15. RESULTS FROM BUSINESS FINLAND TUTLI-PROJECT: CREATION OF AEROFF SOLUTION

Hanna Pihlajarinne, yliopettaja, International Business and Innovation Management, TAMK

Pirkko Pihlajamaa, lehtori, Talotekniikan koulutus, TAMK

Lasse Hillman, lehtori, Konetekniikan koulutus, TAMK

Jussi-Pekka Juvela,lehtori, Talotekniikan koulutus, TAMK

Abstract

IN THIS PAPER, we introduce an innovative solution for improving indoor air quality by purifying the recycled exhaust air from machine tools thoroughly. We developed the innovation further and prepared it to be commercialised as AerOff solution in our project funded by Business Finland (the Finnish Funding Agency for Innovation, nowadays called Business Finland). In the project, we have had multidiscipline co-creation team with companies, customers, research institution, students and teachers from Tampere University of Applied Sciences.

1. Problem that was solved

During machining metal working fluid forms aerosol, that contains both particles and gaseous compounds. Exposure to these gaseous compounds is found to be one cause for respiratory symptoms to workers (Säämänen et al. 2016). Our empirical findings are that although the concentrations of individual contaminants are under recommended levels, employees still suffer from health problems. Machining centers are usually equipped with different kinds of air filtering units in order to reduce exposure to airborne contaminants.

Commonly used high efficiency particulate filters (HEPA filters) that are used for air filtration retain particulate contaminants but the contaminants found in the vapor phase, such as alkanolamines and volatile organic compounds, pass the filters and decrease the air quality in the workshops (Säämänen et al. 2018).

2. Solution solving the problem

The background for AerOff solution was the research idea made in past project (Säämänen et al. 2016) where the performance of the exhaust air treatment methods commonly used in machining centers were examined. This new project was funded by the Finnish Funding Agency for Innovation, Business Finland. Under ”New business from research ideas” funding program the innovation was prepared for commercialisation by further development of the technical solution and the productization aspects, analysed the possible business models and business aspects for the future product.

We ended up with multi-stage solution that is developed to AerOff -solution. The idea of the solution is described in Figure 1. AerOff solution consists of pre-filtering units (part 1) and integrated air handling unit (part 2). Pre-filtering unit is located close or even inside of the machine. It returns most of the captured metal working fluid back to the machine to be re-used. After pre-filtering, the air is lead to the integrated air handling unit, where the air is cooled and after heated, and various small particles and gaseous compound are caught into the condense liquid. The last component in the integrated air handling unit is a chemical filter. Cost effective sensors for remote monitor system were developed. The solution can be tailored to cover one or several machines, depending on the factory needs.

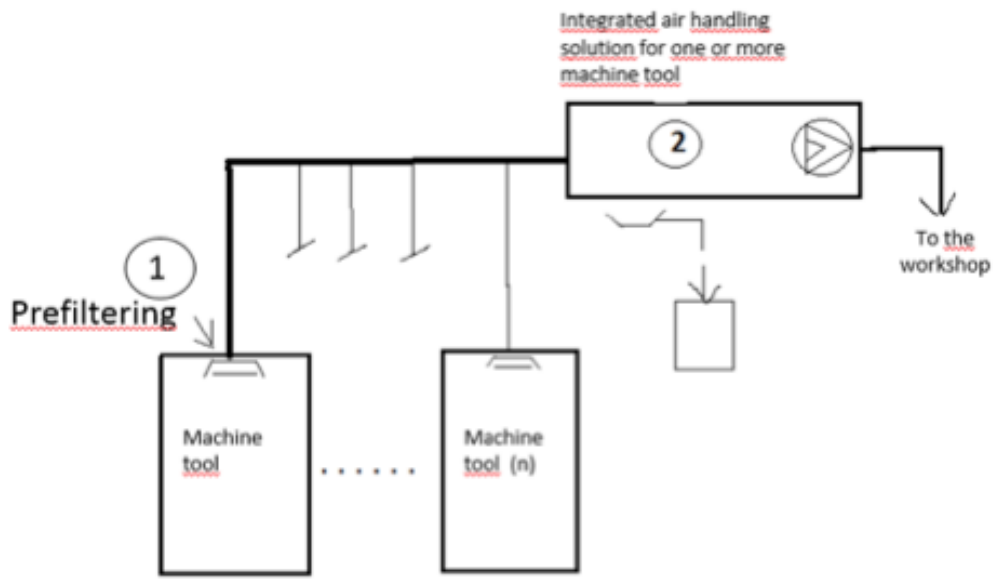

Figure 1. Structure of the new solution, AerOff-solution

In our project, the solution was developed simultaneously in three different locations with a strong co-operation and co-creation with the companies working in the field. With a Finnish partner company we produced and developed the first prototypes of the product. Three complete AerOff- product pilots with pre-filter units in machines were built, tested and measured into a real machine workshop environment of a future customer representative. There, we had test environments for both multi machine system and single machine solution. During the building and testing of these pilots, there was a strong co-creation together with all the organisations to adjust the prototype and its functionality.

The fate of airborne contaminants in the different stages of AerOff air handling unit was studied in the real factory environment (Figure 2). The Finnish Occupational Health Institute carried out the performance measurements for these prototypes. Total concentrations of both alkanolamines (EOHNH) and volatile organic compounds (TVOC) as well as particulate mass concentration were u sed as performance indicators of air purification systems. The EOHNH and TVOC concentrations were analyzed using methods

described by Säämänen et al. (2018). We clearly see that the amount of contaminants before the last chemical filter is reduced in this case by 40–60 %.

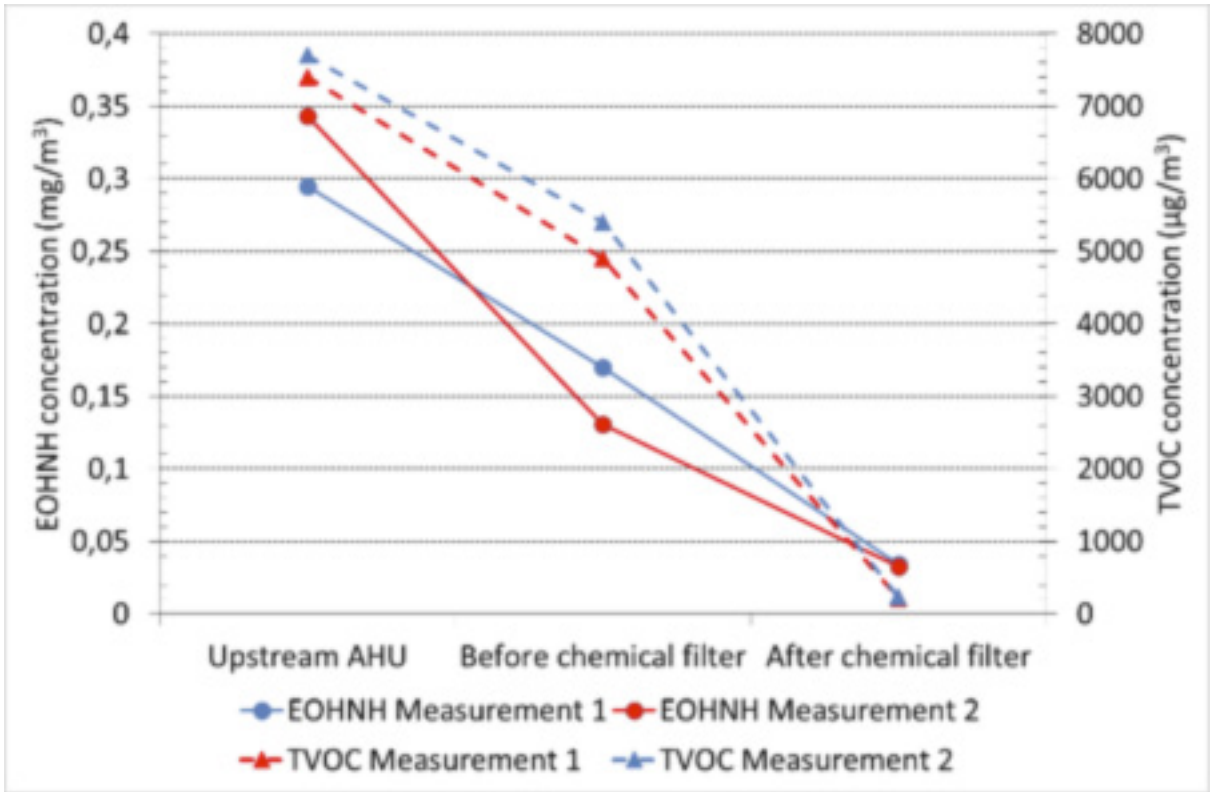

Figure 2. Measured (single machine tool, February 2018) concentrations of alkanolamines and volatile organic compounds in different parts of the AerOff air handling unit.

Understanding the benefits of the innovation from the customer perspective is seen one of the major challenges when commercializing an innovation (e.g. Aarikka-Stenroos and Lehtimäki 2014). We decided to take this challenge as the starting point of our commercialization preparations and started the project by creating marketing material for the future customers. The students from TAMK Media & Arts Degree Program prepared visual design, logo, brochures and short animation video about the solution, concentrating for the customer perspective. Intellectual property rights for the solution were protected by trademark and international EPO patent (The European publication number 3419770).

Configuring the business model is seen as a crucial factor for the success of the future business. The tool that is widely used and discovered to be the most comprehensive one (e.g. by Werani et al 2016) is the "Business Model Canvas" by Osterwalder and Pigneur (2010). This tool was also selected to be used in our project. First, we build business model canvas for each of the six identified business models. The business models were judged on the basis of the value proposition: is the business model fully supporting the AerOff value proposition. With this viewpoint, the business models were prioritized and the work was continued further with them. We identified potential partners to support the business model and had some preliminary discussions with them. In the end of the project, we have a prioritized list of different business model options and risk analysis for the best options. Also, the attributes of the future supply chain models for AerOff solution were studied in two bachelor theses in Degree Program of International Business.

Starting the commercial preparations simultaneously with the product development was beneficial yet challenging. It was clearly seen, that the complexity of new product development project requires strong co-creation with multidisciplinary skills and competences. Also, the strong co-operation with researchers and companies was seen critical to be able to combine the practical and theoretical implications into the final product that will truly fulfill customer needs and expectations. The pilots in real machinery environment with active customer provided useful observations that could have been missed if not seeing the prototypes in the real environment.

Our project is closed in the end of 2018. Story of AerOff solution continues further in the beginning of 2019, when a new spin-off company will start selling and further developing the solution.

REFERENCES

Aarikkala-Stenroos, L. & Lehtimäki, T. (2014) Commercializing a radical innovation: Probing the way to the market. Industrial Marketing Management Volume 43, Issue 8, 1372–1384.

Pries, F. & Guild, P. (2011) Commercializing inventions resulting from university research: Analyzing the impact of technology characteristics on subsequent business models. Technovation Apr. Vol. 31(4), p. 151.

Säämänen, A. et al. (2016) Metallityöstön kohdepoistoilman hallinta. (in Finnish) TSR Loppuraportti NRO 113256.Työterveyslaitos 2016.

Säämänen, A. et al. (2018) Control of exposure to both particulate and SEMIvolatile components of metalworking fluid aerosols. Roomvent & Ventilation 2018.

Werani, T. et al. (2016) How should successful business models be configured? Results from an empirical study in business-to-business markets and implications for the change of business models. J Bus Econ 86:579-60.