DIESEL ASTHMA: REACTIVE AIRWAYS DISEASE FOLLOWING OVER-EXPOSURE TO LOCOMOTIVE EXHAUST. J.F. Wade, III and L.S. Newman. National Jewish Center for Immunology & Respiratory Medicine; University of Colorado School of Medicine, Denver, CO., USA.

While some of the gaseous and particulate components of diesel exhaust can cause pulmonary irritation and bronchial hyperreactivity, diesel engine emissions have not been clearly shown to cause asthma. Three railroad workers developed new-onset asthma following exposure to locomotive diesel emissions while riding immediately behind the lead engines of cabooseless trains. In each case, excessive exhaust from the lead unit entered the cab of the second unit, inducing acute or subacute symptoms. Asthma diagnosis was based on symptoms, pulmonary function tests, and/or measurements of airways hyperreactivity (Table 1). In one case, peak expiratory flow rates declined in a work-related pattern (Figure 1).

Table 1. Demographics and Clinical Features in Diesel Asthma Cases

	Case 1	Case 2	Case 3
Age (yrs.)	40	50	44
Smoking history	former	never	never
Prior respiratory disease	none	rhinitis, polyps	none
Pattern of onset	acute	acute	subacute
Reversible airflow limitation	+	+	+
Airways hyperreactivity	exercise +	mecholyl +	mecholyl +
Duration of symptoms (mos.)	14	24	36

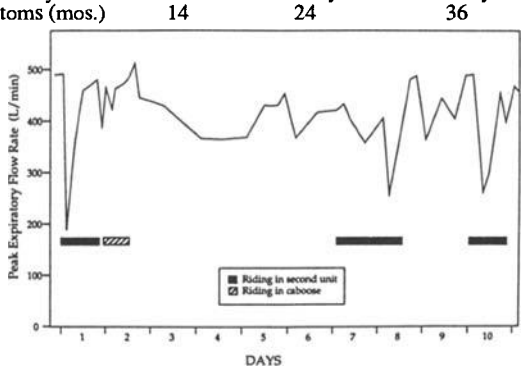

Figure 1. Peak flow rate records from Case 2.

Conclusions: This is the first report implicating diesel exhaust as a cause of reactive airways disease. The disease is persistent. Regulations and work practices which may lead to such over-exposures should be re-examined.

OCCUPATIONAL ASTHMA AND AEROSOL PENTAMIDINE. Lee-Pack L, McIvor RA, Yu DG, Lewis C, Favell K, Moore M, Chan CK. Toronto Aerosol Pentamidine Study Group (TAPS), University of Toronto, Toronto, Canada.

Aerosol pentamidine (AP) is known to cause cough and bronchospasm in 16-30% of individuals receiving therapy. The incidence of respiratory side-effects and the potential for occupational asthma in health care workers (HCW) administering AP treatments appears unknown. The purpose of our study was to prospectively assess pulmonary function by 1) recording symptoms, 2) peak expiratory flow rates 4/day (best of three recordings on each occasion), 3) assessing FEV_1 at the start and end of a working shift (on the first and last working day of the week), and 4) full pulmonary function testings. The Toronto Central AP clinic is staffed by 6 HCW, 3 males and 3 females, mean age 38 years (range:27-47) who have administered 50+ treatments per day over the last 2 1/2 years. The two nebulizers used at the clinic are Fisoneb in 75% of the patients and Porta-Sonic in 25% of the patients. All the treatment rooms are equipped with direct exhaust and high-volume HEPA filtration units. Although nonspecific symptoms of mild headache, itchy eyes and sore throat have been recorded, no HCW has developed asthma and our asthmatic does not require increased therapy. No significant changes were recorded in either PEFR or FEV_1 during working shifts or on days off work. Results of most recent pulmonary function tests on our 6 HCW performed on Sensormedic 4400 system using Knudsen 83 predicted values:

% Predicted	HCW 1	2	3*	4	5*+	6
TLC	84	85	103	68	77	96
FVC	89	87	97	73	84	90
FEV_1	85	88	90	75	83	89
FEV_1/FVC	95	101	92	103	98	99
FEF50	69	92	69	70	78	83
DLCO	145	95	120	88	96	102

*Smoker +Asthmatic

In conclusion, although acute bronchospasm is particularly troublesome with patients, individual HCW in our high- volume AP clinic show no acute or long-term impairment in flow rates, lung volumes or diffusing capacity.

ACUTE EFFECTS OF INHALATION OF GRAIN DUST EXTRACT AND ENDOTOXIN ON UPPER AND LOWER AIRWAYS. W.D. Clapp, P. Thorne, K.L. Frees, X. Zhang, C.R. Lux, D.A. Schwartz. The University of Iowa, Iowa City, Iowa.

To evaluate the biologic activity of grain dust on upper and lower airways, we administered corn extract, soybean extract, endotoxin, and Hank's balanced salt solution (HBSS) by inhalation challenge to 4 female and 2 male non-asthmatic, non-atopic, healthy nonsmokers. Each study subject was challenged with each of the four solutions (corn, soybean, endotoxin, and HBSS) in a double-blind, randomized, crossover design with a minimum of 10 days between each of the challenges. Extracts were produced by mixing 3 g of corn or soybean dust from processing plants with 30 cc HBSS followed by shaking for 60 min, centrifugation, and filter sterilization of the supernatant. E. coli endotoxin (serotype 0111:B4) was mixed with HBSS to attain a final concentration of 7 $\mu g/ml$, which was similar to the concentration of endotoxin in both grain dust solutions. The subjects inhaled 0.08 ml/kg of each solution via a nebulizer with a dosimeter. This was followed by serial spirometry and 24 hour post-challenge nasal lavage. When compared to HBSS, administration of corn extract, soybean extract, and endotoxin, resulted in significant decrements in FEV_1 at 0.5 hours which persisted until 6 hours post-challenge. The maximal percent decrease in FEV_1 was significantly greater following exposure to inhalation of corn extract (9.00 ± 5.00; P = 0.03), soybean extract (7.30 ± 5.33; P = 0.04), and endotoxin (8.97 ± 7.20; P = 0.05) when compared to HBSS (2.29 ± 1.24). In addition, nasal lavages 24 hours after the exposure showed a significant elevation in the percentage of lymphocytes in those exposed to corn extract (P = 0.04). Interestingly, the percentage of lymphocytes in the nasal lavage was also increased following exposure to soybean extract and endotoxin, however, these differences were not significant. Our results indicate that corn extract, soybean extract, and endotoxin are biologically active and result in a similar degree of airflow obstruction that is most pronounced in the first 6 hours following exposure. These physiologic changes appear to be associated with an inflammatory response in the nares.

SERIAL PEAK EXPIRATORY FLOW RATES IN THE STUDY OF WORK-RELATED VARIABLE AIRWAY DISEASE: HOW MANY MEASUREMENTS ARE NEEDED IN A DAY? Edward L. Petsonk, Domyung Paek, Steve Short, Jennifer Howells, John Hankinson Division of Resp. Disease studies, NIOSH, Morgantown, WV, USA

Serial peak expiratory flow (PEF) measurement has been increasingly used in the study of variable airway disease including asthma. In asthmatics, the amplitude of the circadian rhythm in PEF is exaggerated compared to normal. Most commonly, the amplitude has been calculated as the difference between the maximum and minimum flow rates relative to either the maximum or mean flow rates in a day. Different studies have adopted different number of measurements at different times of day. We examined the effect of the time and number of PEF measurements in detecting the evidence for variable airway disease in a group of workers.

Mini-Wright peak flow meters were given to 29 subjects working day shift from Monday to Friday in an insect-rearing facility. They were asked to record three blows every two hours while awake for 8 days. Each participant was checked daily by the study team to insure correct technique and maximal effort. On weekends, they were called at home to encourage compliance. Two workers had only 7 days of recording. All others completed 8 days of PEF measurement. Among 29 workers, 8 showed one or more days of ≥ 20% variation in PEF (maximum minus minimum divided by maximum). Of the total 64 days of PEF measurement in these 8 workers, 16 days had ≥ 20% diurnal variation.

The effect of timing of PEF measurement was examined by calculating the number of days with ≥ 20% variation after deleting the data at one specific time of day, keeping the rest of the data in the analysis. Deleting the 6 am measurements reduced the diurnal variation of 7 days. 8 pm, and 12 noon influenced 4 and 3 days each. Other times of day which changed the status of diurnal variation from ≥ 20% to < 20% included 8 am, 2 pm, 6 pm, and 10 pm.

The influence of number of PEF measurements was examined by keeping the data at specified times of day in the analysis. Analysis of two (6 am and 8 pm), three (6 am, 12 noon, and 8 pm), four (6 am, 12 noon, 2 pm, and 8 pm), and five (6 am, 12 noon, 2 pm, 8 pm, 10 pm) PEF measurements showed that at least five were needed to detect all 8 workers with excessive diurnal variation. Analysis using three and four measurements detected 5 and 7 workers each, while analysis with two was quite inadequate, detecting only 1 subject. These results emphasize the importance of early morning blows and the use of at least 3-4 measurements in detecting excessive diurnal variation of peak flow rates in working people.

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ABSTRACTS

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