disinfection or sterilization, final rinsing after disinfection or liquid chemical sterilization, and post-process handling). The instructions should be written in simple language to the greatest extent possible. They should also be sufficiently detailed to explain the correct procedures for all steps. Charts, diagrams and/or device reprocessing instructions with pictures that can be posted in work stations, are helpful in ensuring adherence to reprocessing instructions. Web-posted pictures/diagrams of devices can also be helpful in answering user questions directly or through customer service representatives.

Where applicable, instructions may include technique diagrams or other graphic representations designed to communicate recommended practices. However, any graphics should be accompanied by explanatory text. The instructions should be validated to ensure that users will be able to understand and to follow them.

VII. Validation of Reprocessing Methods in Accordance with the Quality System Regulation

For class II and class III devices and select class I devices, manufacturers must establish and maintain procedures for validating the design of their device, which shall ensure that the device conforms to defined user needs and intended uses. 21 CFR 820.30(g). Manufacturers must also establish and maintain procedures for monitoring and control of process parameters for validated processes to ensure that the specified requirements continue to be met, 21 CFR 820.75(b). Establishing procedures includes implementation. 21 CFR 820.3(k). FDA interprets these regulations to require manufacturers to validate the design, including reprocessing instructions, of reusable devices to ensure that the device can be effectively reprocessed and safely reused over its use life, as intended. Please note that exemption from 510(k) does not mean a device is exempt from compliance with labeling or Quality System (QS) requirements. Some devices are specifically exempted by regulation from most QS requirements. Manufacturers should refer to applicable regulations for their specific device type to determine what QS requirements apply.

It is possible that similarities in design, materials, and other factors may allow for establishing product families (e.g., devices with a range of available sizes) for the purpose of minimizing reprocessing validation efforts. That is, it may be possible to establish that validation data for the most difficult to reprocess devices in a family (i.e., the worst case device or "master device") covers devices that present an equivalent or lesser reprocessing challenge. If this method is utilized, all design features of the less difficult to reprocess devices in a family, such as lumen length and diameter, materials, configuration, and texture relevant to reprocessing challenges of the subject device should be evaluated and assured to be less challenging to reprocessing than the master device. Any changes in design or materials that could affect sterilant penetration or potency may result in a need to revalidate. If a master device is used, supporting information for the justification should be well documented.

For devices that are subject to design controls under 21 CFR 820.30, the device design, including its labeling (e.g., reprocessing instructions) is to be validated to ensure that the device conforms to defined user needs and intended uses and shall include testing of production units under actual or simulated use conditions. The human factors methods used should ensure that the

characteristics of the user population and operating environment are considered, in accordance with 21 CFR 820.30(g). See Section V.C. of this guidance for more information about human factors in developing reprocessing instructions.

Cleaning, disinfection and sterilization processes should be validated to provide a high degree of assurance that a device will consistently meet predetermined specifications, in accordance with 21 CFR 820.75.

VIII. Validation of Cleaning Process

This section describes FDA's recommendations on how to comply with the QS requirements discussed in the previous section regarding the validation of processes designed to clean reusable medical devices. Although many FDA-recognized consensus standards related to medical device sterilization are available, limited standards or guidances are currently available regarding cleaning of medical devices.

You should conduct validation activities to demonstrate: 1) that your methods (manual or mechanical) are adequate to allow the device to undergo further processing and to eventually be reused safely; and 2) that your reprocessing instructions are effective in conveying the proper reprocessing methods to the user.

A. Validation of the Cleaning Process Using Worst-Case Testing

You should validate the cleaning process you provide in your labeling. Your validation activities should be based on comprehensive validation protocols that use soils that are relevant to the clinical use conditions of the device. These should include the worst-case (least rigorous) implementation of the cleaning process, medical devices that represent the worst-case (most challenging to reprocess and most contaminated), and at least two quantitative test methods that are related to the clinically relevant soil. The cleaning process validation protocols should specify predetermined cleaning test endpoints. These protocols should be designed to establish that the most inaccessible locations on your devices can be adequately cleaned during routine processing.

For all testing, you should choose a justifiable number of replicate samples to support the validity of any instructions based on the tests being performed.

1. Artificial Soil, Inoculation Sites, and Simulated Use

Implementation of a well-established, simulated use test protocol should be an integral part of reprocessing validation.

a. Artificial Soil

The manufacturer should select an artificial test soil, the composition of which accurately represents materials that the device would likely be exposed to during

an actual clinical use, and would create the greatest (worst-case) challenge to the cleaning process. For example, a laryngoscope is intended to provide visualization of the larynx as part of a medical procedure, including facilitation of tracheal intubation, cardiopulmonary resuscitation, and surgery in this anatomical location. A laryngoscope would likely be exposed to both blood and mucus. Therefore, to simulate a worst case cleaning challenge, the artificial test soil should be a multi-component soil that includes substances that simulate both blood and mucus. Note that conducting separate cleaning validations for blood and mucus individually would not be representative of a worst case challenge, because the mixture of blood and mucus is more difficult to clean.

The artificial test soil chosen should allow at least two clinically relevant soil components to be quantified for validation testing (e.g., total organic carbon, protein).

FDA does not recommend the use of spore (or any other microbial marker) log reduction testing as a method to determine the effectiveness of the cleaning method. Currently, there is lack of adequate scientific evidence regarding whether or not the removal of bacterial spores directly correlates to the removal of clinical organic soil from the devices. Such testing only indicates how well a process reduces spore count and provides no information on any other component of organic soil.

b. Inoculation Sites

Soil inoculations should mimic worst-case clinical use conditions. We recommend you use the artificial soil to inoculate the device in all locations likely to contact patient materials, including all locations that are difficult to clean.

c. Simulated Use Conditions

Simulated use conditions for the validation studies should be considered, especially for devices with features at risk for the accumulation of soil with repeated use. In such cases, your validation studies should use devices that have undergone some simulated use. Your validation studies should incorporate multiple full use cycles and should be designed to assess the accumulation of soil over time. The number of simulated use cycles that you use should be scientifically justified.

If the device is powered or becomes hot during clinical use, these situations should be replicated during simulated use testing. Examples of such devices include powered hand-pieces and electrosurgical instruments.

Simulated use conditions should account for real-world use conditions to mimic worst-case clinical use (e.g., the worst-case duration of clinical exposure). You should also conduct all functional procedures (repeated articulations, flexures,

manipulations) for which the device is intended in order to soil the device sufficiently to represent worst-case conditions.

If the device is likely to be repeatedly subjected to "pushing" soil into a hard to reach area during use, validation soiling should include repeated soiling to adequately reproduce such a "worst-case" use situation. If after clinical use of the device, drying of soil might occur and cleaning might not be performed immediately after use (such as with loaner devices that will be shipped without adequate reprocessing), the validation methods should allow soils to dry for a length of time that simulates worst-case (longest duration). The control devices should be prepared and processed in exactly the same manner as the test devices; positive control devices should be soiled and negative control devices should not be soiled.

2. Validation Protocols: Documentation of Methods Designed to Test the Cleaning Process

Validation protocols should support the cleaning instructions provided in your device labeling; they should be detailed and specific with respect to the parameters such as time, temperature and concentrations.

The cleaning validation protocols should use the shortest times, lowest temperatures, weakest dilutions, etc., for each step of the cleaning instructions. You should perform a detailed, side-by-side comparison of the text of the cleaning instructions and the text of the validation protocols, to identify and account for all worst-case processing conditions.

Examples of worst-case processing conditions:

- If the cleaning instructions recommend a 10 to 20 minute pre-soak, the validation protocols should specify 10 minutes.
- If the cleaning instructions advise the user to manually clean at 45°C ± 5°C, the validation protocols should specify cleaning at 40°C.
- Enzymatic Detergents: In general, "worst-case" implies shortest times, lowest temperatures, etc. An exception to validation at lowest temperature would be enzymatic detergents, which typically have "optimally effective" temperature ranges. Validation protocols should adequately address the temperature range specified in the cleaning instructions for enzymatic detergents.
- Medical Washers/Disinfectors: If your process validation uses automated medical washers/washer disinfectors or ultrasonic cleaners, your worst-case should include the extremes of the intended cycle parameters for the available washer/washer disinfector cycles or ultrasonic cleaners.
- If a device consists of lumens, ports, or channels that must be flushed during cleaning, the validation protocol should include minimal flushing specifications, such as time, flush volume or flow rate, and number of repetitions (e.g., 10 mL flush, performed 3 times).

3. Testing: Test Types and Protocols

a. Choice of Test Types

FDA recommends that you use at least two quantitative test methods capable of directly measuring clinically meaningful levels of clinically relevant soil to meet a relevant, predetermined cleaning endpoint. Many potential test methods exist for the evaluation of soil and contamination, and the effectiveness of cleaning processes. The AAMI TIR 30 "A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices" provides a summary of test methods available in the published literature.

When choosing a test method, consideration should be given to a number of factors. These should include, but may not be limited to, the contaminants that the device is expected to come in contact with during actual clinical use (which should be adequately represented in the artificial soil), the test specificity for direct measurement of those constituents, and the sensitivity of the test methods in relation to the proposed cleaning endpoints.

Regardless of the test type you choose, visual inspection of both external and internal surfaces should be performed during validation.

You should provide a justification for the test types chosen, including any relevant documentation (e.g., FDA-recognized standard, published literature, instructions for use for a commercially-available assay). If your chosen test method deviates in any way from what is described in the provided documentation, then you should identify and justify each deviation.

b. Methods Validation

You should validate the test methods you choose to measure residual soil. Your documentation of the method should include analytical sensitivity and specificity information, as well as predetermined cleaning endpoints, and should describe appropriate controls.

The Agency recommends that your test method include the following controls:

- Negative device control – The device should be unsoiled and undergo the same cleaning and extraction as test devices. The amount of residual soil should be at or slightly above the negative sample control.
- Positive device control – The device should be soiled with a known amount of soil, but not cleaned, and residual soil extracted. The amount of residual soil should be equivalent to or slightly lower than the amount of soil placed. Soil recovery efficiencies should be calculated and used during the calculations.

- Negative sample control – "Extraction" is conducted with no device. This sample is used as a blank.
- Positive sample control – A known amount of soil (at or slightly above the limit of quantitation) is added to an "extraction" with no device. This control addresses interference of the extraction fluid and extraction method with soil detection.

c. Extraction Method

Devices should be subjected to a validated method of extraction for recovery of residual soil. The extraction method should be completely described for each device and its recovery efficiency should be determined as part of its validation.

Exhaustive extraction and extraction using a known quantity of soil are commonly used methods for determining recovery efficiency. Extraction should sample all surfaces, including internal surfaces (such as lumens) and mated surfaces. The worst case challenge (most difficult to remove) components of the soil should be addressed in the determination of recovery efficiency testing. You should ensure that the extraction volume used to remove test soil from the device is not so large that the test marker is diluted below the level of detection for the assay.

Some device designs include more complex internal structures (e.g., lumens, internal moving parts) that may become soiled during use, but are difficult to access during cleaning and extraction. Hence, cleaning methods, including disassembly, should be designed to access these surfaces. For such geometrically complex devices, all relevant internal surface areas should be sampled during both the extraction method validation and device cleaning validation. Thus, for validation studies, additional disassembly processes may be required in order to adequately extract residual soil from these difficult to access areas. This additional disassembly should rarely require disassembly beyond the basic elemental component units, or require their actual physical destruction.

For devices with internal compartments that are not intended to come in contact with clinical soil and fluids, you should demonstrate that cleaning solutions, rinse water and/or patient materials will not penetrate into the internal aspects of the devices via incomplete seals, seams, or other internal-external contiguous air spaces.

If you determine that there is a risk of clinical soil or cleaning fluid ingress, you should demonstrate that the cleaning methods meet the cleaning endpoints for all internal surfaces that become contaminated at any time during the device's use life.

B. Resources for Establishing Simulated Use Protocols

FDA recommends the use of worst-case simulated use protocols throughout the validation of the cleaning process. Where applicable, clinicians should be consulted to determine the extent and nature of real-world, worst-case device contamination. Also, practicality and human factors issues should be considered when establishing your reprocessing protocols.

In addition, it may be helpful to refer to the AAMI TIR 30 "A compendium of processes, materials, test methods, and acceptance criteria for cleaning reusable medical devices," for additional information specifically regarding soils and soil recipes described in the published literature.

IX. Validation of the Final Microbicidal Process to Prepare the Device for the Next Patient

A. Disinfection

FDA recommends that you validate your disinfection processes and instructions. FDA also recommends that you follow the recommendations in device-specific FDA guidance documents or any relevant FDA-recognized standards.

B. Sterilization

FDA recommends that you validate as well as provide in your labeling, sterilization cycle specifications that are consistent with the conventional parameters presented in Appendix C. This is to ensure that your device is compatible with the necessary FDA-cleared reprocessing equipment, and the reprocessing instructions are technically feasible for implementation by users. For reusable devices that are intended to be used sterile, labeling should include a sterilization process that you have validated to attain a sterility assurance level (SAL) of 10^{-6} (or 10^{-3}, as appropriate).

Validation data should be generated in FDA-cleared sterilizers and with FDA-cleared sterilization accessories (e.g., biological indicators, physical/chemical sterilization process indicators, sterilization wraps). Alternatively, validation data may be generated in sterilizers that can show equivalent or better control of key sterilization parameters than FDA-cleared sterilizers. If you choose this approach, you should address differences that may exist between the test sterilizer and the FDA-cleared sterilizer.

X. FDA Review of Reprocessing Instructions and Documentation of Reprocessing Method Validation in Submissions

All cleaning, disinfection, and sterilization methods should be validated, and validations should be completed prior to submission of your pre-market submission. Your reprocessing instructions should reflect the validated methods. FDA will review the reprocessing instructions included in

the labeling when we review premarket submissions for reusable medical devices. If the proposed labeling includes reprocessing instructions that do not provide adequate directions for use, FDA will communicate this to the submitter of the premarket submission. In response, the submitter may provide revised labeling or provide a rationale (and any supporting documentation) to explain why the labeling is adequate.

The documentation to be submitted to FDA for the validation of your reprocessing process and instructions will depend upon the type of premarket submission and device type, as described below.

A. Documentation in 510(k)s

Review of Reprocessing Instructions

All 510(k)s must include proposed labels and labeling sufficient to describe the device, its intended use, and the directions for its use. 21 CFR 807.87(e). For a reusable medical device as defined in the scope of this guidance, FDA interprets this to include reprocessing instructions. Validation of the reprocessing instructions should be completed prior to submission of a 510(k).

When evaluating a 510(k), FDA generally compares the labeling for the legally marketed predicate device to the proposed labeling for the new device. A description of FDA's 510(k) decision-making process is described in FDA's guidance The 510(k) Program: Evaluation Substantial Equivalence in Premarket Notifications [510(k)] (http://www.fda.gov/downloads/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/UCM284443.pdf#page=30). As part of this evaluation, differences in proposed labeling, among other product differences, can impact the assessment of whether two devices are substantially equivalent. However, reprocessing instructions for some older, legally-marketed, reusable devices may not be consistent with state-of-the-art science and therefore may not ensure that device is clean, disinfected, or sterile. This may cause those devices to be adulterated under section 501(c) of the FDCA because its purity or quality fall below that which it purports or is represented to possess, or to be misbranded under section 502(f) of the FDCA because its labeling does not bear adequate directions for use or under section 502(j) of the FDCA because it is dangerous to health, among other possible violations. This should be taken into account when preparing reprocessing instructions as part of a 510(k) submission.

Consistent with standard operating procedures for review of premarket submissions, if post-market experience indicates potentially unsafe reprocessing for a particular reprocessing method, FDA may suggest that proposed instructions utilizing such method for a device under review be changed to address the need for improved reprocessing methods to avoid adverse events of the type reported and violations of the type discussed in the preceding paragraph.[5]

[5] SOP: Decision Authority for Additional or Changed Data Needs for Premarket Submissions (http://www.fda.gov/AboutFDA/CentersOffices/OfficeofMedicalProductsandTobacco/CDRH/CDRHReports/ucm279288.htm).

Review of Validation of Reprocessing Instructions

FDA has identified a subset of medical devices that pose a greater likelihood of microbial transmission and represent a high risk of infection (subclinical or clinical) if they are not adequately reprocessed. This identification is based on knowledge gleaned through MDRs; recalls; periodic outbreaks of microbial transmission or patient infection reported in the literature or media; reports provided by the Centers for Disease Control (CDC), the Veterans Administration (VA), and other health care settings; and manufacturer-initiated surveillance studies. These device types are listed in Appendix E. The 510(k)s for these devices should include protocols and complete test reports of the validation of the reprocessing instructions for FDA review, so that FDA has the information it needs to evaluate substantial equivalence.[6] This includes validation of the cleaning instructions as well as the disinfection or sterilization instructions. The reprocessing validation data should demonstrate that the proposed reprocessing instructions will reprocess the subject device at least as well as the reprocessing instructions for the predicate device..

For reusable medical devices not identified in Appendix E, FDA does not expect a complete report of the validation of the reprocessing instructions to be included in a 510(k) submission. FDA staff may request these data, which the manufacturer should have on file in accordance with 21 CFR Part 820, if submission of validation data is recommended in a device-specific guidance or as needed to evaluate substantial equivalence.

B. Documentation in PMAs, HDEs and De Novo Requests

A PMA, HDE or *de novo* request should include the protocols and complete test reports of the validation of the reprocessing instructions in the manufacturing and design section. FDA intends to review the reprocessing validation data in the same manner as the other manufacturing and design data.

C. Documentation in IDEs

An IDE application must include a report of all prior clinical, animal, and laboratory testing of the device as part of the report of prior investigations.[7] We interpret this to include a summary of the validation testing of the reprocessing instructions. Because an approved IDE is not exempt from design controls under 21 CFR 820.30, we recommend that validation of the reprocessing instructions be complete at the time of submission of an IDE.

[6] FDA's submission recommendations and review practices for 510(k)s are described in FDA's guidance "The 510(k) Program: Evaluating Substantial Equivalence in Premarket Notifications [510(k)]." That guidance explains the decision-making process FDA uses to evaluate substantial equivalence, including when submission of data may be necessary.

[7] 21 CFR 812.27 states that the report of prior investigations shall include reports of all prior clinical, animal, and laboratory testing of the device and shall be comprehensive and adequate to justify the proposed investigation.

FDA intends to appropriately consider the extent of the data needed prior to the initiation of clinical studies to document the safety of the recommended reprocessing instructions for the device.

APPENDIX A. Definition of Terms

The following are common terms that may be used in reprocessing instructions in device labeling, some of which are derived from referenced literature.[8, 9, 10, 11, 12, 13] The list is not exhaustive. Some of the terms defined here are derived from other relevant FDA guidances and some terms have been defined here for the purpose of this guidance. Additional definitions of terms can be found in the referenced literature.

Biological Indicator (BI): A test system containing viable microorganisms providing a defined resistance to a specified sterilization process.

Cleaning: Physical removal of soil and contaminants from an item to the extent necessary for further processing or for the intended use.

Design History File (DHF): A compilation of records which describes the design history of a finished device. (21 CFR 820.3(e))

Device Master Record (DMR): A compilation of records containing the procedures and specifications for a finished device. (21 CFR 820.3(j))

Disinfectant: An agent that destroys pathogenic and other kinds of microorganisms by chemical or physical means. A disinfectant destroys most recognized pathogenic microorganisms, but not necessarily all microbial forms, such as bacterial spores.

Disinfection: A process that destroys pathogens and other microorganisms by physical or chemical means. Disinfection processes do not ensure the same margin of safety associated with sterilization processes. The lethality of the disinfection process may vary, depending on the nature of the disinfectant (See Appendix D), which leads to the following subcategories:

a. High Level Disinfection: A lethal process utilizing a sterilant under less than sterilizing conditions. The process kills all forms of microbial life except for large numbers of bacterial spores.

b. Intermediate Level Disinfection: A lethal process utilizing an agent that kills viruses, mycobacteria, fungi and vegetative bacteria, but no bacterial spores.

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[8] Pflug, I.J., Microbiology and Engineering of sterilization Processes, 7th ed. Minneapolis, Environmental sterilization Laboratory. 1990, Chapters 1-3.
[9] Sehulster LM, Chinn RYW, Arduino MJ et al Guidelines for environmental infection control in health care facilities, 2003.
[10] Occupational Safety & Health Administration, available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051.
[11] Association for the Advancement of Medical Instrumentation (AAMI). Sterilization of health care products-Vocabulary. ANSI/AAMI/ISO TIR11139:2006.
[12] Block SS, Definition of Terms In: Block SS, ed. Disinfection, Sterilization and Preservation, 5th ed. Phila: Lippincott Williams & Wilkins 2001:19-28.
[13] Association for the Advancement of Medical Instrumentation (AAMI). Comprehensive guide to steam sterilization and sterility assurance in health care facilities. ANSI/AAMI ST79:2010 & A1:2010.

c. Low Level Disinfection: A lethal process utilizing an agent that kills vegetative forms of bacteria, some fungi, and lipid viruses.

Germicide/Microbicide: An agent that destroys microorganisms, especially pathogenic organisms. Other terms with the suffix *-cide* (e.g., virucide, fungicide, bactericide, sporicide, tuberculocide) indicate an agent that destroys the microorganism identified by the prefix.

Physical/Chemical Sterilization Process Indicator: A physical/chemical sterilization process indicator is a device intended for use by a health care provider to accompany products being sterilized through a sterilization procedure and to monitor one or more parameters of the sterilization process. The adequacy of the sterilization conditions as measured by these parameters is indicated by a visible change in the device. (21 CFR 880.2800(b))

Process Validation: Establishing by objective evidence that a process consistently produces a result or product meeting its predetermined specifications.

Reprocessing: Validated processes used to render a medical device, which has been previously used or contaminated, fit for a subsequent single use. These processes are designed to remove soil and contaminants by cleaning and to inactivate microorganisms by disinfection or sterilization.

Reusable Medical Device: A device intended for repeated use either on the same or different patients, with appropriate cleaning and other reprocessing between uses.

Single-use Device (SUD): A SUD is a device that is intended for one use or on a single patient during a single procedure.[14]

Spore (or Endospore): The dormant state of a microorganism, typically a bacterium or fungus, which exhibits a lack of biosynthetic activity, reduced respiratory activity, and has resistance to heat, radiation, desiccation and various chemical agents.

Sterilant: An agent that destroys all viable forms of microbial life.

Sterile: State of being free from viable microorganisms.

Sterility Assurance Level (SAL): A SAL is the probability of a single viable microorganism occurring on an item after sterilization.

Sterilization: A validated process used to render product free from viable microorganisms.

NOTE: In a sterilization process, the nature of microbial inactivation is described as exponential and, thus, the survival of a microorganism on an individual item can be expressed in terms of probability. While this probability can be reduced to a very low number, it can never be reduced to zero.

[14] Food and Drug Administration (FDA), Reprocessing of Single Use Devices, Definitions, http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/ucm121090.htm (June 18, 2009).

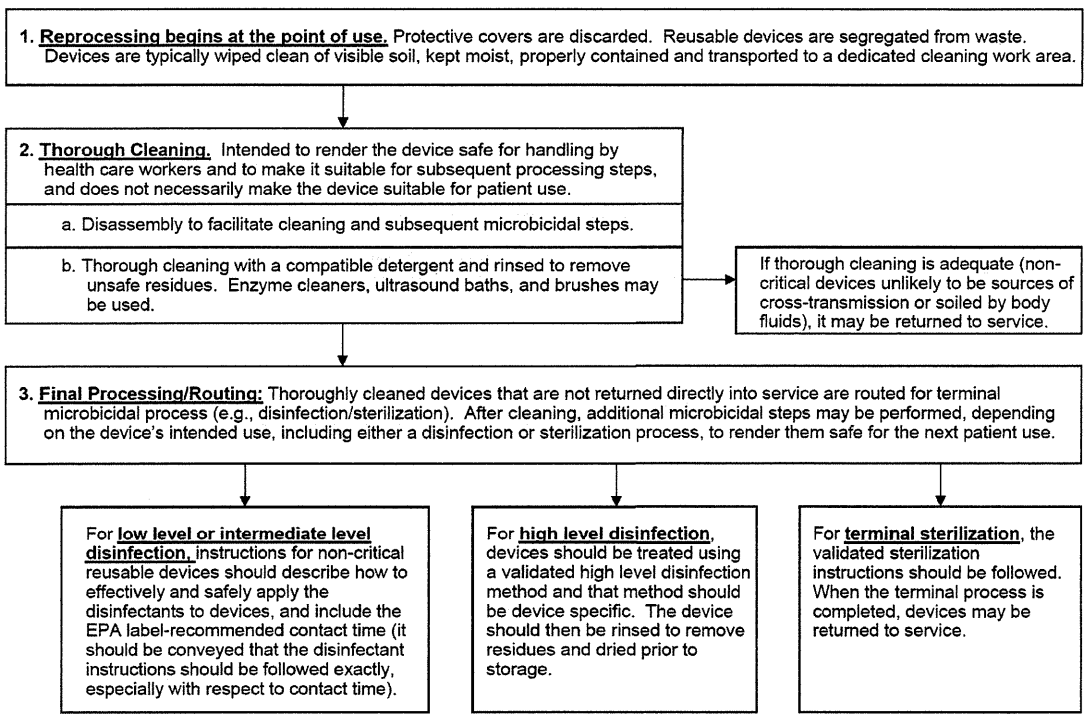
Sterilization Wrap: A sterilization wrap (pack, sterilization wrapper, bag, or accessories) is a device intended to be used to enclose another medical device that is to be sterilized by a health care provider. It is intended to allow sterilization of the enclosed medical device and also to maintain sterility of the enclosed device until used. (21 CFR 880.6850)

APPENDIX B. Overview of Reusable Medical Device Reprocessing

As it is difficult for the health care workers responsible for reprocessing reusable devices to assess the amount and resistance of microbial contamination on the devices to be reprocessed, product labeling, professional practices, and institutional infection control procedures help guide the persons who are responsible for reprocessing devices.

Proper handling and reprocessing of reusable medical devices for the next patient is done by carefully adhering to general reprocessing steps described in the following detailed overview, presented as Figure 2.

FIGURE 2. PROCESS OVERVIEW



We recommend that all reusable medical devices be designed and constructed to allow adequate cleaning, because if a device cannot be adequately cleaned, any subsequent disinfection or sterilization process may not be effective.

Additional information on reprocessing for some specific device types, such as endoscopes and ultrasound transducers, is available from FDA in our database of guidance documents[15] and by consulting specific review divisions.

[15] See http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/default.htm.

APPENDIX C. Examples of Sterilization Cycles Used in Health Care Settings

STEAM STERILIZATION CYCLES

Table 1. Cycle Times for Gravity-Displacement Steam Sterilization Cycles

Item	Exposure Time at 121°C (250°F)	Exposure Time at 132°C (270°F)	Exposure Time at 135°C (275°F)	Minimum Drying Times
Wrapped Instruments	30 minutes	15 minutes		15 - 30 minutes
			10 minutes	30 minutes
Textile Packs	30 minutes	25 minutes		15 minutes
			10 minutes	30 minutes
Wrapped Utensils	30 minutes	15 minutes		15 - 30 minutes
			10 minutes	30 minutes
Nonporous items (e.g., instruments)		3 minutes	3 minutes	0 - 1 minutes
Nonporous and porous items in mixed load		10 minutes	10 minutes	0 - 1 minute

Table 2. Cycle Times for Dynamic-Air-Removal Steam Sterilization Cycles

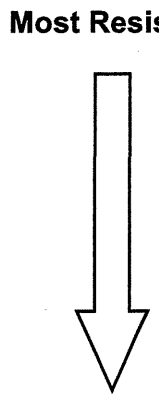
Item	Exposure Time at 132°C (270°F)	Exposure Time at 135°C (275°F)	Minimum Drying Times
Wrapped Instruments	4 minutes		20 - 30 minutes
		3 minutes	16 minutes
Textile Packs	4 minutes		5 - 20 minutes
		3 minutes	3 minutes
Wrapped Utensils	4 minutes		20 minutes
		3 minutes	16 minutes
Nonporous items (e.g., instruments)	3 minutes	3 minutes	N/A
Nonporous and porous items in mixed load	4 minutes	3 minutes	N/A

Tables 1 and 2 modified and reprinted with permission from ANSI/AAMI ST79:2010 & A1:2010 Comprehensive guide to steam sterilization and sterility assurance in health care facilities. Published by the Association for the Advancement of Medical Instrumentation (AAMI). (C) 2012 AAMI www.aami.org.

EO STERILIZATION CYCLES

In general, the most common parameters are EO concentrations from 450 to 1200 milligrams per liter (mg/L), temperatures from 37°C to 63°C (99°F to 145°F), exposure times from 60 to 360 minutes, and chamber humidity from 40% to 80% (ANSI/AAMI ST41:2008 Ethylene oxide sterilization in health care facilities: Safety and effectiveness). Other cycle parameters may be used if available on an FDA-cleared sterilizer.

APPENDIX D. Descending Order of Resistance of Microorganisms to Germicidal Chemicals



Bacterial Spores

Mycobacteria

Nonlipid or Small Viruses

Fungi

Vegetative Bacteria

Lipid or Medium-Size Viruses

Modified from Favero, M.S. and Bond, W.W., Chemical Disinfection of Medical and Surgical Materials. In: Disinfection, Sterilization, and Preservation, 5th Ed Phila: Lippincott Williams & Wilkins 2001: 881-917.

APPENDIX E. Devices for which a 510(k) Should Contain Data to Validate Reprocessing Instructions

The FDA has identified a subset of medical devices that pose a greater likelihood of microbial transmission and represent a high risk of infection (subclinical or clinical) if they are not adequately reprocessed. This identification was based on knowledge gleaned through MDRs; recalls; periodic outbreaks of microbial transmission or patient infections reported in the literature or media; reports provided by the Centers for Disease Control (CDC), the Veterans Administration (VA), and other health care settings; and manufacturer-initiated surveillance studies.

Reprocessing instructions for medical devices should be validated. However, because of the greater risks to the public health posed by the devices listed below, 510(k) submissions for these devices should include protocols and complete test reports of the validation of the reprocessing instructions so that FDA has the information it needs to evaluate substantial equivalence. This includes validation of the cleaning instructions as well as the disinfection or sterilization instructions. The reprocessing validation data should demonstrate that the proposed reprocessing instructions will reprocess the subject device at least as well as the reprocessing instructions for the predicate device. The devices identified by FDA as within this subset are listed as follows:

Bronchoscopes (flexible or rigid) and accessories

Product Code	Device Name	Regulation Number
EOQ	Bronchoscope (flexible or rigid)	21 CFR 874.4680
KTI	Bronchoscope accessory	21 CFR 874.4680
BTG	Brush, biopsy, bronchoscope (non-rigid)	21 CFR 874.4680
JEI	Claw, foreign body, bronchoscope (non-rigid)	21 CFR 874.4680
JEL	Curette, biopsy, bronchoscope (rigid)	21 CFR 874.4680
BST	Curette, biopsy, bronchoscope (non-rigid)	21 CFR 874.4680
BWH	Forceps, biopsy, bronchoscope (non-rigid)	21 CFR 874.4680
JEK	Forceps, biopsy, bronchoscope (rigid)	21 CFR 874.4680
ENZ	Telescope, laryngeal-bronchial	21 CFR 874.4680
KTR	Tube, aspirating, bronchoscope (rigid)	21 CFR 874.4680
JEJ	Tubing, Instrumentation, bronchoscope (brush sheath A/O aspirating)	21 CFR 874.4680

Ear, Nose, and Throat (ENT) endoscopes and accessories

Product Code	Device Name	Regulation Number
EOX	Esophagoscope (flexible or rigid)	21 CFR 874.4710
GCL	Esophagoscope, general & plastic surgery	21 CFR 876.1500
FDW	Esophagoscope, rigid, gastro-urology	21 CFR 876.1500
EOB	Nasopharyngoscope (flexible or rigid)	21 CFR 874.4760
EQN	Laryngoscope, nasopharyngoscope	21 CFR 874.4760
EWY	Mediastinoscope, surgical, and accessories	21 CFR 874.4720

Gastroenterology and Urology Endoscopes* that have elevator channels (not including accessories) [e.g., duodenoscopes used for endoscopic retrograde cholangiopancreatography (ERCP)]

Product Code	Device Name	Regulation Number
FDT	Duodenoscope and accessories, flexible/rigid	21 CFR 876.1500
FAK	Panendoscope (gastroduodenoscope)	21 CFR 876.1500
FTK	Pancreatoscope, biliary	21 CFR 876.1500
ODF	Mini endoscope, gastroenterology-urology	21 CFR 876.1500
FBN	Choledochoscope and accessories, flexible/rigid	21 CFR 876.1500
ODG	Endoscopic ultrasound system, gastroenterology-urology	21 CFR 876.1500

* For endoscopes that fall under the product codes above, 510(k) submissions should include reprocessing validation data for those endoscopes designed with elevator channels.

Automated Endoscope Reprocessors (AERs)

Product Code	Device Name	Regulation Number
FEB	Accessories, cleaning, for endoscopes	21 CFR 876.1500
NZA	Accessories, germicide, cleaning, for endoscopes	21 CFR 876.1500
KOG	Endoscope and/or accessories	21 CFR 876.1500
OUJ	High level disinfection reprocessing instrument for ultrasonic transducers	21 CFR 892.1570

Colonoscopes (not including accessories)

Product Code	Device Name	Regulation Number
FDF	Colonoscope and accessories, flexible/rigid	21 CFR 876.1500
FDA	Enteroscope and accessories	21 CFR 876.1500

Neurological endoscopes (not including accessories)

Product Code	Device Name	Regulation Number
GWG	Endoscope, neurological	21 CFR 882.1480

Arthroscopes and accessories

Product Code	Device Name	Regulation Number
HRX	Arthroscope	21 CFR 888.1100

Laparoscopic instruments and accessories**

Product Code	Device Name	Regulation Number
GCJ	Laparoscope, general & plastic surgery	21 CFR 876.1500
GEI	Electrosurgical, cutting & coagulation & accessories	21 CFR 878.4400

**For laparoscopic instruments and accessories that fall under the product codes above, 510(k) submissions should include reprocessing validation data for those with any of the design features listed in Table 1 below.

Table 1 **510(k) Submissions Should Include Reprocessing Validation Data for Laparoscopic Instruments and Accessories with Any of the Following Design Features**
Lumens (with internal surfaces that are not smooth, have internal ridges or sharp angles, or are too small to permit a brush to pass through)
Hinges
Interior device channels
Sleeves surrounding rods, blades, activators, inserters, etc.
Adjacent device surfaces between which debris can be forced or caught during use
O-rings
Devices with these or other design features that cannot be disassembled for reprocessing
Stopcocks

In the future this list may be updated as additional information regarding reprocessing medical devices becomes available.

欧州１－１　AMDR

MEETING NOTES

Dan Vukelich, President, AMDR

9 a.m. – 10 a.m., February 9, 2016

Berlin, German

Regulated reprocessing of both in-house (hospital) and commercial operations began in Germany in 2002. Regulation is outlined in the *KRINKO*. The German model is different because Germany has chosen to regulate reprocessing as a service rather than as a product/sale. The result is that hospitals are technically allowed to reprocess themselves but the standard is set so high that few are able to do it except for low risk class I devices. As a result, most reprocessing of class II and III devices is done by third-party remanufacturers that meet OEM-like standards.

It is a misunderstanding to think that there shouldn't be regulation for Class I devices. Dirty blood pressure cuffs and stethoscopes can be just as dangerous as a dirty EP catheter. An improperly reprocessed non-invasive device may put patients at risk more than a properly reprocessed invasive devices – creating two different patient safety standards. As a result, it is very important to set standards for how these devices are handled and re-used and AMDR advocates for one standard for all reprocessors regardless of where it takes place.

The U.S. FDA has chosen to regulate re-manufacturing as a product/sale that requires a regulatory premarket submission. Under this style of regulation, the re-manufacturer takes on clear responsibility for the device. In the German model, this is less clear and leaves some room for conflict because if there is a problem with a device, it isn't entirely clear which company carries the responsibility. Aside from Germany, this is the direction of regulation – initiated by the U.S. and also the paradigm for the UK and Canada.

The EU will release its own regulations in June. The EU has decided to follow the manufacturing (FDA-like) model and will regulate re-manufactured devices as products that must be approved by notified bodies. Because Germany is part of the EU, Germany will likely convert to this system once the regulations are set.

Germany's KRINKO requirements doesn't distinguish between "multiple" use or "single-use" devices and doesn't place restrictions on what products can be re-manufactured. Instead, it requires that the re-manufacturers prove that their process is safe for the product that is being re-manufactured. It is left open like this because it is recognized that whether or not something can be re-manufactured depends on the technological development of the underlying device (SUD) as well as the technological development of the technologies used to re-manufacture. Both change over time and there are devices that can be re-manufactured now that couldn't be re-manufactured 10 years ago. This is true in the U.S. as well. In the U.S. there are currently no Class III devices that are re-manufactured but this is because none have applied for approval. It isn't because it is prohibited. EP ablation catheters are re-