SUMMARY: The letters to the Editor of the International Journal of Occupational and Environmental Health by Phyllis Mullenix and Donald Taves on setting appropriate safety standards for industrial levels of fluorides and fluorine are considered as if they were a debate. The participants’ views on gaseous fluorides, hydrofluoric acid and particulate fluoride are summarized. It is concluded that in the end the “real winners” will be the public and industrial workers who will benefit from standards established by science rather than politics and the fear of litigation.

Keywords: Debate on safety standards; Gaseous fluorides; Hydrofluoric acid; Letters to the editor on fluoride; Mullenix PJ; Particulate fluoride; Taves DR.

The Commentary or Letters to the Editor section of a scientific journal often provides delight and enlightenment to the reader, especially if the issues are controversial and are presented as a debate.

A current example is found in the International Journal of Occupational and Environmental Health that presents a letter from Donald R Taves MD, MPH, PhD accusing Phyllis J Mullenix PhD of faulty reasoning in her paper published in a prior issue entitled “Fluoride Poisoning: A Puzzle with Hidden Pieces”. An editorial on and an abstract of the Mullenix paper were published recently in Fluoride.3,4

A reply from Mullenix follows Taves’ letter. The stance of the protagonists is made clear from the outset. Taves states that the review by Mullenix indicating the need for downward revision of industrial levels of fluorides and fluorine for workers is based on flawed reasoning. Mullenix replies with the accusation that Taves’ comments are “scientifically invalid and typical of the camouflage used for decades to thwart fluoride litigation”.

The thrust and parry of debate (or “point/counterpoint” if more gentle terms are preferred) are centered on the three “Puzzle Pieces” presented in the Mullenix paper.

**PUZZLE PIECE ONE**

**Gaseous Fluorides:** Taves charges that Table 2 in the Mullenix paper indicates that most, if not all, the injuries from airborne UF₆ and F₂ were due to factors other than that the permissible limits were set too high. In her rebuttal Mullenix contends that Taves has distorted the data and that his charges have no basis in fact since the causes of most injuries have never been identified. She also accuses Taves of muddying the waters when he suggests that industry was not able to maintain exposure levels at permissible limits. Mullenix cites a letter addressed to Colonel William D Fleming at the Oak Ridge Manhattan Project nuclear energy facility on October 28, 1946. In this the industry (Carbide and Carbon Chemicals Corporation) noted that the maximum allowable concentration (3 ppm for prolonged exposure) was, in all cases, the value in use at the time. Mullenix, voices her suspicion that the safety assurance may not be genuine. In order to be accepted as such exposure-level data must have been collected but such data have yet to surface for any Manhattan Project. She presents examples of how missing exposure data were used to defend the government in litigation for agriculture contamination.
Mullenix cites Taves’ concerns in 1958 when he was a public health officer for the California Shasta County Department of Public Health and quotes a reply from Robert A Kehoe MD, Director of the Kettering Laboratory in Cincinnati, answering a letter of inquiry written by Taves to that institution. Taves’ “Preliminary analysis of the safety of fluorides,” dated August 12, 1958, and his letter of September 4, 1958 to the Kettering Laboratory, found among the Kehoe papers, demonstrated the inadequacies of studies at the time to show how fluorides may be injurious and suggested studies that should be done. Kehoe’s response was evasive and made reference to the fact that a “practical man” would conclude that “we are much more apprehensive about the very small quantities involved in fluoridation, than we are about the very much larger quantities to which many men are being exposed in their daily work”. Mullenix points out that Kehoe in his reply failed to answer any of Taves’ questions, and she concludes that Taves’ 1958 comments, concerns, and questions joined the ranks of the “unpublished” and that the research proposed was never conducted.

PUZZLE PIECE TWO

Hydrofluoric Acid: Taves charges that the three studies referred to by Mullenix to support her conclusions that hydrogen fluoride causes dental and skeletal problems below the currently accepted threshold have little bearing on the issue. Mullenix, in her refutation, points out that Taves does not deal with the considerable detail presented regarding the omission, distortion, and misclassification of data to wipe out evidence that hydrofluoric acid exposure may cause tooth deterioration or loss. The three papers referred to by Taves are, in the opinion of Mullenix, evidence that important questions have gone unanswered.

PUZZLE PIECE THREE

Particulate Fluoride: Taves states that the unpublished study by Davis et al. on the effects of inhaled CaF$_2$ should be repeated before it is used to change occupational exposure standards. He points to the possible contamination of the control group with CaF$_2$ and that inhaled calcium, not fluoride, may have caused the observed lung damage. Mullenix agrees that studies need to be repeated before they are made the basis for changing standards. However, she questions the “logic” that dictates a study must be replicated to make occupational standards more stringent, yet they can be one-of-a-kind when standards are relaxed. She refers to a study by Lyon that was used without replication to relax the F$_2$ standard. Mullenix charges that Taves’ rush to undermine confidence in the Davis study is unjustifiable. She points to the difficulty of avoiding contamination and refutes Taves’ attempt to switch blame from fluoride to calcium. She supports her contention by presenting information from the Davis study and from the results of workers’ exposure to relatively high concentrations of calcium carbonate dusts and the lack of reports of adverse effects on humans from such exposure to calcium sulfate.

In his conclusion, Taves states that Mullenix has not made a persuasive case for lowering industrial limits for fluoride. Mullenix, in rebuttal, charges that “Taves presents no scientifically valid argument to retract her call for more stringent
occupational standards for airborne fluorides and fluorine”. She points to a need to understand that the manipulation of data described in her paper was a legal strategy to offset claims of harm to human health coming from the general and working public. Understanding this shady past, she points out, should turn attention to a more scientific basis for the setting of occupational standards.

In adjudicating a debate, one senses there are “winners” and “losers”. Each reader of the exchange¹ will enjoy the argument and pass judgment. In the end the “real winners” will be the public and industrial workers who will benefit from standards established by science rather than politics and the fear of litigation.

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REFERENCES