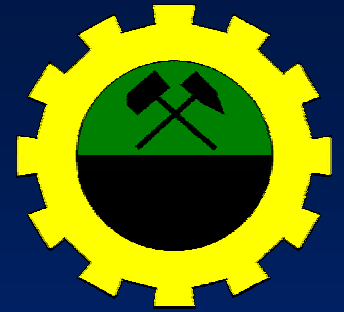




**Technical University of Silesia
Faculty of Mining and Geology**



**Institute of Geotechnology,
Geophysics & Ecology of Industrial
Areas**

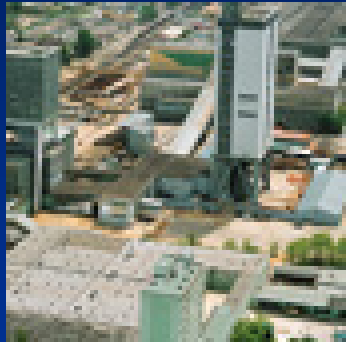
Research in Poland Mining & Geo....

Prof. Jan Palarski



Polish Mining Industry

MINERAL	PRODUCTION
Hard coal	99,7 mln t
Brown coal	60,5 mln t
Copper	29,7 mln t
Zinc – Lead	4,7 mln t
Sulfur	780 th t
Salt	4,2 mln t
Industrial minerals (sand, dolomite, granite, limestone, sandstone, loess, silt...)	250,0 mln t



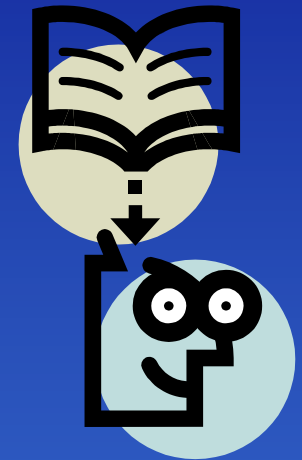
Research & Educational base in the field of mining and geology in Poland

Mining and Geology Faculties:

- University of Technology – Academy of Mining and Metallurgy – Krakow
- Technical University – Gliwice
- Technical University – Wroclaw

Universities – Faculty of Geology:

- University of Silesia in Katowice
- Jagiellonian University in Krakow
- Adam Mickiewicz University in Poznan
- Wroclaw University
- Warsaw University



Research Centre (Agency of Polish Government)

- ❖ Polish Academy of Science (2 Institutes)
- ❖ Research Mining Centre
 - ✓ GIG
 - ✓ KOMAG
 - ✓ EMAG
 - ✓ CUPRUM
 - ✓ POLTEGOR

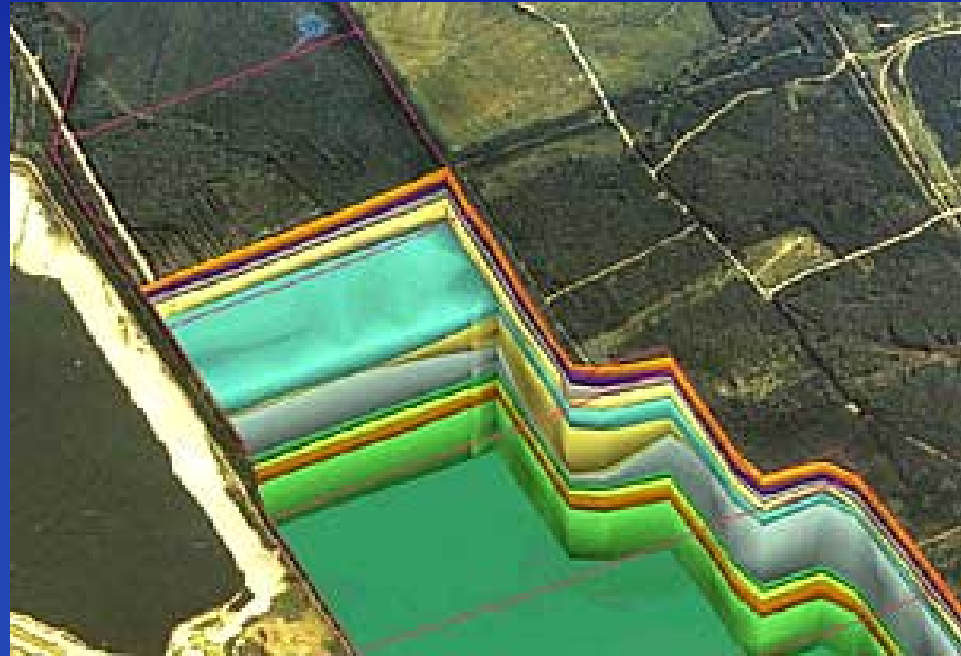
Fields of interest in Mining Research Programmes

- **Mineral Resources Mining and Sustainable Development**
- **Health, Safety and Environment in Mining Industry**
- **Mine Planning and Design**
- **Clean Coal Technologies**
- **Mining Equipment Selection and Adjustment**
- **Advanced Mining Systems and Remote Control Technologies**
- **Mine Maintenance and Production Management**



Fields of interest in Mining Research Programmes - cont.

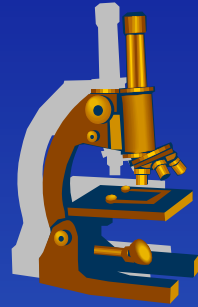
- **Restructuring of Mining Industry**
- **Mine Closure and Rehabilitation as a part of the Mine Planning Process**
- **Post-mining activities**
- **Underground Waste Disposal and Storage of CO₂**



Major UE Research and Educational Programmes

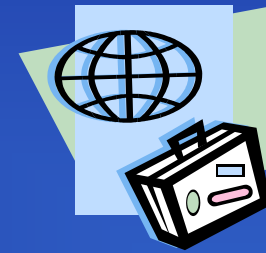
Research & Development Programmes:

- 5th Framework Programme (1998 – 2002)
- 6th Framework Programme (2002 – 2006)
- COST (*European Cooperation in the Field of Scientific and Technical Research*)



Educational Programmes:

- SOCRATES – ERASMUS
- Leonardo da Vinci
- CEEPUS (*Central European Exchange Programme for University Studies*)
- COPERNICUS



International R&D and Educational Programmes in TU of Silesia

- **SOCRATES – ERASMUS** (more than 300 students were sent abroad)
- **TEMPUS Phare** (16 projects)
- **Leonardo da Vinci** (7 students were sent and *Mobility for Practical Placement Programme* is currently conducted)
- **CEEPUS** (3 projects)
- **COPERNICUS** (6 projects)
- **COST** (2 projects)
- **EUREKA**
- **5th Framework Programme** (7 projects)
- **6th Framework Programme - RFCS** (Poland - 5 projects)
- **7th Framework Programme** - start: Jan. 2007



The RECOPOL project

The Example of the successful international cooperation in the field of mining & geology - 5th Framework Programme

- **RECOPOL stands for:** “Reduction of CO₂ emission by means of CO₂ storage in coal seams in the Silesian Coal Basin of Poland”
- **The RECOPOL project** is an EU funded combined research and demonstration project to investigate the possibility of permanent subsurface storage of CO₂ in coal seams.

The field demonstration experiment is the first of it's kind outside Northern America – it's conducted in Kaniów (Poland)

Total budget: 3.5 million EURO

- EU 5th Framework Programme contributes 50%
- Partners contribute 50 %

The RECOPOL Project

- **Partners:**

**Aachen Univ. of Technology
(Germany)**

**Delft Univ. of Technology (The
Netherlands)**

Central Mining Institute (Poland)

Institut Français du Petrol (France)

CSIRO (Australia)

DBI-GUT (Germany)

Gaz de France (France)

Gazonor (France)

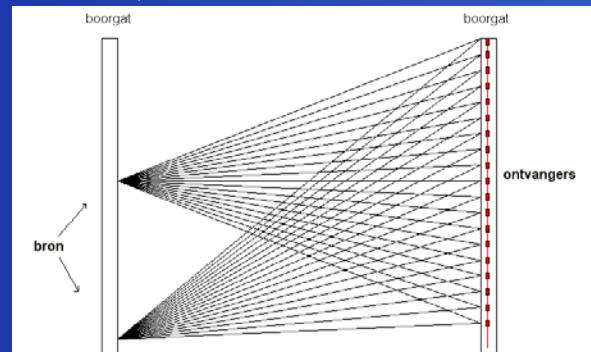
IEA GHG (International)



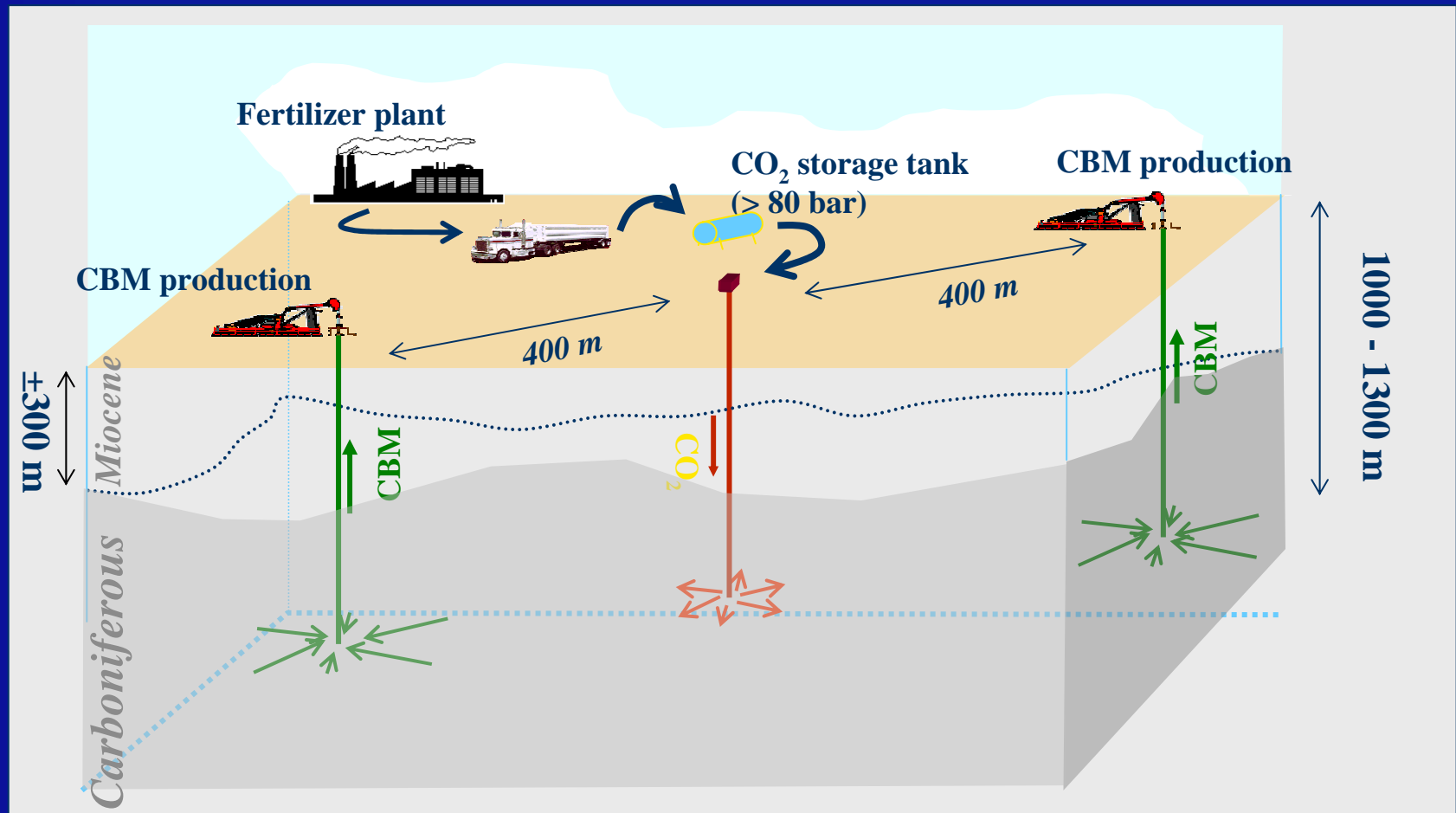
The RECOPOL project

Main questions to be answered:

- Is subsurface storage of CO₂ in coal, while simultaneously producing CBM, a technically viable option under European conditions?
- Is subsurface storage of CO₂ in coal a safe and permanent solution?
- How much CBM is produced for each tonne of injected CO₂?
- Can subsurface storage of CO₂ in coal be applied on a larger scale in an economical and social acceptable way?
- What are the main criteria (geological/technical/economical/social) for any coal basin, in or outside Europe, to be suitable for this technique?



RECOPOL field experiment

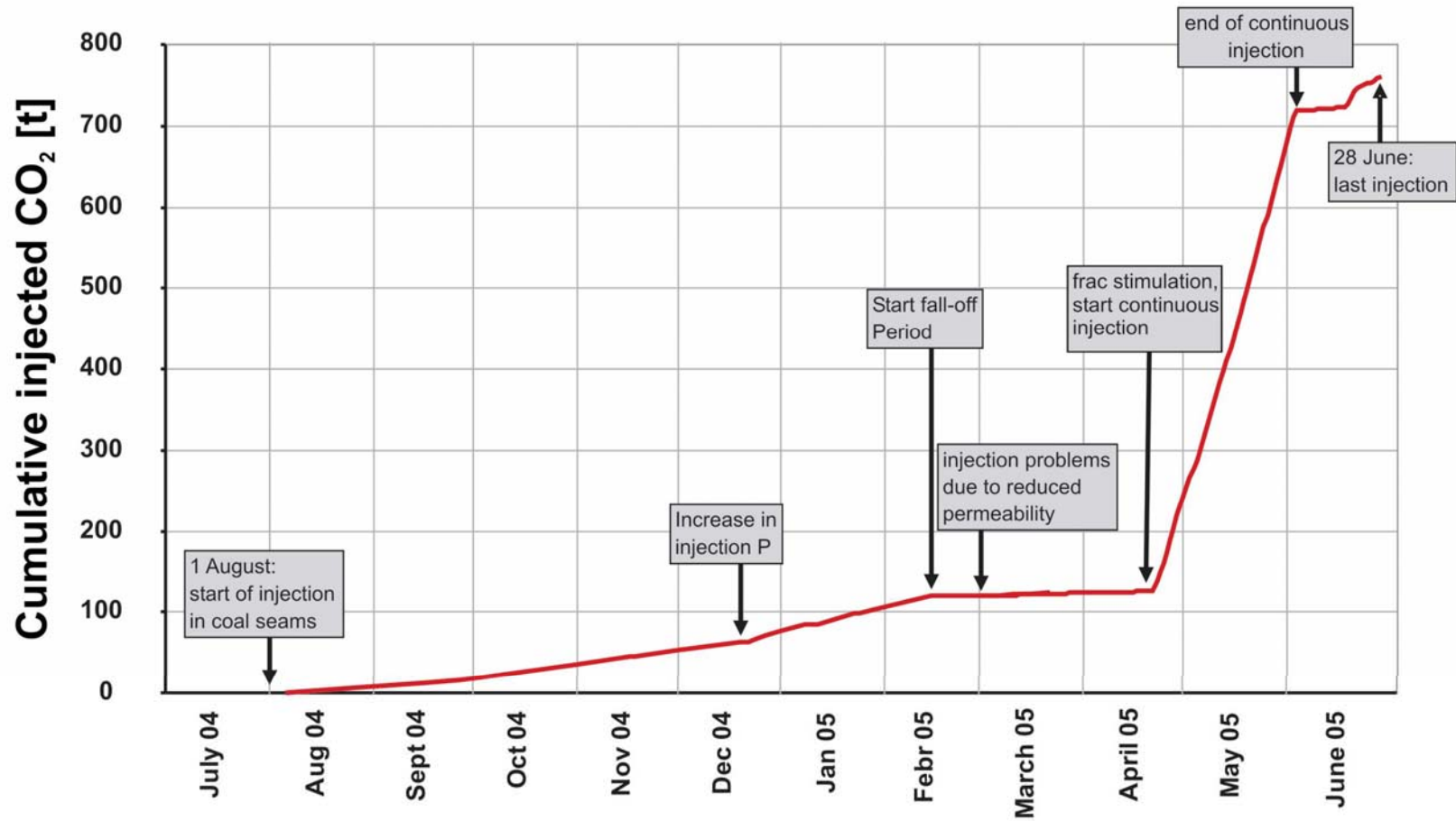


An existing coalbed methane production well at ca 150 m distance was cleaned, repaired and put back into production at the end of May 2004, to establish a baseline production

RECOPOL

CO₂ Injection

- **2003 – development of pilot plant**
- **August 2004 - June 2005 – CO₂ injection**
- **The principal targets for CO₂ injection are coal seams between 1 and 3 m thick in the depth interval between 900-1100 m**
- **Stimulation of injection pressure was required because the permeability of the coal seams reduced in time, presumably due to swelling as the result of contact with the CO₂**
- **In total ca 760 tonnes of CO₂ were injected**



Gas production

- A slow rise in the CO₂ content in the production gas (CH₄) was observed since November 2004 which could be attributed to the injected CO₂
- In April 2005, after stimulation of the injection well, the gas production increased rapidly after a few days → CO₂ concentration in the production gas increased → CO₂ breakthrough
- the amount of „daily produced CO₂” was much lower than the amount of daily injected CO₂

Future Strategies

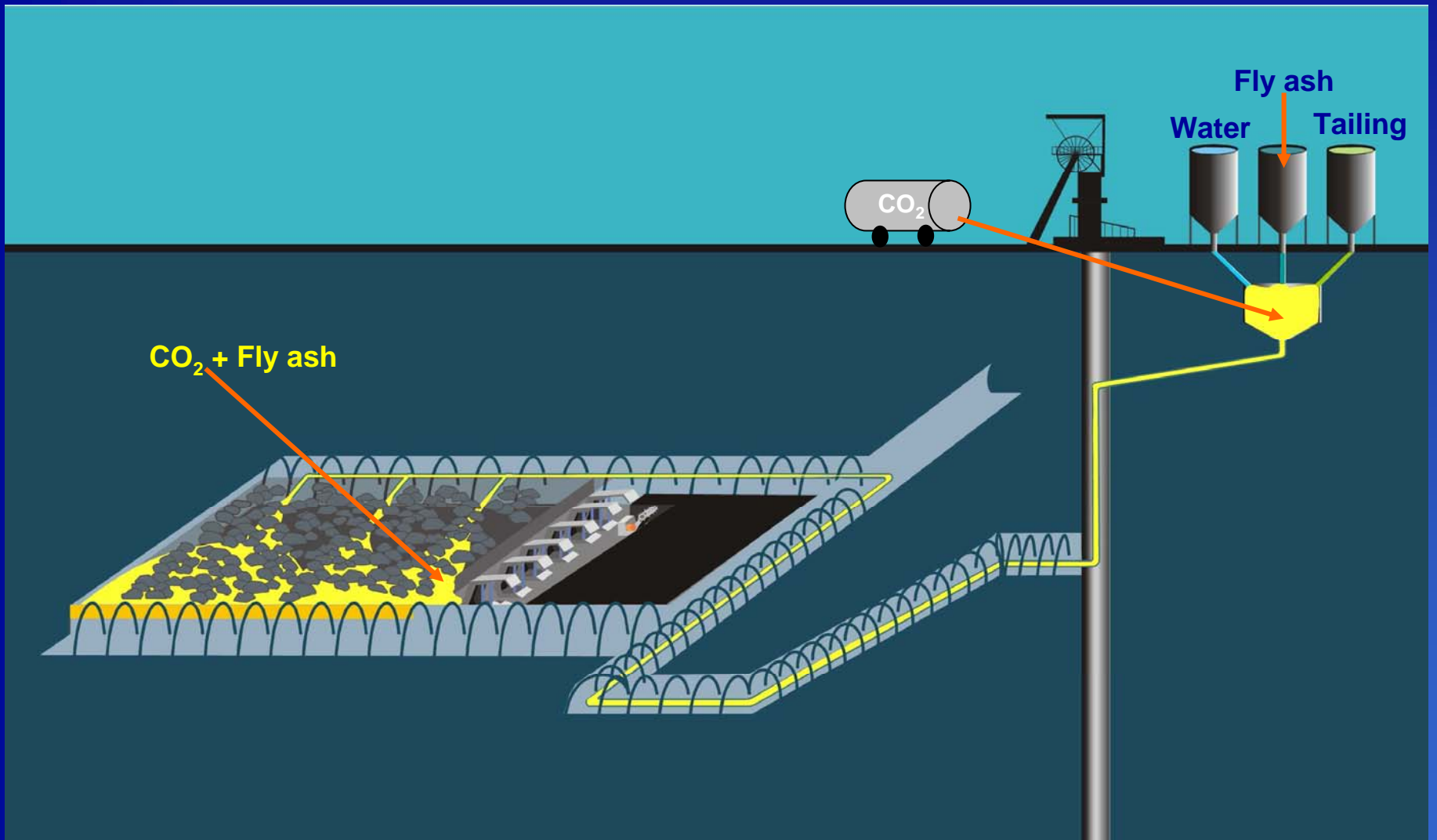
- **„Developing Underground Coal Mining Technology for the 21st Century”**
 - **Increasing the efficiency of roadway drivages through the application of advanced information, automation and maintenance technologies (RFCS 2005 -2007)**
 - **Geotechnical assessment (rockburst, methane emission, outburst – deep mining > 1 200 m)**
 - **Automation and virtual mining (Wireless monitoring system):**
 - a) **high-speed mobile data communications**
 - b) **Mine rescue system**

Future Strategies (cont.)

- **Waste utilization/rehabilitation/subsidence**
- **Greenhouse gas issues**
 - **Utilization of methane emission from mine atmosphere**
 - **Sequestration of carbon dioxide and use of carbon dioxide and fly ash mixture for filling of roof fall materials**

GROUTING OF ROOF FALL ROCK

prof. Jan Palarski - Silesian
University of Technology





UWAGA!
POCZĄS NIOŁADUNKU
PRZEJŚCIE
ZABRONIONE

UWAGA!
POCZĄS NIOŁADUNKU
PRZEJŚCIE
ZABRONIONE

	A	B ₁	B ₂	C
90	40	46	48	56
S	40	46	48	

3

5

RIV

PK

505

ACS

930 5056-4

14,114 m

R 75m



Work station of operator



prof. Jan Palarski - Silesian
University of Technology

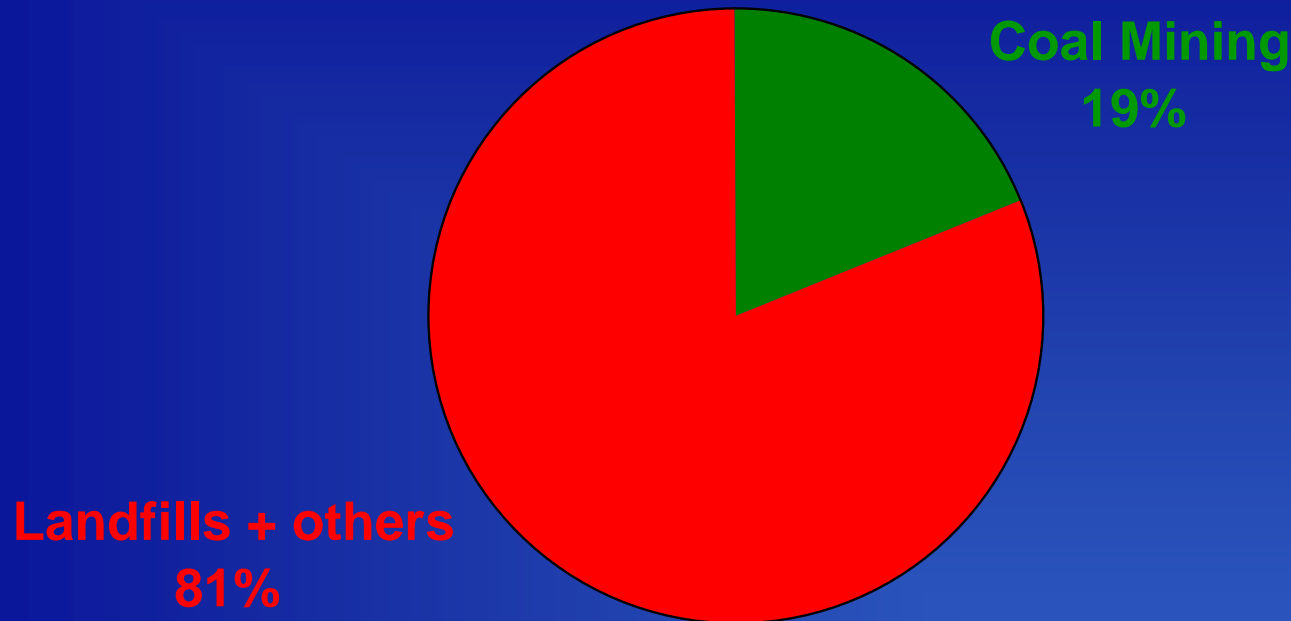
Mixer



METHANE EMISSION

prof. Jan Palarski - Silesian
University of Technology

METHANE EMISSIONS IN POLAND



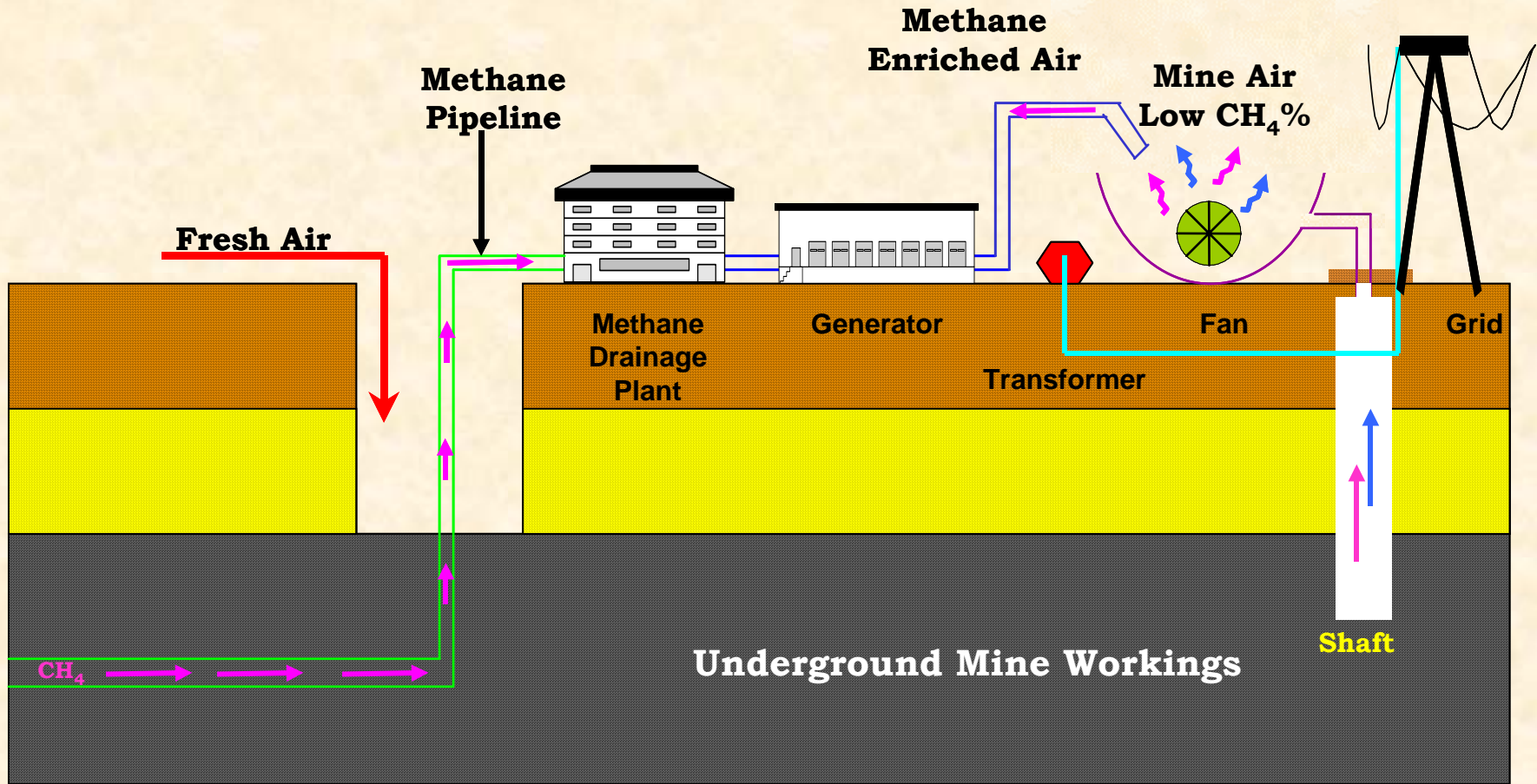
Coal mining - Second largest methane source behind landfills

Top 20 of coal mines account for ~90% of methane emission

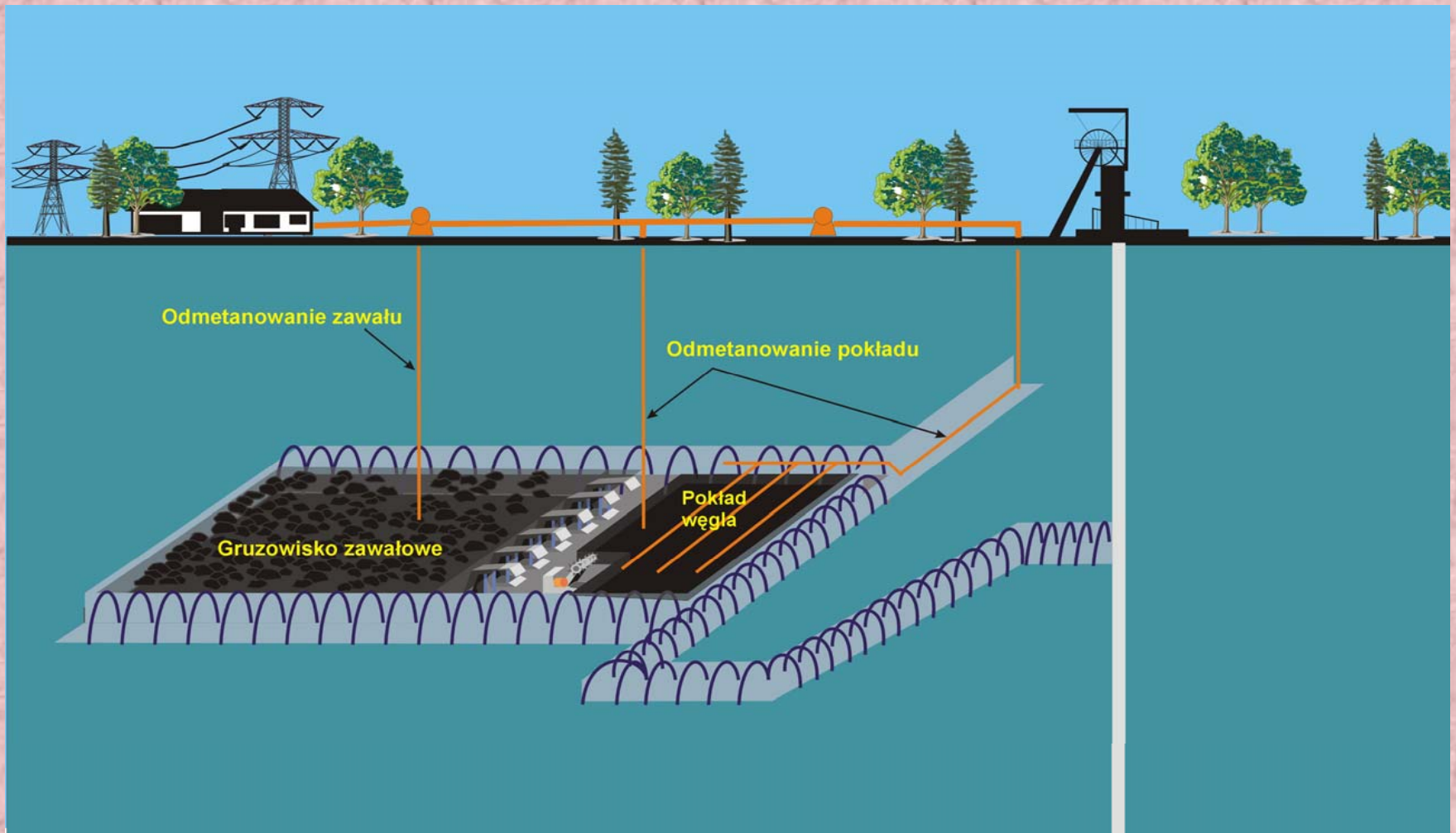
Gas Control in Underground Mining

- **Dilution methane to safe concentration with ventilation air**
 - removing gas away from working areas
- **Underground and surface wells drilled to remove methane before or after mining – drainage and utilization systems**

Methane Drainage und Utilization



Methane Drainage and Utilization



Mine „BUDRYK” - CBM Power Plant



prof. Jan Palarski - Silesian
University of Technology

Future Strategies (cont.)

Copper mining

- **Waste disposal and mine site rehabilitation**
- **Monitoring rock mass performance
– seismic event parameters**
- **Optimisation of climatic conditions**

**HYDROTECHNICAL PLANT -
THE STORAGE OF
FLOATATION WASTE
„ŽELAZNY MOST”**





EFFECT OF ROCK MASS DESTRESSING



prof. Jan Palarski - Silesian
University of Technology

Thank You for Your attention !!!

prof. Jan Palarski - Silesian University
of Technology