

WATER TREATMENT SERVICES



MIRRICO
GROUP OF COMPANIES



More than **30 cities**

4 countries

2500 tons of chemicals per year

12 000 000 m³ of treated water and waste per year

Footprint in over **10 industries**

4 areas of service for the client's water infrastructure

Own research and development laboratory (R&D Lab)

Constant professional training and development of the employees

Published **more than 30 articles** on water treatment, reactant treatment and coal beneficiation

ABOUT COMPANY

Water Treatment Services Business Unit («Osнова» LLC Chemical Group) is a part of the Mirrico Group of Companies and it specializes in reactant treatment of water cycles, water treatment and waste water treatment, and it also provides chemical solutions for the processes of flotation and sludge dewatering.

Water Treatment Services Business Unit offers chemical solutions and services for enterprises of ferrous and non-ferrous metallurgy, coal mining, pipe and tubing production, oil and gas refinery, utilities and other industries.

■ ■ **During 12 years of work as a part of Mirrico Group Water Treatment Services Business Unit has secured a foothold among the leading companies in water quality assurance.** ■ ■

OUR FOOTPRINT INDUSTRIES

Supplies of chemicals and providing dosing services for the water treatment systems, reverse water supply and waste water treatment for industrial establishments.

Supplies of chemicals and providing dosing services for the water treatment systems and reverse water supply systems for petrochemical and oil refinery plants.

Reactant treatment of boiler water and cooling water.

Supplies of flotation chemicals, flocculants and coagulants for beneficiation of coal, ores and minerals.

Supply of chemicals for heating services and conditioning systems.

Mine water treatment.

Waste water treatment at agroindustrial facilities.

Treatment of industrial wastes and household waste waters.

BENEFITS OF WORKING WITH US

1 HIGHLY COMPETENT STAFF:

- qualified engineering service
- experienced service engineers in our regions of operation
- state-of-art research and development laboratory, highly qualified researchers
- professional team of experts in technological audit and engineering
- knowledge-based promotion and demonstration of effectiveness of our products and services in actual business-processes of our clients

Quality of services provided by "Osnova" LLC is confirmed by ISO 9001:2008 certificate



2 EFFICIENT TECHNOLOGIES:

- wide range of chemicals
- capability to adapt chemical solutions to customer needs
- providing equipment for chemical dosing, automation and monitoring of processes
- application of global innovative solutions

3 MODERN PRODUCTION FACILITIES:

- availability of our own production capacities (a chemical plant in Almet'yevsk city (OPU-30))
- customization of the production facilities to specific tasks whenever necessary
- partnerships with the world's leading chemical enterprises

OUR CHEMICAL SOLUTIONS

WATER QUALITY ASSURANCE

Inhibitors of corrosion
SCIMOL

Inhibitors of scale
DESCUM-2

Protection against corrosion and scaling

Biodispersants
ATREN BD

Suppression of biocontamination

ATREN BIO biocides

Suspended solids and petroleum products removal, sludge thickening and dewatering

flocculants
SEURVEY FL

DECLEAVE-M coagulants

Industrial systems of water circulation

Industrial and municipal waste water treatment systems

Removal of suspended solids, petroleum products and other contaminants, thickening and dewatering of activated sludge, cuttings and settlings

Flocculants
SEURVEY FL

Coagulants
DECLEAVE-M

Suppressing foul smells, reducing H2S concentration

Coagulants
DECLEAVE-M

Water treatment systems

Reverse osmosis systems

ATREN BIO biocides

Scale inhibitors
DESCUM-2 RO

Potable water conditioning systems

Flocculants
SEURVEY DW

Coagulants
DECLEAVE-M DW

Industrial water conditioning systems

Flocculants
SEURVEY FL

Coagulants
DECLEAVE-M

ADVANTAGES OF REACTANT TREATMENT



Reduction of operational costs, including expenses on:

- energy consumption;
- regular maintenance;
- major overhaul



Extension of equipment lifetime, reliability and run between repairs



Reduction of water consumption and waste water disposal



Assurance of the necessary levels of waste effluent quality



Increase of float concentrate output



Dewatering of sludge, settlings and cuttings to the required residual moisture level

CHEMICALS FOR WATER CIRCULATION SYSTEMS, WASTE WATER TREATMENT, WATER CONDITIONING AND SLUDGE DEWATERING

Scale inhibitors DESCUM-2

Description: water solutions containing organic phosphonic acids and polymers as active components as well as special technological aids.

Designed to prevent the emergence of carbonate, sulphate, ferruginous and other scale on the internal surfaces of the water-cooled heat-exchange and technological equipment in the water circulation systems of industrial facilities in order to avoid scale build-up on the membrane surfaces of reverse osmosis units. Besides that, application of these inhibitors allows for softening and washing out old scale.

Corrosion inhibitors SCIMOL WS

Description: compositions of organic and inorganic substances.

Designed for reducing corrosion rate in both open and closed water supply systems of industrial enterprises.

They provide efficient protection for ferrous and non-ferrous metals, function as scale inhibitors and dispersers of mineral scale.

ATREN BIO biocides

Description: a line of non-oxidizing biocides ATREN BIO.

Designed to fight biological contamination in water conditioning and water supply systems in different branches of industry. The ATREN BIO product line contains biocidal active substances allowing effective inhibition of various types of bacteria, including legionella bacteria (*Legionella pneumophila*).

ATREN BD biodispersants

Description: alkaline water solutions of surface-active substances ATREN BD biodispersants

Designed for destruction and removal of biological and hydrocarbon film from the surface of processing equipment and pipelines in water-supply systems of industrial enterprises as well as for prevention of the growth of anaerobic bacteria. Increase biocidal efficiency.

DECLEAVE-M coagulants

Description: a line of organic and inorganic DECLEAVE-M coagulants.

Designed for decontamination of waste water and circulating water from suspended solids, oil products and other contaminants, pre-treatment of industrial water in water conditioning processes; used for thickening and dewatering processes of industrial and municipal sludge; in coal, ore and mineral beneficiation processes as well as in other technological processes at enterprises of various industries.

SEURVEY flocculants

Description: powdered and liquid water-soluble polyelectrolytes with different charge density and molecular weight.

Designed for use in various industries in the processes of waste water and process water treatment, thickening and dewatering of slimes and sludges, coal, ore and mineral beneficiation as well as in other technological processes. Using flocculants of SEURVEY series provides a significant increase in productivity of horizontal and radial settling tanks, filtration, flotation and other equipment units. The SEURVEY line also includes chemicals for potable water conditioning and treatment.

CHEMICAL SOLUTIONS FOR COAL, ORE AND MINERAL BENEFICATION

UNICOL flotation agents (C and F grades)

Description: integrated chemicals for coal flotation, containing foaming and collecting agents.

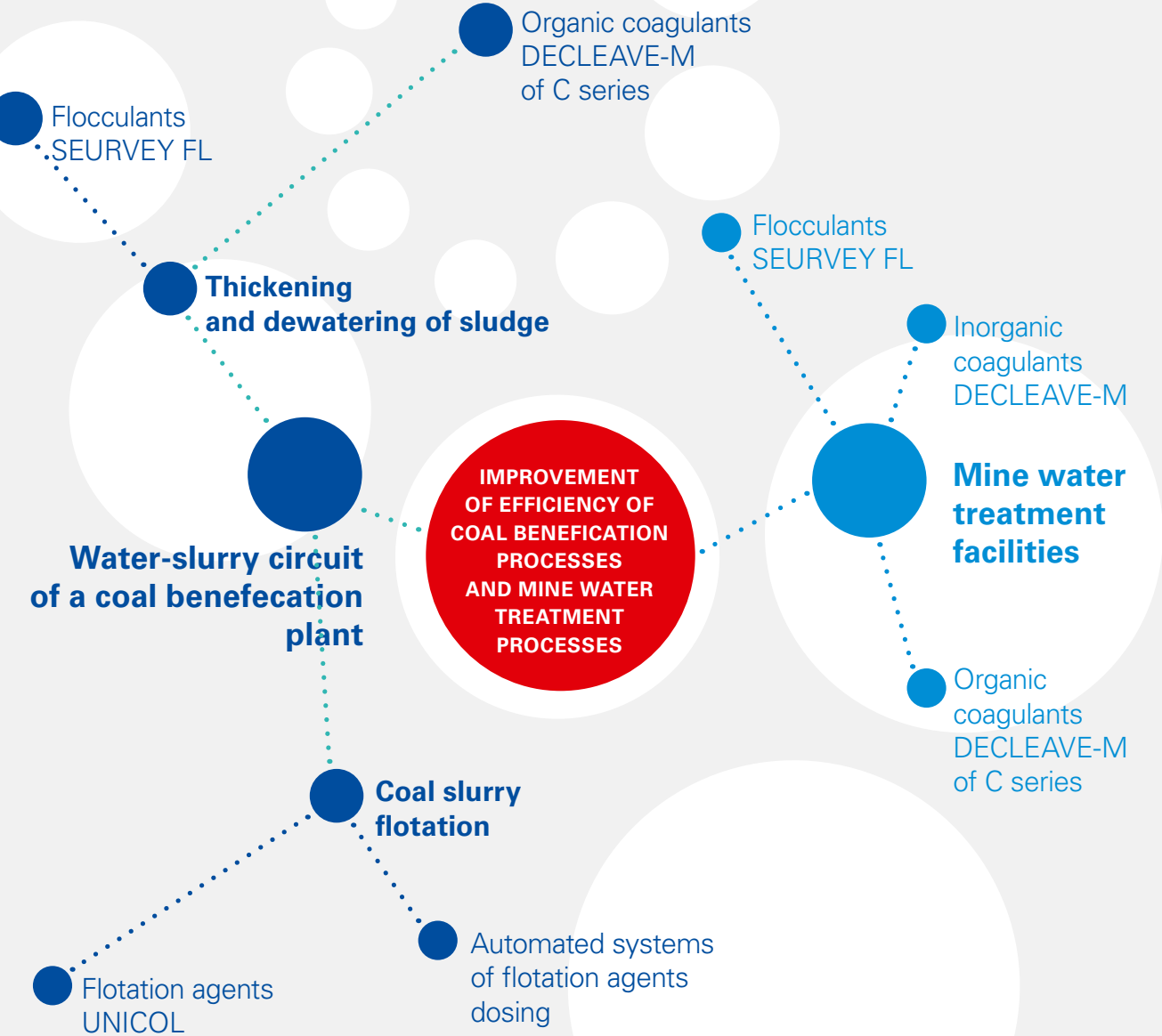
The C grade Unicol exhibits a more pronounced collecting properties.

The F grade Unicol exhibits a more pronounced foaming properties.

Designed for flotation of all known types of coal: fatty, gas, coke, lean and also anthracites.

The C and F grade flotation agents are mixed together in any ratio and used both together and separately depending on conditions. Combined use of these chemicals leads to a synergistic effect.

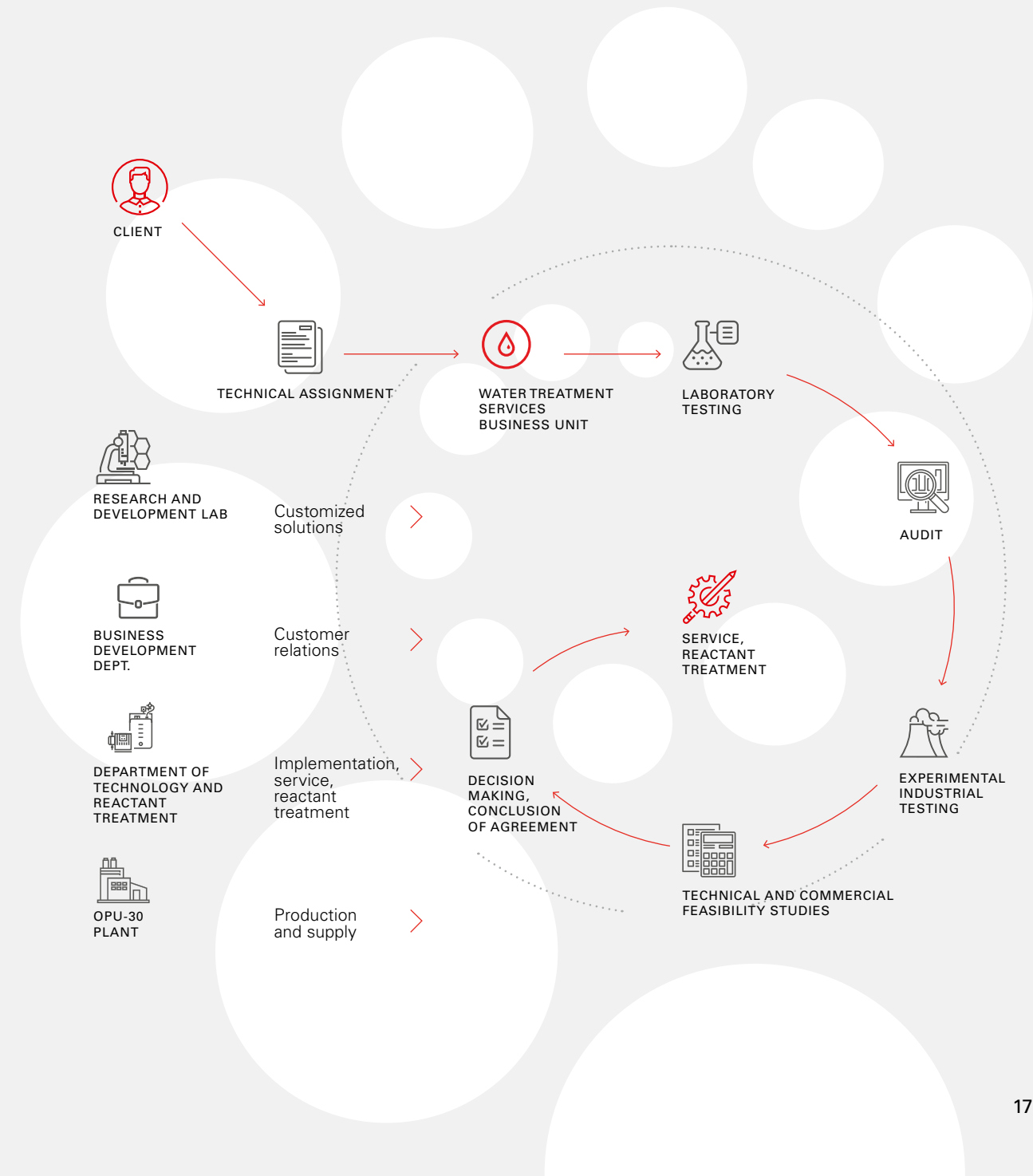
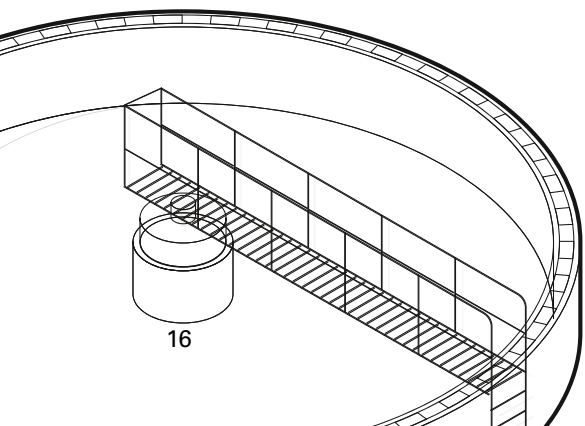
They form a stable foam with good dewatering properties. Act selectively for the entire range of particle sizes in the pulp.



COMPREHENSIVE APPROACH

In order to resolve customer-specific tasks, we perform the following works:

- Inspection of water supply system of the enterprise to evaluate current condition and to identify technological features of water cycles, water conditioning systems, waste water treatment, and sludge dewatering.
- Laboratory-based selection of the most efficient chemicals and their dosage under conditions as close as possible to industrial conditions.
- Development of scientifically justified chemical water treatment program depending on:
 - type of water supply system;
 - initial water composition in the system;
 - customer's requirements to water quality.
- Conducting industrial tests of chemicals.
- Supply of our proprietary chemicals.
- Supply, installation and further regular maintenance of dosing devices and units.
- Continuous monitoring of:
 - chemical composition of water;
 - corrosion rate;
 - solids and petroleum products content;
 - biocontamination of water;
 - scaling rate on heat exchange and other technological equipment.
- Rendering services of reactant treatment.



LONG-TERM WATER RESOURCES MANAGEMENT

The specific feature of this service is outsourcing of the professional management of tasks and processes important for the client company but that are not core of its business. The customer remains the owner of the assets.

The service includes the following:

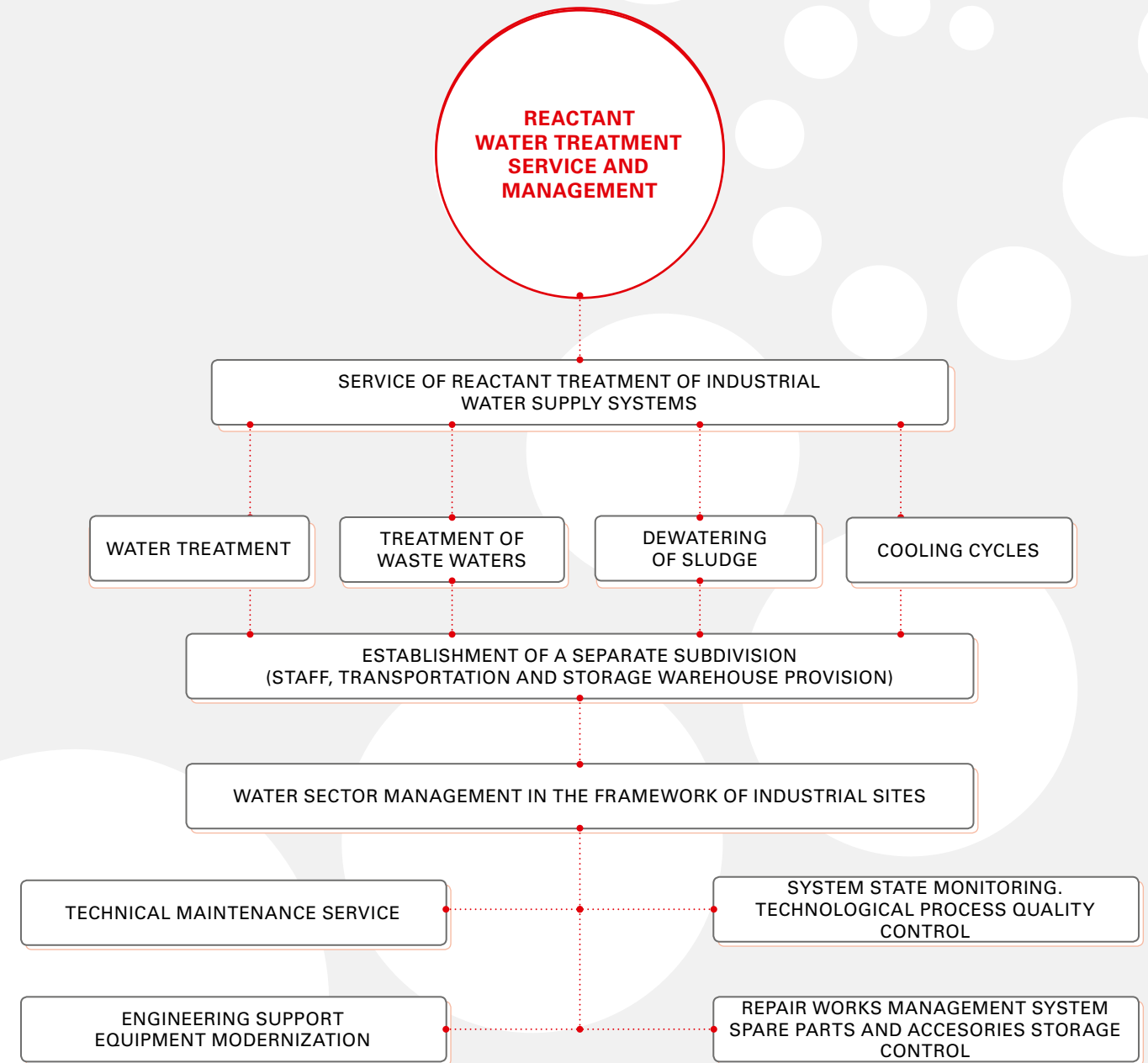
1. Technical audit of water sector.
2. Development of facility reconstruction feasibility report
3. Development and approval of reconstruction projects.
4. Design and construction (general contract).
5. Start-up and commissioning procedures (supervising).
6. Management of water system facilities of the client.

Advantages of long-term water resource management service:

- Reduction of capital investments into construction and reconstruction of water system equipment.
- Reduction of operating costs of ownership, operation and maintenance of infrastructure, which is not core business in terms of manufacturing processes.
- Creation of optimum water system and infrastructure operation scheme.
- Need to control performance of a single contractor instead of a number of companies.
- Transparency of process and water parameter control.
- Minimization of ecological payments by ensuring permitted volume and quality of wastes.

Results of work on long-term water resource management implementation:

- Implementation of brand new approaches to industrial enterprise water sector management.
- Water resource saving.
- Water sector service problem-solving.
- Gaining tangible economic benefits and improvement of competitive capabilities of the company.
- Payment for water quality.



SUPPORT TOOL FOR THE PROCESS CONTROL ENGINEER

1 CORROSION RATE CALCULATION

$$V_{\text{кор}} = \frac{87600 \cdot (m_0 - m)}{S \cdot t \cdot \rho}$$

m_0 — weight of witness sample before installation, g; m — weight of witness sample after exposition, g; S — area size of sample cm²; t — time of sample exposition, hour; ρ — density of sample material, g/cm³ (for steel 20=7,83 g/cm³, for brass L63=8,5 g/cm³).

2 SCALE BUILD-UP INTENSITY CALCULATION

$$\text{Rate of scaling} - C = \frac{M_2 - M_1}{F \cdot T}, \text{ g/m}^2 \cdot \text{hour}$$

$$\text{Rate of scaling} - h = 0,73 \cdot \frac{C}{\gamma}, \text{ mm/month}$$

where M_1 — weight of a sample before exposition, g; M_2 — weight of a sample after exposition, g; F — size of sample, m²; T — length of sample exposition, hour; γ — bulk density of carbonate deposits, g/cm³ (ranges from 2,12 to 2,54 for thick carbonate scale, average value is 2,33).

Hardness transport can be calculated using the following formula:

$$T_h = \frac{I_v^{hCa}}{I_v^{Ec}} = \frac{Ec_{\text{feed}} \cdot H_{\text{circ}}^{Ca}}{Ec_{\text{circ}} \cdot H_{\text{feed}}^{Ca}} \cdot 100,$$

I_v^{hCa} , I_v^{Ec} — vaporization coefficients calculated according to calcium hardness and electrical conductivity (can be applied as a vaporization coefficient calculated according to chloride content or salt content):

$$I_v^{hCa} = \frac{H_{\text{об}}^{Ca}}{H_{\text{feed}}^{Ca}}; \quad I_v^{Ec} = \frac{Ec_{\text{feed}}}{Ec_{\text{circ}}}$$

H_{circ}^{Ca} , H_{feed}^{Ca} — calcium hardness in circulating and feed water;
 Ec_{feed} , Ec_{circ} — electric conductivity of circulating and feed water.



3 OPERATION MODE CALCULATIONS FOR CIRCULATION SYSTEMS

Allowable vaporization coefficient during water circulation cycle operation, depending on the quality of feed water:

$$I_{v, \text{gen}} = (2 - 0,125A_{\text{gen}})(1,4 - 0,01t_1)(1,1 - 0,01H_{\text{gen}})$$

A_{gen} & H_{gen} — respectively, alkaline condition and general hardness of feed water, mg-eq/dm³; t_1 — temperature of circulating water till cooling unit (cooling tower).

Volume of blowdown water:

$$Q_{3 \text{ blow}} = \left(\frac{P_1}{(K_y - 1)} - P_2 \right) \cdot Q_0,$$

Volume of feed water:

$$Q_{\text{feed}} = (P_1 + P_2) Q_0 + Q_{3 \text{ blow}},$$

where Q_0 — circulation water flow rate, m³/hour; P_1 & P_2 — evaporation and drop entrainment coefficient (for water circulation cycles with cooling towers — approximate value is about 0,012 and 0,001).

ABOUT MIRRICO GROUP OF COMPANIES



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

Core activities:

- Development, production and supply of chemicals.
- Maintenance of chemical solutions.

Due to significant investments in research and development, unique products and technologies outperforming competing products are created in Mirrico.

Nowadays our group of companies focuses on offering clients the best solutions at the lowest prices. Stability and high quality of products is confirmed and guaranteed by ISO 9001 quality management system which has been implemented in all subsidiary companies in 2008.

BUSINESS AREAS OF MIRRICO GROUP

MINING & RECOVERY DIVISION
("Mirrico" LLC (Kazan))

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

OIL AND GAS REFINERY AND PETROCHEMICAL INDUSTRY
("Osnova" LLC Chemical Group)

CHEMICALS FOR DRILLING AND MINING
("Promyshlennaya khimiya" LLC)

WATER TREATMENT SERVICES BUSINESS UNIT
("Osnova" LLC Chemical Group)

CHEMICAL WELL TREATMENT
("DELIKA" LLC)

FIELDS OF APPLICATION



WATER AND WASTE TREATMENT



OIL EXPLORATION AND PRODUCTION



PIPELINE TRANSPORTATION OF HYDROCARBONS



COAL MINING AND BENEFICATION



NON-FERROUS AND FERROUS METALLURGY



CHEMICAL AND PETROCHEMICAL INDUSTRY



OIL AND GAS REFINERY



MIRRICO

GROUP OF COMPANIES

INTEGRATED SOLUTIONS FOR TECHNOLOGICAL TASKS

in oil and gas production and refinery, petrochemical,
chemical, mining and concentrating industries,
and metallurgy

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