Warsaw, November 25th, 2013

Artur Jerzy BADYDA
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SELF-PRESENTATION

1. Basic information:
    a. Artur Jerzy BADYDA, born in Warsaw (Poland) on March 21st, 1978.
    b. Education:
        i. Master of Science in environmental protection systems, Warsaw University of Technology, Faculty of Environmental Engineering, Warsaw 2002.
            1. Title of the master thesis: "The use of geostatistical methods to reduce the set of data points";
            2. Supervisor: Jarosław ZAWADZKI, PhD, Eng.;
            3. Graduated with the highest possible grade.
        ii. Doctor of technical sciences (PhD) in the field of environmental engineering, Warsaw University of technology, Faculty of Environmental Engineering, Warsaw 2007.
            1. PhD thesis title: "Analysis and assessment of the effects of selected traffic disturbances on the urban environment of Warsaw";
            2. Supervisor: Prof. Andrzej KRASZEWSKI PhD, DSc, Eng.;
            3. Reviewers:
                a. Prof. Jerzy Zwoździak PhD, DSc, Eng.;
                b. Katarzyna Juda-Rezler PhD, DSc, Eng.;
                c. Col. Prof. Tadeusz Płusa MD, DSc – additional reviewer in the field of medicine;
            4. Dissertation awarded under the resolution of the Scientific Council of the WUTs' Faculty of Environmental Engineering on March 20th, 2007.
    c. Additional education:
        i. Postgraduate, 2-semester studies in the field of "Management and marketing", Kozminski University, Warsaw 2008.

2. Information on employment:
    a. In scientific institutions:

Place of employment	Period of employment	Position
Warsaw University of Technology, Faculty of Environmental Engineering	10.2007 – now	Assistant professor

Warsaw University of Technology, Faculty of Environmental Engineering	10.2006 – 09.2007	Assistant

b. In other institutions:

Place of employment	Period of employment	Position
Innovation Accelerator of the Polish Federation of Engineering Associations NOT (Akcelerator Innowacji NOT Sp. z o.o.)	02.2011 – now	Technology broker
Ministry of Environment	02.2010 – 04.2010	Advisor to the Minister
Warsaw University of Technology, Technology Transfer Centre	07.2007 – 06.2009	Administrative officer

3. Indication of the achievements under paragraph 16.2. of the Polish Act on Academic Degrees and Titles and Degrees and Titles in the Arts (Legal Journal 2003, No. 65, item 595 as amended):
    a. Title of the achievement: "The influence of traffic-related air pollutants on the ventilation parameters efficiency of the inhabitants of Warsaw";
    b. Edition: Prace naukowe Politechniki Warszawskiej, Inżynieria środowiska, z. 65 (Scientific papers of the Warsaw University of Technology, Environmental Engineering, issue 65);
    c. Year of publication: 2013;
    d. Publisher: Oficyna Wydawnicza Politechniki Warszawskiej (Publishing House of the Warsaw University of Technology).

4. Characteristic of the scientific and research achievements:

In 2002 I graduated from the Faculty of Environmental Engineering of the Warsaw University of Technology (course: Environmental Engineering). I made my master thesis under the supervision of Dr. Jarosław Zawadzki (currently professor). Even before graduation I had decided to continue my research activities with the intention to undertake PhD studies at the same Faculty. I started the studies in October 2002 under the supervision of Professor Andrzej Kraszewski.

My scientific interests, developed during the studies, were focused on the evaluation of various effects being the consequences of human activity and thus also of a particular state of the environment. The methods used to determine that state were also the subject of my attention. Therefore in my doctoral thesis I decided to deal with the aspects related to the impact of air pollutants on the environment, and more specifically, with the exposure of the human organism to the effects of pollution derived from transport and health outcomes of that influence. The key research material was gathered through the doctoral research project entitled: "A method of

assessing the effects of reducing road traffic nuisance in terms of urban environment of Warsaw" completed in the years 2005-2006 under the direction of Professor Andrzej Kraszewski.

Although the important part of the dissertation was dedicated to the health effects, they were not the only issue connected with the analysed adverse effects of traffic. The research part of the thesis consisted in fact of three key elements, among which, besides an assessment of the health effects of living in the vicinity of a busy road, I analysed other social consequences and tried to evaluate the level of interference of road network congestion with the quality of life. In addition I carried out a preliminary assessment of the economical effects associated with both economic losses generated by the loss of time in traffic congestions as well as losses caused by health damages. The key results of the research include the demonstration of the statistically significant differences in the pulmonary function parameters values in the group of investigated inhabitants of the Niepodległości Avenue in Warsaw in relation to the control group. Using logistic regression I have also shown that the residents of this important traffic artery have nearly three times higher risk of bronchial obstruction (narrowing of the bronchi) in comparison to the residents of non-urbanized areas, while in the group of non-smokers the risk appeared to be over four times higher as compared to non-smoking representatives of the control group. Other important results encompass the confirmation of a significant impact of traffic congestion on the efficiency of emergency services reactions (medical and fire brigades), which was completed by an extensive survey made among drivers of the Metropolitan Sanitary Transportation Column and State Fire Service. As one of the major negative effects of the traffic problems they considered the extended arrival time to the intervention site, especially during rush hours, which in case of health hazard can result in a significant decrease of the effectiveness of interventions undertaken. An attempt to estimate the economical losses included an estimation of economic losses caused by the loss of time and potential health detriment. Estimates based on the average remuneration in the national economy (in Warsaw) and declared daily time losses indicated at that time that the monthly loss of time may reach 1.3 million hours, which potentially generates costs of at least 27 million PLN (now it is known that these losses can be of a larger magnitude). On the other hand, basing on the annual average costs of medical treatment of people suffering from chronic obstructive pulmonary disease (taking into account that 5% of the of Warsaw population suffer from this disease and all patients were diagnosed and received treatment), it was estimated that the annual cost of medical care of such patients may reach 240 million PLN.

Among the results of my research, before the doctoral degree, were also scientific publications and attendance in national and international scientific conferences at which I presented on-going results of my study. In total, during my PhD studies, I co-authored five scientific publications, including one in a journal from the so-called Master Journal List (in Poland known as Philadelphia List), one congress message published in the *European Respiratory Journal* (also on the ISI list) as well as eight conference papers, including four presented at international conferences. In 2004 I also wrote a chapter on the relation between traffic variability and air pollutants concentrations, which was released in a report on the State of the Environment in the Mazowieckie Voivodeship, published annually by the Regional Inspectorate for Environmental Protection.

I completed my PhD studies in December 2006 with a thesis entitled "Analysis and assessment of the effects of selected traffic disturbances on the urban environment of Warsaw". On March 13th 2007, I defended my thesis and on March 20th 2007 I was granted the scientific degree of doctor. Even before the completion of my PhD study, I started working as an assistant in the Department of

Mathematical Methods Applications where I still work (currently it is called the Department of Informatics and Environment Quality Research).

The results collected during the preparation of my doctoral thesis appeared to be so interesting, and still so weakly explored, that further scientific work in this area has become a great passion for me. My cooperation with the medical team from Military Institute of Medicine, and in particular with Gen. Prof. Wojciech Lubiński M.D., that started at that time, became a basis of my future research activities in the field of the analysis of environmental determinants of health (environmental epidemiology). One of the effects of this collaboration was an implementation of two major research projects, the results of which make key material of my recently completed habilitation monograph. The effects of this cooperation, as well as collaboration with two other national research institutions (the Department of Information Systems of the Gdynia Maritime University and the Department of Meteorology and Climatology of the Warsaw University of Life Sciences), encompass scientific publications, including 7 papers published in journals indexed in the Journal Citation Report as well as 19 other scientific articles. So far only once I had the opportunity to be a reviewer in a reputable scientific journal. I reviewed an article of German scientists, which was published in *Environmental Pollution* (IF=4.094). I also reviewed several publications intended for a local monograph. On the other hand, quite often I deal with the procedure of acceptance of scientific articles, being the editor-in-chief of the scientific journal *Challenges of modern technology*.

Issues that are subject of my research interest were also frequently presented by me and people cooperating with me at national and international scientific conferences, both related to environmental protection and engineering (air quality protection, transportation) as well as medicine (respiratory diseases, epidemiology). In total, since 2007, I have been an author and co-author of 69 conference presentations, 35 of which were presented at international conferences. Out of them, 26 were published in conference proceedings or in journals as conference messages.

I would also like to add that the results of all of my hitherto research met with a lively interest not only of the scientific environment (a list of my own and co-authored publications is attached in the separate annex) but also of the wider society, in particular the mass-media. Thus, it is clear that the matter undertaken constitutes an important social problem. Results of my scientific work were covered by national press (e.g. Gazeta Wyborcza, Dziennik Gazeta Prawna), radio stations (Program Pierwszy PR, RDC, Radio Pin, Radio Eska, Antyradio) as well as local TV stations (TVP Info, TVN Warszawa). This has also resulted in an increasing attention of the public administration (both state and local governments) and non-governmental organisations. Therefore, in a cooperation with the Authorities of the City of Warsaw (but also with a number of scientific institutions and commercial companies), we plan to apply for a project, that will allow not only more accurate understanding of the causes and mechanisms of air pollutants on human health, but will also help to design such a policy of environmental protection management in urban areas that will include the limitation of the anthropogenic pressure on the air quality from the most important sources of emission and thus reduction of the scale of urban population exposure to the health effects of polluted air.

I participated, so far, in six research projects (in two cases I was the project manager), the object of which was to analyse the environmental and health effects of air pollution. Currently I participate in another project, which main objective is the thorough diagnosis, in selected Polish cities, of the composition of particulate matter, which are presently the most serious problem of air quality in Europe and cause of 350,000 premature deaths per year (according to the European Environment

Agency). Considering, however, the fact that the thematic area of environmental determinants of health, or in other words environmental epidemiology, is much less common in Poland than in many Western European countries, not to mention U.S., for several years I have also tried to develop cooperation with a couple of leading foreign research institutions. An important factor was my involvement (through Prof. Katarzyna Juda-Rezler) in an international project entitled *„TAPAS – Transportation, air pollution and physical activities, an integrated health risk assessment programme of climate change and urban policies"*, carried out in six European cities, including Warsaw. The project led to a broader collaboration with the coordinating institution – *Centre de Recerca en Epidemiologia Ambiental* (CREAL) in Barcelona. From July to September 2013, during my internship in CREAL, under the supervision of Dr. James Grellier and Prof. Jordi Sunyer, I explored the issue of assessing health risks of exposure to polluted air. Together with a team of researchers from CREAL, I started a project entitled *„Screening assessment of the burden of disease due to air pollution in eleven Polish urban agglomerations"*, which I hope will result not only in interesting scientific publications, but also in developing the undertaken issues in the planned joint research grants.

Some other cooperation was established mainly during my participation in important international conferences, which therefore I think are highly valuable for scientific development. Together with the team of Dr. Ario Alberto Ruprecht from the Milan's *Laboratorio per la Ricerca Ambientale* (LARS), we plan to take joint action on exploring the efficiency of so-called Low Emission Zones (LEZ), which Dr. Ruprecht's team started recently to investigate in Milan. Last year I established cooperation with two Belgian research centres: *VITO – Flemish Institute for Technological Research* (Dr. Martine Van Poppel) and *Department of Bioscience Engineering* from the University of Antwerp (Prof. Roeland Samson). Both of these centres deal with investigation on personal exposure to air pollutants, which is also a subject of my interest and which was investigated by me in a pilot study made in Poland. As very valuable I treat the cooperation with the Polish Federation of Asthma, Allergy and COPD Patients' Organizations, where I am currently an expert on environmental determinants of health. The results of my research have become one of the elements that contributed to the start of cooperation and the common organization of two Polish (in 2011 and 2013) and one World (2012) edition of the so-called Spirometry Days. Besides the key objective of the organization of the Spirometry Days, which was to increase the social awareness of the causes, consequences as well as the course of respiratory diseases, aspects related to the impact of air pollutants on respiratory system were also taken into account. Results of our joint research have already attracted the interest of European and global counterparts of the Polish Federation (*European Federation of Allergy and Airways Diseases Patients Associations* (EFA) as well as *Global Allergy and Asthma Patient Platform* (GAAPP)), with whom I currently prepare plans for further cooperation in the field of studying the mechanisms of exposure and health outcomes of air pollution.

I would like to emphasize that in addition to strictly scientific activity, very close to me are the activities for the development and promotion of science, including the promotion of young scientists. This activity is reflected, among others, in organization of the annual international conference *Young scientists towards challenges of modern technology*, the participants of which are mainly PhD students and young investigators leading their researches in various disciplines of technical sciences. Moreover, I am extending my assistance on students involved in the Scientific Society of Environmental Protection, and as the President of *The Central Youth Commission* in *Polish Federation of Engineering Associations – NOT* I also try to attract school children to continue their education in technical schools and universities, since the Polish economy needs new generations of engineers. As

a part of my activities carried out at my Faculty, since 2010 I have been the general manager of the Laboratory of Environment Quality Research, which specializes in measuring the intensity of electromagnetic fields (in particular associated with the work of mobile phone base stations or electricity lines) and the issuance of the opinions on safety and hygiene at work as well as on the protection of people and the environment from electromagnetic fields.

In the final part of the characteristic of my achievements, I would like to once again emphasize the importance of the practical application of the research results, which in contemporary world is a very important aspect of the scientific work. For this reason I try to share the results of my research also with public administration, due to the social importance of the issues that are subject of my research activities. I closely cooperate in this area with the Authorities of the City of Warsaw, and more specifically with the Roads and Public Transportation Department as well as the Infrastructure Department. They are really interested in the fact that in the process of changes of the transportation system of the city, which is currently undergoing a phase of a long-term development, particular attention should be paid to air pollutant emission limitation. The results of my PhD thesis as well as effects of further scientific work, including these published in the habilitation monograph, are therefore a subject of the discussion between persons responsible in the city office for the problems of transport or environment.

A kind of a complement activity in the practical research is my involvement in improving the efficiency of the commercialization process of the results of researches carried out at Polish universities and research institutes. Due to the importance of issues related to the application of research results in practice, I try to combine my academic work with the business on commercialization of the scientific results. One of the manifestations of this activity is my over two years work as the technology broker in the Innovation Accelerator of the Polish Federation of Engineering Associations NOT as well as an expert position at the Innovation Centre of the Polish Federation of Engineering Associations. My involvement in the dissemination of the research results, started however earlier, when I was employed in the Technology Transfer Centre of the Warsaw University of Technology.

Recent years of my activities are also connected with my specialization in public consultations in the planning processes of large infrastructure projects as well as a couple of analyses made for the public administration, with the application of a multi-criteria analysis method, developed in Poland by Prof. Andrzej Kraszewski. In both of these thematic areas I conducted numerous courses for the representatives of central and local administration, as well as entrepreneurs implementing infrastructure projects in Poland (transportation, municipal, industrial). I also participated in efforts to manage the environmental conflicts, in particular: in the so-called "Round Table on the Augustów Ring Road", in the process of the location of the Eastern Ring Road of Warsaw or in the process of the development and modernisation of the "Czajka" wastewater treatment plant in Warsaw. Worth mentioning is an episode in 2010 when I was an advisor to the Minister of Environment of the Republic of Poland. Afterwards, I started longer cooperation with the National Commission for Environmental Impact Assessment (of which I am a member) and with the working group "*Environment Protection and Energy*", functioning in the Ministry of Environment and focusing mostly on the aspects of air protection.

My ambition is to build in the Faculty where I work, a research team which will deal with the environmental determinants of health and explore the consequences of the exposure to

anthropogenic pollution of the environment, and in particular the health outcomes of this pollution. My research work, including participation in several research projects, seems to be an expression of the involvement in the development of this area of knowledge. Therefore I also supervise engineering and master theses carried out in this field (up till now I was the supervisor of 23 engineering and 15 master theses). I take care of three PhD students who do their scientific work in environmental epidemiology (in one case I am the auxiliary tutor of the PhD student). This activity is also expressed in the aforementioned care of the student's Scientific Society of Environmental Protection, which part of the activity is also focused on the influence of air pollution on human health (in that area they so far conducted two small projects). Next years of my scientific work I intend to spend on building a team of specialists in the field of environmental epidemiology.

5. Characteristic of the habilitation (postdoctoral) thesis:

The habilitation (postdoctoral) thesis, which is the basis of the procedure on granting the habilitation scientific degree, is an in-depth development of the issues that were the subject of my discussion during the progress of my PhD thesis. In the prepared monograph I focused strictly on the health effects of the exposure to air pollutants originating from traffic.

The dissertation presents risks arising from dynamic development of transport, and in particular from the emissions of air pollutants derived from road transport, characterized by negative implications for human health. Of particular importance I found this aspect in Polish conditions, where over previous several years (1995-2010) there was recorded the largest increase in the volume of freight and passenger road transport in all of 27 European Union member states. Due to the fact, that my research activity has been so far focused on the urban environment of Warsaw, this city has become the object of my scientific consideration on the impact of air pollutants on human health. Objectively speaking there are however other important reasons for conducting these studies in Warsaw. First of all, this city belongs to the group of European metropolises that are at the highest risk of traffic congestions and where the average travel time in peak periods of traffic (rush hours) is more than 90% longer in comparison to conditions of free movement of traffic. This, in turn, with reduced average speed of vehicles, is likely to increase the emissions of air pollutants, causing a decrease of air quality, and thus enhancing the exposure of residents to the effects of air pollution. Whereas the rate of car ownership in Warsaw is the largest in Polish cities and exceeds the average value of this rate for the cities of EU, and traffic in Warsaw is the most important source of air pollutants emission, I considered that Warsaw would be an appropriate object for the research on the health impact of traffic-related air pollutants.

The research part of the dissertation was associated with three main aspects:

a. Measurements of traffic parameters (traffic volume, traffic structure, average speed in each group of considered vehicle types) in cross-sections of selected roads in Warsaw and calculation of the emission of air pollutants resulting from specific traffic conditions and structure;
b. Measurements of air pollutants concentrations (carbon monoxide, nitrogen dioxide, particulate matter PM_{10}, total volatile organic compounds (VOC)) as well as noise intensity in the same cross-sections;
c. Assessment of health outcomes caused by the exposure including a comparison with the results of control group.

The last of abovementioned aspects is, in my opinion, an essential element of the thesis. It presents the results of several years of research on the potential impact of factors related to the place of residence on the presence of bronchial obstruction (narrowing of the bronchi), which is an important symptom demonstrating the possibility of developing an incurable, chronic obstructive pulmonary disease (COPD). In the dissertation I have primarily presented the results of respiratory function tests of people living in the immediate vicinity of 7 selected streets in Warsaw, characterized by a high traffic density. Using the tools of mathematical statistics (including selected statistical tests, generalized linear regression as well as logistic regression models), these results were referenced to the results of investigation carried out in the control group, which were inhabitants of two selected areas of the Eastern part of Poland, characterized by low concentrations of air pollutants. Due to the fact that it is considered (not unreasonably indeed) that a key factor in the development of respiratory diseases is cigarette smoking, the assessment of environmental causes that may condition the expansion of these diseases has been mainly carried out in the group of non-smokers, thus people who are not exposed on the most important factor which severely impairs proper breathing function.

Results presented in the monograph indicate that among inhabitants of the city in relation to the control group there is a more frequent occurrence of major symptoms of proper airflow through the respiratory tract disorder, in particular such as dyspnoea and cough with expectoration (characteristic for COPD) or wheezing (typical symptom of asthma). In the group of city residents it was also found, using an objective functional test, that the rates of predicted values of the most important spirometric parameters (FEV_1, FEV_1/FVC, FEF_{50}) are statistically significantly ($p<0,001$) lower in respect of non-urban inhabitants. Among people living in the proximity of busy roads in Warsaw there was noticed a 4.1-times higher relative risk of bronchial obstruction in relation to the residents of rural areas, where generally very low concentrations of air pollutants were recorded. A more detailed analysis of the results of Warsaw inhabitants, showed that the lowest values of spirometric parameters occur among people living in the vicinities of these streets, where traffic problems appear to be particularly strong, and thus which were characterized by the highest emissions of air pollutants. The proportion of people with bronchial obstruction varied among the city residents (depending on location) between 5.1% and 12.3%, which was considerably higher as compared with the control group, in which they oscillated between 2.0% and 2.6%.

Generalized linear regression models made on the basis of collected data, showed that the most important factors influencing the variability of key spirometric parameters include: the place and period of residence, floor of residence, the prevailing position of windows in the apartment/house in relation to the nearest busy road, but also the presence of other than road traffic sources of emission near the place of residence. It has also been found an important effect associated with a positive impact of physical activity of investigated people on respiratory system efficiency. These results were confirmed by the outcomes of the logistic regression model, indicating that among non-smokers the odds ratio of bronchial obstruction is more than 6 times higher in the group of people living close to busy streets in comparison with the control group.

The research presented in the dissertation confirm previous findings on the existence of a statistically significant relationship between the distributions of the intensity and speed of vehicles and concentrations of air pollutants (especially CO and NO_2) registered in the immediate proximity of

busy streets. They also point to the existence of a statistically significant association between the exposure of selected groups of residents of Warsaw on air pollution and the incidence of adverse health consequences, including in particular the reduction of spirometric parameters values and occurrence of bronchial obstruction. The results of completed studies will form a starting point for further exploration of the subject of air pollutants impact on human health, including the assessment of health consequences not only in the form of respiratory diseases but also cardiovascular disorders. Therefore, the final part of the dissertation, beyond the summary and conclusions, presents the draft of my research plans, which are intended to be a continuation of my scientific work.

Warsaw, November 25th, 2013 .....

Place, date Signature