DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

21 CFR Part 310


RIN 0910–AF69

Safety and Effectiveness of Health Care Antiseptics; Topical Antimicrobial Drug Products for Over-the-Counter Human Use; Proposed Amendment of the Tentative Final Monograph; Reopening of Administrative Record

AGENCY: Food and Drug Administration, HHS.

ACTION: Proposed rule.

SUMMARY: The Food and Drug Administration (FDA) is issuing this proposed rule to amend the 1994 tentative final monograph or proposed rule (the 1994 TFM) for over-the-counter (OTC) antiseptic drug products. In this proposed rule, we are proposing to establish conditions under which OTC antiseptic products intended for use by health care professionals in a hospital setting or other health care situations outside the hospital are generally recognized as safe and effective. In the 1994 TFM, certain antiseptic active ingredients were proposed as being generally recognized as safe for use in health care settings based on safety data evaluated by FDA as part of its ongoing review of OTC antiseptic drug products. However, in light of more recent scientific developments, we are now proposing that additional safety data are necessary to support the safety of antiseptic active ingredients for these uses. We also are proposing that all health care antiseptic active ingredients have in vitro data characterizing the ingredient’s antimicrobial properties and in vivo clinical simulation studies showing that specified log reductions in the amount of certain bacteria are achieved using the ingredient.

DATES: Submit electronic or written comments by October 28, 2015. See section VIII of this document for the proposed effective date of a final rule based on this proposed rule.

ADDRESSES: You may submit comments by any of the following methods:

Electronic Submissions

Submit electronic comments in the following way:

• Federal eRulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.

Written Submissions

Submit written submissions in the following ways:

• Mail/Hand delivery/Courier (for paper submissions): Division of Dockets Management (HFA–305), Food and Drug Administration, 5630 Fishers Lane, Rm. 1061, Rockville, MD 20852.

Instructions: All submissions received must include the Docket No. FDA–2015–N–0101 (formerly Docket No. FDA–1975–N–0012) and RIN 0910–AF69 for this rulemaking. All comments received may be posted without change to http://www.regulations.gov, including any personal information provided.

Docket: For access to the docket to read background documents or comments received, go to http://www.regulations.gov and insert the docket number, found in brackets in the heading of this document, into the “Search” box and follow the prompts and/or go to the Division of Dockets Management, 5630 Fishers Lane, Rm. 1061, Rockville, MD 20852. Earlier FDA publications, public submissions, and other materials relevant to this rulemaking may also be found under Docket No. FDA–1975–N–0012 (formerly Docket No. 1975N–0183H) using the same procedures.

FOR FURTHER INFORMATION CONTACT:

Michelle M. Jackson, Center for Drug Evaluation and Research, Food and Drug Administration, 10903 New Hampshire Ave., Bldg. 22, Rm. 5411, Silver Spring, MD 20993, 301–796–2090.

SUPPLEMENTARY INFORMATION:

Executive Summary

Purpose of the Regulatory Action

FDA is proposing to amend the 1994 TFM for OTC antiseptic drug products that published in the Federal Register on June 17, 1994 (59 FR 31402). The 1994 TFM is part of FDA’s ongoing rulemaking to evaluate the safety and effectiveness of OTC drug products marketed in the United States on or before May 1972 (OTC Drug Review). FDA is proposing to establish new conditions under which OTC health care antiseptic active ingredients are generally recognized as safe and effective (GRAS/GRAE) based on FDA’s reevaluation of the safety and effectiveness data requirements proposed in the 1994 TFM in light of comments received, input from subsequent public meetings, and our independent evaluation of other relevant scientific information we have identified and placed in the administrative file. These health care antiseptic products include health care personnel hand washes, health care personnel hand rubs, surgical hand scrubs, surgical hand rubs, and patient preoperative skin preparations.

Summary of the Major Provisions of the Regulatory Action in Question

We are proposing that additional safety and effectiveness data are necessary to support a GRAS/GRAE determination for OTC antiseptic active ingredients intended for use by health care professionals. The effectiveness data, the safety data, and the effect on the previously proposed classification of active ingredients are described briefly in this summary.

Effectiveness

A determination that a drug product containing a particular active ingredient would be generally recognized as effective (GRAE) for a particular intended use requires consideration of the benefit-to-risk ratio for the drug for that use. New information on potential risks posed by the use of certain health care antiseptic products, as well as input from the Nonprescription Drugs Advisory Committee (NDAC) that met in March 2005 (the March 2005 NDAC), has prompted us to reevaluate the data needed for classifying health care antiseptic active ingredients as GRAE (see new information described in the Safety section of this summary). We continue to propose the use of surrogate endpoints (bacterial log reductions) as a demonstration of effectiveness for health care antiseptics combined with in vitro testing to characterize antimicrobial activity of the ingredient. However, the log reductions required for the demonstration of effectiveness for health care antiseptics have been revised based on the recommendations of the March 2005 NDAC, comments received after the 1994 TFM, and other information that FDA reviewed.

We have evaluated the available literature and the data and other information that were submitted to the rulemaking on the effectiveness of health care antiseptic active ingredients, as well as the recommendations from the public meetings held by the Agency on antiseptics. We propose that the record should contain additional log reduction data to demonstrate the effectiveness of health care antiseptic active ingredients.

Safety

Several important scientific developments that affect the safety evaluation of these ingredients have occurred since FDA’s 1994 evaluation of the safety of health care antiseptic active ingredients under the OTC Drug
Review. Improved analytical methods now exist that can detect and more accurately measure these active ingredients at lower levels in the bloodstream and tissue. Consequently, we now know that, at least for certain health care antiseptic ingredients, systemic exposure is higher than previously thought (Refs. 1 through 5), and new information is available about the potential risks from systemic absorption and long-term exposure. New safety information also suggests that widespread antiseptic use could have an impact on the development of bacterial resistance. Currently, the significance of this new information is not known and we are unaware of any information that would lead us to conclude that any health care antiseptic active ingredient is unsafe (other than those that we proposed to be Category II in the 1994 TFM). The benefits of any active ingredient will need to be weighed against its risks once both the effectiveness and safety have been better characterized to determine GRAS/GRAE status.

The previously proposed generally recognized as safe (GRAS) determinations were based on safety principles that have since evolved significantly because of advances in technology, development of new test methods, and experience with performing test methods. The standard battery of tests that were used to determine the safety of drugs has changed over time to incorporate improvements in safety testing. To ensure that antiseptic active ingredients are GRAS, data that meet current safety standards are needed.

Based on these developments, we are now proposing that additional safety data are needed for each health care antiseptic active ingredient to support a GRAS classification. The data described in this proposed rule are the minimum data necessary to establish the safety of antiseptic active ingredients used in health care antiseptic products in light of the new safety information. Health care practitioners may use health care antiseptics on a daily, long-term (i.e., chronic) basis. Patient preoperative skin preparations, on the other hand, are not usually used on any single patient on a daily basis. Nevertheless, an individual may be exposed to patient preoperative skin preparations (particularly those used for preinjection skin preparation) enough times over a lifetime to be considered a chronic use. The data we propose are needed to demonstrate safety for all health care antiseptic active ingredients fall into four broad categories: (1) Human safety studies described in current FDA guidance (e.g., maximal use trials or MUsT), (2) nonclinical safety studies described in current FDA guidance (e.g., developmental and reproductive toxicity studies and carcinogenicity studies), (3) data to characterize potential hormonal effects, and (4) data to evaluate the development of antimicrobial resistance.

We emphasize that our proposal for more safety and effectiveness data for health care antiseptic active ingredients does not mean that we believe that health care antiseptic products containing these ingredients are ineffective or unsafe, or that their use should be discontinued. However, now that we have enhanced abilities to measure and evaluate the safety and effectiveness of these ingredients, we believe we should obtain relevant data to support a GRAS/GRAE determination. Consequently, based on new information and improvements in safety testing and in our understanding of log reduction testing and the use of surrogate endpoints since our 1994 evaluation, we are requesting more safety and effectiveness data to ensure that these health care antiseptic active ingredients meet the updated standards to support a GRAS/GRAE classification. Considering the prevalent use of health care antiseptic products in health care settings, it is critical that the safety and effectiveness of these ingredients be supported by data that meet the most current standards.

**Active Ingredients**

In the 1994 TFM, 27 antiseptic active ingredients were classified for three OTC health care antiseptic uses: (1) Patient preoperative skin preparation, (2) health care personnel hand wash, and (3) surgical hand scrub (59 FR 31402 at 31435–31436) (for a list of all active ingredients covered by this proposed rule, see tables 4 through 7). Our detailed evaluation of the effectiveness and safety of the active ingredients for which data were submitted can be found in sections VLA and VILD. In the 1994 TFM, alcohol (60 to 95 percent) and povidone-iodine (5 to 10 percent), which are active ingredients that are being evaluated for use as a health care antiseptic in this proposed rule, were proposed to be classified as GRAS/GRAE (59 FR 31402 at 31435–31436) for patient preoperative skin preparation, health care personnel hand wash, and surgical hand scrub. Iodine tincture, iodine topical solution, and isopropyl alcohol were proposed to be classified as GRAS/GRAE for patient preoperative skin preparations (59 FR 31435–31436). However, we now propose that the health care antiseptic active ingredients classified as GRAS/GRAE for use in health care antiseptics in the 1994 TFM need additional safety and effectiveness data to support a classification of GRAS/GRAE for health care antiseptic use.

Several health care antiseptic active ingredients evaluated in the 1994 TFM were proposed as GRAS, but not GRAE, for use in health care antiseptics because they lacked sufficient evidence of effectiveness for health care use (see tables 4 and 5). We are now proposing that these ingredients need additional safety data, as well as effectiveness data, to be classified as GRAS/GRAE.

The data available and the data that are missing are discussed separately for each active ingredient in this proposed rule. For those ingredients for which no data have been submitted since the 1994 TFM, we have not included a separate discussion section, but have indicated in table 10 that no additional data were submitted or identified.

In certain cases, manufacturers may have the data we propose as necessary in this proposed rule, but to date these data have not been submitted to the OTC Drug Review. Although currently we expect to receive the necessary data, if we do not obtain sufficient data to support monograph conditions for health care antiseptic products containing these active ingredients, these products may not be included in the future OTC health care antiseptic final monograph. Any health care antiseptic product containing the active ingredients being considered under this rulemaking that are not included in a future final monograph could obtain approval to market by submitting new drug applications (NDAs) under section 505 of the Federal Food, Drug, and Cosmetic Act (the FD&C Act) (21 U.S.C. 355). After a final monograph is established, these products might be able to submit NDA deviations in accordance with § 330.11 (21 CFR 330.11), limiting the scope of review necessary to obtain approval.

**Costs and Benefits**

Benefits represent the monetary values associated with reducing the potential adverse health effects associated with the use of health care antiseptic products containing active ingredients that could potentially be shown to be unsafe or ineffective for their intended use. We estimate annual benefits to roughly range between $0 and $0.16 million. Total upfront costs are estimated to range between $64 and $90.8 million. Annualizing these costs over a 10-year period, we estimate total annualized costs to range from $7.3 and $10.4 million at a 3 percent discount
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I. Introduction

In the following sections, we provide a brief description of terminology used in the OTC Drug Review regulations and an overview of OTC topical antiseptic drug products, and then describe in more detail the OTC health care antiseptics that are the subject of this proposed rule.

A. Terminology Used in the OTC Drug Review Regulations

1. Proposed, Tentative Final, and Final Monographs

   To conform to terminology used in the OTC Drug Review regulations ($330.10), the September 1974 advance notice of proposed rulemaking (ANPR) was designated as a “proposed monograph.” Similarly, the notices of proposed rulemaking, which were published in the Federal Register of January 6, 1978 (43 FR 1210) (the 1978 TFM), and in the Federal Register of June 17, 1994 (59 FR 31402) (the 1994 TFM), were each designated as a “tentative final monograph.” The present proposed rule, which is a reproposal regarding health care antiseptic drug products, is also designated as a “tentative final monograph.”

2. Category I, II, and III Classifications

   The OTC drug procedural regulations in §330.10 use the terms “Category I” (generally recognized as safe and effective and not misbranded), “Category II” (not generally recognized as safe and effective or misbranded), and “Category III” (available data are insufficient to classify as safe and effective, and further testing is required). Section 330.10 provides that any testing necessary to resolve the safety or effectiveness issues that formerly resulted in a Category III classification, and submission to FDA of the results of that testing or any other data, must be done during the OTC drug rulemaking process before the establishment of a final monograph (i.e., a final rule or regulation). Therefore, this proposed rule (at the tentative final monograph stage) retains the concepts of Categories I, II, and III.

   At the final monograph stage, FDA does not use the terms “Category I,” “Category II,” and “Category III.” In place of Category I, the term “monograph conditions” is used; in place of Categories II and III, the term “nonmonograph conditions” is used.

B. Topical Antiseptics

   The OTC topical antimicrobial rulemaking has had a broad scope, encompassing drug products that may contain the same active ingredients, but that are labeled and marketed for different intended uses. In 1974, the Agency published an ANPR for topical antimicrobial products that encompassed products for both health care and consumer use (39 FR 33103, September 13, 1974). The ANPR covered seven different intended uses for these products: (1) Antimicrobial soap, (2) health care personnel hand wash, (3) patient preoperative skin preparation, (4) skin antiseptic, (5) skin wound cleanser, (6) skin wound protectant, and (7) surgical hand scrub (39 FR 33103 at 33140). FDA subsequently identified skin antiseptics, skin wound cleansers, and skin wound protectants as antiseptics used primarily by consumers for first aid use and referred to them collectively as “first aid antiseptics.” We published a separate TFM covering the first aid antimicrobials in the Federal Register of July 22, 1991 (56 FR 33844) (1991 First Aid TFM). Thus, first aid antiseptics are not discussed further in this document.

   The four remaining categories of topical antimicrobials were addressed in the 1994 TFM. The 1994 TFM covered: (1) Antiseptic hand wash (i.e., consumer hand wash), (2) health care personnel hand wash, (3) patient preoperative skin preparation, and (4) surgical hand scrub (59 FR 31402 at 31442). In the 1994 TFM, FDA also identified a new category of antiseptics for use by the food industry and requested relevant data and information (59 FR 31402 at 31440). Antiseptics for use by the food industry are not discussed further in this document.

   As we proposed in the consumer antiseptic wash proposed rule published in the Federal Register of December 17, 2013 (78 FR 76444) (the Consumer Wash PR), our evaluation of OTC antiseptic drug products is being further subdivided into health care antiseptics and consumer antiseptics. We believe that these categories are distinct based on the proposed use setting, target population, and the fact...
that each setting presents a different level of risk for infection. For example, in health care settings, the patient population is generally more susceptible to infection than the general U.S. consumer population (i.e., the population who use consumer antiseptic washes). Consequently, in the health care setting, the potential for spread of infection and the potential for serious outcomes of infection may be relatively higher than in the U.S. consumer setting. Therefore, the safety and effectiveness should be evaluated separately for each intended use to support a GRAS/GRAE determination.

Health care antiseptics are drug products intended for use by health care professionals in a hospital setting or other health care situations outside the hospital. Patient preoperative skin preparations, which include products that are used for preparation of the skin prior to an injection (i.e., preinjection), may be used by patients outside the traditional health care setting. Some patients (e.g., diabetics who manage their disease with insulin injections) self-inject medications that have been prescribed by a health care professional at home or at other locations and use patient preoperative skin preparations prior to injection. In 1974, when the ANPR (39 FR 33103) to establish an OTC topical antimicrobial monograph was published in the *Federal Register*, antimicrobial soaps used by consumers were distinct from professional use antiseptics, such as health care personnel hand washes. (See 78 FR 76444 for further discussion of the term “antimicrobial soaps.”) In contrast, in the 1994 TFM, we proposed that both consumer antiseptic hand washes and health care personnel hand washes should have the same effectiveness testing and performance criteria. In response to the 1994 TFM, we received submissions from the public arguing that consumer products serve a different purpose and should continue to be distinct from health care antiseptics. We agree, and in this proposed rule, we make a distinction between consumer antiseptics and the general population and health care antiseptics for use in hospitals or in other specific health care settings outside the hospital.

The health care setting is different from the consumer setting in many ways. Among other things, health care facilities employ frequent, standardized disinfection procedures and stringent infection control measures that include the use of health care antiseptics. The use of these measures is critical to preventing the spread of infection within health care facilities. The population in a hospital or health care facility also is different from the general consumer population. In addition, the microorganisms of concern are different in the health care and consumer settings. These differences have resulted in our proposing different effectiveness data requirements. (See section VI.B. about the different effectiveness data requirements.)

C. This Proposed Rule Covers Only Health Care Antiseptics

We refer to the group of products covered by this proposed rule as “health care antiseptics.” In this proposed rule, FDA proposes the establishment of a monograph for OTC health care antiseptics that are intended for use by health care professionals in a hospital setting or other health care situations outside the hospital, but that are not identified as “first aid antiseptics” in the 1991 First Aid TFM. In this proposed rule, we use the term “health care antiseptics” to include the following products:

- Health care personnel hand washes
- Health care personnel hand rubs
- Surgical hand scrubs
- Surgical hand rubs
- Patient preoperative skin preparations

This proposed rule covers products that are rubs and others that are washes. The 1994 TFM did not distinguish between products that we are now calling “antiseptic washes” and products we are now calling “antiseptic rubs.” Washes are rinsed off with water, and include health care personnel hand washes and surgical hand scrubs. Rubs are sometimes referred to as “leave-on products” and are not rinsed off after use. Rubs include health care personnel hand rubs, surgical hand rubs, and patient preoperative skin preparations.

The 1994 TFM did not distinguish between consumer antiseptic washes and rubs, and health care hand washes and rubs. This proposed rule covers health care personnel hand washes and health care personnel hand rubs, as well as the other health care antiseptic categories previously listed in this section. This proposed rule does not cover consumer antiseptic washes or consumer antiseptic hand rubs.

Completion of the monograph for Health Care Antiseptic Products and certain other monographs for the active ingredient triclosan are subject to a Consent Decree entered by the United States District Court for the Southern District of New York on November 21, 2013, in *Natural Resources Defense Council, Inc. v. United States Food and Drug Administration, et al.*, 10 Civ. 5690 (S.D.N.Y.).

D. Comment Period

Because of the complexity of this proposed rule, we are providing a comment period of 180 days. Moreover, new data or information may be submitted to the docket via [http://www.regulations.gov within 12 months of publication, and comments on any new data or information may then be submitted for an additional 60 days (see § 330.10(a)(7)(iii) and (a)(7)(iv)). In addition, FDA will also consider requests to defer further rulemaking with respect to a specific active ingredient to allow the submission of new safety or effectiveness data to the record if such requests are submitted to the docket within the initial 180-day comment period. Upon the close of the comment period, FDA will review all data and information submitted to the record in conjunction with all timely and complete requests to defer rulemaking. In assessing whether to defer further rulemaking for a particular active ingredient to allow for additional time for studies to generate new data and information, FDA will consider the data already in the docket along with any information that is provided in any requests. FDA will determine whether the sum of the data, if submitted in a timely fashion, is likely to be adequate to provide all the data that are necessary to make a determination of general recognition of safety and effectiveness.

We note that the OTC Drug Review is a public process and any data submitted is public. There is no requirement or expectation that more than one set of data will be submitted to the docket for a particular active ingredient, and it does not matter who submits the data. Additionally, data and other information for a single active ingredient may be submitted by any interested party and not all data for an ingredient must be submitted by a single party.

II. Background

In this section, we describe the significant rulemakings and public meetings relevant to this proposed rule, and how we are responding to comments received in response to the 1994 TFM.

A. Significant Rulemakings Relevant to This Proposed Rule

A summary of the significant *Federal Register* publications relevant to this proposed rule is provided in table 1. Other *Federal Register* publications relevant to this proposed rule are available from the Division of Dockets Management (see ADDRESSES).
In response to the 1994 TFM, FDA received approximately 160 comments from drug manufacturers, trade associations, academia, testing laboratories, consumers, health professionals, and law firms. Copies of the comments received are on public display at http://www.regulations.gov (see ADDRESSES).

Because only health care antiseptics are discussed in this proposed rule, only those comments and data received in response to the 1994 TFM that are related to health care antiseptic active ingredients are addressed. We also received comments related to final formulation testing and labeling conditions proposed in the 1994 TFM. If in the future we determine that there are monograph health care antiseptic active ingredients that are GRAS/GRAE, we will address these comments. We invite further comment on the final formulation testing and labeling conditions proposed in the 1994 TFM, particularly in light of the conditions proposed in this proposed rule. Comments that were received in response to the 1994 TFM regarding other intended uses of the active ingredients are addressed in the Consumer Antiseptic Wash TFM (78 FR 76444), or will be addressed in future documents related to those other uses.

This proposed rule constitutes FDA’s evaluation of submissions made in response to the 1994 TFM to support the safety and effectiveness of OTC health care antiseptic active ingredients (Refs. 11 and 12). We reviewed the available literature and data and other comments submitted to the rulemaking and are proposing that adequate data for a determination of safety and effectiveness are not yet available for the health care antiseptic active ingredients.
eligibility for the OTC Drug Review and the ingredients submitted to the OTC Drug Review that lack adequate evidence of eligibility for evaluation as health care antiseptic products.

A. Eligibility for the OTC Drug Review

An OTC drug is covered by the OTC Drug Review if its conditions of use existed in the OTC drug marketplace on or before May 11, 1972 (37 FR 9464). Conditions of use include, among other things, active ingredient, dosage form and strength, route of administration, and specific OTC use or indication of the product (see § 330.14(a)). To determine eligibility for the OTC Drug Review, FDA typically must have actual product labeling or a facsimile of labeling that documents the conditions of marketing of a product prior to May 1972 (see § 330.10(a)(2)). FDA considers the product labeling or a facsimile of labeling to be the OTC drug monograph system to be a new drug that will require FDA approval through the NDA process. Ineligibility for use as a specific type of health care antiseptic (e.g., health care personnel hand wash or surgical hand scrub) does not affect eligibility for other indications under the health care antiseptic monograph (e.g., patient preoperative skin preparations) or under any other OTC drug monograph.

Section III.B discusses those ingredients that currently do not have adequate evidence of eligibility for evaluation under the OTC Drug Review based on a review of the labeling submitted to the Panel. Some ingredients are ineligible for any of the categories of health care antiseptics. Others are eligible for some, but not others. Because of their lack of eligibility, effectiveness and safety information that has been submitted to the rulemaking for these health care antiseptic active ingredients are not discussed in this proposed rule for such use(s). However, if documentation of the type described in this section is submitted, these active ingredients could be determined to be eligible for evaluation for such use(s).

B. Eligibility of Certain Active Ingredients for Certain Health Care Antiseptic Uses Under the OTC Drug Review

Table 3 lists the health care antiseptic active ingredients that have been considered under this rulemaking and shows whether each ingredient is eligible or ineligible for each of the five health care antiseptic uses: Patient preoperative skin preparation, health care personnel hand wash, health care personnel hand scrub, surgical hand scrub, and surgical hand scrub. After the table, we discuss the ineligibility of ingredients in this section of the proposed rule.

### TABLE 3—ELIGIBILITY OF ANTISEPTIC ACTIVE INGREDIENTS FOR HEALTH CARE ANTISEPTIC USES

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Patient preoperative skin preparation</th>
<th>Health care personnel hand wash</th>
<th>Health care personnel hand scrub</th>
<th>Surgical hand scrub</th>
<th>Surgical hand scrub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol 60 to 95 percent</td>
<td>..................................................</td>
<td>2 Y</td>
<td>3 N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Benzalkonium chloride</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Benzethonium chloride</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<tr>
<td>Chlorhexidine gluconate</td>
<td>..................................................</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Chloroxylenol</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<tr>
<td>Clofucarban</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<tr>
<td>Fluorosalan</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<tr>
<td>Hexylresorcol</td>
<td>..................................................</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
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<tr>
<td>Iodine Active Ingredients:</td>
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<tr>
<td>Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate)</td>
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<tr>
<td>Iodine complex (phosphate ester of alkylaryloxy polyethylene glycol)</td>
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<tr>
<td>Iodine tincture USP</td>
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<td>Iodine topical solution USP</td>
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<td>Nonylphenoxypoly(ethylenoxy) ethanoliodine</td>
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<tr>
<td>Poloxamer-iodine complex</td>
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<tr>
<td>Povidone-iodine 5 to 10 percent</td>
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<tr>
<td>Undecylium chloride iodine complex</td>
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<tr>
<td>Isopropyl alcohol 70–91.3 percent</td>
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<tr>
<td>Mercufenol chloride</td>
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<tr>
<td>Methylbenzethonium chloride</td>
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<tr>
<td>Phenol (less than 1.5 percent)</td>
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<tr>
<td>Phenol (greater than 1.5 percent)</td>
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<tr>
<td>Secondary amyltricresols</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium oxychlorosene</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclocarban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tricosan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combinations:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calomel, oxyquinoline benzoate, triethanolamine, and phenol derivative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercufenol chloride and secondary amyltricresols in 50 percent alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple dye</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1 Hexachlorophene and tribromsalan are not included in this table because they are the subject of final regulatory action (see section IV).
2 Y = Eligible for specified use.
3 N = Ineligible for specified use.

1 Also, note that drugs initially marketed in the United States after the OTC Drug Review began in 1972 and drugs without any U.S. marketing experience can be considered in the OTC monograph system based on submission of a time and extent application. (See § 330.14(c).)
1. Alcohols
   a. Alcohol (ethanol or ethyl alcohol). In the 1994 TFM, alcohol (ethanol or ethyl alcohol) 60 to 95 percent by volume in an aqueous solution was evaluated for use as a health care personnel hand wash, surgical hand scrub, and patient preoperative skin preparation (59 FR 31402 at 31442). The only health care antiseptic products containing alcohol that were submitted to the OTC Drug Review were products that were intended to be used without water (i.e., rubs and skin preparations) (Ref. 13). Consequently, based on the information we currently have about eligibility, we propose to categorize as new drugs these health care antiseptic washes and surgical scrubs (both of which are washes and are by definition intended to be rinsed off with water) that contain alcohol as the active ingredient, and we do not include a discussion of safety or effectiveness of alcohol for such rinse-off uses in this proposed rule.

   Alcohol, however, has been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand rub, surgical hand rub, and patient preoperative skin preparation (59 FR 31402 at 31435–31436). Thus, we include a discussion of the safety and effectiveness data for isopropyl alcohol in this proposed rule for such uses.

   b. Isopropyl alcohol. In the 1994 TFM, isopropyl alcohol 70 to 91.3 percent by volume in an aqueous solution (isopropyl alcohol) was classified for use as a health care personnel hand wash and surgical hand scrub (59 FR 31402 at 31435–31436). Isopropyl alcohol also was evaluated as a patient preoperative skin preparation (59 FR 31402 at 31442–31443). The only health care antiseptic products containing isopropyl alcohol that were submitted to the OTC Drug Review were products that were intended to be used without water (i.e., rubs and skin preparations) (Ref. 13). Consequently, isopropyl alcohol has not been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand wash or a surgical hand scrub drug product, both of which are washes and by definition are intended to be rinsed off with water.

   Thus, we propose to categorize isopropyl alcohol for these uses as a new drug and do not include a discussion of safety or effectiveness of isopropyl alcohol for such rinse-off uses in this proposed rule.

   Isopropyl alcohol, however, has been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand rub, surgical hand rub, and patient preoperative skin preparation (59 FR 31402 at 31435–31436). Thus, we include a discussion of the safety and effectiveness data for isopropyl alcohol in this proposed rule for such uses.

2. Benzalkonium Chloride
   Benzalkonium chloride has not been demonstrated to be eligible for the OTC Drug Review for use as a surgical hand rub. Based on the information we currently have about eligibility, we propose to categorize as a new drug benzalkonium chloride for use as a surgical hand rub. Benzalkonium chloride, however, has been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand rub, health care personnel hand scrub, surgical hand scrub, and patient preoperative skin preparation (59 FR 31402 at 31435–31436). Thus, we include a discussion of the safety and effectiveness data for benzalkonium chloride in this proposed rule for such uses.

3. Chlorhexidine Gluconate
   Previously, chlorhexidine gluconate 4 percent aqueous solution (chlorhexidine gluconate) was found to be ineligible for inclusion in the monograph for any health care antiseptic use and was not included in the 1994 TFM (59 FR 31402 at 31413). We have not received any new information since the 1994 TFM demonstrating that this active ingredient is eligible for the monograph.

   Consequently, we are not proposing to change the categorization of chlorhexidine gluconate from that of a new drug based on the lack of documentation demonstrating its eligibility as a health care antiseptic, and we do not include a discussion of any safety or effectiveness data submitted for chlorhexidine gluconate in this proposed rule.

4. Iodine and Iodine Complexes
   a. Iodine topical solution USP and iodine tincture USP. Iodine topical solution and iodine tincture have not been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand wash or as a surgical hand scrub drug product, both of which are washes and by definition are intended to be rinsed off with water. Neither iodine topical solution nor iodine tincture was evaluated for these uses in the 1994 TFM (59 FR 31402 at 31435–31436), and we have not received any new information to demonstrate eligibility for these uses since publication of the 1994 TFM. Based on the information we currently have about eligibility, we propose to categorize as a new drug these iodines intended for use as a health care personnel hand wash or rub or as a surgical hand scrub or rub, and we do not include a discussion of safety or effectiveness of iodine solution or tincture for such uses in this proposed rule.

   However, both iodine topical solution and iodine tincture have been demonstrated to be eligible for the OTC Drug Review for use as a patient preoperative skin preparation (59 FR 31402 at 31435–31436). Thus, we include a discussion of the safety and effectiveness of these iodines for this use in this proposed rule.

   b. Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate). The only health care antiseptic products containing this iodine complex submitted to the OTC Drug Review were health care personnel hand washes and surgical hand scrubs intended to be used with water (Ref. 13). Consequently, iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate) has not been demonstrated to be eligible for the OTC Drug Review for evaluation as a health care personnel hand rub or a surgical hand rub, both of which are intended to be leave-on products used without water. This iodine complex also has not been demonstrated to be eligible for the OTC Drug Review for use as a patient preoperative skin preparation. It was not evaluated for use as a patient preoperative skin preparation in the 1994 TFM (59 FR 31402 at 31435–31436) and we have not received any new information to demonstrate eligibility for this use since publication of the 1994 TFM. Based on the information we currently have about eligibility of this active ingredient, we propose to categorize as a new drug these iodines intended for use as patient preoperative skin preparation as well. This iodine complex, however, has been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand wash and surgical hand scrub (59 FR 31402 at 31435–31436).

   c. Iodine complex (phosphate ester of alkylaryloxy polyethylene glycol, nonylphenoxypoly (ethyleneoxy) ethanoliiodine, poloxamer-iodine complex, and undecoylium chloride iodine complex). The only health care antiseptic products containing these iodine complexes that were submitted to the OTC Drug Review were health care personnel hand washes and surgical hand scrubs intended to be used without water. Consequently, iodine complex
7. Other Individual Active Ingredients

In the 1994 TFM, each of the following ingredients was evaluated for use as a patient preoperative skin preparation, a health care personnel hand wash, and a surgical hand scrub (59 FR 31402 at 31435–31436):

- Benzenethionium chloride
- Chloroxylenol
- Cloflucarban
- Fluorosalan
- Hexylresorcinol
- Methylbenzenethionium chloride
- Phenol (less than 1.5 percent)
- Secondary amyltricresols
- Sodium oxychlorosene
- Triclocarban
- Triclosan

The only health care personnel hand wash or surgical hand scrub containing any of these ingredients that were submitted to the OTC Drug Review were products that were intended to be used with water (i.e., rinse-off products) (Ref. 13). Consequently, based on the information we currently have about eligibility, we propose to categorize as a new drug each of these ingredients for use as a health care personnel hand rub or a surgical hand rub, and we do not include a discussion of safety or effectiveness of these ingredients for these uses in this proposed rule.

8. Combination Active Ingredients

The combination active ingredients (1) calomel, oxyquinoline benzoate, triethanolamine, and phenol derivative; (2) mercufenol chloride and secondary amyltricresols in 50 percent alcohol; and (3) triple dye have not been demonstrated to be eligible for the OTC Drug Review for use as a health care personnel hand wash, surgical hand scrub, and patient preoperative skin preparation.

IV. Ingredients Previously Proposed as Not Generally Recognized as Safe and Effective

FDA may determine that an active ingredient is not GRAS/GRAE for a given OTC use (i.e., nonmonograph) because of lack of evidence of effectiveness, lack of evidence of safety, or both. In the 1994 TFM (59 FR 31402 at 31435–31436), FDA proposed that the active ingredients fluorosalan, hexachlorophene, phenol (greater than 1.5 percent), and tribromsalan be found not GRAS/GRAE for the uses referred to in the 1994 TFM as antiseptic hand wash and health care personnel hand wash. FDA did not classify hexachlorophene or tribromsalan in the 1975 TFM (43 FR 1210 at 1227) because it had already taken final regulatory action against hexachlorophene (21 CFR 250.250) and certain benzoic acid esters, salicylamides, notably tribromsalan (21 CFR 310.502). No substantive comments...
or new data were submitted to the record of the 1994 TFM to support reclassification of any of these ingredients to GRAS/GRAE status. Therefore, FDA is continuing to propose that these active ingredients be found not GRAS/GRAE for OTC health care antiseptic products as defined in this proposed rule and that any OTC health care antiseptic drug product containing any of these ingredients not be allowed to be introduced or delivered for introduction into interstate commerce unless it is the subject of an approved application, effective, except as otherwise provided in other regulations, as of 1 year after publication of the final monograph in the Federal Register.  

V. Summary of Proposed Classifications of OTC Health Care Antiseptic Active Ingredients  

Tables 4 through 7 in this proposed rule list the classification proposed in the 1994 TFM for each OTC health care antiseptic active ingredient according to intended use and the classification being proposed in this proposed rule. The specific data that has been submitted to the public docket (the rulemaking) and evaluated by FDA and the description of data still lacking in the administrative record is later described in detail for each active ingredient for which we have some data in section VII.D.

Tables 4 and 5 list ingredients for which a different status is being proposed in this proposed rule than was proposed in the 1994 TFM.

### Table 4—Classification of OTC Health Care Personnel Hand Wash and Surgical Hand Scrub Antiseptic Active Ingredients in This Proposed Rule and in the 1994 TFM

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>1994 TFM</th>
<th>This proposed rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol 60 to 95 percent</td>
<td>I</td>
<td>IIISE²</td>
</tr>
<tr>
<td>Hexylresorcinol</td>
<td>I</td>
<td>IIISE</td>
</tr>
<tr>
<td>Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaureate)</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Iodine complex (phosphate ester of alkylarylxy polyethylene glycol)</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Isopropyl alcohol 70 to 91.3 percent</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Nonylphenoxypoly (ethyleneoxy) ethanolidine</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Poloxamer iodine complex</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Povidone-iodine 5 to 10 percent</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Secondary amyltricresols</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Triclocarban</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Undecylylium chloride iodine complex</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
</tbody>
</table>

¹ “I” denotes a classification that an active ingredient has been shown to be safe and effective.  
² “III” denotes a classification that additional data are needed. “S” denotes safety data needed. “E” denotes effectiveness data needed.

### Table 5—Classification of OTC Patient Preoperative Skin Preparation Antiseptic Active Ingredients in This Proposed Rule and in the 1994 TFM

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>1994 TFM</th>
<th>This proposed rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol 60 to 95 percent</td>
<td>I</td>
<td>IIISE²</td>
</tr>
<tr>
<td>Benzalkonium chloride</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Benzethonium chloride</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Chloroxylenol</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Hexylresorcinol</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Iodine complex (phosphate ester of alkylarylxy polyethylene glycol)</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Iodine tincture USP</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Isopropl alcohol 70 to 91.3 percent</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Mercuferon chloride</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Methylbenzethonium chloride</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Nonylphenoxypoly (ethyleneoxy) ethanolidine</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Phenol (less than 1.5 percent)</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Poloxamer iodine complex</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Povidone-iodine 5 to 10 percent</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Triclocarban</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Triclosan</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
<tr>
<td>Undecylylium chloride iodine complex</td>
<td>IIIE</td>
<td>IIISE</td>
</tr>
</tbody>
</table>

¹ “I” denotes a classification that an active ingredient has been shown to be safe and effective.  
² “III” denotes a classification that additional data are needed. “S” denotes safety data needed. “E” denotes effectiveness data needed.
This proposed rule does not change the status of a number of antiseptic active ingredients previously proposed as lacking sufficient evidence of safety or effectiveness or the status of several ingredients previously proposed as having been shown to be unsafe, ineffective, or both (see tables 6 and 7).

TABLE 6—OTC HEALTH CARE PERSONNEL HAND WASH AND SURGICAL HAND SCRUB ANTISEPTIC ACTIVE INGREDIENTS WITH NO CHANGE IN CLASSIFICATION IN THIS PROPOSED RULE COMPARED TO THE 1994 TFM

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>No change in classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzalkonium chloride</td>
<td>IISE 1</td>
</tr>
<tr>
<td>Benzethonium chloride</td>
<td>II</td>
</tr>
<tr>
<td>Chloroxylenol</td>
<td>II</td>
</tr>
<tr>
<td>Clofuciarban</td>
<td>IISE/II 2</td>
</tr>
<tr>
<td>Fluorosalan</td>
<td>II 3</td>
</tr>
<tr>
<td>Hexachlorophene</td>
<td>II</td>
</tr>
<tr>
<td>Methylenebenezonium chloride</td>
<td>IISE 1</td>
</tr>
<tr>
<td>Phenol (less than 1.5 percent)</td>
<td>II</td>
</tr>
<tr>
<td>Phenol (greater than 1.5 percent)</td>
<td>II</td>
</tr>
<tr>
<td>Sodium oxychlorosene</td>
<td>IISE 1</td>
</tr>
<tr>
<td>Tribromosalan</td>
<td>II</td>
</tr>
<tr>
<td>Triclosan</td>
<td>IISE</td>
</tr>
</tbody>
</table>

1 "II" denotes a classification that additional data are needed. "S" denotes safety data needed. "E" denotes effectiveness data needed.

2 Health care personnel hand wash proposed as IISE and surgical hand scrub proposed as IIISE.

3 "III" denotes a classification that additional data are needed. "S" denotes safety data needed. "E" denotes effectiveness data needed.

VI. Effectiveness (Generally Recognized as Effective) Determination

OTC regulations (§§ 330.10(a)(4)(ii) and 314.126(b)) define the standards for establishing that an OTC drug containing a particular active ingredient would be GRAE for its intended use. These regulations provide that supporting investigations must be adequate and well-controlled, and able to distinguish the effect of a drug from other influences such as a spontaneous change in the course of the disease, placebo effect, or biased observation. In general, such investigations include controls that are adequate to provide an assessment of drug effect, are adequate measures to minimize bias, and use adequate analytical methods to demonstrate effectiveness. For active ingredients being evaluated in the OTC Drug Review, this means that a demonstration of the contribution of the active ingredient to any effectiveness observed is required before an ingredient can be determined to be GRAE for OTC drug use.

In the 1994 TFM, we proposed a log reduction standard (a clinical simulation standard) for establishing effectiveness of consumer and health care antiseptics (59 FR 31402 at 31448) for the proposed intended use of decreasing bacteria on the skin. The 1994 TFM log reduction standard for effectiveness is based on a surrogate endpoint (i.e., number of bacteria removed from the skin), rather than a clinical outcome (e.g., reduction in the number of infections). In accordance with recommendations made by NDAC at its March 2005 meeting, we continue to propose a log reduction standard to demonstrate the general recognition of effectiveness of health care antiseptic active ingredients. See section VI.B for our current proposed log reduction standard.

Unlike the use of antiseptics in the consumer setting, the use of antiseptics by health care providers in the hospital setting is considered an essential component of hospital infection control measures (Refs. 21, 22, and 23). Hospital-acquired infections can result in prolonged hospital stays, additional medical treatment, adverse clinical outcomes, and increased health care costs (Refs. 24 through 27). The reliance on antiseptics in the clinical setting goes back over 150 years when, in the mid-1800s, Semmelweis observed that the mortality associated with childbed fever at the General Hospital in Vienna could be reduced by disinfection of physicians’ hands with chloroform prior to patient care (Ref. 28). Around the same time, Lister demonstrated the effect of skin disinfection on surgical site infection rates (Ref. 28). This observational evidence of the effect of antiseptics on infection by Semmelweis and Lister form the basis for the current role of antiseptics as a critical component of hospital infection control procedures. Adequate and well-controlled clinical trials demonstrating a definitive link between antiseptic use and a reduction in infection rates are lacking, however.

The March 2005 NDAC acknowledged the difficulty in designing clinical trials to demonstrate the impact of health care antiseptics on infection rates. This difficulty was one reason the committee advised against clinical outcome trials to demonstrate the effectiveness of health care antiseptics. Numerous factors contribute to hospital-acquired infections and, therefore, would need to be controlled for in the design of these types of studies. For example, some of the known risk factors for surgical site infection that must be controlled for include the following: Patient age, nutritional status, diabetes, smoking, obesity, coexistent infections at a remote body site, colonization with microorganisms, altered immune response, length of preoperative stay, duration of surgical scrub, preoperative shaving, preoperative skin prep, duration of the operation, inadequate sterilization of instruments, foreign material in the surgical site, surgical drain, and surgical technique (Ref. 22). There are also standard infection control measures such as gloving, isolation procedures, sterilization of instruments, and waste disposal that make it difficult to demonstrate the independent contribution of antiseptics to the reduction of the risk of hospital infection (Ref. 28).

Although we found a few studies that could serve as a basis for designing a clinical outcome study in the consumer setting (78 FR 8444 at 8450), we have not found any acceptable clinical outcome study designs for health care antiseptics. The March 2005 NDAC recommended that sponsors perform an array of trials to look simultaneously at the effect on the surrogate endpoint and the clinical endpoint to try to establish a link between the surrogate and clinical endpoints, but provided no guidance on possible study designs. We have not seen any studies of this type. The March 2005 NDAC also believed that it would be unethical to perform a hospital trial using a vehicle control instead of an antiseptic. Although the NDAC thought...
that performing a placebo-controlled study for routine patients on the ward might be feasible, it stated that the Centers for Disease Control and Prevention hand hygiene guidelines and hospital accreditation requirements would prohibit such a practice. The NDAC also believed that an institutional review board would not approve a hospital trial that did not involve an antiseptic.

We agree that a clinical outcome study in the health care setting raises ethical concerns. For a clinical outcome study to be adequately controlled the study design would need to include a vehicle or negative control arm. However, the inclusion of such control arms in a clinical outcome study conducted in a hospital setting could pose an unacceptable health risk to study subjects (hospitalized patients and health care providers). In such studies a vehicle or negative control would be a product with no antimicrobial activity. The use of a nonantimicrobial product in a hospital setting (a setting with an already elevated risk of infections) could increase the risk of infection for both health care providers and their patients. Thus, it is generally considered unethical to perform placebo-controlled clinical studies to show the value of health care antiseptics (Ref. 8). Based on these considerations NDAC recommended the continued use of clinical simulation studies to validate the effectiveness of health care antiseptics.

FDA has relied upon clinical simulation studies to support the approval of health care antiseptics through the NDA process. Although it is not possible to quantify the contribution of NDA health care antiseptics to reduced hospital infection rates, in general, infection rates in the United States are low. For example, only 2 to 5 percent of over 40 million inpatient surgical procedures each year are complicated by surgical site infections (Ref. 29). We acknowledge that the use of surrogate endpoints to assess the effectiveness of these products is not optimal, but we believe it is the best means available of assessing the effectiveness of health care antiseptic products.

Thus, we are continuing to rely on surrogate endpoints to evaluate the effectiveness of health care antiseptics while requiring data from clinical outcome studies to support the effectiveness of consumer antiseptics (78 FR 76444 at 76450). Unlike consumer antiseptics, however, health care antiseptics are considered an integral part of hospital infection control strategies (Refs. 21, 23, and 30). As is the case for consumer antiseptics, we lack clinical outcome data from adequate studies demonstrating the impact of health care antiseptics on infection rates. Given this, FDA faces the challenge of regulating this important component of current hospital infection control measures without methods to directly assess their clinical effect. We nonetheless need a practical means to assess the general recognition of effectiveness of health care products, such as the clinical simulation studies.

As discussed in section VI.A, we evaluated all the available effectiveness studies for health care antiseptics (i.e., health care personnel hand washes and rubs, surgical hand scrubs and rubs, and patient preoperative skin preparations) to determine whether the data supported finding the health care antiseptic active ingredient to be GRAE based on the 1994 TFM effectiveness criteria (which we are now proposing to update). We found that the available studies are not adequate to support a GRAE determination for any health care antiseptic active ingredient under the 1994 TFM effectiveness criteria (59 FR 31402 at 31445, 31448, and 31450). We note that alcohol, isopropyl alcohol, and some iodine-containing active ingredients were proposed as GRAEs in the 1994 TFM; however, the studies that supported that proposal do not meet our current standards for adequate and well-controlled studies. See discussion in section VI.A.1.

 Determined after use of the test product. This contamination and hand wash procedure is repeated several times, and bacterial reductions are measured at various time points. This aspect of the study design is intended to mimic the repeated use of the product (59 FR 31402 at 31448).

The testing proposed in the 1994 TFM for surgical hand scrubs and patient preoperative skin preparations involves testing against resident skin microflora (bacteria that normally colonize the skin), and there is no artificial contamination of the skin in these studies. Testing demonstrates that the resident bacterial load is highly variable among individuals within the general population (Refs. 31 and 32). Although the 1994 TFM methods specify a minimum bacterial count for individuals to be included in the assessment of surgical hand scrubs and patient preoperative skin preparations, there can be considerable intersubject variability. Similar to the health care personnel hand washes, the testing of a surgical hand scrub proposed in the 1994 TFM involves multiple test product uses and the repeated measurement of bacterial reductions to determine both immediate and persistent antimicrobial activity (59 FR 31402 at 31445). The patient preoperative skin preparation test evaluates a single application of the product on a dry skin site (abdomen or back) and a moist skin site (groin or axilla) with higher numbers of resident bacteria (59 FR 31402 at 31450). The effectiveness criteria for patient preoperative skin preparations and surgical hand scrubs proposed in the 1994 TFM also require that bacterial growth be suppressed for 6 hours (59 FR 31402 at 31445 and 31450).

We evaluated all clinical simulation studies that were submitted to the OTC Drug Review for evidence of health care personnel hand antiseptic, surgical hand antiseptic, and patient preoperative skin preparation effectiveness demonstrated under the log reduction criteria proposed in the 1994 TFM (59 FR 31402 at 31445, 31448, and 31450) (Ref. 33). We also searched the published literature for clinical simulation studies that assessed health care personnel hand antiseptic, surgical hand antiseptic, and patient preoperative skin preparation effectiveness using the log reduction criteria in the 1994 TFM (Refs. 33 through 36).

Overall, the studies used a variety of study designs, including nonstandard study designs. In some cases, such as for surgical hand antiseptics, data submitted to the OTC Drug Review was
in the form of abstracts and technical reports. There is insufficient information to evaluate the scientific merit of studies described in abstracts and technical reports. Most importantly, none of the evaluated studies were adequately controlled to demonstrate the contribution of the active ingredient to the effectiveness observed in the studies (43 FR 1210 at 1240) and, therefore, cannot be used to demonstrate that the active ingredient tested is GRAE.

In general, the evaluated studies also had other deficiencies. Each study had at least one of the following deficiencies:

- Some studies that were described as using a standardized method (American Society for Testing and Materials (ASTM) or 1994 TFM) varied from these methods without explanation or validation, and the majority of studies did not provide sufficient information about critical aspects of the study conduct.
- Many studies did not include appropriate controls; for example, some studies did not include a vehicle control or an active control (59 FR 31402 at 31446, 31448, and 31450), and some studies that included an active control failed to use the control product according to its labeled directions (59 FR 31402 at 31446, 31448, and 31450).
- Many studies did not provide sufficient detail concerning neutralizer use (43 FR 1210 at 1244) or validation of neutralizer effectiveness.
- The studies evaluated a small number of subjects (59 FR 31402 at 31446, 31448, and 31450).
- Some studies did not sample at all of the time points specified by the test method (59 FR 31402 at 31446, 31448, and 31450).
- In the case of patient preoperative skin preparation studies, some studies used subjects with baseline values that were too low and other studies did not provide baseline values at all (59 FR 31402 at 31451). Many of the studies only tested one type of test site (dry or moist), but the 1994 TFM (as well as the testing proposed here) requires testing of both dry and moist test sites to demonstrate effectiveness (59 FR 31402 at 31450).

2. Clinical Outcome Studies

Although we are not currently proposing to require clinical outcome studies to support a GRAE determination in this proposal, FDA has evaluated all the clinical outcome studies that were submitted to the OTC Drug Review to look for evidence of a clinical benefit from the use of health care antiseptics (Ref. 33). In addition, we searched the published literature for clinical outcome studies that would provide evidence of a clinical benefit from the use of a health care antiseptic (Ref. 37). Most of these studies were designed to evaluate health care worker compliance with hand hygiene protocols, and thus, were not adequately controlled to demonstrate a reduction of infection rates. Most importantly, none of the studies used a vehicle control. In general, the studies had additional design flaws such as the following:

- A small sample size.
- A lack of randomization, blinding, or both.
- Inadequate statistical power, and in some cases, a failure to analyze results for statistical significance.
- Inadequate description of methodology and data collection methods.
- Inadequate documentation of proper training in hand wash or rub, surgical hand scrub or rub, or patient preoperative skin preparation technique.
- Failure to observe and document hand washing technique.
- Inadequate controls to address the multifactorial nature of surgical site infection.
- Some patients received antibiotic treatment and others did not.
- Some studies addressed nonmonograph indications.

As discussed in section VI, the March 2005 NDAC agreed that there are currently no clinical trials presented that showed any clinical benefit. The committee stated that conducting such a study in the hospital setting would be unethical, especially considering the need to introduce a placebo or vehicle control to show contribution of an antiseptic drug product. This would put the subjects’ health at risk.

B. Current Standards: Studies Needed To Support a Generally Recognized as Effective Determination

In the 1994 TFM, we proposed that the effectiveness of antiseptic active ingredients could be demonstrated in vitro by a determination of the in vitro spectrum of antimicrobial activity, minimum inhibitory concentration (MIC) testing against 15 fresh clinical isolates and 25 laboratory strains, and time-kill testing against 23 laboratory strains (59 FR 31402 at 31444).

Comments received in response to the 1994 TFM objected to the proposed in vitro testing requirements, stating that they were overly burdensome (Ref. 38). Consequently, submissions of in vitro data submitted to support the effectiveness of antiseptic active ingredients were far less extensive than what was proposed in the 1994 TFM (Ref. 39). Although we agree that the in vitro testing proposed in the 1994 TFM is overly burdensome for testing every final formulation of an antiseptic product that contains a GRAE ingredient, we continue to believe that a GRAE determination for a health care antiseptic active ingredient should be supported by adequate in vitro characterization of the antimicrobial activity of the ingredient. In addition, we now propose the option of assessing the minimum bactericidal concentration (MBC) as an alternative to testing the MIC to demonstrate the broad spectrum activity of the antiseptic. The ability of an antiseptic to kill microorganisms, rather than inhibit them, is more relevant for a topical product. Because the determination of GRAE status is a very broad statement that can apply to many different formulations of an active ingredient, we continue to propose that an evaluation of the spectrum and kinetics of antimicrobial activity of a health care antiseptic active ingredient should include the following:

- A determination of the in vitro spectrum of antimicrobial activity against recently isolated normal flora.
and cutaneous pathogens (59 FR 31402 at 31444).

- MIC or MBC testing of 25 representative clinical isolates and 25 reference (e.g., American Type Culture Collection) strains of each of the microorganisms listed in the 1994 TFM (59 FR 31402 at 31444).

- Time-kill testing of each of the microorganisms listed in the 1994 TFM (59 FR 31402 at 31444) to assess how rapidly the antiseptic active ingredient produces its effect. The dilutions and time points tested should be relevant to the actual use pattern of the final product.

Despite the fact that the in vitro data submitted to support the effectiveness of antiseptic active ingredients were far less extensive than proposed in the 1994 TFM, manufacturers may have data of this type on file from their own product development programs that has not been submitted to the rulemaking. Furthermore, published data may be available that would satisfy some or all of this data requirement.

2. In Vivo Studies

Based on the recommendations of NDAC at its March 23, 2005, meeting, we are continuing to propose the use of bacterial log reductions as a means of demonstrating that health care antiseptics are GRAE (Ref. 8). The 1994 TFM also proposed final formulation testing for health care personnel hand washes (59 FR 31402 at 31448), surgical hand scrubs (59 FR 31402 at 31445), and patient preoperative skin preparations (59 FR 31402 at 31450). We do not discuss final formulation testing here because we are not proposing that any of the active ingredients are GRAS/ GRAE. Although these proposed test methods are intended to evaluate the effectiveness of antiseptic final formulations, this type of clinical simulation testing when adequately controlled also can be used to demonstrate that an active ingredient is GRAE for use in a health care antiseptic product. Based on our experience with the approval of NDA antiseptic products and input from the March 2005 NDAC, we recommend that the bacterial log reduction studies used to demonstrate that an active ingredient is GRAE for use in health care antiseptic drug products include the following:

- A vehicle control to show the contribution of the active ingredient to effectiveness. The test product should be statistically superior to the vehicle control for the clinical simulation to be considered successful at showing that the test product is effective for use in health care antiseptic products.

- An active control to validate the study conduct to assure that the expected results are produced. For the results to be valid, the active control should meet the appropriate log reduction criteria.

- A sample size large enough to show statistically significant differences from the results achieved using the vehicle, and meeting the threshold of at least a 70 percent success rate for the health care antiseptic, including justification that the number of subjects tested is adequate for the test.

- Use of an appropriate neutralizer in all recovery media (i.e., sampling solution, dilution fluid, and plating media) and a demonstration of neutralizer validation. The purpose of neutralizer validation is to show that the neutralizer used in the study is effective against the test and control products, and that it is not toxic to the test microorganisms. If a test product can be neutralized through dilution, this should be demonstrated in the neutralizer validation study.

- An analysis of the proportion of subjects who meet the log reduction criteria based on a two-sided statistical test for superiority to vehicle and a 95 percent confidence interval approach.

To establish that a particular active ingredient is GRAE for use in health care antiseptics, clinical simulation studies using the parameters described in this section should be evaluated using log reduction criteria similar to those proposed in the 1994 TFM (59 FR 31402 at 31445, 31448, and 31450). Our current criteria are laid out in table 8. We have revised the log reduction criteria proposed for health care personnel hand washes and rubs, and surgical hand scrubs and rubs based on the recommendations of the March 2005 NDAC and comments to the 1994 TFM that argued that the demonstration of a cumulative antiseptic effect for these products is unnecessary. We agree that the critical element of effectiveness is that a product must be effective after the first application because that represents the way in which health care personnel hand washes and rubs and surgical hand scrubs and rubs are used. For these indications, log reduction criteria are proposed only for a single-product application rather than multiple-product applications. Given that we are no longer requiring a cumulative antiseptic effect, the log reduction criteria were revised to reflect this single product application and fall between the log reductions previously proposed for the first and last applications. The GRAE criteria proposed for all the health care antiseptic indications are based on log reductions achieved by antiseptics as shown in the published literature and evaluated under the NDA process. In addition, based on the timeframes within which patient preoperative skin preparations are commonly used, we are recommending that these products also be able to demonstrate effectiveness at 30 seconds because we believe that injections and some incisions might be made as soon as 30 seconds after skin preparation. The log reductions that we would expect an effective health care antiseptic active ingredient to meet to show that it is GRAE are shown in table 8.

**Table 8—Clinical Simulation Testing Bacterial Log Reduction Effectiveness Criteria in This Proposed Rule and in the 1994 TFM**

<table>
<thead>
<tr>
<th>Indication</th>
<th>1994 TFM</th>
<th>This proposed rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health care personnel hand wash or health care personnel hand rub.</td>
<td>• reduction of 2 ( \log_{10} ) on each hand within 5 minutes after the first wash, and • reduction of 3 ( \log_{10} ) on each hand within 5 minutes after the tenth wash.</td>
<td>• reduction of 2.5 ( \log_{10} ) on each hand within 5 minutes after a single wash or rub.</td>
</tr>
</tbody>
</table>
TABLE 8—CLINICAL SIMULATION TESTING BACTERIAL LOG REDUCTION EFFECTIVENESS CRITERIA IN THIS PROPOSED RULE AND IN THE 1994 TFM—Continued

<table>
<thead>
<tr>
<th>Indication</th>
<th>1994 TFM</th>
<th>This proposed rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical hand scrub or surgical hand rub</td>
<td>• reduction of 1 log₁₀ on each hand within 1 minute after the first wash on day 1, and</td>
<td>• reduction of 2 log₁₀ on each hand within 1 minute after a single wash or rub, and</td>
</tr>
<tr>
<td></td>
<td>• does not exceed baseline at 6 hours on day 1, and</td>
<td>• does not exceed baseline at 6 hours</td>
</tr>
<tr>
<td></td>
<td>• reduction of 2 log₁₀ on each hand within 1 minute after the last wash on day 2, and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• reduction of 3 log₁₀ on each hand within 1 minute after the last wash on day 5.</td>
<td></td>
</tr>
<tr>
<td>Patient preoperative skin preparation</td>
<td>• reduction of 2 log₁₀ per square centimeter on abdominal site within 10 minutes after use, and</td>
<td>• reduction of 2 log₁₀ per square centimeter on abdominal site within 30 seconds after use, and</td>
</tr>
<tr>
<td></td>
<td>• reduction of 3 log₁₀ per square centimeter on groin site within 10 minutes after use, and</td>
<td>• reduction of 3 log₁₀ per square centimeter on groin site within 30 seconds after use, and</td>
</tr>
<tr>
<td></td>
<td>• does not exceed baseline at 6 hours</td>
<td>• does not exceed baseline at 6 hours</td>
</tr>
</tbody>
</table>

VII. Safety (Generally Recognized as Safe) Determination

In the 1994 TFM, 11 active ingredients were classified as GRAS for both health care personnel hand wash and surgical hand scrub use, and 18 active ingredients were classified as GRAS for patient preoperative skin preparation use (59 FR 31402 at 31435). As described in section I.C., health care personnel hand rubs and surgical hand rubs were not separately addressed in the 1994 TFM. There have since been a number of important scientific developments affecting our evaluation of the safety of these active ingredients and causing us to reassess the data necessary to support a GRAS determination. There is now new information regarding systemic exposure to antiseptic active ingredients (Refs. 1 through 5). The potential for widespread antiseptic use to promote the development of antibiotic-resistant bacteria also needs to be evaluated.

Further, additional experience with and knowledge about safety testing has led to improved testing methods. Improvements include study designs that are more capable of detecting potential safety risks. Based on our reassessment, we are proposing new GRAS data standards for health care antiseptic active ingredients. In order to fully address these new safety concerns, additional safety data will be necessary to support a GRAS determination for all health care antiseptic active ingredients.

Many of the safety considerations for the five health care antiseptic uses are the same because each use is considered a “chronic” use as that term is defined by the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH).² A use is considered chronic if the drug will be used for a period of at least 6 months over the user’s lifetime, including repeated, intermittent use (Ref. 40). Health care personnel washes and rubs are used on a frequent daily basis, as are surgical hand scrubs and rubs. Rubs are used on a frequent daily basis, including repeated, intermittent use, which can result in systemic exposure. Although some systemic exposure data exist for alcohol and triclosan, many of the other health care antiseptic active ingredients have not been evaluated in this regard. Currently, there is also a lack of data to assess the impact of important drug use factors that can influence systemic exposure such as dose, application frequency, application method, duration of exposure, product formulation, skin condition, and age.

The evaluation of the safety of drug products involves correlating findings from animal toxicity studies to the level of drug exposure obtained from pharmacokinetic studies in animals and humans. Our administrative record lacks the data necessary to define a margin of safety for the potential chronic use of health care antiseptic active ingredients. Thus, we are continuing to propose that both animal and human pharmacokinetic data are necessary for health care antiseptic active ingredients. This information will help identify any potential safety concerns and help determine the safety margin for OTC human use.

One potential effect of systemic exposure to health care antiseptic active ingredients that has come to our attention since publication of the 1994 TFM is data suggesting that some health care antiseptic active ingredients have hormonal effects. Triclosan and triclocarban can cause alterations in
thyroid and reproductive systems of neonatal and adolescent animals (Refs. 42 through 51). Hormonally active compounds have been shown to affect not only the exposed organism, but also subsequent generations (Ref. 52). These effects may not be related to direct deoxyribonucleic acid (DNA) mutation, but rather to alterations in factors that regulate gene expression (Ref. 53).

A hormonally active compound that causes reproductive system disruption in the fetus or infant may have effects that are not apparent until many years after initial exposure. There are also critical times in fetal development when a change in hormonal balance that would not cause any lasting effect in an adult could cause a permanent developmental abnormality in a child. For example, untreated hypothyroidism during pregnancy has been associated with cognitive impairment in the offspring (Refs. 54, 55, and 56).

Because health care antiseptics are chronic use products and are used by sensitive populations such as pregnant women, evaluation of the potential for chronic toxicity and effects on reproduction and development should be included in the safety assessment. The designs of general toxicity and reproductive/developmental studies are often sufficient to identify developmental effects that can be caused by hormonally active compounds through the use of currently accepted endpoints and standard good laboratory practice toxicology study designs. As followup in some cases, additional study endpoints may be needed to fully characterize the potential effects of drug exposure on the exposed individuals. Section VII.C describes the types of studies that can adequately evaluate an active ingredient’s potential to cause developmental or reproductive toxicity, or adverse effects on the thyroid gland.

B. Antimicrobial Resistance

Since publication of the 1994 TFM, there is new information available concerning the impact of widespread antiseptic use on the development of antimicrobial resistance (Refs. 57 through 60). Bacteria use some of the same resistance mechanisms against both antiseptics and antibiotics. Thus, the use of antiseptic active ingredients with resistance mechanisms in common with antibiotics may have the potential to select for bacterial strains that are also resistant to clinically important antibiotics, adding to the problem of antibiotic resistance. In the health care setting where infection-control practices are multifaceted and include the use of antiseptics, antibiotics, and frequent disinfection, it is difficult to identify the source of antimicrobial resistance or to quantify the impact of antiseptics on the selection, survival, and spread of antimicrobial resistant bacterial strains.

Laboratory studies of some of the antiseptic active ingredients evaluated in this proposed rule demonstrate that bacteria can develop reduced susceptibility to antiseptic active ingredients and some antibiotics after growth in nonlethal amounts of the antiseptic (i.e., low-to-moderate concentrations of antiseptic) (Refs. 61 through 78). These studies indicate that further data needs to be gathered regarding whether bacterial resistance mechanisms exist that could select for cross-resistance in the health care setting.

Laboratory studies examining the antiseptic and antibiotic susceptibilities of clinical isolates of *Staphylococcus aureus* and methicillin-resistant *S. aureus* (MRSA) have found strains of these organisms with reduced susceptibility to antiseptics and antibiotics (Refs. 67 and 79 through 83). However, the impact of such dual tolerances in the clinical setting is unclear. Studies of the impact of such tolerance in *S. aureus* and *Escherichia coli* in the clinical setting have yielded mixed results (Refs. 84 through 87). Interpretation of these data is further limited by the fact that only *S. aureus* and *E. coli* have been studied. All of the organisms studied constitute a very small subset of the organisms of concern, and one of these organisms (MRSA) is already resistant to some antimicrobials. Thus, the available data are not sufficient to support a finding that these mechanisms of reduced susceptibility would have meaningful clinical impact in a setting where extensive infection control measures that include antibiotic use and frequent disinfection are the norm. In other words, bacteria in the health care setting will be exposed to multiple sources of antimicrobials—regardless of the use of health care antiseptics—which may lessen the impact of the role of health care antiseptics in the development of bacterial resistance.

FDA has been evaluating the role that all antiseptic products, including health care antiseptic products, may play in the development of antibiotic resistance for quite some time, and has sought the advice from expert panels on this topic. In 1997, a joint Nonprescription Drugs and Anti-Infective Drugs Advisory Committee concluded that the data were not sufficient to take any action on this issue at that time (Ref. 6). The Joint Committee recommended that FDA work with industry to establish surveillance mechanisms to address antiseptic and antibiotic resistance. FDA also plays a major role on the Interagency Task Force on Antimicrobial Resistance and helped draft the Public Health Action Plan to Combat Antimicrobial Resistance (Ref. 88). The Action Plan discusses how to sufficiently implement the surveillance, prevention and control, and research elements of the Action Plan.

Reports of the persistence of low levels of some antiseptic active ingredients in the environment (Refs. 89, 90, and 91) signal the need to better understand the impact of all antiseptics, including health care antiseptic drug products. Although it is important to consider the relative contribution of the use of health care antiseptic products to any possible environmental impact, it is also important to consider the benefits of these products. Hospital-acquired infections can result in prolonged hospital stays, additional medical treatment, adverse clinical outcomes, and increased health care costs. The use of health care antiseptics is considered an important component of the multifaceted approach that hospitals use to keep hospital acquired infection rates low (Refs. 21 and 23). Furthermore, in situations where there is extensive use of antibiotics, exposure to antibiotics, rather than exposure to antiseptics, plays a dominant role in emerging antibiotic resistance. This makes it difficult to determine whether antiseptics play a significant role in the development of antimicrobial resistance in the hospital setting. Despite this, the use of antiseptics in health care settings may also contribute to the selection of bacterial genera and species that are less susceptible to both antiseptics and antibiotics. We are requesting additional data and information to address this issue. Section VII.C describes the data that will help establish a better understanding of the interactions between antiseptic active ingredients and bacterial resistance mechanisms in health care antiseptic products and will provide the information needed to perform an adequate risk assessment for these health care product uses. FDA recognizes that the science of evaluating the potential of compounds to cause bacterial resistance is evolving and acknowledges the possibility that alternative data different from that listed in section VII.C may be identified as an appropriate substitute for evaluating resistance.

C. Studies To Support a Generally Recognized as Safe Determination

A GRAS determination for health care antiseptic active ingredients must be
supported by both nonclinical (animal) and clinical (human) studies. To issue a final monograph for these products, this safety data must be in the administrative record (i.e., rulemaking docket).4

To assist manufacturers or others who wish to provide us with the information we expect will establish GRAS status for these active ingredients, we are including specific information, based in part on existing FDA guidance, about the other kinds of studies to consider conducting and submitting. We have published guidance documents describing the nonclinical safety studies that a manufacturer should perform when seeking to market a drug product under an NDA (Refs. 40 and 92 through 98). These guidance documents also provide relevant guidance for performing the nonclinical studies necessary to determine GRAS status for a health care antiseptic active ingredient. Because health care antiseptics may be used repeatedly and in sensitive populations, we propose that health care antiseptic active ingredients will need to be tested for carcinogenic potential, developmental and reproductive toxicity (DART), and other potential effects as described in more detail in this section.

### Table 9—FDA Guidance Documents Related to Requested Safety Data and Rationale for Studies

<table>
<thead>
<tr>
<th>Type of study</th>
<th>Study conditions</th>
<th>What the data tell us</th>
<th>How the data are used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal pharma cokinetic absorption, distribution, metabolism, and excretion (ADME) (Refs. 93 and 99).</td>
<td>Both oral and dermal administration.</td>
<td>Allows identification of the dose at which the toxic effects of an active ingredient are observed as a result of systemic exposure of the drug. ADME data provide: The rate and extent an active ingredient is absorbed into the body (e.g., AUC, Cmax, Tmax);1 where the active ingredient is distributed in the body; whether metabolism of the active ingredient by the body has taken place; information on the presence of metabolites; and how the body eliminates the original active ingredient (parent) and its metabolites (e.g., T½).2</td>
<td>Used as a surrogate to identify toxic systemic exposure levels that can then be correlated to potential human exposure via dermal pharmacokinetic study findings. Adverse event data related to particular doses and drug levels (exposure) in animals are used to help formulate a safety picture of the possible risk to humans.</td>
</tr>
<tr>
<td>Human pharmacokinetics (MUS¹) (Ref. 97).</td>
<td>Dermal administration using multiple formulations under maximum use conditions.</td>
<td>Helps determine how much of the active ingredient penetrates the skin, leading to measurable systemic exposure.</td>
<td>Used to relate the potential human exposure to toxic drug levels identified in animal studies.</td>
</tr>
<tr>
<td>Carcinogenicity (ICH S1A, S1B, and S1C (Refs. 40, 92, and 95)).</td>
<td>Minimum of one oral and one dermal study for topical products.</td>
<td>Provides a direct measure of the potential for active ingredients to cause tumor formation (tumorogenesis) in the exposed animals.</td>
<td>Identifies the systemic and dermal risks associated with drug active ingredients. Taken together, these studies are used to identify the type(s) of toxicity, the level of exposure that produces these toxicities, and the highest level of exposure at which no adverse effects occur, referred to as the “no observed adverse effect level” (NOAEL). The NOAEL is used to determine a safety margin for human exposure.</td>
</tr>
<tr>
<td>Developmental toxicity (ICH S5 (Ref. 94)).</td>
<td>Oral administration.</td>
<td>Evaluates the effects of a drug on the developing offspring throughout gestation and postnatally until sexual maturation.</td>
<td>Used in hazard assessment to determine whether the drug has the capacity to induce a harmful effect at any exposure level without regard to actual human exposures.</td>
</tr>
<tr>
<td>Reproductive toxicity (ICH S5 (Ref. 94)).</td>
<td>Oral administration.</td>
<td>Assesses the effects of a drug on the reproductive competence of sexually mature male and female animals.</td>
<td>Used in hazard assessment to determine whether the drug has the capacity to induce a harmful effect at any exposure level without regard to actual human exposures.</td>
</tr>
<tr>
<td>Hormonal effects (Ref. 98).</td>
<td>Oral administration.</td>
<td>Assesses the drug’s potential to interfere with the endocrine system.</td>
<td>Used in hazard assessment to determine whether the drug has the capacity to induce a harmful effect at any exposure level without regard to actual human exposures.</td>
</tr>
</tbody>
</table>

1 “AUC” denotes the area under the concentration-time curve, a measure of total exposure or the extent of absorption. “Cmax” denotes the maximum concentration, which is peak exposure. “Tmax” denotes the time to reach the maximum concentration, which aids in determining the rate of exposure.

2 “T½” denotes the half-life, which is the amount of time it takes to eliminate half the drug from the body or decrease the concentration of the drug in plasma by 50 percent.

These studies represent FDA’s current thinking on the data needed to support a GRAS determination for an OTC antiseptic active ingredient and are

4 At the 2014 NDAC meeting, FDA received comments referencing data or other information that appears to be relevant to the safety assessment of health care antiseptic active ingredients, but the referenced data and information were not submitted similar to those recommended by the Antimicrobial I Panel (described in the ANPR [39 FR 33103 at 33135]) as updated by the recommendations of the 2014 NDAC. However, even before the 2014 NDAC meeting, the Panel’s recommendations for data to support the safety of an OTC topical

The safety studies that are described in the existing FDA guidelines (Refs. 40 and 92 through 98) provide a framework for the types of studies that are needed for FDA to assess the safety of each antiseptic active ingredient according to modern scientific standards and make a GRAS determination. A description of each type of study and how we would use this information to improve our understanding of the safety of health care antiseptic active ingredients is provided in table 9.
amicrobial active ingredient included studies to characterize the following:

- Degree of absorption through intact and abraded skin and mucous membranes
- Tissue distribution, metabolic rates, metabolic fates, and routes of elimination
- Teratogenic and reproductive effects
- Mutagenic and carcinogenic effects

2. Studies To Characterize Maximal Human Exposure

Because the available data indicate that some dermal products, including at least some antiseptic active ingredients, are absorbed after topical application in humans and animals, it is necessary to assess the effects of long-term dermal and systemic exposure to these ingredients. Based on input from the 2014 NDAC meeting, the Agency has also determined that results from a human pharmacokinetic (PK) maximal usage trial (MUsT) are needed to support a GRAS determination. This design is also referred to as a maximal use PK trial and is described in FDA’s 2005 draft guidance for industry on developing drugs for treatment of acne vulgaris (Ref. 97). The purpose of the MUsT is to evaluate systemic exposure under conditions that would maximize the potential for drug absorption in a manner consistent with possible “worst-case” real world use of the product. In a MUsT, the collected plasma samples are analyzed, and the resulting in vivo data could be used to estimate a safety margin based on animal toxicity studies.

A MUsT to support a determination that an active ingredient is GRAS for use in health care antiseptics is conducted by obtaining an adequate number of PK samples following administration of the active ingredient. For studies of active ingredients to be used in topically applied products like these that are used primarily on adults, for which there is less information available and for which crossover designs are not feasible, a larger number of subjects are required compared to studies of orally administered drug products. A MUsT using 50 to 75 subjects should be sufficient to get estimates of the PK parameters from a topically applied health care antiseptic. The MUsT should attempt to maximize the potential for drug absorption to occur by considering the following design elements (Ref. 100):

- Adequate number of subjects (steps should be taken to ensure that the target population (for example, age, gender, race) is properly represented);
- Frequency of dosing (e.g., number of hand rub applications during the study);
anogenital distance, and nipple retention. Behavioral assessments (e.g., mating behavior) of offspring may also detect neuroendocrine effects.

Carcinogenicity studies. A variety of tumors that result from long-term hormonal disturbance can be detected in carcinogenicity assays. For example, the effect of a persistent disturbance of particular endocrine gland systems (e.g., hypothalamic-pituitary-adrenal axis) can be detected in these bioassays. Certain hormone-dependent ovarian and testicular tumors and parathyroid hormone-dependent osteosarcoma also can be detected in rodent carcinogenicity bioassays.

b. Supplementary studies. If no signals are obtained in the traditional RDT, DART, and carcinogenicity studies, assuming the studies covered all the life stages at which a health care antiseptic user may be exposed to such products (e.g., pregnancy, infancy, adolescence), then no further assessment of drug-induced hormonal effects are needed. However, if a positive response is seen in any of these animal studies and this response is not adequately understood, then additional studies, such as mechanistic studies involving alternative animal models, may be needed (Refs. 98, 104, 105, and 106). For example, juvenile animal studies can help address the long-term hormonal effects from acute or continuous exposure to drugs that are administered to neonates and children, when these effects cannot be adequately predicted from existing data. As an alternative, to, or in addition to, supplemental nonclinical assessment of hormonal effects, inclusion of endocrine endpoints (e.g., hormone levels) in clinical studies can be important to clarify the relevance of adverse hormonal effects identified in nonclinical studies.

Juvenile animal studies. Young animals are considered juveniles after they have been weaned. In traditional DART studies, neonatal animals (pups) are typically dosed only until they are weaned. If a drug is not secreted via the mother’s milk, the DART study will not be able to test the direct effect of the drug on the pup. Furthermore, since pups are not dosed after weaning, they are not exposed to the drug during the juvenile stage of development. A juvenile animal toxicity study in which the young animals are dosed directly can be used to evaluate potential drug-induced effects on postnatal development for products intended for pediatric populations.

d. Prepubertal studies. The period between the pup phase and the adult phase, referred to as the juvenile phase of development, includes the pubertal period in which the animal reaches puberty and undergoes important growth landmarks. In mammals, puberty is a period of rapid morphological changes and endocrine activity. Studies in pubertal animals are designed to detect alterations of pubertal development, thyroid function, and hypothalamic-pituitary-gonadal system maturation (Ref. 107).

In those cases where adverse effects are noted on the developing offspring, FDA intends to conduct a risk-benefit analysis based on the dose-response observed for the findings and the animal-to-human exposure comparison. If such an assessment indicates a potential risk to humans, then we will include that risk in our risk-benefit analysis in order to determine whether the antiseptic active ingredient at issue is suitable for inclusion in an OTC monograph.

4. Studies To Evaluate the Potential Impact of Antiseptic Active Ingredients on the Development of Resistance

Since the 1994 TFM published, the issue of antiseptic resistance and whether bacteria that exhibit antiseptic resistance have the potential for antibiotic cross-resistance has been the subject of much study and scrutiny. One of the major mechanisms of antiseptic and antibiotic cross-resistance is changes in bacterial efflux activity at nonlethal concentrations of the antiseptic (Refs. 66, 69, 76, 108, 109, and 110). Efflux pumps are an important nonspecific bacterial defense mechanism that can confer resistance to a number of substances toxic to the cell, including antibiotics (Refs. 111 and 112). The development of bacteria that are resistant to antibiotics is an important public health issue, and additional data may tell us whether use of antiseptics in health care settings may contribute to the selection of bacteria that are less susceptible to both antiseptics and antibiotics. Therefore, we are requesting additional data and information to address this issue.

Laboratory studies are a feasible first step in evaluating the impact of exposure to nonlethal amounts of antiseptic active ingredients on antiseptic and antibiotic bacterial susceptibilities. As discussed in section VII.D, some of the active ingredients evaluated in this proposed rule have laboratory data demonstrating that bacteria have developed reduced susceptibility to antiseptic active ingredients and antibiotics after exposure to sublethal concentrations of the antiseptic active ingredient. However, only limited data exist on the effects of antiseptic exposure on the bacteria that are predominant in the oral cavity, gut, skin flora, and the environment (Ref. 113). These organisms represent pools of resistance determinants that are potentially transferable to human pathogens (Refs. 114 and 115). Broader laboratory testing of each health care antiseptic active ingredient would more clearly define the scope of the impact of antiseptic active ingredients on the development of antibiotic resistance and provide a useful preliminary assessment of an antiseptic active ingredient’s potential to foster the development of resistance.

Studies evaluating the impact of antiseptic active ingredients on the antiseptic and antibiotic susceptibilities of each of the following types of organisms could help support a GRAS determination for antiseptic active ingredients intended for use in OTC health care antiseptic drug products:

• Human bacterial pathogens;
• Nonpathogenic organisms, opportunistic pathogens, and obligate anaerobic bacteria that make up the resident microflora of the human skin, gut, and oral cavity; and
• Nonpathogenic organisms and opportunistic pathogens from relevant environmental sources (e.g., patient rooms, surgical suites).

If the results of these studies show no evidence of changes in antiseptic or antibiotic susceptibility, then we propose that no further studies addressing the development of resistance are needed to support a GRAS determination.

However, for antiseptic active ingredients that demonstrate an effect on antiseptic and antibiotic susceptibilities, additional data will be necessary to help assess the likelihood that changes in susceptibility observed in the preliminary studies would occur in the health care setting. Different types of data could be used to assess whether or not ingredients with positive laboratory findings pose a public health risk (Ref. 291). We do not anticipate that it will be necessary to obtain data from multiple types of studies for each active ingredient to adequately assess its potential to affect resistance. Such types of data could include, but are not limited to, the following:

• Information about the mechanism(s) of antiseptic action (for example, membrane destabilization or inhibition of fatty acid synthesis), and whether there is a change in the mechanism of action with changes in antiseptic concentration;
• Information clarifying the bacteria’s mechanism(s) for the development of
resistance or reduced susceptibility to the antiseptic active ingredient (for example, efflux mechanisms);
• data characterizing the potential for reduced antiseptic susceptibility caused by the antiseptic active ingredient to be transferred to other bacteria that are still sensitive to the antiseptic;
• data characterizing the concentrations and antimicrobial activity of the antiseptic active ingredient in biological and environmental compartments (for example, on the skin, in the gut, and in environmental matrices); and
• data characterizing the antiseptic and antibiotic susceptibility levels of environmental isolates of bacteria in areas of prevalent health care antiseptic use (for example, patient rooms and surgical suites).

These data can help ascertain whether or not a health care antiseptic active ingredient is likely to induce nonspecific bacterial resistance mechanisms. These data could also help determine the likelihood that changes in susceptibility would spread to other bacterial populations and whether or not concentrations of health care antiseptics exist in relevant biological and environmental compartments that are sufficient to induce changes in bacterial susceptibilities. Data on the antiseptic and antibiotic susceptibilities of bacteria in areas of prevalent health care antiseptic use can help demonstrate whether or not changes in susceptibility are occurring with actual use. Because actual use concentrations of health care antiseptics are much higher than the MICs for these active ingredients, data from compartments where sublethal concentrations of biologically active antiseptic active ingredients may occur (e.g., environmental compartments) can give us a sense of the potential for change in antimicrobial susceptibilities in these compartments (Refs. 116, 117, and 118). FDA recognizes, however, that methods of evaluating this issue are an evolving science and that there may be other data appropriate to evaluate the impact of health care antiseptic active ingredients on the development of resistance. For this reason, FDA encourages interested parties to consult with the Agency on the specific studies appropriate to address this issue for a particular active ingredient.

D. Review of Available Data for Each Antiseptic Active Ingredient

We have identified for each health care antiseptic active ingredient whether the studies outlined in section VII.C are publicly available. Table 10 lists the types of studies available for each antiseptic active ingredient proposed as Category I or Category III in the 1994 TFM and indicates whether the currently available data are adequate to serve as the basis of a GRAS determination. Although we have some data from submissions to the rulemaking and from information we have identified in the literature, our administrative record is incomplete for at least some types of safety studies for each of the active ingredients (see table 10). As noted previously in this document, only information that is part of the administrative record for this rulemaking can form the basis of a GRAS/GRAE determination.

We recognize that data and information submitted in response to the 2013 Consumer Wash PR may be relevant to this proposed rule for those active ingredients eligible for use as both consumer and health care antiseptics. At the time of publication of this proposed rule, FDA’s review of all submissions made to the 2013 Consumer Wash PR had not been completed. To be considered in this rulemaking, any information relevant to health care antiseptic active ingredients must be resubmitted under this docket (FDA—2015–N–0101) for consideration.

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**TABLE 10—SAFETY STUDIES AVAILABLE FOR HEALTH CARE ANTISEPTIC ACTIVE INGREDIENTS**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Human pharamaco-kinetic (MUsT)</th>
<th>Animal pharamaco-kinetic (ADME)</th>
<th>Oral carcinogenicity</th>
<th>Dermal carcinogenicity</th>
<th>Reproductive toxicity (DART)</th>
<th>Potential hormonal effects</th>
<th>Resistance potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzalkonium chloride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzethonium chloride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloroxylenol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexylresorcinol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Simple iodine solutions**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Human pharamaco-kinetic (MUsT)</th>
<th>Animal pharamaco-kinetic (ADME)</th>
<th>Oral carcinogenicity</th>
<th>Dermal carcinogenicity</th>
<th>Reproductive toxicity (DART)</th>
<th>Potential hormonal effects</th>
<th>Resistance potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodine tincture USP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iodine topical solution USP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Iodine complexes**

<table>
<thead>
<tr>
<th>Active ingredient</th>
<th>Human pharamaco-kinetic (MUsT)</th>
<th>Animal pharamaco-kinetic (ADME)</th>
<th>Oral carcinogenicity</th>
<th>Dermal carcinogenicity</th>
<th>Reproductive toxicity (DART)</th>
<th>Potential hormonal effects</th>
<th>Resistance potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Povidone-iodine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isopropyl alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclocarban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclosan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Empty cell indicates no data available; “/” indicates incomplete data available; “*” indicates available data are sufficient to make a GRAS/GRAE determination.

2 The following active ingredients are not included in the table because no safety data were submitted or identified since the 1994 TFM: Clofucarban; combination of calomel, oxyquinoline benzoate, and phenol derivative; combination of mercufenol chloride and secondary amyttricresols in 50 percent alcohol; fluorosalan; iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate); iodine complex (phosphate ester of alkylarylpolyoxyethylene glycol); mercufenol chloride; methylbenzethonium chloride; nonylphenoxypoly (ethylencyoxy) ethanololiodine; phenol (less than 1.5 percent); phenol (greater than 1.5 percent); poloxamer-iodine complex; secondary amyttricresols; sodium oxychlorosene; triple dye; and undecoylium chloride iodine complex.

3 Based on studies of potassium iodide.

4 The change in classification from sufficient data to incomplete data compared to the Consumer Wash PR (78 FR 76444 at 76458) is a reflection of the higher frequency of use in the health care setting.

5 Applies to povidone molecules greater than 35,000 daltons.

In the remainder of this section, we discuss the existing data and data gaps for each of the following health care antiseptic active ingredients that was proposed as GRAS in the 1994 TFM and explain why these active ingredients are
no longer proposed as GRAS for use in health care antiseptics (i.e., why they are now proposed as Category III):

- Alcohol
- Hexylresorcinol
- Iodine tincture USP
- Iodine topical solution USP
- Isopropyl alcohol
- Povidone-iodine
- Triclocarban

We also discuss the following antiseptic active ingredients that were proposed as Category III in the 1994 TFM and for which there are some new data available and explain why these ingredients are still Category III:

- Benzalkonium chloride
- Benzethonium chloride
- Chloroxylenol
- Triclosan

We do not discuss the following antiseptic active ingredients that were proposed as Category III in the 1994 TFM because we are not aware of any new safety data for these active ingredients:

- Cloflucarban
- Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate)
- Iodine complex (phosphate ester of alkarylxylo polyethylene glycol)
- Mercufenol chloride
- Mercufenol chloride and secondary amyltricresols in 50 percent alcohol

1. Alcohol

In the 1994 TFM, FDA proposed to classify alcohol as GRAS for all health care antiseptic uses based on the recommendation of the Miscellaneous External Panel, which concluded that the topical application of alcohol is safe (47 FR 22324 at 22329 and 59 FR 31402 at 31412). FDA is now proposing to classify alcohol as Category III.

Extensive studies have been conducted to characterize the metabolic and toxic effect of alcohol in animal models. Although the impetus for most of the studies has been to study the effects of alcohol exposure via the oral route of administration, some dermal toxicity studies are available and have shown that, although there is alcohol absorption through human skin, it is much lower than absorption via the oral route. Overall, there are adequate safety data to make a GRAS determination for alcohol, with the exception of human pharmacokinetic data under maximal use conditions.

**Table 11—Results of Alcohol Hand Rub Absorption Studies in Humans**

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of subjects</th>
<th>Amount of alcohol in hand rub (percent)</th>
<th>Volume of hand rub used (milliliter (mL))</th>
<th>Number of hand rub applications during the study</th>
<th>Total length of assessment</th>
<th>Highest blood alcohol level detected (Milligram/Deciliter (mg/dL))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>95</td>
<td>4</td>
<td>20</td>
<td>30 minutes</td>
<td>2.10</td>
</tr>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>95</td>
<td>1.4</td>
<td>10</td>
<td>80 minutes</td>
<td>1.75</td>
</tr>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>95</td>
<td>4</td>
<td>10</td>
<td>30 minutes</td>
<td>1.15</td>
</tr>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>85</td>
<td>1.4</td>
<td>10</td>
<td>80 minutes</td>
<td>3.01</td>
</tr>
<tr>
<td>Kirschner, et al. (Ref. 120)</td>
<td>14</td>
<td>74.1</td>
<td>20</td>
<td>One 10-minute application</td>
<td>10 minutes</td>
<td>-0.175</td>
</tr>
<tr>
<td>Brown, et al. (Ref. 121)</td>
<td>20</td>
<td>70</td>
<td>1.2–1.5</td>
<td>30</td>
<td>1 hour</td>
<td>1.2</td>
</tr>
<tr>
<td>Ahmed-Lecheheb, et al. (Ref. 122)</td>
<td>86</td>
<td>70</td>
<td>3</td>
<td>Average of 9.3</td>
<td>4 hours</td>
<td>0.022</td>
</tr>
<tr>
<td>Miller, et al. (Ref. 5)</td>
<td>5</td>
<td>62</td>
<td>5</td>
<td>50</td>
<td>4 hours</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Miller, et al. (Ref. 123)</td>
<td>1</td>
<td>62</td>
<td>5</td>
<td>25</td>
<td>2 hours</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>55</td>
<td>4</td>
<td>20</td>
<td>30 minutes</td>
<td>0.69</td>
</tr>
<tr>
<td>Kramer, et al. (Ref. 4)</td>
<td>12</td>
<td>55</td>
<td>1.4</td>
<td>10</td>
<td>80 minutes</td>
<td>0.88</td>
</tr>
<tr>
<td>Bessonneau, V. and O. Thomas (Ref. 124)</td>
<td>1</td>
<td>70</td>
<td>3</td>
<td>5</td>
<td>NA</td>
<td>1.43</td>
</tr>
<tr>
<td>Bessonneau, V. and O. Thomas (Ref. 124)</td>
<td>1</td>
<td>70</td>
<td>1.3 mL x 2</td>
<td>5</td>
<td>NA</td>
<td>2.02</td>
</tr>
</tbody>
</table>

1 Product applied using a surgical scrub procedure.
2 Product applied to the subject's back rather than to the hands to exclude any significant interference of inhaled uptake of evaporated alcohol.
3 Assessed under actual use conditions in a hospital.
4 Not available because of different study design.
5 Alcohol concentration measured in air collected from the subject's breathing zone.

One alcohol-containing drink is equivalent to approximately 14 grams of alcohol (Ref. 290).
Alcohol ADME data. Animal absorption studies have been conducted both in vitro (Ref. 125) and in vivo in several species (Refs. 126 through 129). After absorption, alcohol is metabolized primarily in the liver by alcohol dehydrogenase to acetaldehyde. Acetaldehyde, in turn, is rapidly metabolized to acetic acid by aldehyde dehydrogenase. These data are sufficient to show that about 5 percent of consumed alcohol is excreted in breath and another 5 percent in urine, with negligible amounts excreted in sweat and feces. Overall, the available animal ADME data are adequate to make a GRAS determination.

Alcohol carcinogenicity data. The carcinogenicity of alcohol has been studied by both the dermal and oral routes of administration in animals and by the oral route of administration in humans. These studies are sufficient to characterize the risk of carcinogenesis from the use of alcohol-containing health care antiseptics. Based on two adequate and well-controlled trials, chronic dermal application of alcohol does not appear to be carcinogenic in animals and no further dermal carcinogenicity data are needed to make a GRAS determination (Refs. 130 and 131).

Dermal carcinogenicity data have been obtained from studies where alcohol was used as a vehicle control in 2-year studies. For example, a study performed by the National Toxicology Program (NTP) evaluated the carcinogenic potential of diethanolamine by the dermal route of administration in rats and mice (Ref. 130). Each species had a vehicle control group that was treated with alcohol only. The skin of F334/N rats (50/sex/group) and B6C3F1 mice (50/sex/group) was treated with 95 percent alcohol for 5 days per week for 103 weeks. The amount of alcohol administered corresponds to a daily dose of 442 mg/kg/day and 1,351 mg/kg/day in rats and mice, respectively. None of the alcohol-treated rats or mice showed any skin tumors; however, every mouse group, including the alcohol-alone treatment, showed high incidences of liver tumors. It is unclear whether the high liver tumor incidence was caused by background incidence or by the chronic topical application of alcohol. Dermal administration of alcohol to the skin did not result in skin tumors under the conditions of this study.

Another study performed by the NTP evaluated the carcinogenic potential of benzethonium chloride by the dermal route of administration in rats and mice (Ref. 131). Each species had a vehicle control group that was treated with 95 percent alcohol only. The rats and mice were treated for 5 days per week for 103 weeks. There was no evidence of an increased incidence of skin tumors in the alcohol-treated rats or mice.

In another study, alcohol was used as a vehicle control in the dermal administration of 9,10-dimethyl-1,2-benzanthracene (DMBA), a known carcinogen (Ref. 132). Application of 0.02 mL alcohol alone on the skin of mice 3 times per week for 20 weeks did not cause any tumors. Despite the fact that this study did not cover the entire lifespan of the mice, it provides additional support that alcohol is not tumorigenic to skin after prolonged dermal administration.

In contrast, chronic administration of orally ingested alcohol has been associated with carcinogenicity in both animals and humans (Ref. 133). In animals, alcohol treatment increased tumor incidences in multiple organs (Refs. 134, 135, and 136). In humans, drinking around 50,000 mg of alcohol per day increased the risk for cancers of the oral cavity, pharynx, larynx, esophagus, liver, colon, and rectum in both men and women, and breast cancer in women (Refs. 119 and 137). However, no significant increases in cancer risk for any of these types of cancer appear to be associated with less than one alcoholic drink (about 14,000 mg of alcohol) per day. Based on currently available human absorption data, the highest observed alcohol exposure was 1,500 mg after use equivalent to 40 rubs per hour (Ref. 4), which is far below the alcohol levels that have been shown to be associated with cancer.

Bevan and colleagues evaluated the potential cancer risk from occupational exposures to alcohol via the inhalation and dermal routes, including the risk to health care workers (Ref. 119). They estimated that under a “worst-case scenario” of a hospital worker disinfecting both hands and lower arms with alcohol 20 times per day, dermal uptake would be approximately 600 mg of alcohol/day. When a more realistic worst-case estimate of 100 hand rubs per day is used (Ref. 101), systemic alcohol exposure may be as high as 6,825 mg/day, assuming bioavailability remains at 2.3 percent for 95 percent alcohol (Ref. 4). Ultimately, systemic exposure data from a human MUsT are needed to fully assess the risk to health care workers.

Alcohol DART data. The developmental and reproductive toxicity profile of orally administered alcohol is well characterized. In many animal species, alcohol consumption during pregnancy can result in retarded development and structural malformations of the fetus. In humans, consumption of even small amounts of alcohol in pregnant women may result in fetal alcohol spectrum disorders (FASD) and other major structural malformations; therefore, according to the Centers for Disease Control and Prevention, there is no known level of safe alcohol consumption during pregnancy (Ref. 138). The most severe form of FASD, fetal alcohol syndrome, has been documented in infants of mothers who consumed large amounts of alcohol throughout pregnancy (Ref. 292). Based on available absorption data, however, it is highly unlikely that the levels of alcohol absorbed as a result of health care antiseptic use would approach the levels that cause fetal alcohol syndrome.

Alcohol data on hormonal effects in animals. Alcohol exposure affects the level of a number of different hormones in animals. In vitro studies have shown that alcohol at a concentration of 280 to 300 mg/dL increased production of human chorionic gonadotropin and progesterone by cultured trophoblasts (Ref. 139), and at concentrations of at least 2,500 mg/dL, decreased the ability of rat Leydig cells to secrete testosterone by up to 44 percent (Ref. 140). There are also many in vivo studies of the effects of alcohol on hormone levels in animals after oral administration. Alcohol exposures are associated with suppression of the hypothalamic pituitary gonadal (HPA) axis in male rats. For example, in an alcohol feeding study where adult rats were treated for 5 weeks with 6 percent alcohol, resulting in blood alcohol levels of 110 to 160 mg/dL, the serum and testicular testosterone concentrations of the alcohol group were significantly lower than in untreated controls (P < 0.01) (Ref. 141). The serum luteinizing hormone concentration of alcohol-treated rats was significantly higher than that of diet controls (P < 0.01), but the pituitary luteinizing hormone, the serum and pituitary follicle-stimulating hormone, and the prolactin concentrations did not differ. When the effect of alcohol exposure was compared in prepubescent and adult rats, treatment with 500 to 4,000 mg/kg decreased serum testosterone levels in adult rats as expected (Ref. 293). In contrast, the opposite effect was observed in prepubescent male rats (25–30 days old) where alcohol treatment produced dose-dependent increases in serum testosterone levels. Serum luteinizing hormone levels in alcohol-treated rats were either unchanged or only modestly decreased in all ages tested. Results of this study suggest that
alcohol at serum levels of greater than 200 mg/dL exerts age-dependent effects on the synthesis and secretion of testosterone throughout sexual maturation in rats. Overall, the effects of alcohol on hormones in animals have been well characterized and no additional data are needed to make a GRAS determination.

**Alcohol data on hormonal effects in humans.** The effects of alcohol on human hormones are multiple and complex. Several variables, including the type, length, and pattern of alcohol exposure, and coexisting medical problems, such as malnutrition and liver dysfunction, must be considered when assessing the impact of alcohol on hormonal status (Ref. 142). Pregnant health care workers are a potentially vulnerable population given that alcohol is a teratogen, and alcohol-containing antiseptic hand rubs are used frequently in health care settings. Alcohol in the maternal bloodstream crosses readily into the placenta and the fetal compartment (Ref. 143). This results in similar blood alcohol concentrations in the mother, the fetus, and the amniotic fluid (Ref. 143). The fetus has very limited metabolic capacity for alcohol primarily because of low to absent hepatic activity for the metabolism of alcohol (Ref. 144). Although both the placenta and fetus have some capacity to metabolize alcohol, the majority of alcohol metabolism occurs in maternal metabolic systems outside of the fetal compartment (Ref. 143). The maternal alcohol use (by ingestion) is the leading known cause of developmental and cognitive disabilities in the offspring, and is a preventable cause of birth defects (Ref. 145).

However, based on available absorption data, it is highly unlikely that the levels of alcohol absorbed as a result of health care antiseptic use would approach the levels that cause fetal alcohol syndrome. Nonetheless, children exposed to lower levels of alcohol in utero may be vulnerable to more subtle effects. Currently, the levels of alcohol exposure that cause more subtle effects are unknown.

Unlike the abundance of data from oral exposure, there are no data on the effects of systemic exposure to alcohol during pregnancy from the use of alcohol-containing hand rubs. There are, however, some pharmacokinetic data on alcohol absorption after hand rub use in the nonpregnant population (described in the human pharmacokinetic subsection of this section of the proposed rule). As noted previously, the available data suggest that with moderate health care antiseptic hand rub use (e.g., evaluations of the amount of alcohol in the blood at up to 4 hours of use), systemic alcohol exposure is relatively low, but may be as high as 10 percent of an alcohol-containing drink. However, health care workers who use these products chronically and repetitively may be required to use alcohol-containing hand rubs in situations such as prior to and following contact with patients or contact with body fluids, and therefore may be exposed to these products a hundred times or more per day (Ref. 101).

Consequently, additional human pharmacokinetic data are needed to determine the level of alcohol exposure following maximal use of health care antiseptics (i.e., MUST) to determine the level of risk from the use of these products.

**Alcohol resistance data.** The antimicrobial mechanism of action of alcohol is considered nonspecific. It is believed that alcohol has multiple toxic effects on the structure and metabolism of microorganisms, primarily caused by denaturation and coagulation of proteins (Refs. 146 through 149). Alcohol’s reactive hydroxyl (-OH) group readily forms hydrogen bonds with proteins, which leads to loss of structure and function, causing protein and other macromolecules to precipitate (Ref. 148). Alcohol also lyases the bacterial cytoplasmic membrane, which releases the cellular contents and leads to bacterial inactivation (Ref. 146). Because of alcohol’s speed of action and multiple, nonspecific toxic effects, microorganisms have a difficult time developing resistance to alcohol. Of note, researchers have been attempting to develop alcohol-tolerant bacteria for use in biofuel production and beverage biotechnology applications. One of the most alcohol-tolerant bacteria, *Lactobacillus*, has been shown to grow in the presence of up to 13 percent alcohol, which is far lower than the alcohol concentrations present in health care antiseptic products (Ref. 150). Health care antiseptic products contain at least 60 percent alcohol (59 FR 31402 at 31442), and bacteria are unable to grow in this relatively high concentration of alcohol. Furthermore, alcohol evaporates readily after topical application, so no significant antiseptic residue is left on the skin that could contribute to the development of resistance (Refs. 146 and 148).

Consequently, the development of resistance as a result of health care antiseptic use is unlikely, and additional data on the development of antimicrobial resistance to alcohol are not needed to support a GRAS determination.

**b. Alcohol safety data gaps.** In summary, our administrative record for the safety of alcohol is incomplete with respect to the following:

- Human pharmacokinetic studies under maximal use conditions when applied topically (MUST), including documentation of validation of the methods used to measure alcohol and its metabolites and
- data to help define the effect of formulation on dermal absorption.

2. Benzalkonium Chloride

In the 1994 TFM, FDA categorized benzalkonium chloride in Category III because of a lack of adequate safety data for its use as both a health care personnel hand wash and surgical hand scrub (59 FR 31402 at 31435). FDA continues to propose benzalkonium chloride as Category III. Because of its widespread use as an antimicrobial agent in cosmetics and as a disinfectant for hard surfaces in agriculture and medical settings, the safety of benzalkonium chloride has also been reviewed by the Environmental Protection Agency and an industry review panel (Cosmetic Ingredient Review (CIR)) (Refs. 151 and 152) and found to be safe for disinfectant and cosmetic uses, respectively. Both these evaluations have been cited by the comments in support of the safety of benzalkonium chloride as a health care antiseptic wash active ingredient (Ref. 153).

Each of these evaluations cites findings from the type of studies necessary to support the safety of benzalkonium chloride for repeated daily use. However, the data that are the basis of these safety assessments are proprietary and are publicly available only in the form of summaries. Consequently, these studies are not available to FDA and are precluded from a complete evaluation by FDA. In addition, the submitted safety assessments with study summaries do not constitute an adequate record on which to base a GRAS classification (see generally § 330.10(a)(4)(i)). For FDA to evaluate the safety of benzalkonium chloride for this rulemaking, these studies must be submitted to the rulemaking or otherwise be made publicly available.

In addition to these summaries, as discussed in the 2013 Consumer Wash PR (78 FR 76444 at 76463), FDA has reviewed studies on resistance data and antibacterial susceptibility of certain bacteria (Refs. 62, 68, 70, 71, 73, 154, 155, and 156), and determined that the available studies have examined few
bacterial species, provide no information on exposure levels, and are not adequate to define the potential for the development of resistance or cross-resistance. Additional data are needed to more clearly define the potential for the development of resistance to benzalkonium chloride. Also, currently, no oral or dermal carcinogenicity data are publicly available. Thus, additional safety data are needed before benzalkonium chloride can be confirmed to be GRAS for use in health care antiseptic products.

Benzalkonium chloride safety data gaps. In summary, our administrative record for the safety of benzalkonium chloride is incomplete with respect to the following:

- Human pharmacokinetic studies under maximal use conditions when applied topically (MU’sT), including documentation of validation of the methods used to measure benzalkonium chloride and its metabolites;
- Data to help define the effect of formulation on dermal absorption;
- Animal ADME;
- Oral carcinogenicity;
- Dermal carcinogenicity;
- DART studies;
- Potential hormonal effects; and
- Data from laboratory studies that assess the potential for the development of resistance to benzalkonium chloride and cross-resistance to antibiotics as discussed in section VII.C.4.

4. Chloroxylenol

In the 1994 TFM, FDA classified chloroxylenol as lacking sufficient evidence of safety for use as a health care personnel hand wash and surgical hand scrub (59 FR 31402 at 31435). FDA is now proposing to classify benzethonium chloride as Category III for both safety and effectiveness. Since publication of the 1994 TFM, two industry review panels (CIR and a second industry panel identified in a comment only as an “industry expert panel”) and a European regulatory advisory board (Scientific Committee on Cosmetic Products and Non-food Products Intended for Consumers) have evaluated the safety of benzethonium chloride when used as a preservative in cosmetic preparations and as an active ingredient in consumer hand soaps (Refs. 157, 158, and 159). These advisory bodies found benzethonium chloride to be safe for these uses. However, all these safety determinations have largely relied on the findings of proprietary studies that are not publicly available. One of these evaluations, by the unidentified industry expert panel, was submitted to the rulemaking to support the safety of benzethonium chloride (Ref. 160).

Some of the safety data reviewed by the unidentified industry expert panel represent the type of data that are needed to evaluate the safety of benzethonium chloride for use in consumer antiseptic wash products, e.g., ADME, DART, and oral carcinogenicity studies. The safety assessments used to support the unidentified industry expert panel’s finding of safety, however, are publicly available only in the form of summaries. Consequently, these studies are not available to FDA for a complete evaluation. Furthermore, the submitted safety assessments with study summaries do not constitute an adequate record on which to base a GRAS classification (see generally § 330.10(a)(4)(ii)). For FDA to include these studies in the administrative record for this rulemaking, the studies must be submitted to the rulemaking or otherwise made publicly available.

In addition to these summaries, as discussed in the 2013 Consumer Wash PR (78 FR 76444 at 76464–76465), FDA has reviewed the following: (1) ADME studies providing data from dermal and intravenous administration to rats and a rat in vitro dermal absorption study (Refs. 131 and 160 through 163). FDA determined that additional data from ADME studies in animals are necessary to support a GRAS determination because of highly variable results in the submitted studies, the need to clearly define the level of dermal absorption, the effect of formulation on dermal absorption, and the distribution and metabolism of benzethonium chloride in animals; (2) A dermal carcinogenicity study (Ref. 131), which is adequate to show that benzethonium chloride does not pose a risk of cancer after repeated dermal administration; however, oral carcinogenicity data are still lacking; (3) DART data from teratology studies on rats and rabbits, as well as an embryo-fetal rat study (Ref. 160) and determined that the DART data are not adequate to characterize all aspects of reproductive toxicity and that studies are needed to assess the effect of benzethonium chloride on male and female fertility and on prenatal and postnatal endpoints; and (4) Resistance data from studies on bacterial susceptibility for benzethonium chloride and antibiotics (Refs. 164 and 165) and determined that the available studies examine few bacterial species, provide no information on the level of benzethonium chloride exposure, and are not adequate to define the potential for the development of resistance and cross-resistance to antibiotics.

Additional laboratory studies are necessary to more clearly define the potential for the development of resistance to benzethonium chloride. In addition, we lack human pharmacokinetic studies under maximal use conditions, which are needed to define the level of systemic exposure following repeated use. Thus, additional safety data are needed before benzethonium chloride can be confirmed to be GRAS for use in health care antiseptic products.

Benzethonium chloride safety data gaps. In summary, our administrative record for the safety of benzethonium chloride is incomplete with respect to the following:

- Human pharmacokinetic studies under maximal use conditions when applied topically (MU’sT), including documentation of validation of the methods used to measure benzethonium chloride and its metabolites;
- Data to help define the effect of formulation on dermal absorption;
- Animal ADME;
- Oral carcinogenicity;
- DART studies (fertility and embryo-fetal testing);
- Potential hormonal effects; and
- Data from laboratory studies that assess the potential for the development of resistance to benzethonium chloride and cross-resistance to antibiotics as discussed in section VII.C.4.

In the 1994 TFM, FDA classified chloroxylenol as lacking sufficient evidence of safety for use as a health care personnel hand wash and surgical hand scrub for FDA to determine whether chloroxylenol is GRAS for use in health care antiseptic products (59 FR 31402 at 31435). FDA is now proposing to classify chloroxylenol as Category III for both safety and effectiveness. Additional safety data continue to be needed to support the long-term use of chloroxylenol in OTC health care antiseptic products. As discussed in the 2013 Consumer Wash PR, chloroxylenol is absorbed after topical application in both humans and animals. However, studies conducted in humans and animals are inadequate to fully characterize the extent of systemic absorption after repeated topical use or to demonstrate the effect of formulation on dermal absorption. The administrative record also lacks other important data to support a GRAS determination for this antiseptic active ingredient.

As discussed in the 2013 Consumer Wash PR (78 FR 76444 at 76465–76467), FDA reviewed the following:
• Human pharmacokinetic data from dermal and percutaneous absorption studies (Refs. 166 and 167) and determined that the human pharmacokinetic studies are inadequate and studies using dermal administration under maximal use conditions are needed to define the level of systemic exposure following repeated use and the effect of formulation on dermal absorption;

• dermal ADME studies (Refs. 168 and 169) that demonstrated that absorption of chloroxylenol occurs after dermal application in humans and animals, but that the administrative record for chloroxylenol still lacks data to fully characterize the rate and extent of systemic absorption, the similarities and differences between animal and human metabolism of chloroxylenol under maximal use conditions, and data to help establish the relevance of findings observed in animal toxicity studies to humans;

• carcinogenicity data from a dermal toxicity study in mice (Ref. 170) and determined that a long-term dermal carcinogenicity study and an oral carcinogenicity study are needed to characterize the systemic effects from long-term exposure;

• DART data from a teratology study in rats (Ref. 171) and determined that additional studies are necessary to assess the effect of chloroxylenol on fertility and early embryonic development and on prenatal and postnatal development; and

• resistance data from studies on antibiotic susceptibilities in chloroxylenol-tolerant bacteria and antimicrobial susceptibilities of bacteria from industrial sources (Refs. 156, 164, 171, and 172) and determined that these studies examine few bacterial species, provide no information on the level of chloroxylenol exposure, and are not adequate to define the potential for the development of resistance to chloroxylenol and cross-resistance to antibiotics. Thus, additional safety data are needed before chloroxylenol can be considered to be GRAS for use in health care antiseptic products.

Chloroxylenol safety data gaps. In summary, our administrative record for the safety of chloroxylenol is incomplete with respect to the following:

• Human pharmacokinetic studies under maximal use conditions when applied topically (i.e., MUsT), including documentation of validation of the methods used to measure chloroxylenol and its metabolites;

• animal ADME at toxic exposure levels;

• dermal carcinogenicity;

• oral carcinogenicity;

• DART studies defining the effects of chloroxylenol on fertility and prenatal and postnatal development;

• potential hormonal effects; and

• data from laboratory studies that assess the potential for the development of resistance to chloroxylenol and cross-resistance to antibiotics as discussed in section VII.C.4.

5. Hexylresorcinol

In the 1994 TFM, FDA proposed to classify hexylresorcinol as GRAS for all antiseptic uses covered by that TFM, including health care antiseptic uses, based on the recommendations of the Panel, who concluded that the topical application of hexylresorcinol is safe (39 FR 33103 at 33134). FDA is now proposing to classify hexylresorcinol as Category III. In support of its GRAS conclusion, the Panel cited hexylresorcinol’s long history of use as an oral antihelmintic (a drug used in the treatment of parasitic intestinal worms) in humans and the lack of allergic reactions or dermatitis associated with topical use. The Panel noted that no information was provided regarding dermal or ophthalmic toxic potency or absorption and blood levels attained after application to intact or abraded skin or mucous membranes, but concluded that the few animal toxicity studies submitted as summaries indicated a “low order” of toxicity (Ref. 173).

In light of the new safety information about systemic exposure to antiseptic active ingredients, the data relied on by the Panel should be supplemented to support a GRAS determination. Currently, there are only minimal data available to assess the safety of the repeated, daily, long-term use of hexylresorcinol. As discussed in the proposed rule covering consumer antiseptic washes (78 FR 76444 at 76458), FDA has reviewed an adequate oral carcinogenicity study with results it considers negative (Ref. 174), an ADME study providing data from oral administration to dogs (Ref. 175) and humans (Ref. 176), and other information, and determined that additional safety data are needed before hexylresorcinol can be considered GRAS for use in OTC antiseptic products. We conclude that these data gaps also exist for use as a health care antiseptic.

Hexylresorcinol safety data gaps. In summary, our administrative record for the safety of hexylresorcinol is incomplete with respect to the following:

• Human pharmacokinetic studies under maximal use conditions when applied topically (i.e., MUsT), including documentation of validation of the methods used to measure hexylresorcinol and its metabolites;

• data to help define the effect of formulation on dermal absorption;

• animal ADME;

• dermal carcinogenicity;

• DART studies;

• potential hormonal effects; and

• data from laboratory studies that assess the potential for the development of resistance to hexylresorcinol and cross-resistance to antibiotics as discussed in section VII.C.4.

6. Iodine-Containing Ingredients

Elemental iodine, which is the active antimicrobial component of iodine-containing antiseptics, is only slightly soluble in water (Ref. 177). Consequently, iodine is frequently dissolved in an organic solvent (such as a tincture) or complexed with a carrier molecule. Both surfactant (e.g., poloxamer) and nonsurfactant (e.g., povidone) compounds have been complexed with iodine. The carrier molecules increase the solubility and stability of iodine by allowing the active form of iodine to be slowly released over time (Ref. 177). The rate of the release of “free” elemental iodine from the complex is a function of the equilibrium constant of the complexing formulation (39 FR 33103 at 33129). In the 1994 TFM, all the iodine-containing active ingredients were proposed as GRAS for OTC health care antiseptic use (59 FR 31402 at 31435). FDA is now proposing to classify all iodine-containing active ingredients as Category III for both safety and effectiveness. Since the publication of the 1994 TFM, we have identified new safety data for the following active ingredients:

• Iodine tincture USP

• Iodine topical solution USP

• Povidone-iodine 5 to 10 percent

Iodine is found naturally in the human body and is essential for normal human body function. In the body, iodine accumulates in the thyroid gland and is a critical component of thyroid hormones. People obtain iodine through their food and water, which are often supplemented with iodine to prevent iodine deficiency. Because people are widely exposed to iodine, it has been the subject of comprehensive toxicological review by public health organizations (Refs. 178 and 179). Much of the safety data we reviewed pertained to elemental iodine alone.
Consequently, additional data on some of the carrier molecules are needed. In the 1994 TFM, FDA stated that neither the medium nor large molecular weight size povidone molecules (35,000 daltons or greater) presented a safety risk when limited to the topical uses described in the monograph and that larger size povidone-iodine molecules would not be absorbed under the 1994 TFM conditions of use (59 FR 31402 at 31424). We continue to think that data on the larger size molecules are not necessary to support a GRAS determination for iodine-containing ingredients. However, data are lacking on the absorption of smaller molecular weight povidone molecules and for other small molecular weight carriers (less than 500 daltons (Ref. 180)).

Human absorption studies following maximal dermal exposure to these carriers can be used to determine the potential for systemic toxicity from the carrier molecule. For carrier molecules that are absorbed following dermal exposure, we propose that the following data are needed to support a GRAS determination: Systemic toxicity of the carrier in animal studies that identify the target organ for toxicity, and characterization of the metabolic fate of the carrier as recommended by the Panel (39 FR 33103 at 33130).

As discussed in the 2013 Consumer Wash PR (78 FR 76444 at 76459–76461), FDA has reviewed the following:

- Human pharmacokinetic data from absorption studies (Refs. 178, 181, 182, and 183) and determined that they do not provide sufficient information to estimate typical amounts of iodine that could be absorbed from health care antiseptic products containing iodine and iodine complexes;
- Iodine ADME data (Refs. 178, 184, and 185), and determined that the distribution, metabolism, and excretion of iodine have been adequately assessed in humans and no further animal ADME data are needed to support a GRAS determination;
- Oral carcinogenicity studies providing data from oral administration to rats and tumor promotion in rats (Refs. 186, 187, and 188) and determined that based upon the available data, oral doses of iodine do not significantly raise the risk of cancer in animals and no further oral carcinogenicity data are needed to make a GRAS determination;
- DART data from studies assessing the effects of iodine on reproduction, embryo-fetal development, lactation, and survival in animals (Refs. 178 and 189) and determined that the effect of iodine on development and reproductive toxicology are well characterized and additional DART studies are not needed to make a GRAS determination; and
- Iodine data on hormonal effects, including studies of the effect of iodine on the thyroid gland (Refs. 178, 179, 181, 183, 190, 191, 192, and 196 through 206), and determined that, despite limitations in some of the studies, FDA believes there are adequate data regarding the potential of iodine to cause changes in thyroid hormone levels and additional studies are not necessary to make a GRAS determination.

In addition, based on the available data, more information is needed to support the frequent, topical use of iodine-containing health care antiseptics by pregnant and breastfeeding health care personnel. Iodine-containing health care antiseptics, particularly povidone-iodine, are used frequently as surgical hand scrubs. Although the daily exposure from surgical hand scrubs would be much lower than from health care personnel hand washes, because of the potential for absorption of iodine and transient hypothyroidism in newborns (Refs. 191, 192, 199, and 203), chronic use of iodine-containing health care antiseptics by pregnant and breastfeeding health care personnel needs to be evaluated. Consequently, additional human pharmacokinetic data are needed to determine the level of iodine exposure following maximal health care antiseptic use (i.e., MUsT) to determine the potential effects from chronic use of these products.

**Iodine safety data gaps.** In summary, our administrative record for the safety of iodine-containing active ingredients is incomplete with respect to the following:

- Human pharmacokinetic studies of the absorption of iodine under maximal use conditions when applied topically (MUsT) for each of the iodine-containing active ingredients, including documentation of validation of the methods used to measure iodine and its metabolites;
- Human absorption studies of the carrier molecule for small molecular weight povidone molecules (less than 35,000 daltons) and the other small molecular weight carriers (less than 500 daltons);
- Dermal carcinogenicity studies for each of the iodine-containing active ingredients; and
- Data from laboratory studies that assess the potential for the development of resistance to iodine and cross-resistance to antibiotics as discussed in section VII.C.4.

7. **Isopropyl Alcohol**

In the 1994 TFM, FDA proposed to classify isopropyl alcohol (70 to 91.3 percent) as GRAS for all health care antiseptic uses (59 FR 31402 at 31436). FDA is now proposing to classify isopropyl alcohol as Category III. The GRAS determination in the 1994 TFM was based on the recommendations of the Miscellaneous External Panel, which based its recommendations on human absorption data and blood isopropyl alcohol levels (47 FR 22324 at 22329). There was no comprehensive nonclinical review of the toxicity profile of isopropyl alcohol, nor was there a nonclinical safety evaluation of the topical use of isopropyl alcohol. We believe the existing evaluations need to be supplemented to fully evaluate the safety of isopropyl alcohol.

a. **Summary of Isopropyl Alcohol Safety Data**

**Isopropyl alcohol human pharmacokinetic data.** Based on a review of published literature, there are some data to characterize the level of dermal absorption and expected systemic exposure in adults following topical use of isopropyl alcohol-containing products. However, these data do not cover maximal use in the health care setting. In a study by Brown, et al., the cutaneous absorption of isopropyl alcohol from a commonly used hand rub solution containing 70 percent isopropyl alcohol was assessed in 19 health care workers ranging in age from 22 to 67 years (Ref. 121). The hand rub solution was administered under “intensive clinical conditions” by application of 1.2 to 1.5 mL of the isopropyl alcohol-containing hand rub 30 times during a 1-hour period on 2 separate days separated by a 1-day washout. Serum isopropyl alcohol concentrations at 5 to 7 minutes post-exposure as assessed by gas chromatography (lower limit of quantitation of 2 mg/dL) were not detectable in these subjects following the simulated “intense clinical conditions.”

Another study examined the pharmacokinetics of alcohol and isopropyl alcohol after separate and combined application in a double-blind, randomized, three-way crossover study (Ref. 120). Results show that all isopropyl alcohol concentrations measured in volunteers treated with 10 percent isopropyl alcohol in aqueous solution and the commercial combination product were below the detection limit of 0.5 mg/L. Another study by Turner and colleagues investigated the amount of isopropyl
alcohol absorbed through the skin in 10 healthy male and female adults following application of 3 mL of an isopropyl alcohol-containing hand rub (56 percent w/w isopropyl alcohol) applied to the hands every 10 minutes over a 4-hour period (Ref. 207). Nine of the 10 subjects exhibited measurable blood isopropyl alcohol concentrations at 5 minutes following final application of the hand rub (limit of detection, 0.5 mg/L). The range of isopropyl alcohol concentrations observed in this study was less than 0.5 mg/L to 1.8 mg/L.

A recent report assessed systemic absorption following the use of a hand rub containing 63.14 percent w/w isopropyl alcohol, using a surgical scrub method on 10 adults (Ref. 208). First, a hygienic hand rub was performed for 30 seconds. Ten minutes later, a 1.5-minute surgical hand rub procedure was performed before each of the three consecutive 90-minute surgical interventions. After application of the hand rub and air-drying, surgical gloves were donned. Samples were collected three times at 90-minute intervals after each surgical procedure and at 60 and 90 minutes after the third surgical procedure. The authors report that the highest median blood level was 2.56 mg/L for isopropyl alcohol.

In summary, dermal absorption of isopropyl alcohol following topical application of antiseptic hand rubs under simulated clinical conditions in adults suggests the systemic exposure to isopropyl alcohol when used as an active ingredient in health care antiseptic products is expected to be low. Clinical effects (mild intoxication) of elevated blood isopropyl alcohol levels occur at concentrations exceeding approximately 50 mg/dL (Ref. 209). The highest blood concentration of isopropyl alcohol observed across studies following various application scenarios with isopropyl alcohol-containing products was less than 2 mg/dL, or 4 percent of the systemic levels associated with acute clinical effects. However, the available studies did not assess the highest potential concentration of isopropyl alcohol (91.3 percent) that may be used in a health care antiseptic (50 FR 31402 at 31436), and these studies do not reflect the amount of exposure that may occur during a regular 8- to 12-hour work shift in a health care facility. Consequently, human pharmacokinetic data under maximal use conditions as determined by a MUsT are still needed to support a GRAS determination for isopropyl alcohol for use in health care antiseptic products.

**Isopropyl alcohol ADME data.** There are few animal studies that examine the absorption of isopropyl alcohol following dermal exposure. The majority of studies used non-dermal routes of exposure (i.e., oral or inhalation) (Refs. 210 and 211). The available dermal exposure studies have demonstrated that there is some systemic exposure to isopropyl alcohol following dermal application. However, the extent of that exposure has not been fully characterized.

In a dermal exposure study in rats, 70 percent aqueous isopropyl alcohol solution was applied to a 4.5 square centimeter area of skin on the shaved backs of male and female Fischer F–344 rats and maintained under a sealed chamber for a period of 4 hours (Ref. 212). Most of the drug (approximately 85 percent of the dose) was recovered from the application site (i.e., was not absorbed). The remainder of the dose (approximately 15 percent) was detected in the blood within 1 hour after application, indicating that dermal exposure resulted in some systemic exposure. Maximum blood isopropyl alcohol concentrations of isopropyl alcohol were attained at 4 hours and decreased steadily following removal of the test material. The half-life of elimination (T1/2) of isopropyl alcohol from blood was 0.77 and 0.94 hours for male and female rats, respectively. AUC was not determined.

Martinez, et al. compared isopropyl alcohol blood levels in rabbits after oral, dermal, and inhalation exposure (Ref. 213). Male rabbits (unidentified strain, three animals per group) were given 2 or 4 g/kg isopropyl alcohol via oral gavage, or unknown doses of isopropyl alcohol via inhalation exposure with or without concomitant dermal exposure. Isopropyl alcohol blood levels were measured for up to 4 hours after the initiation of treatment. The highest blood isopropyl alcohol concentrations were observed from the oral route of administration (262 and 278 mg/dL in the 2 and 4 g/kg groups, respectively). The dermal and inhalation groups produced a mean blood isopropyl alcohol concentration of 112 mg/dL. The inhalation-only group had a mean blood concentration of 6 to 8 mg/dL. However, the study provides little information regarding the bioavailability of dermally applied isopropyl alcohol because of the unknown dosing for the group given isopropyl alcohol via the combination of inhalation and dermal exposures.

The available animal ADME data from non-dermal routes of exposure are sufficient to characterize the absorption, distribution, metabolism, and excretion of isopropyl alcohol. Isopropyl alcohol is rapidly absorbed following oral ingestion and inhalation (Ref. 214). Isopropyl alcohol is metabolized to acetone in both animals and man by the hepatic enzyme alcohol dehydrogenase and is then metabolized further to carbon dioxide through a variety of metabolic pathways (Refs. 215 and 216).

In animals, the excretion of isopropyl alcohol is pulmonary with approximately 3 to 8 percent excreted in the urine (Ref. 214). In humans, isopropyl alcohol is predominantly eliminated in the urine with a small amount being excreted through expiration (Ref. 217).

Slauter, et al. characterized the disposition and pharmacokinetics of isopropyl alcohol following intravenous (IV), oral (single and multiple doses), and inhalation exposure in male and female F–344 rats and B6C3F1 mice (Ref. 214). Animals were exposed to either an IV dose of 300 mg/kg, inhalation of 500 or 5,000 parts per million isopropyl alcohol for 6 hours, single oral doses of 300 mg/kg or 3,000 mg/kg, or multiple doses of 300 mg/kg for 8 days. AUC and T1/2 were calculated based on the study data. No major differences in the rate or route of elimination between sexes or routes of exposure were demonstrated, and repeated exposure had no effect on excretion. However, the rate of elimination was shown to be dose-dependent, with higher doses increasing the T1/2. Isopropyl alcohol and its metabolites were distributed to all tissues without accumulation in any particular organ. While these data are adequate to define the ADME profile of isopropyl alcohol following non-dermal exposure, they are not sufficient to characterize what would occur following dermal exposure. Absorption data following dermal absorption in animals are still needed in order to determine the extent of systemic exposure following maximal dermal exposure to isopropanol-containing health care antiseptic products.

Information on the distribution, metabolism, and excretion of isopropyl alcohol can be extrapolated from published data on the other routes of exposure.

**Isopropyl alcohol carcinogenicity data.** No data exist for the carcinogenicity potential of isopropyl alcohol following oral or dermal exposure in humans. The International Agency for Research on Cancer (IARC) monograph states that there is inadequate evidence of carcinogenicity of isopropyl alcohol in humans (Ref. 218). The IARC monograph indicates that an increased incidence of cancer of the paranasal sinuses was observed in workers at factories where isopropyl alcohol was manufactured by the strong-
acid process. In this instance, the primary route of exposure was through inhalation, rather than topical. The risk for laryngeal cancer may also have been elevated in these workers. However, it is unclear whether the cancer risk was caused by the presence of isopropyl alcohol itself or one of its by-products (diisopropyl sulfate, which is an intermediate in the process; or isopropyl oils, which are formed as by-products; or to other chemicals, such as sulfuric acid).

Inhalation carcinogenicity studies have been performed in animals to assess the potential carcinogenicity of isopropyl alcohol for industrial workers under occupational exposure conditions (Ref. 219). In a study in Fisher 344 rats and CD-1 mice by Burleigh-Flayer, et al., high-dose treated rats had higher mortality rates and shorter survival times compared to controls. However, lower exposure groups of rats and mice did not experience significant increases in any tumors following exposure to isopropyl alcohol via the inhalation route for up to 2 years (Ref. 219). Groups of animals were exposed via whole-body exposure chambers to 0 (control), 500 (low-dose), 2,500 (mid-dose) or 5,000 (high-dose) parts per million of isopropyl alcohol vapor 6 hours per day, 5 days per week for up to 78 weeks in CD-1 mice (55/sex/dose) and 104 weeks in Fischer 344 rats (65/sex/dose). These respective isopropyl alcohol exposure levels in the low-dose, mid-dose, and high-dose groups correspond to doses of approximately 570, 2,900, and 5,730 mg/kg/day in mice, and 350, 1,790, and 3,530 mg/kg/day in rats. At the end of treatment, a large panel of organs was collected from control and high-dose treated groups for histopathological examination. In the mid- and low-dose groups, only kidneys and testes were examined.

No increases in the incidence of neoplastic lesions were observed in either mice or rats. In mice, no differences in the mean survival time were noted for any of the exposure groups. No increases in the incidence of neoplastic lesions were noted from treatment groups in either sex. In rats, survival was poor in males but adequate in females; none of the high-dose males survived beyond 100 weeks of dosing. The mean survival time was 631 and 577 days (p < 0.01) for the control and high-dose groups, respectively. No difference in mean survival time was noted for female rats.

The main cause of death was chronic renal disease. Concentration-related increases in the incidence of interstitial cell adenoma of the testes were observed in male rats; however, this type of tumor is common among aged rats and was not considered to be treatment related. No increased incidence of other neoplastic lesions was observed in male rats, and no increased incidence of neoplastic lesions was observed for female rats from any exposure group.

No dermal carcinogenicity studies of isopropyl alcohol have been completed in animals, and little dermal data from other sources are available. In a subchronic 1-year dermal toxicity study, Rockland mice (30 per group) were treated three times weekly for 1 year with isopropyl alcohol (Ref. 216). No skin tumors were observed, but the sex, dose, and observation period were not specified. Although no evidence of carcinogenic potential was seen in this study, it was not long enough to be considered adequate for the assessment of the carcinogenicity potential of isopropyl alcohol via the dermal route.

Isopropyl alcohol DART data. A number of fertility and multigenerational studies were conducted for isopropyl alcohol administered via the oral route of exposure (Refs. 220 through 225). Isopropyl alcohol was associated with maternal toxicity when pregnant animals were exposed to high doses during pregnancy, but no teratogenic effects were noted on the pups. Isopropyl alcohol was not found to be teratogenic in rats in a number of studies using the oral exposure route using a 2-generation study design. Adverse effects noted for postnatal pups treated at high doses of isopropyl alcohol were limited to decreased pup body weights and increased liver weights (Ref. 221). Based on the weight of evidence from several studies, Faber and colleagues calculated the no observed adverse effect level (NOAEL) for pup postnatal survivability as 700 mg/kg/day in rats (Ref. 221). However, using an alternative, quantitative approach that takes dose-response information into account (i.e., benchmark dose approach), other researchers have estimated a benchmark dose of 420 mg/kg/day (Ref. 229). In conclusion, additional DART data are not needed to support a GRAS determination for health care antiseptic products containing isopropyl alcohol.

Isopropyl alcohol data on hormonal effects. Studies evaluating hormonal effects of isopropyl alcohol are limited. We found only one study in the literature, which showed that exposure to high levels of isopropyl alcohol via the intraperitoneal route was associated with some perturbations in brain hormones (e.g., noradrenaline, and serotonin) (Ref. 227). The significance of these changes in hormone levels on the long-term development of the treated pups has not been evaluated. Overall, this study is not adequate to characterize the potential for hormonal effects of isopropyl alcohol. The existing data come from a single study, using a route of exposure that is not relevant to health care antiseptics, and the study did not evaluate other important types of hormones (e.g., thyroid, sex hormones). Additional data to characterize the potential for hormonal effects of isopropyl alcohol are still needed to make a GRAS determination.

Isopropyl alcohol resistance data. We found no reports of bacterial resistance to isopropyl alcohol. Like alcohol, the antimicrobial mechanism of action of isopropyl alcohol is nonspecific, primarily caused by denaturation and coagulation of proteins (Refs. 146 through 149). High concentrations of isopropyl alcohol are toxic to most microorganisms due to its high oxygen demand and membrane-disruptive characteristics (Ref. 228). Because of isopropyl alcohol’s speed of action and multiple, nonspecific toxic effects, microorganisms have a difficult time developing resistance to it.

Isopropyl alcohol is a common, cheap industrial solvent and researchers have been attempting to develop isopropyl alcohol-tolerant bacteria for use in biological treatment of isopropyl alcohol-containing industrial waste. A recent study identified an isopropyl alcohol-tolerant strain of Paracoccus denitrificans that could grow in isopropyl alcohol at a concentration of 1.6 percent (Ref. 229), and a strain of Bacillus pallerius has been shown to grow in isopropyl alcohol up to 2.4 percent (Ref. 230). Thus, even isopropyl alcohol-tolerant strains could not survive in health care antiseptic products, which would contain at least 70 percent isopropyl alcohol (59 FR 31402 at 31442). Furthermore, isopropyl alcohol evaporates readily after topical application, so no antiseptic residue is left on the skin that could contribute to the development of resistance (Refs. 146 and 148). Consequently, the development of resistance as a result of health care antiseptic use is unlikely and additional data on the development of antimicrobial resistance to isopropyl alcohol are not needed to make a GRAS determination.

b. Isopropyl alcohol safety data gaps. In summary, our administrative record for the safety of isopropyl alcohol is incomplete with respect to the following:

- Human pharmacokinetic studies under maximal use conditions when applied topically (MUST), including
9. Triclosan

In the 1994 TFM, FDA classified triclosan as lacking sufficient evidence of safety for use as a health care personnel hand wash and surgical hand scrub (59 FR 31402 at 31436). FDA is now proposing to classify triclosan as Category III for all health care uses. Since the 1994 TFM, a large number of studies have been conducted to characterize the toxicological and metabolic profile of triclosan using animal models. Most of these studies have focused on understanding the fate of triclosan following exposure to a single source of triclosan via the oral route of administration. However, dermal studies in both humans and animals are also available. These studies show that triclosan is absorbed through the skin, but to a lesser extent than oral absorption.

As discussed in the 2013 Consumer Wash PR (78 FR 76444 at 76467–76469), FDA has reviewed the following:

- Human absorption data (Refs. 243 through 248) in the consumer setting;
- animal ADME data (Refs. 243, 244, and 248 through 253) and determined that the data are not adequate and additional pharmacokinetic data (e.g., AUC, Tmax, and Cmax) at steady-state levels continue to be necessary to bridge animal data to humans;
- short-term dermal toxicity studies in animals (Refs. 254 through 257) and determined that a long-term dermal carcinogenicity study is needed to assess the relevance of the short-term dermal toxicity findings to a chronic use situation;
- a 2-year oral carcinogenicity study of triclosan in hamsters (Refs. 258 and 259) and determined the data are adequate to show that triclosan does not pose a risk of cancer after repeated oral administration under the experimental conditions used;
- DART data (Refs. 260 and 261) and determined that the triclosan DART data are adequate and additional traditional DART studies are not necessary to make a GRAS determination;
- data on hormonal effects (Refs. 42 through 48, 51, and 262) and determined that the consequences of short-term thyroid and reproductive findings on the fertility, growth, and development of triclosan-exposed litters could be addressed by studies in juvenile animals; and
- data on the potential for development of antimicrobial resistance and cross-resistance between triclosan and antibiotics (Refs. 61, 62 through 66, 69, 72, 74 through 77, and 263) and determined that triclosan exposure can change efflux pump activity and alter antibiotic susceptibilities, but data are still needed that would clarify the potential public health impact of the currently available data.

In the 2013 Consumer Wash PR (78 FR 76444 at 76467), new data for some of the safety categories has also become available.

a. Summary of New Triclosan Safety Data

New triclosan human pharmacokinetics data. A recent biomonitoring study compared urine triclosan levels in a convenience sample of 76 health care workers in two hospitals (Ref. 264). One hospital used a 0.3 percent triclosan-containing soap in all patient care areas and restrooms. The second hospital used plain soap and water, having previously phased out triclosan-containing soaps. Both hospitals also had alcohol-based hand rub available. The use of triclosan-containing toothpaste and other personal care products was assessed through a questionnaire. Although the urinary concentrations of total (nonconjugated plus conjugated) triclosan were higher in health care workers that worked at the hospital using triclosan-containing soap, the use of triclosan-containing toothpaste was correlated with the highest urinary triclosan levels.

This study provides some information about health care worker exposure to triclosan, but it does not attempt to measure triclosan exposure under maximal use conditions. In summary, although human absorption of triclosan has been adequately characterized for moderate daily use, such as in the consumer setting, studies to evaluate maximal use in the health care setting are not available and MUST data are needed to make a GRAS determination.

New triclosan carcinogenesis data. A recent study examined the effect of triclosan treatment on the development of liver cancer in mice (Ref. 265). Oral exposure to triclosan at a daily dose of approximately 68.6 mg/kg for 8 months resulted in the proliferation of liver cells (hepatocytes); elevated accumulation of collagen in the liver, which is an indicator of fibrosis of the liver; and oxidative stress. Collectively, these findings suggest that long-term triclosan treatment in mice can lead to the type of liver injury that is a risk factor for the development of liver cancer (hepatocellular carcinoma).

The ability of triclosan to function as a tumor promoter (i.e., something that stimulates existing tumors to grow) also was evaluated. Male mice were pretreated with a single injection of a
chemical that can initiate tumors (diethylnitrosamine (DEN)). Test mice then received triclosan at approximately 28.6 mg/kg in their drinking water while control mice received untreated water for 6 months. Triclosan-treated mice had a higher number of liver tumors, larger tumor size, and greater tumor incidence than mice given DEN alone, suggesting that triclosan may be a tumor promoter for other carcinogens in the liver. The authors conclude that long-term triclosan treatment substantially accelerates the development of hepatocellular carcinoma in mice. The relevance of this study to humans, however, is not clear. The concentrations of triclosan used in this study are likely much higher than the concentrations that health care workers would be exposed to during antiseptic use. We invite comment on what these findings tell us about triclosan’s potential impact on human health and the submission of additional data on this subject.

New triclosan findings on muscle function. In the 2013 Consumer Wash PR, we described a study on the physiological effects of triclosan treatment on muscle function in mice and fish (Ref. 266). A newer study further examined the physiological effects of triclosan treatment on muscle function in fish (Ref. 267). This study examined whether triclosan’s effect on fish swimming performance correlates with altered messenger ribonucleic acid (mRNA) and protein expression of genes known to be critical for muscle function, including those that mediate the negative effects on muscle function seen in the previous study. We invite comment on what these findings tell us about triclosan’s potential impact on human health and the submission of additional data on this subject.

New triclosan data on hormonal effects. The studies reviewed in the 2013 Consumer Wash PR have demonstrated that triclosan has effects on the thyroid, estrogen, and testosterone systems in several animal species, including mammalian species (Refs. 42, 44 through 48, 51, and 262). A recent report describes two studies of the effect of triclosan exposure on thyroid hormone levels in pregnant and lactating rats, and in directly exposed offspring (Ref. 268). Pregnant rats (dams) were treated with 75, 150, or 300 mg triclosan per kilogram of body weight per day (mg/kg bw/day) throughout gestation and the lactation period by gavage. Total thyroxine (T₄) serum levels were measured in both the dams and offspring, which had indirect exposure to triclosan through the placenta and maternal milk. All doses of triclosan significantly lowered T₄ levels in dams, but no significant effects on T₄ levels were seen in the offspring at the end of the lactation period. In the second study, pups were dosed directly (gavaged) with 50 or 150 mg triclosan/kg bw/day from postnatal day 3 to 16. Significant reductions in the T₄ levels of 16-day-old offspring in both dose groups were noted. This study corroborates the effects on the thyroid seen in previous animal studies, but does not provide long-term data on the hormonal effects of triclosan exposure. Another new study showed that when triclosan was administered directly into the stomach (i.e., intragastrically) of adult rats at doses of 10, 50, and 200 mg/kg for 8 weeks, it resulted in a significant decrease in daily sperm production, changes in sperm morphology, and epididymal histopathology in rats treated with the highest dose of triclosan (Ref. 269).

The information in these studies has not changed our assessment of the need for additional data on hormonal effects. At this time, no adequate long-term (i.e., more than 30 days) in vivo animal studies have been conducted to address the consequences of these hormonal effects on functional endpoints of growth and development (e.g., link of prepubertal separation to sexual differentiation and fertility, link of decreased thyroxine/triiodothyronine to growth and neurobehavioral development) in exposed fetuses or pups. Studies in juvenile animals (of the type described in section VII.C.3) could address the consequences of short-term thyroid and reproductive findings on the fertility, growth, and development of triclosan-exposed litters.

New triclosan resistance data. The studies reviewed in the 2013 Consumer Wash PR showed that bacterial species with reduced susceptibility to triclosan were also resistant to one or more of the tested antibiotics (Refs. 61 through 66, 69, 72, 74 through 77, and 263). Several studies suggested that an efflux mechanism is responsible for the observed reduced triclosan susceptibility in some of the bacteria exhibiting resistance (Refs. 66, 69, 76, and 109). Newer studies have further characterized efflux pump activity in response to triclosan in a variety of these bacterial species (Refs. 110 and 270 through 274). Although the clinical relevance of these studies is not clear, the possibility that triclosan contributes to changes in antibiotic susceptibility warrants further evaluation.

In addition to bacterial efflux activity, other mechanisms have been described that may also contribute to reduced triclosan susceptibility. At low concentrations, triclosan can inhibit an essential bacterial enzyme (enoyl-acyl carrier protein reductase) involved in fatty acid synthesis (Refs. 275 and 276). In bacteria, four enoyl-acyl carrier protein reductases have been identified: FabI, FabK, FabL, and FabV (Refs. 276 and 277). Several recent studies have further characterized the effect of triclosan on enoyl-acyl carrier protein reductases in different bacterial species, which confirmed that over-expression of the fabI gene results in reduced triclosan susceptibility in S. aureus (Ref. 278), demonstrated that FabK can confer resistance to triclosan in Pseudomonas aeruginosa (Ref. 279), and refuted the theory that FabB from Enterococcus faecalis is responsible for the inherent triclosan resistance of this organism (Ref. 280). Taken together, these studies suggest that some bacteria have multiple resistance mechanisms that can be used to survive in the presence of triclosan.

A recent study analyzed 1,388 clinical isolates of S. aureus to determine their triclosan susceptibilities (Ref. 79). Sixty-eight strains that exhibited reduced susceptibility to triclosan, defined as a minimum bactericidal concentration greater than 4 mg/L, were chosen for further characterization, including sequencing of the fabI gene. Previous studies have shown that mutations in, or overexpression of, the fabI gene can result in reduced susceptibility to triclosan (Ref. 275). Among the 68 clinical isolates with reduced susceptibility to triclosan, only 30 had a mutation in the fabI gene, while 38 strains had a normal (wild-type) fabI gene. Further molecular analysis identified novel resistance mechanisms linked to the presence of an additional, alternative fabI gene derived from another species of Staphylococcus in some of the strains, which was most likely acquired by horizontal transfer (the transmission of DNA between different organisms, rather than from parent to offspring). Clinical S. aureus strains with decreased susceptibility to triclosan had a strong association with the presence of a mutated fabI gene or the alternative fabI gene (Ref. 281). The authors suggest that this finding is the first clear evidence that utilization of antiseptics can drive development of antiseptic resistance in clinical isolates. The possibility that an antiseptic may drive the development of resistance and the possibility of horizontal transfer of resistance determinants to clinical isolates warrant further evaluation.

Other studies have evaluated the antiseptic and antibiotic susceptibility profiles of clinical isolates or isolates of bacteria associated with specific hospital outbreaks. In one study, the
triclosan susceptibility of clinical isolates of *S. epidermidis* isolated from blood cultures of patients that were collected prior to the introduction of triclosan (during 1965–1966, “old” isolates) was compared to modern isolates, collected in 2010–2011 (Ref. 281). None of the isolates from 1965–1966 were tolerant to triclosan; however, 12.5 percent of the modern isolates had decreased triclosan susceptibility, with MIC values that were up to 32-fold higher than the highest value found in the old isolates. When triclosan-susceptible strains were grown in increasing concentrations of triclosan, both old and modern isolates could be adapted to the same triclosan MIC level as found in modern tolerant isolates. Although this study suggests that decreased susceptibility to triclosan can occur in relevant organisms as a result of triclosan exposure, the source(s) and extent of triclosan exposure for the modern isolates are unknown, which makes the relevance of these data to the clinical setting unclear. In another recent study (Ref. 282), the antimicrobial activity of triclosan was evaluated for a multidrug-resistant strain of *P. aeruginosa* that had caused an outbreak in an oncology unit in Italy (Ref. 283). Experimental exposure to triclosan has been shown to lead to changes in bacterial efflux pump activity, which can result in antibiotics being removed from the bacterial cell and bacterial resistance (Ref. 66). The authors of this study examined whether triclosan exposure increased the level of antibiotic resistance in the outbreak strain. The outbreak strain was adapted to grow in the presence of triclosan by serial passage in gradually increasing triclosan concentrations, up to 3,400 mg/L triclosan. Then, the susceptibility of triclosan-adapted and unadapted *P. aeruginosa* to a panel of antibiotics that are typically exported by efflux pumps, namely tetracycline, ciprofloxacin, amikacin, levofloxacin, carbencillin, and chloramphenicol, was determined. For all antibiotics examined, the MIC of the triclosan-adapted strain was 2-fold higher than the unadapted strain. The addition of efflux pump inhibitors reduced the MICs 2- to 4-fold for both strains and all antibiotics examined, suggesting that an efflux pump mechanism is involved in the reduced susceptibility. Despite the trend for the triclosan-adapted strain to be less susceptible to the tested antibiotics, the differences were very modest and the clinical relevance of these small changes in MIC, if any, are not known.

Overall, the administrative record for triclosan is complete on the following aspects of the resistance issue:

- Laboratory studies demonstrate triclosan’s ability to alter antibiotic susceptibilities (Refs. 61 through 66, 69, 72, 74 through 77, and 263).
- Data define triclosan’s mechanisms of action and demonstrate that these mechanisms are dose dependent (Ref. 113).
- Data demonstrate that exposure to triclosan changes efflux pump activity, a common nonspecific bacterial resistance mechanism (Refs. 66, 69, 76, and 109).
- Data show that low levels of triclosan may persist in the environment (Refs. 91, 116, 117, and 284 through 289).

However, the administrative record is not complete with respect to data that would clarify the potential public health impact of the currently available data. Examples of the type of information that could be submitted to complete the record include the following:

- Data to characterize the concentrations and antimicrobial activity of triclosan in various biological and environmental compartments (e.g., on the skin, in the gut, and in environmental matrices);
- Data to characterize the antiseptic and antibiotic susceptibility levels of environmental isolates in areas of prevalent antiseptic use, e.g., in health care, food handler, and veterinary settings; and
- Data to characterize the potential for the reduced antiseptic susceptibility caused by triclosan to be transferred to other bacteria that are still sensitive to triclosan.

b. Triclosan Safety Data Gaps.

In summary, our administrative record for the safety of triclosan is incomplete with respect to the following:

- Human pharmacokinetic studies under maximal use conditions when applied topically (MUsT), including documentation of validation of the methods used to measure triclosan and its metabolites;
- Animal ADME: demamitor carcinogenicity; potential hormonal effects; and data to clarify the relevance of antimicrobial resistance laboratory findings to the health care setting.

### VIII. Proposed Effective Date

Based on the currently available data, this proposed rule finds that additional data are necessary to establish the safety and effectiveness of health care antiseptic active ingredients for use in OTC health care antiseptic drug products. Accordingly, health care antiseptic active ingredients would be nonmonograph in any final rule based on this proposed rule. We recognize, based on the scope of products subject to this monograph, that manufacturers will need time to comply with a final rule based on this proposed rule. However, because of the potential effectiveness and safety considerations raised by the data for some antiseptic active ingredients evaluated, we believe that an effective date later than 1 year after publication of the final rule would not be appropriate or necessary. Consequently, any final rule that results from this proposed rule will be effective 1 year after the date of the final rule’s publication in the *Federal Register*. On or after that date, any OTC health care antiseptic drug product that is subject to the monograph and that contains a nonmonograph condition, i.e., a condition that would cause the drug to be not GRAS/GRAE or to be misbranded, could not be introduced or delivered for introduction into interstate commerce unless it is the subject of an approved new drug application or abbreviated new drug application. Any OTC health care antiseptic drug product subject to the final rule that is repackaged or relabeled after the effective date of the final rule would be required to be in compliance with the final rule, regardless of the date the product was initially introduced or initially delivered for introduction into interstate commerce.

### IX. Summary of Preliminary Regulatory Impact Analysis


A. Introduction

FDA has examined the impacts of the proposed rule under Executive Order 12866, Executive Order 13563, the Regulatory Flexibility Act (5 U.S.C. 601–612), and the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4). Executive Orders 12866 and 13563 direct Agencies to assess all costs and benefits of available regulatory alternatives and, when regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity). The Agency believes that this proposed rule is a significant regulatory action as defined by Executive Order 12866.
The Regulatory Flexibility Act requires Agencies to analyze regulatory options that would minimize any significant impact of a rule on small entities. The proposed rule could impose significant economic burdens on a substantial number of small entities. Section 202(a) of the Unfunded Mandates Reform Act of 1995 requires that Agencies prepare a written statement, which includes an assessment of anticipated costs and benefits, before proposing “any rule that includes any Federal mandate that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100,000,000 or more (adjusted annually for inflation) in any one year.” The current threshold after adjustment for inflation is $141 million, using the most current (2013) Implicit Price Deflator for the Gross Domestic Product. FDA expects that this proposed rule could result in a 1-year expenditure that would meet or exceed this amount.

B. Summary of Costs and Benefits

The proposed rule’s costs and benefits are summarized in table 12 entitled “Economic Data: Costs and Benefits Statement.” Benefits are attributed to reducing the potential adverse health effects associated with exposure to antiseptic active ingredients in the event that any active ingredient is shown to be unsafe or ineffective for chronic use. Annual benefits are estimated to range between $0 and $0.16 million. We estimate the present value associated with $0.16 million of annual benefits, over a 10-year period, to approximately equal $1.4 million at a 3 percent discount rate and $1.1 million at a 7 percent discount rate.

Costs include the one-time costs associated with reformulating products, relabeling reformulated products, and conducting both safety and efficacy tests. We estimate one-time upfront costs to approximately range between $64.0 million and $90.8 million. Annualizing these costs over a 10-year period, we estimate total annualized costs to range from $7.3 and $10.4 million at a 3 percent discount rate to $8.5 and $12.1 million at a 7 percent discount rate.

FDA also examined the economic implications of the rule as required by the Regulatory Flexibility Act. If a rule will have a significant economic impact on a substantial number of small entities, the Regulatory Flexibility Act requires Agencies to analyze regulatory options that would lessen the economic effect of the rule on small entities. The rule could impose a significant economic impact on a substantial number of small entities. For small entities, we estimate the rule’s costs to roughly range between 0.01 and 82.18 percent of average annual revenues. In the Initial Regulatory Analysis, we assess several regulatory options that would reduce the proposed rule’s burden on small entities. These options include extending testing compliance time to 24 months (rather than 12 months), and extending relabeling compliance times to 18 months (rather than 12 months).


### TABLE 12—ECONOMIC DATA: COSTS AND BENEFITS STATEMENT

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<tr>
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Notes
TABLE 12—ECONOMIC DATA: COSTS AND BENEFITS STATEMENT—Continued

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</table>

Effects:
State, Local, or Tribal Government: Not applicable.
Small Business: The costs associated with potentially affected small entities range between 0.01 and 82.18 percent of their average annual revenues.
Wages: No estimated effect.
Growth: No estimated effect.

X. Paperwork Reduction Act of 1995
This proposed rule contains no collections of information. Therefore, clearance by the Office of Management and Budget under the Paperwork Reduction Act of 1995 is not required.

XI. Environmental Impact
We have determined under 21 CFR 25.31(a) that this action is of a type that does not individually or cumulatively have a significant effect on the human environment. Therefore, neither an environmental assessment nor an environmental impact statement is required.

XII. Federalism
FDA has analyzed this proposed rule in accordance with the principles set forth in Executive Order 13132. FDA has determined that the proposed rule, if finalized, would have a preemptive effect on State law. See section 751 of the FD&C Act. Section 751(a) of the FD&C Act provides that ''when an Executive order requires Agencies to 'construe . . . a Federal statute to operate to preempt State law only where the statute contains an express preemption provision or there is some other clear evidence that the Congress intended preemption of State law, or where the exercise of State authority conflicts with the exercise of Federal authority under the Federal statute.''' Section 751 of the FD&C Act (21 U.S.C. 379r) is an express preemption provision. Section 751(a) of the FD&C Act provides that no State or political subdivision of a State may establish or continue in effect any requirement that: (1) Relates to the regulation of a drug that is not subject to the requirements of section 503(b)(1) or 503(f)(1)(A) of the FD&C Act and (2) is different from or in addition to, or that is otherwise not identical with, a requirement under the FD&C Act, the Poison Prevention Packaging Act of 1970 (15 U.S.C. 1471 et seq.), or the Fair Packaging and Labeling Act (15 U.S.C. 1451 et seq.). Currently, this provision operates to preempt States from imposing requirements related to the regulation of nonprescription drug products. (See section 751(b) through (e) of the FD&C Act for the scope of the express preemption provision, the exemption procedures, and the exceptions to the provision.) This proposed rule, if finalized as proposed, would remove from the health care antiseptic monograph any active ingredient for which the additional safety and effectiveness data required to show that a health care antiseptic product containing that ingredient would be GRAS/GRAE have not become available. Any final rule would have a preemptive effect in that it would preclude States from issuing requirements related to OTC health care antiseptics that are different from, in addition to, or not otherwise identical with, a requirement in the final rule. This preemptive effect is consistent with what Congress set forth in section 751 of the FD&C Act. Section 751(a) of the FD&C Act displaces both State legislative requirements and State common law duties. We also note that even where the express preemption provision is not applicable, implied preemption may arise (see Geier v. American Honda Co., 529 U.S. 861 (2000)).

FDA believes that the preemptive effect of the proposed rule, if finalized, would be consistent with Executive Order 13132. Section 4(e) of the Executive order provides that "when an agency proposed to act through adjudication or rulemaking to preempt State law, the agency shall provide all affected State and local officials notice and an opportunity for appropriate participation in the proceedings." FDA is providing an opportunity for State and local officials to comment on this rulemaking.

XIII. References
The following references have been placed on display in the Division of Dockets Management (see ADDRESSES) and may be seen by interested persons between 9 a.m. and 4 p.m., Monday through Friday, and are available electronically at http://www.regulations.gov. (FDA has verified all Web site addresses in this reference section, but we are not responsible for any subsequent changes to the Web sites after this proposed rule publishes in the Federal Register.)


List of Subjects in 21 CFR Part 310

Admistrative practice and procedure, Drugs, Labeling, Medical devices, Reporting and recordkeeping requirements.

Therefore, under the Federal Food, Drug, and Cosmetic Act and under authority delegated to the Commissioner of Food and Drugs, 21 CFR part 310, as proposed to be amended December 17, 2013, at 78 FR 76444, is proposed to be further amended as follows:

PART 310—NEW DRUGS

1. The authority citation for part 310 continues to read as follows:


2. Amend § 310.545 as follows:

a. Add paragraph (a)(27)(v) through (x);

b. Add paragraphs (a)(27)(vi) through (s);

c. In paragraph (d) introductory text, remove “(d)(39)” and in its place add “(d)(42);” and

d. Add paragraph (d)(42).

The additions read as follows:

§ 310.545 Drug products containing certain active ingredients offered over-the-counter (OTC) for certain uses.

(a) * * *

(27) * * *

(v) [Reserved]

(vi) Health care personnel hand wash drug products. Approved as of [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER].

Benzalkonium chloride

Benzethonium chloride

Chloroxylenol

Clobucarban

Florosalan

Hexachlorophene

Hexylresorcinol

Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate)

Iodine complex (phosphate ester of alkylarylxylo polyethylene glycol)

Methylbenzethonium chloride

Nonylphenoxypoly (ethyleneoxy) ethanoliodine

Phenol

Polymer iodine complex

Povidone-iodine

Secondary amylose resols
Sodium oxychlorosene
Tribromsalan
Triclocarban
Triclosan
Undecoylium chloride iodine complex
   (vii) Health care personnel hand rub drug products. Approved as of [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER].
   Alcohol (ethanol and ethyl alcohol)
   Benzalkonium chloride
   Isopropyl alcohol
   (viii) Surgical hand scrub drug products. Approved as of [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER].
   Benzalkonium chloride
   Benzethonium chloride
   Clofucarban
   Fluorosalan
   Hexachlorophene
   Hexylresorcinol
   Iodine complex (ammonium ether sulfate and polyoxyethylene sorbitan monolaurate)
   Iodine complex (phosphate ester of alkylaryloxy polyethylene glycol)
   Methylbenzethonium chloride
   Nonylphenoxypoly (ethylenoxy) ethanolidine
   Phenol
   Poloxamer iodine complex
   Povidone-iodine
   Secondary amyltricresols
   Sodium oxychlorosene
   Tribromsalan
   Triclocarban
   Triclosan
   Undecoylium chloride iodine complex
   (ix) Surgical hand rub drug products. Approved as of [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER].
   Alcohol (ethanol and ethyl alcohol)
   Isopropyl alcohol
   (x) Patient preoperative skin preparation drug products. Approved as of [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER].
   Alcohol (ethanol and ethyl alcohol)
   Benzalkonium chloride
   Benzethonium chloride
   Chloroxylenol
   Clofucarban
   Fluorosalan
   Hexachlorophene
   Hexylresorcinol
   Iodine complex (phosphate ester of alkylaryloxy polyethylene glycol)
   Iodine tincture
   Iodine topical solution
   Isopropyl alcohol
   Mercufenol chloride
   Methylbenzethonium chloride
   Nonylphenoxypoly (ethylenoxy) ethanolidine
   Phenol
   Poloxamer iodine complex
   Povidone-iodine
   Secondary amyltricresols
   Sodium oxychlorosene
   Tribromsalan
   Triclocarban
   Triclosan
   Triple dye
   Undecoylium chloride iodine complex
   Combination of calomel, oxyquinoline benzoate, triethanolamine, and phenol derivative
   Combination of mercufenol chloride and secondary amyltricresols in 50 percent alcohol
   * * * * *
   (d) * * *
   (42) [DATE 1 YEAR AFTER DATE OF PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER], for products subject to paragraphs (a)(27)(vi) through (a)(27)(x) of this section.


Leslie Kux,
Associate Commissioner for Policy.