NRC Panel Scientists Slams SAB's Draft Report on Arsenic
In addition to the comments previously submitted, dated 29 August 2000 and an erratum dated 1 September 2000, it has been suggested that we provide material for the EPA indicating how cancer risks, including lung cancer risks, could be estimated. In addition, I wish to comment on the Drinking Water Committee (DWC) report of the SAB.


There is extensive information from several countries for use in lung cancer risk assessment, which is the main site for cancer mortality. We previously submitted a graph integrating data from Taiwan, Argentina, Chile and Japan. This includes results from a case-control study (Chile), a cohort study (Japan), and ecological studies (Argentina, Chile, Taiwan and Japan). We attach this graph again (Figure 1).

Table 1 presents the risk assessment calculations which were part of our report to the Office of Environmental Health Hazard Assessment, California EPA. The lung cancer risk estimates for drinking 1 liter of water per day containing 50 ug/L were 7.8 per 1000 for men, and 9.9 per 1000 for women. Thus, the risk for lung cancer alone is on the order of 1 per 100.

The methods used are standard risk assessment methods with linear relative risk extrapolation. This is the standard default. As can be seen in Figure 1, there is no basis for the incorporation of sub-linear or threshold models.

The use in calculations of 2.3 liters as the volume of water consumed per day was estimated from extensive interview studies in several countries (Table 2).

As can be seen in Table 3, lung cancer related to arsenic was a more important cause of death in Taiwan, Chile and Argentina. This was particularly true for Argentina and Chile, both of which have populations which are similar to the U.S. population with regard to various characteristics, such as nutrition, ethnicity and lifestyle.

Full details of the risk calculations are available in the report submitted to the California EPA.

2. The Drinking Water Committee Report.

Rather than reviewing the full report, I will comment on three points raised in the cover letter to The Honorable Carol Browner.
The letter states that "In the opinion of the DWC, the Agency misinterpreted some of the conclusions of the NRC report".

This point was elaborated with the statement that "The NRC (1999) noted, there are several reasons why the Taiwanese data should not be accepted as being directly applicable to the U.S.".

This is simply not correct and it is misleading to imply that such a statement was made in the NRC report. The following are pertinent quotes from the NRC report:

"Ecological studies in Chile and Argentina have observed risk of lung and bladder cancer of the same magnitude as those reported in the studies in Taiwan at comparable levels of exposure" (page 7).

"Human susceptibility to adverse effects resulting from chronic exposure to inorganic arsenic is likely to vary based on genetics, nutrition, sex, and other possible factors. Some factors, such as poor nutrition and arsenic intake from food might affect assessment of risk in Taiwan or extrapolation of results in the United States"(page 8) (italics added).

"A wider margin of safety might be needed when conducting risk assessments of arsenic because of variations in metabolism and sensitivity among individuals or subgroups" (page 244) (italics added).

In short, there may indeed be susceptible sub-populations. These would be present both in Taiwan and also in the United States. Added margins of safety may be called for, not reduced ones. The DWC has grossly distorted information in the NRC report without any good basis.

The most serious error in the DWC report concerns the statement that "Further analyses of the Taiwanese data have been performed since the NRC report was issued that bring into serious question the use of the comparison populations outside the study area for estimating cancer risks due to arsenic. A study in Utah suggests that some U.S. populations may be less susceptible to arsenic .". In the body of the DWC report it is stated that "For one thing, if the lifetime cancer risk at the current standard (50 ug/L) was really 1 case in 100 persons in the population, or greater, then there should be more evidence of effects in the U.S."

The above demonstrates a serious basic misunderstanding of epidemiological studies. To start with, the Utah study involved a highly select population from which no inference can be made about risk assessment.

There are no studies in the U.S., or anywhere else, conflicting with a 1 in 100 risk estimate. It needs to be understood that it is very hard to demonstrate if a 1 in 100 risk estimate truly exists. One example of this is that it took many studies (about 16) before an NRC report could conclude that lung cancer risks from passive smoking by non-smokers married to smokers were indeed increased and of the order of 1 in 100. In the case of arsenic in drinking water, one would need large populations who over many years (at least 30) consumed water containing 50 ug/L every day. The background risk of cancer mortality is about 20 per 100 (i.e. about 1 in 5 people die from cancer). For lung cancer alone it is about 5 in 100. The relative risk for a population having an increment of 1
in 100 would be 1.2. Such a relative risk is extremely hard to prove. There are simply not enough people in the U.S. with long enough exposures at the 50 ug/L level to demonstrate if the risk estimate of 1 in 100 is real or not. Even if there were enough people in the U.S. with long enough exposures at this level, you would need many studies over several years to demonstrate this risk. In short, the assumption that risks cannot possibly be as high as 1 in 100 has no scientific basis, and is in fact, very dangerous.

- It is imperative that any good arsenic risk assessment using epidemiological data should have a comparison population group that is clearly known not to be exposed to increased concentrations of arsenic in drinking water. While Morales et al. have conducted a good risk assessment in many aspects, no weight should be given to findings in their publication which do not include a comparison population known to be unexposed. Within the endemic area of Taiwan, only single samples from wells taken at one point in time were available. People migrate, they move to different villages, they do not drink from the same well for their total life. This means that within the endemic region, there is no comparison population known to be unexposed. Therefore, attention should be confined to the risk assessment results that were reported using external comparison populations.

Again, for further information, feel free to contact my office at 510-843-1736 or the web page at http://socrates.berkeley.edu/~asrg, which contains information on our research.

Sincerely,

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