

Draft Guidance for Industry and FDA Staff

Submission and Review of Sterility Information in Premarket Notification (510(k)) Submissions for Devices Labeled as Sterile

DRAFT GUIDANCE

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**When final, this document will supersede Updated 510(k) Sterility
Review Guidance K90-1, dated August 30, 2002.**



**U.S. Department of Health and Human Services
Food and Drug Administration
Center for Devices and Radiological Health**

Center for Biologics Evaluation and Research

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Preface

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Table of Contents

I.	INTRODUCTION.....	1
A.	BACKGROUND.....	2
	THE LEAST BURDENSOME APPROACH.....	2
B.	SCOPE	3
C.	EXCLUSIONS.....	3
II.	METHODS OF STERILIZATION	4
A.	DEFINITIONS	4
B.	EXAMPLES (AS OF THE DATE OF THIS GUIDANCE)	4
III.	STERILIZATION INFORMATION FOR STERILE DEVICES	5
IV.	REVIEW ROUTING FOR STERILE DEVICES	6

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This draft guidance, when finalized, will represent the Food and Drug Administration's (FDA's) current thinking on this topic. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. You can use an alternative approach if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative approach, contact the FDA staff responsible for implementing this guidance. If you cannot identify the appropriate FDA staff, call the appropriate number listed on the title page of this guidance.

I. Introduction

This draft guidance document updates and clarifies the procedures for reviewing premarket notification submissions (510(k)s) for devices labeled as sterile, particularly with respect to sterilization technologies FDA considers novel, and provides details about the pyrogenicity information that we recommend you include in your 510(k) submissions.¹ This draft guidance document also addresses the information regarding sterilization processes that we recommend you include in 510(k)s for devices labeled as sterile.

This draft guidance document does not apply to sterilizers that are themselves medical devices subject to 510(k).^{2,3} This draft guidance document also does not address 510(k) submissions for reusable medical devices that are reprocessed in health care settings,⁴ 510(k) submissions for

¹When final, this guidance will supersede “Updated 510(k) Sterility Review Guidance K90-1” (available at <http://www.fda.gov/cdrh/ode/guidance/361.pdf>) issued August 30, 2002, which superseded the Blue Book Memorandum #K90-1, issued on February 12, 1990.

² Ethylene oxide gas sterilizer, 21 CFR 880.6860, dry-heat sterilizer, 880.6870, and steam sterilizer 880.6880.

³ “Guidance on Premarket Notification 510(k) Submissions for Sterilizers Intended for Use in Health Care Facilities,” <http://www.fda.gov/cdrh/ode/hcfsteril.pdf>.

⁴ For devices marketed as “non-sterile intended for sterilization at the health care facility,” FDA recommends the immediate package label and labeling prominently identify the device as non-sterile. ODE scientific reviewers should consult “Labeling Reusable Medical Devices for Reprocessing in Health Care Facilities: FDA Reviewer Guidance” (available at <http://www.fda.gov/cdrh/ode/198.pdf>) for additional labeling recommendations.

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reprocessed single-use devices,⁵ or information to be included in 510(k)s for devices that contain animal tissue.⁶ Finally, FDA notes that the sterilization methods used in manufacturing settings are subject to FDA's Quality System (QS) regulation requirements, 21 CFR Part 820.

FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word *should* in Agency guidances means that something is suggested or recommended, but not required.

The Least Burdensome Approach

This draft guidance document reflects our careful review of what we believe are the relevant issues related to review of devices labeled as sterile (including those regulated by the Center for Biologics Evaluation and Research (CBER)) and what we believe would be the least burdensome way of addressing these issues. If you have comments on whether there is a less burdensome approach, however, please submit your comments as indicated on the cover of this document.

A. Background

In recent years, FDA has received an increased number of 510(k)s for devices labeled as sterile that use **non-traditional** sterilization methods in their manufacture. FDA has experience with some types of **non-traditional** methods of sterilization. We recognize, however, there may be **novel non-traditional** sterilization technologies used in the manufacture of class I and class II devices. (The terms **non-traditional** and **novel non-traditional** are defined in Section II.A. below.)

Under section 513(f)(5) of the Federal Food, Drug, and Cosmetic Act (the act), FDA may not withhold 510(k) clearance for failure to comply with any provision of the act unrelated to a substantial equivalence decision, including failure to comply with Good Manufacturing Practice (GMP),⁷ unless FDA finds that there is a substantial likelihood that failure to comply with the provision “will potentially present a serious risk to human health.” We believe that using **novel non-traditional** sterilization technologies carries a substantial risk of inadequate sterility assurance and that, consequently, devices sterilized using **novel non-traditional technologies** may not comply with GMP. Failure to assure sterility presents a serious risk to human health because of the risk of infection. Therefore, we intend to inspect the manufacturing facility before clearing a 510(k) for a device that is sterilized by a **novel non-traditional** sterilization process. We believe inspecting devices sterilized using novel

⁵ See the guidance entitled, “Medical Device User Fee and Modernization Act of 2002, Validation Data in Premarket Notification Submissions (510(k)s) for Reprocessed Single-Use Medical Devices” available at <http://www.fda.gov/cdrh/ode/guidance/1216.html>.

⁶ FDA intends to issue a separate draft guidance to address the sterilization of human and animal tissue for use in medical devices because this subject matter involves concerns unique to materials from these sources. The branch responsible for the review of your device (the lead review branch) is available to discuss your questions about 510(k)s for devices that contain human or animal tissue.

⁷ The implementing regulations for GMP requirements, section 520(f) of the Federal Food, Drug, and Cosmetic Act, are referred to as Quality System (QS) requirements (see also 21 CFR Part 820).

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non-traditional sterilization technologies will help ensure the safety and effectiveness of these devices and mitigate the risks to human health.

B. Scope

The scope of this guidance is limited to the review of 510(k)s for devices labeled as sterile that are subject to industrial terminal sterilization processes based on microbial inactivation. Examples of these processes include radiation, steam, ethylene oxide (EtO), and new technology sterilization processes.

C. Exclusions

1. Processes that rely on microbial exclusion, rather than microbial inactivation, are outside the scope of this guidance. Examples of microbial exclusion processes include sterilizing filtration methods and aseptic processing, commonly used in pharmaceutical manufacturing. Heparin and saline lock flush solutions, which are regulated as devices,⁸ belong to this category and, therefore, are excluded.
2. Processes intended to sterilize medical devices that incorporate materials of animal origin (i.e., human or animal tissues) are outside the scope of this guidance. We intend to address in a future guidance the processing of these devices and the sterilization methods used (including the use of liquid chemical sterilants). The branch responsible for the review of your device is available to discuss your questions about devices that contain materials of human or animal origin.
3. Processes intended to be used by reprocessors of single-use devices are outside the scope of this document. See “**Medical Device User Fee and Modernization Act of 2002, Validation Data in Premarket Notification Submissions (510(k)s) for Reprocessed Single-Use Medical Devices.**”⁹
4. Information on the cleaning, disinfecting, and sterilizing of reusable devices that are reprocessed at healthcare facilities (and for single-use devices that are provided non-sterile for further sterilization at healthcare facilities) are outside the scope of this document. Please refer to “**Labeling Reusable Medical Devices for Reprocessing in Health Care Facilities: FDA Reviewer Guidance.**”¹⁰

⁸ “Heparin Catheter Lock-Flush Solutions; Transfer of Primary Responsibility from Center for Drug Evaluation and Research to Center for Devices and Radiological Health.” 71 FR 47499, August 17, 2006.

⁹ <http://www.fda.gov/cdrh/ode/guidance/1216.html>.

¹⁰ <http://www.fda.gov/cdrh/ode/198.pdf>.

II. Methods of Sterilization

A. Definitions

FDA recognizes three categories of sterilization methods currently used to sterilize medical devices in manufacturing settings – **Traditional, Non-traditional, and Novel Non-traditional**. These processes are defined as:

1. **Traditional Sterilization Methods:** methods that have a long history of safe and effective use as demonstrated by ample literature, clearances of 510(k)s or approvals of premarket approval applications, and satisfactory QS inspections, and for which there are voluntary consensus standards for validation that are recognized by FDA.
2. **Non-traditional Sterilization Methods:** methods that do not have a long history of safe and effective use and for which there are no FDA-recognized standards, but for which published information on validation of these methods exists and for which FDA has previously evaluated data as part of a QS evaluation and determined the methods to be adequate.
3. **Novel Non-traditional Sterilization Methods:** newly developed methods for which there are no FDA recognized standards, there is no FDA inspectional history, or there is little or no published information on validation, and for which there is no history of comprehensive FDA evaluation of sterilization validation data. A **Novel Non-traditional Sterilization Method** is also a method that has not been evaluated by FDA as part of a QS evaluation and that employs sterilization methods that FDA has not reviewed and determined to be adequate to provide reasonable assurance of safe and effective use.

B. Examples of Sterilization Methods (as of the date of this guidance)

1. **Traditional**
 - a. Dry Heat
 - b. Ethylene Oxide (EtO) with devices in a fixed chamber
 - c. Moist Heat or Steam
 - d. Radiation (e.g., gamma, electron beam)
2. **Non-traditional**
 - a. Hydrogen Peroxide (H₂O₂) Gas Plasma
 - b. Ozone (O₃)
3. **Novel non-traditional**
 - a. Chlorine Dioxide (ClO₂)
 - b. Ethylene Oxide-in-a-Bag (EtO-in-a-Bag, Diffusion method, or Injection method)
This method differs from **traditional** EtO methods in that Ethylene Oxide-in-a-Bag specifies a volume of EtO instead of a concentration (e.g., 7.2 grains instead of 500-600 mg/L), uses an EtO cartridge or capsule, uses humidichips, or uses a long gas dwell time (e.g., greater than 8 hours).
 - c. High Intensity Light or Pulse Light
 - d. Microwave Radiation

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- e. Sound Waves
- f. Ultraviolet Light
- g. Vaporized Chemical Sterilant Systems (e.g., hydrogen peroxide or peracetic acid).

III. Sterilization Information for Devices Labeled as Sterile

A. ODE and CBER scientific reviewers should evaluate **traditional** sterilization methods submitted in 510(k)s for the following information. ODE and CBER scientific reviewers should also document that this information was provided.

1. For the sterilant, the reviewer should document the following:
 - a. a description of the sterilization method;
 - b. in the case of radiation sterilization, the radiation dose; and
 - c. the maximum levels of sterilant residuals that remain on the device, and an explanation of why those levels are acceptable for the device type and the expected duration of patient contact.

In the case of EtO sterilization, CDRH has accepted EtO residuals information based on the recognized standard, “ANSI/AAMI/ISO 10993-7:1995 Biological Evaluation of Medical Devices – Part 7: Ethylene Oxide Sterilization Residuals.”

2. For the sterilization method, the reviewer should document a description of the method used to validate the sterilization cycle (e.g., the half-cycle method) but not the validation data itself. The submission should also identify all relevant consensus standards used and aspects of the standards that were not met.
3. The reviewer should document the sterility assurance level (SAL) of 10^{-6} for devices labeled sterile unless the device is intended only for contact with intact skin. FDA recommends a SAL of 10^{-3} for devices intended only for contact with intact skin.
4. The reviewer should document the testing performed to demonstrate that all blood contacting devices, permanent implants, devices that contact cerebrospinal fluid, and devices labeled pyrogen free or non-pyrogenic are, in fact, non-pyrogenic. The documentation should include the following:
 - a. a description of the method used to make the determination, e.g., bacterial endotoxins test (BET), also known as the *limulus* amoebocyte lysate (LAL) test;
 - b. identification of the testing endpoint that was reached; and

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- c. an explanation supporting the selected endpoint. We recommend the following endotoxin endpoint: 0.5 EU/ml for general medical devices (e.g., blood contacting) and 0.06 EU/ml for devices that contact cerebrospinal fluid. These endpoints assume an extraction methodology described in the guidance or standards listed below (i.e., based on a 40 ml extraction volume per device). See:
 - FDA “Guideline on Validation of the Limulus Amebocyte Lysate Test as an End Product Endotoxin Test for Human and Animal Parenteral Drugs, Biological Products, and Medical Devices” (1987)¹¹
 - United States Pharmacopeia (USP) <85> Bacterial Endotoxins Test
 - ANSI/AAMI ST72:2002 Bacterial endotoxins—Test methodologies, routine monitoring, and alternatives to batch testing
5. The reviewer should document a description of the packaging and how it will maintain the device’s sterility, and a description of the package test methods, but not package test data.¹²
- B. ODE and CBER scientific reviewers should evaluate **non-traditional** sterilization methods in 510(k)s and document the information submitted following the recommendations above for **traditional** sterilization methods.
- C. ODE scientific reviewers should refer **novel non-traditional** sterilization methods in 510(k)s to the Infection Control Devices Branch (INCB) for sterility consultation review. INCB should, in coordination with the Lead Review branch, send any requests for clarification or additional data to the Office of Compliance to enable the Agency to fully characterize and assess the method described in the 510(k). CBER lead reviewers should ask for a sterility consultation review from the appropriate CBER and/or CDRH offices.

IV. Review Routing for Sterile Devices

- A. In order to maintain consistency in our approach to sterility review in 510(k) submissions, the 510(k) should be reviewed in accordance with the following procedures. A summary table is provided below in section B.
 1. The Lead Reviewer should follow the recommendations in **Section III. Sterilization Information for Sterile Devices** for reviewing information in a 510(k) for a device intended to be subjected to **traditional** Sterilization Methods.
 2. The Lead Reviewer should follow the recommendations in **Section III. Sterilization Information for Sterile Devices** when reviewing information in a 510(k) submission for a device intended to be subjected to **non-traditional** sterilization methods. Additionally, the Lead Reviewer should notify the appropriate Division of

¹¹ <http://www.fda.gov/cder/guidance/old005fn.pdf>.

¹² Package test methods should include simulated distribution followed by one whole package integrity test and one seal strength test.

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Enforcement Branch Chief within the CDRH Office of Compliance that a 510(k) for a device using a **non-traditional** sterilization method has been submitted. The notification should also request that Office of Compliance consider a priority QS “Post-Clearance Inspection” after FDA clears the 510(k). For CBER-led reviews, the Lead Reviewer should consult with the CBER Office of Compliance and Biologics Quality (OCBQ), Division of Inspection Surveillance (DIS) on any requests for Post-Clearance inspections.

3. The Lead Reviewer (with the concurrence of his or her Branch Chief) should forward the information in a 510(k) for a device intended to be subjected to what appears to be a **novel non-traditional** sterilization method to the Branch Chief, INCB, with a formal request for a comprehensive sterility consultation review. Upon receiving the request, the Branch Chief, INCB, and Division Director, Division of Anesthesiology, General Hospital, Infection Control, and Dental Devices, along with the referring ODE Division Director (i.e., the lead review division), should work with the ODE Deputy Director for Science and Review Policy to decide whether the sterilization method is a **novel non-traditional** sterilization method as defined in this guidance. The CBER lead reviewer should consult with appropriate CBER and/or CDRH offices depending on the scientific expertise required to evaluate whether the sterilization method is a novel non-traditional method as defined in this guidance.

If CDRH believes the sterilization method is a **novel non-traditional** method, INCB should initiate a review. At the same time, and in coordination with the Lead Reviewer of the reviewing Division, INCB should notify the appropriate Division of Enforcement Branch Chief within CDRH Office of Compliance that a 510(k) for a device sterilized using a **novel non-traditional** method has been received.

The notice should include a formal request that CDRH Office of Compliance initiate a priority QS “Pre-Clearance Inspection” prior to the clearance of the 510(k). The ODE request for a directed inspection may include instructions to collect specific data for evaluation, as recommended by INCB. For CBER-led reviews, the lead reviewer should consult with CBER OCBQ / DIS on any requests for inspections.

Throughout the review process, INCB will be available to provide technical expertise to the Office of Compliance and the Office of Regulatory Affairs. After FDA issues a 510(k) clearance letter, the Lead Reviewer should notify the Branch Chief, INCB, and the Office of Compliance that FDA has cleared a 510(k) with a newly validated **novel non-traditional** sterilization method. The Branch Chief, INCB, should inform the ODE review staff that FDA now considers the newly validated **novel non-traditional** sterilization method to be a **non-traditional** sterilization method. From that point on, ODE should review new 510(k)s for devices that use the sterilization method following the recommendations in **Section IV. Review Routing for Sterile Devices** subsection A. 2. above. For very unique and/or difficult to validate sterilization procedures, FDA may request that more than

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one device using the new method be cleared before considering the novel non-traditional sterilization method a non-traditional sterilization method.

B. Summary Table: Recommended Review Routing.¹³

Sterilization Method	INCB Consult	QS Inspection
Traditional	No	Routine Post-Market
Non-traditional	No	“Priority” Post-Clearance
Novel non-traditional	Yes	“Priority” Pre-Clearance

C. INCB is available to provide technical consultation to the CDRH Office of Compliance, and the Office of Regulatory Affairs on both **non-traditional** and **novel non-traditional** sterilization methods.

¹³ This recommended procedure is specific for CDRH. CBER has similar review routing procedures that are specific to the offices responsible for various aspects of 510(k)s reviews. Any questions regarding CBER’s review routing procedures should be directed to the relevant product offices.