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ROZPRAWA DOKTORSKA

Doskonalenie doboru najlepszych dostępnych technik
(Best Available Techniques – BAT)
w zakładach koksowniczych

mgr inż. Jolanta Telenga-Kopczyńska

Praca doktorska napisana pod kierunkiem naukowym
dr hab. Izabeli Jonek-Kowalskiej, prof. PŚ
oraz promotora pomocniczego
dr. inż. Aleksandra Sobolewskiego

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Doctoral dissertation synopsis

Author: Jolanta Telenga-Kopczyńska, MEng,

titled, *Improving the selection of Best Available Techniques (BAT) in coking plants*

Dissertation Advisor: Dr hab. Izabela Jonek-Kowalska, Professor of Silesian University of Technology

Auxiliary Advisor: Dr inż. Aleksander Sobolewski; Institute for Chemical Processing of Coal, Zabrze

Given the contemporary legal and environmental conditions and theoretical and practical difficulties encountered in selecting BAT while considering a coking plant as a whole, the dissertation seeks an answer to the following research problem: *How to identify, select and choose BAT given the multi-carbon nature of coke production and multi-criteria decision-making in this regard (environmental, economic, and technical criteria)?*

The main objective of the dissertation is to develop a procedure algorithm for the selection of the best available techniques to reduce emissions from the coking plant when multiple emission sources are present, considering technical, environmental, and economic criteria. An algorithm is a universal tool supporting production managers in planning investments reducing the impact of the coking plant on the environment in the most economically beneficial way with simultaneous use of BAT techniques. The main goal defined thereunder was subordinated to subgoals implemented systematically in three following chapters of the work. These objectives include:

1. properties of the coke production process;
2. definition of the role of Polish coke producers in the national and international economy;
3. identification of the impact of the coke production process on the natural environment;
4. analysis of the influence of EU environmental regulations on the course of coke production and operation of coking plants;
5. designing the course of particular stages in the algorithm of BAT selection in coking plants;
6. application of the developed algorithm of BAT selection in the real conditions of the given coking plant.

Objectives 1-4 are achieved in Chapter 1 of the dissertation based on the analysis of production processes, literature studies, analysis of environmental legal acts, and economic conditions in the production of coke in Poland and worldwide. The steps to achieve the fifth objective, which is the essence of the dissertation, are presented in Chapter 2. This chapter is methodical. In its first part, based on an in-depth literature study and analysis of existing technical solutions used in coke production, the choice of the dissertation topic is justified, and the existing research gap is identified. Subsequently, the principles of multi-criteria analysis and the scenario method are adapted to solve the research problem posed and to achieve the main objective of the dissertation. The last part of this chapter presents the author's universal algorithm for selecting the best available techniques in coke plants. The use of this algorithm as a tool to support investment decision-making in coke production is described in Chapter 3. It opens with a description of the assumptions made and the coking plant under study. Subsequent BAT selection scenarios are then presented along with specific emission reduction techniques, the financial effort required to implement them, and holistic environmental effects covering the entire coke

production process. Next, the scenarios are evaluated in an aggregated manner, taking into account technical, environmental, and economic criteria, to determine their overall ranking and to finally select the most favorable variant in terms of all the analyzed requirements.

Given the existing theoretical and practical solutions when selecting BAT, the algorithm proposed herein facilitates the following:

- considering multiple emission sources while selecting techniques associated with coke production;
- reducing the difficulties associated with the simultaneous presence of multiple emitters;
- providing the decision-maker with a universal tool for the identification, selection and final choice of BAT, while considering all stages of coke production and the development strategy of the coking company;
- reducing the risk associated with the selection of an inappropriate emission reduction technique, with the use of a holistic environmental analysis of coke production and simultaneous consideration of technological and economic criteria;
- improving coking plant production processes in terms of increasing environmental requirements in the European Union, which is particularly important for the Polish economy, in which coking is an industry of strategic importance;
- reducing the harmful influence of the coking plant on its environmental and social surroundings.

The practical aspect of using the described algorithm is not limited solely to the process of supporting investment decisions on coke production. It can also be used as:

- a tool to support environmental cost-benefit analyses necessary in the process of applying for the temporary derogation from compliance with the requirements of BAT conclusions in the coking industry;
- a set of preparation guidelines for a computer program to automate the process of selecting techniques to reduce emissions from industrial installations in the coking industry;
- an instrument supporting the process of obtaining funds to implement projects in the coking industry (using synthetic and understandable assessment of the effects of the implementation of a given and alternative project);
- a universal way to approach the process of selecting BAT in other industries (given industry-specific emission and technological criteria).