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Application of Single-Use Systems in Pharmaceutical Manufacturing

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PDA Application of Single-Use Systems in Pharmaceutical Manufacturing Technical Report Team

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1.0 Introduction

Single-use technology, often described as single-use systems (SUSs) or single-use equipment, has the potential to transform pharmaceutical manufacturing by offering tremendous opportunities to reduce cost, improve flexibility or cycle time, and shorten the time needed to build a manufacturing process for new, lifesaving drugs. This success, however, is very much dependent on how effectively the industry approaches the development and implementation of single-use technology. Ultimately, a new drug can only be successful if it is effective, safe, and available. Traditionally, only a comprehensive understanding of the drug product and manufacturing process can achieve these goals. This remains true as SUS is introduced in place of traditional reusable equipment. Encouraging an open science- and risk-based dialogue during supplier audits and evaluation of SUS supply chains significantly improves an SUS implementation.

This document is intended to provide the reader with critical concepts or points to consider when implementing an SUS strategy in a pharmaceutical manufacturing process. These concepts are intended to be valid both for chemically synthesized small molecules and for bioprocesses that produce large-molecule biopharmaceutical products. However, to be truly effective, many of these critical concepts must start with the design, supply chain, manufacturing, and distribution of SUSs themselves, as many inherent quality attributes can impact either the product molecule or its production process. Pharmaceutical manufacturers and single-use technology suppliers have become partners whose success is dependent on the control strategies implemented.

This document discusses SUSs that are in either direct or indirect contact with the raw materials, intermediates, and pharmaceutical drug substances or drug products. The document does not intend to discuss disposable items related to laboratory activities, final delivery system to the patient, transfusion bags, packaging, or medical devices.

Successful SUS implementation needs a comprehensive approach balancing the product and process goals achieved by using single-use technology. Section 3, Manufacturing Strategy, of this technical report is intended to present an approach that ties together key considerations when evaluating single-use technology. A well-designed manufacturing strategy will address technical, quality, business, and implementation considerations. Each topic has a dedicated section in this technical report, providing a detailed discussion of the associated considerations.

Determining the optimal manufacturing strategy involves concepts from many disciplines. An effective evaluation will have a balanced viewpoint, with input from engineering, regulatory, quality, project management, and accounting. Balancing risks and rewards of an SUS over a multiple-use system (MUS) will help determine the most appropriate manufacturing strategy. Thus, a structured science- and risk-based approach is recommended and should be consistent with principles described in ICH Guidelines Q6, Q7, Q8, Q9, Q10, and Q11. Primary goals, when developing any manufacturing strategy, should focus on controlling impacts to patient safety, product availability, and product and process understanding ***(1–6).***

Only a formal partnership with an SUS supplier can ensure that quality is as good as or better than what is achieved with traditional systems (e.g., a purchase order is not a partnership). SUS suppliers provide equipment that includes the outsourced, value-added activities that the end user no longer performs. These value-added activities are important for the success of both organizations, and a winning control strategy for SUS has elements in both the supplier's and the end user's quality systems.

The concepts and recommendations presented in this technical report were developed over several years of discussion within the task force, at PDA workshops, and at other industry meetings. The authors of this technical report recognize that the conversation regarding how best to implement SUSs is just beginning. Ultimately the success of these systems will be determined by the decisions suppliers and end users make during implementation, and the hope is that this report provides a foundation for the industry to build on.