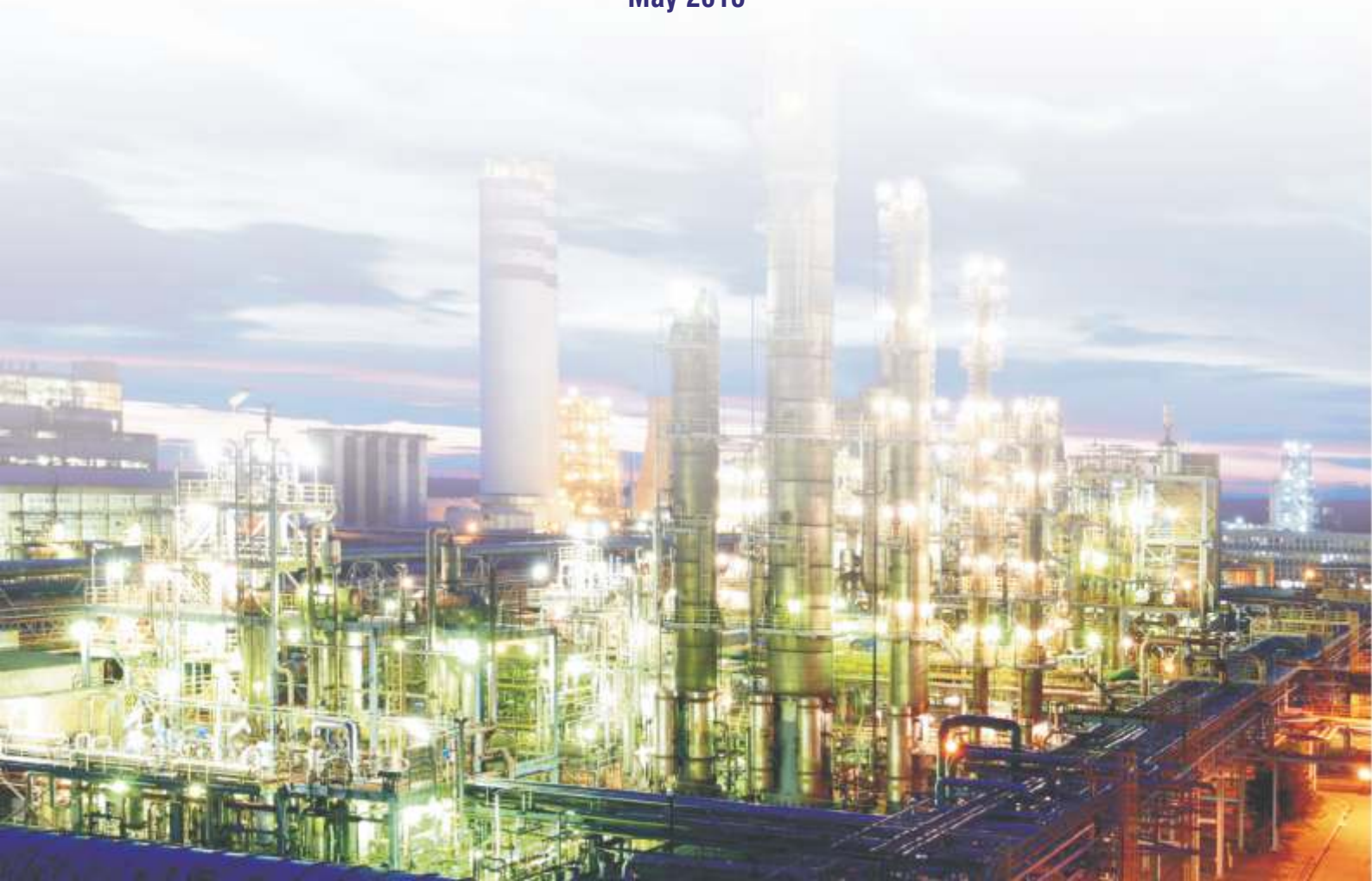
PUŁAWY

GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.

Investment or Cooperation Offer

May 2015



PUŁAWY

PUŁAWY PRODUCTION PARK

PODSTREFA PUŁAWY
EXPERIENCE. TRUST. COOPERATION

Puławy Production Park - (PPP) Subzone Puławy SEZ Starachowice

www.sse.pulawy.com

On 24 April, 2003, Puławy Municipality and Zakłady Azotowe "Puławy" S.A. (ZAP S.A.), set up the Puławy Production Park.

Today Puławy Production Park spreads out on the area of nearly 700 ha and it covers four areas of competence:

1. Puławy Production Park (PPP) - area of approx. 570 ha, administered by Zakłady Azotowe "Puławy" S.A.
2. Puławy Subzone of The "Starachowice" Special Economic Zone - area of approx. 99 ha, located with in the premises of Puławy Production Park - administered by the Management of SSE "Starachowice" S.A. and the Management Board of GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.
3. Puławy Production Park - area of approx. 130 ha, administered by Puławy Municipality.
4. Puławy Science and Technology Park (PPN-T) - curently erected within the premises of PPP, administered by Puławy Municipality.

Location

Puławy is situated in the South-East Poland, where the three following geographic regions meet: Nizina Mazowiecka, Małopolski Przełom Wisły and Wyżyna Lubelska.

Distances from bigger towns of the region, Poland and Europe:

- Warsaw 110 km
- Lublin 45 km
- Lwów 260 km
- Berlin 700 km

Nearest airports:

- Świdnik 55 km
- Warsaw 110 km
- Rzeszów 167 km

Nearest sea ports:

- Gdańsk, Gdynia approx. 450 km - own transshipment terminal.

Profile of the Subzone

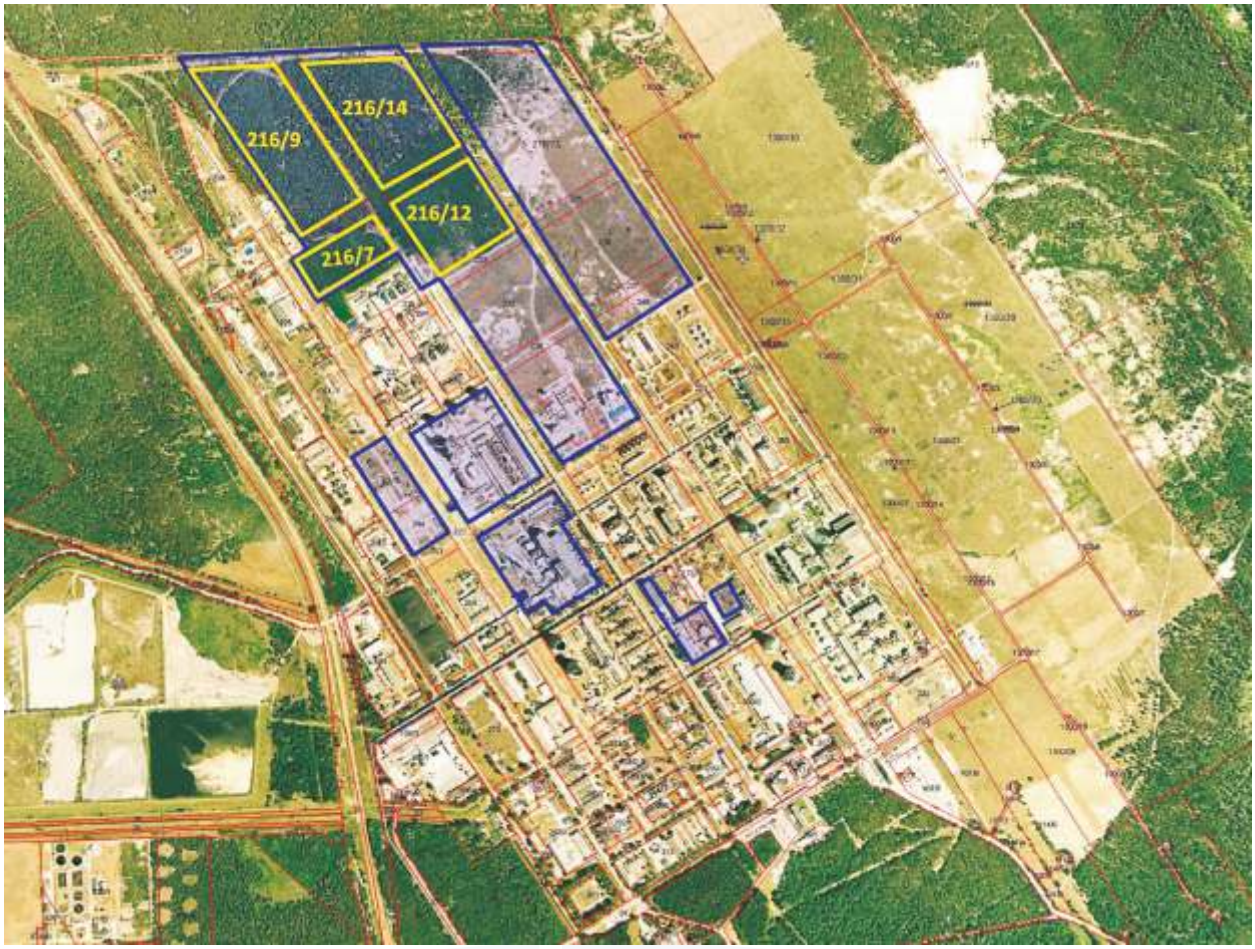
Due to specific activity of GRUPA AZOTY Zakłady Azotowe "Puławy" S.A., closely related to the "Great Chemical Synthesis Sector", the Puławy Subzone of the Starachowice Special Economic Zone is a perfect location for investors whose undertakings can be realized in cooperation with GA ZAP SA, based on a broad basis of products and components manufactured in Puławy, available here unique media and feedstocks.

The Puławy Subzone is also open to investors from other branches, not related to the chemical/ fertilizer sector. A unique in Poland offer for the potential and scope of available media and

feedstocks, creates a broad basis for many projects based on various processes and products. The location of the Puławy Subzone in the eastern part of Poland is another advantage for the entrepreneurs starting their eastern markets-oriented business activity.

The Puławy Subzone areas for investment:

Lands/properties offered by the Puławy Subzone have the status of greenfields, free investment areas.



Actual property offer:

32 307 m^2 (land parcel No. 216/7)
106 963 m^2 (land parcel No. 216/9)
64 107 m^2 (land parcel No. 216/12)
92 201 m^2 (land parcel No. 216/14)

Ownership

Treasury, perpetual lessee - GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.

Use

Industrial areas.

Characteristic

Land properties, not built-up, ecologically clean, partly wooded with easy access via a 4m wide internal asphalt road. Changing the forest land status is possible through obtaining the building permit and it does not prolong the procedure of land preparation for projects execution.

Building conditions

Necessity of maintaining 10% of area biologically active, max. height of buildings - 20 m, built-up density not higher than 2,0 of total land area.

The complex available utilities

Electricity:

- for 6 kV available:
  - 5 MW at distance approx: 800 m,
  - 9 MW at distance approx:1000 m,
  - 5 MW at distance approx:1300 m,
- for 30 kV available 100 MW at distance approx: 2500 m

Natural gas:

- DN 200, volume 500 m^3/h at approx: 350 m

Water:

- industrial DN 250 at distance: 30 m,
- potable DN 200 at distance: 400 m,
- well DN 500 at distance: 730 m

Sewage:

- industrial DN 600 at distance: 730 m,
- precipitation water DN 500 at distance: 30 m

Internet:

- possibility of using the existing broadband network at Zakłady Azotowe "Puławy" S.A. - connection approx. 100 m

Telecommunication:

- possibility of using the existing ISDN telecommunication network at Zakłady Azotowe "Puławy" S.A. - connection approx. 100 m

Additional products, media and feedstock

Products:

Ammonium nitrate PULAN®
Urea PULREA™
PULASKA®
Urea Ammonium Nitrate RSM®
RSM®S
Ammonium sulphate PULSAR™
Melamine
Caprolactam
Hydrogen peroxide
NOX-y™
Hydroxyloamina
Cyclohexanone
Nitric acid
Ammonia
Hydrogen 99,999
Liquid Carbon dioxide
Carbon dioxide snow
Polyethylene foil

Heat plant products:

Process steam 4.0 MPa
Process steam 3.2 MPa
Process steam 1.4 Mpa

Media:

Thermal energy
Electricity
Demineralized water
Decarbonized water
Hot water
Nitrogen
Oxygen
Instrument air
Process air
Interconnection power lines

Feedstock:

Natural gas
Benzene
Sulphur
Sulphuric acid
Coal
Polyethylene
Hydrochloric acid

Technical and transport Infrastructure

Puławy Production Park is prepared to provide complex services for investors from various industry branches and sectors.

Those who are interested in starting their activities on its territory are offered the following:

- Medium and low voltage power networks,
- Natural gas network,
- Process steam networks,
- Water systems, sewerages, waste water treatment plants,
- Process air, instrument air,
- Vast variety of feedstocks and products for further processing,
- Freight siding - total railway length is 57 km, which enables fast transport of feedstocks and products by railway transport,
- Electronic weighbridge - for lorries and trains,
- Modern parking lots for trucks,
- The area of Puławy Production Park, connected with a network of access and internal roads, enabling free access of cars, cargo vans and trucks,
- Easy connections with the national roads network, using the ring road and the new Vistula River bridge crossing,
- Unlimited access to broadband internet (permanent and wireless connections, ETHERNET, e-mail accounts, websites), as well as access to telecommunication network (own telephone exchange).

Investment advantages

Regional public assisstance

The location of the Pulawy Subzone of the Starachowice Special Economic Zone in the Lubelskie Province, gives opportunity to take advantage of the highest possible in Poland social assistance, which is:

- 70% for small companies
- 60% for medium companies
- 50% for big companies.

This means that the entities acting on its territory on the basis of special permissions, are exempt from the income tax respectively up to 70, 60, 50%, qualified investment spendings or two-years employees labour costs, generated by such new investments.

Business surrounding

Puławy is a town founded on the basis of the residence designed in XVII Century on the river bank slope by Tylman of Gameren, for the Great Crown Marshal Stanisław Herakliusz Lubomirski. The glory days for Puławy came at the time of Duchess Izabela Czartoryska, who created there at the turn of XIX Century an important political, intellectual, cultural and artistic centre, often called the "Polish Athens".

The current status of Puławy was influenced mainly by the decision made in 1960 about locating there a huge chemical complex. Today Zakłady Azotowe "Puławy" S.A. is a leader of the Polish fertilizer/chemical industry, a significant expoerter and a driving force for the 50.000 inhabitants town as well as the whole Lubelskie Province.

Puławy is also a dynamic sciencitific centre in Poland and Europe, with the following five scientific institutes exist:

- New Chemical - Sintesis Institute (Instytut Nowych Syntez Chemicznych)
- Institute of Soil Science and Plant Cultivation (Instytut Uprawy Nawożenia i Gleboznawstwa PIB)
- National Veterinary Research Institute (Państwowy Instytut Weterynaryjny PIB)
- Military Institute of Hygiene and Epidemiology (Wojskowy Instytut Higieny i Epidemiologii - Ośrodek Diagnostyki i Zwalczania Zagrożeń Biologicznych),
- Research Institute of Pomology and Floriculture (Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa) in Puławy.

In 2006 Puławy was granted the valid indefinitely title "Golden Business Location" (Złota Lokalizacja Biznesu) an award for three times winning the title of "Fair Play Municipality" (Gmina Fair Play) - Certified Location of Investment Project (Certyfikowana Lokalizacja Inwestycji), and to honour the pro-ecology activities and investments the title of Polish Ecology Leader (Lider Polskiej Ekologii) (2005) and Polish Ecology Patron (Mecenas Polskiej Ekologii) (2007).

The quality of management and relevant solutions are confirmed by other titles and certificates: Safe Municipality (Bezpieczna Gmina), Transparent Poland (Przejrzysta Polska) and ISO 9001.

The town is active economically, it offers a system of conveniences and allowances for entrepreneurs, it supports the institutions and business-related instruments, it is the founder of Puławy Production Park (2003), farthest to the East UE territory of such important and specific production and logistic potential. Puławy is the Puławy Scientific/Technology Park originator and investor.

In 2011 Puławy was granted a honourable right to use the promotion logo "Now Poland" (Teraz Polska), Active City certificate and European Diploma.

Dynamic and progressive character of Puławy is found in the investment projects among the most important in 2006-2012 were:

- The Jan Paweł II bridge, the biggest in Poland, and third in Europe arch bridge: PLN 400 mln,
- First stage of the Puławy ring road (12, 71km): PLN 311 mln,
- Dutch Town (safe solutions in road traffic): PLN 30 mln,
- Puławy online (Puławy w sieci) - implementation of the informative society solutions: PLN 19 mln,
- Modificaton and revamping stadium: PLN 49 mln,
- Puławy Science and Technology Park and preparation of investment areas: PLN 78 mln.
- Using values of Vistula River - a joint tourist product Kazimierz Dolny-Puławy-Janowiec: PLN 65 mln.

Investment Projects and Companies in the Puławy Subzone of the Starachowice Economic Zone:

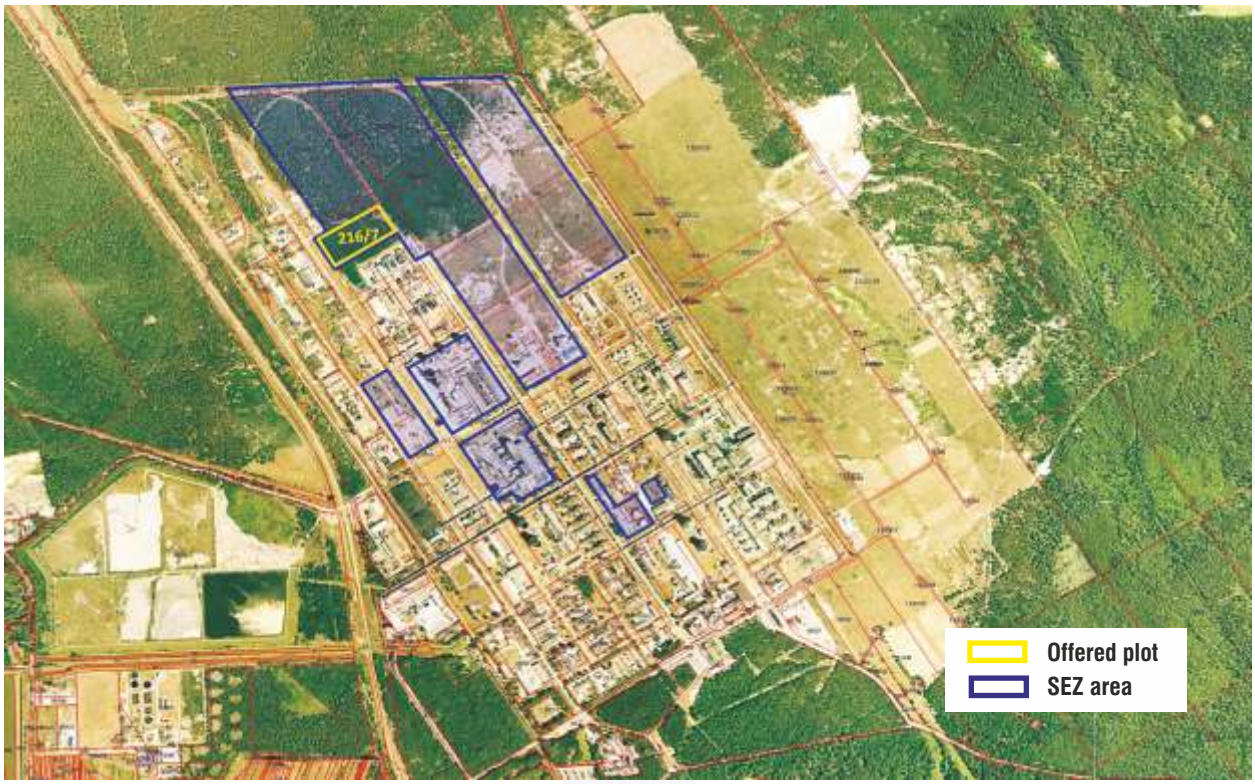
- Revamping of Urea and AdBlue plants -ZAP S.A. investment project, the area for the investment - 7,6572 hectares, minimum planned investment outlays - 45.700.000 EUR, spent outlays - EUR 46,378,677.72, investment project has been executed and started.
- Air Separation Unit - a project by Air Liquide Polska Sp. z o.o., area occupied for the project - 0,9678 hectare, an investment project executed and started.
- Manufacture of liquid fertilizers based on urea and ammonium sulphate - PULASKA - investment project by ZAP S.A., area occupied by the investment project - 5,4472 hectares, minimum planned outlays - PLN 50.000.000, spent outlays - 54.770.000 PLN, investment project has been executed and started.
- Production of solid fertilizers based on urea and ammonium sulphate - PULGRAN S - investment project by ZAP S.A., area occupied by the investment project - 3,4737 hectares, minimum planned outlays - PLN 68.000.000,- spent outlays - 85.000.000 PLN, investment project has been executed and started.

Plot 216/7 site details

Location	
Site name	- Zakłady Azotowe "Puławy" S.A. Puławy Subzone of the "Starachowice" Special Economic Zone
Town (Commune)	- Puławy
Poviat	- Puławy
Voivodeship	- Lubelskie
Property area	
Area	- 3,23 ha
Shape of the site	- Rectangular
Land expansion	- Is possible
Property details	
Owners	- GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.
Valid zoning plan	- Yes
Zoning	- Productions areas, warehouses and storage facilities and services
Plot details	
Soil class with area	- Industrial area
Differences in land level	- 1÷2 m
Current use	- Not used
Pollution to underground and surface waters	- No
Risk of flooding or land slide	- No
Underground obstacles	- No
Ground level obstacles	- Tree and bush planting
Environmental restriction in force	- Tree and bush planting, consent required for cutting down
Buildings and other structures on site	- No
Transport links	
Access road to the plot	- Asphalt road, 4 m wide
Nearest motorway/national road	- National road No. 12, National road No. 17 Hrebenne - Warsaw - approx. 8 km from Puławy
Railway line	- On the area of Zakłady Azotowe "Puławy" S.A.
Railway siding	- 1km
Nearest international airport	- Warsaw - 110 km, Świdnik - 55 km
Nearest voivodeship capital	- Lublin - 45 km

EXISTING INFRASTRUCTURE

Electricity	- Yes
Connection point	- 800 m÷2500 m
Voltage	- 0,4 kV, 6 kV, 30 kV
Available power	- 20 MW (6 kV), 100 MW (30 kV)
Gas	- Yes
Connection point	- 350 m
Calorific value	- 36,198 MJ/m^3
Pipe diameter	- DN 200
Available capacity	- 500 m^3/h
Water supply	- Yes
Connection point	- 30 m÷730 m
Available capacity	- As required
Sewage discharge	- Yes
Connection point	- Industrial - DN 600 - 730 m, precipitation - DN 500 - 30 m
Available capacity	- As required
Wastewater treatment plant on the site or nearly	- No
Telephone lines/internet	- On the area of Zakłady Azotowe "Puławy" S.A.

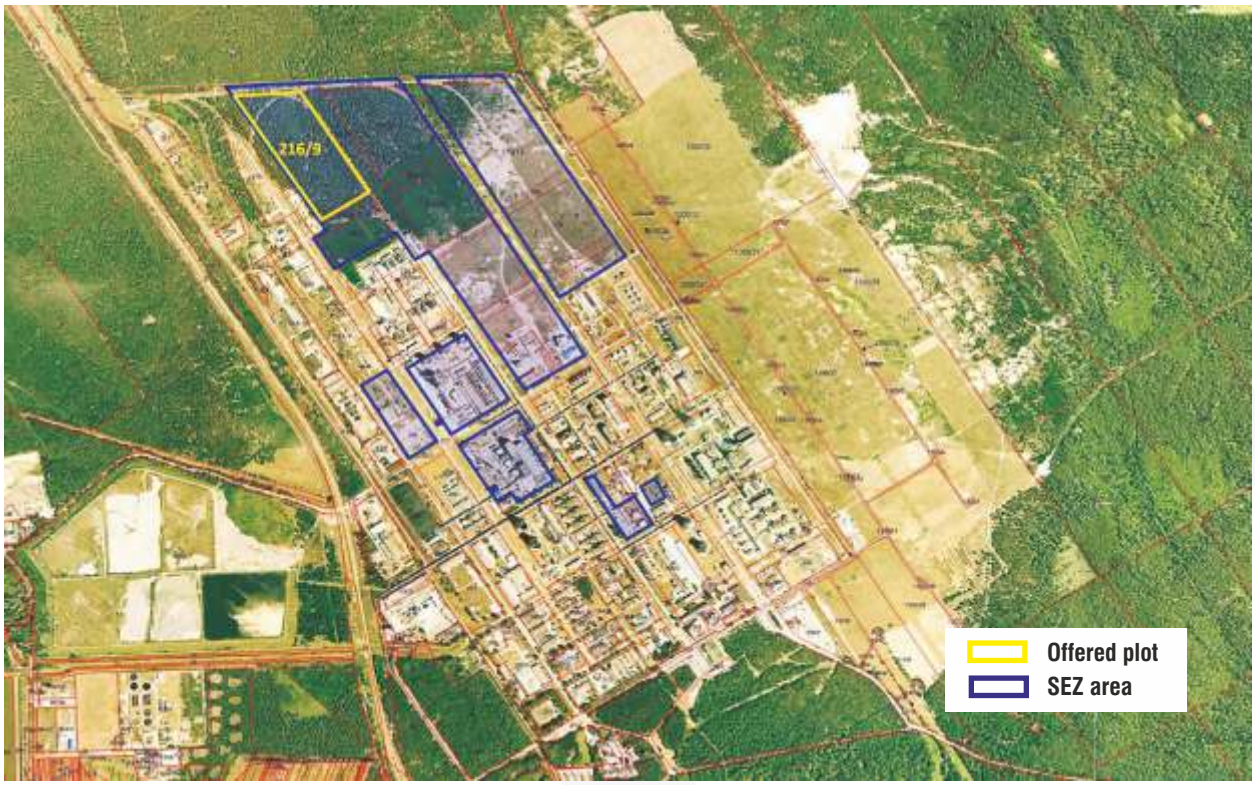


Plot 216/9 site details

Location	
Site name	- Zakłady Azotowe "Puławy" S.A. Puławy Subzone of the "Starachowice" Special Economic Zone
Town (Commune)	- Puławy
Poviat	- Puławy
Voivodeship	- Lubelskie
Property area	
Area	- 10,69 ha
Shape of the site	- Trapeze
Land expansion	- Is possible
Property details	
Owners	- GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.
Valid zoning plan	- Yes
Zoning	- Productions areas, warehouses and storage facilities and services
Plot details	
Soil class with area	- Industrial area
Differences in land level	- 1÷2 m
Current use	- Not used
Pollution to underground and surface waters	- No
Risk of flooding or land slide	- No
Underground obstacles	- No
Ground level obstacles	- Tree and bush planting
Environmental restriction in force	- Tree and bush planting, consent required for cutting down
Buildings and other structures on site	- No
Transport links	
Access road to the plot	- Asphalt road, 4 m wide
Nearest motorway/national road	- National road No. 12, National road No. 17 Hrebenne - Warsaw - approx. 8 km from Puławy
Railway line	- On the area of Zakłady Azotowe "Puławy" S.A.
Railway siding	- 1km
Nearest international airport	- Warsaw - 110 km, Świdnik - 55 km
Nearest voivodeship capital	- Lublin - 45 km

EXISTING INFRASTRUCTURE

Electricity	- Yes
Connection point	- 800 m÷2650 m
Voltage	- 0,4 kV, 6 kV, 30 kV
Available power	- 20 MW (6 kV), 100 MW (30 kV)
Gas	- Yes
Connection point	- 700 m
Calorific value	- 36,198 MJ/m^3
Pipe diameter	- DN 200
Available capacity	- 500 m^3/h
Water supply	- Yes
Connection point	- 350 m÷950 m
Available capacity	- As required
Sewage discharge	- Yes
Connection point	- Industrial - DN 600 - 650 m, precipitation - DN 500 - 100 m
Available capacity	- As required
Wastewater treatment plant on the site or nearly	- No
Telephone lines/internet	- On the area of Zakłady Azotowe "Puławy" S.A.

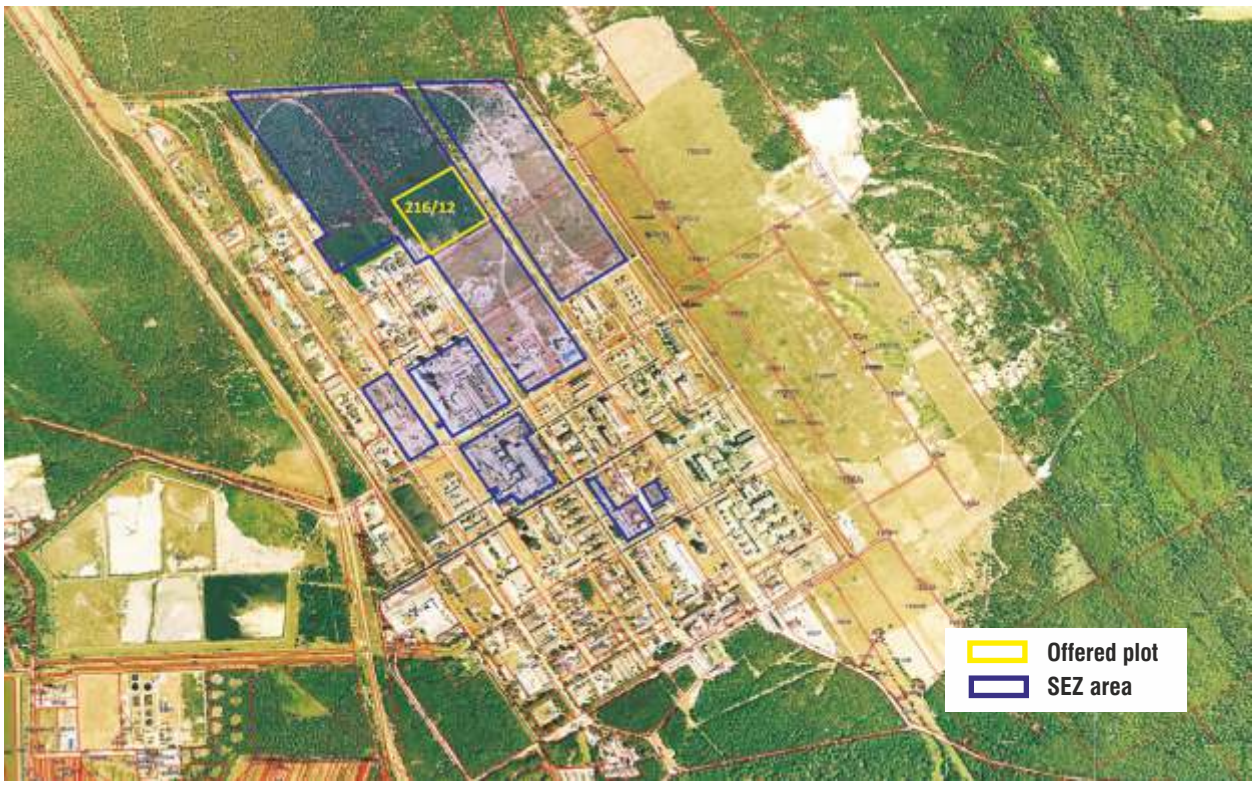


Plot 216/12 site details

Location	
Site name	- Zakłady Azotowe "Puławy" S.A. Puławy Subzone of the "Starachowice" Special Economic Zone
Town (Commune)	- Puławy
Poviat	- Puławy
Voivodeship	- Lubelskie
Property area	
Area	- 6,41 ha
Shape of the site	- Rectangular
Land expansion	- Is possible
Property details	
Owners	- GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.
Valid zoning plan	- Yes
Zoning	- Productions areas, warehouses and storage facilities and services
Plot details	
Soil class with area	- Industrial area
Differences in land level	- 1÷2 m
Current use	- Not used
Pollution to underground and surface waters	- No
Risk of flooding or land slide	- No
Underground obstacles	- No
Ground level obstacles	- Tree and bush planting
Environmental restriction in force	- Tree and bush planting, consent required for cutting down
Buildings and other structures on site	- No
Transport links	
Access road to the plot	- Asphalt road, 4 m wide
Nearest motorway/national road	- National road No. 12, National road No. 17 Hrebenne - Warsaw - approx. 8 km from Puławy
Railway line	- On the area of Zakłady Azotowe PUŁAWY SA
Railway siding	- 1km
Nearest international airport	- Warsaw - 110 km, Świdnik - 55 km
Nearest voivodeship capital	- Lublin - 45 km

EXISTING INFRASTRUCTURE

Electricity	- Yes
Connection point	- 800 m÷2500 m
Voltage	- 0,4 kV, 6 kV, 30 kV
Available power	- 20 MW (6 kV), 100 MW (30 kV)
Gas	- Yes
Connection point	- 350 m
Calorific value	- 36,198 MJ/m^3
Pipe diameter	- DN 200
Available capacity	- 500 m^3/h
Water supply	- Yes
Connection point	- 20 m÷640 m
Available capacity	- As required
Sewage discharge	- Yes
Connection point	- Industrial - DN 600 - 320 m, precipitation - DN 500 - along the border of the lot
Available capacity	- As required
Wastewater treatment plant on the site or nearly	- No
Telephone lines/internet	- On the area of Zakłady Azotowe "Puławy" S.A.

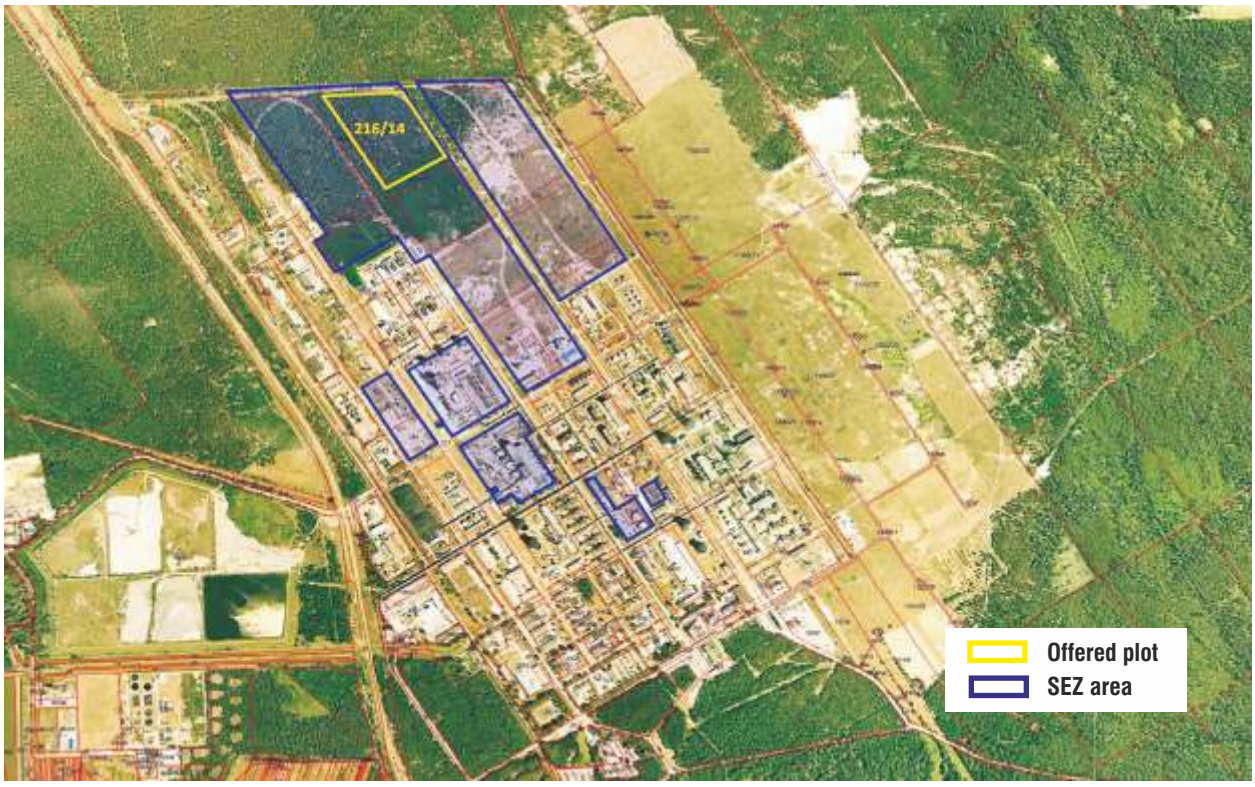


Plot 216/14 site details

Location	
Site name	- Zakłady Azotowe "Puławy" S.A. Puławy Subzone of the "Starachowice" Special Economic Zone
Town (Commune)	- Puławy
Poviat	- Puławy
Voivodeship	- Lubelskie
Property area	
Area	- 9,22 ha
Shape of the site	- Trapeze
Land expansion	- Is possible
Property details	
Owners	- GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.
Valid zoning plan	- Yes
Zoning	- Productions areas, warehouses and storage facilities and services
Plot details	
Soil class with area	- Industrial area
Differences in land level	- 1÷2 m
Current use	- Not used
Pollution to underground and surface waters	- No
Risk of flooding or land slide	- No
Underground obstacles	- No
Ground level obstacles	- Tree and bush planting
Environmental restriction in force	- Tree and bush planting, consent required for cutting down
Buildings and other structures on site	- No
Transport links	
Access road to the plot	- Asphalt road, 4 m wide
Nearest motorway/national road	- National road No. 12, National road No. 17 Hrebenne - Warsaw - approx. 8 km from Puławy
Railway line	- On the area of Zakłady Azotowe PUŁAWY SA
Railway siding	- 1km
Nearest international airport	- Warsaw - 110 km, Świdnik - 55 km
Nearest voivodeship capital	- Lublin - 45 km

EXISTING INFRASTRUCTURE

Electricity	- Yes
Connection point	- 800 m÷2500 m
Voltage	- 0,4 kV, 6 kV, 30 kV
Available power	- 20 MW (6 kV), 100 MW (30 kV)
Gas	- Yes
Connection point	- 350 m
Calorific value	- 36,198 MJ/m^3
Pipe diameter	- DN 200
Available capacity	- 500 m^3/h
Water supply	- Yes
Connection point	- 320 m÷640 m
Available capacity	- As required
Sewage discharge	- Yes
Connection point	- Industrial - DN 600 - 640 m, precipitation - DN 500 - 300 m
Availble capacity	- As required
Wastewater treatment plant on the site or nearly	- No
Telephone lines/internet	- On the area of Zakłady Azotowe "Puławy" S.A.



PUŁAWY

Cooperation Offer

Directions for downstream processing of main products of

GRUPA AZOTY Zakłady Azotowe "Puławy" S.A.

Urea

Urea Formaldehyde Resins (UF)

UF resins are produced in the reaction of polycondensation of urea and formaldehyde at a molar ratio of reactants of 1: (1.5 ÷ 5).

UF resin curing takes place in the presence of strong acids at temperatures below 100°C.

It should be noted that the process uses formalin with a small addition of methanol (3 - 4%) as a stabilizer.

The properties of urea resins depend on the degree of urea methylation by formaldehyde, and thus on the molar ratio of the reactants.

Urea resins are used on a large scale as adhesives for the manufacture of wood-based materials.

Chemical synthesis

On a large industrial scale, urea is mainly used for the synthesis of melamine.

Other applications are of marginal significance due to small scale of production:

- Sulfamic acid, produced by the reaction of urea with oleum, is used in the pulp industry, in dyeing processes, and in electroplating baths;
- Guanidine produced by the reaction of urea and ammonia, is used in the synthesis of drugs, dyes and explosives;
- Cyanuric acid, obtained by thermal decomposition of urea, is used mainly in the form of salt as a flame retardant;
- Acetamide obtained in the reaction of urea with acetic acid, is used in the plastics industry as a plasticizer, and in paints and varnishes industry.

In addition, urea and its derivatives are used in the synthesis of pharmaceuticals (barbiturates) and certain herbicides.

Melamine

Melamine Formaldehyde Resins (MF)

The technology of manufacturing melamine resins is similar to that of UF resins, however, in contrast to the latter, addition of HCHO to melamine can take place in alkaline, acidic as well as neutral environment.

The reaction depends on pH and the molar ratio of melamine to formaldehyde (usually 1: 2 ÷ 6).

Melamine resin curing occurs at temperatures >100°C and in the presence of strong acids or combined chemical mixtures.

Due to their high reactivity, MF resins are typically produced in dry form (the commercial product is a resin powder mixed with an appropriate hardener), and have been applied in the production of laminates and coatings, as well as adhesives in cabinetmaking; however, they are used very rarely in the manufacturing technologies of other wood-based materials (e.g. chipboards).

Melamine - Urea - Formaldehyde Resins (MUF)

With relatively low melamine content, of the order of several percent, MUF resins feature significantly better electrical properties and increased resistance to water compared with urea resins, and are much cheaper than melamine resins. They are mostly used as adhesives for the manufacture of water-resistant panels and in the production of plywood.

Modified Melamine Resins

MF resins have excellent electrical properties (e.g. high resistance to tracking) and a fairly good water resistance, which makes them a valuable component of urea and phenolic resins. Even a small addition (10%) of a melamine resin significantly improves the functional properties of other amino plastics and phenolic plastics.

However, mainly due to their high reactivity, brittleness after curing, and the price, melamine resins are rarely used as a standalone component in wood technology.

In order to reduce or eliminate adverse functional attributes of MF resins, they are subjected to chemical modification with phenolic resins, butanol, acrylic compounds, polyetheroles, urethanes, etc. The type of modifier is determined by the end use of a resin.

Other modern formulations of MF resins include melamine foams, used i.a. in aviation (licensed by BASF, Nisshinbo Industries Inc., Japan), and sulfonated melamine resins used as concrete admixtures.

Other

Melamine is regarded a compound of low chemical reactivity. The following derivatives are of significant industrial importance as flame retardants:

- Melamine cyanurate is used to impart flame retardancy to polyamides; on a much smaller scale it is used as an additive to polyolefins, polyesters, polyurethanes and epoxy resins.
- Melamine phosphates are used to impart flame retardancy to glass fiber reinforced polyamide 66, and to a lesser extent in polyurethanes, polyolefins and polyesters.

Caprolactam

Polyamide 6 (PA 6)

Polyamide 6 is the main direction of caprolactam downstream processing. PA 6 production technology for engineering applications includes prepolymerization as a first step, during which acid-catalysed caprolactam hydrolysis (e.g. with acetic acid) takes place with simultaneous rupture of the lactam ring. The aminocaproic acid formed polymerizes to polyamide 6 at temperatures in the range of 250°C - 270°C. The next step of the process is granulation, yielding approx. 2-mm polymer cylinders. The suspension of the polymer in water is separated in a centrifuge, and then the granules are subjected to hot water extraction to remove undesired low molecular weight reaction products. The last steps of the manufacturing process are polymer drying under nitrogen, followed by packaging. An important element of the process is modifying the obtained polyamide by dyeing, compounding, flame retarding, etc.

The polymerization process by which PA 6 fibers are obtained is carried out at different conditions: the key here is the viscosity of the polymer.

Polyamide 6 is widely used in various industries such as automotive, electrical, construction and textiles.

PA6 Elastomer

The production process of PA 6 elastomer is carried out in two steps: in the first step dicarboxylic polyamide is formed by the reaction of caprolactam with adipic acid. In the second stage the polyamide is reacted with polytetramethylene ether glycol (PTMEG). Water released in the reaction is removed from the reactor under vacuum. The resulting product, block polyether polyamide, is removed from the reactor in a molten state, then extruded and pelleted.

PA 6 elastomer owes its excellent functional properties to the fact that it combines the strength of polyamide 6 with the flexibility of rubber, however, its high price determines the specific, niche applications (e.g. sports equipment).

Other

Caprolactam is a compound of low chemical reactivity. Among the few of its useful derivatives one should mention poly (N-vinyl caprolactam) which is used in mining and natural gas transmission.

Hydrogen peroxide

Sodium Percarbonate (SPC)

The manufacturing process is based on the reaction of hydrogen peroxide with sodium carbonate, which results in an adduct $Na_2CO_3 \cdot 1\frac{1}{2} H_2O_2$.

The synthesis reaction is conducted in a crystallizer from which a diluted SPC slurry is subjected to compaction, centrifugation, and then the finished product is dried and packaged.

Sodium percarbonate is used as an oxidizing and whitening substance in detergents, disinfectants and bleach chemicals.

In many applications SPC displaces the previously used sodium perborate.

Hydrazine

The synthesis of hydrazine from hydrogen peroxide and ammonia is carried out using methyl ethyl ketone (MEK), and the intermediate product of the reaction is oxaziridine which oxidizes ammonia to hydrazine.

The peroxygen route to hydrazine has the advantage over other methods in that no by-products are formed and the yield is high.

The most important applications of hydrazine and its derivatives are blowing agents for foamed plastics, production of pesticides and production of rocket fuel components.

Commercial form of hydrazine is usually an aqueous solution (hydrate).

Potassium monopersulfate

The process of obtaining potassium monopersulfate runs in two steps: In the first step hydrogen peroxide reacts with oleum, resulting in a mixture containing, inter alia, peroxymonosulfuric acid and sulfuric acid, and in the second stage the mixture is partially neutralized with a basic salt. The product in crystal form is separated from the solution and dried.

Potassium monopersulfate is used for water treatment and as an ingredient of detergents and disinfectants.

Propylene oxide

In the manufacturing process propylene reacts with hydrogen peroxide in the presence of methanol as a solvent. The process is carried out under mild conditions of temperature and pressure. The crude propylene oxide produced is distilled to technical quality.

The advantage of the process is the avoidance of chlorine in the raw materials feed and in the waste.

Propylene oxide is a substance widely used in organic synthesis, mainly for the production of propylene glycol and polyoxypropylene glycols, intermediates for the manufacture of polyurethane resins.

Ammonium nitrate PULAN®

Nitrous oxide

The process involves thermal decomposition of ammonium nitrate in the presence of a catalyst, diammonium orthophosphate, and the end product of the decomposition is crude nitrous oxide and water vapor.

The crude product is purified to a content of 98% N_2O for use in medical applications.

The process uses high purity ammonium nitrate (NH_4NO_3 - 99%; Cl-5 ppm; Fe-5 ppm), and the plant for the production of nitrous oxide by this method operates at Azoty-Adipol in Chorzów.

Porous ammonium nitrate

Prilled ammonium nitrate is subjected to heat treatment at an appropriate temperature (pore-forming process) resulting in multiple crystalline transformations, and the surface of the granules becomes microporous, which increases the absorption capacity of the ammonium nitrate thus obtained.

Porous ammonium nitrate is used to manufacture explosives of the ANFO type (ammonium nitrate containing up to 5% of fuel oil) used in rock mining.

Carbon dioxide

Urea

Methanol

The synthesis of methanol is based on exothermic and reversible reactions between the components of synthesis gas: carbon monoxide and carbon dioxide.

Two synthesis routes are used on a large industrial scale: medium-pressure route and high-pressure route, using a copper-zinc catalyst and a zinc-chromium catalyst. The composition of the synthesis gas, including CO_2 content, depends on the process used.

Methanol is one of the basic raw materials used in large-scale chemical synthesis.

Salicylic acid

Obtained by reaction of phenol or its sodium salt with carbon dioxide. The process runs in two steps: in the first step sodium phenolate is saturated with carbon dioxide at temperatures above 100°C and a pressure of several atmospheres, thereby forming sodium salicylate, which in the second step is converted into salicylic acid in an acidic environment.

Salicylic acid in the free state is used as a disinfectant, but of industrial importance are mainly derivatives of salicylic acid, which are the basis of popular drugs (including aspirin).

Since CO_2 is one of the main greenhouse gases, intensive research into new methods of its processing has been going on for several years now.

Such studies are mainly focused on obtaining fuels from carbon dioxide; e.g. Los Alamos National Laboratory USA, conducts work aimed at processing of carbon dioxide captured from the atmosphere.

PUŁAWY

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