

# **AKPF-Mitteilungen, Sonderausgabe Newsletter Special ISSUE, Health Effects Jan. 2003**

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Summary of news deemed to be of interest for AKPF-members  
Jan..20th., 2003

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## **AKPF-Summary of Recent Publications on Health-Effects of Engine Exhaust**

### **Gesundheitsaspekte von Dieselabgasen**

Diese Spezialausgabe ist Gesundheitsaspekten der Abgase gewidmet, es handelt sich im Wesentlichen um Abstracts, die für den medizinischen Laien schon allein wegen des Ranges der Quellen besorgniserregend sind. M.E. sollte man im Interesse der Allgemeinheit, wozu auch die eigenen Kinder zählen, diese Referenzen jedem Verantwortlichen im öffentlichen Gesundheitsdienst zukommen lassen, damit er sich selbst ein Bild mache und mögliche Schritte in seinem Kompetenzbereich ins Kalkül ziehe

Note: These are abstracts of publications of interest to medical professionals; they just happened to cross an engineer's desk, who felt concern due to the rank of the sources. According to my modest opinion, these references should be brought to the attention of everybody in charge of public health, such that this person may form his/her opinion on his/her own and consider steps to be taken within his/her terms of reference.

Yours sincerely, F. J. LEGERER

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### ***Is there a similarity to asbestos?***

- 1. Researchers from the Catholic University of Leuven, Belgium** claim they found a proof that solid particles can enter the bloodstream from the lungs. The researchers base their claim on a finding of increased blood radioactivity in volunteers who inhaled carbon particles of below 100 nm in diameter, labelled with radioactive technetium. It has been always believed that only gases can pass through the lungs into the blood circulation. If the new finding is confirmed, it could help explain the known but not understood link between particulate air pollution and cardiovascular disease.

<http://circ.ahajournals.org/cgi/content/abstract/105/4/411>

2. **"Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution"** -- a JAMA article summarising the findings of a new epidemiologic study by the Young University of Utah. Fine particulate and sulphur oxides related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality. Each 10 µg/m<sup>3</sup> elevation in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively. The prime source of particulate pollution in the U.S. is industrial and utility fuel combustion, such as coal-fired power plants, but diesel engines are also a significant contributor. <http://jama.ama-assn.org/issues/v287n9/abs/joc11435.html>

3. **6<sup>th</sup> International ETH-Conference on Nanoparticle Measurement**

**Session 2: Health Effects and Chemical Reactivity**

P. Gehr, M. Geiser, S. Schürch, B. Rothen, N. Kapp /

UNI BERNE, INSTITUTE of ANATOMY

Interaction of nanoparticles with internal lung surface - what we can learn from experimental work with fine particles There is increased concern about the associations between particulate air pollution and human health. Inhaled and deposited particles play a crucial role in the aetiology of a range of pulmonary diseases. With each breath millions of particles may enter the lung where they are deposited on the internal surface. A variety of pulmonary diseases develop from the inhalation and deposition of pathogenic organisms or noxious particles.

Nanoparticles, mostly formed by emissions from combustion processes, are small in mass but large in number and, hence have a greater total surface area. The toxic material carried by these particles may be likely to interact with cells in the lung. Therefore, it has been proposed that nanoparticles are especially toxic. The internal tissue surface of the lung is coated with an aqueous liquid layer and at the air-liquid interface there is a film of phospholipids, called surfactant. This lipid film is surface active, and any fine particles deposited on it will be wetted and displaced into the liquid layer. Subsequently these particles may be cleared or they may be phagocytized by cells. From preliminary studies we conclude that the interaction of nanoparticles with the surfactant film as well as with the cell membrane is different and governed by a mechanism called adhesive interaction.

Supported by the Swiss National Science Foundation, grant nr. 32-65352.01 and by the Silva

Casa Foundation.

Keywords: internal lung surface, surfactant, cells, fine particles, nanoparticles, particle displacement, adhesive interaction

abstract and full paper [www.nanoparticles.ethz.ch](http://www.nanoparticles.ethz.ch)

4. Health Effects Institute (HEI) publishes new issue of its quarterly newsletter, Summer 2002

<http://www.healtheffects.org/Pubs/UpdQsummer02.pdf>

<http://www.healtheffects.org/Pubs/UpdQfall02.pdf>

<http://www.healtheffects.org/Pubs/UpdQwinter02.pdf>

5. **Health Effects Institute publishes new reports related to diesel exhaust:**
  - Report 112, Health Effects of Acute Exposure to Air Pollution.  
Part I: Healthy and Asthmatic Subjects Exposed to Diesel Exhaust.  
Full report: <http://www.healtheffects.org/Pubs/Holgate.pdf>  
Synopsis: <http://www.healtheffects.org/Pubs/st112.htm>
  
6. Report 110, Particle characteristics responsible for effects on human lung epithelial cells.  
Full report: <http://www.healtheffects.org/Pubs/Aust.pdf>  
Synopsis: <http://www.healtheffects.org/Pubs/st110.htm>
  
7. **"Emissions from Diesel and Gasoline Engines Measured in Highway Tunnels" -- HEI Report #107 (January 2002)** summarises the results of two research projects: one measuring concentrations of particulates and gaseous emissions, the other measuring carbonyl compounds (aldehydes), both conducted in highway tunnels in the US. It was found that, as expected, diesel engines emitted particles at a greater rate per mile than did gasoline engines and that ultrafine particles (below 0.1  $\mu\text{m}$  in aero-dynamic diameter) dominated the number of particles from both sources. It is believed that because gasoline-powered vehicles predominate in the on-road vehicle fleet, their contribution to particle levels in ambient air may exceed that of diesel-powered vehicles. Unfortunately, the methods used in the study did not allow for precise quantification of this statement. The investigators also reported substantial decreases in diesel emissions of particles, hydrocarbons, carbon monoxide, and carbon dioxide (the latter an indication of improved fuel economy) between their current study and earlier studies. Levels of nitrogen oxides remained essentially unchanged. The authors suggest that newer diesel engines are being operated in a manner to improve fuel economy at the cost of emitting nitrogen oxides. Total carbonyl emission factors from diesel powered trucks were found to be about 4 times those from gasoline powered cars when both were calculated on a distance-travelled basis. On a fuel-consumed basis, total carbonyl emission factors for diesel trucks were slightly less than for cars. Formaldehyde, acetaldehyde and acetone were the three major carbonyls present. There were distinct differences between emissions of diesel trucks and cars for some carbonyls, with heavy vehicles emitting more unsaturated carbonyls, aromatic carbonyls, and dicarbonyls (as a percentage of total carbonyl emissions) in comparison to light-duty vehicles.  
**Statement:** <http://www.healtheffects.org/Pubs/st107.htm>  
**Full report:** (1.83 MB): <http://www.healtheffects.org/Pubs/GertGros.pdf>
  
8. A new report titled **"Impact Of Low-Emission Diesel Engines On Underground Mine Air Quality"** by Susan Bagley, Win Watts, et al. has been posted on the DEEP.org web site. This study was conducted at the Cote Blanche salt mine in the spring of 2000. The study found that total and elemental carbon concentrations were reduced by at least 60% with use of the modern, low

emission diesel engines. Organic carbon levels were also reduced but to a lesser extent. The total number particle concentration was reduced by 50%. Levels of polycyclic aromatic hydrocarbons and biological activity (mutagenicity) associated with diesel particulates also decreased by up to 90% with use of the modern engines. The study also demonstrated that near real-time instruments like the diffusion charger, photoelectric aerosol sensor and condensation particle counter can be used to track diesel activity on a real time basis in an underground mine.

Summary: [http://deep.org/reports/2002\\_watts\\_sum.html](http://deep.org/reports/2002_watts_sum.html)

Full Report: [http://deep.org/reports/2002\\_watts\\_report.pdf](http://deep.org/reports/2002_watts_report.pdf)

9. **HEI publishes Report #109 - Ozone-Induced** Modulation of Airway Hyper-responsiveness in Guinea Pigs, which examines the effects of longer term exposure to ozone on the development of hyperresponsiveness, one of the three characteristics normally found in those having asthma. The investigators found that animals without prior hyperresponsiveness did not develop effects after exposure, although prolonged exposure did exacerbate preexisting symptoms.

Synopsis: <http://www.healtheffects.org/Pubs/st109.htm>

Full Report: <http://www.healtheffects.org/Pubs/Schlesinger.pdf>

10. Two publications advocating (not really justifiably) switching to natural gas power as the best method of controlling diesel emissions from school buses:

-from Environment and Human Health, Inc.

[http://www.ehhi.org/pubs/children\\_diesel.html](http://www.ehhi.org/pubs/children_diesel.html)

- from Union of Concerned Scientists

<http://www.ucsus.org/publications/PollutionRptCard.pdf>

11. "**Airborne Toxic Control Measure to Reduce Diesel Particulate Matter Emissions from New Stationary Diesel-Fueled Engines**", California ARB.

A draft proposed regulation order requiring that (1) the PM and gaseous emissions from new stationary diesel engines meet performance standards that would apply if the engines were subject to the Off-Road Compression-Ignition Engine Regulations (for mobile engines), and (2) the NO<sub>2</sub> fraction be no more than 20% of total NO<sub>x</sub> emissions.

<http://www.arb.ca.gov/diesel/documents/040402draftATCM-new.pdf>

12. "**Mobile Source Emissions - Past, Present, and Future**" -- a new Web site by the US EPA provides basic, general information on air pollution from motor vehicles, engines and equipment.

<http://www.epa.gov/otaq/invtory/overview/index.htm>

**The following reprint from *Neue Zürcher Zeitung*, an international daily of high, reputation provides references to research in relative frequency of certain symptoms depending on distance of residence to high density traffic road.**

### 13. Copy from Neue Zurcher Zeitung with interesting references



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## Verbesserte Luftqualität senkt die Sterblichkeit

Luftschadstoffe führen nicht nur zu Asthma und Bronchitis, sie erhöhen auch das Risiko, an einer Herz-Kreislauf- oder Atemwegs-Erkrankung zu sterben. Ursächlich beteiligt an diesen zusätzlichen Todesfällen, so kommen zahlreiche epidemiologische Studien zum Schluss, sind vor allem feine Russpartikel, wie sie etwa bei der Verbrennung von Dieselöl und Kohle entstehen. Während die meisten dieser Arbeiten den Zusammenhang zwischen kurzzeitigen, extrem hohen Schadstoffbelastungen (beispielsweise bei Smog-Episoden) und den täglichen Schwankungen der Sterberaten dokumentieren, berichten nur wenige über Langzeiteffekte. Zwei kürzlich veröffentlichte Studien zeigen nun erstmals für den europäischen Raum, dass vermutlich auch länger andauernde, mässig erhöhte Konzentrationen derartiger Luftpartikel die Mortalität für Herz- und Lungenkrankheiten erheblich beeinflussen.

Die eine Studie untersuchte die Auswirkungen eines Kohleverbotes in Dublin, welches die irische Regierung im Jahr 1990 wegen der schlechten Luftqualität in der Stadt verhängte. Unmittelbar nach Inkrafttreten dieser Verordnung sank der Gehalt an «schwarzem Rauch» (black smoke), einem vornehmlich aus Russ bestehenden Feinstaubgemisch, um durchschnittlich 70 Prozent, die Schwefeldioxid-Konzentration ging um ein Drittel zurück. In der Folge verringerte sich die Zahl aller Todesfälle - mit Ausnahme der gewaltbedingten - dauerhaft um 6 Prozent. An Atemwegserkrankungen starben in den Jahren nach dem Kohleverbot sogar 15 Prozent, an Herz-Kreislauf-Leiden 10 Prozent weniger Dubliner als vorher. Am deutlichsten ging die Mortalität während der Hauptheizperiode in den Wintermonaten zurück.<sup>1</sup>

Dass Luftschadstoffe die Sterberaten erhöhen, hätten auch andere Studien schon gezeigt, erläutert Annette Peters, Epidemiologin am GSF-Forschungszentrum für Umwelt und Gesundheit in Neuherberg bei München. Hier aber sei erstmals deutlich geworden, dass eine langfristige Verbesserung der Luftqualität die Sterblichkeit tatsächlich vermindere.

Im Rahmen der zweiten Studie analysierten niederländische Forscher Langzeiteffekte, die von verkehrsbedingten Luftschadstoffen ausgehen. Zu diesem Zweck beobachteten sie 5000 Personen im Alter von 55 bis 69 Jahren während 8 Jahren. Die Wissenschaftler berücksichtigten erstmals eng begrenzte, lokale Unterschiede in der Luftqualität: Personen, die in unmittelbarer Nähe grosser Strassen wohnten - weniger als 100 Meter von einer Autobahn oder weniger als 50 Meter von einer Hauptstrasse entfernt - und die damit hohen Konzentrationen an «schwarzem Rauch» und Stickoxiden ausgesetzt waren, hatten ein um 40 Prozent höheres Mortalitätsrisiko als die gesamte Bevölkerung und ein nahezu doppelt so hohes Risiko, an einer Herz- oder Lungenkrankung zu sterben.<sup>2</sup>

Bisher sei die Luftqualität in Städten ausschliesslich an sogenannten Hintergrundstandorten, etwa in einem Stadtpark, gemessen worden, nicht jedoch in unmittelbarer Nähe von Emissionsquellen, so

Annette Peters. Laut den Ergebnissen der niederländischen Studie werden jedoch die Gesundheitsgefahren für diejenigen Personen, die in der Nähe der Emissionsquellen leben, durch Durchschnittswerte unterschätzt.<sup>3</sup>

Auch in der Schweiz läuft zurzeit eine umfangreiche Studie, die «Sapaldia-Study» mit 9600 Teilnehmern, die bereits vor zehn Jahren begonnen wurde. Damals haben Ursula Ackermann-Liebrich von der Universität Basel und ihre Kollegen nachgewiesen, dass Personen, die an Orten mit schlechter Luftqualität leben, häufiger an Lungenkrankheiten leiden.<sup>4</sup> Seit Beginn dieses Jahres untersuchen die Wissenschaftler nun bei denselben Probanden, wie sich Luftschadstoffe langfristig auf Herzrhythmusstörungen auswirken.

*Annette Wegner*

<sup>1</sup> The Lancet 360, 1210-1214; <sup>2</sup> 1203-1209; <sup>3</sup> 1184 (2002); <sup>4</sup> Am. Journal Respir. Crit. Care Med. 159, 1257-1266 (2002).

## ***Finally, the reference to health costs***

### **Health Costs due to Road Traffic-related Air Pollution An impact assessment project of Austria, France and Switzerland**

#### **Synthesis report**

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