

November 18, 2002

Dear ASTM Working Task Group:

Below is a discussion of a patent recently granted to Muscarella et al. The patent, which is a simulated in-use instrument decontamination method, is entitled: "Method for determining the efficacy of a decontamination procedure" and is registered as U.S. Patent 6,428,746.

The goal of Muscarella et al.'s patent is simple: to raise public health standards, improve the standard of care, and reduce the risk of patient infection. And by doing so, this patent significantly improves upon the methodologies of the American Society for Testing and Materials' (ASTM's) three simulated in-use standards that address: (1) sterilization (**Designation: E1766-95; Revised 2002**), (2) disinfection (**Designation: E1837-96; Revised 2002**), and cleaning (**Designation: E2314-03;2003**). Some of the simulated in-use test data that has been submitted to the FDA for the clearance of reusable instruments (e.g., liquid chemical sterilants, automated endoscope reprocessors) were collected using at least one of these three ASTM's standards, each of which is flawed in scope and application.

In short, Muscarella et al.'s patent is a simulated in-use testing methodology that evaluates the effectiveness of decontamination procedures (e.g., cleaning, disinfection, sterilization) in a unique and more thorough manner. It compares the initial number of microorganisms inoculated onto each of several sites of a reusable device before exposure to the decontamination process being evaluated to the final number of microorganisms remaining on each of these respective sites after exposure to the decontamination process. This numerical comparison permits calculation of a log reduction for each of the reusable instrument's multiple sites. The greater the log reduction, the more effective the decontamination process would be expected to be.

ASTM's simulated in-use testing protocols, like most others used to determine the effectiveness of disinfection, sterilization, and cleaning processes for reusable instruments, are not as challenging or as comprehensive as this patent: For instance, instead of determining a log reduction for each of the instrument's contaminated sites (i.e., "per site") as uniquely prescribed by Muscarella et al.'s patent, ASTM's standards permit determination of a log reduction for as few as one of the instrument's contaminated sites (i.e., "per instrument"; refer to: sections 4.2 and 8.4 of E1837; sections 1.5 and 3.2.3 of E1766; and sections 4.4, 8.2.4, 8.3, and 8.7). The effectiveness of a decontamination process that is evaluated using ASTM's *per instrument* methodology (or paradigm) rather than the Muscarella et al.'s patent's *per site* methodology may be wrongly characterized due to the potential for the former (but not the patent) to yield false-negative results (see diagrams, below).

By way of an example, imagine a scenario in which, say, each of 3 internal channels (or sites; see diagram) of a flexible endoscope is contaminated during simulated in-use testing with at least 10^6 bacterial spores. The entire endoscope is then exposed to the sterilization process under review and one of its channels sampled. The results indicate that this channel is sterile (that is, this channel had its initial inoculum of spores reduced by 6 logs), although the other 2 channels remain heavily contaminated (see diagram). In accordance with ASTM's *per instrument* methodology, because one of the endoscope's channels was sampled and shown to be sterile, this sterilization process would (erroneously) be claimed effective and the entire endoscope

Continued on next page

claimed “sterile” (even though in this example the other 2 channels remain heavily contaminated). The application of standards such as ASTM’s that do not account for each contaminated channel, or site, is therefore prone to yielding false and misleading results.

In contrast, the Muscarella et al. patent, which is more challenging and utilizes instead a *per site* methodology, requires that in order for the process in this aforementioned example to be correctly claimed effective and the entire endoscope claimed to be sterile, a 6 log reduction of spores would have to have been shown for each of the endoscope's three channels, not just for one of them as the *per-instrument* methodology of ASTM’s three documents (i.e., **E1766-95; Revised 2002, E1837-96; Revised 2002**, and **E2314-03;2003**) permits. As a result, in this example, the Muscarella et al. patent correctly reveals that the sterilization process was ineffective and that the endoscope remained contaminated. No doubt, this patented protocol “raises the bar” for acceptability allowing only the most effective of decontamination processes to satisfy its stringent criteria.

Let me know if you have any questions. I await your reply.

Regards,

Lawrence F Muscarella, PhD

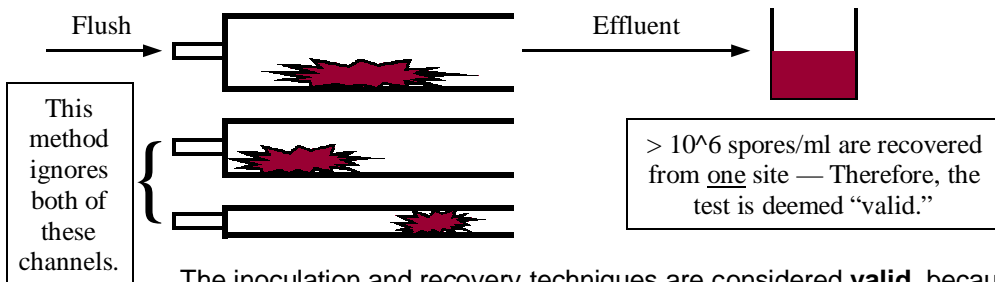
Custom Ultrasonics, Inc.
Director, Research and Development
Chief, Infection Control
144 Railroad Drive
Ivyland, PA 18974
T: 215-364-8577; Fax: 561-258-8051
editor@myendosite.com
<http://www.myendosite.com>

ASTM standards E1766-95 and E1837-96: A single site simulated in-use method

STEP 1: INOCULATION: By way of example, contaminate each of 3 internal channels of a flexible endoscope with resistant bacterial endospores:



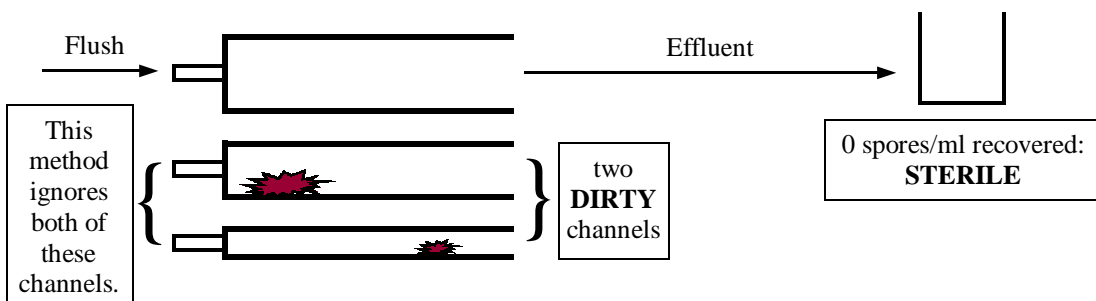
STEP 2: RECOVERY CONTROLS: After inoculation and without subjecting the control endoscope to the sterilization process, sample one of the endoscope's channels, to see if this test is valid:



The inoculation and recovery techniques are considered **valid**, because at least 10⁶ spores/milliliter (ml) were recovered from one channel (the widest channel in this example)—that is, at least 10⁶ spores/ml were recovered **per instrument (or device)**, satisfying ASTM's criterion.

STEP 3: STERILIZATION: After having validated the effectiveness of the inoculation and recovery techniques using controls (step 2, above), re-contaminate each of the endoscope's channels and expose them to a potent sterilant capable of destroying spores.

STEP 4: RECOVERY: After sterilization, sample one of the endoscope's channels.

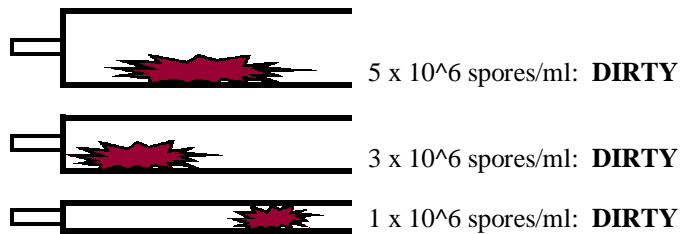


STEP 5: ANALYSIS: In accordance with ASTM's **per instrument** requirement, the test is deemed valid, the endoscope is declared to be “**sterile**,” and the sterilization process is said to be **effective**. *But is this result correct?*

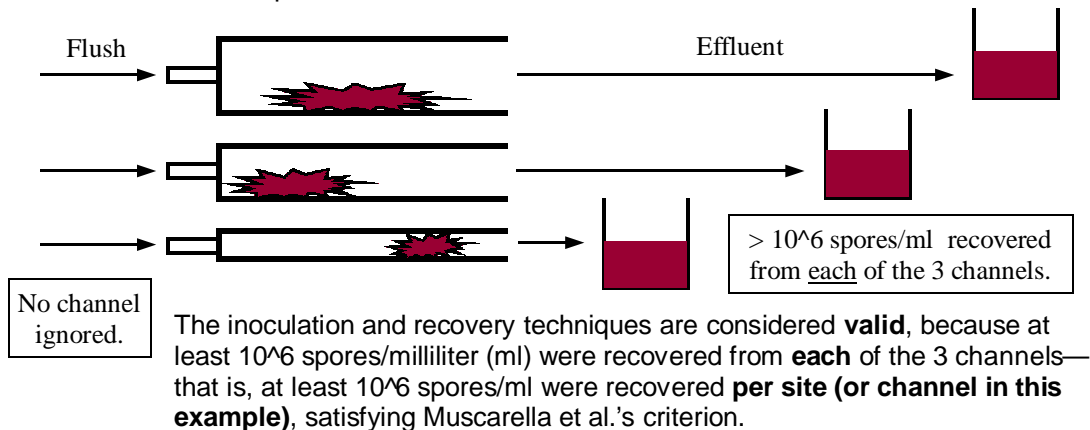
This is a **false-negative** result, because the endoscope is not sterile—only its widest channel is sterile. The endoscope's other two channels remain contaminated. This example displays how ASTM's standards for sterilization, disinfection (and cleaning) are **flawed**, yielding **incorrect** results.

Muscarella et al.'s patented protocol: A multiple site simulated in-use method

STEP 1: INOCULATION: By way of example, contaminate each of 3 internal channels of a flexible endoscope with resistant bacterial endospores:

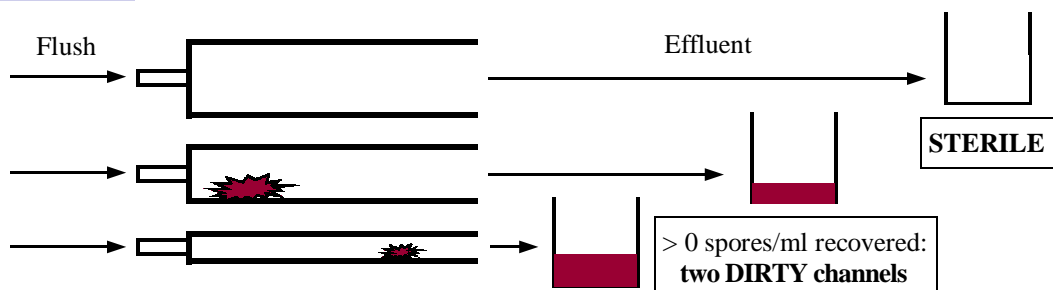


STEP 2: RECOVERY CONTROLS: After inoculation and without subjecting the control endoscope to the sterilization process, sample each of the endoscope's 3 channels, to see if the test is valid:



STEP 3: STERILIZATION: After having validated the effectiveness of the inoculation and recovery techniques using controls (step 2, above), re-contaminate each of the endoscope's channels and expose them to a potent sterilant capable of destroying spores.

STEP 4: RECOVERY: After sterilization, sample each of the endoscope's 3 channels.



STEP 5: ANALYSIS: In accordance with Muscarella et al.'s **per site** requirement, the test is deemed valid and the sterilization process is said to be **ineffective**, based on the results of sampling the entire endoscope.

This result is a **true-positive** result—that is, the correct result, because the endoscope is **unsterile**—only one of its channels is sterile. The endoscope's other two channels remain contaminated, rendering the sterilization process **ineffective**. This protocol, unlike ASTMs', yields the correct result.