

# Long history

**66 years of Central Mining Institute (GIG means CMI)  
86 years of Experimental Mine „Barbara”**



**Mikolow, October 12<sup>th</sup>, 2011  
GMI participants' site visit**

**CMI has an integrated management system according to following standards:**

**PN-EN ISO 9001:2009**

**PN-EN-18001:2004**

**PN-EN ISO 14001:2005**

**which was confirmed**

**by Polish Centre for Accreditation**

**by Certificate Number JBS-54/5/2009**

**CMI obtained authorization  
given by the Minister of Economy  
as a notified body in the European Union  
concerning the following directives:**

- **93/15/EEC of 5 April 1993 on the harmonization of the provisions relating to the placing on the market and supervision of explosives for civil uses,**
- **94/9/EC on the approximation of the laws concerning equipment and protective systems intended for use in potentially explosive atmospheres (ATEX),**
- **37/98/EC of 22 June 1988 on the approximation of the laws of the member states relating to machinery.**



**CENTRAL MINING INSTITUTE**  
**has the following number in UE:**

**1453**

# Structure of the Experimental Mine „Barbara”

- **Department of Gas Hazard Control**
- **Department of Dust Hazard Control**
- **Blasting Safety Department**
- **Department of Explosion-proof Protection**
- **Mining Department**
- **Department of Technical Services**



# Department of Gas Hazard Control

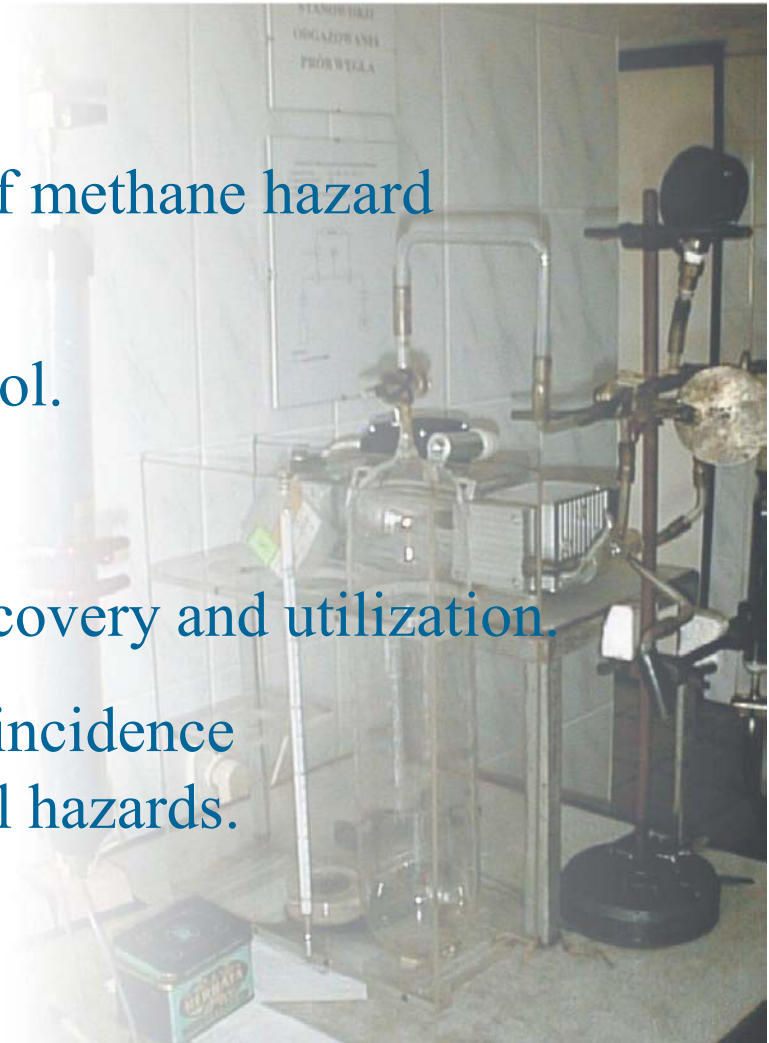
- **Department of Gas Hazard Control**
- **Laboratory of Gas Analyses**
- **Laboratory of Expertises and Underground Researches**
- **Laboratory of Gas and Rock Outburst Hazard Combating**



# Department Of Gas Hazard Control

Offer of services:

- Research, forecasts and assessment of methane hazard in underground mines.
- Methane hazard prevention and control.
- Methane drainage.
- Ecological and economic methane recovery and utilization.
- Safe technologies in conditions of coincidence of the methane hazard with other natural hazards.



# Department Of Gas Hazard Control

## References:

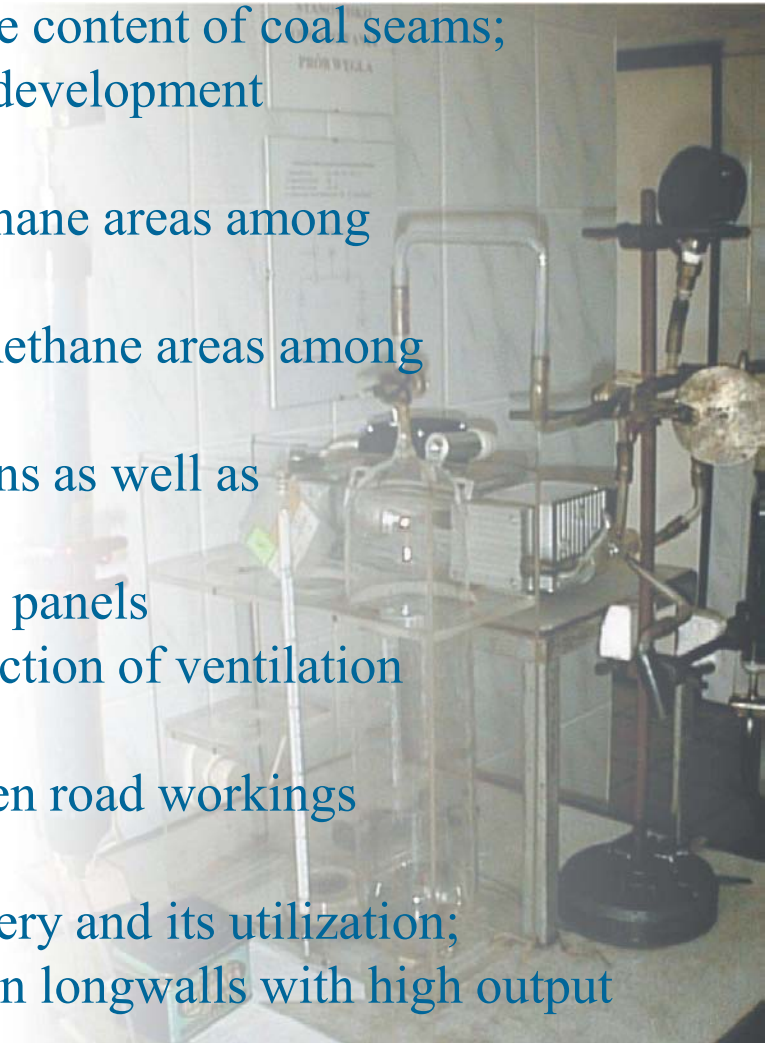
- Development of assumptions to the reservoir storage of methane in inactive mine workings.
- Development of the method of testing wet coal sorptive properties for the determination of prediposition's to methane drainage.
- Development of the method of direct assessment of the real coal deposit saturation with methane.
- Intensification of rock mass methane drainage in areas of longwalls of high output concentration in seams.





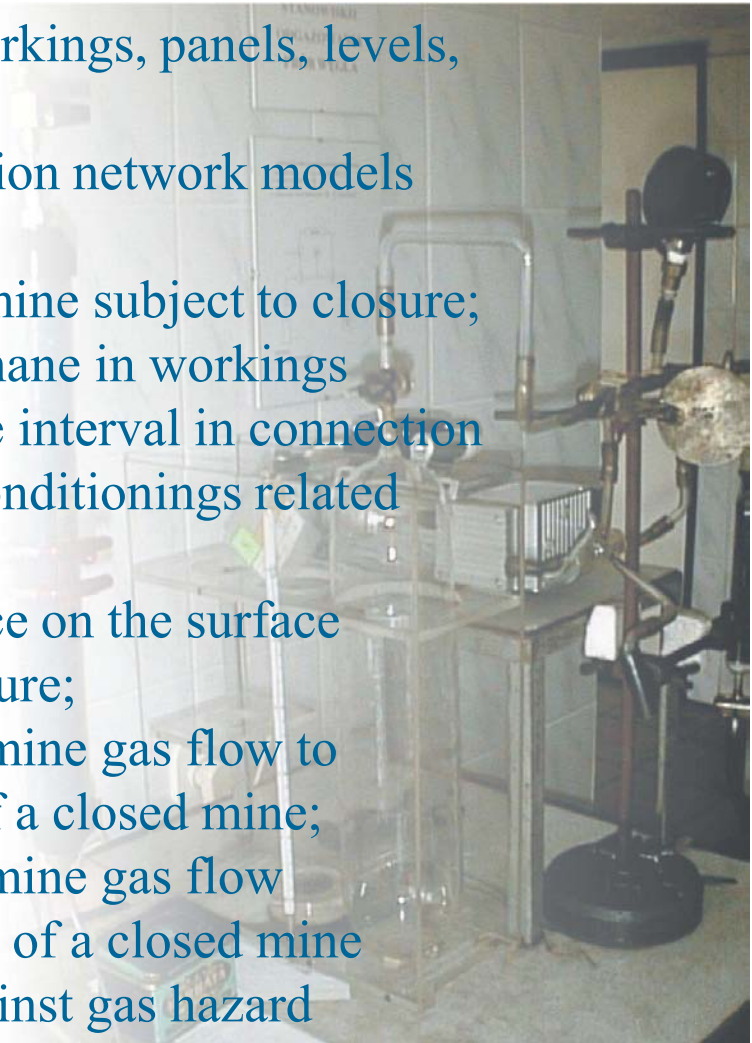
## Research-service activities for active mines

- gas content, including determination of methane content of coal seams;
- prediction of methane emissions to extraction, development and opening mine workings;
- classification of mine workings (rooms) in methane areas among adequate methane explosion hazard degrees;
- classification of coal seams or their parts and methane areas among adequate methane hazard categories;
- control of hazards relating to methane explosions as well as gas and rock outbursts;
- determination of ventilation methods of mining panels in methane hazard conditions along with the selection of ventilation systems for its combating;
- design of auxiliary ventilation systems for driven road workings in gassy seams;
- technologies relating to coalbed methane recovery and its utilization;
- risk assessment regarding methane explosions in longwalls with high output concentration.



# Research-service activities for mines under closure procedure

- investigations and assessment of the methane hazard for consecutive stages of exclusion from mining operations of workings, panels, levels, shafts of a mine subject to closure;
- variant analyses of simplification of the ventilation network models of gassy mines designed for closure;
- insulation technologies of workings in a gassy mine subject to closure;
- preparation of balance of accumulated free methane in workings of a closed mine in a conventionally adopted time interval in connection with hydrogeological conditions, tectonics and conditionings related to neighboring mines;
- prediction of possibility of gas hazard occurrence on the surface in the mining area of a gassy mine subject to closure;
- investigations into the kinetics and intensity of mine gas flow to the zone close to the surface in the mining area of a closed mine;
- investigations into the kinetics and intensity of mine gas flow to the zone close to the surface in the mining area of a closed mine development of methods of active prevention against gas hazard in zones close to the surface in post-mining areas of closed mines.





**Układ sorpcyjny**  
**Equipment for assessment of outburst parameters**

# Department of Dust Hazard Control

- **Laboratory of Combating Dust and Gas Explosion in the Mines**
- **Laboratory of Air Dustiness Measurements**





# Laboratory of Air Dustiness Measurements

**Laboratory of Air Dustiness Measurements (LPZP)** is accredited at Polish Accreditation Center as a standardizing laboratory no. AP 010.

Laboratory has the accreditation for standardizing of the dust counters:  
Barbara 3A, CIP-10, SKC, AP-2000Ex.

Laboratory also possesses PCA accreditation as a **research laboratory no. AB 005** in the range of:

measurements of dustiness concentration at work stations;  
measurements of respirable fibres concentration in the air (asbestos).

Employees of LPZP conduct also the tests of dust separators and spraying installations on the combines in regard of:  
dustiness combating effectiveness,  
mechanical spark methane ignition combating.

Endurance tests of elastic air pipes are also conducted in the Laboratory.





# Laboratory of Industrial Dust Explosiveness

Laboratory occupies with the problems connected with dust explosions and the methods of combating in all the branches of industry except underground mining plants.

The activity of the Laboratory includes:

## Research works:

- experimental explosions in large scale and in laboratory scale with the measurement of the parameters characterizing the explosion;
- numeric simulations of dust-air mixture explosion;
- verification and calibration of dust explosion models with the usage of experimental results.



# Laboratory of Industrial Dust Explosiveness

## Service works conducted for industry:

- determination of ignitability and explosiveness of dust;

Laboratory determines full range of standard parameters of ignitability and explosiveness according to current European norms:

- explosiveness dust test according to VDI 2263;
- characteristics of explosiveness including: maximum explosion pressure  $P_{max}$  and explosiveness indicator  $K_{st max}$ ;
- lower limit of dust explosiveness;
- minimum temperature of dust layer ignition  $DGW$ ;
- minimum temperature of dust cloud ignition  $T_{CL}$ ;
- minimum temperature of dust layer ignition  $T_{5mm}$ ;
- minimum energy of dust cloud ignition  $MIE$ ;
- determination of self-ignition of dust accumulation susceptibility  $SIT$ ;
- limiting oxygen concentration for explosion  $GST$ ;
- resistivity of dust layer  $\rho$
- dust explosion risk assessment:
  - for working installations (directive 1999/92/WE ATEX 137);
  - on the basis of installation project (directive 1999/92/ WE ATEX 137);
  - for devices and protective systems destined for operation in atmospheres endangered by dust explosion (directive 94/9/WE ATEX 95).
- examinations of devices within the certification process (directive 94/9/WE ATEX 95);
- consultations concerning dust explosion hazard problems.

# Laboratory of Combating Dust and gas Explosion in the Mines

- examinations and assessment of coal dust explosion in coal seams hazard state;
- examinations and assessment of coal dust explosion in shafts and pit-holes hazard state;
- examinations and assessment of coal dust explosion nearby coal containers hazard state;
- examinations and assessment of coal dust explosion nearby functional chambers (blasting agents storage places, pump chambers, switching station chambers, workshop chambers etc.) hazard state;
- examinations and assessment of coal dust explosion in stone and coal excavation hazard state;
- examinations and opinion on effectiveness of coal dust swiftness elimination by chemical agents;
- examinations and assessment of dust explosion hazard state in mechanical coal processing plants;
- trainings in the range of dust hazard combating with coal dust explosion demonstration in experimental gallery;
- demonstration of methane extinction in the aspect of coal dust explosion hazard;
- other opinions, expertises and elaborations concerning coal dust explosion hazard;
- assessment of roof rocks, floor rocks and bands susceptibility to methane-igniting sparking during heading machines extraction in galleries or longwalls;
- examinations of heading machine knives used in gallery and longwall heading machines towards susceptibility to methane-igniting sparking during heading machine extraction in galleries or longwalls;
- examinations of wear resistance of protective covers used to protect igedurs against sparking.

# Laboratory Of Airborne Dust Measurements:

- **investigations into the efficiency of dust suppression installations in mines**
- **assessment of efficiency of spraying installations in mines**
- **calibration of dust samples for the entire coal industry in the framework of the Accredited Laboratory activities**
- **measurements of air dustiness at workstations**



# Blasting Safety Department

- **Laboratory Of Explosives And Electric Detonators Testing**
- **Laboratory Of Blasting Equipment**

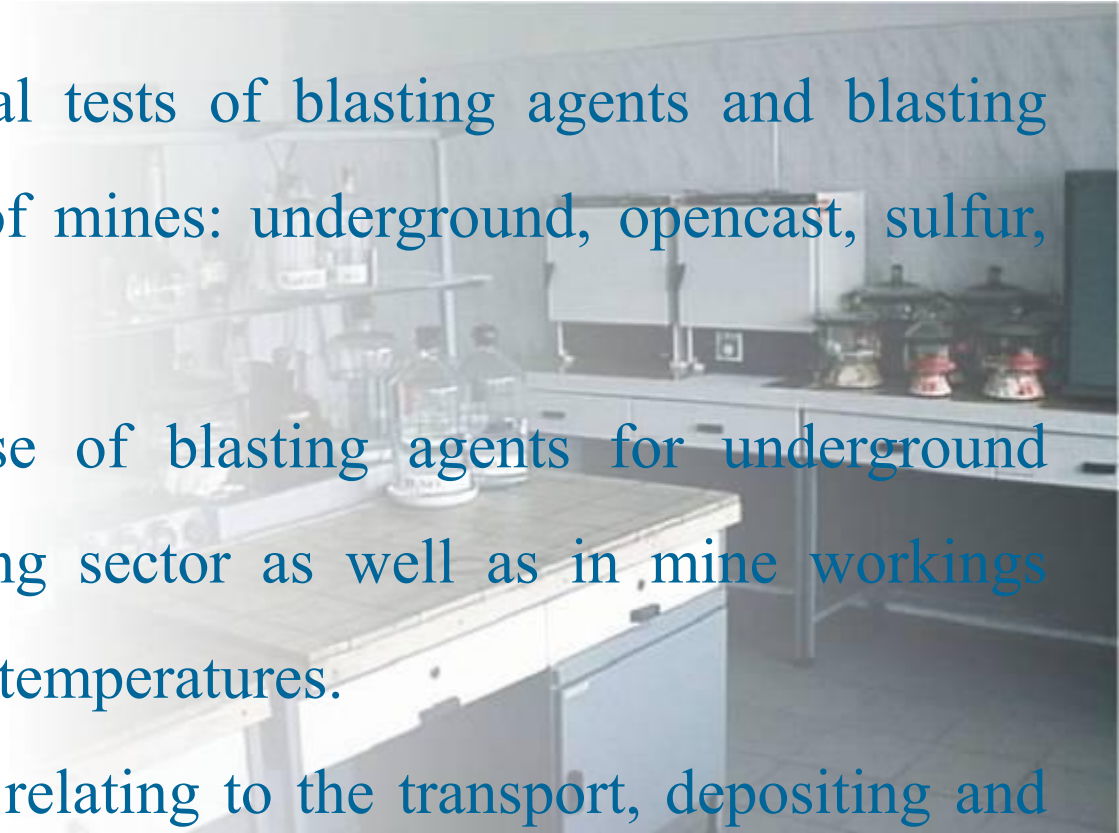




# Blasting Safety Department

## Offer of services:

- Carrying out of approval tests of blasting agents and blasting equipment for the needs of mines: underground, opencast, sulfur, oil and gas.
- Investigation on the use of blasting agents for underground mining, oil and gas mining sector as well as in mine workings at increased and decreased temperatures.
- Issue of expert opinions relating to the transport, depositing and application of blasting agents.



## Range of activity

tests of blasting materials for civil usage including detonators, fuses, initiators, explosives, according to European and Polish norms;

realization of the tasks of the Notified Unit no. 1453 constituted by the Central Mining Institute in the range of the assessment of the blasting materials conformity to the procedures:

- WE type researches;
- product verification;
- type conformity assurance;
- verification of unit production in conformity with basis safety requirements ESR (Essential Safety Requirements) of 93/15/WE Directive concerning introducing and control of blasting materials of civil usage;

tests and certification and technical opinions of blasting equipment;

control, post-accident and other tests of blasting agents and equipment;

expert opinions, technical consultancy and effective works concerning blasting agents and equipment;

tests of blasting agents and equipment for foreign companies;

elaboration of new research methods for blasting agents and equipment;

elaboration of new and amendments to existing norms from the range of blasting agents and equipment;

specialist training courses on blasting agents and blasting equipment;

realization of own research, goaldirected and other projects both state and in the framework of European Union members.





**The equipment of lab:**  
a climatic chamber Weiss Umwelttechnik GmbH, laboratory sieves and sieve shaker of the RETSCH firm, VOD meter for explosives with optic fiber sensors EXPLOMET- FO-2000, a single compound spectrometer HELIOS-β UV/VIS.



a TOPAZE 3020 analyser for continuous testing NO/NO<sub>x</sub>/NO<sub>2</sub>,  
a BERYL 100 analyser for continuous testing CO.

## Bunkier strzałowy

### The bunker for testing explosives



#### Parameters of bunker

- Max. explosive charge – 1 kg RDX,
- Inside diameter of hemisphere – 16 m,
- Capacity – 1557 m<sup>3</sup> ,
- Area of inside bunker – 201 m<sup>2</sup> ,
- Thickness of ferro-concrete walls – 0,5 m,
- Area of laboratory rooms – 50 m<sup>2</sup> .



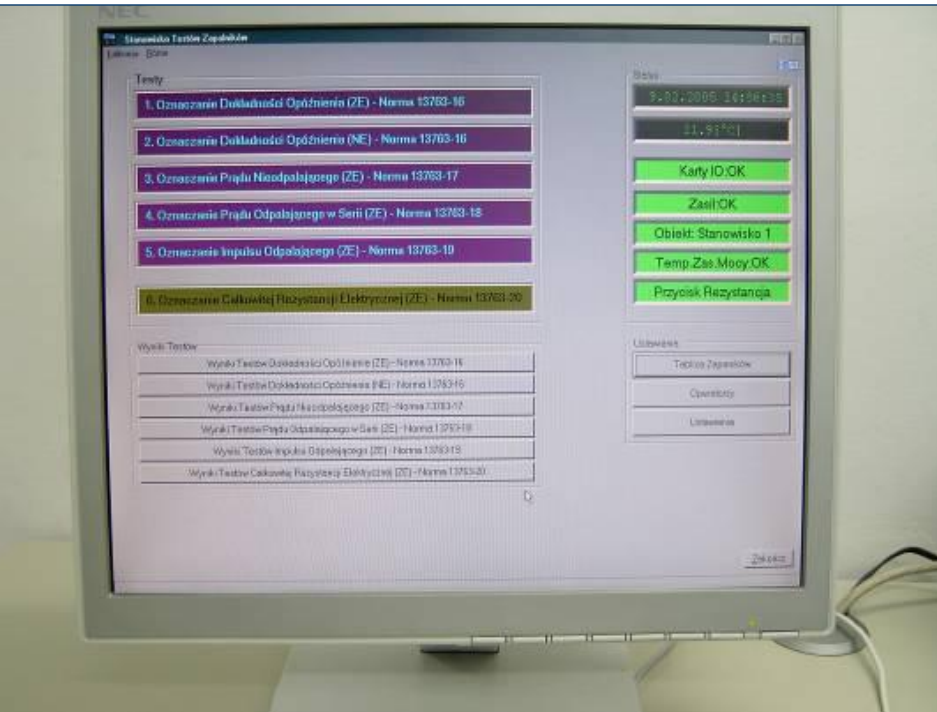


**Sztolnia 44m**  
**Gallery 44 m long in EM „Barbara”**





# Testing Detonators Laboratory



# Department Of Explosion-proof Protection

- **Explosion-proof Protection Assessment Team**
- **Laboratory of Explosion-proof Systems and Protections and Explosimetry**
- **Officer Iecex**



## Range of activity:

- opinions concerning explosion-proof protection of devices and protective systems in industrial plants (chemistry, petrochemistry, light industry, mining: underground, opencast, borehole drilling, storage and transmission of gas and fuels) where potentially explosion-endangered space occurs;
- conformity assessments according to the Decree of the Minister of Economy dated 22 Dec. 2005 (ATEX) concerning fundamental requirements of protective systems designed for use in potentially explosive atmospheres:
  - certificates of tests of EC type,
  - ensuring of conformity with the type,
  - ensuring of the quality of the product,
  - individual unit verification;
- tests in accordance with the norms harmonized with the ATEX Directive (94/9/WE) and with the procedures carried out in the Laboratory of Explosion-Proof Systems and Protection and Explosimetry.



The Accreditation Certificate no. AB43 issued by the Polish Accreditation Center

- tests of the explosion-proof equipment
- of I group of M1 and M2 category, II group of 1, 2 and 3 category of “d” explosion-proof, “e” heavy-duty, “o” oil, “q” sand, “p” ventilated, “i” spark-proof and “m” encapsulated structure,
- tests of electrostatic properties of non-metal materials,
- tests of the scale of IP protection,
- tests of protection and explosimetry systems,
- tests of explosion engines.

•we conduct also works in the range of: repair workshops assessment; expertises and opinions; trainings in the range:

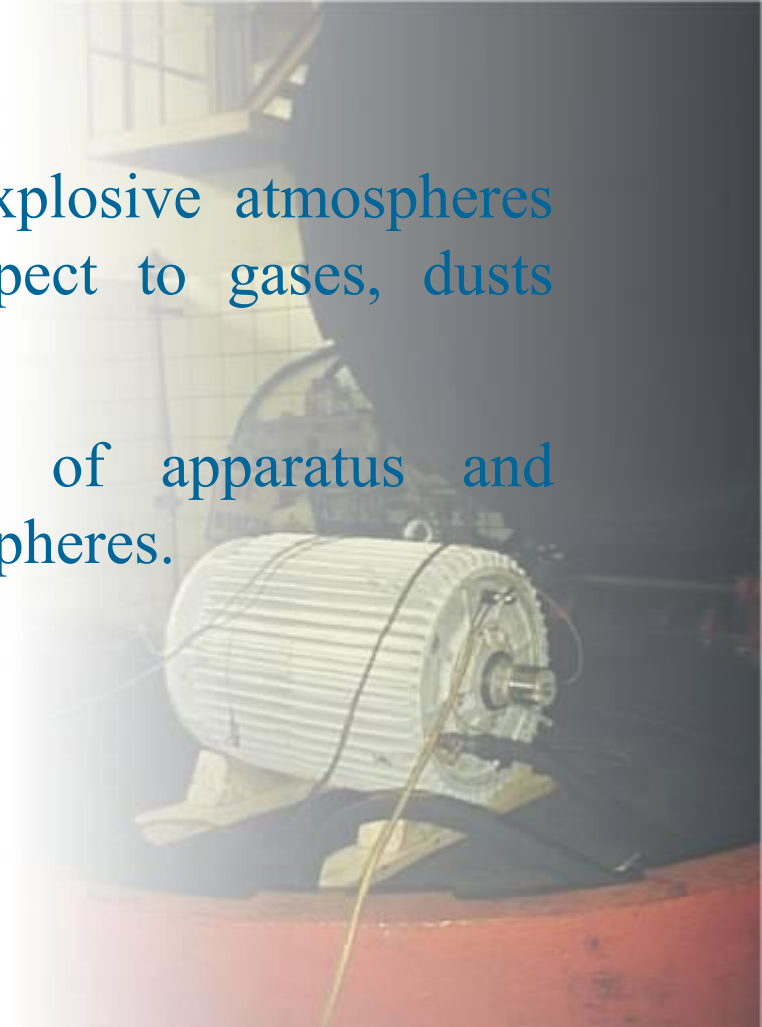
- explosion-proof protection,
- ATEX Directive (94/9/WE),
- norms harmonized,
- requirements for repair workshops.



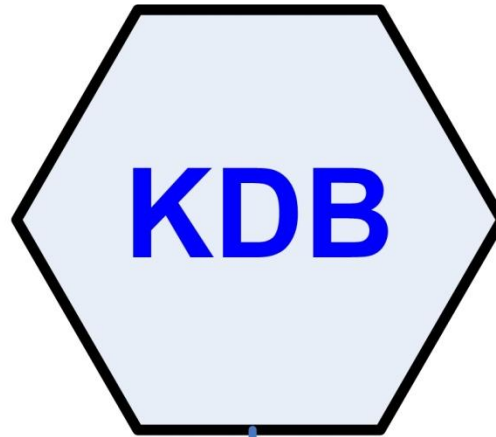
# Department Of Explosion-proof Protection

## Offer of services:

- Testing of equipment for potentially explosive atmospheres in zones, areas and premises with respect to gases, dusts and combustible fibers.
- Expertise's relating to the selection of apparatus and installations in potentially explosive atmospheres.







# Explosionproof Protection Department

## KDB

**ATEX  
Directive**



**IECEX  
Certification**

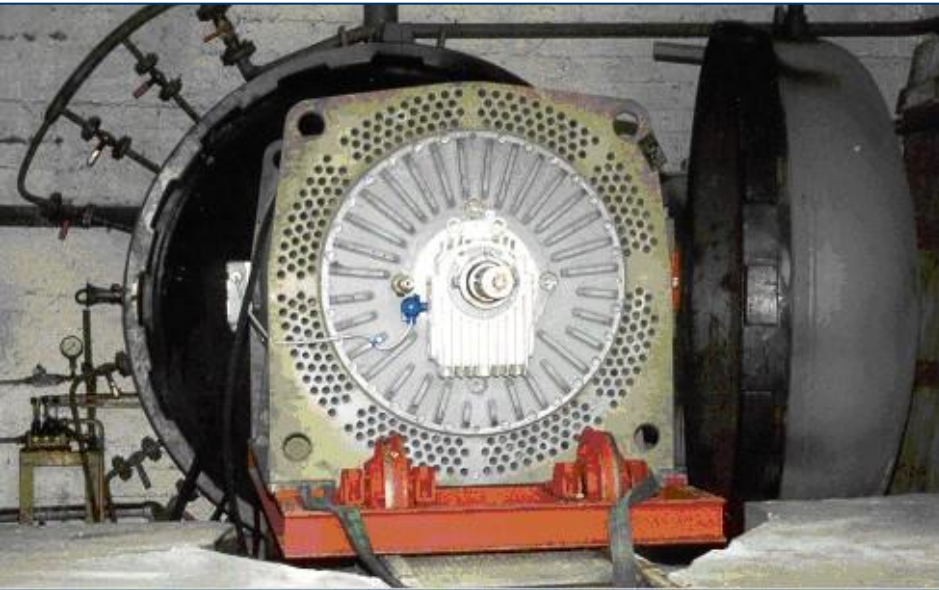


**Opinion,  
assessments,  
investigations**



**Laboratory testing**

## The set of experimental vessels



### The chamber for testing explosion propagation

- Certification tests of equipment intended to use in presence of explosive atmospheres
- A set of experimental vessels: 0.25 m<sup>3</sup>, 0.75 m<sup>3</sup>, 2 m<sup>3</sup>, 16 m<sup>3</sup>
- All types of protection for the Group I and Groups IIA, IIB, and IIC
- Experiments at ambient and elevated pressures

- The 64 m<sup>3</sup> experimental chamber
- Mining diesel locomotives testing in the atmospheres containing methane

# Accidents investigations:





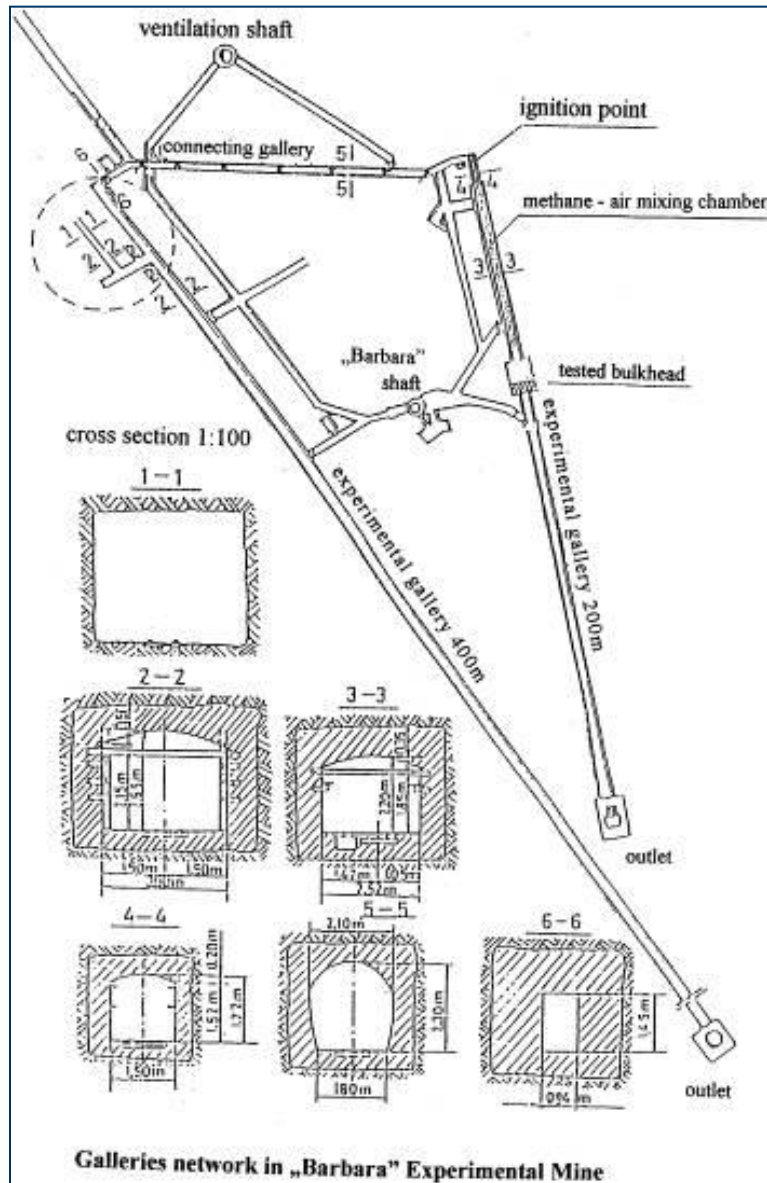
# Mining Department

- investigations into the course of coal dust and methane explosions in experimental gates 400 m and 200 m,
- investigations into the course of other organic dusts explosions, including corn dusts,
- strength tests of explosion-proof dams of different thickness and construction in the experimental gate 200 m at the testing stand with cross-section 11 m<sup>2</sup> and length 10 m,
- testing of explosion-proof barriers of various types - dust, water, trigger barriers with the use of detectors,
- show coal dust explosions in experimental gallery 100 m along with training in the field of dust hazard control.

# **Large scale experimental facilities at EM “Barbara” of CMI**

- **The 100 m surface gallery**
- **The 5 m<sup>3</sup> explosion chamber**
- **The 400 m and 200 m underground entries**
- **Experimental field for explosives testing**
- **The set of experimental vessels**
- **Demonstration stand for methane fires**

# The 400 m and 200 m underground entries



- Very strong dust/gas explosions, up to detonation
- Measuring panels along entries walls
- Experiments in interconnected workings

# The 400 m and 200 m underground entries



- Performance of stone dust and water barriers
- Testing of mining seals
- Experiments on triggered barrier of different types
- Performance of a valve for metro ventilation system



## The 100 m surface gallery. Large scale testing – coal dust explosion



- Explosion propagation in the coal dust/methane hybrid mixtures
- Extinguishing properties of stone dusts
- Demonstration of coal dust explosion propagation

## Demonstration stand for methane fires



- Efficiency/inefficiency of different means in extinguishing methane fires
- Water and extinguishing powders as the extinguishing agent



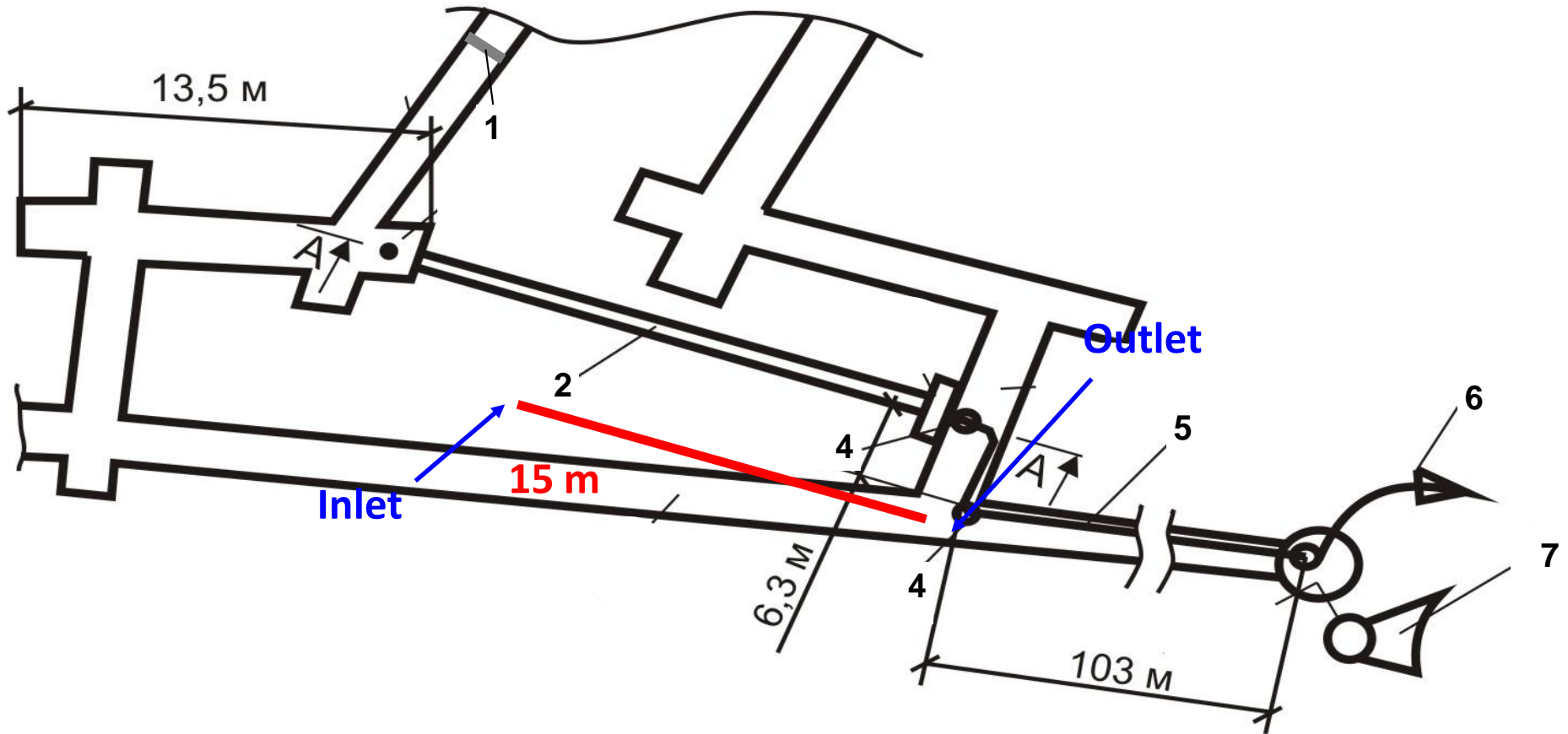


**In situ gasification  
experiment**

**Experimental Mine  
„Barbara”**

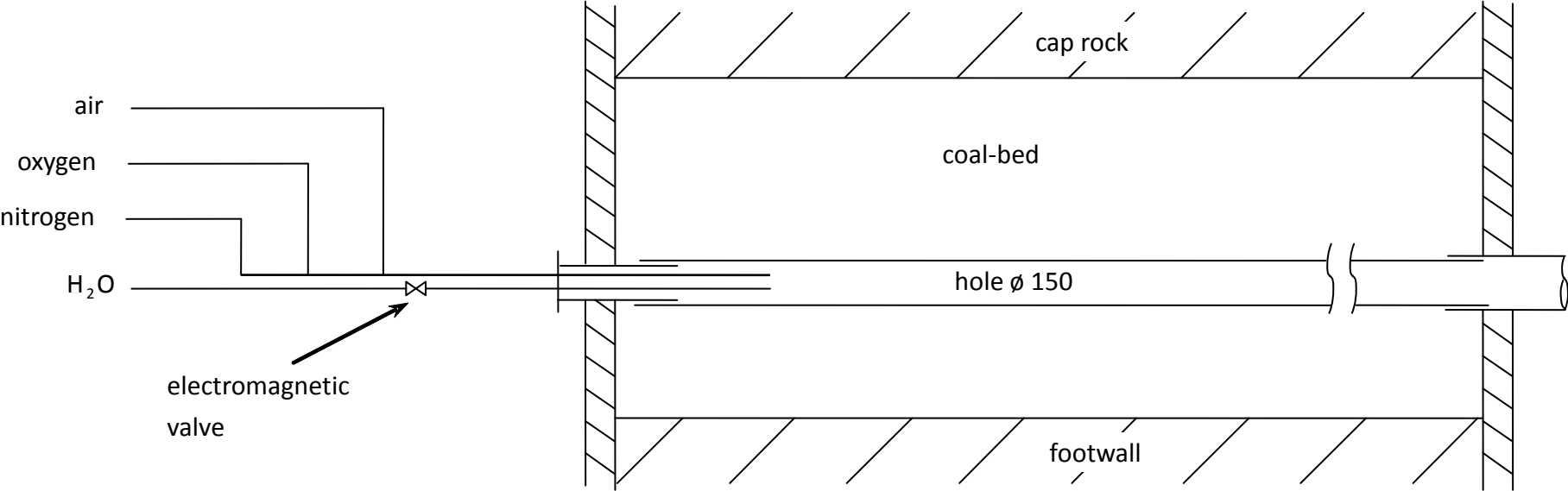
**7<sup>th</sup> – 22<sup>nd</sup> April 2010  
Mikołów**

# Underground reactor





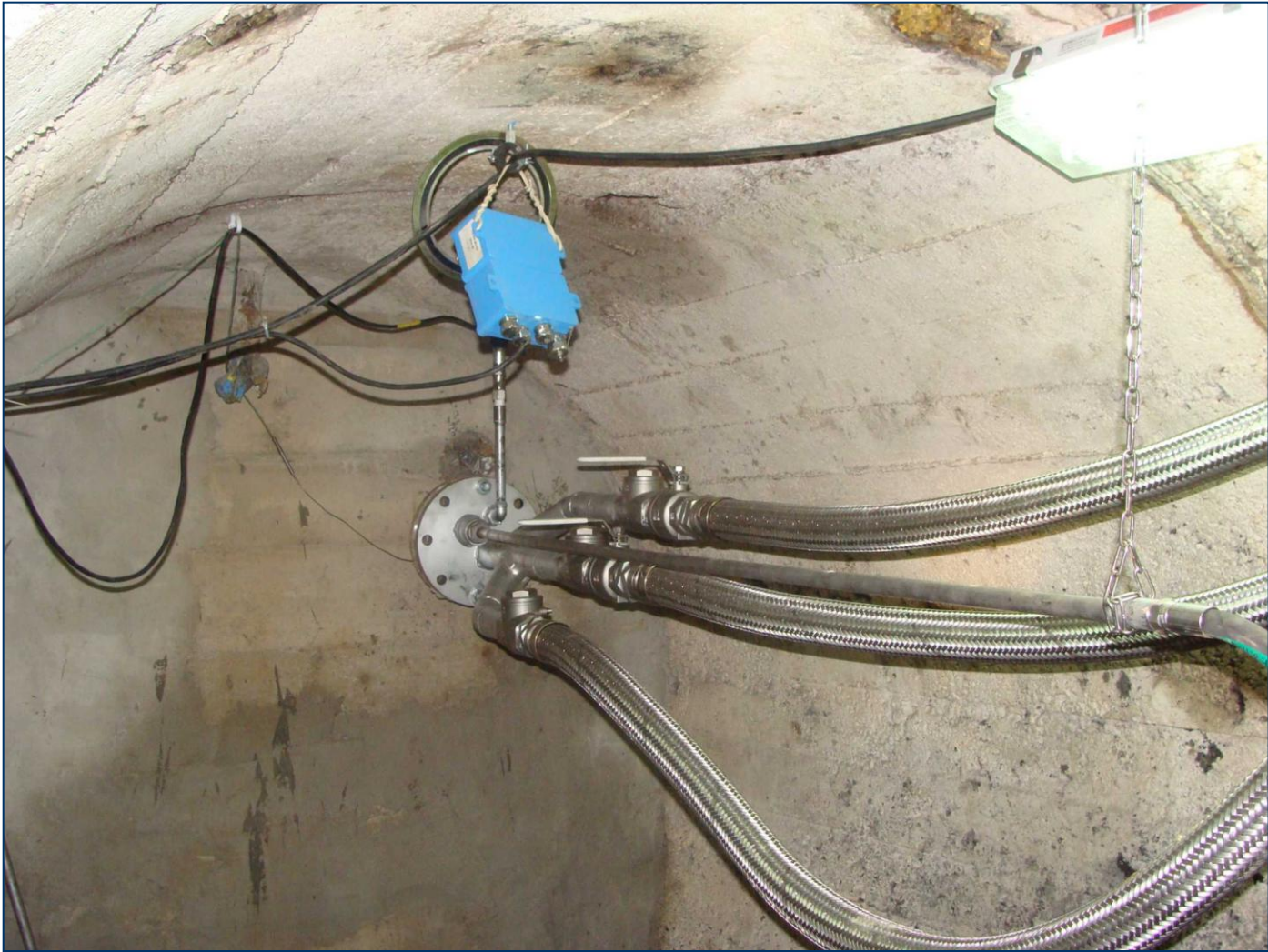
# Underground reactor



# Surface gas collection system

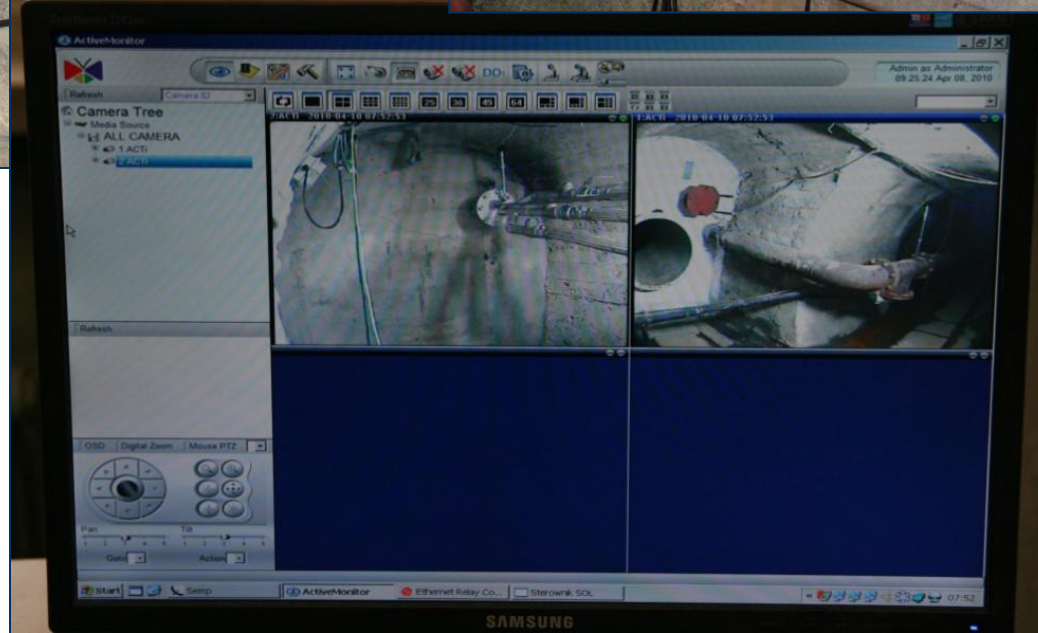
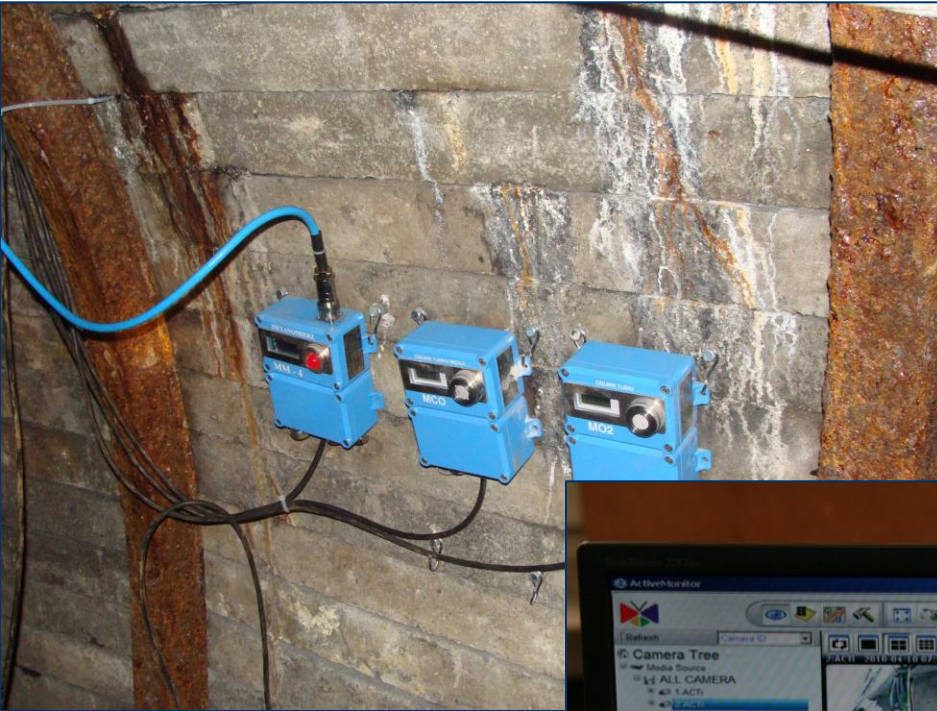


# Reactor inlet





# Elements of monitoring system





**Moment zapalenia pokładu węgla**  
**Moment of ignition of coal seam**



**Widok zapalonego pokładu**  
**View of ignited coal seam**



Pochodnia gazowa na powierzchni.  
Gas flare on the surface



# Process parameters

<u>Gasification agents:</u>	oxygen, air
<u>Safety agent:</u>	nitrogen
<u>Area of the reactor:</u>	15m x 5m x 1,5m
<u>Coal consumption rate:</u>	30 – 40 kg/hour
<u>Gas production rate:</u>	150 – 200 m <sup>3</sup> /hour
<u>Amount of gasified coal:</u>	12 – 15 tones