be avoided if our aim is to create a good work environment. The exact meaning of words such as "adverse", "toxic", "disease", or "illness" is important but the process of defining them must not obstruct the improvement of the working environment.


These studies use often spot urinary Hg concentrations readily available from routine biological monitoring strategies in the chloralkali and other Hg utilizing industries. Diurnal variation in the metal's excretion has been noted,4 but the higher concentrations found in morning samples compared with afternoon and evening samples have been suggested as being of no practical relevance in a biological monitoring scheme.4 Urinary Hg concentrations are said to reflect integrated exposure over the preceding weeks or months in workers with long term exposure. There has been debate about whether correction for differences in urinary Hg to correct for intra-individual variation of urinary Hg and thus making a single spot measurement more closely reflect true Hg excretion.3 We present some data on the effect of suggested methods for the correction of spot urinary Hg samples in reducing within day and between day intridual variation.

Within day variation was studied in 17 workers with long term exposure to Hg vapour at a single factory. All spot urine samples were taken during a single day at the approximate times of of work, 1000, 1300, and 2200 hours. Mercury was measured by an automated method; creatinine, specific gravity (SG), and osmolality were also measured. The total analytical imprecision (CVT) for urinary Hg corrected for creatinine, SG or osmolality was between 5% and 6%. All Hg measurements were either uncorrected (nmol/L) or corrected per m creatinine, to SG 1016, and to 504 mosmol. The between day variation was studied in 10 workers with relatively constant, long term exposure to Hg vapour at a single factory. Spot urine samples were taken from each worker on the same day of each day of the working week (five days). The samples from this study were uncorrected or corrected for creatinine concentration or for an SG 1 of 0.16.

The mean urinary Hg excretion was higher in the workers. The mean urinary Hg concentrations of the workers from the within day and between day studies were 58 (4-268) and 32 (6-50) nmol/mmol creatinine respectively. The table shows the calculated mean and standard deviation (SD) of the intridual variation coefficients of variation (CVI) for urinary Hg results in the two studies and, the comparison of our data with that of ANOVA, of the mean CVs of corrected urinary Hg results with uncorrected. The data from the within day study confirmed the previously reported diurnal variation.3

A low mean and SD of intridual CVs derived from multiple spot urinary Hg values would imply that a single urine sample closely reflects the true Hg excretion in that individual subject. Creatinine correction of Hg concentration significantly reduced mean intridual variation, both between and within day, to about 50% of the variation in uncorrected urine values.8 Although the mean intridual CVI, both between and within day, was less with creatinine correction than with SG correction, the difference did not reach significance (ANOVA, Bonferroni multiple comparison test). There was some evidence from F tests, however, that creatinine correction may be more reproducible between subjects than SG correction. It should be noted that, even with creatinine correction, the mean CVI of around 15% with the imprecision of our method implies that two consecutive daily spot urine samples, taken at the same time, would be expected to have a standard deviation of within day variation, could statistically be around 45%-50% apart (t.<2). This has been widely accepted in clinical pathology that acceptable analytical imprecision should be less or equal to half the average intridual biological variation (CVI). This value for urinary Hg corrected for creatinine can be derived from the formula CVI = CVI + CVI. Thus we suggest that the combined analytical precision of urinary Hg and creatinine method should be less than 7.3%.

Correction for creatinine and, perhaps slightly less satisfactorily, correction for SG reduce the uncertainty of a spot urinary Hg concentration in reflecting accurately the true Hg excretion in an individual subject. Corrected spot urinary Hg results have proved their use both in routine biological monitoring and in studies describing dose-effect relations that may aid in setting standards. It is important, however, that the limitations and errors associated with their use as dose measures are understood.

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The correction of urinary mercury concentrations in untimed, random urine samples.

Editor,—We note with interest the continuing number of reports defining dose-effect relations for occupational exposure to mercury (Hg) that have used urinary Hg concentrations in untimed, random samples (spot urines) either as a cumulative exposure dose1 or a simple dose index.2

Comparison of mean CVs of corrected urinary Hg results with uncorrected results

<table>
<thead>
<tr>
<th>CVI1</th>
<th>Creatinine corrected mean (SD)</th>
<th>CVI1</th>
<th>SG (1 of 0.16) corrected mean (SD)</th>
<th>CVI1</th>
<th>Omolality corrected mean (SD)</th>
<th>CVI1</th>
<th>Uncorrected mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within day 100 subjects</td>
<td>p &lt; 0.001</td>
<td>22.4 (7.9%)</td>
<td>32.2 (12.3%)</td>
<td>36.5 (15.1%)</td>
<td>47.3 (22.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between day 10 (subjects)</td>
<td>p &lt; 0.001</td>
<td>15.6 (7.2%)</td>
<td>22.0 (14.0%)</td>
<td>37.3 (23.6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Coal mining, emphysema, and compensation revisited

NJ Wikeley

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