data suggesting that adjusting for social class would increase risk estimates slightly.

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10 The Hopkins telephone worker study: special report; transmission/distribution health and safety report: 1989; 31 December, 3-4.

Mortality among workers potentially exposed to epichlorohydrin

Sir,—In a recent study, Enterline et al (1990;47:269-76) reported the mortality experience of workers at two Shell Oil Company chemical plants. These men had had potential exposure to epichlorohydrin (ECH). That work was supported by Shell, and the Company recognises that the investigation was thorough and well done. We do not share, however, the interpretation that ECH alone or in combination with allyl chloride is associated with deaths due to heart disease.

Our table reproduces the essential findings. The study group as a whole had a mortality from heart disease that is 32%, below that of the general population. Furthermore, there is no consistent pattern of excess deaths. Among men with nil or light exposure, the SMR is significantly (p = 0.03) low even after 20 years or more of follow up. Among the men with moderate or heavy exposure, there is but a slight (less than one observed death in excess) and non-significant (p = 0.89) excess only 20 years or more after exposure was initiated. In other words, even for this group, there is no true excess of heart disease. Curiously, for all deaths, the average age at death for the moderate to heavy exposure group is 10 years older than that for the nil to low exposure group, and about five years older for deaths due to heart disease—the reverse of that expected for an exposure induced outcome. Important confounders such as smoking and dietary habits were not examined. It should also be pointed out that “follow up” in this study is not necessarily a good surrogate for extent of exposure. That is, the duration of exposure is not the same as the period of follow up.

In the Abstract, the authors state that “The relation of heart disease and exposure does not appear to be an artifact, although the fact that many other causes of death were also related to exposure argues against a causal relation.” Finally, we point out that the suggestion that a possible interaction between ECH and allyl chloride is responsible for the “excess” of disease upon heart deaths is a speculation. Enterline et al point out that men who had worked in ECH production were more likely to have been exposed to allyl chloride than were other ECH workers. In fact, this study has made no effort to distinguish the effects (if any) of ECH alone from those of ECH in combination with allyl chloride. The authors state on page 276 of the article that “There is little in human or animal experience to suggest a relation between allyl chloride and cardiovascular disease.” This statement, we believe, places their interpretation in a more correct perspective.

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Author's reply:

I would agree that the findings we reported with regard to heart disease among men with potential exposure to epichlorohydrin are curious. Ross points to the fact that the group of workers we studied had a mortality from heart disease 32% below that of the general population. Whereas this is true, the SMR for these workers was higher than the SMR for heart disease for the chemical plant as a whole. Moreover, we pointed out in our article, the SMR of 54:4 in the nil to light exposure group 20 years from first exposure was not much different than an SMR of 51:1 for the entire chemical plant. Thus it appeared to us that the SMR of 101:6 for the higher exposure group was the one that was unusual. This points to a problem in using rates for the general population to calculate expected deaths in an industrial cohort.

Ross also points out the age at death in the higher exposure group was roughly five years older than the age at death in the lower exposure group. We did not make this calculation; the difference, however, is probably because the workers in the higher exposure group were older than those

<table>
<thead>
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<th>ECH exposure</th>
<th>Follow up period</th>
<th>&lt; 20 years</th>
<th>≥ 20 years</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil, light</td>
<td>56 (6)</td>
<td>39 (5)</td>
<td>47 (11)</td>
<td></td>
</tr>
<tr>
<td>Moderate, heavy</td>
<td>73 (7)</td>
<td>105 (17)</td>
<td>93 (24)</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>64 (13)</td>
<td>76 (22)</td>
<td>71 (35)</td>
<td></td>
</tr>
</tbody>
</table>
Mortality among workers potentially exposed to epichlorohydrin.

C E Ross

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