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### **CITIZEN PETITION**

Pfizer Inc ("Pfizer") submits this petition under the Federal Food, Drug, and Cosmetic Act ("FFDCA") to request that the Food and Drug Administration ("FDA") take appropriate remedial action against apparent misbranding of generic azithromycin products marketed by Teva Pharmaceuticals USA ("Teva") and Sandoz Inc. ("Sandoz"). In addition, Pfizer urges FDA to reexamine the Teva and Sandoz Abbreviated New Drug Applications ("ANDAs") filed for azithromycin, to ensure that they contain accurate and complete information regarding the active ingredients contained in the Teva and Sandoz products.

#### **A. Actions Requested**

The generic azithromycin products marketed by Teva and Sandoz appear to be misbranded because their labels incorrectly identify the polymorphic<sup>1</sup> forms of the active ingredient<sup>2</sup> contained in the products. This discrepancy is significant because, as FDA consistently has noted, differences in polymorphic forms may affect drug quality, safety, and efficacy. In response to the misbranding of these products, Pfizer requests

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<sup>1</sup> FDA defines polymorphic form to refer to, *inter alia*, solvate and hydrate forms. FDA further describes solvates as "crystal forms containing either stoichiometric or nonstoichiometric amounts of a solvent. If the incorporated solvent is water, the solvate is commonly known as a hydrate." FDA, Guidance for Industry, ANDAs: Pharmaceutical Solid Polymorphism, Chemistry, Manufacturing, and Controls Information, December 2004 ("Polymorphism Guidance"), at 2.

<sup>2</sup> We use the term "active ingredient" and "drug substance" interchangeably in this Citizen Petition in a manner consistent with FDA's use of the terms in its guidance documents, *e.g.*, Polymorphism Guidance.



### **b. Polymorphs of Azithromycin**

The U.S. Pharmacopoeia (“USP”) monograph for azithromycin identifies two polymorphic forms of the molecule: a monohydrate form (one molecule of water per molecule of azithromycin) and a dihydrate form (two molecules of water per molecule of azithromycin). As described in the USP monograph, azithromycin monohydrate has a molecular formula of  $C_{38}H_{72}N_2O_{12} \cdot H_2O$  and a molecular weight of 767.02. Azithromycin dihydrate has a molecular formula of  $C_{38}H_{72}N_2O_{12} \cdot 2H_2O$  and molecular weight of 785.02. The USP monograph specifies that an azithromycin product should be labeled “to indicate whether it is the monohydrate or the dihydrate.” USP Monograph, Attachment 1.

In addition to the two crystal forms described in the USP, a number of other specific forms of azithromycin have been identified to date. These polymorphs include several monohydrate forms that contain solvates in addition to the one water molecule per azithromycin molecule. A sesquihydrate form (Form G) also has been identified, which contains 1.5 water molecules per azithromycin molecule and has the molecular formula  $C_{38}H_{72}N_2O_{12} \cdot 1.5H_2O$ .

Pfizer’s *Zithromax*<sup>®</sup> product contains azithromycin dihydrate. As required by FDA labeling regulations and the USP monograph, the FDA-approved product label for *Zithromax*<sup>®</sup> specifically discloses that the active ingredient of *Zithromax*<sup>®</sup> is azithromycin in its dihydrate form. The label states: “Zithromax is supplied for oral administration as film-coated, modified capsular shaped tablets containing azithromycin dihydrate.”

### **c. Generic Azithromycin Products Marketed by Teva and Sandoz**

Teva and Sandoz both hold approved ANDAs for generic azithromycin products, and currently are marketing such products. According to these products’ labels, the active ingredient contained in each product is azithromycin “as the monohydrate.” Teva Label and Sandoz Label, Attachments 2 and 3.

Analytical tests run on samples of the Teva and Sandoz products indicate, however, that these products are not accurately labeled with respect to the polymorphic form of azithromycin they contain. Pfizer tested market samples of the Teva (250 mg, 500 mg and 600 mg) and the Sandoz (250 mg, 500 mg and 600 mg) generic azithromycin products, using a combination of Fourier Transform Infrared Spectroscopy (“FTIR”), Powder X-Ray Diffraction (“PXRD”), and <sup>13</sup>C Solid State NMR (“ssNMR”). The results of the tests were compared to the data generated from reference materials of azithromycin sesquihydrate (Form G), monohydrate hemi-ethanolate (Form F) and dihydrate (Form A). The results demonstrate that Teva’s product contains, in addition to azithromycin monohydrate hemi-ethanolate, significant amounts of azithromycin sesquihydrate (over 20%). The results of tests also demonstrate that Sandoz’s product contains *only* azithromycin sesquihydrate and no detectable azithromycin dihydrate. Attachments 4 and 5.

Pfizer has no information on why the Teva and Sandoz generic azithromycin products are inaccurately labeled with respect to the polymorph.<sup>3</sup> Pfizer also does not know whether the polymorphic form of azithromycin was incorrectly identified in either of the ANDAs submitted for these products. Finally, Pfizer has no information on whether Teva and Sandoz adequately assessed any impact these different polymorphic forms would have on the safety and efficacy of generic azithromycin.

## **2. *The Misidentification of Azithromycin Polymorph Raises Significant Concern***

As FDA consistently has noted, differences in chemical and physical forms of an active ingredient may affect drug performance, including stability, dissolution, and bioavailability. Thus, FDA's ANDA and labeling regulations, and related guidances, require manufacturers to identify with particularity the chemical and physical form of a drug substance, including the specific solvate and hydrate polymorph, in the ANDA submission and the drug product label. FDA also has made clear that accurate identification and assessment of the polymorphic characteristics of an active drug substance are particularly important for generic drug products.

FDA's regulations governing the content of ANDAs incorporate by reference the chemistry and manufacturing information requirements that apply as well to NDAs. Pursuant to 21 C.F.R. §314.94(a)(9), an ANDA must contain the information outlined in 21 C.F.R. §314.50(d)(1). That provision requires drug applications to include "a full description of the drug substance *including its physical and chemical characteristics*" (emphasis added).

FDA's 2004 Polymorphism Guidance explicitly directs those preparing ANDA applications to focus on the chemical and physical forms of polymorphs of an active ingredient. FDA defines polymorph in this document to describe, among other things, solvate and hydrate forms:

Polymorphic forms in the context of this guidance refer to crystalline and amorphous forms as well as solvate and hydrate forms . . . Solvates are crystal forms containing either stoichiometric or nonstoichiometric amounts of a solvent. If the incorporated solvent is water, the solvate is commonly known as a hydrate.

Polymorphism Guidance at 2.

As the Polymorphism Guidance makes clear, proper characterization of a drug polymorph is necessary to ensure effective regulatory review of manufacturing processes and drug performance:

Polymorphic forms of a drug substance can have different chemical and physical properties . . . [which] can have a direct effect on the ability to process and/or manufacture

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<sup>3</sup>Pfizer owns patents claiming azithromycin dihydrate and azithromycin sesquihydrate, but not azithromycin monohydrate.

the drug substance and the drug product, as well as on drug product stability, dissolution, and bioavailability. Thus, polymorphism can affect the quality, safety, and efficacy of the drug product.

*Id.* at 3.

The Polymorphism Guidance directs applicants to carefully characterize drug polymorphism, and refers applicants to the ICH Guidance, *Common Technical Document – Quality: Questions and Answers/Location Issues*, Section III.A.3.1 (“ICH Guidance”) in order “to find the suggested placement of information related to the polymorphism that is important to include.” Polymorphism Guidance at 2. The ICH Guidance, in turn, specifies where such information can be included in an ANDA for those submitting a document in the Common Technical Document format. ICH Guidance at §§3.2.S.1.3 - 3.2.S.4.5. The requested information includes: a list of polymorphic forms, a description of manufacturing process and controls established to ensure that the correct polymorph is produced, and studies performed to identify the potential polymorphic forms of the drug substance. *Id.*

Thorough analysis and explication of polymorphism is especially important in ANDAs that seek approval of generic products containing polymorphs that differ from the polymorph in the reference listed drug (“RLD”). As FDA made clear in a 2002 response to a citizen petition, the agency, in reviewing such a proposed generic drug, must make a scientific assessment that the polymorphism does not adversely affect drug performance, compared to the RLD. Letter from FDA to Donald O. Beers et al., Docket No. 00P-1550 (February 15, 2002)

The Preamble to the Orange Book<sup>4</sup> reiterates this point, emphasizing that polymorphic forms can only be considered the same if there is scientific evidence demonstrating that their structures result in the same bioavailability and bioequivalence:

Anhydrous and hydrated entities, as well as different polymorphs, are considered pharmaceutical equivalents and must meet the same standards and, where necessary, as in the case of ampicillin/ampicillin trihydrate, their equivalence is supported by appropriate bioavailability/bioequivalence studies.

Orange Book at xiii-xiv.

The need for specific review of polymorphic forms is thus clear. FDA consistently places the burden on the ANDA applicant to identify and characterize the polymorphic form of an active ingredient proposed for use in a generic formulation.

**a. FDA Should Initiate Recalls of the Apparently Misbranded Teva and Sandoz Generic Azithromycin Products**

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<sup>4</sup> Approved Drug Products with Therapeutic Equivalence Evaluations (26<sup>th</sup> Ed., 2006) (“Orange Book”).

The FDCA and FDA label regulations require that drug labels accurately and completely describe “the proprietary name and the established name of the drug,” as well as the “chemical name and structural formula of the drug.” 21 C.F.R. §§201.57(a)(1)(i) and (vi). This includes identifying the polymorph of the drug. As the USP monograph for azithromycin explicitly requires, the label for an azithromycin drug product must “indicate whether [the drug] is the monohydrate or the dihydrate.” USP Monograph, Attachment 1. An azithromycin drug label that does not accurately identify the polymorph contained in the product is misbranded. *See* 21 U.S.C. §§352(a), (e), and (g).

The Teva label identifies its generic azithromycin tablets as “containing *azithromycin monohydrate* equivalent to 250mg or 500 mg azithromycin.” Teva Label, Attachment 2 (emphasis added). The Sandoz label states “Each azithromycin tablet, intended for oral administration, contains *azithromycin monohydrate* equivalent to 250 mg or 500 mg of azithromycin.” Sandoz Label, Attachment 3 (emphasis added).

In contradiction to these label statements, analytical tests conducted by Pfizer indicate that Teva’s azithromycin product contains, in addition to azithromycin monohydrate hemi-ethanolate, significant amounts of azithromycin sesquihydrate (over 20%). Attachment 4. Analytical tests demonstrate that Sandoz’s product contains *only* azithromycin sesquihydrate and no detectable azithromycin dihydrate. Attachment 5.

The Teva and Sandoz azithromycin products are misbranded because their labels do not correctly identify the polymorphic form of the active ingredient in the products. *See* 21 U.S.C. §§352(a) and (e). The products are also misbranded because they are not labeled in accordance with the USP monograph for azithromycin. *See* 21 U.S.C. §352(g).

FDA should initiate recalls so that inaccurate labeling of the Teva and Sandoz products can be removed and corrected. A recall will ensure that the misbranded products no longer misidentify their active ingredient as being azithromycin monohydrate.

### ***3. FDA Should Determine Whether ANDAs Submitted by Teva and Sandoz Are Defective and Thus Subject to Withdrawal***

In addition to initiating a recall, FDA should review the Teva and Sandoz ANDAs to determine whether the polymorphic form of azithromycin was correctly stated, and whether appropriate testing was conducted to assess product performance characteristics, including stability, dissolution, and bioavailability. As FDA notes in the Polymorphism Guidance, proper characterization of the chemical and physical properties of drug polymorphs is critical to review of drug product quality, safety, and efficacy. Polymorphism Guidance at 3. Moreover, such characterization is especially important when, as here, a generic drug contains a polymorph different from the polymorph contained in the RLD.

FDA should therefore thoroughly investigate the accuracy and completeness of the information provided by Teva and Sandoz in their ANDAs regarding the form of the azithromycin ingredient contained in their generic azithromycin products.

FDA should take steps to withdraw the respective ANDAs if such information is not correct or complete. *See* 21 U.S.C. §355(e); 21 C.F.R. §314.150(a)(2)(iv).

Withdrawal also may be appropriate if FDA determines that an ANDA mischaracterizes drug polymorphism, and that such mischaracterization reflects a lack of control over drug manufacturing. 21 U.S.C. §355(e)(5)(2). FDA should therefore investigate whether the manufacturing processes for the Teva and Sandoz products are “inadequate to assure and preserve the identity, strength, quality, and purity” of the generic azithromycin products. *Id.*

**C. Environmental Impact**

The petition requests that FDA review the applications to market generic azithromycin. Because the requested action would not increase the use of the active moiety, the petition is subject to a categorical exclusion from the requirement of an environmental impact assessment. *See* 21 C.F.R. §25.31(a).

**D. Economic Impact**

Information on the economic impact of this petition will be submitted if requested by the Commissioner.

**E. Certification**

Pfizer certifies, that, to the best knowledge and belief of Pfizer, this petition include all information and views on which the petition relies and that it includes representative data and information known to Pfizer which are unfavorable to the petition.

Respectfully submitted,



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