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Contamination Control and Minienvironment Consulting Services

Welcome to the premier issue of **Contamination Control News**, A bi-monthly mini-newsletter from Bartlett Bay Consulting. I hope you find them interesting, informative, and a value-add to your business. I am interested in your comments.

-Steve Silverman

P.S. If you would like to be removed from this list, please send me an [email](#)

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Contamination Control: News, Views and Trends
A quarterly mini-newsletter from Bartlett Bay Consulting

ISO 14644-1 vs. Federal Standard 209E: yes, it is true: the Federal Standard 209E for classification of airborne particulates is no longer supported, and has been replaced by ISO 14644-1. Despite the fact that all of us have used 209E for years and have a good feeling for what class 1, etc means, we have to make the mental “shift” and start using the new standard. While the two standards are not exactly mathematically equivalent, they are close enough so that we can say 209E class 1 (the lowest class described by this system) is approximately equal to ISO 3, and 209E class 10 is approximately equal to ISO 4, etc. It will take a little while to get use to this. In addition to the change to the metric units (cubic feet to cubic meters), the most compelling reason for the change is due to the fact that 209E was put in place for cleanrooms/environments in the class 1,000+ range when 0.5um particles were state of the art for semiconductor processes and measurement. Now, of course, 0.5um is a LARGE particle, and the industry is interested in environments (minienvironments) having a cleanliness <<class 1 measured at 0.01um. To describe these ultra-clean systems, we veterans of the contamination control industry, “cheated” and used non-existent class distinctions such as class 0.1

and called it an “extended” Class. Now, however, that isn’t necessary, as the lowest ISO class 1 (approximately equivalent to “extended” 209E class 0.01) is a valid class. Now we can all be happy, but just wait a few years when the minienvironment requirements demand better than ISO 1 cleanliness, and we will of course start “cheating” once again with “extended” ISO 0.1!

PWP: Part 1: what and why? While airborne particle measurements are important for insuring that environments are clean, the industry demands measurements *on the wafer (frontside and backside!)* to insure that the entire *system* is operating with a minimum of particle-producing attributes. The PWP (Particle per Wafer per Pass) test was devised to stimulate the actual operation of the tool, where, by measuring the particles added to the wafers after cycling, one could ascertain the number of particles added per cycle. This information is of tremendous interest to both the supplier and the user(s) as semiconductor yields are very dependent upon defect/particle free processes; consequently, low PWP values are not only a major selling point for a supplier, it is key to high yield processes. It wasn’t long ago that “frontside” PWP values of 1 (measured at 0.3um) were standard: that meant that every time a wafer was passed into the tool it added one particle. Today, the specification averages about 0.01 measured at 90nm (0.09um), over 1400¹ times higher! Determining this value is a complex test requiring detailed understanding of the test methods, controls, statistics, and tool operation. Next issue we’ll explore these methods

¹. This is using the standard extrapolated calculations: $(1/0.01)(0.3/0.09)^{2.2}$

Preview of coming attractions:

Backside particle PWP.... a whole NEW ballgame!