ACADEMY OF SCIENCES OF TATARSTAN REPUBLIC

JS VNIIUS

VOLGA
RESEARCH INSTITUTE OF HYDROCARBON FEED

Established in 1965 as a chief All-Union Research Institute in the field of balances and technologies of production and processing light hydrocarbon feed stock

TECHNOLOGIES, CATALYSTS AND EQUIPMENT FOR PROCESSING AND TREATING HYDROCARBON FEED FOR SULFUR COMPOUNDS

Business and scientific ties of VNIIUS

VNIIUS developed high-efficient technologies of treating hydrocarbon feed and waste waters for sulfur compounds. The institute patented the first all-over-the-world process of oil treating for low molecular weight mercaptans, organized production of high-efficient catalysts for desulfurization processes and pure C_1-C_6 hydrocarbons for metrology. VNIIUS has a licence on technologic estimations UK/DM 2946 and accreditation certificate of test center No. RA. RU.21 НП 39.

JS «VNIIUS» is a member society of technical committee for standardization and metrology TC-52 «Natural and Liquefied Gases».

Area of activity

- Development of technologies:
  - — desulfurization of oil, gas condensates, liquefied gases, associated oil gases;
  - — field oil treatment;
  - — gas fractionation;
  - — sulfuric-alkaline waste water neutralization
- Development and manufacture of catalysts for hydrocarbon feed desulfurization
- Development and implementation of gas chromatographic methods of analysis
- Production and supply of sorbents, catalysts and columns for gas chromatography
- Adjusting and start-up procedures and maintenance of gas chromatographic equipment
- Delivery of gas chromatographic equipment for solving specific analytic tasks
- Production of test gas mixtures with a wide range of compositions and concentrations for metrology which have a status of State Standard Samples
- Study of oil, petroleum product and gas properties in accredited test center
- Development of regulatory documentation on products of oil-and gas processing
- Analysis of resource base, state and perspectives of use of hydrocarbon feed
- Development of standards of process losses and fuel consumption in oil refining

VNIIUS proposes a wide range of services

- Inspection of plants, analysis of production and consumption, reserves and sales markets of light hydrocarbon feed on refineries, petrochemical plants and oil field objects.
- Analysis and investigation of oils and oil products according to GOST and ASTM.
- Development and supply of modular complex plants on «a turn-key» basis for desulfurization and gas fractionation.
- Supervision during design, start-up and operation of plants.

➤ On a Client's request VNIIUS performs qualified sampling and analysis of the samples, works out a technical assignment for design, carries out plant design and commissioning, provides personnel training in new technologies of desulphurization and gas fractionation of hydrocarbon feed stock.

➤ VNIIUS has appropriate agreements and uses services of leading Russian (J.S. «VNIPINeft», LLC ICC «Inzhekhim») and foreign companies (Chevron, CAC, RIPI, Merichem, Propak System, Linde) during the development and supply of plants on a turn-key basis.

➤ Nomenclature of our scientific-technical products is increasing constantly according to requirements of a Client.

➤ We developed efficient desulphurization technologies and are ready to work out recommendations for new processes and modify existing plants using equipment of your enterprise.

We are always open for business cooperation.
Give your problems to us and we will solve them!

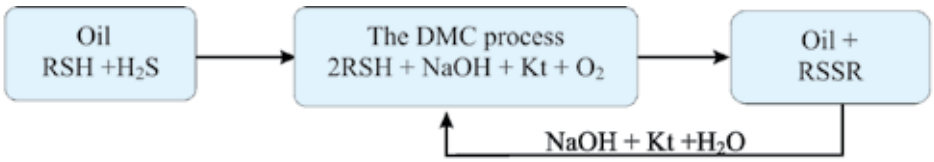
Processes of oil and gas condensate demercaptanization
DMC-1, DMC-1M, DMC-1MA, DMC-2, DMC-3

Sphere of application

Treatment of oil and gas condensates for toxic low molecular weight C_1-C_4 mercaptans to residual content of a sum of methyl- and ethyl mercaptans of no more than 20 ppm and that of hydrogen sulfide below 5 ppm.

Chemistry of the processes

Low molecular weight C_1-C_4 mercaptans are oxidized to disulfides, and hydrogen sulfide is oxidized to sulfates with air oxygen over phthalocyanine IVKAZ catalyst in an aqueous-alkaline solution following a reaction:



The technology provides treatment of feed stock (depending on Client's requirements):

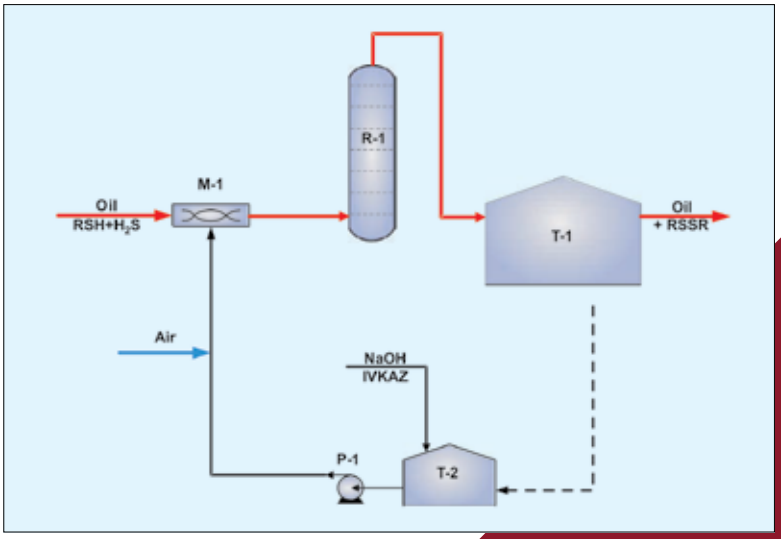
- for C_1-C_2 mercaptans (one-stage treatment to 10 ppm) — DMC-1
- for C_1-C_4 mercaptans (two-stage treatment to 30 ppm) — DMC-3

The DMC-1 M process is proposed for treating heavy oils, which form stable emulsions with an alkaline solution.

THE DMC-1M PROCESS (DMC-1MA)

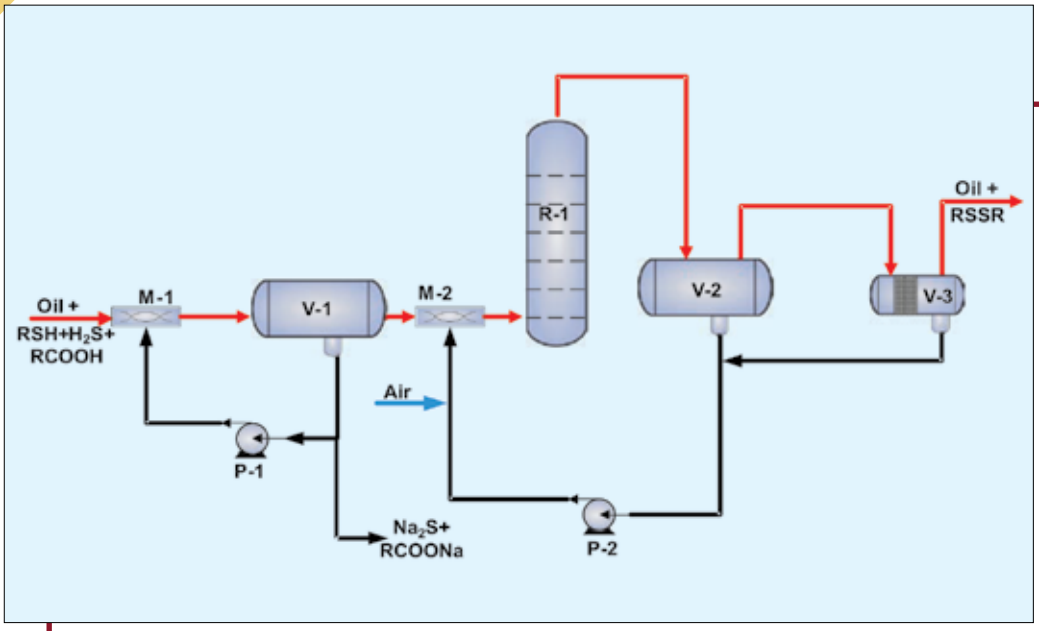
Commissioned for the first time on JS «Aktobemunaygaz» in 2001 and PJS «Tatneft» in 2005

To treat heavy oils for hydrogen sulfide we propose DMC-1MA process using an aqueous-ammonia solution of IVKAZ catalyst to oxidize hydrogen sulfide to elemental sulfur. The advantage of the process is low operational costs. The DMC-1MA process was commissioned on the oil and gas producing plant of «Nurlatneft» in 2005.



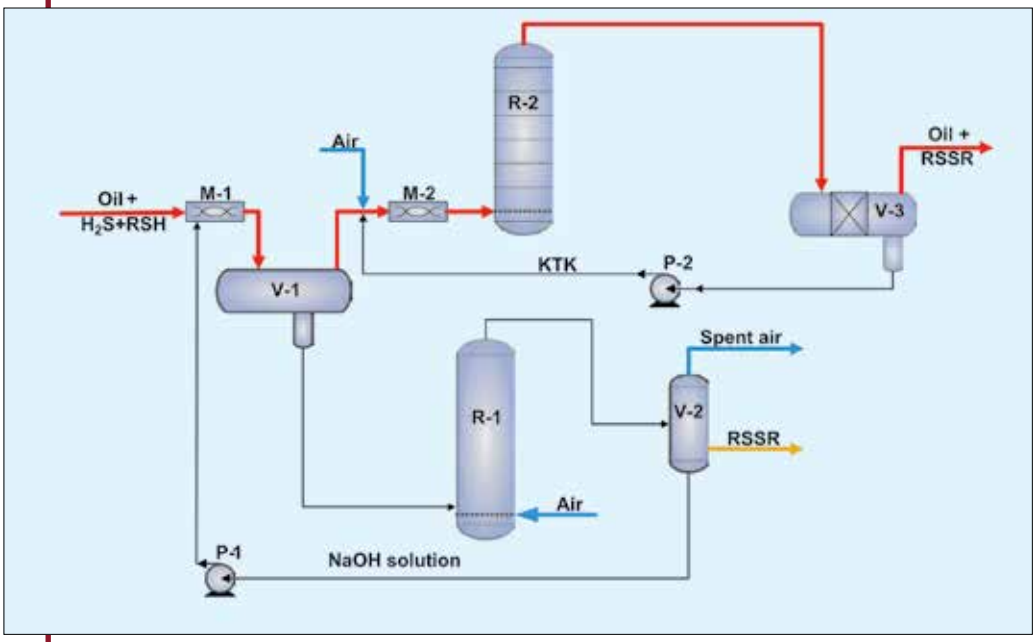
THE DMC-1 PROCESS

Commissioned for the first time at «Tengizchevroil» in 1995



THE DMC-3 PROCESS

Commissioned for the first time at Orenburg gas processing plant in 2000



Processes of oil product and waste water treatment for sulfur compounds (DMD, SEROX)

Sphere of application

- Demercaptanization of gasoline, kerosene and diesel fuel — DMD-1, DMD-3 processes
- Treatment of light hydrocarbon feed stock (C_2-C_6 fraction) for H_2S + RSH + COS + CS_2 — DMD-2 process
- Treatment of gasolines and gas condensates with production of an odorant (a mixture of C_1-C_4 mercaptans) — DMD-2 «Odorant» process
- Treatment of pentane-hexane fraction for mercaptans and dimethyl sulfide — DMD-4 process
- Treatment of waste waters for toxic sulfur compounds (NaSH, Na_2S, RSNa, Na_2SO_3) — SEROX process
- Adsorptive final treetment...

Chemistry of the processes:

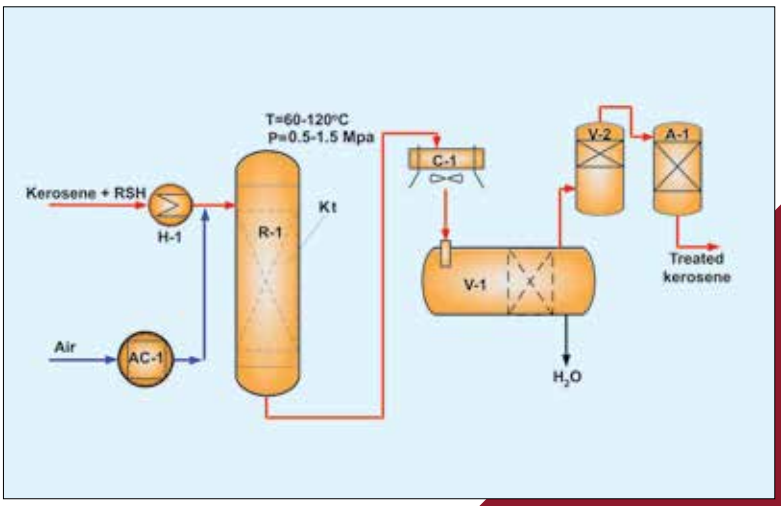
$$2RSH + 0.5\,O_2 \xrightarrow[NaOH]{Kt} RSSR + H_2O \qquad \textbf{(DMD-1, DMD-3)}$$

$$\left.\begin{aligned} &RSH + NaOH \longrightarrow RSNa + H_2O \\ &2RSNa + 0.5O_2 + H_2O \xrightarrow{Kt} RSSR + 2NaOH \\ &CS_2 + 6NaOH \longrightarrow 2Na_2S + Na_2CO_3 + 3H_2O \\ &COS + 4NaOH \longrightarrow Na_2S + Na_2CO_3 + 2H_2O \end{aligned}\right\} \textbf{(DMD-2)}$$

$$\left.\begin{aligned} &3Na_2S + 4O_2 + H_2O \xrightarrow{Kt} Na_2S_2O_3 + Na_2SO_4 + 2NaOH \\ &2NaHS + 2O_2 \xrightarrow{Kt} Na_2S_2O_3 + H_2O \\ &2Na_2SO_3 + O_2 \xrightarrow{Kt} 2Na_2SO_4 \end{aligned}\right\} \textbf{SEROX}$$

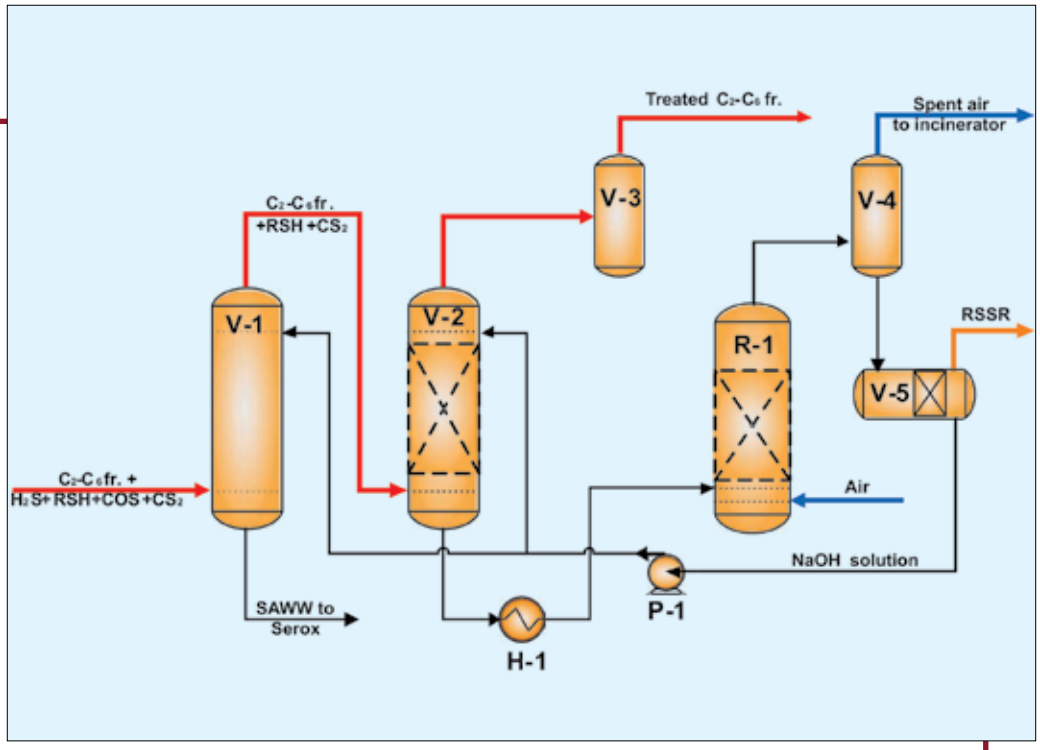
THE DMD-1 PROCESS

Commissioned for the first time at Kuibyshev Oil Refinery in 2000.



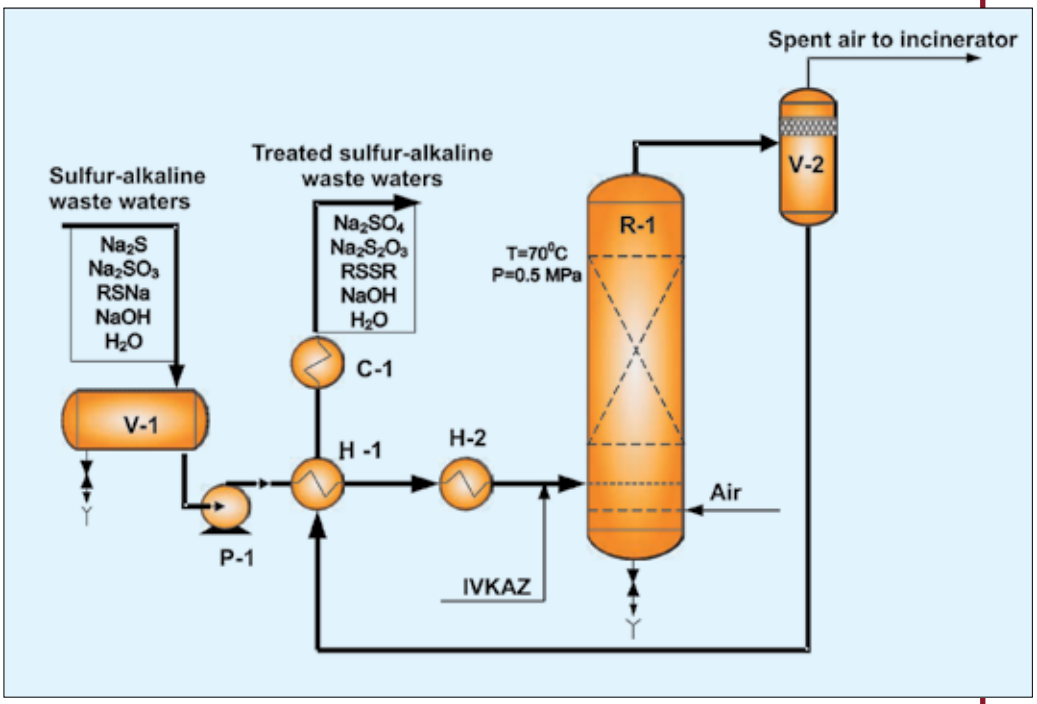
THE DMD-2 PROCESS

Commissioned for the first time at Novokuibyshevsk PCC in 1974



THE SEROX PROCESS

Commissioned for the first time at Ryazan Oil Refinery in 1991



STANDARD SAMPLES
are a basis of accuracy and authenticity of analytic measurements

J.S. «VNIIUS» produces certified gas mixtures,
including multicomponent mixtures, of wide concentration range.

CERTIFIED GAS MIXTURES

Certified binar and multicomponent mixtures of hydrocarbons, organic sulfur (hydrogen sulfide, methyl and ethyl mercaptans) and non-organic compounds in nitrogen, helium, argon, air and other gases are produced.

A volume fraction range of the components in a mixture is 0.0005-99 %. The mixtures are supplied in 1, 2, 4, 5, 10, 40-liter cylinders (of VNIIUS or Customer).

Orders are fulfilled during 2–5 weeks depending on complexity.

Gas mixtures are designed for analyzer graduating and checking, for product quality control and for metrological certification of analytical procedures.

Sphere of application — enterprises of refining, petrochemical, petroleum and gas industries, ecology, power engineering, medicine.

The mixtures are produced according to a certificate of registration of working standard cathegory No. РЭ154-1-42-2013.

OUR MAJOR IMPLEMENTATIONS
desulfurization of hydrocarbon feed and waste waters

1. **DMC-1 process** (Tengiz crude demercaptanization plant)

Kazakhstan, JV «Tengizchevroil»
In operation since 1995 (1 line), 1996 (2 line)
Capacity-2 x 4 MMt/ yr (2 x 80 000 bbl/day),
after reconstruction in 1999 capacity 2x6 MMt/yr (2 x 120 000 bbl/day)
Catalyst — IVKAZ
Mercaptan sulfur content (methyl- and ethyl mercaptans):

- before treatment — 0.026-0.03% mass (260-300 ppm)
- after treatment — < 0.0005 % mass. (5 ppm)

The design is developed by «Bechtel Co.», England The plant is built by «Brown and Root Co.»

2. **DMD-2 process** (n-Pentane demercaptanization plant)

Russia, Novokuibyshevsk PCC
In operation since 1974
Capacity —120 000 t/yr (3 800 bbl/day)

3. **DMD-2 process** (demercaptanization plant for C_2-C_6 fraction)

Russia, J.S. «Salavatnefteorgsintez»
In operation since 1975
Capacity — 400 000 t/yr (12 700 bbl/day)

4. **DMD-2 process** (demercaptanization plant for C_2-C_6 fraction)

Russia, J.S. «Salavatnefteorgsintez»
In operation since 1976
Capacity — 600 000 t/yr (19 000 bbl/day)

5. **DMD-2 process** (demercaptanization plant for butane — butylene fraction)

Russia, Samara Oil Refinery
In operation since 1977
Capacity — 130 000 t/yr (4 000 bbl/day)

6. **DMD-2 ODORANT process** (gas condensate demercaptanization and odorant production)

Russia, J.S. Orenburg Gazprom»
In operation since 1983
Capacity:

- for condensate 600 000 t/yr (12 000 bbl/day)
- for odorant production — 3 000 t/yr

7. DMD-2 process
(demercaptanization of butane-butylene and pentane-amylene fractions)

Russia, Ryazan Oil Refinery
In operation since 1985
Capacity —125 000 t/yr (4 000 bbl/day)

8. DMD-2 process (demercaptanization plant for butane-butylene fraction)

Lithuania, J.S. «Mazheiku NAFTA»
In operation since 1990
Capacity — 220 000 t/yr (7 000 bbl/day)

9. Serox-W process (plant for sulfur-alkaline waste water treatment)

Lithuania, J.S. «Mazheiku NAFTA»
In operation since 1990
Capacity — 25 m^3/hr

10. Serox-W process (plant for sulfur-alkaline waste water treatment)

Russia, Moscow Oil Refinery
In operation since 1990
Capacity — 30 m^3/hr

11. DMD-2 process (demercaptanization plant for butane-butylene fraction)

Russia, Ufa Oil Refinery
In operation since 1991
Capacity — 220 000 t/yr (7 000 bbl/day)

12. Serox-W process (plant for sulfur-alkaline waste water treatment)

Russia, Ryazan Oil Refinery
In operation since 1991
Capacity — 20 m^3/hr

13. Serox-W process (plant for sulfur-alkaline waste water treatment)

Kazakhstan, Pavlodar Oil Refinery
In operation since 1991
Capacity — 25 m^3/hr

14. DMD-2 process (demercaptanization plant for butane-butylene fraction)

Russia, Moscow Oil Refinery
In operation since 1992
Capacity — 220 000 t/yr (7 000 bbl/day)

15. DMD-2 process (demercaptanization plant for liquefied gases)

Russia, J.S. «Astrakhan Gasprom»
In operation since 1992
Capacity — 400 000 t/yr (13 000 bbl/day)

16. Serox-W process (plant for sulfur-alkaline waste water treatment)

Russia, Omsk Oil Refinery
In operation since 1992
Capacity — 20 m^3/hr

17. Serox-W process (plant for sulfur-alkaline waste water treatment)

Bulgaria, Burgas oil refinery
In operation since 1994
Capacity — 5 m^3/hr

18. Complex for demercaptanization of light petroleum fractions

Russia, kuibyshev Oil Refinery
In operation since 1996:

- **DMD-2** unit of C_3-C_4 fraction treatment for 200 000 t/yr (6 400 bbl/day)
- **DMD-2** unit of C_5 fraction treatment for 110 000 t/yr (3 400 bbl/day)
- **DMD-3** unit of C_{6+} fraction treatment for 310 000 t/yr (9 000 bbl/day)
- **Serox-W** unit of sulfur-alkaline waste water treatment for 6 m^3/hr

19. DMD-4 process
(plant for iso-pentane fraction treatment for dimethyl sulfide)

Russia, Sterlitamak, J.S. «Cauchuk»
In operation since 1996
Capacity — 25 000 t/yr

20. Serox-W process (plant for sulfur-alkaline waste water treatment)

Russia, Yaroslavl Oil Refinery
In operation since 1999
Capacity — 20 m^3/hr

21. DMC-3 process (plant for gas condensate demercaptanization)

Russia, Orenburg, J.S. «YUPK»
In operation since 2000
Capacity — 2 MM t/yr (40 000 bbl/day

22. DMC-1 process (plant for kerosene demercaptanization)

Russia, Samara Oil Refinery
In operation since 2000
Capacity — 310 000 t/yr (6 500 bbl/day)

23. DMD-2 process (plant for C_2-C_6 fraction demercaptanization)

Russia, Perm Oil Refinery
In operation since 2000
Capacity — 300 000 t/yr (9 500 bbl/day)

24. DMD-4 process
(plant for iso-pentane fraction treatment for dimethyl sulfide)

Russia, J.S. «Novokuibyshevskaya khimicheskaya kompaniya»
In operation since 2000
Capacity — 40 000 t/yr

25. DMC-1M process (plant for crude oil demercaptanization)

Kazakhstan, CNPC «Aktobemunaigaz»
In operation since 2001
Capacity — 2.5 MM t/yr (50 000 bbl/day)

26. DMD-2 process (plant for NGL demercaptanization)

Russia, J.S. «Novokuibyshevsk petrochemical company»
In operation since 2002
Capacity —150 000 t/yr (4 700 bbl/day)

27. DMC-3 process (plant for gas condensate demercaptanization)

Lithuania, J.S. «Mazheiku NAFTA»
In operation since 2002
Capacity — 700 000 t/yr (14 000 bbl/day)

28. DMD-1 process (plant for kerosene demercaptanization)

Russia, Ukhta Oil Refinery
In operation since 2002
Capacity — 50 000 t/yr (1 000 bbl/day)

29. DMC-1M process (plant for crude oil demercaptanization)

Kazakhstan, J.S. «Kazakhoil Aktobe»
In operation since 2002
Capacity — 2.5 MM t/yr (50 000 bbl/day)

30. DMC-2 process (plant for condensate demercaptanization)

Latvia, J.S. «Stena» (crude oil tank farm)
In operation since 2003
Capacity —150 m^3/hr (22 500 bbl/day)

31. DMD-2 process (demercaptanization plant for butane-butylene fraction)

Russia, Omsk Oil Refinery
In operation since 2003
Capacity —150 000 t/yr (4 700 bbl/day)

32. DMD-2 process (demercaptanization plant for propane-butane fraction)

Russia, Orenburg Gas Refinery
In operation since 2003
Capacity — 550 000 t/yr (17 500 bbl/day)

33. DMC-2 process (plant for condensate demercaptanization)

Russia, Taganrog, J.S. «Neklinovsknefteproduct» (crude oil tank farm)
In operation since 2004
Capacity —150 m^3/hr (22 500 bbl/day)

34. DMC-3 process (plant for crude oil demercaptanization)

Kazakhstan, J.S. «Kazakhoil Aktobe»
In operation since 2004
Capacity — 3 300 t/day (24 000 bbl/day)

35. DMD-3 + DMD-2 process
(pilot plant for gasoline and LPG demercaptanization)

Iran, Tehran, Iranian Research Institute
of Petroleum Industry «RIPI»
In operation since 2002
Capacity —100 liters/hr (15 bbl/day)

36. DMC-1MA process
(plant for heavy oil treatment for H_2S + RSH)

Tatarstan, JSC «Tatneft», NGDU «Nurlatneft»
Commissioning in 2005
Capacity — 4 900 t/day (24 000 bbl/day)

37. Serox-W process (plant for sulfuric-alkaline waste water treatment)

Belorus, Novopolotsk, J.S. «NAFTAN»
In operation since 2005
Capacity — 0.25 m^3/hr

38. DMC-1 process (oil demercaptanization plant)

Kazakhstan, Aktobe, J.S. «KDO»
In operation since 2006
Capacity — 60 m^3/hr (9 000 bbl/day)

39. DMD-2 process
(demercaptanization plant for butane-butylene fraction of catalytic cracking)

Russia, Nizhnekamsk, Gasoline Plant, of J.S. «TAIF-NK»
In operation since 2007
Capacity — 300 000 t/yr (9 000 bbl/day)

40. DMD-2 process (demercaptanization plant for butanes)

Bulgary, Burgas, «Lukoil Neftochim Burgas AD»
In operation since 2007
Capacity —100 000 t/yr (3 000 bbl/day)

41. Demercaptanization complex for naphtha and liquefied gases

Iran, Kharg island, KHARG Petrochemical Co.

- **DMD-2** unit of propane treatment for 165 000 t/yr (6 300 bbl/day)
- **DMD-2** unit of butane treatment for 165 000 t/yr (5 500 bbl/day)
- **DMD-3** unit of naphtha treatment for 140 000 t/yr (4 000 bbl/day)
- **Serox-W** unit of sulfur-alkaline waste water treatment for 2 000 t/yr

In operation since 2009

42. DMC-3 process (oil demercaptanization plant)

Kazakhstan, Uralsk, Chinarev NGKM, TOO «Zhaikmunai»
In operation since 2008
Capacity — 400 000 t/yr (8 000 bbl/day)

43. DMC-1 process (oil demercaptanization plant)

Kazakhstan, Aktyubinsk region, «Kaspiy neft» company
In operation since 2010
Capacity —1 500 t/day (11 000 bbl/day)

44. DMC-3 process (gas condensate demercaptanization plant)

Iran, Assaluye, Pars Oil and Gas Company (POGC)
To be put into operation in 2019
Capacity — 3 trains each of 4 MM t/yr (3x80 000 bb/day)
The design was developed by «RIPI and PetroSina Aria» companies

45. DMD-2 ODORANT process

Iran, Assaluye,National Iranian Gas Company (NIGC)
To be put into operation in 2018
Capacity:

- Gas condensate — 600 000 t/yr (15 000 bbl/day)
- Odorant — 800 t/yr.

The design was developed by «Iranian Engineering & Development Group», Teheran

46. Plant for adsorption treatment of propan-butan fraction for aerosol packings

Russia, TR, Almetyevsk, PJS «Tatneft»
In operation since 2000
Capacity —10 000 t/yr
The design was developed by PKO of «TNGP»

47. **Plant for associated oil gas treating** for hydrogen sulfide on Minnibaev USO

Russia, TR, Almetyevsk, PJS «Tatneft»
In operation since 2004
Capacity —100 MM nm^3/yr
Hydrogen sulfide content:
before treatment — 6% mole
after treatment — <20 ppm
The design was developed by J.S. «Neftehimproekt», Kazan

48. **Plant for ethanolamine tretment** of flare gases for hydrogen sulfide

Russia, J.S. «Salavatnefteorgsintez»
In operation since 2005

49. **Plant for ethanolamine** treatment of refluxes for hydrogen sulfide

Belarus, J.S. «NAFTAN»
In operation since 2006

50. **Plant for ethanolamine** treatment of BBF for hydrogen sulfide

Russia, Nizhnekamsk, J.S.«TAIF-NK»
In operation since 2006

51. **Plant for ethanolamine** treatment of gases for hydrogen sulfide of SMSGP oil field complex

Sirya
In operation since 2009
Capacity — 500 MM m^3/yr of natural gas
Hydrogen sulfide content:
before treatment — 0.25% mole
after treatment — <0.0005% mole.

52. **Plant for ethanolamine** treatment of refinery gases and refluxes for hydrogen sulfide

Belarus, J.S. «NAFTAN»
In operation since 2010
Capacity:
- for gases
  of both units — 280 MM m^3/yr
- for refluxes
  of straight-run and hydrocracking — 328 000 t/yr
  of plant of delayed coking — 62 800 t/yr

The design was developed by UNIS a.s. (AO)
IOOO «UNIS nefteproekt»

53. Plant of oil
treatment for hydrogen sulfide by purging with hydrocarbon gas
equipped with a unit for ethanolamine treatment of purging gas

Russia, RT, UPVSN-2 NGDU «Nurlatneft», UKPN «Sheshma»
The plant is planned to be put into operation in 2015
Capacity:

- Sales oil — 2.1 MMt/yr
- Treated gas — 10.6 MM nm^3/yr

The design was developed by «Standartnefteproekt Ltd.», Kazan

54. Serox-W process (Plant for Sulfur-Alkaline Waste Water Treatment)

Russia, Ryazan oil refinery, Ryazan.
In operation since 2014
Capacity 90 m^3/hr

55. Desulfurization plant of liquefied hydrocarbon gases

Belarus, RUP PO «Belarusneft», Belarus gas refinery
In operation since 2014
Unit for adsorptive propane treatment
Capacity — 346 000 t/yr
Unit for adsorptive butane treatment
Capacity — 205 400 t/yr
Unit for adsorptive treatment of dry stripped gas
Capacity — 3 460 kg/hr

56. Plant for butane-butylene fraction demercaptanization

Russia, Kuibyshev refinery
In operation since 2016
Capacity — 300 000 t/yr

57. Modification of raw gas compressor unit
of «Tatneftgazopererabotka»

Russia, RT, Almetievsk city, PJS «Tatneft»
In operation since 2016
The design was developed by «Tehnoproekt KNHP LLC», Novokuibyshevsk

58. Gas dehydration unit
on Bavly plant of gas treating for hydrogen sulfide

Russia, RT, Bavly city, PJS «Tatneft»
In operation since 2017
Gas production — 60 MM m^3/yr.

59. **Gas dehydration unit** on Minnibaev desulfurization plant (MUSO)

Russia, RT, Almetievsk city, PJS «Tatneft»
In operation since 2016
Gas production — 200 MM m^3/yr
The design was developed by «Tehnoproekt KNHP LLC», Novokuibyshevsk.

60. **Unit of amine treatment on Irgiz gas**
processing plant-replacement of import absorbent (diglycolamine) by domestic one-methyldiethanolamine

Russia, Glushitsa settlement, OJS «Tatneft-Samara»
In operation since 2017
Gas production — 42 MM m^3/yr

61. **Developed are basic engineering designs and detail designs of the plants for:**

— treatment of gases of delayed coking plants for carbonyl sulfide and mercaptans (Omsk refinery);
— treatment of gases of delayed coking plants for carbonyl sulfide and mercaptans (OJS «Taneko», PJS «Tatneft»);
— demercaptanization of liquefied gases of EDS-AVT (Omsk refinery)

OIL PROCESSING, GAS FRACTIONATION

1. Technology of light hydrocarbon removal from oil without using compressors

At high-capacity AVT plants and LK-6u complexes in Ufa, Moscow, Kirishi, Nizhnekamsk,Omsk, Kstovo, Achinsk, Novokuibyshevsk, as well as on enterprises of Belarus, Ukraine, Kazakhstan, Lithuania — more than 20 plants in all.
In operation since 1971

2. Modification of gas fractionating section on GO-4 plant

Russia, Salavat
In operation since 1980

3. Plants for complex oil processing (UKPN) of PJS «Tatneft»

Period of modification 1982–2005
Capacity —1 800 000–3 300 000 t/yr

4. Modification of gas fractionation sections in LK-6U, G-43-107, KT-1 complexes

Refineries in Moscow, Pavlodar, Ufa, Mazheikai, Mozyr
In operation since 2000

5. Modification of sections S-100 (AT) of Elkhov NPU of PJS «Tatneft»

Russia, TR, Almetyevsk, PJS «Tatneft»
In operation since 2001
Capacity — 500 000 t/yr
The design was developed by J.S. «Neftehimproekt», Kazan

6. Plant for oil processing (UPN) of «Irkutsk oil company Ltd»

Russia, Irkutsk region, Yaraktinsk oil field.
In operation since 2004
Capacity — 800 000 t/yr of sales oil
The design was developed by J.S. «Neftehimproekt», Kazan

7. Plant for oil processing (UPN) of J.S «Bogorodskneft»

Russia, Saratov
In operation since 2006
Capacity — 400 000 t/yr of sales oil
The design was developed by J.S. «Neftehimproekt», Kazan

8. Plant for oil processing (UPN) of J.S. «Udmurtneft»

Russia, Udmurtia Republic, Votkinsk
In operation since 2008
Capacity — 1 400 000 t/yr of sales oil
The design was developed by J.S. «Neftehimproekt», Kazan

9. Plant for oil processing (UPN) of NGDU «Suleevneft»

Russia, TR, Almetyevsk, J.S. «Tatneft»
In operation since 2009
Capacity — 1 000 000 t/yr of sales oil
The design was developed by J.S. «Neftehimproekt», Kazan

10. Section for benzene removal from stable catalysate of reforming for production of sales gasoline with benzene content of no more than 1% on Elkhov NPU of PJS «Tatneft»

Russia, TR, Almetyevsk
In operation since 2012
Capacity — 47700 t/yr of catalysate
The design was developed by J.S. «Tehnoproekt KNHP», Novokuibyshevsk

11. ELOU-AVT-2 plant
(Technical re-equipment for oil capacity increase)

Russia, Tyumen, OJS «Antipinskiy NPZ»
In operation since 2013
Capacity — 3.3 MM t/yr
The design was developed by OJS «Neftekhimproekt», Kazan.

12. Modification of a plant for oil processing of OJS «Udmurtneft»

Russia, Udrmurtiya, OJS «Udmurtneft», Kiengop field
In operation since 2013
Capacity:

- Emulsion CDNG-1 — 6 787 000 m^3/yr
- Emulsion CDNG-2 — 1 737 000 m^3/yr

The design was developed by OJS «Neftekhimproekt», Kazan

13. Complex plant for primary oil processing,
bitumen production and a unit of afterburning furnaces for oxidation gases (scientific and technical re-equipment)

Russia, Surgut, OJS «Surgutneftegaz»
In operation since 2013

14. Modification with replacement of oil heating furnaces
of oil stabilization unit of North-Aimetievsk UKPN NGDU «Almetievskneft»

Russia, RT, Aimetievsk city, PJS «Tatneft»
In operation since 2014
Finished oil production — 3.2 MM t/yr
The design was developed by LLC «Institute of Technology»,

LIST OF STANDARDS DEVELOPED BY JS «VNIIUS»

Position	Standard number	Standard name
1	GOST 24676	Pentanes. Method of hydrocarbon composition determination
2	GOST 13379	Oil. Method of C_1-C_6 hydrocarbons content determination
3	GOST 32918	Oil. Method of hydrogen sulfide, methyl- and ethyl mercaptan determination
4	GOST 14920	Dry gas. Method of component composition determination
5	GOST 17567	Gas chromatography. Terms and definitions
6	GOST 11382	Oil refinery gases. Method of hydrogen sulfide determination
7	GOST 20448	House-hold hydrocarbon liquefied fuel gases
8	GOST 27578	Hydrocarbon liquefied gases for automobile transport
9	GOST 22985	Hydrocarbon liquefied gases. Method of hydrogen sulfide and mercaptan sulfur determination
10	GOST 22986	Hydrocarbon liquefied gases. Method of total sulfur determination
11	GOST 10679	Hydrocarbon liquefied gases. Method of component composition determination
12	GOST 14921	Hydrocarbon liquefied gases. Sampling method
13	GOST 28656	Hydrocarbon liquefied gases. Computation method for determination of saturated vapor density and pressure
14	GOST P 52087	Fuel hydrocarbon liquefied gases
15	GOST P 50994	Hydrocarbon liquefied gases. Method of determination of saturated vapor pressure

CERTIFIED METHODS DEVELOPED BY JS «VNIIUS»

Item	Number of certificate	Name of measurement procedure (MP) document	Measurement range
Analytical control of processes of amine treating and elemental sulfur production			
1	65606-04 of 23.08.2004 FR.1.31.2005.01509	Component volume fraction. Acid gases of waste water stripping (CO_2, H_2S, NH_3)	from 0.1 % to 50.00 %
2	68606-04 of 25.08.2004 FR.1.31.2005.01508	Volume fraction of H_2S, CO_2, and H_2. Process gas	from 0.02 % to 10.00 %
3	68806-04 of 25.08.2004 FR.1.31.2005.01506	Component volume fraction. Process gas (N_2, CO_2, H_2S and SO_2)	from 0.02 % to 70.00 %
4	68706-04 of 25.08.2004 FR.1.31.2005.01507	Volume fraction of CO_2, H_2S and H_2O. Process gas	from 0.3 % to 80.00 %
5	68906-04 of 28.08.2004 FR.1.31.2005.01505	Component volume fraction. Acid gases of amine regeneration (CO_2, H_2S, NH_3, H_2O and C_1-C_5 hydrocarbons). H_2S — basic component.	from 0.1 % to 3.00 %
6	1459-06 of 23.11.2006	Acid gases of amine regeneration of the plant for elemental sulfur production. Component volume fractions (CO_2, H_2S, NH_3, H_2O and C_1-C_5 hydrocarbons). H_2S — basic component +mercaptans	from 0.01 % to 3.00 % from 10 ppm to 500 ppm
7	1559-06 of 23.11.2006	Aqueous amine solutions and washing waters. Mass fraction of DEA	from 0.3 to 4.0 % from 20.0 % to 35.0 %
8	1659-06 of 23.11.2006 FR.1.31.2016.23700	Acid gases of waste water stripping. Component volume fraction (CO_2, H_2S, NH_3 and C_1-C_5 hydrocarbons)	from 0.05 % to 50.00 % from 10 ppm 500 ppm

9	89706-08 of 28.05.2008 FR.1.31.2016.23698	Aqueous amine solutions and reflux water. Mass fractions of CO_2, H_2S and NH_3. MP	from 0.01 to 5.00 %
10	137806-08 of 24.06.2008	Aqueous amine solutions and washing waters. Determination of mass fraction of MEA. MP	from 0.1 to 0.3 % from 10.0 % to 20.0 %
11	7606-09 of 02.07.2009	State System for Ensuring Uniform Measurement. Aqueous amine solutions. Mass fraction of C_1-C_5 hydrocarbons. MP	from 0.003 to 1.00 %
12	11106-09 of 25.07.2009 FR.1.31.2016.23699	Acid gas of amine regeneration. Component volume fraction. MP	from 0.01 % to 10.00 % from 75.00 % to 95.00 %
13	24806-09 of 21.12.2009	Acid gases of waste water stripping. Determination of CO_2, NH_3, H_2S and C_1-C_5 hydrocarbons. MP	from 0.05 to 50.00 % from 20 to 1000 mg/m^3
14	65706-04 of 23.08.2004 FR.1.31.2005.01510	Mass fraction of hydrogen sulfide, ammonia and carbon dioxide. Saturated and regenerated solutions of MEA and MDEA	from 0.1 to 5.0 МЭА from 1.0 to 30.0 MDEA
Study of light hydrocarbon fractions			
15	99906-01 of 29.11.2001	MP of mass fraction of methanol in natural gas liquids by chromatography	from 0.003 % to 0.3 % and above
16	100006-01 of 29.11.2001	MP of mass fraction of components in natural gas liquids by chromatography	from 0.3 % to 30.0 % and above
17	40106-02 of 28.06.2002	MP of mass fraction of CO_2 in ethane fraction by GC	from 0.003 % to 0.03 %
18	40606-02 of 28.06.2002	MP of mass fraction of water in associated oil gas by GC	from 0.3 % to 3.0 %
19	42006-04 without date	Component volume fraction. Stabilization and flash gases	from 0.3 % to 30.0 % and above
20	182406-07 1 of 8.08.2007	Hydrocarbon gas. Mass fraction of C_2-C_4 hydrocarbons	from 0.1 to 60.0 %

21	144206-08 of 28.07.2008	Gas-air mixture in oil tank cavities of the compressor. Volume fractions of hydrocarbon components	from 0.1 to 80.0 %
22	(98606-07) of 30.05.2007 16806-13 of 13.09.2013	Ethane fraction. Chromatographic method of component composition determination	from 0.001% to 3.5 % (mass)
23	11206-09 of 25.07.2009	Ethane fraction. Mass fraction of CO_2	from 0.003 to 1.00 %
24	4406-10 of 25.02.2010	Flare gas from hydrogen-flare system. Component volume fractions. MP (H_2, H_2S, NH_3, C_1-C_5 hydrocarbons)	from 0.30 to 90.00 %
25	01.00257-2008/ 18706-11 of 13.12.2011 FR.1.29.2011.11468	Fuel gas. Determination of component composition by GC (H_2, O_2, N_2, CO, CO_2, H_2S)	from 0.10 to 85.00 % from 0.5 g/m^3 to 150 g/m^3
26	29306-12 of 29.10.12 FR.1.31.2013.14306	Component volume fraction. Stabilization and flash gases	from 0.01 % to 70.0 % from 0.3 to 30% and above
27	01.00257-2008/ 4006-13 of 02.04.2013 17506-10 of 15.09.2010	Ethanized natural gas liquids. Mass fraction of CO_2. MP	from 0.01 to 3.00 % from 0.1 to 3.00 %
28	01.00257-2013/ 28606-15 of 19.10.2015	MP of mass fraction of C_1-C_6 hydrocarbons and methanol in NGL	from 0.010 to 50.000 %
29	01.00257-2008/ 25406-13 of 29.11.2013 FR.1.31.2014.18560	Associated petroleum gas. Determination of component composition by GC	from 0.001 to 95.000 moles, %
30	36806 of 3.12. 2015 FR.1.31.2016.23951	Acid gas. Determination of component molar fraction by GC	from 0.01 to 80.00 %
31	36706 of 3.12. 2015 FR.1.31.2016.23952	Associated petroleum gas. Determination of water volume fraction by GC	from 0.03 to 4.00 %

Determination of sulfur-containing compounds			
32	170806-07 of 30.06.2007	Spent air of caustic solution regeneration unit. Mass fraction of dialkyl disulfides. MP	from 0.03 to 10.00 %
33	20506-07 of 26.02.2007 FR.1.31.2015.19926	Disulfide oil. Mass fraction of dialkyl disulfides.	from 0.1 to 95.0 %
34	157106-08 of 14.06.2008	Hydrocarbon solvent. Mass fraction of dialkyl disulfides. MP	from 0.01 to 60.0 %
35	7506-09 of 02.07.2009 FR.1.31.2015.19932	Purified associated petroleum gas. Mass concentration of sulfur-containing compounds. MP	from 3 mg/m^3 to 1000 mg/m^3
36	29306-09 of 15.12.2009 FR.1.31.2015.19929	State System for Ensuring Uniform Measurement. Liquefied hydrocarbon gases. Mass fraction of sulfur-containing compounds	from 0.0003 % to 0.1000 % .
37	01.00257-2008/ 22906-12 of 31.08.2012 FR1.31.2013.14307	Light gasoline fraction. Determination of mass fraction of sulfur-containing compounds by GC. MP	1-100 ppм mass of elemental sulfur
38	№ 01.00257—2013/ 7106-17	Ethane fraction. Determination of mass fraction of sulfur-containing compounds. MP-IS	from 0.0001 % to 0.0300 %
Non-hydrocarbon gases			
39	01.00257-2008/ 18806-11 of 13.12.2011	Argon fraction. Determination of oxygen volume fraction by GC. MP	from 0.10 to 50.00 %
40	01.00257-2008/ 13306-11 of 27.09.2011	Bulk oxygen gas. Determination of impurities content by GC (Ar, He, H_2, CH_4, N_2, CO and CO_2)	from 0.01 to 1.00 % vol. from1.0 mg/m^3 to 50.0 mg/m^3
41	01.00257-2008/ 38806-12 of 27.12.2012 FR.1.31.2015.20972	Liquid oxygen. Determination of volume fraction of oxygen, argon and nitrogen	Oxygen from 60.00 to 99.90 Argon from 0.10 to 10.00 % Nitrogen from 0.10 to 40.00 %

42	01.00257-2008/ 32506-12 FR1.31.2013.14329	Liquid air. Determination of volume fraction of oxygen, argon and nitrogen	Argon from 0.5 % to 10 % Oxygen from 20.0 % to 40.0 % Nitrogen from 50 % to 80 %
43	01.00257-2013/ 26506-14 replaced of 26.12.2014	Liquid oxygen. Determination of oil content by GC. MP	from 0.010 to 5.000 mg/dm^3 (from 0.050 to 5.000 mg/dm^3)
44	01.00257-2008/ 30706-13 of 26.07.2013	Liquid air. Determination of carbon dioxide by GC. MP	from 0.10 to 5.00 cm^3/dm^3
45	01.00257-2013/ 17706-17 of 20.12.2017	MP of water mass concentration in hydrogen-containing and hydrocarbon gases by GC	from 1mg/m^3 to 300 mg/m^3
46		Nitrogen gas. Determination of component composition by GC	0.010 % vol. and above
Miscellaneous analytical tasks			
47	209806-07 of 23.10.2007	Non-stabilized gas condensate. Measurement procedure for determination of density	from 600 kg/m^3 to 800 kg/m^3
48	89606-08 of 28.03.2008	Catalyst. Coke mass fraction	from 0.01 to 2.00 %
49	01.00257-2008/ 27606-10 of 25.10.2010	Non-stabilized gas condensate. Measurement procedure for determination of density	from 500 kg/m^3 to 900 kg/m^3
50	01.00257-2008/ 39006-12 of 27.12.2012	Water-methanol mixture. Mass fraction of methanol in water-methanol mixture	from 0.10 % to 3.00 %
51	№ 01-00257—2013/ 3306-17 of 27.04.17 FR.1.31.217.26390	Stabilization and flash gases. Method of density determination under standard conditions by computational method	from 0.950 to 1.400 kg/m^3 from 1.400 to 2.000 kg/m^3

We propose the processes of treatment of the following items:

OILS AND GAS CONDENSATES for mercaptans and hydrogen sulfide — DMC

- Light oils and gas condensates (DMC-1)
- Heavy oils and gas condensates in oil fields (DMC-1M, DMC-1MA)
- Oils and gas condensates (DMC-2)
- Oils and gas condensates with high mercaptan content (DMC-3)
- Oils and gas condensates in oil fields using neutralizers (NSM)

LIQUEFIED GASES for hydrogen sulfide, mercaptans and carbonyl sulfide — DMD

- IBP-62°C fraction and liquefied hydrocarbon C_2-C_6 gases (DMD-2)
- Gas condensates and gasolines with production of a mixture of natural mercaptans (DMD-2 «Odorant»)
- Pentane-hexane fraction for mercaptans and dimethyl sulfide (DMD-4)

HYDROCARBON GASES for hydrogen sulfide and carbon dioxide using ethanolamines and oxidation of regeneration gases to elemental sulfur («Dirox» process)

LIQUEFIED C_2-C_4 HYDROCARBON GASES for sulfur compounds according to EN-589

- Kerosene and diesel fuel (DMD-1)
- Gasoline with decreased total sulfur content (DMD-3)

WASTE WATERS for sulfides, mercaptides, sulfite over homogeneous IVKAZ-W catalyst (SEROX)

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