DRAFT FOR COMMENTS
as of 22 July 2019

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FDA Circular
No. _____

SUBJECT: GUIDELINES ON THE REGISTRATION OF FOOD PRODUCTS, INCLUDING RAW MATERIALS AND FOOD INGREDIENTS, CONTAINING ALUMINUM LAKE COLORS, AND AS SUCH AS FOOD ADDITIVES FOR FURTHER PROCESSING

I. BACKGROUND

Colors are added to foods in many countries of the world, but the type of colorants permitted for use varies greatly among countries. Since international trade is becoming increasingly important, color legislation is now of international concern. Unfortunately, a worldwide list of permitted color additives does not exist; therefore, color additives have, in some instance, become trade barriers for foods.

Based on Bureau Circular No. 2006-016 or the *Updated List of Food Additives* from the List in Administrative Order No. 88-A s. 1984 or *Regulatory Guidelines Concerning Food Additives*, it adopts the latest Codex Alimentarius *General Standard for Food Additives* (Codex GSFA) as additional items not listed in BC 2006-016. Aluminum Lake Colors are not listed in the GSFA nor in FDA AO No. 88-A and BC No. 2006-016.

Bureau Circular No. 2006-016 underwent WTO notification prior to its finalization through the Department of Trade and Industry – Bureau of Philippine Standards as Philippine Contact Point for the Technical Barrier to Trade Notifications, where member countries were given the chance to comment on the said issuance.

Aluminum Lake Colors are included in the *Combined Compendium of Food Additive Specifications, FAO JECFA* (Joint FAO/WHO Expert Committee on Food Additives) Monographs for its general specifications, with an established Provisional Tolerable Weekly Intake (PTWI) of 2 mg/kg body weight for aluminum. Aluminum Lake Colors are prepared under aqueous conditions by reacting aluminum oxide with coloring matter (straight dye). The resulting compound gives out a more pronounced color than that of the straight dye and that unreacted aluminum oxide may also be present in the final product.

Rule 9b.1 of the Implementing Rules and Regulations (IRR) of the Food Safety Act of 2013 states that "Codex standards shall be adopted except when these are in conflict with what is necessary to protect consumers and scientific justification exists for the action taken." While standards other than Codex may be adopted subject to certain conditions, specifically, Rule 9b.2 of the same IRR, provides that the adoption of standards other than Codex shall be based on risk assessment. Hence, in order to formally adopt standards other than Codex, risk assessment must be done.

Currently, the Center for Food Regulation and Research is approving applications for registration of food products with Aluminum Lake Colors which started in 2017 to give the affected food industry a two-year period to reformulate their food products. However, it also set for a deadline on September 2019 for the approved applications for registration on food products with lake colors. Said deadline was reflected as part of the Remarks found at the bottom part of the Certificate of Product Registration, as a temporary measure to address registration applications while waiting for Codex inclusion of Aluminum Lake Colors in the General Standard for Food Additives in two years' time. There is no formal memorandum or advisory issued to that effect. Consequently, there has been a clamor for the affected industry that such regulation can be a possible barrier to trade.

Initially, the Food and Drug Administration (FDA) issued FDA Advisory No. 2019-037 on the *Use of Color Additives in Food Products* dated 20 February 2019. The Advisory sought to clarify that it has not issued any ban on the use of color additives in food products registered with the Agency, or implemented any new regulation restricting its use in food products.

Consistent with the FDA mandate to assure safe and quality food products as stated in Republic Act (RA) No. 9711 or the Food and Drug Administration Act of 2009 and its Implementing Rules and Regulations (IRR), as well as provisions stated in RA No. 10611 or the Food Safety Act of 2013 and its IRR, this FDA Circular is hereby issued to serve as guide to all food manufacturers, importers and distributors of processed food products containing Aluminum Lake Colors, in particular, and the general public, at large; and to demonstrate compliance to food safety and quality prior to issuance of FDA authorizations.

II. DIRECTIVES

A. The Aluminum Lake Colors in processed food products, including raw materials, food ingredients, is allowed for use on conditions, as stated in the proceeding provisions, are met upon filing of initial Certificate of Product Registration (CPR) application or for renewal.

B. Additional requirements to be submitted by applicants upon renewal or initial application, with regards to the application of CPR for food products containing Aluminum Lake Colors, are as follows:

1. Presentation of results of the conduct of Dietary Exposure Assessment to ensure that consumption of food products containing Aluminum Lake Colors both in retail and in food service do not exceed the established Provisional Tolerable Weekly Intake (PTWI) for such product at 2 mg/kg body weight (bw) aluminum as set by the Joint FAO/WHO Experts Committee on Food Additives (JECFA) as against the Food Consumption Data of the Filipino population on a particular food product at 55 kg body weight, an average weight assumed for the adult Asian population. (CAC/GL3-1989; EHC Chapter 6, p.42).

   It is noted that Aluminum Lake Colors are considered safe by JECFA, if total exposure (from across all food sources) falls within the PTWI of 2 mg/kg for aluminum that was established at the 74th JECFA in 2011.

2. Presentation of certificate of analysis based on the JECFA General Specifications of Aluminum Lakes of Coloring Matters, for its purity and identity for pure Aluminum Lake Colors for further processing.

C. Furthermore, the conduct of the Dietary Exposure Assessment (DEA) in Section II.B.1 above would be an interim measure until complete risk assessment of Aluminum Lake colors specific to the Filipino population will be established; and shall be based on the Codex *Guidelines for the Simple Evaluation of Dietary Exposure to Food Additives* (CAC/GL3-1989, Adopted 1989, Revision 2014 or latest), see Annex A.

Based on the said Guidelines, Dietary Exposure Assessment combines food consumption data and the concentration of the food additive in food. The resulting dietary exposure estimate may then be compared with the ADI for the food additive [or the PTWI for aluminum lake color in this case].

Three elements must be taken into account in assessing the dietary exposure to a food additive, as stated in the same Guidelines:

1. The concentration of the food additive in food;
2. The amount of food consumed; and
3. The average body weight

$$\text{Dietary exposure} = \frac{\Sigma\ (\text{Concentration of food additive in food} \times \text{Food Consumption})}{\text{Body weight (kg)}}$$

In lieu of actual consumption data from national surveys, to determine DEA, annual food product sales volume, food balance sheet, food disappearance data or total diet studies (if available) may be considered to approximate consumption and eventually establish a Theoretical Maximum Daily Intake (TMDI) and thus arrive at dietary exposure.

$$\text{Food Consumption} = \frac{\text{Sales volume for a year}}{\frac{365 \text{ days}}{\text{National Population}}}$$

Thus,

$$\text{PTWI} = \Sigma \text{ Dietary exposure} \times 7 \text{ days}$$

D. The provision currently appearing on issued CPR with regards to the deadline on acceptance of the application for registration of food products with aluminum lake colors shall be lifted. Processed food products with lake colors should satisfy requirements of this Circular. The safety of the food products should not be compromised such that the Food Business Operators shall be primarily responsible for the safety of food products including those in the food service, that are offered for sale to the consumers.

E. Aluminum Lake Colors banned from other countries due to safety issues are automatically not permitted to be registered in the Philippines as well as its use in any food product, i.e. Aluminum Lake form of FD&C Red No. 3 or Erythrosine.

F. Use of aluminum lake colors on processed food products (raw materials, food ingredients, food additives, and finished products) which are exclusively distributed for

export market only shall be allowed, without the above stated requirements, provided that such use is permitted in the regulations of the importing country. The CPRs to be issued shall indicate "For export market only."

G. All existing applications of products containing aluminum lake colors shall be processed based on the requirements of this Circular.

H. This measure will be in effect immediately unless proof of the safety of the processed food products containing aluminum lake color/s is established with supporting documents upon filing or refiling of CPR applications.

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ANNEX A

GUIDELINES FOR THE SIMPLE EVALUATION OF DIETARY EXPOSURE TO FOOD ADDITIVES

(CAC/GL3-1989, Adopted 1989, Revision 2014)

CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS
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GUIDELINES FOR THE SIMPLE EVALUATION OF DIETARY EXPOSURE TO FOOD ADDITIVES

CAC/GL 3-1989
Adopted 1989. Revision 2014
(formerly *Guidelines for the Simple Evaluation of Food Additive Intake*)

1. INTRODUCTION

The *General Standard for Food Additives* (GSFA) states in its Preamble that the use of food additives is justified only when such use has an advantage, does not present an appreciable health risk to consumers, does not mislead the consumer, and serves one or more technological functions. The quantity of a food additive added to food shall be limited to the lowest level necessary to achieve the intended technical effect[1], according to the basic principle of the Good Manufacture Practice (GMP).

In regard to protecting the health of the consumers, principles for risk analysis have been applied in the framework of the Codex Alimentarius. Risk analysis has been defined by the Codex Alimentarius Commission (CAC) as a process consisting of three closely linked components: risk assessment, risk management and risk communication[2]. Risk assessment is defined as a scientifically based process consisting of the following steps: 1) hazard identification, 2) hazard characterization, 3) exposure assessment and 4) risk characterization[3].

The Joint FAO/WHO Expert Committee on Food Additives (JECFA) is primarily responsible for performing the risk assessments upon which Codex Committee on Food Additives (CCFA) and ultimately the CAC base their risk management decision[4].

On an international level, the first step in the consideration of the safety assessment of food additives is an evaluation by JECFA, including the establishment of an Acceptable Daily Intake (ADI), where relevant, and the elaboration of their identity and purity criteria. The ADI is an estimate of the amount of a food additive in food or beverages expressed on a body weight (bw) basis that can be ingested daily over a lifetime without appreciable health risk to the consumer[5]. It is derived on the basis of all the known facts at the time of the evaluation. The ADI is expressed in milligrams of the food additive per kilogram of body weight[6] on a daily basis. JECFA evaluates the estimated dietary exposures and, in the risk characterization step, compares the probable exposure to the food additive with the relevant ADI[7].

In the second step, proposals for the permitted use of an additive in different foods are made by the responsible national authorities or by the Codex Commodity Committees to the CCFA. The endorsement of the proposed use by the CCFA should take into account the ADI, or an equivalent health based guidance value, established for the additive by JECFA and the probable daily dietary exposure to the additive from all food sources. When the food additive is to be used in foods eaten by special groups of consumers (e.g., diabetics, those on special medical diets, sick individuals on formulated liquid diets), account shall be taken of the probable daily dietary exposure to the food additive by those consumers.

There are different approaches for estimating the probable daily dietary exposure to food additives. Some of these approaches are very expensive and time consuming and may pose difficulties to some countries in initiating such dietary exposure assessments for food additives. Therefore, the present guidelines are intended to facilitate the work of governments, particularly for countries with limited resources, on the assessment of dietary exposure to food additives by reflecting current procedures in place to carry out such work in a simple way. The present guidelines are not intended to provide support to CCFA on the work on the GSFA, as JECFA is the international expert scientific advisory body to provide such advice to the Committee based on the Principles and Methods for The Risk Assessment of Chemicals in Food - Environmental Health Criteria (EHC) 240.

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1 Preamble to the *General Standard for Food Additives* (GSFA; CODEX STAN 192-1995, available at www.codexalimentarius.org/codex-home/en/ under the "Standards" menu).

2 Codex Alimentarius Commission Procedural Manual (21st Ed.) Section IV: Risk Analysis, Working Principles for Risk Analysis for Application in the framework of the Codex Alimentarius, pp. 107 - 113.

3 Codex Alimentarius Commission Procedural Manual (21st Ed.) Section IV: Risk Analysis, Definitions of Risk Analysis Terms Related to Food Safety, pp. 114 -115.

4 Codex Alimentarius Commission Procedural Manual (21st Ed.) Section IV: Risk Analysis, "Risk Analysis Principles Applied by the Codex Committee on Food Additives", pp. 116-120.

5 For this purpose, "without appreciable risk" is taken to mean the practical certainty that injury will not result even after a life-time's exposure (Preamble to the GSFA; CODEX STAN 192-1995).

6 The methods used to establish health-based guidance value such as an ADI are described in Chapter 5 of the publication Principles and Methods for the Risk Assessment of Chemicals in Food - Environmental Health Criteria 240 (EHC 240; Food and Agriculture Organization of the United Nations and the World Health Organization, 2009; www.who.int/foodsafety/chem/principles/en/index1.html) Chapter 5.

7 JECFA´s monographs are available at http://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/jecfa-additives/en/.

2. DIETARY EXPOSURE ASSESSMENT

Dietary exposure assessment[8] combines food consumption data and the concentration of the food additive in food. The resulting dietary exposure estimate may then be compared with the ADI for the food additive, if available, as part of the risk characterization.

Three elements must be taken into account in assessing the dietary exposure to a food additive: (1) the concentration of the food additive in food; (2) the amount of food consumed; and (3) the average body weight of the population (kg). The general equation for dietary exposure is:

$$\text{Dietary exposure} = \frac{\Sigma\ (\text{Concentration of food additive in food} \times \text{Food consumption})}{\text{Body weight (kg)}}$$

There are different methods for estimating probable dietary exposure[9]. The method used should be appropriate for the purpose, clearly stated and reproducible. Information about the model and data sources used, assumptions, limitations and uncertainties should also be documented. National or regional data should be used whenever possible.

A stepwise approach is recommended in which screening methods based on conservative assumptions can be applied to identify those of no safety concern that may be present, among the large number of food additives using minimal resources in the shortest possible time. If no safety concerns are identified[10], no additional exposure assessment is required. Where potential safety concerns are identified, the subsequent steps of the framework provide methods that incorporate increasingly specific and refined data (as they also require more resources).

The screening methods should overestimate dietary exposure of high consumers by using conservative assumptions for food consumption and food additive concentration. This overestimation will avoid situations where the dietary exposure estimated by the screening process may erroneously indicate no safety concern (i.e., underestimate exposure, particularly for high consumers). However, in order to effectively screen food additives and establish risk assessment priorities, the first steps of the procedure should not consider unsustainable diets, or the results will be too unrealistic to be useful. At a minimum, physiological limits of food consumption should be taken into account[11].

If the existence of a safety concern cannot be ruled out on the basis of dietary exposure assessed at the initial steps, more refined assessments of dietary exposure may be needed. Refinements to a point estimate would include less conservative assumptions based on more specific information about the foods consumed. For example, the use of market share data to identify specific types or brands of food to refine the amount of food consumed; the use of actual levels of additive in foods obtained fromthe food industry and/or laboratory analysis to refine the concentration of the food additive in food; and consideration of the impact of food processing and preparation. Considering the aim of this guideline, two approaches have been proposed for a simple evaluation of dietary exposure to food additives: Theoretical Maximum Daily Intake (TMDI) and Estimated Daily Intake (EDI).

2.1 Theoretical Maximum Daily Intake (TMDI)

The TMDI is calculated by multiplying the average per capita[12]daily food consumption for each food by the maximum use level (ML)[13]of the food additive established by national regulations or contained in the GSFA[14] or by the proposed use levels by the food industry and summing the resulting exposure values to give total dietary exposure.

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[8] The use of standard terminology is recommended to ensure consistent application and understanding. It is recommended that "consumption" be used to refer to the amount of food consumed and "dietary exposure" to the amount of food additive ingested via food. The term "dietary exposure" is used synonymously with the term "dietary intake", depending upon existing regulatory frameworks or other related considerations. Food also includes beverages, drinking-water and food supplements (EHC 240, Chapter 6, p. 3).

[9] For more detailed information on the dietary exposure assessment methods, see EHC 240, Chapter 6

[10] For this purpose, there is no safety concern if the estimated dietary exposure to a food additive does not exceed its ADI value.

[11] EHC 240, Chapter 6, p. 45. The budget method is recognized as an initial screening approach to assess exposure based on physiological limit.

[12] The per capita food consumption data represents the food intake by the entire population of a country. For most foods, only a certain percentage of the population will consume that food. Therefore, the per capita food consumption includes "eaters" as well as "non-eaters" of that food. As such, the amount of food consumed on a per capita basis will generally be lower than the "eaters-only" amount (i.e., the amount of food consumed only by those individuals who actually consumed the food). In the case where the entire population consumes the food, the per capita and "eaters-only" food consumption amount will be the same.

[13] Maximum Use Level of an additive is the highest concentration of the additive determined to be functionally effective in a food or food category and agreed to be safe by the Codex Alimentarius Commission. It is generally expressed as

The TMDI only approximates the dietary exposure to a food additive since it does not take into consideration the food consumption by special populations groups. This approach assumes that:

(a) all foods in which a food additive is permitted contain that additive;

(b) the food additive is always present at the ML;

(c) the foods in question containing the additive are consumed by people every day of their lives at the mean per capita level;

(d) the amount of the food additive in the food does not change as a result of storage, cooking or processing techniques;

(e) all foods permitted to contain the food additive are ingested and nothing is discarded.

2.2 Estimated Daily Intake (EDI)

The EDI of a food additive is the amount of an additive ingested by the average consumer of the food based on a) the actual use of the additive by industry, or b) if the food additive is used according to Good Manufacturing Practice (GMP), an approximation as close as possible to the actual uses levels.

3. DATA AVAILABLE

The first step is to identify and collect all data available in the country and check if these data can provide sufficient information (i.e., concentration of the food additive in food, food consumption data and body weights of the population of interest) to assess the dietary exposure to the food additive.

It is recommended to use national data on food additive concentrations, food consumption and body weight, and international toxicological reference values[15].National toxicological reference values may also be used, if available.

3.1 Concentration of the food additives in food

The type of data required for assessing dietary exposure for food additives is determined by the objective of the assessment. Dietary exposure can be assessed for a food additive before it has been approved for use (pre-regulation) or after it has been in the food supply for years (post-regulation). In a pre-regulation exposure assessment, food additive concentration data should be available from or estimated by the manufacturer.

MLs established for food additives by national authorities can be used in post regulation dietary exposure assessments. In the absence of a national regulation for the use of the food additive, the assessment can be conducted using the MLs in the GSFA[14]. It is recognized that the use of these MLs will overestimate the dietary exposure to a food additive because it is not typical that a person would consume all foods containing the food additive at the corresponding ML.

In a post-regulation exposure assessment, in addition to all pre-regulation data sources, information on the specific foods containing the food additive in the market and the actual use levels of the food additives in those foods may be obtained from food manufacturers or food processors. Available analytical data on the concentrations of the food additive in food may also be used to more realistically estimate the levels of the food additive likely to be found in the diet as consumed. These data can be derived from monitoring and surveillance data on food.

When using data provided by national authorities as well as other sources in international exposure assessments, it is important, whenever possible, to have detailed information on the data source, survey type or design, sampling procedures, sample preparation, analytical method, analytical parameters such as limit of detection (LOD) or limit of quantification (LOQ), and quality assurance procedures, as applicable to the assessment methodology.

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mg additive/kg of food." (Preamble to the GSFA; CODEX STAN 192-1995).The ML may similarly be established by national authorities.

[14] The use of the MLs established in the GSFA will necessarily overestimate the exposure to a food additive from its use in a given food. The MLs in the GSFA are *acceptable* MLs that "... will not usually correspond to the optimum, recommended, or typical level of use. Under GMP, the optimum, recommended, or typical use level will differ for each application of an additive and is dependent on the intended technical effect and the specific food in which the additive would be used, taking into account the type of raw material, food processing and post-manufacture storage, transport and handling by distributors, retailers, and consumers."(Preamble to the GSFA; CODEX STAN 192-1995).

[15] EHC 240, Chapter 6, pp. 4-5.

3.1.1 *Regulation of use of food additives*

The use of national or international standards of food additives for dietary exposure assessments should be made taking into consideration the regulations in force concerning the additives.

The following three types of regulations will be considered:

(a) Authorization for using the food additive is given according to a specific use and thereby there is a positive list. That is, for each additive there is a list of foods in which the additive may be used with an indication of the ML of use. Here data on consumption of foods in which the additive is specifically authorized are needed.

(b) The food additive is authorized for use in specified foods, but according to GMP. Here also, as in (a), consumption data are needed for the specified foods. However, numerical use levels representing current GMP need to be provided. The food industry can provide actual levels for the additive in different foods. Foods in which the use of the additive is authorized may be sampled and analyzed to determine the levels of the additive present in foods.

(c) The food additive is authorized according to GMP in all foods, but the use in certain foods is under specific provision. This legislative situation requires close collaboration with the food industry and/or a rather complete sampling and analytical evaluation of the levels present in foods. The financial consequences of this approach may limit its applicability.

In some countries, incomplete regulations for the use of food additives can make the problem even more complicated, especially when the majority of processed food is imported. In these cases, information on the ML authorized by the exporting countries and/or the actual use levels may be provided by exporters.

It should be noted that distinguishing the imported food products from those produced domestically is not simple. Consumers may not realize that a product has been imported (e.g., in household-based food consumption surveys), or may not report it as such. However, data on the amount of imported food may be available from national food balance sheet data, depending on the reporting requirements.

3.2 Food consumption data

Food consumption data reflect what individuals or groups consume in terms of solid foods, beverages (including drinking water), and food supplements. Food consumption can be estimated through surveys at an individual, household level or approximated through national food balance sheet statistics. The latter two provide gross annual estimates of the type and amount of food available for human consumption within a household or country, respectively, and can be used to derive a gross estimate of average food consumption per capita without indicating the distribution of consumption in the population. Such data at international level can be obtained through FAOSTAT[16] and/or OECD.stat[17].

There are two general approaches in order to obtain information on the dietary habits: (i) involving the collection of inferred data on the movement and disappearance of food in a region or home; and (ii) involving the collection of direct personal data on the actual amounts of food consumed by an individual or household. A combined analysis of both types of data may be performed.

A summary of the generally used methods is given in Table 1.

Table 1: Approaches for Determining Food Consumption Data

Approaches	Method	Characteristics
Inferred data on the movement and disappearance of food in a region or home		
Population-based methods	food balance sheets; food disappearance data	Represent the total annual amount of a commodity available for domestic consumption per year. The amount consumed daily by an individual may be estimated by dividing the total annual amount by 365 and by the national population. Because consumption is expressed in terms of raw and semi-processed commodities, these data are not generally useful for estimating dietary exposure to food additives, which are primarily used in processed foods.
Household-based methods	data on food purchased by a household; follow-up of consumed foods or changes in food stocks	Useful for comparing food availability among different communities, geographic areas and socioeconomic groups and for tracking dietary changes in the total population. However, these data do not provide

[16] http://faostat.fao.org/
[17] http://stats.oecd.org/

		information on the distribution of food consumption among individual members of the household.
Personal data on the actual food consumption by an individual or household		
Individual-based methods	food record; 24 h dietary recall; food frequency questionnaires (FFQs); diet history survey; food habit questionnaire	Provide detailed information on food consumption patterns. Data from individual dietary surveys are also understood to more closely reflect actual consumption. However, these data may be prone to bias. For instance, individuals may tend to overestimate consumption of foods perceived as "good" foods and underestimate consumption of foods perceived as "bad" foods.

When examining existing food consumption data, the possible variation of food habits within subgroups of the population should be considered. The methodologies should take into consideration non-average individuals, which may be possible at the household or individual survey level.

Some subgroups within the population will show patterns of food consumption that differ widely from those of the population as a whole and include, for example, ethnic and cultural minority groups within a community; and individuals consuming large portions of specific food items. Some consumers may also be loyal to those foods or brands of food containing the highest concentrations of the food additive or may occasionally consume foods with very high concentrations of the food additive. In these cases, data from individual-based methods are the most useful.

Sub-population groups that consume large quantities of food in general or of specific food items may be taken into account by considering higher percentiles of food consumption data (e.g., 90th, 95th or 97.5th). Individual survey methods typically contain food consumption data for different sex, age, ethnic, economic, and regional populations[18].

A simple approach to determine the food consumption of the sub-population groups that consume large quantities of food is the assumption that the high consumer is only a high consumer of one food category and has an average consumption of other food categories. In this case, a particular food category is selected which contributes most to the intake of the specific food additive. A correction factor of three is used to estimate the high consumers consumption from the average users consumption[19].

3.3 Body weight

For the purposes of dietary exposure estimates, an average body weight of 60 kg for adults and 15 kg for children are assumed for most populations in the world. However, for certain regions, the average body weight of the adult population may differ significantly from 60 kg. For example, an average body weight of 55 kg is assumed for the adult Asian population[20].

It is important that the average body weight used is representative of the individuals in the country or region or population sub-group of interest as much as possible. For food consumption data collected using individual-based methods, it is recommended that the actual body weights of the survey participants be used. If the default 60 kg adult body weight underestimates the actual individual body weights, the dietary exposure estimate on a per kg body weight basis will be overestimated. Similarly, if the default 60 kg adult body weight overestimates the actual individual body weights, the dietary exposure estimate on a per kg body weight basis will be underestimated.

4. SIMPLE APPROACH FOR THE EVALUATION OF DIETARY EXPOSURE TO FOOD ADDITIVES

Estimates of dietary exposure may be sequentially calculated starting with the simplest TMDI and proceeding to more refined EDI if necessary. Data on consumption of "eaters" and of specific foods should be available and checked to verify that the average consumption of "eaters" is not higher than the average consumption of the whole population. An estimate based upon the TMDI can give adequate assurance of safe use if the estimated dietary exposure is lower than the ADI. However, if the estimated dietary exposure using this approach exceeds the ADI, a more refined estimate would be necessary. The TMDI can be refined by taking into account food consumption by appropriate population subgroups.

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[18] A discussion of approaches to estimating exposure for "high" consumers is provided in EHC 240, Chapter 6, pp. 56-57.

[19] The correction factor of three is based on information from the "Guidelines for the Study of Dietary intakes of Chemical Contaminants" (WHO, 1985), which indicates that 95thpercentile of the population eats less than three times the average consumption.

[20] EHC 240, Chapter 6, p. 42.

4.1 Criteria for prioritization of evaluation of dietary exposure to food additives

The following criteria may be used to prioritize those food additives for which a dietary exposure assessment is applicable. A low priority can be given to additives that have been assigned an ADI of "not specified" when they are used according to GMP[21].

(i) Additives assigned a low ADI and also authorized for use at a high level in foods.

(ii) Additives authorized in foods consumed in large quantities or by a significant proportion of the population or consumed by potentially-at-risk subgroups (e.g. children, diabetics, pregnant women, elderly), as appropriate.

(iii) Additives that have been assigned a numerical ADI when they are used according to GMP.

4.2 Proposed method for a simple evaluation of the dietary exposure to food additives

The following stepwise procedure is proposed:

A. Evaluation of the TMDI

A.1 Elaboration of the list of foods in which the additive is permitted. This approach assumes that the additive is used in all of the foods in which it is regulated for use.

A.2 Determination of the levels of use:

A.2.1 MLs according to the regulation;

A.2.2 Actual levels if authorization is given according to GMP (levels obtained from industry or from analysis of foods);

A.2.3 Proposed use levels before the food additive has been approved for use (pre-regulation).

A.3 Determination of the average consumption of the food in which the additive is permitted:

A.3.1 Collection of all available information regarding food habits in the country;

A.3.2 When little information is available, the national population-based method (i.e., per capita estimate) should be used as a first step;

A.3.3 Check whether the average consumption of "eaters" is not higher than the average consumption of the population. Consumption data for "eaters" should be used when "eaters" consume greater quantities of the food than the total population over long periods.

A.3.4 Obtain a better estimate of food consumption by replacing average values obtained from the national population-based method by average consumption for "eaters" (see example in the Annex), taking into account the physiological limits of food consumption, in order to not consider patterns of unsustainable diets[22].

If the TMDI < ADI, the actual dietary exposure is considered to be lower than the ADI (overestimations in A.1 and A.2). If the TMDI > ADI, the EDI approach should be followed.

B. Evaluation of the EDI

B.1 Check the list of foods:

Modify the list in such a way that only foods within a food group that actually contain the additive are considered. For example, if an additive is only used in fruit-flavoured soft drinks, use the food consumption data for this more specific category rather than that for all soft drinks.

B.2 Check the actual levels of use:

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[21] According to JECFA, an ADI of "not specified" is a term applicable to a food additive of very low toxicity that, on the basis of the available chemical, biochemical and toxicological data, as well as the total dietary exposure of the additive (from its use at the levels necessary to achieve the desired effect and from its acceptable background in food), does not represent a hazard to health. For that reason, the establishment of an ADI expressed in numerical form is not necessary. An additive meeting this criterion must be used in accordance with GMP: that is, it should be technologically efficacious and should be used at the lowest level necessary to achieve this effect, it should not conceal inferior food quality or adulteration, and it should not create a nutritional imbalance. (EHC 240, Annex 1 – Glossary of Terms, p. 2)

[22] EHC 240, Chapter 6, p. 6.

Determine whether the additive is used at the maximum authorized level for all the foods, or only for some subcategories. Use actual maximum reported levels of use of the additive obtained from the food industry and/or mean concentration determined from the analysis of foods (see example in the Annex), as appropriate.

B.3 Introduce these more refined data (B.1 and B.2) in the TMDI previously calculated (see section A).

If the EDI < ADI, the actual intake is considered to be lower than the ADI. If the EDI > ADI, check the need and the possibility to conduct a more refined exposure assessment and, when appropriate, discuss with the food industry reviewing the MLs of the additive and the foods in which it is used.

5. SUMMARY

This document describes a stepwise approach to estimate exposure to additives to check whether an ADI is potentially exceeded.

ANNEX

Example of Calculation of TMDI and EDI

Table 1 – ADI and acceptable daily amount per person

ADI 0-5 mg/kg bw		
Average body weight (kg)	**ADI x bw**	**Acceptable daily amount per person (mg)**
Adults (Asian) = 55	5 x 55	275
Adults = 60	5 x 60	300
Children = 15	5 x 15	7 5

Table 2 – Example of MLs by food category

	Food categories and subcategories with permitted use of the food additive	**MLs (mg/kg food)**
1.	Dairy products and analogues	-
	1.1 Dairy-based desserts	-
	1.1.1 Dulce de leche	1000
2.	Fats and oils, and fat emulsions	-
	2.1. Fat spreads, dairy fat spreads and blended spreads	-
	2.1.1. Margarine	1000
3.	Processed fruit	-
	3.1. Jams, jellies, marmalades	1000
	3.2. Coconut milk	3000
4.	Processed vegetables	-
	4.1. Pickled vegetables and olives	1000
5.	Fruit and vegetable juices and nectars	1000
6.	Water-based flavoured drinks, including "sport," "energy," or "electrolyte" drinks and particulated drinks	-
	6.1. Carbonated water-based flavoured drinks	500
7.	Alcoholic beverages, including alcohol-free and low-alcoholic counterparts	-
	7.1. Aromatized alcoholic beverages	-
	7.1.1. Cooler-type beverages	500
	7.1.1.1. Sangria	500
	7.2. Distilled spirituous beverages containing more than 15% alcohol	-
	7.2.1. Cachaça	500
	7.2.2. Aperitifs	500
	7.2.3. Liqueurs	500
8.	Table-top sweeteners (liquid form)	2000
9.	Salts, spices, soups, sauces, salads and protein products	-
	9.1 Seasonings and condiments (including mayonnaise)	1000

Theoretical Maximum Daily Intake (TMDI)

Table 3 – Example of TMDI

	Food categories and subcategories	MLs (mg/kg food)	Average consumption per capita (g or ml/day)	Food additive intake (mg/day)
1.	Dairy products and analogues	-	-	-
	1.1. Dairy-based desserts	-	-	-
	1.1.1. Dulce de leche	1000	0.36	0.36
2.	Fats and oils, and fat emulsions	-	-	-
	2.1. Fat spreads, dairy fat spreads and blended spreads	-	-	-
	2.1.1. Margarine	1000	4.0	4.0
3.	Processed fruit	-	-	-
	3.1. Jams, jellies, marmalades	1000	0.84	0.84
	3.2. Coconut milk	3000	negligible	0.0
4.	Processed vegetables	-	-	-
	4.1. Pickled vegetables and olives	1000	negligible	0.0
5.	Fruit and vegetable juices and nectars	1000	2.0	2.0
6.	Water-based flavoured drinks, including "sport," "energy," or "electrolyte" drinks and particulated drinks	-	-	-
	6.1.Carbonated water-based flavoured drinks	-	-	-
	6.1.1 Soft drinks	500	57.1	28.55
7.	Alcoholic beverages, including alcohol-free and low-alcoholic counterparts	-	-	-
	7.1. Cooler-type beverages, sangria, aperitifs and liqueurs	500	0.74	0.37
	7.2. Cachaça	500	0.76	0.38
8.	Table-top sweeteners (liquid form)	2000	negligible	0.0
9.	Salts, spices, soups, sauces, salads and protein products	-	-	-
	9.1. Mayonnaise	1000	0.96	0.96
	9.2. Other seasonings and condiments	1000	0.72	0.72
	TMDI (mg/day)	-	-	**38.18**

Remarks: The TMDI is lower than the acceptable daily amount for adults and children (see Table 1). To obtain a better estimate of food consumption, check whether the average consumption of "eaters" is not much higher than the average consumption of the population (see Section A.3.3).

Improved Theoretical Maximum Daily Intake (TMDI)

Average consumption of soft drinks and juices of "eaters":

- Vegetable juices and nectars: 275ml (instead of 2.0ml average intake of the population).

- Soft drinks: 259ml (instead of 57.1ml average intake of the population).

As the average consumption of soft drinks and juices by "eaters" is much higher than the average consumption of the population, consumption data for "eaters" were used to refine the estimate (See Section A.3.3.)

The revised consumption values for these two food categories are indicated in **bold** in Table 4.

Table 4 – Example of improved TMDI

Food categories and subcategories	MLs (mg/kg food)	Consumption (g or ml/day)*	Food additive intake (mg/day)
Dulce de leche	1000	0.36	0.36
Margarine	1000	4.0	4.0
Jams, jellies, marmalades	1000	0.84	0.84
Fruit and vegetable juices and nectars	1000	**275**	275
Soft drinks	500	**259**	129.5
Cooler-type beverages, sangria, aperitifs and liqueurs	500	0.74	0.37
Cachaça	500	0.76	0.38
Mayonnaise	1000	0.96	0.96
Other seasonings and condiments	1000	0.72	0.72
Improved TMDI (mg/day)	-	-	**412.13**

*Average consumption per capita, except for bolded figures where average consumption for "eaters" were used.

In order to calculate the TMDI for high consumers, the food additive intake from the food category that is the major contributor (fruit and vegetables juices and nectars) should be multiplied by 3. In the example in table 4, the food additive intake from this food category for high consumers will be 825 mg/day (275 mg/day x 3), and the TMDI for high consumers is estimated at 962mg/day.

Remarks: The estimated dietary exposure exceeds the acceptable daily amount for adults (275 and 300 mg – see Table 1) and children (75 mg - see Table 1). A more refined evaluation is therefore needed.

Estimate Daily Intake (EDI)

As the Improved TDMI exceeded the acceptable daily amount of the food additive for adults and children consumers (Table 1), the EDI approach was then followed. The actual levels of use (based on analytical data) of the food additive in the most representative sources of the additive in the diet (soft drinks, juices, nectars and margarine) were used in the calculations. (See Section B.2.)

Analytical data on the concentrations of the food additive:

- Mean concentration in margarine: 552.7 mg/kg (instead of 1000 mg/kg).
- Mean concentration in fruit and vegetable juices and nectars: 533.6 mg/kg (instead of 1000 mg/kg).
- Mean concentration in soft drinks: 259.2 mg/kg (instead of 500 mg/kg).

The revised concentration of the food additive for these three food categories are indicated in **bold** in Table 5.

Table 5 – Example of EDI

Food categories and subcategories	MLs or mean concentration of the food additive (mg/kg)*	Consumption (g or ml/day)**	Food additive intake (mg/ day)
Dulce de leche	1000	0.36	0.36
Margarine	**552.7**	4.0	2.21
Jams, jellies, marmalades	1000	0.84	0.84
Fruit and vegetable juices and nectars	**533.6**	**275**	146.74
Soft drinks	**259.2**	**259**	67.13
Cooler-type beverages, sangria, aperitifs and liqueurs	500	0.74	0.37
Cachaça	500	0.76	0.38
Mayonnaise	1000	0.96	0.96
Other seasonings and condiments	1000	0.72	0.72
EDI (mg/day)	-	-	**219.71**

*Except for bolded figures where actual levels of use (based on analytical data) MLs were used.

**Average consumption per capita, except for bolded figures where average consumption for 'eaters' were used.

In order to calculate the EDI for high consumers, the food additive intake from the food category that is the major contributor (fruit and vegetables juices and nectars) should be multiplied by 3. In the example in table 5, the food additive intake from this food category for high consumers will be 441 mg/day (147 mg/day x 3), and the EDI for high consumers is estimated at 513 mg/ day".

Remarks: This estimated daily dietary exposure exceeds the acceptable daily amount of the food additive for children (75 mg – see Table 1). Check the need and the possibility to conduct further refinement, using more specific data (e.g. average food consumption and specific weight by children, specific types or brands of foods in which the additive is used, and the impact of food processing and preparation). If appropriate, discuss with the food industry to review the current MLs of the food additive and/or the foods in which it is used.