



**ALVIGO**

We Design Success

# **Alvigo Group of Companies. Areas of Business**

## Engineering Services

Services offered to our prospective Clients cover all stages of investment process from the very early stages to startup of the plant and its bringing to design conditions.

We commit ourselves to meeting our Clients' demands regardless of the project being proposed:

- New plant;
- Revamping or expansion of an operating plant;
- New plant and revamping of an existing one using second-hand equipment (second-hand plant).

Software being in hand, both in-house and purchased, databases for physical and chemical properties of substances and their mixtures and their long-term practical use enable us to analyze and develop with confidence various technology processes, design the plants including development of 3D design.

Many years's experience in cooperation with the Clients and partners from different countries on all continents, besides Antarctica, allows us to develop the design documentation in compliance with regulations and standards as required by the Clients (RF, Ukraine, Kazakhstan, Europe, the USA) in Russian, Ukrainian and English.

Alvigo Group of Companies offers to the investors (Clients) the following engineering services in different phases of the investment process:

### **Pre-Design Engineering:**

- Development and assessment of concept of process plants, chemical complexes, new plants with required utilities complexes.
- Research and development works;
- Analysis of operation of operating plants, some process stages, equipment and catalyst systems;
- Preparation of feasibility studies in accordance with the Client's demands;
- Preparation of permitting documentation for plant construction;
- Assistance in selection of the technology and Licensor;
- Support of the Client during preparation of technical design assignment for Basic Design and Detail Designs;
- Technical support of the Client on receipt of specifications and information required for the design.

## Technology Licensing

### Basic Engineering

Alvigo Group of Companies has an extensive portfolio of process technologies for chemical industry. In this case we grant a license, develop the basic design, supply required licensed equipment, conduct personnel training, give technical support during detail engineering, provide designer's supervision during construction, mechanical completion and commissioning, performance test of the plant.

In case the technology is licensed and the basic design documentation is delivered by another company we provide the following services:

- Engineering support of the Client during preparation of the contract with the Licensor and technical appendices thereto;
- Engineering support of the Licensor to bring the Basic Design in compliance with Russian and Ukrainian regulations and standards;
- Acceptance of the Basic Design documentation developed by the Licensor in accordance with the Client's requirements.

### Engineering

We carry out comprehensive design and engineering of both individual plants and whole chemical complexes. We have all necessary permits and licenses to design chemical plants and refineries of any complexity in Russia, Ukraine, Belarus.

Our services cover:

- Development of permitting documentation in full scope required for approval;
- Technical support of the Client at approval of the project documentation by State Expertise;
- Detail design documentation (detail design in full scope as required by regulatory documents);
- Development of design documentation for non-standard equipment;
- Review of detail design documentation developed by other companies;
- Preparation of process operator's manual;
- Preparation of operating manual.

### Equipment and Materials Procurement for the Project

Our services include:

- Technical support of the Client during procurement and delivery of equipment:
  - A) Determination of possibility of procurement of equipment and materials, making a list of would-be vendors and their inspection
  - B) Preparation of technical appendices to the contracts for purchase of equipment.
  - C) Technical support of the Client during manufacture and acceptance of equipment.
    - Obtaining permits for the use of both individual equipment items and package units;
    - Equipment supply in accordance with the Client's demands together with full permitting documentation set.

## Construction

We provide the following services during plant construction:

- Designer's supervision during construction;
- Supervision of pre-commissioning/commissioning works and startup of the plant;
- Technical support of the Client in interfacing with inspection organizations;
- Detail design documentation revision.

Work experience of Alvigo Group companies is characterized in brief as follows: all ammonia, methanol, nitric acid, ammonium nitrate, calcium-ammonium nitrate, caprolactam, adipic acid, potassium nitrate, nitrite and nitrate salts, ammonium carbonates and bicarbonates, acetic acid, acetylene, catalysts production plants, etc. inside the former USSR from 1935 till now were designed by our companies. We have designed several hundreds of large-scale plants and about 15 thousand of small ones.

Please find below the reference list of major projects realized by us in 21 century.



**Acetylene plant, China, Gansu Liuhua(Group) Co., Ltd.**

## REFERENCE LIST (2006-2012)

No.	Name of Project	Brief Characteristic	Services	Year of Completion	Client	Country
1.	Ammonia plant	1700 t/day	Authority Engineering	2012	JSC Dorogobuzh, Dorogobuzh	Russia
2.	Methanol plant	600,000 tpy	Basic Design acceptance.	2011	JSC "UralMethanolGroup", Nizhny Tagil	Russia
3.	Methanol plant	450,000 tpy	Basic Design acceptance. Detail Design. Designer's supervision	2011	JSC Shchekinoazot,	Russia
4.	Acetylene plant	30,000 tpy	Licensing. Basic Design	2011	Sichuan Tianhua Fubang Chemical Co, Ltd., Rongshan	China
5.	Ammonium nitrate plant	Air conditioning unit for AC-71/1 unit	Authority Engineering.	2011	JSC Dorogobuzh, Dorogobuzh	Russia
6	Ammonium nitrate plant	Reduction in contaminants emissions into atmosphere	Authority Engineering.	2011	Mineral Fertilizer Plant, Kirovo-Chepetsk	Russia
7.	Electrodialysis package unit for waste water treatment from ammonium nitrate plant	from 40 to 70 m <sup>3</sup> /h	Authority Engineering.	2011	JSC Achema, Jonava	Russia
8.	Liquid ammonia storage	Storage capacity - 8 000 tons	Authority Engineering	2011	Balakovo Mineral Fertilizers, LLC	Russia



No.	Name of Project	Brief Characteristic	Services	Year of Completion	Client	Country
9.	Nitrogen-containing waste water treatment package unit for JSC Mineral Fertilizers, Rossosh	60 m <sup>3</sup> /h	Authority Engineering.	2011	JSC Achema,Jonava	Lithuania
10.	Ammonia plant (AM-70)	1450 tons/ day	Basic Design	2010	JSC Achema, Jonava	Lithuania
11.	Ammonia, methanol and dimethyl ether plants	Refined methanol –	Обоснование инвестиций	2010	JSC GAZPROM, Moscow Sobinsk Gas-Chemical	Russia
12.	Methanol and dimethyl ther plants	Refined methanol - 20 ths. tons per year DME- 3.3 ths. tons per year	Justification of investments	2010	JSC GAZPROM, Moscow, Chikansk gas- condensate field	Russia
13.	Urea plant	1150 t/day	Permit for use of package unit.	2010	JSC Novomoskovsk Azot, Novomoskovsk	Russia
14.	UKL-7 nitric acid plants	355 t/day	Authority engineering.	2010	JSC Nevinnomyssk Azot	Russia
15.	Urea plant revamping	1500 t/day	Detail design documentation.	2010	JSC Nevinnomyssk Azot	Russia
16.	Polyamide-6 plant	160 tons/day	Basic Design acceptance. Authority engineering.	2009	JSC Chernigov Khimvolokno, Chernigov	Ukraine

No.	Name of Project	Brief Characteristic	Services	Year of Completion	Client	Country
17.	Methanol plant (M-450)	450 ths. tons per year	Basic Design.	2009	JSC Shchekinoazot, Pervomayskiy	Russia
18.	Ammonia plant (AM-80)	1500 tons/day	Basic Design and Detail Design, Equipment ordering, technical support, designer's supervision, participation in precommissioning/ commissioning and performance test.	2009	JSC AMMIT, Jonava	Lithuania
19.	Technical re-equipment of ammonia plant	Reconstruction of gaseous mixture heating system	Authority engineering, detail design documentation, participation in complete equipment procurement and delivery	2009	JSC Togliattiazot	Russia
20	Ammonia and methanol plants, isothermal liquid ammonia storage	Ammonia - 2050 tpd. At integrated production – 1492 tpd of ammonia and 668 tpd of methanol, liquid ammonia storage capacity - 10 000 tons	Basic Design acceptance. Authority engineering, technical support at approval by State Expertise.	2009	Design Institute Sojuzkhimpromproekt", Kazan	Russia
21	Phosphogypsum plant	Ammonium sulfate – 200 ths. tons per year Lime powder – 102 ths. tpy Dry calcium carbonate – 163,4 ths. tons per year	Justification of investments.	2008	JSC Ammofos, Cherepovets	Russia

No.	Name of Project	Brief Characteristic	Services	Year of Completion	Client	Country
22	Methanol plant	130 ths. tons per year	Basic Design, startup, fine tuning of operating conditions, designer's supervision of operation.	2008	JSC Achema, Jonava	Lithuania
23	Ammonia plant	1700 t/day	Basic Design.	2008	JSC Grodnoazot	Belarus
24	Technical re-equipment of ammonia plant	Reconstruction of gaseous mixture heating system	Detail design documentation. Designer's supervision.	2008	JSC Mineral Fertilizers	Russia
25	Ammonia plant (A-5)	1780 tons/day	Basic Design. Detail design documentation. Technical assistance. Designer's supervision.	2007	JSC Azot, Cherkassy	Ukraine
26	Technical re-equipment of ammonia plant	Reconstruction of gaseous mixture heating system	Detail design documentation. Designer's supervision.	2007	Mineral Fertilizer Plant, Kirovo-Chepetsk	Russia
27	Technical re-equipment of ammonium nitrate plant	90 tons/hour	Basic Design. Authority engineering. Complete equipment procurement and delivery. Designer's supervision.	2007	NEOKHIM, Dimitrovgrad	Bulgaria
28	NPK storage	Storage capacity – 60,000 tons	Detail design documentation	2007	JSC Mineral Fertilizers, Rossosh	Russia
29	Partially desalted water unit	400 m <sup>3</sup> /h	Detail design documentation.	2007	JSC Dorogobuzh	Russia
30	Ammonia plant	Tandem unit for 600 tpd ammonia plant	Basic Design. Designer's supervision. Participation in startup and performance test.	2006	CNCCC INTERNATIONAL TENDERING CO. Gansu	China



No.	Name of Project	Brief Characteristic	Services	Year of Completion	Client	Country
31	Ammonia plant	Reconstruction of gaseous mixture heating system	Detail design documentation. Complete equipment procurement and delivery. Designer's supervision.	2006	JSC Nevinnomyssk Azot	Russia
32	Ammonia pipeline between JSC Cherepovets Azot and JSC Ammofos	60 t/h of liquid ammonia, length – 14 km.	Detail design documentation.	2006	JSC Cherepovets Azot	Russia
33	Toxic industrial wastes disposal site	Reconstruction of disposal site with capacity extension to 16866.3 tpy including 2 class wastes – 45 tpy, 3 class wastes and soluble 4 class wastes -8720.65 tpy, insoluble 4 class wastes -8100.65 tpy	Authority engineering.	2006	JSC NAK Azot, Novomoskovsk	Russia

## Collection and Disposal of Sludge Containing Platinum Group Metals

ALVIGO Group of Companies provides services for nondestructive and destructive physicochemical and mechanical cleaning of operating and dismantled equipment of nitric acid, hydrocyanic acid and hydroxylamine sulfate plants from sludge containing precious metals. Improving constantly the work technique, ALVIGO is the leader in the market for services pertaining to cleaning of equipment of chemical plants and disposal of wastes containing platinum group metals (PGMs). In the past decade more than 200 cleaning operations were performed to recover PGMs resulting in collection and recovery of several tons of precious metals. Due to such cleaning works the Client gets recycled up to 50% of platinoids – loss of gauze catalyst mass in the course of operation of the plants.

Destructive and nondestructive techniques, mechanical and chemical methods of cleaning as well as proprietary agents are used in practice which ensures in the end high cleaning degree with full guarantee for remaining life of equipment cleaned.

Some unique mobile production packages (MPP) were developed and built for cleaning works. These packages are based on truck chassis and equipped with some equipment required to fulfill the works on the Client's site, including compressors, pumps, folding tanks for agents solutions, mixers, industrial vacuum cleaners, etc.. As a rule, the Client provides only the power source. At the moment ALVIGO Group of Companies has five such MPPs at its disposal.

In CIS-countries, JSC GIAP and STC Alvigo being a part of ALVIGO Group of Companies offer and successfully implement high-efficient mechanical cleaning of equipment of UKL-7 plants and physicochemical nondestructive cleaning of equipment of GIAP 3,5 plants and large-scale nitric acid plants AK-72. Equipment cleaning of AK-72 plant is carried out using the cutting-edge technique without dismantling the heat exchangers, which allows to reduce the down time of the plant shut down for cleaning to 5-6 days instead of one month in case gauze catalyst packs are replaced.

We carry out the works for the plants owned by such large industrial holdings as Eurokhim, Akron, Uralkhim, Fosagro, Ostkhim, etc.. Our long-standing partners and Customers are JSC Akron, Veliky Novgorod; JSC Dorogobuzh, Verkhnedneprovsk village, Smolensk region; JSC Novomoskovsk Azot and Novomoskovsk Khlor, Novomoskovsk; JSC Nevinnomyssk Azot, Nevinnomyssk; JSC Mineral Fertilizers, Perm; JSC Voskresensk Mineral Fertilizers, Voskresensk; JSC Azot, Berezniki; JSC Mineral fertilizers plant of Kirov-Chepetsk chemical complex, Kirov-Chepetsk; JSC Cherepovets Azot, Cherepovets; JSC Shchekinoazot, Shchekino; JSC Mineral Fertilizers, Rossosh; JSC Salavatnefteorgsintez, Salavat; JSC Severodonetsk Azot, etc..

You can send your inquiry for examination of the plant, preliminary assessment as for PGMs recovery and preparation of technical and commercial proposal for cleaning works to e-mail: [project@alvigo.ee](mailto:project@alvigo.ee).

## Industrial Safety Expert Review

Reliability, long service life and industrial safety of equipment are today's problems of paramount priority to be solved for reliable and safe operation of major hazard facilities (MHF) that, in turn, related to qualified expert appraisal of the following:

- process operating parameters for process optimization purpose;
- equipment technical condition by comparing actual performance values with allowable values in order to evaluate a necessity to do maintenance and repair;
- specific operating features of most equipment and units at enterprises of nitrogen industry within Russian Federation.

There is Scientific & Technical Center (S&TC) as a part of Alvigo Group of Companies dealing with issues of industrial safety expert review of equipment and technical documentation. The expert activities in sphere of industrial safety of mineral fertilizer plants and allied branches of chemical industry were the tasks of this center.

As expert organization, S&TC specializes in sphere of general metallurgy, material strength and structural integrity, welding, corrosion protection. The center has a certified NDT laboratory conducting technical diagnostics in order to evaluate the actual technical condition of equipment. The center performs the following activities on industrial safety expert review:

- expert review of MHF design documentation;
- expert review of MHF equipment;
- expert review of industrial safety declarations;
- expert review of other documents related to MHF operation.

The analysis of technical condition and residual safe life is conducted for various types of equipment including HP vessels, piping and steam piping, rotating equipment and other types.

In order to do expert examination of technical condition and forecast residual life of the equipment the experts of S&TC of JSC "GIAP" use state-of-the-art NDT methods and tools such as acoustic emission, thermal vision, ultrasonic, magnetic (including metal magnetic memory method), capillary as well as methods of determining mechanical properties with sample and without sample, metallographic and corrosion examinations of metals. Based on examination results they do equipment strength and stability analysis considering operating conditions and actual loads as well as possible changes of material mechanical properties during operation followed by residual life forecasting.



Scope of works performed by S&TC during the last five years:

	Client	Performed work, TU number
<b>Industrial safety expert review of equipment</b>		
1	JSC "Akron"	374
2	JSC "Dorogobuzh"	138
3	JSC "Novomoskovsk Chlorine"	508
4	JSC "Novomoskovsk Azot"	484
5	JSC "Nevinnomyssk Azot"	126
6	JSC "Azot" (Berezniki)	23
7	JSC "Voskresensk Mineral Fertilizer Plant"	32
8	JSC "Shchekinoazot"	40
9	JSC "Cherepovets Azot"	32
10	JSC "Nizhnekamskneftekhim"	11
11	JSC "Mineral Fertilizer Plant", Rossosh	39
12	JSC "Salavatnefteorgsynthesis"	50
13	JSC "NEFTESERVICE"	22
<b>Expert examination of plant technical condition to extend time between overhauls</b>		
1	JSC "Akron"	Ammonia plants No. 2 (2006, 2010) and No. 3 (2006, 2007)
2	JSC "Novomoskovsk Azot"	Ammonia plants Nos. 2, 3, 4 and urea plant No.3
3	JSC "Nevinnomyssk Azot"	Ammonia plants 1-B, 1-V and urea plant 2-A
<b>Obtaining a permit for use</b>		
1	JSC "Novomoskovsk Azot"	Y1150tpd urea plant (Urea plant-4)
2	JSC "Dorogobuzh"	6
3	EUROTECH, LTD	2

We fulfilled industrial safety expert reviews of more than one thousand eight hundred equipment items (they include ammonia synthesis equipment operating in high temperature and pressure service, reformers, isothermal storage tanks, gas holders and reservoirs, cryogenic equipment and many others) at enterprises of nitrogen industry and chemical complexes of

allied branches.

Our permanent partners and clients are JSC "Akron", Velikiy Novgorod; JSC "Dorogobuzh", Verkhnedneprovsky, Smolensk Reg.; JSC "Novomoskovsk Azot" and JSC "Novomoskovsk Chlorine", Novomoskovsk; JSC "Nevinnomyssk Azot", Nevinnomyssk; JSC "Voskresensk Mineral Fertilizer Plant", Voskresensk; JSC "Azot", Berezniki; JSC "Mineral Fertilizer Plant of Kirovo-Chepets Chemical Complex", Kirovo-Chepets; JSC "Cherepovets Azot", Cherepovets; JSC "Shchekinoazot", Shchekino; JSC "Mineral Fertilizer Plant", Rossosh; JSC "Salavatnefteorgsynthesis", Salavat, and other enterprises who know well that safe operation of major hazard facilities depends on efficient and reliable operation of equipment.

New focus areas in sphere of industrial safety expert review appeared in recent years:

1. Expert examination of technical condition of large-capacity plants in order to prolong time between overhauls. After completion of this work at JSC "Akron", JSC "Novomoskovsk Azot" and JSC "Nevinnomyssk Azot" their ammonia and urea plants are successfully operating now with overhaul life extended to 2-3 years that allows gaining experience and information for future studies.

2. Obtaining a permit for use of equipment at major hazard facilities of chemical, petrochemical and allied industries including package units that significantly expands the opportunities of international cooperation for industrial enterprises.

In particular, in 2010 a permit for plant use was obtained for the project "Urea Plant Expansion with Capacity Increase by 1150tpd based on Plant Relocated from Serbia (Urea Plant-4)" with direct involvement of S&TC experts.

## Why Can You Select Alvigo Group of Companies

- Our companies are located in Russia, Ukraine, Estonia (EC) and we can offer to our Clients the organization of activities that is optimum from the financial, organizational and technical point of view.
- A great variety of the plants, both new and revamped, designed and constructed by our companies in the former USSR countries and worldwide.
- Expertise and experience of personnel realizing the most challenging projects for chemical industry;
- Scrupulous planning and close follow-up control enabling the Client to track fulfillment of his order;
- Convenient communication centers: Moscow, Kiev, Tallinn;
- Engineering capacity more than 700 000 engineering hours per year;
- Flexible approach focused on maximum benefit to the Client.





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