

Streszczenie pracy doktorskiej.

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DZIEDZINA: DZIEDZINA NAUK INŻYNIERYJNO-TECHNICZNYCH

DYSCYPLINA: Inżynieria Środowiska, Górnictwo i Energetyka

Title: "Monitoring system for concentrations of air pollutants emitted from exhaust systems of mining machines for the purpose of air quality management in underground mine workings of KGHM PM S.A."

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Keywords: monitoring, diesel engine exhaust, emissions, underground mines, mining machinery, occupational health and safety.

PhD dissertation: "Monitoring system for concentrations of air pollutants emitted from exhaust systems of mining machines for the purpose of air quality management in underground mine workings of KGHM PM S.A.". was carried out as part of the implementation doctorate program at the Quality Research Center in Lubin (KGHM PM S.A. Capital Group).

The work presents an overview of legal regulations regarding measurements of air pollutants emitted from the flue gases of self-propelled mining machines in underground mines. Provisions in various types of regulations or standards were analyzed in order to identify regulations in this area. The impurities that should be monitored were identified and the principles and frequency of measurements resulting from the information obtained were described.

The work also reviews the methods of sampling and measurement methods that can be used to measure selected pollutants from diesel engine exhaust, m.in nitrogen oxides, carbon oxides, hydrocarbons or elemental carbon (solid particles), with particular emphasis on methods that can be used in underground mining excavations.

During the doctoral thesis, measurements of selected pollutants from diesel engine exhaust in real conditions in underground mines were made. Measurements were made in various places and workplaces in mining excavations, with particular emphasis on places exposed to emissions of pollutants from exhaust systems. Among other things, the concentrations of hydrocarbons (aromatic, aliphatic), aldehydes and ketones, carbon oxides, nitrogen oxides or elemental carbon were measured, and their concentrations were compared with normative values and with literature data, which described similar measurements in various underground mines around the world.

During the measurements, the process of validation of methods was also carried out with the estimation of the parameters of the components of the uncertainty budget (repeatability, reproducibility, indirect precision, recovery, calibration of the device, etc.) in order to determine the total uncertainty of the measurement method described above, taking into account the uncertainty associated with the measurements in underground mining excavations, in particular with variable ventilation and climatic conditions in underground mines.

During my doctorate, two new measurement methods were implemented at my employer (determination of elemental carbon in air – the first accredited method in Poland and a method for the determination of hydrocarbons in air using the Torion T9 portable gas chromatograph), which allowed to expand the scope of the laboratory's activities and acquire new customers and increase the company's revenues in the described research areas.

To sum up, the concept of the air pollution concentration monitoring system described in the paper from the exhaust gases of self-propelled mining machines will allow:

- development of a measurement methodology for a uniform metrological approach and measurement, which will be extremely important for the subsequent interpretation of the obtained results in underground mines,
- as a result of the developed methodology (validation through tests in laboratory conditions and measurements in underground mining excavations of selected air pollutants emitted from the flue gases of mining machines) will allow to estimate measurement uncertainty taking into account the specific ventilation and climatic conditions in underground mining excavations and their impact on the uncertainty of measurements,
- obtaining data that can be used for ongoing control and monitoring of the amount of pollutants from exhaust systems in the adopted time unit,
- the information obtained can also be used to assess the actions taken to reduce the concentration of certain gases (e.g. nitrogen oxides, hydrocarbons or elemental carbon EC) in the mine air, and thus at workplaces. This is extremely important due to the safety and comfort of work of people staying and working in these conditions.