, max	2.5	Not required
Funnel viscosity at 20°±1 °C, by B3-4, sec, max	25	Not required
Acid value, mg NaOH/g	Not required	145±5





## CHEMICALS FOR ENHANCED OIL/GAS RECOVERY

### Complex additive for acid compounds KATOL of 22A brand

**Description:** a composition of the acid reaction retarder, demulsifier, corrosion inhibitor, scale inhibitor in the mixture of thinners.

**Usage:** used as a multi-component modifying additive into inhibited chlorohydric acid which is applied during bottom-hole treatment in producing and injection wells for build-up or improvement of permeability of the rocks. Application of KATOL 22A additive enables to achieve a more uniform effect on the layer during acid treatment, allowing for the acid to penetrate deeper into the oil saturated reservoir without losing the reactive capacity.

**Specific features:**

- Enables to retard the reaction velocity of chlorohydric acid with the reservoir rocks.
- Contains chelated complexing agent, which prevents formation of insoluble salts of iron and other metals during interreaction between the composition and the reservoir rocks.
- Improves the treated rocks wetting by the acid composition, improves dispersing effect of the acid on deposits of asphalts, resins, and paraffins.
- Reduces the corrosion rate of metal surfaces contacting with the acid composition injected into the well.

**Recommended consumption:** added to 12–24% inhibited chlorohydric acid in the amount of 0.5–5% in mass.

**Physical and chemical properties**

Parameter	Standard value
Appearance	Liquid, from light yellow to dark brown in color with ammonia smell
Mass fraction of the base substance, %, min	18
pH 5% water solution	not more than 4

### Complex acid composition ATREN STIM of K and T brands

**Description:** acids composition with addition of surfactants, complexing agent, metal corrosion inhibitor and acid reaction retarder.

composition is produced in two brands: ATREN STIM of K brand — for the treatment of carbonate reservoirs and ATREN STIM of T brand for the treatment of terrigenous reservoirs.

**Usage:** used in oil production industry in enhanced oil recovery technologies, in bottom-hole acid treatment operations in order to build-up or improve permeability of the reservoir. Acid composition ATREN STIM enables to carry out bottom-hole acid treatment that causes deeper penetration effect compared to standard. The acid

**Physical and chemical properties**

Parameter	Standard value	
	for K brand	for T brand
Appearance at 20 °C	Transparent liquid from colorless to light brown in color	
Mass fraction of hydrogen chloride, %, min	11	
Mass fraction of hydrogen fluoride, %, max	–	5
Corrosion rate at 20 °C, g/m <sup>2</sup> *h, max	0.20	0.23

### Demulsifier for acid compositions ATREN D-EM

**Description:** a composition based on polymeric and co-polymeric compounds in a mixture of thinners.

**Usage:** used to prevent the formation of the oil-water emulsion in the enhanced oil recovery processes; can be used within process fluids for acid treatment of wells with carbonate and terrigenous reservoirs.

**Specific features:**

- Totally compatible with the acids used in bottom-hole treatment processes.
- Effectively prevents the formation of oil-water emulsions and also breaks the already existing emulsions without causing a negative impact on consequent oil recovery processes.
- Does not cause any negative impact on the other technological features of the acid composition.
- Applied in a wide range of temperatures.

**Recommended consumption:** demulsifier content in the ready-to-use composition may vary from 0.2 to 0.5%.

**Physical and chemical properties**

Parameter	Standard value
Appearance	Homogeneous liquid from colorless to brown in color, opalescence is allow-able
Solidification temperature, °C, max	-40
pH factor (pH) of a 1% water solution at 20 °C, units	5–9

### Corrosion inhibitor for acid compositions ATREN IC

**Description:** a composition based on surfactants (alkylimidazolines, quaternary arsenical compounds) in a mixture of thinners.

**Usage:** used for protection of the equipment in enhanced oil recovery processes; can be used within process fluids for acid treatment of wells with carbonate and terrigenous reservoirs.

**Specific features:**

- Exhibits excellent absorptive features at the equipment surface.
- Effectively prevents corrosion caused by downhole environment (sour gases content) as well as by composition of the process fluid (aggressive acid solution).
- Does not cause any negative impact on the other technological features of the acid composition.

**Recommended consumption:** in the ready-to-use composition may vary from 0.1–1%.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Liquid from colorless to brown in color
Solidification temperature, °C, max	-25
Density at 20°C, g/cm <sup>3</sup>	0.9–1.1
pH factor (pH) at 20 °C, units	1.5–7.5

## Additive for acid compositions ATREN IRON

**Description:** Atren Iron is used in matrix acidizing performed to enhance oil recovery.

**Usage:** corrosion on the tubing walls, fire scale, and iron contained in formation rocks can be the source of iron during the acid job. The function principle of Atren Iron is based on the ability of the chemical to restore trivalent ions of iron (Fe+3) to bivalent ions of iron (Fe+2) which affects the ions of iron so that they cause no impact on the formation fluid.

### Specific features:

- Prevents formation of stable emulsions of interreaction of the acid with the formation rocks containing hydroxides, ferrous sulphide, and other products of interreaction of iron ions with formation fluid components.
- If polymeric acid reaction retarder is applied prevents undesired cross-linking with ions of iron.
- Effective if used for chlorohydric acid of various concentrations.
- Does not form solid sediments with formation water and formation fluids.
- Does not require additional equipment.

**Recommended consumption:** preparation process consists of adding the chemical in the concentration of 1–10 kg/m<sup>3</sup> into solution of 1–28% chlorohydric acid using the acid unit of SiN-32 type. Necessary concentration of the additive: 0.8–1.0% (5,000 ppm of iron) and 0.5–0.7% (2,000 ppm of iron).

### Physical and chemical properties

Parameter	Standard value
Appearance at 20 °C	Transparent liquid from light yellow to dark brown in color
Solidification temperature, °C, max	-50
Decoloring of acid containing 5,000 ppm of iron	Decolors



## Gelling agent for acid compositions SEURVEY of A brand

**Description:** a modified polyacrylamide used in the enhanced oil recovery processes as a thickener of acid compositions during acid treatment of bottom-hole formation zone.

**Usage:** several brands are manufactured for oil and gas wells production stimulation: Seurvey A1, Seurvey A2 and Seurvey A3. By application of Seurvey A chemical chlorohydric acid of any concentration ranging from 1% and up to 28% can be thickened.

### Особенности:

- Reduces leakage losses of acid and retards the reaction velocity.
- Enables deeper penetration of acid into the formation.
- Enables to use the chlorohydric acid more efficiently and economically.
- Due to stable viscosity, it keeps the products of interreaction of acid with rocks suspended washing them over to the surface.
- Ensures higher viscosity level at high temperatures.

### Physical and chemical properties

Parameter	Standard value		
	for A1 brand	for A2 brand	for A3 brand
Appearance at 20 °C	Powdery substance of white to light-yellow color		Liquid from colorless to white in color, opalescence allowed
Density at the temperature of 20 °C, g/cm <sup>3</sup>	0.55–0.75		0.95–1.15
Dynamic viscosity of 1% solution of the additive in 10% solution of NaCl, MPa*sec	400–650	not less than 200	
Solidification temperature, °C, max			-15



## Chemicals for self-diverting acid compositions KATOL-40

**Description:** a composition based on amphoteric surfactants in the thinner mix.

**Usage:** used in technologies of matrix acidizing performed to stimulate oil recovery.

**Specific features:**

- Selective treatment of the reservoir without application of "diverter sweeps".
- No clogging of pore volume in contrast with polymer compositions.
- Possibility to adjust the viscosity of the initial process solution.
- Thinning of viscoelastic gel at contact with oil.

**Recommended consumption:** preparation of the process solution consists of adding the chemical in 5–7.5% concentration to the 12–15% solution of chlorohydric acid using the acidizing unit of SiN-32 type.

**Physical and chemical properties**

Parameter	Standard value
Appearance	Liquid from light yellow to brown in color
Density at 20°C, g/cm <sup>3</sup>	1.00 ± 0.1
Mass fraction of dry residue, %, min	28.0–30.0



## Oil viscosity modifier SEURVEY of ORM brand

**Description:** a composition of surfactants and non-ionic polymer.

**Usage:** to improve the recovery rate of high-viscosity oil. The function of the chemical is based on interreaction of the surfactants with oil and formation of the low-viscous dispersions. Polymer components contained in the composition of the chemical form thin film at the oil product and water phase boundaries and prevent coalescence by stabilizing oil type emulsion in the water.

**Specific features:**

- It is manufactured in two brands SEURVEY ORM 1 (liquid form) and SEURVEY ORM 2 (granular form).
- Reduces the viscosity of highly viscous petroleum products (from 500 to 1,000%) at the temperature of 20 °C.

- Resistant to shear load and stands heating up to 200 °C.
- Ensures separation of oil-water emulsion within 16 hours of production seasoning.
- Can be renewed after degrading of the emulsion and used again in the process of high-viscosity oil treatment.
- Its active components are compatible with most of the used corrosion inhibitors, demulsifiers, and other chemicals.

**Recommended consumption:** periodic injection of the SEURVEY ORM viscosity modifier together with well steam treatments. Proposed concentration is 0.5–2 %.

**Physical and chemical properties**

Parameter	Standard value	
	ORM brand 1	ORM brand 2
Appearance at 20 °C	Transparent liquid, transparent precipitation allowable	Granules from to white in color
Density at the temperature of 20° +2 °C, g/cm <sup>3</sup>	1.0–1.2	0.65–0.8
Mass fraction of the base substance, %, min	4	95
Moisture content, % max	96	5

## Chemical for washing over the mechanic impurities DESANDOL of 711 brand

**Description:** a complex chemical for mechanic impurities washover control and water cut control in the produced fluids.

**Usage:** for reduction of the amount of mechanical impurities in the recovered fluids.

**Specific features:**

- Ensures stabilization of producing formation in poorly consolidated sandstone reservoirs.

- Reduces the water cut of the recovered oil.
- Reduces operational costs by increasing the run between repairs of the equipment, the electric submersible pump units first of all.

**Recommended consumption:** 4–10%, the optimum concentration is determined based on the results of pilot industrial tests.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Homogeneous liquid, from colorless to dark yellow in color
Density at 20°C, g/cm <sup>3</sup>	0.91–1.01
Kinematic viscosity at 20 °C, sq.mm/sec max	15
Solidification temperature, °C, max	-50

## CHEMICALS FOR HYDRAULIC FRACTURING

### Gelling agent GUAMIN of MV, HV, UHV, FHV brands

**Description:** dry guar polysaccharide of various viscosity and rate of hydration in water.

**Usage:** used in oil industry during enhanced oil recovery operations, remedial cementing operations, well killing and hydraulic fracturing. The chemical solutions exhibit high plastic viscosity and form strong cross-linked gels. Gelling agent FHV is featured by a high rate of hydration in water and gains up to 90% viscosity within 3 minutes.

**Specific features:**

- It exhibits good thermal and salt resistance.
- Easily cross-links with of bivalent metals (e.g. borates) thus ensuring the multi-fold increase of viscosity.
- Environment-friendly product, undergoes biological decomposition, without causing a negative impact on the reservoir.

**Recommended consumption:** 1.8–6 kg/m<sup>3</sup>.

**Physical and chemical properties**

Indicator	Standard value			
	for MV brand	for HV brand	for UHV brand	for FHV brand
Appearance at 20 °C	Powdery substance from white to cream in color			
Moisture content, % max	12			
Brookfield viscosity of 1% aqueous solution in the range, cPs (No. 3, 20 rpm, 25 °C)	5,500–7,000	7,000–8,500	8,500–9,500	7,000–8,500
Viscosity measured by Ofite Model-900 viscometer, 300 rpm, after 3–60 minutes, loading 4.8 g/dm <sup>3</sup> , cPs	35–40	40–45	44–49	40–45

### GUAMINE gelling agent of SLURRY brand

**Description:** a self-hydrating suspension in hydrocarbon thinner with high sedimentation stability.

**Usage:** used in oil industry during enhanced oil recovery operations, remedial cementing operations, well killing and hydraulic fracturing processes. The chemical solutions exhibit high plastic viscosity and form strong cross-linked gels.

**Specific features:**

- It exhibits good thermal and salt resistance.
- Easily cross-links with of bivalent metals (e.g. borates) thus ensuring the 3-fold or 4-fold increase of the gel viscosity.
- Undergoes biological decomposition without causing a negative impact on the reservoir.

**Recommended consumption:** 6–9 l/m<sup>3</sup>.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Suspension from light brown to dark brown in color. Allowable stratification is not more than 10% of the total volume
Density at 20°C, g/cm <sup>3</sup>	1.02±0.05
Solidification temperature, °C, max	-20
Viscosity*, MPa*sec, max	300

\*using Fan 35 flow meter, R1-B1-F1, 300 rpm.

### System of guar-free hydraulic fracturing fluids Ves-Frac

**Description:** the absence of polymer in the in the composition implies a totally different mechanism of the formation of the structured gel. At the dissolution of the product in water, spherical micelles are formed, the solution rheology remains the same, and viscosity does not increase. After adding the activator agent, spherical micelle structure turns into worm tube: Immediate formation of viscoelastic gel.

**Usage:** as a liquids thickener for the water-based hydraulic fracturing fluids.

**Specific features:**

- Very soluble and activates after adding salt.
- The gel degrades at contact with formation fluids.
- Applied in a wide range of temperatures.
- Exhibits excellent proppant-carrying capacity.
- Instantly reduces after unloading
- No pore volume clogging.

**Recommended consumption:** added into fresh water in 3–5% concentration and stirred until fully dissolved. Formation of viscoelastic gel is achieved by activation adding 1–3% activator agent.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20±2 °C	Liquid from yellow to dark brown in color (opalescence is allowable)
Density at 20°C, g/cm <sup>3</sup>	0.88–0.95



## Instant breaker Atren GB

**Description:** a composition based on inorganic oxidizing agent.

**Usage:** used for oxidative degradation of gels, formed during hydraulic fracturing. At temperatures above 30°C, enters into an oxidizing reaction with chains of hydrocarbons in polymer gel and destroys their structure.

**Specific features:**

- It ensures a minimum amount of insoluble residue formed as a result of destruction of guar based cross-linked gel;
- As a result of oxidizing reaction decomposes into environmentally sound substances.
- **Recommended consumption:** from 0.05 to 0.5 kg/m<sup>3</sup>.

### Physical and chemical properties

Parameter	Standard value
Appearance at 20 °C	Белый, кристаллический порошок
Mass fraction of the base substance, %, min	98
Mass fraction of insoluble residue, %, max	0.05
Bulk density at 20°C, g/cm <sup>3</sup>	0.98–1.15
pH value (1% aqueous solution)	4.0–6.0

## Liquid breakers of delayed action Atren GB of Liq series

**Description:** peroxide compound in thinner. Dual action breakers ensure more complete breaking of a cross-linked gel due to the decrease of pH system and presence of an oxidizing agent.

**Usage:** for the delayed breaking of the cross-linked gels used for hydraulic fracturing. The concentration of the breaker allows you to adjust the time required for gel decomposition.

**Specific features:**

- Temperature range of ATREN GB-Liq-LT is 60–80 °C.
- Temperature range of ATREN GB-Liq-HT 55–120 °C after adding Atren GB-A activator agent.
- Dual action breakers ensure more complete breaking of a cross-linked gel due to the decrease of pH system and presence of an oxidizing agent.

**Recommended consumption:** breakers filling from 0.2 to 3 l/m<sup>3</sup>.

### Physical and chemical properties

Parameter	Standard value
Appearance at 20 °C	Liquid, from transparent to yellow in color
Density at 20°C, g/cm <sup>3</sup>	0.860–0.880
Solidification temperature, °C, max	-25

## Capsular delayed breakers Atren GB of EN series

**Description:** strong oxidizer in a special conformal coating

**Usage:** for the delayed breaking of the cross-linked gels used for hydraulic fracturing. The concentration of the breaker allows you to adjust the time required for gel decomposition.

**Specific features:**

- Temperature range of ATREN GB-En-LT 60–75 °C.
- Temperature range of ATREN GB-En-HT 75–100 °C.

**Recommended consumption:** standard filling of the — breakers from 0.05 to 1 kg/m<sup>3</sup>.

### Physical and chemical properties

Parameter	Standard value
Appearance at 20 °C	Transparent crystals or granules
Mass fraction of the base substance, %, min	95
Mass fraction of water insoluble residue, %, max	0.03

## Activator agent for liquid delayed breaker Atren GB-A

**Description:** breaker activator agent in thinner.

**Usage:** used for activation of the liquid delayed breaker Atren-GB-Liq-HT. Enables to change the activation temperature for Atren- GB-Liq-HT breaker in the range of 55 °C to 120 °C.

**Specific features:**

- Widens the operational temperature range of the high-temperature delayed breaker ATREN GB-Liq-HT.

**Recommended consumption:** activator agent filling from 0.1 to 0.5 l/m<sup>3</sup>.

### Physical and chemical properties

Parameter	Standard value
Appearance at 20 °C	Liquid of brown color
Density at 20°C, g/cm <sup>3</sup>	1.01–1.02
Solidification temperature, °C, max	-15

## Delayed action cross-linker Atren D-BCL

**Description:** mixed composition based on the boron minerals in the organic dispersing medium. Depending on the cross-linking speed, the chemical subdivides into three brands: Atren DBCL 20, Atren DBCL 90 and Atren DBCL 240, where the 20, 90 and 240 figures refer to the average time of cross-linking of the guar gel in seconds.

**Specific features:**

- High manufacturability of the process liquids for hydraulic fracturing.
- High dispersability and hydratability of the chemical.
- Adjustable jelling time.
- High stability and sheer load capacity values.
- High efficiency despite the guar filling.

**Recommended consumption:** filling from 1.5 to 3.5 l/m<sup>3</sup>.

**Physical and chemical properties**

Parameter	Standard value		
	20	90	240
Appearance at 20 °C	Suspension from light brown to dark brown in color. Yellow tint is allowable, stratification not more than 10% of the total volume.		
Cross-linking starting time at 25 °C, sec	15–20	30–45	70–100
Dynamic viscosity, cPs, min e	200	200	200
Density, g/cm <sup>3</sup>	1.20–1.26	1.08–1.2	
Solidification temperature, below °C	-30	-20	-20

## Instant cross-linker Atren BCL

**Description:** concentrated, strongly alkaline instant cross-linker. Represents a mixed composition based on boron minerals. It is a regular solution.

**Specific features:**

- Does not require additional batching of a regulating agent pH.

**Usage:** used for instant cross-linking of the guar gel. Cross-linking time ~7 sec.

**Recommended consumption:** 0.5–1.5 l/m<sup>3</sup>.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Transparent colorless liquid
pH value	10–12
Congelation temperature, below °C	-20
Density, g/cm <sup>3</sup>	1.10–1.30

## Biocide ATREN-BIO of A and B brands

**Description:** liquid soluble biocides are designed for prevention of bacterial degrading of biopolymer water-based gels.

**Recommended consumption:** in concentration starting from 0.25 to 1 l/m<sup>3</sup>.

**Usage:** used in oil and gas industry for prevention of bacterial degrading of organic components of water-based drill-ing fluids and hydraulic fracturing fluids with biopolymers. Impact on aerobic and anaerobic types of bacteria.

**Physical and chemical properties**

Indicator	Standard value	
	Atren Bio of A brand	Atren Bio of B brand
Appearance at 20 °C	Liquid from colorless to light yellow in color without apparent mechanic impurities	Homogeneous liquid from yellow to red in color, light opalescence is al-lowable.
Density, g/cm <sup>3</sup>	1.0–1.1	1.07–1.11
Exponent of hydrogen ion activity, pH	3–7	9–12
Solidification temperature, below °C	-	Below minus 15

## Bactericide Atren Bio of P brand

**Description:** dry water-soluble bactericide packaged in 400 g water-soluble bags; designed for prevention of bacterial degrading of polysaccharide and biopolymeric water-based gels.

**Specific features:**

- Effective at very low concentrations;
- Effective against aerobic and anaerobic microorganisms.
- Dissolves in water rapidly and easily.

**Usage:** suppresses the bacterial action for most of the bacteria.

**Recommended consumption:** 2 bags are sufficient for decontamination of a 50 m<sup>3</sup> tank.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Solid crystalline matter from white to gray in color
Bulk density, g/cm <sup>3</sup>	0.65–0.85
pH factor of ion activity, pH 0.01% of water solution, units	5.5–7

## Shale inhibitor ATREN CS-135

**Description:** shale stabilizer, an additive for technological fluids used while drilling, workover operations, well completion and hydraulic fracturing of the reservoir layers.

**Usage:** used in hydraulic fracturing systems, both in traditional systems and systems using slick water.

**Specific features:**

- Does not affect cross-linking properties of hydraulic fracturing fluid.
- The product is compatible with anionic and nonionic surfactants.

**Recommended consumption:** from 1–2 liters per 1 m<sup>3</sup> of hydraulic fracturing process fluid.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20+2 °C	Transparent colorless liquid (opalescence allowed)
Density at 20+2°C, kg/m <sup>3</sup>	0.99–1.19
Hydrogen ions activity, pH, units	5–8

*\*ATREN CI, ATREN SL are shale inhibitors used in drilling fluids, but they are not applicable in hydraulic fracturing fluids.*

## Scale inhibitor DESCUM 2D 3811 C

**Description:** complex composition based on organic chelating agents with phosphonic compounds.

**Usage:** to prevent deposition of calcium carbonate and calcium sulphate on the downhole and surface oil field equipment in various salinity environments; can be injected into the reservoir together with the hydraulic fracturing fluid, thus preventing scaling on the electrical submersible pump. The function principle of scale inhibitor is based on blocking the incipient crystallization centers, suppressing the growth of salt crystals and keeping them in the solution in suspended state.

**Specific features:**

- Effective under conditions of high salinity produced waters;
- Does not contain inorganic polyphosphates;
- Does not cause negative impact on constructive materials of the oilfield equipment.
- Does not affect the oil treatment processes, the quality of commercial oil and the bottom water.

**Recommended consumption:** 100–300 g/m<sup>3</sup> directly into flowing hydraulic fracturing fluid.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Transparent liquid
Oxygen corrosion rate (steel ST-20, mm/year, max)	0.08
pH value	9

## Thermal stabilizer of the cross-linked gels ATREN TS

**Description:** a crystallohydrate, which retards the oxidizing process ensuring high rheological properties.

**Usage:** to build-up thermal stability of a cross-linked gel used for hydraulic fracturing at the temperatures above 90 °C.

**Recommended consumption:** from 1 to 4 kg/m<sup>3</sup> depending on temperature regime of injection.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Transparent crystals or granules
Mass fraction of the base substance, %, min	95
Mass fraction of insoluble residue, %, max	0.03

## Hydraulic fracturing fluid demulsifier Atren D-Em

**Description:** Atren D-Em additive is used to prevent the formation of oil-water emulsions under reservoir conditions. It is a balanced mix of polyethers in a hydrocarbon-spirit solvent.

**Usage:** added to hydraulic fracturing fluid. Does not affect its properties.

**Specific features:**

- Exhibits instant demulsifying feature in small dosage.

**Recommended consumption:** 1.5–2 l/m<sup>3</sup>.

**Physical and chemical properties**

Parameter	Standard value
Appearance at 20 °C	Liquid from light yellow to yellow in color
Solidification temperature, °C, below	below -40
Exponent of hydrogen ion activity of pH 1% water solution, within the range	8–9

## ABOUT MIRRICO GROUP



**Mirrico Group is a Russian group of manufacturing and service companies in the field of chemical solutions for industrial markets.**

Due to significant investments in research and development, unique products and technologies outperforming market analogs are created in Mirrico. Nowadays the group of companies focuses on offering consumers the best solutions at the lowest prices.

Stability and high quality of products is confirmed and guaranteed by ISO 9001:2008 quality management system, which has been implemented in all the subsidiary companies.

### Core activities:

- **Development, production, and supply of chemicals.**
- **Chemical solutions support.**

### BUSINESS AREAS MIRRICO GROUP OF COMPANIES

**MINING AND RECOVERY DIVISION**  
(MIRRICO LLC)

**DRILLING FLUIDS AND TECHNOLOGIES**  
(Sovremenniyе Servisniye Resheniya LLC)

**OIL AND GAS PROCESSING AND PETROCHEMICAL INDUSTRY**  
(Osnova Chemical group LLC)

**CHEMICALS FOR DRILLING AND RECOVERY**  
(«PROMYSHLEMNAYA KHIMIYA» LLC)

**WATER TREATMENT SERVICES**  
(Osnova Chemical group LLC)

**CHEMICAL WELL TREATMENT**  
(Delika LLC)

### FIELDS OF APPLICATION



OIL EXPLORATION AND RECOVERY



PIPELINE TRANSPORTATION OF HYDROCARBONS



COAL MINING AND BENEFICATION



NON-FERROUS AND FERROUS METAL INDUSTRY



CHEMICAL AND PETROCHEMICAL INDUSTRY



OIL AND GAS PROCESSING



WATER AND WASTE TREATMENT



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