STERIS
Life Sciences

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Factors to Consider for a Cleaning and Disinfection Program

An effective cleaning and disinfection program is critical to controlling the bioburden in a cleanroom. Cleaning and disinfection procedures are important elements in the overall cleanroom contamination control program, which is essential to ensuring that drug products meet current standards of safety, purity and efficacy. But what are the factors to consider when designing an effective cleaning and disinfection program?

The following are the important factors to consider.

1) Disinfectant Technologies

   Understanding the various types of sanitizing agents, disinfectants and sporicidal agents in terms of their actives, characteristics and efficacy against various groups of microorganisms is important. Sound understanding will enable the selection of the appropriate disinfection agent which is critical for bioburden control in any cleanroom.

   - Decontaminating or Sanitizing agents are used to reduce residues and potentially the population of microorganisms. They are used on a daily basis to reduce residues or bioburden on inanimate surfaces, and also gloves. Examples of decontaminating or sanitizing agents are 70% ethanol or 70% isopropanol (IPA). Due to the sanitizing agent's mode of action on microorganisms, it may not be effective against the hard to kill microorganisms such as fungal spores and bacteria endospores.
   - Disinfectants are effective against vegetative bacteria, but may not be effective against bacterial and fungal spores. Examples of disinfectants are phenolic disinfectants, or Quarternary Ammonium Compounds (commonly known as Quats).
   - Sporicidal agents (or Sterilants) can be strong oxidizing agents, and are effective against all microorganisms, including bacterial and fungal spores. Sporicidal agents are generally more corrosive as they are often strong oxidizing chemistries. Examples of sporicidal agents include peracetic acid and hydrogen peroxide blends, sodium hypochlorite, peracetic acid, and chlorine dioxide.

2) Rotation Strategy and Frequency of Use

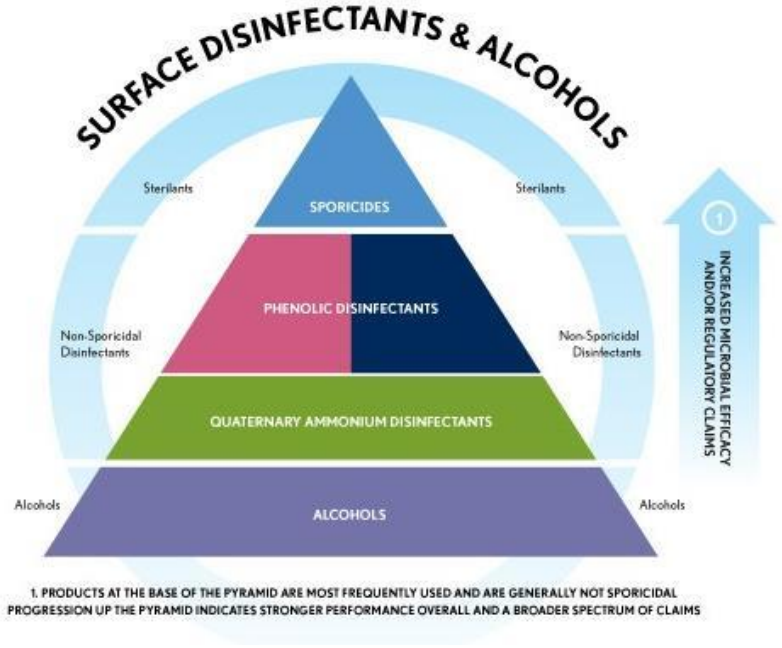
   It is important to include both disinfectants and sporicidal agents in the cleanroom contamination control program. Typically, the program includes daily use of either one disinfectant or rotation between two disinfectants, plus the periodic use of a sporicidal

agent. This is to ensure that the whole spectrum of microorganisms is covered. The frequency of use of sporicidal agents depends on environmental monitoring data and is closely related to the frequency of the isolation of fungal spores, or harder to kill bacterial spores from cleanrooms.

The usage frequency of these various products can be represented by the pyramid diagram shown below. The sporicidal agent is at the top of the pyramid as it is the most powerful biocidal agent that will kill the most difficult to kill bacterial endospores such as *B. sphaericus* and *B. cereus*. Typically, sporicides are not used on a daily basis for room cleaning as most are often strong oxidizing agents and can be more corrosive to cleanroom substrates compared to disinfectants and sanitizers.

Disinfectants such as phenolic or quarternary ammonium compounds are commonly used on a daily basis to reduce the bioburden level in cleanrooms. They are not effective against some hard to kill bacterial and fungal spores but are generally broad spectrum and effective against most microorganisms found in cleanrooms.

Alcohols are used as decontaminating agents or sanitizers on a daily basis to reduce residues or low levels of susceptible bacteria on surfaces, without leaving behind additional residues. While some alcohol products have label claims against bacteria and some viruses, they are not effective against hard to kill bacterial and fungal spores.



3) Rinsing and Residue Removal

All disinfectants and sporicidal agents leave behind some residues on surfaces. The residues could be due to the surfactants or stabilizers in the formulation. If the residues are not removed through regular rinsing, they will accumulate over time and may pose functional and/or aesthetic issues, such as sticky or tacky floors, or visible residue. To

avoid this, it is important to incorporate regular rinsing into the cleaning and disinfection program. So how regularly should we perform rinsing and residue removal? It all depends on the type of cleaning agents and the frequency that they are used. The following are some tell-tale signs that rinsing should be performed:

- The floor becomes sticky and has a tacky feeling.
- Residues are visible on the room and equipment surfaces.
- 'Streaks' are seen on the glass or windows.

Based on the experience from the above criteria, a company can determine the frequency of rinsing.

Another commonly asked question about rinsing is 'How do I perform rinsing?'. Rinsing is typically done by the following:

- ISO 5 cleanrooms – Rinsing is done using sterile Water-For Injection (WFI) to rinse ISO 5 cleanroom surfaces (floors, walls, ceilings). In the case of smaller surfaces such as equipment surfaces, laminar flow hoods or cleanroom furniture, rinsing can also be done by using sterile 70% isopropyl alcohol (IPA) or 70% sterile ethanol, or a sterile cleaner followed by a sterile Water-For Injection (WFI) rinse step.
- ISO 7, ISO 8 and CNC (Controlled but not classified) cleanrooms – Rinsing is done using purified water or Water-For Injection (WFI). In the case of smaller surfaces such as equipment surfaces, laminar flow hoods or cleanroom furniture, rinsing can also be done by using 70% isopropyl alcohol (IPA) or 70% ethanol, or a cleaner followed by a purified water / Water-For Injection (WFI) rinse step

4) Compatibility with cleanroom substrates

It is always prudent for users to perform a substrate compatibility study and risk assessment prior to full implementation of a new disinfectant / sporicidal agent. This is because there are numerous types of cleanroom surfaces and some substrates may not be compatible with the disinfectant / sporicidal agent. The substrate compatibility study can be done using coupons of cleanroom substrates, where disinfectants / sporicidal agents are applied onto the surfaces to replicate the cleanroom usage pattern. Attributes such as visual observation, hardness, and gravimetric weight change can be tested. These studies can prevent unexpected substrate compatibility issues such as discoloration or peeling of the surfaces. Disinfectant suppliers may also have performed substrate compatibility studies on the most common cleanroom surfaces that are made available to end-users.

Controlling bioburden in pharmaceutical, biotech, and medical device cleanrooms is dependent on various factors. These factors include the cleanroom design, environmental conditions, personnel hygiene, gowning, personnel practices / behavior, and commitment to adhere strictly to contamination control procedures. More importantly, selection of suitable products and implementation of robust procedures are critical to ensuring the success of the contamination control program.