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**1<sup>st</sup> International  
Quality Conference  
On Quality of Life**

09.06.-10.06.2016. Center for Quality, Faculty of Engineering, University of Kragujevac



**Theoretical Approaches**

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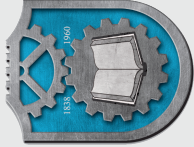
**Impact of development  
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and Happiness**

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**09.06.-10.06.2016., Kragujevac, Serbia**

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# **1. International Conference on Quality of Life**



## **CONFERENCE MANUAL**

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***June 09<sup>th</sup>-10<sup>th</sup> - 2016, Kragujevac  
Faculty of Engineering, University of Kragujevac***

# 1. International Conference on Quality of Life

## Conference manual

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*Dear friends,*

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*This Conference has a motto "From quality to happiness".*

*We invite you to participate in this important event.*

*Sincerely yours,  
President of Organization Committee*

*Prof. dr Slawko Arsouski*

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## AIRBORNE WEAR PARTICLES FROM AUTOMOTIVE BRAKE SYSTEMS: ENVIRONMENTAL AND HEALTH ISSUES

**Abstract:** Road traffic emissions are a major contributor to ambient particulate matter concentrations and therefore, these emissions are targeted through increasingly stringent European emission standards. These legal restrictions succeed in reducing exhaust emissions, but do not address “nonexhaust” emissions from brake wear, tire wear, clutch wear, road surface wear, and corrosion of other vehicle components in air of road dust. Several studies were done to understand the synthesis, composition and distribution of brake dust because of the growing awareness of environmental and health effects, for example, with antimony and copper in the brake pads. This is mainly because of the complex and susceptible characteristics of a brake system and the limitations of many measurement systems. With every change in temperature, braking speed, braking pressure, pad formulation, brake type and history of the friction partner, differences of the properties of brake dust particles will be recognizable. The aim of the present literature review study is to present the state-of-the-art of the different aspects regarding particulate emissions resulting from non-exhaust sources and particularly from brake wear.

**Keywords:** Brake System, Wear Particles, Legal Requirements, Health

### 1. INTRODUCTION

Road traffic-related sources have been recognized as a significant contributor of particulate matter especially within major cities. Over the last decades, the automotive industry has made huge efforts to reduce vehicle emissions which resulted in a reduction of emission level in inner city areas. In Europe, limitations for particle emissions from diesel engines have dropped by 97% during the last two decades. In addition, friction materials have undergone many changes and components with an associated health hazard potential have been gradually replaced. Currently, several attempts were made to understand the synthesis, composition and distribution of brake dust because of the growing awareness of environmental and health effects, for example with antimony and copper in the brake pads.

However, with regards to a continuously further concentration of traffic in urban city areas, further measures and legal restrictions are

to be expected. Vehicle homologation registration could in the near future go beyond just emissions from engines to address total vehicle emissions. This would make the contribution from tires, clutch, and road surfaces together with brake friction pads and discs a part of the overall balance [1].

In Europe and US ambient air quality standards have been developed or are under discussion as concerns novel issues. The Environmental Agencies and WHO are reporting exceeded limits of air pollutants and their increasing effects on human health and environment. In Europe, the effects of poor air quality have been felt the most in urban areas, where the majority of the European population lives, leading to adverse effects on public health and on ecosystems, where the pressures of air pollution impairs vegetation growth and harms biodiversity. Human health is the most vulnerable sector and many reports are showing a negative impact of air pollution on respiratory or cardiovascular morbidity, cancer, increased















