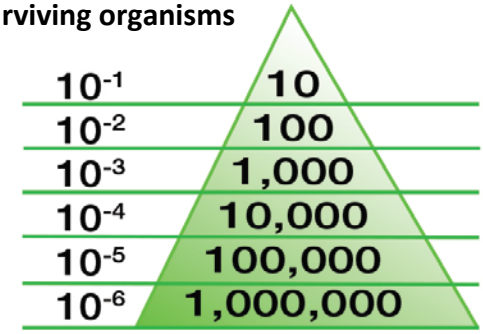
Sterility Assurance Level (SAL) vs. Log Reduction: Understanding the Difference

To assess the effectiveness of any sterilization process, scientists use a unit of measure called sterility assurance level, or SAL. This figure expresses the *probability of a single item* in a batch being *non-sterile* after being subjected to a sterilization process. An effective process has a very low SAL, meaning that there is an extremely small likelihood of any infecting microbes surviving the sterilization.

For example, if a sterilization method has an SAL of 10^{-3}, which means there is a 1 in 1,000 chance of an organism surviving the sterilization process. SAL of 10^{-6} indicates a 1 in 1,000,000 likelihood of an organism surviving to the end of the sterilization process. SAL is used in the sterilization industry because the ultimate goal is to have the lowest probability, or 10^{-6}, of non-sterile units.

- **SAL likelihood of surviving organisms**

10^{-1} = 1:10
10^{-2} = 1:100
10^{-3} = 1:1,000
10^{-4} = 1:10,000
10^{-5} = 1:100,000
10^{-6} = 1:1,000,000



Log reduction does *not* equal SAL

While logarithmic calculations are used to express the above reduction of probability, it's important to understand that SAL is *not* the same measurement as log reduction. While SAL measures the *probability* of organisms surviving the sterilization process, log reduction measurements show the *amount or percentage of live microbes eliminated* after sterilization.

For example, a 3-log reduction means that the number of microbes has been *lowered* by 10^{-3}, or 1,000-fold. So, if a surface begins with 1,000 microbes on it, a 3-log reduction would reduce the number of microorganisms to 1. Log reduction is a risk-based function that also ties in manufacturing, packaging, and other criteria.

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- **Percentage of microbial reduction**

  1 log = 90%
  2 log = 99%
  3 log = 99.9%
  4 log = 99.99%
  5 log = 99.999%
  6 log = 99.9999%

Many consumer disinfection products list the percentage of reduction to help consumers understand which products provide a better disinfection rate. Unfortunately, most consumers do not understand that a disinfection product with a high percentage of reduction could still leave behind a large number of microorganisms. For instance, to say your product kills 99.9% of microbes sounds impressive, but in fact this percentage would still allow for hundreds of thousands of microorganisms to survive.

Sterility Assurance Level (SAL) represents the *probability* of a non-sterile unit surviving sterilization. Log reduction measures the *percentage* of microbes eliminated.

The easiest way to consider the difference is that SAL is the *probability* of there being a non-sterile unit and log reduction is the percentage of microbes *eliminated*. To calculate the probability expressed in SAL, double the log reduction number that represents the amount of microbes killed. In other words, a 6-log reduction translates to an SAL of 10^{-3}. The REVOX room-temperature vaporized peracetic acid (VPA) solution, therefore, provides a theoretical *12-log reduction* with the overkill method of validation, because it achieves an SAL of 10^{-6}, which means there is a one in a million chance of retaining any trace of surviving microbes. The overkill method of validation is how vapor-based sterilization methods are verified to be effective, and it is a key part of the REVOX team's testing process for any product or material.

Practical application

In order to achieve an industry-leading SAL of 10^{-6}, especially for medical devices, it's critical to use a reliable method with an extremely low SAL, such as REVOX VPA, which can achieve a 12-log reduction in microbes. For more information about how the REVOX process works so effectively, please visit the technology section of the REVOX Sterilization Solutions website.

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