

**Detection of Spontaneous Combustion of Coal  
in Ostrava-Karvina Coalfield,  
Czech Republic**

*Prof. Ing. Alois Adamus, Ph.D.*

*2007*

# Czech Republic

128 000 km<sup>2</sup>, population 10 mil.

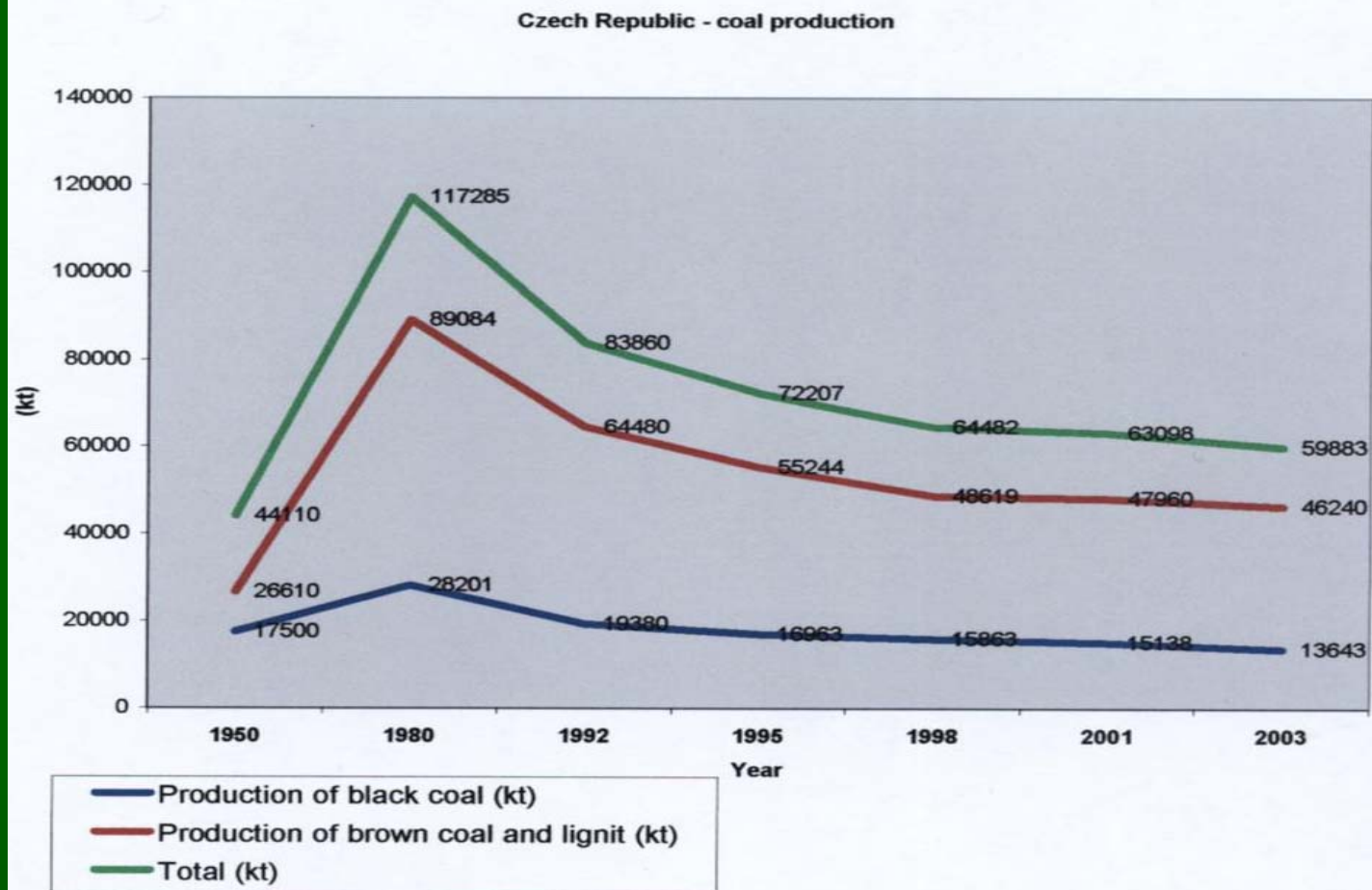


# Czech Republic

Coal production -  
2006

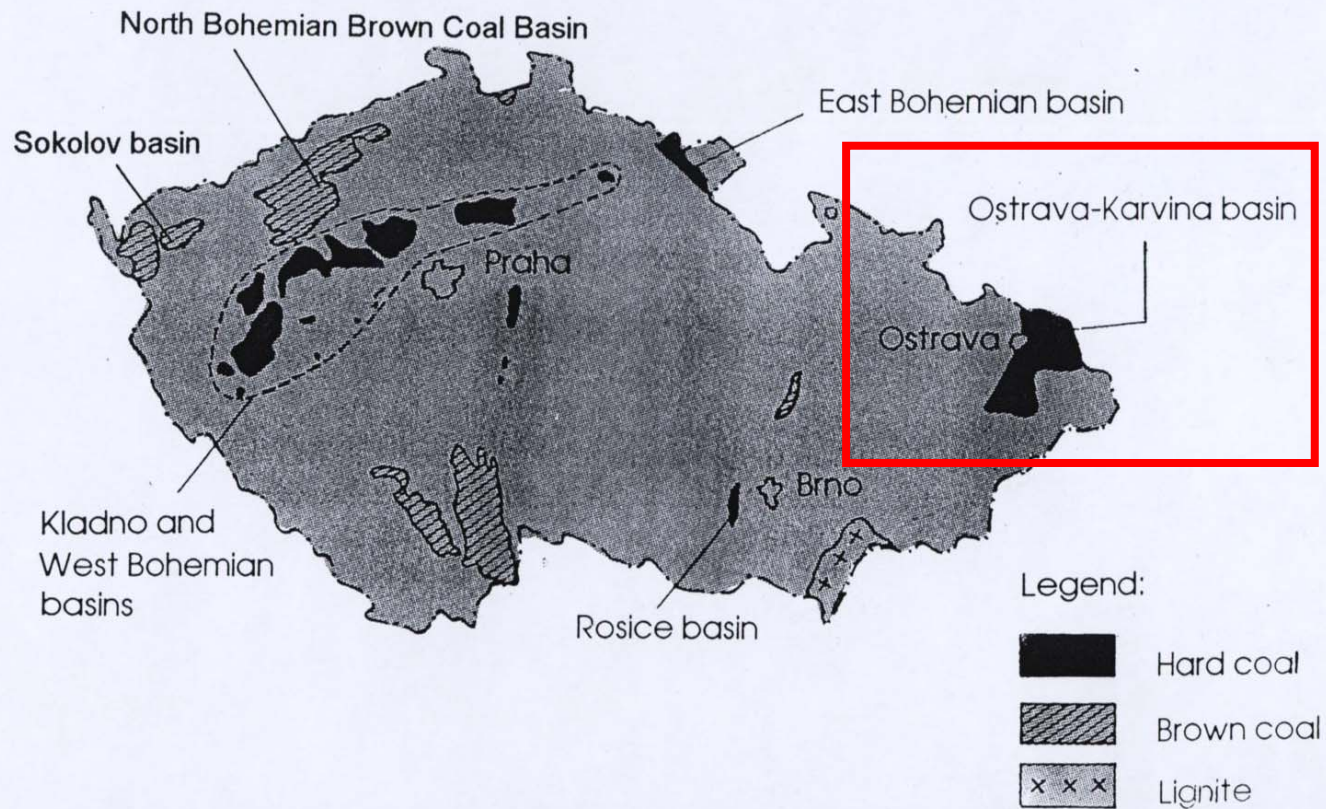
total 59 mil.t  
brown c. 45 mil.t  
hard c. 14 mil.t

specif. p. 5,9 t/cit.  
specif. p. 460 t/km<sup>2</sup>



# Czech Republic

## Principal coal deposits in Czech Republic





OKD, a. s.,  
DŮL  
DARKOV  
KARVINÁ



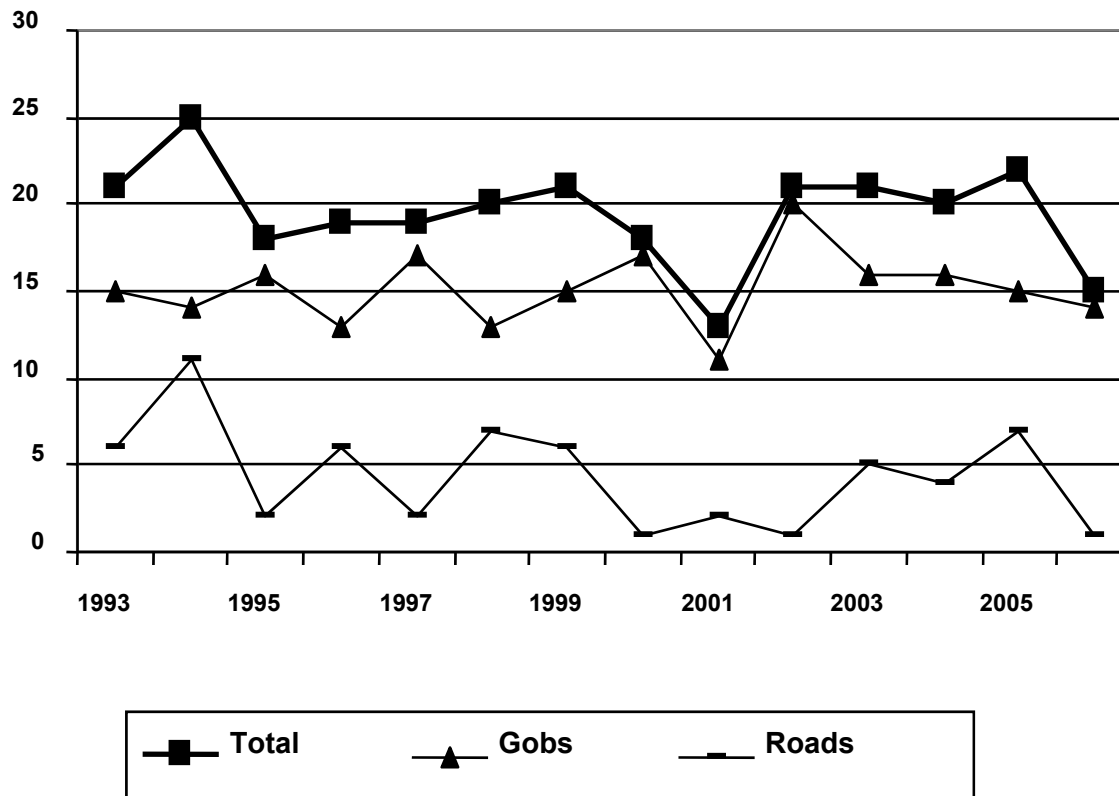
## Ostrava-Karvina Coalfield Carboniferous deposit

8 mines, depth  $\varnothing$  900 m u.s.  
production 14,3 mil. hard coal 2006  
labour 18 ths. w.



# Spontaneous combustion

## Ostrava-Karvina Coalfield



# Detection of Spontaneous Combustion of Coal

## The historical overview

- 1920 GRAHAM, J.I.: The normal production of carbon monoxide in coal-mines, Transaction Institution of Mining Engineers, vol.60, 1920-21, s. 222-234.
- 1959 KITTAGOWAM, T.: Detection of underground spontaneous combustion in its early stage with detectors, 10th International Conference of Directors of Safety in Mines Research, Pittsburgh, PA, 1959.
- 1966 MUZYCZUK, J., KOLODZIEICZYK, B.: Współczesne kierunki rozwoju metod wczesnego wykrywania pożarów endogenicznych w kopalniach węgla kamiennego. Przegląd górniczy, 1966, s. 364-370.
- 1970 CHAMBERLAIN, E.A.C, HALL, D.A., THIRLAWAY, J.T.: The Ambient Temperature Oxidation of Coal in Relation to the Early Detection of Spontaneous Heating – part1, The Mining Engineer, vol. 130, October 1970
- 1975 LANKOVÁ, S., ČERNÝ, V., DOBAL, V. : Vývoj uhlovodíků při oxidaci uhlí, Hornický ústav ČSAV, Praha 1975.
- 1976 ALJPEROVIČ, V.J, ČUNTU, G.J., PASKOVSKIJ, P.S., KOSOVSKIJ, B.J. Bezopasnost truda v promyslenosti, p. 25, 6/1975
- 1978 CHAKRAVORTY R.N., FENG K.K.: Studies on the Early Detection of Spontaneous Combustion in a Hydraulic Coal Mine, CIM Buletin, January 1978, s.83

# Detection of Spontaneous Combustion of Coal Czech Republic

Utilisation of the results of research in 1980s :

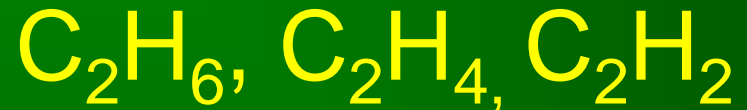
- 1987 - recommended methodology of an assessment of temperature of spon-com
- 1990 - generally binding regulation nr. 10/1990 of the Regional State Mining Authority of Ostrava

## Monitored indication gases of spon-com :

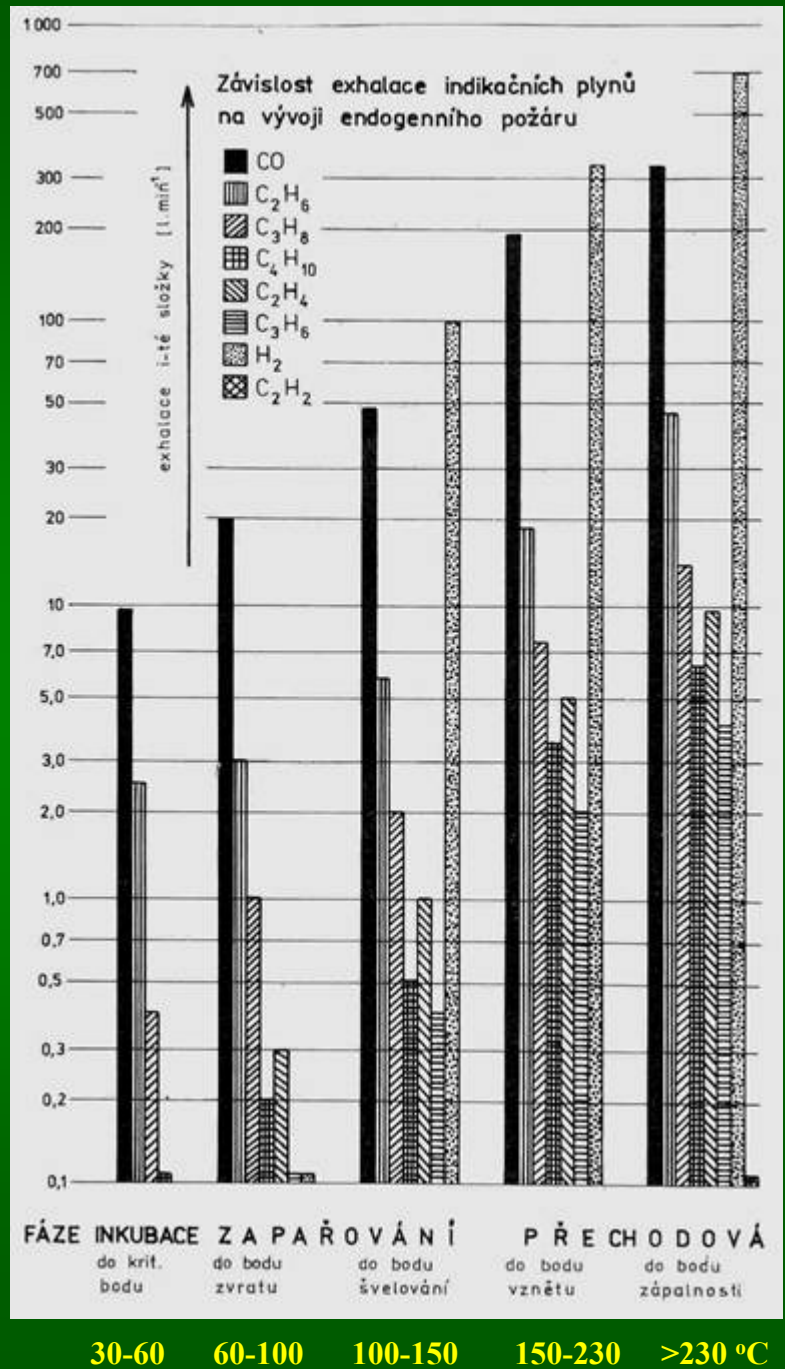
**Majoryty gases (wet sampels) :**



**Minority gases (dry samples) :**



- 1987 - recommended methodology of an assessment of temperature of spon-com



## Generally binding regulation nr. 10/1990 of Regional State Mining Authority of Ostrava :

- CO is continuously monitored in inlet and outlet air stream of a longwall face,
- wet samples are taken in outlet of a longwall face 1 per month,
- the limit concentration value of CO is 10 ppm, or release at 10 l.min<sup>-1</sup> of CO,
- if values at this limit are found, samples of dry mine atmosphere must be taken for chemical and chromatographic analysis of indication gases  
CO, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>3</sub>H<sub>8</sub>, C<sub>3</sub>H<sub>6</sub>, n-C<sub>4</sub>H<sub>10</sub>, i-C<sub>4</sub>H<sub>10</sub>  
once a week if the concentration value does not grow,  
and twice or more often a week if the concentration value does grow,
- if C<sub>2</sub>H<sub>4</sub> or C<sub>3</sub>H<sub>6</sub> has repeatedly occurred, the concentration value of CO grows steadily, and the centre of spontaneous combustion cannot be suppressed, the risk area must be closed,
- if the analysis of atmosphere establishes occurrence of C<sub>2</sub>H<sub>2</sub>, the risk area must be closed immediately.

# Facility - Ostrava-Karvina Coalfield :

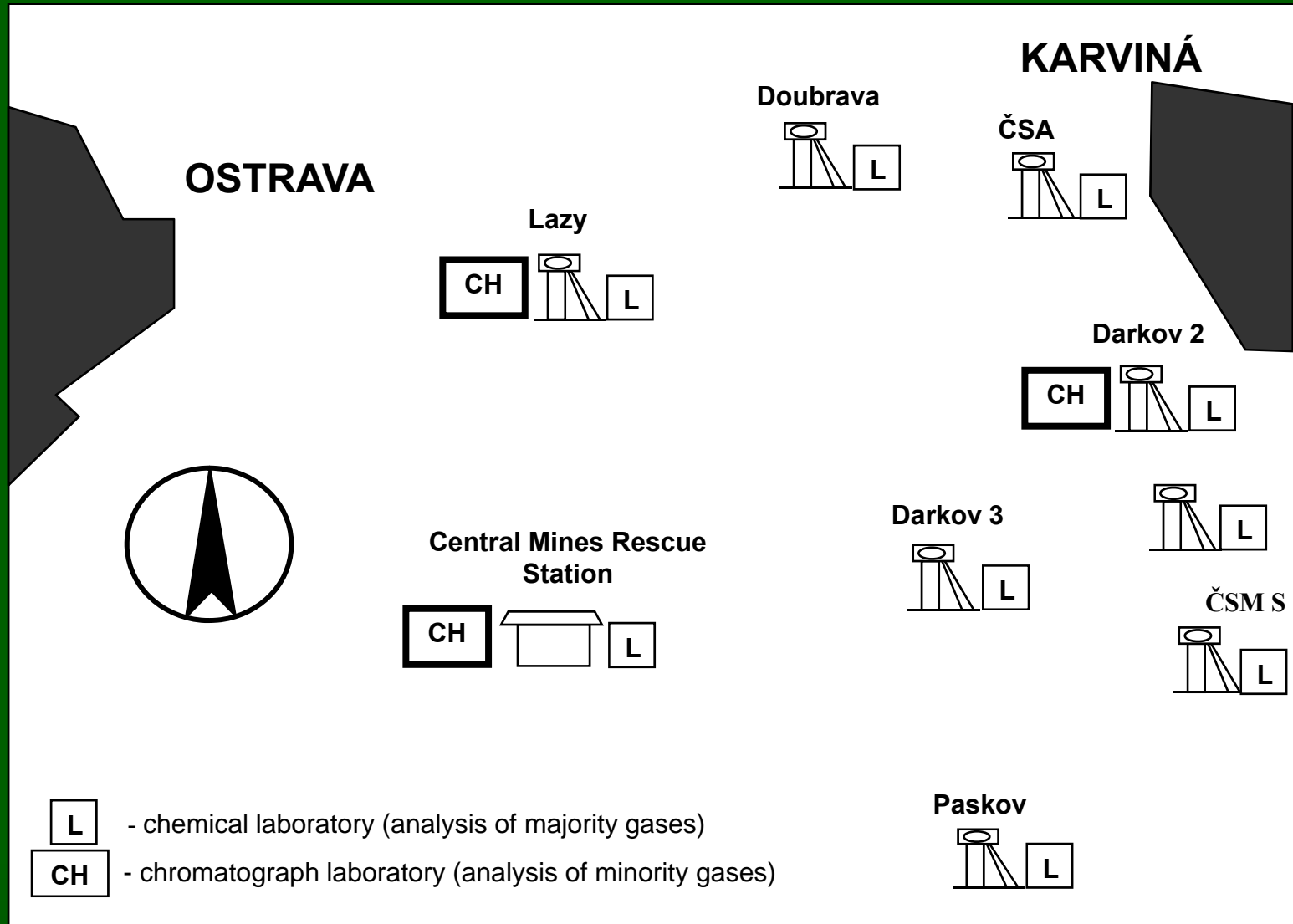
## **Praktice :**

- **8 chemical laboratories**
- **3 chromatograph laboratories**

## **Research :**

- **2 chromatograph laboratories**

# Facility - Ostrava-Karvina Coalfield :



# Darkov 2 Colliery



## Chromatograph PERKIN-ELMER type 4890

Analysis :

H<sub>2</sub>

C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>

C<sub>3</sub>H<sub>8</sub>, C<sub>3</sub>H<sub>6</sub>

n-C<sub>4</sub>H<sub>10</sub>

i-C<sub>4</sub>H<sub>10</sub>

sensitivity 0,1 ppm  
time of response 5 min



# Lazy Colliery



## Chromatograph PERKIN-ELMER type XL

Analysis :

H<sub>2</sub>

C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>

C<sub>3</sub>H<sub>8</sub>, C<sub>3</sub>H<sub>6</sub>

n-C<sub>4</sub>H<sub>10</sub>

i-C<sub>4</sub>H<sub>10</sub>

sensitivity 0,1 ppm

time of response 5 min



# Central Mines Rescue Station Ostrava



## Chromatograph DANI GC 1000 DPH

Analysis :

H<sub>2</sub>

C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>

C<sub>3</sub>H<sub>8</sub>, C<sub>3</sub>H<sub>6</sub>

n-C<sub>4</sub>H<sub>10</sub>

i-C<sub>4</sub>H<sub>10</sub>

SF<sub>6</sub>

sensitivity 0,1 ppm

time of response 7 min



# Research

**VSB-Technical University Ostrava**  
**Chromatographs**  
**Hewlett Packard 5890 Series II**

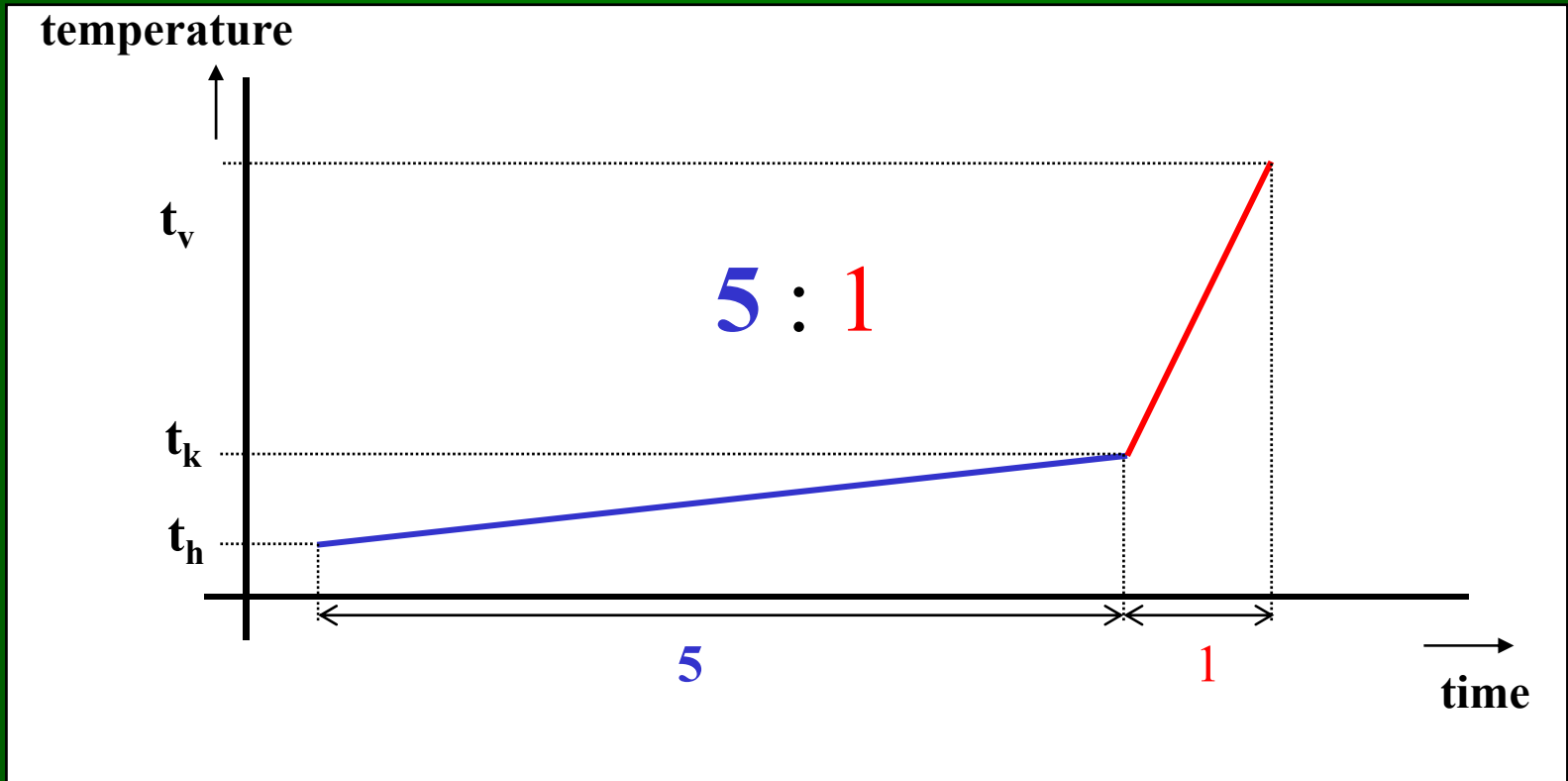


**Institute of Geonics AS CR Ostrava**  
**Chromatograph**  
**VARIAN 3400**



# Experience :

Dynamic of spontaneous combustion  
(Coal of the Ostrava-Karvina Coal Basin)



$$t_k = 60 - 100 \text{ } ^\circ\text{C}, \quad \varnothing 83 \text{ } ^\circ\text{C}$$

*Thank You for Your Attention*

*Prof. Ing. Alois Adamus, Ph.D.*