HEI

STATEMENT

Synopsis of Research Report 101

HEALTH EFFECTS INSTITUTE

Penetration of Lung Lining and Clearance of Particles Containing Benzo[*a*]pyrene

Diesel exhaust is a mixture of gases and soot. Soot consists of carbon particles with bound inorganic salts, metals, and more than 450 organic compounds. The organic compounds include genotoxic polynuclear aromatic hydrocarbons (PAHs), such as benzo[a]pyrene (B*a*P), that cause cancer in laboratory animals. Soot inhalation is believed to be a potential contributor to lung cancer risk in occupationally exposed humans because it is readily inhaled and deposits in the lungs. Some researchers believe that PAHs must be released from soot and become bioavailable before they exert genotoxicity. However, the fate of the PAHs and their role in the toxicity of diesel exhaust are not well understood.

For the current study, Dr Alan Dahl and colleagues of the Lovelace Institutes in Albuquerque, New Mexico, planned to expose the dog trachea to B*a*P bound to model soot particles and to determine whether it became bioavailable and reacted with the tracheal epithelium. When Dr Dahl left the Lovelace Institutes, Dr Per Gerde became the Principal Investigator on this project and added exposures of the peripheral lung alveolar region to the study design.

APPROACH

The investigators removed most of the organic compounds from diesel exhaust particles and bound radioactive B*a*P to them to create surrogate PAH. They exposed the lower respiratory tract of three dogs to the particles and measured the levels of particle-bound B*a*P and free B*a*P released from particles in the peripheral alveolar region of the lungs. After approximately six months, they exposed only the trachea to the particle-bound B*a*P for similar measurements and isolated peripheral lung tissue to measure the long-term stability of B*a*P on the particles.

RESULTS AND INTERPRETATION

Soon after alveolar exposure, free B*a*P was detected in blood but its concentration quickly dropped, indicating that most of the bioavailable B*a*P had been released. Metabolites of B*a*P later appeared in blood, and some radioactive material became bound to peripheral lung tissue.

Six months later, much of the B*a*P remained particle-bound in peripheral lung tissue and lymph nodes and was considered unavailable for genotoxic reactions. Some B*a*P became bioavailable and was metabolized after tracheal exposures. Therefore, both exposures in this study indicate that some particle-bound B*a*P becomes bioavailable and has the potential to exert genotoxic effects.

Diesel exhaust particles may not react the same as the model particles used in this study. The model particles contain B*a*P as a single surrogate for a complex mixture of PAHs and other organic molecules normally found on diesel exhaust particles. Release of the other organic constituents from normal particles would likely affect the rate and extent of B*a*P release. Further the binding strength between B*a*P and the model particles may differ from that in particles in diesel engine exhaust. In addition, the B*a*P concentration on the model particles was much greater than that calculated to be present on diesel soot particles. This would be expected to influence its release rate. The investigators recognize these concerns but defend their study design as critical to address their aims.

The interesting and provocative results of this small pilot study must be interpreted carefully. The importance of genotoxic PAHs in the diesel exhaust remains to be confirmed.

This Statement, prepared by the Health Effects Institute, summarizes a research project conducted by Dr Per Gerde of the Lovelace Respiratory Research Institute, Albuquerque NM. The complete report, *Respiratory Epithelial Penetration and Clearance of Particle-Borne Benzo[a]pyrene,* can be obtained from our website in PDF format or requested from HEI (see reverse side). GERDE 101

Research Report 101

Respiratory Epithelial Penetration and Clearance of Particle-Borne Benzo[*a*]pyrene

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