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
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\textsubscript{1}-C\textsubscript{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:

$$2RSH + NaOH + Kt + O_2 \rightarrow RSSR + NaOH + Kt + H_2O$$

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
Sphere of application

- Demercaptanization of gasoline, kerosene and diesel fuel — DMD-1, DMD-3 processes
- Treatment of light hydrocarbon feed stock (C₂-C₆ fraction) for H₂S + RSH + COS + CS₂ — DMD-2 process
- Treatment of gasolines and gas condensates with production of an odorant (a mixture of C₁-C₄ 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, Na₂S, RSNa, Na₂SO₃) — SEROX process
- Adsorptive final treatment...

Chemistry of the processes:

\[
\begin{align*}
2\text{RSOH} + 0.5 \text{O}_2 & \xrightarrow{K_t} \text{RSSR} + \text{H}_2\text{O} \\
\text{RSOH} + \text{NaOH} & \rightarrow \text{RSNa} + \text{H}_2\text{O} \\
2\text{RSNa} + 0.5\text{SO}_2 + \text{H}_2\text{O} & \xrightarrow{K_t} \text{RSSR} + 2\text{NaOH} \\
\text{CS}_2 + 6\text{NaOH} & \rightarrow 2\text{Na}_2\text{S} + \text{Na}_2\text{CO}_3 + 3\text{H}_2\text{O} \\
\text{COS} + 4\text{NaOH} & \rightarrow \text{Na}_2\text{S} + \text{Na}_2\text{CO}_3 + 2\text{H}_2\text{O} \\
3\text{Na}_2\text{S} + 4\text{O}_2 + \text{H}_2\text{O} & \xrightarrow{K_t} \text{Na}_2\text{S}_2\text{O}_3 + \text{Na}_2\text{S}_4 \text{O}_4 + 2\text{NaOH} \\
2\text{NaHS} + \text{O}_2 & \xrightarrow{K_t} \text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O} \\
2\text{Na}_2\text{SO}_3 + \text{O}_2 & \xrightarrow{K_t} 2\text{Na}_2\text{SO}_4
\end{align*}
\]

(DMD-1, DMD-3)

(DMD-2)

SEROX

THE DMD-1 PROCESS
Commissioned for the first time at Kuibyshev Oil Refinery in 2000.
THE SEROX PROCESS
Commissioned for the first time at Ryazan Oil Refinery in 1991

THE DMD-2 PROCESS
Commissioned for the first time at Novokuibyshevsk PCC in 1974
J.S. «VNIIOUS» 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 VNIIOUS 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 category 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 C₂-C₆ 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 C₂-C₆ 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 m³/hr

10. **Serox-W process** (plant for sulfur-alkaline waste water treatment)
    Russia, Moscow Oil Refinery
    In operation since 1990
    Capacity — 30 m³/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 m³/hr

13. **Serox-W process** (plant for sulfur-alkaline waste water treatment)
    Kazakhstan, Pavlodar Oil Refinery
    In operation since 1991
    Capacity — 25 m³/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 m³/hr

17. **Serox-W process** (plant for sulfur-alkaline waste water treatment)  
   Bulgaria, Burgas oil refinery  
   In operation since 1994  
   Capacity — 5 m³/hr

18. **Complex for demercaptanization** of light petroleum fractions  
   Russia, Kuibyshev Oil Refinery  
   In operation since 1996:  
   - **DMD-2 unit** of C₃-C₄ fraction treatment for 200 000 t/yr (6 400 bbl/day)  
   - **DMD-2 unit** of C₅ fraction treatment for 110 000 t/yr (3 400 bbl/day)  
   - **DMD-3 unit** of C₆+ fraction treatment for 310 000 t/yr (9 000 bbl/day)  
   - **Serox-W unit** of sulfur-alkaline waste water treatment for 6 m³/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 m³/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 C₂-C₆ 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. «Novokuibyshevske 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 m³/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 m³/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 \(\text{H}_2\text{S} + \text{RSH}\))
   - 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 m³/hr

38. **DMC-1 process** (oil demercaptanization plant)
   - Kazakhstan, Aktobe, J.S. «KDO»
   - In operation since 2006
   - Capacity — 60 m³/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)
    Bulgaria, 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, PJSC «Tatneft»
   In operation since 2004
   Capacity — 100 MM nm³/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 treatment**
   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
   
   Syria
   In operation since 2009
   Capacity — 500 MM m³/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 m³/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, UPVS N-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 nm³/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 m³/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 m³/yr.
59. **Gas dehydration unit** on Minnibaev desulfurization plant (MUSO)
   - Russia, RT, Almetievsk city, PJS «Tatneft»
   - In operation since 2016
   - Gas production — 200 MM m³/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-methyl diethanolamine
   - Russia, Glushitsa settlement, OJS «Tatneft-Samara»
   - In operation since 2017
   - Gas production — 42 MM m³/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)
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, Udmurtiya, OJS «Udmurtneft», Kiengop field
    In operation since 2013
    Capacity:
    - Emulsion CDNG-1 — 6 787 000 m³/yr
    - Emulsion CDNG-2 — 1 737 000 m³/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»**

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<tr>
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<td>GOST 24676</td>
<td>Pentanes. Method of hydrocarbon composition determination</td>
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<td>Oil. Method of C\textsubscript{1}-C\textsubscript{6} hydrocarbons content determination</td>
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<td>Oil. Method of hydrogen sulfide, methyl- and ethyl mercaptan determination</td>
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## Analytical control of processes of amine treating and elemental sulfur production

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<td>1</td>
<td>65606-04 of 23.08.2004 FR.1.31.2005.01509</td>
<td>Component volume fraction. Acid gases of waste water stripping (CO₂, H₂S, NH₃)</td>
<td>from 0.1 % to 50.00 %</td>
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<td>2</td>
<td>68606-04 of 25.08.2004 FR.1.31.2005.01508</td>
<td>Volume fraction of H₂S, CO₂, and H₂. Process gas</td>
<td>from 0.02 % to 10.00 %</td>
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<td>3</td>
<td>68806-04 of 25.08.2004 FR.1.31.2005.01506</td>
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<td>4</td>
<td>68706-04 of 25.08.2004 FR.1.31.2005.01507</td>
<td>Volume fraction of CO₂, H₂S and H₂O. Process gas</td>
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<td>5</td>
<td>68906-04 of 28.08.2004 FR.1.31.2005.01505</td>
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<td>from 0.1 % to 3.00 %</td>
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<td>6</td>
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<td>Acid gases of amine regeneration of the plant for elemental sulfur production. Component volume fractions (CO₂, H₂S, NH₃, H₂O and C₁-C₅ hydrocarbons). H₂S — basic component + mercaptans</td>
<td>from 0.01 % to 3.00 % from 10 ppm to 500 ppm</td>
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<td>7</td>
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<td>from 0.3 to 4.0 % from 20.0 % to 35.0 %</td>
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<td>9</td>
<td>28.05.2008</td>
<td>89706-08</td>
<td>Aqueous amine solutions and reflux water. Mass fractions of CO₂, H₂S and NH₃.</td>
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<td>10</td>
<td>24.06.2008</td>
<td>137806-08</td>
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<td>7606-09</td>
<td>State System for Ensuring Uniform Measurement. Aqueous amine solutions. Mass fraction of C₁-C₅ hydrocarbons.</td>
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<td>25.07.2009</td>
<td>11106-09</td>
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<td>13</td>
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<td>24806-09</td>
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<td>14</td>
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<td>65706-04</td>
<td>Mass fraction of hydrogen sulfide, ammonia and carbon dioxide. Saturated and regenerated solutions of MEA and MDEA</td>
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**Study of light hydrocarbon fractions**

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<td>29.11.2001</td>
<td>99906-01</td>
<td>MP of mass fraction of methanol in natural gas liquids by chromatography</td>
<td>from 0.003 % to 0.3 % and above</td>
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<td>29.11.2001</td>
<td>100006-01</td>
<td>MP of mass fraction of components in natural gas liquids by chromatography</td>
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<td>28.06.2002</td>
<td>40106-02</td>
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<td>28.06.2002</td>
<td>40606-02</td>
<td>MP of mass fraction of water in associated oil gas by GC</td>
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<td>19</td>
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<td>182406-07 1</td>
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<td>21</td>
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<td>Gas-air mixture in oil tank cavities of the compressor. Volume fractions of hydrocarbon components</td>
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<td>Acid gas. Determination of component molar fraction by GC</td>
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<td><strong>Determination of sulfur-containing compounds</strong></td>
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<td>Spent air of caustic solution regeneration unit. Mass fraction of dialkyl disulfides. MP</td>
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<td>Light gasoline fraction. Determination of mass fraction of sulfur-containing compounds by GC. MP</td>
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**Non-hydrocarbon gases**

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<td>01.00257-2008/18806-11 of 13.12.2011</td>
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<td>01.00257-2008/13306-11 of 27.09.2011</td>
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<td>01.00257-2008/38806-12 of 27.12.2012 FR.1.31.2015.20972</td>
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<td>42</td>
<td>01.00257-2008/32506-12</td>
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<td>01.00257-2013/17706-17</td>
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<td>MP of water mass concentration in hydrogen-containing and hydrocarbon gases by GC</td>
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<td>Nitrogen gas. Determination of component composition by GC</td>
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**Miscellaneous analytical tasks**

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<td>Catalyst. Coke mass fraction</td>
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<td>51</td>
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<td>Stabilization and flash gases. Method of density determination under standard conditions by computational method</td>
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<td>from 0.950 to 1.400 kg/m³</td>
<td>from 1.400 to 2.000 kg/m³</td>
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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 C₂-C₆ 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 C₂-C₄ 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)
Russia, 420061, Kazan, N.Ershov str., 35-A, JS «VNIUS»
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Fax: + (843) 272-40-93                 http: www.vniius.com

General Director, academician of RAS & IAS,
prof. A. MAZGAROV