



SIGNIFICANT R&D ACHIEVEMENTS

PARENT >

In accordance with the Group's R&D strategy, the research conducted in 2014 was focused on improving the quality of the Group's products, operational optimisation of selected production lines, as well as on innovative product development technologies. For this purpose the Parent closely cooperated with a number of reputable universities and scientific institutions.

The most important R&D initiatives in 2014 included:

- › In the area of fertilizers – enhancement of the fertilizer manufacturing process through appropriate selection of inorganic additives and anti-caking agents improving the physical and chemical properties of the fertilizers.
- › In the area of plastics – research into potential broadening of the product range by engineering new varieties of modified plastics, with the use of various additives enabling specialist application of the plastics, e.g. in the automotive industry.
- › Research was also made to examine the possibility of reducing the costs of production of caprolactam, one of the Group's key products, and further improving its quality (including through operational optimisation of selected centres), as well as enhancing the quality of polyoxymethylene (including with respect to reduction of emissions of residual formaldehyde).
- › In the area of product diversification – research to develop a technology for production of technologically advanced materials and products.

During the PLASTPOL International Plastics and Rubber Processing Fair, Grupa Azoty received a medal in the 'Modern Solutions for the Polish Industry' category for its second generation Tarnoform plastic, characterised by low emissions of formaldehyde and intended for use in the automotive industry. Moreover, in 'Modern Solutions for the Polish Industry' category, the fairs jury awarded the Parent for its caprolactam-modified Tarnamid.

GRUPA AZOTY PUŁAWY GROUP >

In June 2014, the biological wastewater treatment plant's precipitate dehydration unit was put in service. The facility was constructed under the project 'Optimisation of Drilling Waste Management Methods' carried out as part of the 'Blue Gas - Polish Shale Gas' programme. The Company acts as the Leader of the Consortium responsible for the project, which is co-financed by the National Centre for Research and Development.

The fertilizer segment saw the ending of preliminary work on a project set to enable granulation of ammonium nitrate fertilizers. The investment process is expected to begin in 2015.

On December 23rd 2014, the National Centre for Research and Development announced that it had carried out a factual evaluation of the project 'Support for low-emission agriculture able to adapt to climate change now and within the 2030 and 2050 timeframes' with positive results and recommended that the project be subsidised.

The project is carried out by a consortium which comprises Grupa Azoty PUŁAWY and the following entities:

- › Institute of Soil Science and Plant Cultivation – State Research Institute – Project Coordinator,
- › Agrophysical Institute – Polish Academy of Sciences,
- › Environmental Protection Institute – State Research Institute.

The objective of the three-year project is to enable more efficient resource utilisation by implementing innovative low-carbon agricultural solutions and promoting sustainable application of mineral fertilizers at Polish farms. An analysis will be carried out as part of the project to evaluate the technological and economic efficiency of agricultural practices now and in view of the climate changes forecast to take place by 2030 and 2050.

Also under the project, emissions due to fertilizer applications will be analysed, which will include an evaluation covering fertilizer production and emission intensity of current agricultural practices based on a representative sample of Polish farms, verification of methods for estimating emissions in the case of the most promising mitigation mechanisms (taking into account field measurements), and evaluation of technological and economic efficiency of the practices using the LCA (Low Carbon Agriculture) method, taking into consideration the need to adapt farms to changing climate conditions.

Based on these surveys, certificates will be issued to designate fertilizer applications with a reduced carbon footprint (greenhouse gas emissions). The results will be used to chart Poland's agricultural policy with respect to climate-related activities and improving the methods for estimating agricultural emissions within the National System for Surveying and Estimating Emissions.

In GZNF Fosfory Sp. z o. o., a company of the Grupa Azoty PUŁAWY Group, a technology for recovering phosphates from the Wiślinka phosphogypsum landfill site's leachate was developed, enabling recovery of 100% of the phosphates contained in the leachate by introducing them into the crystalline structures of the compound fertilizers manufactured by the company. In addition to generating positive economics, the technology has significant environmental implications, as it enables faster reclamation of landfill sites, improves the state of the natural environment, and supports sustainable development by reducing consumption of water and phosphorus from natural sources.

Another company of the Grupa Azoty PUŁAWY Group, Zakłady Azotowe Chorzów S.A., developed a technology for producing a magnesium nitrate solution and carried out conceptual work into obtaining fatty acids through fractional distillation of light fractions from residual distilled fatty acids remaining from stearin production.

In addition, conceptual work was carried out into obtaining KNO_3 from waste solutions.

GRUPA AZOTY ZAK S.A.



In 2014, the company's R&D activities focused on search for new products to expand the product range, as well as potential technical and technological upgrades to reduce energy consumption in the manufacture of key intermediates.

In the OXOPLAST Business Unit, R&D initiatives were focused on new types of non-phthalate plasticizers and potential non-alcohol products of butyraldehyde processing (intermediate product of OXO synthesis). In addition, the start-up of a new unit for producing bis(2-ethylhexyl)-1,4-benzene dicarboxylate (a plasticizer), with an annual capacity of 50 thousand tonnes, commenced. Grupa Azoty ZAK S.A. continued research activities geared towards expanding the offering of non-phthalate plasticizers, including bio-based plasticizers.

In the area of fertilizer production, the company is working on new compound fertilizers and on launching the production of liquid fertilizers.

Various approaches to reducing energy consumption in the manufacturing of key intermediate products (primarily ammonia) are also being analysed. The company seeks to improve technological reliability of manufacturing processes for key intermediate products used in fertilizer production.

GRUPA AZOTY POLICE



The research and development activities conducted by the company comprised:

- › laboratory research and quarter-technical analyses,
- › industrial-scale tests,
- › feasibility studies, expert reports and analyses.

These activities were conducted in partnership with third-party institutions in Poland and abroad.

In addition to the new research themes, in 2014 the company continued its work on the projects commenced in 2013.

The following is a list of major completed R&D projects:

- › feasibility study into modernisation of the Phosphoric Acid Department evaporation system - upgrade from a single-step to a

three-step evaporation process,

- › research into the possibility of recovering phosphorous from a phosphogypsum landfill site leachate,
- › research into removal of contaminants from phosphoric acid,
- › comprehensive research into fertilizer quality enhancement methods – choice of coating agents and evaluation of the impact of cooling air parameters on the quality of fertilizers,
- › research into the usability of magnesium sulfate obtained through magnesite neutralisation of hydrolytic acid in the fertilizer segment,
- › analysis of the possibility to produce AdBlue solution directly from urea solution discharged from the synthesis unit.