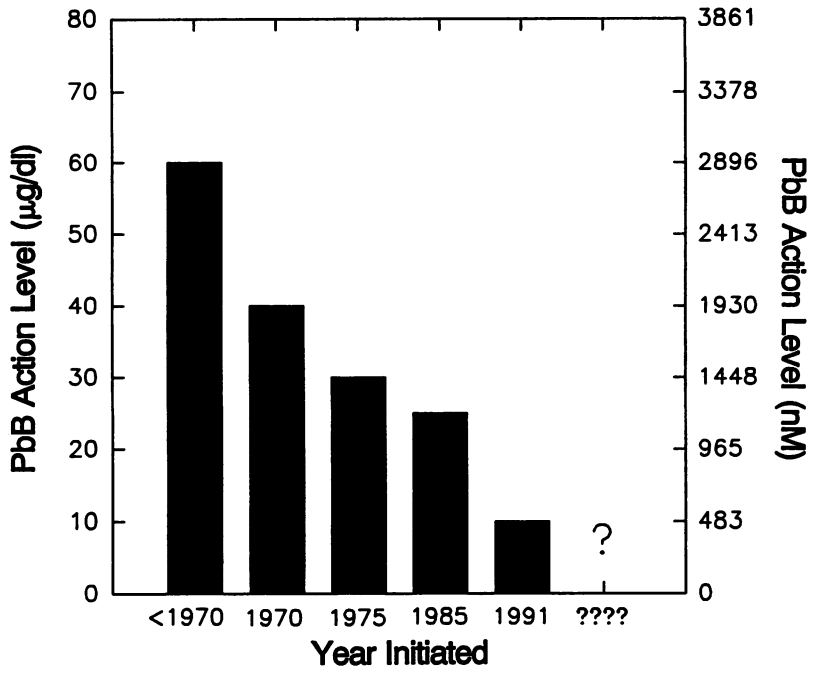

FIGURE 2—Blood lead (PbB) action levels proposed by the Centers for Disease Control and the Public Health Service[2].

This is based on our estimate of the natural PbB concentration in humans and on recent studies that have documented neurobehavioral and cognitive deficits in infants with PbB levels as low as 340 nmol/L (7 μg/dL).[3,5]

Our estimate also indicates that current studies may be insensitive in detecting the pervasiveness of low-level lead toxicity, because their control groups are exposed to elevated environmental levels of lead that result in "baseline" PbB concentrations that are 200 to 600 times above natural levels. These order-of-magnitude increases in environmental and body lead levels have occurred throughout the terrestrial biosphere due to industrialization, and they have confounded work to determine subclinical toxicity thresholds for lead. This is acknowledged in the CDC statement,[2] which points out that limitations in the ability to detect low-level lead poisoning may thwart establishing lower PbB action levels. Therefore, public health agencies should now focus on the development of strategies to achieve body lead burdens that more closely approach natural lead concentrations. □

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Community Health and Odor Pollution Regulation

I read with great interest the report by Haahtela et al. on community health complaints after an episodic release of hydrogen sulfide (H_2S) and mesityl oxide from a pulp mill.[1] The authors documented symptoms at H_2S exposure levels that, although exceeding the World Health Organization's (WHO) half-hour guideline of 7 μg/m^3 (0.005 ppm) for "odor nuisance," were below the WHO's 24-hour guideline of 150 μg/m^3 (0.11 ppm) for "health hazards."[2] As I will argue, the patterns of H_2S-related symptom reporting should lead one to question the distinction between "odor nuisance" and "health hazard."

Haahtela et al. point out that the toxicology literature does not lead one to expect irritative effects from H_2S below approximately 15 mg/m^3 (10 ppm).[3] My colleagues and I previously reported on a cluster of odor and symptom complaints that occurred in a community downwind of a hazardous-waste site, following the release of reduced sulfur gases (including H_2S) from settling ponds.[4] Like Haahtela et al.'s, our investigation documented subjectively reported headaches, upper respiratory tract irritation, eye irritation, and nausea among community complainers. However, in contrast to the Haahtela et al. study, although the exposure levels associated with acute and reversible symptoms in our study were linked with odors, they were below levels of detection by sensitive air monitoring techniques. (Levels of detection were 0.0001 ppm [0.14 μg/m^3] for H_2S, and 0.00002 ppm for various mercaptans.) The similarity of symptoms reported after exposures to reduced sulfur compounds at "high" (0.025 to 0.1 ppm or 35 to 135 μg/m^3) and "low" (below 0.0001 ppm) levels gives rise to speculation regarding the role of odor perception per se as a mediator of symptoms. This possibility has been explored elsewhere in a meta-analysis of symptoms near hazardous waste sites[5] and in a review of community health studies near industrial, hazardous waste, and agricultural odor sources.[6]

Complicating the picture described by Haahtela et al. was the issue of coexposure to mesityl oxide, which was alluded to but not dealt with extensively in their article. The "odor safety factor" (or ratio between irritant and odorant thresholds) is lower for mesityl oxide (15 ppm

[irritant threshold]/0.45 ppm [odor threshold] = 33) than for H_2S (10 ppm/0.008 ppm = 1200).[7] Thus, if it was in fact present, mesityl oxide could have played a significant role in the pathogenesis of the irritative symptoms. However, the odor that the authors ascribed to the compound ("catty") differs from that appearing elsewhere in the literature ("honey-like" or "sweet"),[8,9] and one wonders what independent evidence existed for its presence in community air.

Observations such as the above led California state regulators to establish an ambient air quality standard (AAQS) for H_2S that is based on the endpoint of odor "annoyance." This standard—0.03 ppm (42 $\mu g/m^3$) on a 1-hour average basis—is set at approximately four times the population-mean odor threshold for H_2S. This methodology assumes that, on a population-average basis, the annoyance threshold occurs at a fixed multiple of the odor threshold; at the level chosen, approximately 40% of the population is expected to be annoyed by H_2S odors.[10] Rather than following the conventional method of extrapolating down from levels at which adverse health effects are observed, California's H_2S standard extrapolates up from the odor threshold. A significant advantage of this approach is that arbitrarily large safety factors are avoided. Although the specific AAQS chosen is not inviolate—and although it is possible that more sensitive investigational methods will provide the basis for an irritancy-based H_2S standard in the future[11,12]—odor-annoyance–derived standards represent the most reproducible and health-conservative methodology currently available for regulating compounds with high odor safety factors.

Annoyance and health complaints associated with odorous air pollutants generate the majority of calls to air-pollution control districts in California. Under California law (Cal Health & Safety Code §§ 3479, 41700), the abatement of odor nuisances does not require proof of lasting physiologic impairment among residents of affected areas. Haahtela et al.'s study of H_2S-related symptoms helps underscore the rationale for such tight regulation of odor pollution sources. □

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