

“Řešení havarijních situací” and DPL – system for monitoring and evaluation of coal mine atmosphere explosibility

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Content of the presentation


- ◆ Introduction
 - ◆ DPL description
 - ◆ “Řešení havarijních situací”
description
 - ◆ The system application
 - ◆ Conclusions
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Introduction

- ◆ Rescue operations during mine fires or methane explosions are highly dangerous for rescue workers.
- ◆ The knowledge of the composition of the coal mine atmosphere and the calculation of its explosibility may help to increase the safety of the rescuers.



Introduction

- ◆ During the last years the new model of DPL ("Mine Gas Laboratory") was developed.
 - ◆ The design of the new DPL model together with the special software code named "Řešení havarijních situací" ("Solving the Accidental Situation") were developed as the project No. 43-05 commissioned by the Czech Bureau of Mining: "Continuous Evaluation of Mine Atmosphere during Fires and Methane Explosions".
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DPL description



Analyzer PN1

Analyzer PN2

Commutator
of gas lines

Control unit

DPL description

Explosion safety
fuse

Commutator of
gas lines

Protection against
condensate




DPL accessories – wind speed, temperature and humidity sensors



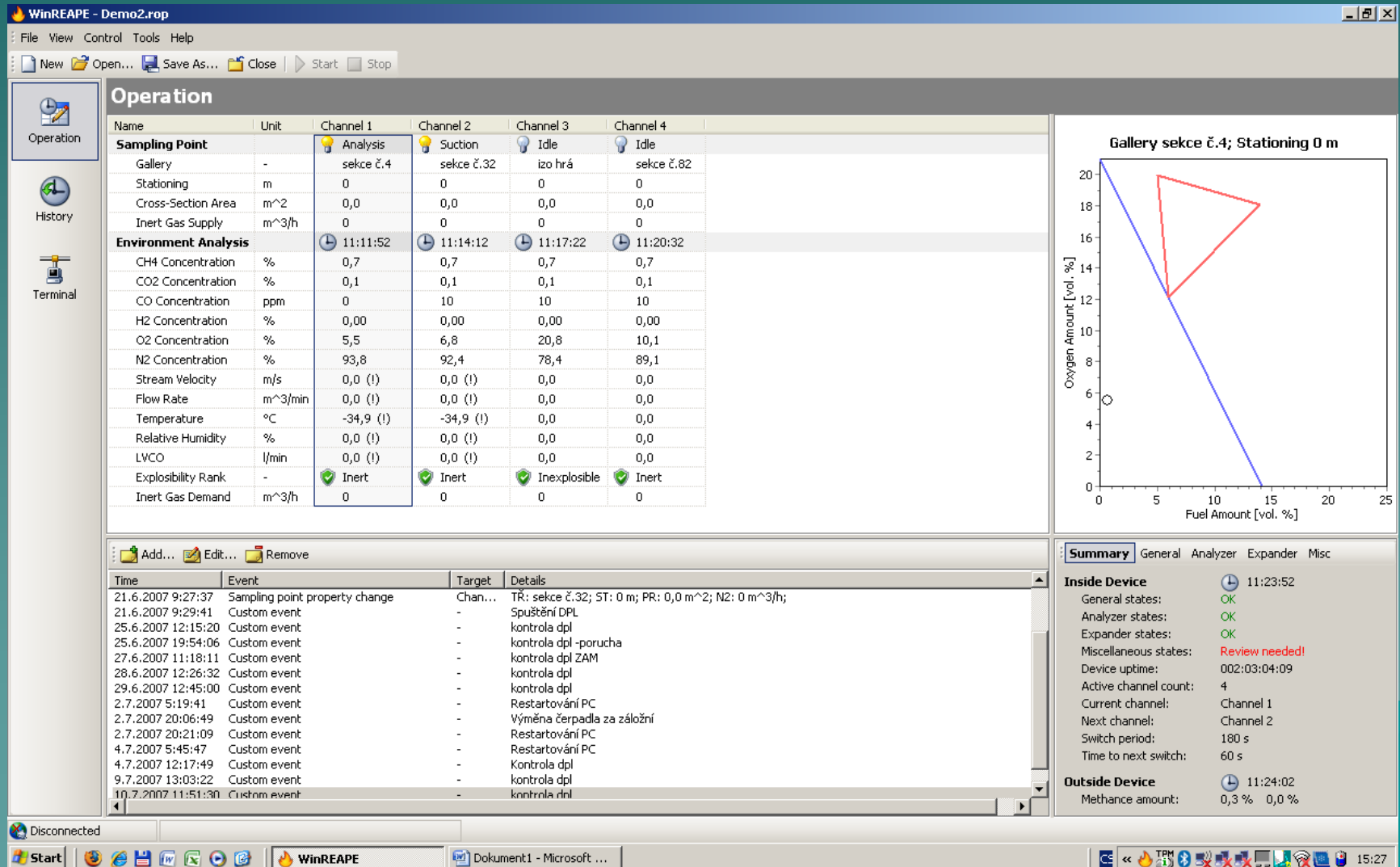
The DPL capabilities

Description	Range	Accuracy
CH ₄ analyzer - PN1	0 – 10 % vol. 0 – 100 % vol.	0,1 % vol.
O ₂ analyzer – PN2	0 – 25 % vol.	0,1 % vol.
CO ₂ analyzer – PN2 PN1	0 – 5 % vol. 0 – 25 % vol.	0,01 % vol. 0,1 % vol.
CO analyzer – PN2 PN1	0 – 0,1 % vol. 0 – 10 % vol.	0,001 % vol. 0,1 % vol.
H ₂ analyzer - PN1	0 – 5 % vol.	0,01 % vol.
Analyzer CH4 (DPL surrounding)	0 – 5 % vol.	0,01 % vol.
Wind speed	0,2 – 10 m / s	0,1 m/s
Temperature	0 – 60 °C	0,1 °C
Relative humidity	0 – 100 % RH	1 % RH

The DPL capabilities

- ◆ Measurement of all parameters at up to six spots in the mine.
 - ◆ The installed pumps have the capability to take samples from distances up to 1000 m with the sampling time not exceeding 3 min.
 - ◆ Data can be transmitted into the control PC at ground through the telephone line up to 5 km distance.
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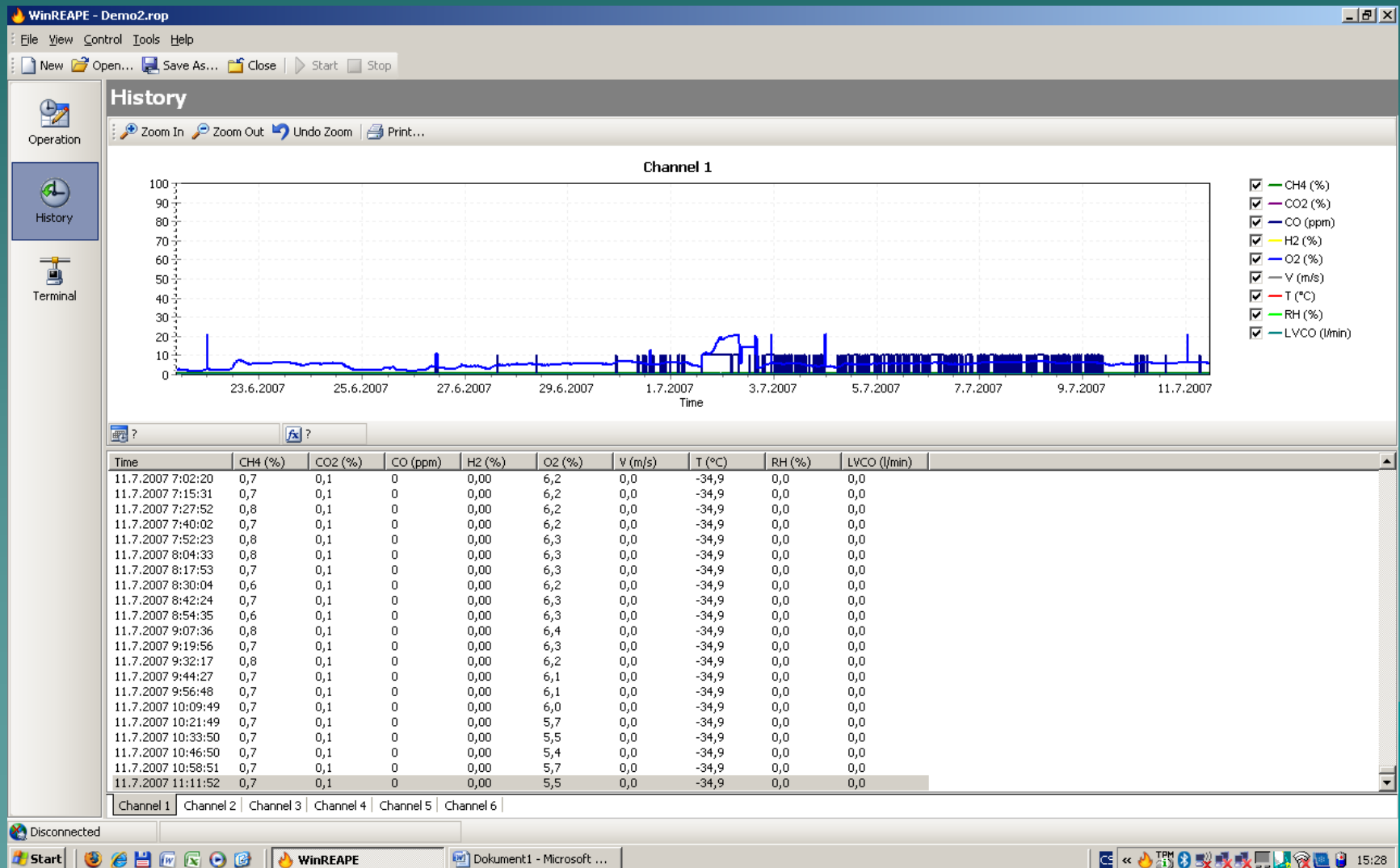
“Řešení havarijních situací” (Solution of Accidental Situations)




“Řešení havarijních situací” (Solution of Accidental Situations)

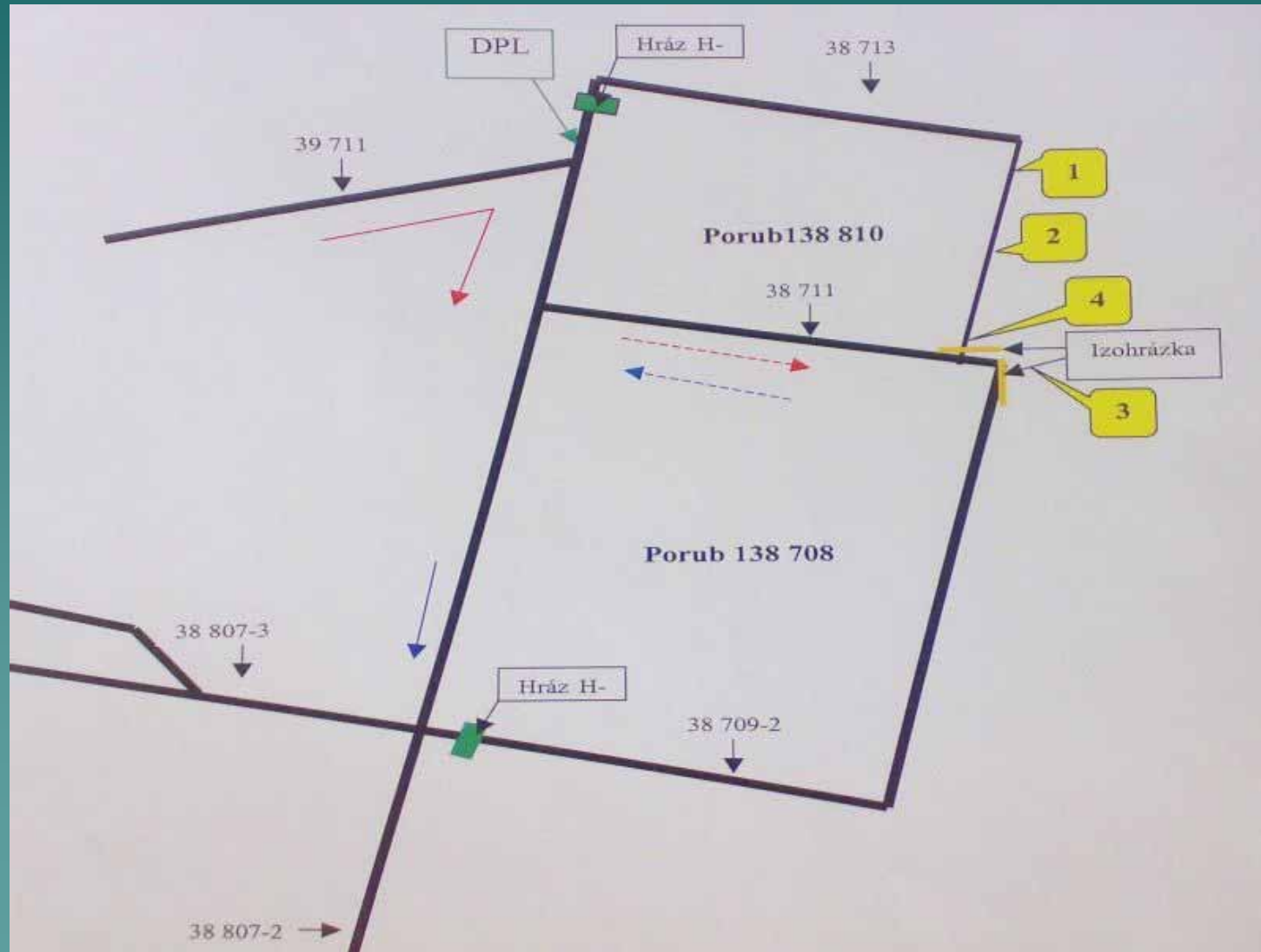
- ◆ Inertisation calculation
 - Calculation of the nitrogen flow rate necessary to inert the given atmosphere composition of the measured flow rate.
- ◆ CO build-up monitoring
 - This function monitors the amount of carbon monoxide in the mine atmosphere and it is compared with the critical value of 10 l.min^{-1} as stipulated in the law.
 - Reaching this value may indicate dangerous processes going on in the mine and it means that it is necessary to sample the so-called “dry sample” for chromatographic analysis.

“Řešení havarijních situací” (Solution of Accidental Situations)



The system application

- ◆ The preventive application of the system - making galleries, previously closed because of the mine fire, accessible.
 - ◆ Colliery "Lazy" application - 138 708 and 138 810 longwalls area was closed to be the explosion-proof on dams H1, H2 and H3 because of the mine fire.
 - ◆ The DPL system application for the continual "long distant" monitoring of the oxygen concentration behind the dams during sequential opening of the longwalls.
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DPL transport above the ground



DPL transport in the mine



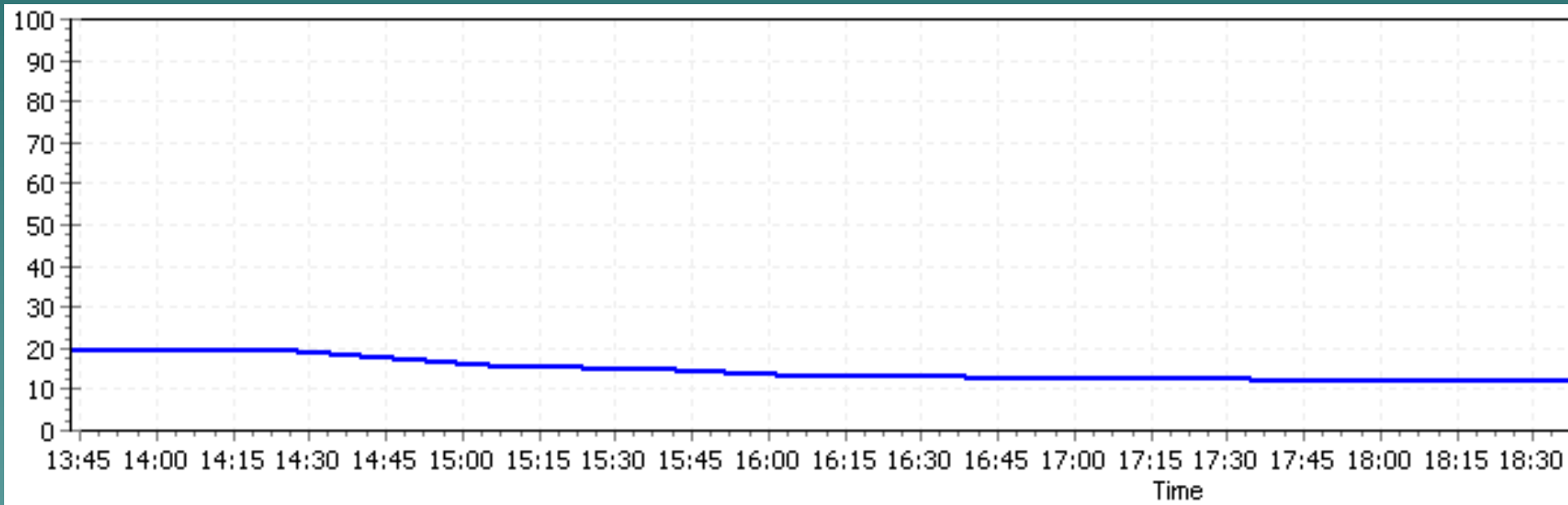
Wind speed, temperature and humidity sensors in the gallery



Data transmitted to the inspection service




Inertization to required value




Tuning of the O₂ concentration

Time	CH4 (%)	CO2 (%)	CO (ppm)	H2 (%)	O2 (%)	V (m/s)	T (°C)	RH (%)	LVCO (l/min)
7.4.2008 7:51:30	0,0	0,1	10	0,49	12,5	0,0	0,0	0,0	0,0
7.4.2008 8:10:16	0,0	0,1	10	0,54	12,6	0,0	0,0	0,0	0,0
7.4.2008 8:28:52	0,0	0,1	10	0,56	12,6	0,0	0,0	0,0	0,0
7.4.2008 8:46:53	0,0	0,1	10	0,56	12,8	0,0	0,0	0,0	0,0
7.4.2008 9:05:44	0,0	0,1	10	0,56	12,9	0,0	0,0	0,0	0,0
7.4.2008 9:24:45	0,0	0,1	10	0,54	12,6	0,0	0,0	0,0	0,0
7.4.2008 9:43:43	0,0	0,1	10	0,55	12,6	0,0	0,0	0,0	0,0
7.4.2008 10:01:47	0,0	0,1	10	0,55	12,9	0,0	0,0	0,0	0,0
7.4.2008 10:20:37	0,0	0,1	10	0,54	12,8	0,0	0,0	0,0	0,0
7.4.2008 10:39:48	0,0	0,1	10	0,54	12,7	0,0	0,0	0,0	0,0
7.4.2008 10:58:29	0,0	0,1	10	0,54	12,5	0,0	0,0	0,0	0,0
7.4.2008 11:17:24	0,0	0,1	10	0,52	12,0	0,0	0,0	0,0	0,0
7.4.2008 11:35:53	0,0	0,1	10	0,50	11,4	0,0	0,0	0,0	0,0
7.4.2008 11:54:01	0,0	0,2	10	0,50	10,9	0,0	0,0	0,0	0,0
7.4.2008 12:12:12	0,0	0,2	10	0,49	10,6	0,0	0,0	0,0	0,0
7.4.2008 12:31:03	0,0	0,2	10	0,46	9,9	0,0	0,0	0,0	0,0
7.4.2008 12:49:44	0,0	0,2	10	0,44	10,2	0,0	0,0	0,0	0,0
7.4.2008 13:08:35	0,0	0,2	10	0,46	10,1	0,0	0,0	0,0	0,0
7.4.2008 13:27:26	0,0	0,2	10	0,46	10,2	0,0	0,0	0,0	0,0
7.4.2008 13:46:29	0,0	0,2	10	0,42	10,7	0,0	0,0	0,0	0,0
7.4.2008 14:05:06	0,0	0,2	10	0,43	10,9	0,0	0,0	0,0	0,0
7.4.2008 14:23:41	0,0	0,1	10	0,43	11,3	0,0	0,0	0,0	0,0
7.4.2008 14:42:17	0,0	0,1	10	0,42	11,3	0,0	0,0	0,0	0,0
7.4.2008 15:00:52	0,0	0,1	10	0,43	11,6	0,0	0,0	0,0	0,0
7.4.2008 15:19:28	0,0	0,1	10	0,42	11,5	0,0	0,0	0,0	0,0
7.4.2008 15:38:03	0,0	0,1	10	0,40	11,4	0,0	0,0	0,0	0,0
7.4.2008 15:56:04	0,0	0,1	10	0,40	11,8	0,0	0,0	0,0	0,0
7.4.2008 16:14:55	0,0	0,1	10	0,40	12,0	0,0	0,0	0,0	0,0
Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6				

Conclusions

- ◆ The Czech Bureau of Mining project allowed the development of the powerful system helping to improve the safety during rescue operations.
 - ◆ Developed system, the new model of “Mine Gas Laboratory” together with the code “Řešení havarijních situací” (Solution of Accidental Situations), is used for the continual “long distant” monitoring and explosibility evaluation of the mine atmosphere.
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Conclusions

- ◆ The system is modular, very simple for use and can be easily modified to fulfill special requirements.
 - ◆ The system is capable to be applied not only in case of potential accident (e.g. mine fire) but also in case of preventing actions.
 - ◆ The system was already applied for making longwalls, previously closed because of the mine fire, accessible.
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Acknowledgements

- ◆ The authors would like to thank the Czech Bureau of Mining for grant-in-aid for Project No. 43-05 "Continuous Evaluation of Mine Atmosphere during Fires and Methane Explosions".
- ◆ And my special thanks belongs to Mr. Pošta and his colleagues for help and cooperation during the project.

Thank you for your attention.

