CODEX ALIMENTARIUS COMMISSION

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Agenda Item 6 **CX/MAS 20/41/8 Add.1**

JOINT FAO/WHO FOOD STANDARDS PROGRAMME
CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING

PROPOSED DRAFT INFORMATION DOCUMENT ON PROCEDURES FOR THE ESTIMATION OF MEASUREMENT UNCERTAINTY

Comments at in reply to CL 2020/31-MAS

Comments of Honduras, Japan, Norway, Thailand

NOTE: CCMAS41 has been postponed to 17 – 21 May 2021. In order to ensure work continuity, CL 2020/31/OCS was issued requesting comments. See background information in the aforementioned CL. The comments compiled in this document will be made available to Germany for further consideration and preparation of a revised version of the of the Information document for consideration by CCMAS41.

Background

1. This document compiles comments received through the Codex Online Commenting System (OCS) in response to CL 2020/31-MAS issued in May 2020. Under the OCS, comments are compiled in the following order: general comments are listed first, followed by comments on specific sections.

Explanatory notes on the appendix

2. The comments submitted through the OCS are hereby attached as **Annex I** and are presented in table format.

ANNEX I

GENERAL COMMENTS		
Thailand Regarding the Sections under this information document, Thailand proposes some rearrangement for continuity and clear grouping of the text. For instance, Section 2 Top-down versus bottom-up approaches should be changed to Section 2 Approaches and under this Section separate the text into 2 sub-sections, 2.1 Top-down approach and 2.2 Bottom-up approach. In addition, to our view, Section 6 Empirical versus rational methods should come right after Section 1 Introduction, then follow by Section on Approaches and so on.		
Japan CCMAS in 2018 clarified that the purpose of this information document is to support CXG 54 by including practical examples, referring to corresponding international standards (REP18/MAS, AppendixIV). In this view, Japan supports inclusion of some examples on procedures for estimating measurement uncertainty and some references on the general topics for users. Japan, however, has some concerns about inclusion of explanation on sampling uncertainty in the information document because the proposed revised CXG 54 only deals with analytical measurement uncertainty. CCMAS in 2018 agreed that the measurement uncertainty should refer only to laboratory samples and not to the lot (CXG 54-2004 does not contain the uncertainty derived by sampling), REP18/MAS, Appendix IV. As agreed by CCMAS and shown in paragraph 57 of REP18/MAS, measurement uncertainty for the purpose of the revised CXG 54 refers only to laboratory samples, i.e., solely concerning the uncertainty of results from laboratory test samples, including subsamples . While measurement uncertainty relating to sampling is supposed to be covered by the ongoing revision of CXG 50, the existing Guidelines on Sampling (CXG 50) do not involve sampling uncertainty itself. There has been neither agreed definition nor agreed explanation about sampling uncertainty in Codex. For consistency throughout Codex guidelines, CCMAS should deter inclusion of sampling or sampling uncertainty pending clear definition on sampling uncertainty. If it will become necessary, this information document could be updated after the completion of the revision of CXG 50. Considering the Codex purposes, the guidelines should to be used by exporting/ importing countries. CCMAS should keep in mind that importing governments, or even exporting governments, usually cannot know sampling error of the inspection lot (or sampling uncertainty) before inspection, and sampling error of a lot (or sampling uncertainty) is known only after testing is done for samples for inspection. For the reasons above and considering other factors such as economic cost etc., CCMAS should not recommend requesting sampling uncertainty. Sampling uncertainty can and should only be considered when CCMAS or Commodity Committees develop new sampling plan. We should also consider practical sample size for inspection from the viewpoint of human resources, time necessary, economic costs, etc. We should not link sampling uncertainty with analytical measurement uncertainty associated with the result of testing in CXG 54 even if sampling uncertainty is scientific or theoretical. If necessary, sampling uncertainty can be considered in the revision of CXG 50.		
SPECIFIC COMMENTS		
1. Introduction		
124	This document provides guidance regarding those sources of uncertainty which originate in the laboratory itself, i.e. in connection with the procedures and conditions starting with the laboratory sample and ending with the measurement result~~. In particular: the question of~~	**Japan** The last sentence should be deleted because sampling uncertainty is out of scope of the CXG 54. This document should be within the scope of CXG 54. We should keep in mind that CXG

	~~sampling uncertainty and the extent to which laboratory samples are representative of the content in the container will not be addressed~~. ~~Such questions are addressed in CXG 50-2004 [12].~~	50 is still under revision. It is therefore premature to refer to the uncompleted CXG 50.
126	Accordingly, the present document provides background information and clarifies basic notions which are central to a correct evaluation and interpretation of measurement uncertainty. First, the top-down and bottom-up approaches are described and compared. Then, the basic model for the top-down approach is presented. This constitutes a convenient framework within which to elucidate some of the basic conceptual aspects of measurement uncertainty. In the course of the discussion, it will become increasingly clear how important it is to understand what is involved in specifying the measurand and due clarifications will be given. The relationship between the top-down and bottom-up approaches will be further clarified on the basis of a more general classification of uncertainty sources. The question of the statistical uncertainty in estimating dispersion parameters – such as standard deviation values – will be addressed; and the effect of the number of observations on this statistical uncertainty will be examined. Specific designs for the evaluation of the different components of the top-down approach will then be provided, including designs for the evaluation of subsampling and matrix effects. Finally, examples will illustrate how measurement uncertainty influences in developing sampling plans.	**Japan** Japan proposes that the last sentence should be amended adding the terms "in developing" before "sampling plan". It reads as follows: "Finally, examples will illustrate how measurement uncertainty influences in developing sampling plans". Regarding this last sentence, we understand the "measurement uncertainty" here means "analytical measurement uncertainty" as the body of CXG 54 only includes analytical measurement uncertainty. Analytical measurement uncertainty should be quantified and minimized when developing analytical methods. Sampling error should also be quantified using analytical results of samples designed to estimate sampling error when developing sampling plan. Sampling error can be minimized by developing appropriate sampling plan and by conducting appropriate sampling procedure, but when sampling plan is established, sampling plan should not be revised/influenced by measurement uncertainty.
2. Top-down versus bottom-up approaches		
131	3rd para	**Norway** EURACHEM/CITAC Guide CG4 and ISO 21748 are carried over from the main document, but not Nordtest TR 537 and NMKL Procedure No .5. Suggest to also include both Nordtest and NMKL in the information documents as references for top down estimation of measurement uncertainty and rephrase the sentence "An alternative approach – described e.g. in EURACHEM/CITAC Guide CG4 [2], Nordtest TR 537 [NN], NMKL Procedure No. 5 [NN] and in ISO 21748 [3] – consists in making use of available method validation data. The NNs and numbering of references needs to be updated to make the numbering of references appropriate.
3. Basic model for the top-down approach		
143		**Japan** For user friendliness, in the last part of this section, Japan

		proposes to insert the existing table in page5 of the section "7 Values of Measurement Uncertainty Estimates" in the Explanatory notes of the existing CXG 54, which shows the relationship between nominal concentrations and typical values of expanded measurement uncertainty. The table is helpful for users to understand the relationship between nominal concentrations and typical values of measurement uncertainty.
4. Specifying the measurand		
160		**Japan** Japan proposes modification of 4th and 5th paragraphs considering the following points: 1) Sampling uncertainty should be deleted in this information document as sampling uncertainty is out of scope of the revised CXG54. The definition of the term "sampling uncertainty" has not been agreed in Codex. 2) The JCGM:100 2008writes "The objective of a measurement is to determine the value of the measurand, that is, the value of the particular quantity to be measured. A measurement therefore begins with an appropriate specification of the measurand, the method of measurement, and the measurement procedure." In this basic concept, the term "measurement" does not include sampling, and measurement uncertainty does not include sampling uncertainty. For consistency throughout Codex guidelines, CCMAS should deter inclusion of sampling uncertainty pending clear definition on sampling uncertainty in Codex. The second sentence in the 4th paragraphs should be deleted. The first sentence in the 5th paragraph should read: Generally, while measurement uncertainty is always determined on the basis of the analytical result of laboratory sample, it is nevertheless important to include all available information about the laboratory sample in the evaluation of measurement uncertainty, e.g.
168	In particular, the specification of the measurand should include information as to whether analyte concentration is to be measured in a laboratory sample or in a "larger sample" or a batch of products in a container~~. Only in the latter case is ~~.~~*sampling*~~ Similarly, if measurement	**Japan**

	results from several laboratory samples are used to assess the conformity of bulk material from a container, it is the measurement uncertainty ~~relevant (see Section~~ of the mean value across the results corresponding to the individual laboratory samples which is relevant.~~7 for an overview of the different sources of uncertainty). Similarly, if measurement results from several laboratory samples are used to assess the conformity of bulk material from a container, it is the measurement uncertainty of the mean value across the results corresponding to the individual laboratory samples which is relevant.~~	
169	~~More generally~~Generally, while measurement uncertainty is always determined on the basis of the analytical result of laboratory sample, it is nevertheless important to include all available information about the laboratory sample in the evaluation of measurement uncertainty, e.g.	**Japan**
5. Relation between measurand and validation data		
180	**Las condiciones bajo las cuales los datos de validación** del método analítico **se pueden usar para respaldar la estimación de la incertidumbre de la medición se pueden establecer de la siguiente manera:**	**Honduras**
6. Empirical versus rational methods		
201		**Thailand** This section describes that in the Codex system, empirical methods include Type I methods, and meanwhile rational methods include Type II-IV methods. However, in our opinions, some empirical methods could be endorsed as Type IV, since their validation data do not yet complete to be endorsed as Type I methods. So we would like to propose the following: - "Empirical method (type I methods in the CODEX system)" should be amended to "Empirical method (type I methods and some of type IV methods which are empirical methods in the CODEX system)" - This section should provide more explanation and recommendations for the evaluation of measurement uncertainty for the Type IV methods which are empirical methods.

203	• Empirical method (type I methods in the CODEX system)	**Norway** Empirical methods may be typed as Type I or Type IV in Codex. Suggest to rephrase the bullet point to “Empirical method (type I or type IV methods in the CODEX system)”
7. Uncertainty sources in the top-down and bottom-up approaches		
208	**1 Uncertainty sources in the top-down and bottom-up approaches**	**Japan** Sampling uncertainty, e.g. the fourth paragraph of this section, should be deleted in this information document because sampling uncertainty is out of scope of CXG54. The definition of sampling uncertainty has not been agreed in the Codex. For consistency throughout Codex guidelines, CCMAS should deter inclusion of sampling uncertainty pending clear definition on sampling uncertainty in Codex. Regarding description about sampling as a source of uncertainty in relation with ISO/IEC 17025, it should be deleted because main uncertainty source of sampling in ISO/IEC 17025 is sampling procedure rather than sampling plan.
212	~~Sampling (The question of sampling uncertainty is not addressed in the present document. The reader is referred to CXG 50-2004 [12])~~	**Japan**
220	~~*Sampling*~~	**Japan**
Source of uncertainty		
Sampling		
221	~~If the measurand is defined in terms of e.g. analyte concentration in a container or in a batch of products, then sampling is required, and its contribution to measurement uncertainty must be assessed, see Section 7.6 in ISO 17025 [9].~~	**Japan**
8. Requirements regarding data size		
244		**Thailand** We found that the method of the estimate of a standard deviation described in Revised Draft Revision of CXG 54 – 2004 (agenda item 5), section: Procedures for estimating measurement uncertainty, para 20, and this section are different. The former describes that the estimate of a standard deviation can be calculated with the provided Excel formula, meanwhile, the latter describes the estimate of a standard deviation Table 3 in CXG 59 by application of Table 3 in CXG 59.

		So, in this section, the method for an estimate of a standard deviation which is more appropriate should be used.
244		**Japan** Regarding the first and the second paragraphs, it is helpful to add formula or excel function for calculation of multiple factors for the data size n because there is no formula in CXG59. As this document is supposed to be an “information document”, any recommendations in paragraphs 2 and 3 should be modified to information and paragraph 6 should be deleted.
246	Accordingly, ~~it is recommended that~~ standard deviations ~~be~~ is computed on the basis ~~of a minimum of~~ of values (corresponding to 11 degrees of freedom for the estimation of the standard deviation), and at N=12 the confidence interval for the standard deviation is .	**Japan**
247	As far as the simultaneous estimation of e.g. between-laboratory (or between-matrix) standard deviation and repeatability standard deviation is concerned, ~~this recommendation means that~~ measurement results from at least 12 laboratories (or matrices) should be made available, each with at least two replicates per laboratory (or matrix).	**Japan**
251	~~The recommendation is to ensure a minimum of 11 degrees of freedom for the combined uncertainty.~~	**Japan**
9. Simple procedures for evaluating uncertainty components		
285	4th para.	**Norway** Committee drafts (CD) should not be referenced and hence “CD ISO” should be changed to “ISO” before publication. Suggest the following changes “More sophisticated procedures for simultaneously estimating several components of variation are provided in [11]. The reader is also referred to CD ISO 5725-3 [18] and DTS 23471 [19].”
9.1 Procedure for characterizing in-house variation		
286		**Japan** In the fourth paragraph, a recommendation should be deleted as this document is not guidelines.
293	~~As explained in Section 8, it is recommended that, at a minimum, different in-house measurement conditions (e.g. different days) be represented in the data set.~~	**Japan**
9.2 Procedures for characterizing variation across matrices		
322	~~***Procedures for characterizing variation across matrices***~~	**Japan**

323	~~In this section it is assumed that heterogeneity between laboratory samples is negligible, and that the measurand is specified in terms of a number of matrices, from which matrices are selected[7]. Selection should be based on the method's intended use/scope. As explained in Section 8, it is recommended that, at a minimum, matrices be included.~~	**Japan** In the first paragraph, a recommendation should be deleted as this is an information document, not guidelines. This kind of strict matrix variation study has not been considered in CCMAS when endorsing Codex method of analysis. Japan suggests deleting this section:
325	~~A simple approach for characterizing variation across matrices consists in spiking the matrices and obtaining duplicate measurement results in a single laboratory for each matrix. In this manner, variation between the matrices (matrix-specific bias) can be distinguished from variation within each matrix (repeatability error). In this procedure, the matrix is modelled as a random effect, and the result is a standard deviation characterizing variation across all the matrices included in the specification of the measurand.~~	**Japan**
Example		
326	~~Example~~	**Japan**
Table 5		
327	**Table 5**	**Thailand** For better understanding, we would like to request for clarification for "MV1" and "MV2" in Table 5.
327	~~**Table 5: Data from an experiment for the calculation of the matrix bias**~~	**Japan** Delete the table
329	~~Applying the same calculation procedure as in Section 9.1, the following precision estimates are obtained:~~	**Japan**
Table 6		
330	~~**Table 6: Precision estimates for the calculation of matrix bias**~~	**Japan** Delete the table
Table 7		
339	**Table 7**	**Thailand** For better understanding, we would like to request for clarification for "MV1" and "MV2" in Table 7.
Table 8		
349	Procedure 2: If ~~PT~~ proficiency testing (PT) data are available, and a sufficient number of participants (ideally, at least 12) have used the same method – then these data can be used to characterize variation across laboratories. In order to ensure neutral data evaluation and avoid conflicts of interest, the data should come from PT schemes run by competent authorities.	**Japan** The first "PT" in this section should be spelled out as "proficiency testing".

10. Influence of measurement uncertainty on sampling plans: examples		
386		**Japan** CCMAS should be reminded that importing government, or even exporting government, usually cannot know sampling error of the inspection lot (or sampling uncertainty) before inspection. Sampling error of a lot (or sampling uncertainty) is known only after sampling and analysis designed to estimate sampling error is done. Sampling error can be minimized by developing appropriate sampling plan and by conducting appropriate sampling procedure, but when sampling plan is established, sampling plan should not be revised/influenced by measurement uncertainty. While this section refers to the ISO standards and provide theoretical concept, it can only be applied lot-by-lot inspection by manufacturers. Importing governments usually can not apply lot-by-lot inspection using process standard deviation because variability of inspection lots and relationship among different inspection lots cannot be known by importing governments.
Example		
393	The sodium content is evaluated in a batch of 500 units of bottled mineral water. If measurement uncertainty is not taken into account, for an agreed AQL of 2.5% (maximum concentration 200 mg/l), general inspection level II (default level), a sample of 30 units should be collected for evaluation (ISO 3951-2 [14], Annex A, Table A1 and Annex B, Table B1. Production is ~~well~~ under control and the control charts give a process standard deviation of 2 mg/l. The standard deviation of the measurement uncertainty is 1 mg/l and is therefore not negligible. With this the sample size should be increased to 38.	**Honduras**