Service life of respirator cartridges with organic vapors: two approaches for a better understanding

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INRS (French National Research and Safety Institute) is conducting a three year study to improve the technical and scientific knowledge concerning service life of organic vapors cartridges. In order to improve health and safety at the workplace, it is very important to determine the effective duration of protection of cartridges. This presentation will summarize the two approaches investigated: predictive model based on Wheeler-Jonas equation and ESLI (End of Service Life Indicator) based on chemical sensor.

For the Wheeler-Jonas approach, we chose to work on extrapolation by modeling of the results obtained with a normative test gas (cyclohexane) to real pollutants in order to develop a predictive computer-based tool. This presentation will summarize the results for six commercially available European cartridges. Cyclohexane data were obtained for at least four inlet concentrations and give access to carbon parameters such as micropore volume (W_0) and structural constant B. These two experimental parameters are then used to calculate a predictive breakthrough time for other pollutants. Experimental results for these pollutants are compared with calculated results and are in good agreement. The results of this study were used to develop a predictive computer-based tool called PREMEDIA. An overview of the future online tool is proposed.

Concerning the second approach, with ESLI concept, experiments were conducted on semiconductor sensors (SnO_2). These sensors were chosen due to their high sensitivity to many organic vapors at very low concentrations. Various experimental parameters were tested such as relative humidity, temperature or type and concentration of pollutants. This presentation will describe the results of the experiments and explain the concept of an on-board active saturation sensor for the cartridge. Following this study, an operational on-board saturation sensor demonstrator is under development. The demonstrator is powered by a Li-ion battery and three LED (green, orange and red) inform the worker about the protection offered by the cartridges.

These two approaches are complementary to each other.