

Science and Research

In 2022, the training ecology specialists moved to a new level due to foundation of Dissertation Council assessing scientific works and awarding degrees in 1.5.15 “Ecology” and 2.1.4 “Water supply, sewerage, building security systems water resources”. The Council includes 12 university scientists, chairman - rector Dmitry Bykov, deputy chairman - head of the department of "Water supply and sanitation" Alexander Strelkov, scientific secretary - head of the department of "Chemical technology and industrial ecology" Olga Tupitsyna. In 2022, Dissertation Council was presented dissertation on topic: “An integrated environmental system for the assessment and elimination of technogenic hydrocarbon deposits” which was successfully asserted. In 2023, 4 defenses are planned.

The University’s role is to coordinate key projects within State Program "Improving waste management system, including municipal solid waste, in Samara region in 2018-2024", as well as to hold strategy for ensuring environmental safety and waste management in the region, and also participate in a number of Federal Projects corresponding to National Project "Ecology", including: "Integrated solid waste management system", "Infrastructure for waste management of hazard class 1-2", "Clean Water", "Improvement of the Volga", "Introduction of the best available technologies ", "Liquidation of objects of accumulated environmental damage".

Today Samara Polytech is a major participant in Research and Education Center within the projects “Hydrogen – the fuel of the future” and “Development of digital twins of materials and technological processes for their processing.”

Owing to University’s competency profile in Engineering and Environmental Risk Management, Samara Polytech is able to design new technologies and production facilities, provide engineering support for operation of hazardous and technically complex facilities, and carry out specialized work commissioned by industrial partners, such as:

- Reconstruction of rainwater drainage networks in Samara urban district and construction of surface wastewater treatment facilities, Department of Municipal Economy and Ecology of Samara Region Administration, 2022-2024, 180 million rubles;
- Design and survey for the design and construction (reconstruction) of centralized water supply system (Samara Region, Novokuybyshevsk city),

State Public Institution "Capital Construction Administration", 2022, 109 million rubles;

- Development of multifunctional waste management complexes for Municipal Institutions of Samara Region, Ministry of Energy and Housing and Communal Services of Samara Region, 2020-2022, 69 million rubles;
- Development of working documentation for "Acid gas recovery plant" LLC "VPK-Oil" 2021-2022, 46 million rubles;
- Development, support and coordination of environmental documentation with obtaining comprehensive environmental permits for the facilities of Samaraneftegaz JSC, SamaraNIPIneft LLC, 2020-2022, 28 million rubles;
- Services for "Inspection of a local wastewater treatment unit with issuance of recommendations for replacing diisopropyl ether", JSC "SvNIINP", 2020-2022, 28 million rubles;
- Inspection of a local wastewater treatment unit with issuance of recommendations for replacing diisopropyl ether", JSC "SvNIINP", 2021-2022, 8 million rubles;
- Services for development of documents for obtaining a Integrated Environmental Permit, JSC SNPZ, 2021-2022, 16 million rubles.

A great number of innovation infrastructure facilities provide access to special-purpose equipment necessary for research and development works, such as:

- Scientific and Analytical Center for Industrial Ecology;
- Institute for Design and Survey Works;
- Scientific and educational center for environmental monitoring, forecasting and reducing the impact of technical systems on the biosphere;
- Volga Region Resource Center for Environmental Engineering and Chemical Technology;
- Laboratory "Multidimensional analysis and global modeling";
- Laboratory "Advanced technologies for processing renewable organic raw materials and hydrogen accumulation";
- Laboratory of Intelligent Systems;
- Production and engineering center.

The volume of funding for R&D in environmental management, environment and sustainable development is estimated at more than 200 million rubles.

Samara State Technical University researchers are nominated in Elsevier rankings on account of their significant contribution to world science. In 2022, among 967 Russia's scientists the following academics are recognized:

- Head of the Department of General and Inorganic Chemistry Vladislav Blatov (38th among Russia's scientists, 16590th among world's scientists);
- Associate Professor of the Department of Industrial Heat and Power Engineering Dmitry Pashchenko (112th among Russia's scientists, 40173rd among world's scientists);
- Professor of the Department of Chemical Technology and Industrial Ecology, Director of the Volga Region Resource Center for Engineering Ecology and Chemical Technology Andrey Vasiliev (344th among Russia's scientists, 124531st among world's scientists);
- Professor of the Department of Physics Alexander Volokitin (464th among Russia's scientists, 169453rd among world's scientists).

The total number of articles published in highly rated issues focusing on Sustainable Development in 2022 reached 405 articles.

In 2022, the Higher Attestation Commission of the Ministry of Education and Science of Russia approved the list of peer-reviewed scientific publications and their distribution by category. Thus, the Samara Poytech Scientific Journal "Urban Planning and Architecture" is classified as category K1.

In the reporting year, University ecologists entered the Board of Experts and became Members of Public Councils run by Ministries and Federal and Regional Departments, for instance:

- Public Council for Environmental Safety of Samara Region;
- Public Council of Samara Region Ministry of Forestry, Environmental Protection and Natural Resources Management;
- Strategic Council of Samara Region Ministry of Energy and Housing and Communal Services of the Samara Region.

In order to use and commercialize the results of intellectual property in 2022, SSTU submitted 4 invention applications and 1 utility model application:

1. Invention Application No. 2022117984 dated 07/01/2022 "Device for purifying artesian waters";

2. Invention Application No. 2022117996 dated 07/01/2022 “Method for purifying artesian water”;
3. Invention Application No. 2022120660 dated July 28, 2022 “Device for neutralizing toxic components of flue gases without introducing an external reagent”;
4. Invention Application No. 2022120661 dated July 28, 2022 “Method for neutralizing toxic components of flue gases without introducing an external reagent”;
5. Utility Model Application No. 2022120807 dated July 29, 2022 “Device for cleaning flue gases.”

Submitted application resulted in receiving intellectual property protection documents:

1. Certificate of state registration of computer program No. 2022669216 dated 10/18/2022 “Multi-criteria optimization of complex processing of oil-containing waste according to system quality criteria”;
2. Patent for invention No. 2781900 dated October 19, 2022 “Combined device for damping pressure fluctuations in pipelines and power plants and reducing noise of power plants (together with Vasiliev Center)”;
3. Utility model patent No. 215634 dated December 21, 2022 “Device for cleaning flue gases.”

Scientific projects by young scientists of Samara Polytech are highly rated by National Agencies. For instance, presentation by post-graduate Alexey Ganin supervised by Andrey Vasiliev, director of the Volga region resource center for engineering ecology and chemical technology, was recognized as one of the top projects at the All-Russian Scientific and Public Forum “Ecological Foresight” (EPANT-2022). This project is sponsored by Russian Science Foundation and is focusing on studying low-frequency noise characteristics produced by a vehicle and developing technical solutions for noise cancellation. The event gathered 150 scientists and students from different parts of the country and 700 attendees joined online.

Focusing on environmental safety, the University’s Scientific Community annually comes up with new developments and solutions for improving biodegradable (edible) technologies reducing the level of waste and plastic pollution. In the reporting year, as part of the International Competition of Young Researchers’ Projects “Food

Security” of the Eurasian Economic Youth Forum program, Samara Polytech student presented project of biodegradable bag made of starch, acid, glycerin and water. It can be a decent alternative to the usual polymer one.

Long-term cooperation with industrial partners and high-tech companies speak for a great demand for multi-difficulty designs. Thus, in 2022, according to the results of the All-Russian Architectural Open Creative Competition “Natural Green Shelter for Tourist”, the works of Samara Polytech students were recognized as the best for paying special attention to computer modeling. The idea of the projects lays in autonomous control of residential units for tourists, located in nature regardless the landscape types, and meeting the GREEN ZOOM energy-efficient construction standard.

SSTU offers a list of engineering works, services, and expertise:

- R&D for construction, reconstruction, technical re-equipment and liquidation, including technical documentation:
 - 1) technological installations, linear structures, petrochemical complex facilities (including dangerous and technically complex capital construction facilities), incl. construction site preparation
 - 2) complexes for the neutralization and disposal of waste and effluents of various origins, including petrochemical waste
 - 3) hydraulic structures (classes II-IV) and disposal facilities for liquid and paste waste (sludge pits, sludge pits, buffer ponds)
- Development of technological regulations and technical assistance in the implementation of new technologies for recycling waste from petrochemicals, oil production, oil refining, including the production of secondary resource components;
- Carrying out comprehensive surveys and monitoring studies of the quality of components of the natural environment of area and linear objects;
- Development of permission and license approved by supervising departments and agencies for the operation of industrial enterprises;
- Development of water use projects, sanitary protection zones for water bodies, monitoring programs for water bodies approved by supervising departments and agencies;

- Conducting an examination of design documentation for conservation and liquidation of a hazardous production facility;
- Conducting an industrial safety examination of documentation for the technical re-equipment of a hazardous production facility;
- Conducting an industrial safety assessment of technical devices used at a hazardous production facility;
- Conducting an examination of the industrial safety of buildings and structures at a hazardous production facility designed for technological processes, storage of raw materials or products, transferring people and goods, detection and elimination of accident aftermaths;
- Development of unique environmental protection technological solutions with obtaining patents and permits for technologies and installations;
- Laboratory and analytical environmental protection support for companies, including: inventory of sources of waste, emissions, measurements and laboratory tests, certification, experimental research and development of new methods for studying composition;
- Performing an environmental quality assessment in a specific location, including: radiation levels (alpha, beta, gamma radiation, radon concentration), electromagnetic radiation (industrial frequencies and microwave radiation), noise and vibration levels, soil pollution levels, water quality;
- Expert support for all types of activities, including representing the opinions of specialists in legal disputes on ecology and environmental protection issues.

SSTU engineering schools are planning development of experimental and technological design for industrial partners in the following areas:

- Industrial ecology, rational use of natural resources and technogenic safety;
- Improving water management, water supply and sanitation systems;
- Chemical technological processes, gas and oil production, processing and transportation;
- Design and maintenance of energy services;
- Industrial safety examination;
- Urban planning and urban environment, reconstruction and restoration of architectural heritage, etc.

These tasks will be solved within two strategic directions:

1. Creation of a higher biotechnological school “EcoPromBiotech”, including:
 - a. Projects to create industrial technology, develop and produce equipment for creating pilot industrial production of microbiological feed protein. This direction includes both fundamental and exploratory research, as well as design and modeling of equipment, the technology being developed and its individual stages;
 - b. Environmental Safety and Recycling Projects are aimed at developing solutions to major environmental problems of accumulated industrial waste. This direction includes both projects at the junction with the first block of projects, and individual projects aimed at developing models, methods, methods and engineering solutions for processing, recycling and disposal of industrial waste.

Partnership: in terms of fundamental principles of biotechnological processes, Samara Polytech relies on cooperation with the Federal Research Center of Biotechnology of the Russian Academy of Sciences, in terms of organizing production and technological processes using biotechnologies Samara Polytech has strong bonds with industrial partners: LLC "ERESSIPI", PJSC "Kuibyshevazot", JSC " Novokuibyshevsk Refinery", JSC "Novokuibyshevsk Petrochemical Company", LLC "SIBUR PolyLab", JSC "Samaraneftegaz", and Open Code LLC in terms of creating digital technologies and digital twins.

2. The development of prospective technologies for generating and accumulating hydrogen is being implemented in the laboratory “Advanced technologies for processing renewable organic raw materials and accumulating hydrogen,” created under megagrant No. 14.Z50.31.0038 dated February 20, 2017, within the framework of Decree 220 of the Government of the Russian Federation (2017-2020, 90 million rubles). The project's scientific team is developing approaches to hydrogen accumulation based on the use of aromatic or heterocyclic compounds, in which the storage and release of hydrogen is dependent on catalytic hydrogenation-dehydrogenation reactions.