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New Drug Product Impurities

Regulatory Guidance



NEW DRAFT GUIDANCE
FDA Viewpoint

IAGIM Scientific Committee
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SUMMARY: The Food and Drug Administration (FDA) has published a **draft** revised guidance entitled "**Q3B(R) Impurities in New Drug Products.**" The **R** in the **Q3B(R)** code signifies that this guideline has been revised as this guidance has been previously published.

The draft revised guidance, which updates a published guidance¹ on the same topic was prepared under the auspices of the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH).

¹Federal Register May 19, 1997 (1997 Guidance)

FDA is revising the
EXISTING
Impurity Guides
for both **NDA**
Drug Products &
Drug Substances

The draft revised guidance clarifies the 1997 guidance, adds information, and provides consistency with more recently published ICH guidances.

The draft revised **NDA** guidance is intended to provide guidance for registration or marketing applications on the content and qualification of impurities in **new drug products** produced from chemically synthesized new drug substances not previously registered in a region or member State.

The draft revised guidance is a complement to the ICH guidance entitled "**Q3A Impurities in new Drug Substances,**" which is being revised also.

The Two Revised
Guides are
Q3A (Actives) and
Q3B (Products)
Unusual Procedures
for Rounding-up
have been introduced

In October 1999, the ICH Steering Committee agreed that a draft revised guidance entitled "**Q3B(R) Impurities in New Drug Products**" should be made available for public comment.

This draft revised guidance is a revision of a guidance on the same topic as published¹.

Harmonization

SUPPLEMENTARY INFORMATION:

In recent years, many important initiatives have been undertaken by regulatory authorities and industry associations to promote international harmonization of regulatory requirements

FDA has participated in many meetings designed to enhance harmonization and is committed to seeking scientifically based harmonized technical procedures for pharmaceutical development.

One of the goals of harmonization is to identify and then reduce differences in technical requirements for drug development among regulatory agencies.

ICH was organized to provide an opportunity for tripartite harmonization initiatives to be developed with input from both regulatory and industry representatives.

FDA also seeks input from consumer representatives and others. ICH is concerned with harmonization of technical requirements for the registration of pharmaceutical products among three regions: The European Union, Japan, and the United States.

The six ICH sponsors are the European Commission, the European Federation of Pharmaceutical Industries Associations, the Japanese Ministry of Health and Welfare, the Japanese Pharmaceutical Manufacturers Association, the Centers for Drug Evaluation and Research and Biologics Evaluation and Research, FDA, and the Pharmaceutical Research and Manufacturers of America.

The ICH Secretariat, which coordinates the preparation of documentation, is provided by the International Federation of Pharmaceutical Manufacturers Associations (IFPMA).

The ICH Steering Committee includes representatives from each of the ICH sponsors and the IFPMA, as well as observers from the World Health Organization, the Canadian Health Protection Branch, and the European Free Trade Area.

The draft revised guidance is the product of the Quality Expert Working Group of the ICH. Comments about this draft will be considered by FDA and the Quality Expert Working Group.

¹Federal Register of May 19, 1997 (62 FR 27454)

²(62 FR 8961, February 27, 1997)

³Federal Register of January 4, 1996 (61 FR 372)

In accordance with FDA's good guidance practices², this document is now being called a guidance, rather than a guideline.

The guidance addresses degradative impurities in Drug Products from the Active, excipients or container-closure

In the agency ICH guidance³ entitled "**Q3A Impurities in New Drug Substances.**" ICH Q3A, which is being revised also, provides guidance to applicants for drug marketing registration on the content and qualification of impurities in new drug substances produced by chemical synthesis and not previously registered in a country, region, or member State.

This draft revised guidance is a complement to the ICH Q3A guidance and provides guidance for registration or marketing applications on the content and qualification of impurities in new drug products produced from chemically synthesized new drug substances not previously registered in a region or member State.

The DRAFT revised guidance addresses only those impurities in drug products classified as degradation products of the active ingredient or reaction products of the active ingredient with an excipient and/or immediate container/closure system.

Impurities arising from excipients present in the drug product are not addressed in this draft revised guidance.

New FDA Definitions on ROUNDING-UP Significantly impact on impurity testing

The DRAFT revised guidance includes revised text on threshold limits, revised text on degradation products, and new guidance on rounding.

Additions to the glossary include definitions for the terms "identification threshold," "qualification threshold," "reporting threshold," and "rounding."

The DRAFT revised guidance was updated to include references to ICH guidances on analytical validation and specifications.

Minor editorial changes were made to improve the clarity and consistency of the document.

The Actual - DRAFT GUIDANCE

The text of the DRAFT revised guidance is as follows:

Q3B(R) Impurities in New Drug Products.

1. Introduction

1.1 Objective of the Guidance

This document provides guidance recommendations for registration or applications for marketing on the content and qualification of impurities in **new drug products** produced from chemically synthesized new drug substances not previously registered in a region or member State.

1.2 Background

This guidance is a **complement** to the ICH Q3A guidance on impurities in **new drug substances**, which should be consulted for basic principles.

1.3 Scope of the Guidance

This guidance addresses only those impurities in drug products classified as degradation products of the drug substance or reaction products of the drug substance with an excipient and/or immediate container/closure system (collectively referred to as "degradation products" in this guidance).

Impurities arising from excipients present in the product are not covered by this guidance.

Existing excipient
based impurities are
not covered
ONLY
Newly Formed
Degradative Products

Exclusions

This guidance also does not address the regulation of products used during the clinical research stages of development. Biological / biotechnological products, peptides, oligonucleotides, radiopharmaceuticals, fermentation and semisynthetic products derived therefrom, herbal products, and crude products of animal or plant origin are not covered.

Also excluded from this guidance are: Extraneous contaminants that should not occur in drug products and are more appropriately addressed as good manufacturing practice issues, polymorphic form, a solid state property of the new drug substance, and enantiomeric impurities. Impurities present in the new drug substance need not be monitored or specified in drug products unless they are also degradation products (see ICH Q6A guidance for specifications).

2. Guidance

2.1 Analytical Procedures

The application for a marketing authorization should include documented evidence that the analytical procedures have been validated and are suitable for the detection and quantitation of degradation products.

Analytical methods should be validated to demonstrate that impurities unique to the new drug substance do not interfere with, or are separated from, specified and unspecified degradation products in the product (see ICH Q2A and Q2B guidances for analytical validation).

The Test Method
must discriminate
between existing
Active Impurities
& new
Product Degradants

Degradation product levels can be measured by a variety of techniques, including those which compare an analytical response for a degradation product to that of an appropriate reference standard or to the response of the new drug substance itself.

Reference standards used in the analytical procedures for control of degradation products should be evaluated and characterized according to their intended uses.

The drug substance may be used to estimate the levels of degradation products. In cases where the response factors are not close, this practice may still be used if a correction factor is applied or the degradation products are, in fact, being overestimated.

Specifications and analytical procedures used to estimate identified or unidentified degradation

products are often based on analytical assumptions (e.g., equivalent detector response).

These assumptions should be discussed in the application for marketing authorization.

Differences in the analytical procedures used during development and those proposed for the commercial product should be discussed.

2.2 Rationale for the Reporting and Control of Impurities

The applicant should summarize those degradation products observed during stability studies of the drug product.

This summary should be based on sound scientific appraisal of potential degradation pathways in the drug product and impurities arising from the interaction with excipients and/or the immediate container/closure system.

In addition, the applicant should summarize any laboratory studies conducted to detect degradation products in the drug product.

IDENTIFY

- [1] Product degradants
- [2] Process Impurities
- [3] Excipient Impurities

Separate Degradant
Growth from
Static Impurities.

This summary should include test results of batches manufactured during the development process and batches representative of the proposed commercial process.

A rationale should be provided for exclusion of those impurities that are not degradation products, e.g., process impurities from the drug substance and excipients and their related impurities.

The impurity profile of the batches representative of the proposed commercial process should be compared with the profiles of batches used in development, and any differences discussed.

Degradation products observed in stability studies conducted at recommended storage conditions should be identified when present at a level greater than (>) the identification thresholds given in **Attachment 1**.

When identification of a degradation product is not feasible, a summary of the laboratory studies demonstrating the unsuccessful effort should be included in the application for marketing authorization.

Compare side-by-side
Comparisons of
Development &
Commercial Process
Impurities

Degradation products present at a level of not more than (\leq) the threshold generally would not need to be identified.

However, analytical procedures should be developed for those degradation products that are suspected to be unusually potent, producing toxic or significant pharmacologic effects at levels lower than indicated. **Conventional rounding rules should be applied, and the results presented with the same number of decimals as given in the limit.**

2.3 Reporting Impurity Content of Batches

Analytical results should be provided in tabular format for all relevant batches of new drug product used for clinical, safety, and stability testing, as well as batches that are

representative of the proposed commercial process.

Because the degradation test procedure can be an important support tool for monitoring the manufacturing quality as well as for deciding the expiration dating period of the product, the reporting level should be set below the identification threshold.

The recommended target value for the reporting threshold (expressed as a percentage of the drug substance) is found in Attachment I.

A higher reporting threshold should only be proposed, with justification, if the target reporting threshold cannot be achieved.

Discuss the Origin
of Impurities from
Synthesis Route

In addition, where an analytical method reveals the presence of impurities in addition to the degradation products (e.g., impurities arising from the synthesis of the drug substance), the origin of these impurities should be discussed.

Chromatograms or equivalent data (if other methods are used) from representative batches including long-term and accelerated stability conditions should be provided.

The Agency's
Definition of Rounding
Impurities Requires
Close Scrutiny

The procedure should be capable of quantifying at least at the reporting threshold, and the chromatograms should show the location of the observed degradation products and impurities from the new drug substance.

The following information should be provided:

- Batch identity, strength, and size
- Date of manufacture
- Site of manufacture
- Manufacturing process, where applicable
- Immediate container/closure
- Degradation product content, individual and total
- Use of batch
- Reference to analytical procedure(s) used
- Batch number of the drug substance used in the drug product
- Storage conditions

2.4 Specification Limits for Degradation Products

The specifications for a new drug product should include limits for degradation products expected to occur during manufacture and under recommended storage conditions. Stability studies, knowledge of degradation pathways, product development studies, and laboratory studies should be used to characterize the degradation profile.

Monitor the
Growth of the
Degradation Products
and set Maximum
Self Life Limits

Specifications should be set taking into account the qualification of the degradation products, the stability data, the content arising from the drug substance specification, the expected expiry period, and the recommended storage conditions for the product, allowing sufficient latitude to deal with normal manufacturing, analytical, and stability profile variation.

The specifications for the product should include, where applicable, limits for:

- Each specified degradation product
- Any unspecified degradation product
- Total degradation products

Although some variation is expected, significant variation in batch-to-batch degradation profiles may indicate that the manufacturing process of the new drug product is not adequately controlled and validated.

A rationale for the inclusion or exclusion of impurities in the specifications should be presented. This rationale should include a discussion of the impurity profiles observed in the safety and clinical studies, together with a consideration of the impurity profile of the product manufactured by the proposed commercial process.

Identify Impurities
present in drug product
but not present in
Drug Substance

All impurities at a level greater than (>) the reporting threshold should be summed and reported as Total Impurities.

The summation should be performed on the un-rounded individual values, and the total value should be rounded and reported as per section 2.2.

2.5 Qualification of Degradation Products

Qualification is the process of acquiring and evaluating data that establishes the biological safety of an individual degradation product or a given degradation profile at the level(s) specified.

The applicant should provide a rationale for selecting degradation product limits based on safety considerations.

The level of any degradation product present in a new drug product that has been adequately tested and found safe in safety and/or clinical studies is considered qualified.

Therefore, it is useful to include any available information on the actual content of degradation products in the relevant batches at the time of use in safety and/or clinical studies.

Degradation products that are also significant metabolites, present in animal and/or human studies, do not need further qualification.

It may be possible to justify a higher level of a degradation product than the level administered in safety studies.

When a degradation product is a metabolite as well no qualification is necessary

The justification should include consideration of factors such as: The amount of degradation product administered in previous safety and/or clinical studies and found to be safe; the percentage change in the degradation product; and other safety factors, as appropriate.

If data are not available to qualify the proposed specification level of a degradation product, studies to obtain such data may be needed (see Attachment 2) when the usual qualification thresholds set out in Attachment 1 are exceeded.

Higher or lower thresholds for qualification of degradation products may be appropriate for some

individual products based on scientific rationale and level of concern, including drug class effects and clinical experience.

For example, qualification may be especially important when there is evidence that such degradation products in certain drug products or therapeutic classes have previously been associated with adverse reactions in patients.

LOWER THRESHOLDS

In these instances, a lower qualification threshold may be appropriate. Conversely, a higher qualification threshold may be appropriate for individual products when the level of concern for safety is less than usual based on similar considerations (e.g., patient population, drug class effects, and clinical considerations).

Qualification means molecule identification and evaluation of safety aspects

In unusual circumstances, technical factors (e.g., manufacturing capability, a low drug substance to excipient ratio, or the use of excipients that are also crude products of animal or plant origin) may be considered as part of the justification for selection of alternative threshold limits based upon manufacturing experience with the proposed commercial process. Proposals for alternative thresholds would be considered on a case-by-case basis.

DECISION TREE

The "Decision Tree for Safety Studies" (Attachment 2) describes considerations for the qualification of impurities when thresholds are exceeded.

Alternatively, if data are available in the scientific literature, then such data may be submitted for consideration to qualify a degradation product.

Threshold levels can be adjusted on a case-by-case basis

If neither is the case, additional safety testing should be considered. The studies desired to qualify a degradation product will depend on a number of factors, including the patient population, daily dose, and route and duration of product administration.

Such studies should normally be conducted on the product or substance containing the degradation products to be controlled, although studies using isolated degradation products are considered acceptable.

2.6 New Degradation Products

During the course of drug development studies, the qualitative degradation profile of a new drug product may change, resulting in new degradation products that exceed the identification and/or qualification threshold.

In this event, these new degradation products should be identified and/or qualified.

There are Three Impurity Threshold levels:

- ➔ Reporting Level
- ➔ Identification Level
- ➔ Qualification Level

Such changes call for qualification of the level of the degradation product unless it is present at a level of not more than NMT (\leq) the threshold values as set out in Attachment 1.

When a new degradation product exceeds the threshold, the "Decision Tree for Safety Studies" should be consulted.

Safety studies should provide a comparison of results of safety testing of the product or substance containing a representative level of the degradation product with previously qualified material, although studies using the isolated degradation products are also considered acceptable (these studies may not always have clinical significance).

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TABLE I.

Impurity Assay Percentage	Rounded to standard Significant Figures	FDA and EU New Proposal
0.051 - 0.054	0.050	0.10
0.055 - 0.059	0.060	0.10
0.060 - 0.064	0.060	0.10
0.065 - 0.069	0.070	0.10
0.070 - 0.074	0.070	0.10
0.075 - 0.079	0.080	0.10
0.080 - 0.084	0.080	0.10
0.085 - 0.089	0.090	0.10
0.090 - 0.094	0.090	0.10
0.095 - 0.099	0.10	0.10

The proposed FDA EU rounding procedure is poorly defined and illogical and oppose the 1999 ANDAs guidelines

TABLE 1 and 2:

Column 1 shows the common HPLC/TLC impurity test result data; Column 2 the correct rounded-up figures and Column 3 the proposed FDA/EU rounded-up values by arbitrary agency definition. Table 3 highlights a typical working example.

TABLE 2:

Impurity Percentage	Rounded to Significant Figures	FDA and EU New Proposal
0.105 - 0.109	0.11	0.10
0.111 - 0.114	0.11	0.10
0.115 - 0.119	0.12	0.10
0.120 - 0.124	0.12	0.10
0.125 - 0.129	0.13	0.10
0.130 - 0.134	0.13	0.10
0.135 - 0.139	0.14	0.10
0.140 - 0.144	0.14	0.10
0.145 - 0.149	0.15	0.10

TABLE 3:

Test Impurity Percentage (%)	Rounded to Significant Figures (%)	FDA and EU New Proposal (%)
Impurity I 0.076	0.08'	0.1%
Impurity II 0.069	0.07'	0.1%
Total 0.145	Total 0.15'	0.1 %

Attachment 1

Thresholds for REPORTING of Degradation Products in New Drug Products	
Maximum Daily Dose ¹	Threshold ²
<1 gram (g)	0.1%
>1 g	0.05%
Thresholds for IDENTIFICATION of Degradation Products in New Drug Products	
<1 milligram (mg)	1% or 5 µg TDI ³ whichever is lower
1 mg - 10mg	0.5% or 20µg TDI ³ , whichever is lower
>10mg - 2g	0.2% or 2 mg TDI ³ , whichever is lower
>2g	0.1%
Thresholds for QUALIFICATION of Degradation Products in New Drug Products	
<10mg	1% or 50 µg TDI ³ whichever is lower
10 mg - 100 mg	0.5% or 200 µg TDI ³ , whichever is lower
>100 mg - 2g	0.2% or 2 mg TDI ³ , whichever is lower
> 2g	0.1%
¹ The amount of substance administered per day.	² Threshold is based on percent of the substance. Higher reporting thresholds should be scientifically justified.
³ TDI = TOTAL DAILY INTAKE	

GLOSSARY

Degradation product: A molecule resulting from a chemical change in the substance brought about over time and/or by the action of, e.g., light, temperature, pH, or water or by reaction with an excipient and/or the immediate container/closure system (also called decomposition product).

Degradation profile: A description of the degradation products **observed** in the drug substance or drug product.

Development studies: Studies conducted to scale-up, optimize, and validate the manufacturing process for a drug product.

Identification threshold: A limit above which (>) an impurity needs identification.

Identified degradation product: A degradation product for which a structural characterization has been achieved.

Impurity: Any component of the drug product that is not the chemical entity defined as the drug substance or an excipient in the product.

Impurity profile: A description of the identified and unidentified impurities present in a drug product.

New drug substance: The designated therapeutic moiety that has not been previously registered in a region or member State (also referred to as a new molecular entity or new chemical entity). It may be a complex, simple ester, or salt of a previously approved substance.

Potential degradation product: An impurity that, from theoretical considerations, may arise during or after manufacture or storage of the drug product. It may or may not actually appear in the substance or product.

Qualification: The process of acquiring and evaluating data that establishes the biological safety of an individual impurity or a given impurity profile at the level(s) specified.

Qualification threshold: A limit above which (>) an impurity needs to be qualified.

Reaction product: Product arising from the reaction of a substance with an excipient in the drug product or immediate container/closure system.

Reporting threshold: A limit above which (>) an impurity needs to be reported.

Rounding: The process of reducing a result to the number of significant figures or number of decimal places as dictated by the appropriate limit. For example, a result greater than or equal to (\geq) 0.05 and less than (<) 0.15 is rounded to 0.1.

Safety information: The body of information that establishes the biological safety of an individual impurity or a given impurity profile at the level(s) specified.

Specified degradation product: An identified or unidentified degradation product that is selected for inclusion in the new drug product specifications and is individually listed and limited in order to ensure the safety and quality of the new drug product.

Toxic impurity: An impurity having significant undesirable biological activity.

Unidentified degradation product: A degradation product that is defined solely by qualitative analytical properties, e.g., chromatographic retention time.

Unspecified degradation product: A degradation product that is not included in the list of specified degradation products.

Where To Download Copies

An electronic version of this guidance is available on the Internet at:

<http://www.fda.gov/cder/guidance/index.htm>

<http://www.fda.gov/cber/publications.htm>

Where To Get Print Copies

Copies of the draft revised guidance are available from the Drug Information Branch (HFD-210), Center for Drug Evaluation and Research, Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, 301-827-4573.

Where To Get Single Copies

Single copies of the draft revised guidance may be obtained by mail from the Office of Communication, Training, and Manufacturers Assistance (HFM-40), Center for Biologics Evaluation and Research (CBER), 1401 Rockville Pike, Rockville, MD 20852, or by calling the CBER Voice Information System at 1-800-835-4709 or 301-827-1800. Copies may be obtained from CBER's FAX Information System at 1-888-CBER-FAX or 301-827-3844.

WHO TO CONTACT

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FDA Current Thinking

This draft revised guidance represents the agency's current thinking on impurities in new drug products. It does not create or confer any rights for or on any person and does not operate to bind FDA or the public. An alternative approach may be used if such approach satisfies the requirements of the applicable statute, regulations, or both.

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