Opinions and Suggestions for Sampling Standard version 02.0 (EB65 annex2) and Best Sampling Examples version 01.0 (EB67 annex 6)

Author: Jiang Zhi, Tim (GHG auditor, worked in DNV and in TUV-NORD with the focus on PoA[Ref1] now employed by Re-consult)
Date: 2012-07-20
Email: Zjiang_Tim@126.com; Zhijiang@re-consult.net
Tel: (86) 1311-6063-748

Table of Contents

1. Sampling Standard version 02.0

1.1 Sampling for determining the mean value/proportion value for a population parameter (i.e. section III-IV of Sampling Standard)

1.1.1 Sample size in the monitoring plan

My opinion is as follows:

The requirement that the PDD, PoA-DD and CPA-DDs shall include a sampling plan including the sample size, stipulated in paragraph 6 and Appendix 3 of Sampling standard[/Ref4/], is not appropriate.

My opinion is base on the following five arguments:

➢ As per the professional sampling books of *"Sampling Survey Principle"*[/Ref2/] completed by Mr. Huang LiangWen and *"Elements of Sample Survey Theory"* [/Ref3/] completed by Statistical Office of the United Nations, the sample size is determined prior to the actual onsite survey. For CDM project or CPAs under a PoA, the most appropriate time to determine the sample size is the verification period (In details, determined prior to and near to the monitoring period and reflected in the MR) but not the validation period.

➢ According to the paragraph 11 of Sampling standard[/Ref4/], in the monitoring plan of PDD, PoA-DD and CPA-DDs, the calculation of sample size is based on the *ex-ante* estimates of two parameters: mean value/proportion value and variance. Actually, the estimated values from the pilot study or expert are very rough and could not be ensured to be close to the actual mean value/proportion value and the actual variance of a population respectively. In this case, if the sample size calculated in the validation phase is used in the verification phase, the confidence and the precision are more unlikely to be met. Therefore, if the sample size calculated in the validation phase is lower to the extent required to ensure the confidence and the precision, a revision of MP will be requested. However, this unfortunate scenario could be avoided in fact. Compared with the information regarding the characteristics of the population obtained by PP during the validation period, the information regarding the characteristics of the population are more specific and comprehensive during verification period. Thus, due to the comprehensive information available during verification period, the sampling approach can more easily and correctly be determined during verification period and thus the sample size can be calculated based on the selected sampling approach.

➢ For a PoA, the calculation of sample size in the PoA-DD is not possible. For

example, it is assumed that a PoA is within a boundary of Gansu province, China, as shown in below maps 1&2 and each CPA is located in a county of Gansu province. Thus, the population covers the whole Gansu province. When first CPA is included in the PoA, only the information regarding a small part of population within the PoA (i.e. information regarding a county) is available and thus the *Sample Random Sampling* can be applied by PP which corresponding to the sample size of n_s. When 100 CPAs located in the South of Gansu province are included in the PoA, the information regarding population within the PoA is more comprehensive and homogeneous and thus the *Stratified Random Sampling* (without considering the error of strata) can be applied by PP which corresponding to the sample size of n_c. When total 400 CPAs located in the whole Gansu province are included in the PoA, the information regarding population within the PoA is completely comprehensive but heterogeneous and thus the *Multi-stage Sampling* (with considering the error of phases) can be applied by PP which corresponds to the sample size of n_m. As per sampling theory, $n_s \neq n_c \neq n_m$. Therefore, the sample size cannot be calculated in the PoA-DD but can be in the monitoring report.

Map 1 Gansu province in China[/Ref6/]

Map 2 There are fourteen administrative areas in Gansu[/Ref6/]

➤ The objective of sampling is to make sure that the estimated proportion

value/mean value for the parameter of interest determined by sampling meet the required confidence and precision. Both the sample size selected and the sampling approach applied are only means to ensure the confidence and precision. If the sample size and the sampling approach are not appropriate, the confidence and precision cannot be ensured and the PP would have to put more efforts, time and money to do additional sample in order to reach the confidence and precision. Thus, the sample size is not important factor in comparison with confidence and precision. It is not necessary to pay more attention to sample size in the validation period.

My suggestion is as follows:

The sample size included in the sampling plan is required to be developed in the verification period instead of validation period.

1.1.2 Sampling approaches in the monitoring plan

My opinion is as follows:

The requirement that the PDD, PoA-DD and CPA-DDs shall include a sampling plan including the sampling approach, stipulated in paragraph 6 and Appendix 3 of Sampling standard[/Ref4/], is not appropriate.

My opinion is base on the following arguments:

➢ Compared with the information regarding the characteristics of the population obtained by PP during the validation period, the information regarding the characteristics of the population are more specific and comprehensive during verification period. Thus, due to the comprehensive information available during verification period, the sampling approach can be more easily and correctly determined during verification period.

➢ For a PoA, the sampling approach selected by PP is changing over time. For example, it is assumed that a PoA is within a boundary of Gansu province, China, as shown in above maps 1&2 and each CPA is located in a county of Gansu province. Thus, the population covers the whole Gansu province. When first CPA is included in the PoA, only the information regarding a small part of population within the PoA (i.e. information regarding a county) is available and thus the *Sample Random Sampling* can be applied by PP. When 100 CPAs located in the South of Gansu province are included in the PoA, the information regarding population within the PoA is more comprehensive and homogeneous and thus the *Stratified Random Sampling* (without considering the error of strata) can be applied by PP. When total 400 CPAs located in the whole Gansu province are included in the PoA, the information regarding population within the PoA is completely comprehensive but heterogeneous and thus the *Multi-stage Sampling* (with considering the error of phases) can be applied by PP. Therefore, the sampling approach selected by PP for the PoA cannot be determined in the

4

PoA-DD.

My suggestion is as follows:

The sampling approach included in the sampling plan is required to be developed in the verification period instead of validation period.

1.1.3 Sampling frame in the monitoring plan

My opinion is as follows:

The requirement that the PDD, PoA-DD and CPA-DDs shall include a sampling plan including the sampling frame, stipulated in paragraph 6 and Appendix 3 of Sampling standard[Ref4], is not appropriate.

My opinion is base on the following arguments:

➢ As per sampling theory[Ref2], the sampling frame is defined as parts of a population which can be selected as sample. But, as analyzed above, the information regarding the characteristics of the population obtained by PP during the validation period is not complete. Thus, the sampling frame can be determined during the verification period.

My suggestion is as follows:

The sampling frame included in the sampling plan is required to be developed in the verification period instead of validation period.

1.1.4 Paragraph 20 and Appendix 5 (Recommended evaluation criteria for DOE Validation)

My opinion is as follows:

➢ As per paragraph 20 and Appendix 5 of Sampling standard[Ref4], the sample size, sampling approach and sampling frame shall be validated by DOE during validation period. However, as analyzed above, the sample size, sampling approach and sampling frame shall be developed during the verification period. Thus, the paragraph 20 and Appendix 5 are not appropriate.

➢ The para 20(a) is incorrect. During the validation period, the sampling is not actually implemented. So, the confidence and precision cannot be calculated by PP and thus cannot be validated by DOE.

➢ The para 20(b) is incorrect. During the validation period, the sampling is not actually implemented. So, the random selection of sample does not occur and thus cannot be validated by DOE.

My suggestion is as follows:

➢ The sample size, sampling approach and sampling frame should be excluded from the Appendix 5 of Sampling standard. Instead, the sample size, sampling approach and sampling frame are required to be verified by DOE during verification period.

1.2 Acceptance Sampling related to the inspection and acceptance of lots (i.e. section V of Sampling Standard only used by DOE)

1.2.1 The objective of Acceptance Sampling

As per para 23 of sampling standard[Ref4],

*23.   The DOE shall use **acceptance sampling** as described in below steps as part of validation/verification activities to **meet** the requirements of **paragraph 20 and 21 above:***

My question is as follows:

The objective of Acceptance Sampling, which is different from the sampling discussed in the section 1.1 above, is to select a sample from a lot, then inspect this selected sample and finally decide that this lot/sample is accepted or rejected. I don't think that the Acceptance Sampling has direct relationship with paras 20 and 21 of Sampling standard.

The PP's sample records can be considered as a lot, and DOE make an Acceptance Sampling on this lot and decide whether or not the PP's sample records are accepted. Therefore, the DOE's Acceptance Sampling can only be deemed as a cross-check/verification of the PP's sample records and would not help ensuring the requirements stipulated in paras 20 and 21.

1.2.2 What is the target population for Acceptance Sampling

As per para 22 of sampling standard[Ref4],

*22.   As one means of validation/verification, a **DOE** may apply a **sampling approach** when the project proponents have not applied a sampling approach provided the **indicated level of assurance** in paragraphs **below is met**. This is for example the case of a multi-site CDM project activities or CDM PoAs applying small-scale or large scale methodologies.*

My question is as follows:

➢ If the sampling approach, stated in para 22, refers to the " Acceptance Sampling ", the target population for Acceptance Sampling in para 22 must be the whole population for a parameter of interest within a project or a PoA because the PP has not applied a sampling approach (all units/elements in the population are

6

monitored by PP and all monitored data are used by PP to calculate GHG ERs). However, as analyzed in the section 1.2.1 above, the target population for Acceptance Sampling is the PP's sample records. The self-contradiction is requested to be clarified.

➢ If the sampling approach, stated in para 22, refers to the sampling method provided in the section III of Sampling Standard, It is beyond the DOE's capacity due to the costs, time and limited DOE's manpower. More importantly, using sampling approach is not necessary because all units/elements in the population are monitored by PP and the calculated value for a parameter of interest using all monitoring records is more accurate than that calculated by sampling approach. Finally, if the value for a parameter calculated by a DOE through using a sampling approach is much different from that calculated by the PP through using all monitored data, it can not be confirmed that the value calculated by PP is inaccurate because there are sampling error and systematic error between these two values. Thus, the sampling approach used by DOE for cross-checking the PP's calculated value based on all monitored data is questionable.

1.2.3 Application of Acceptance Sampling to multi-site project and PoA.

How the Acceptance Sampling is applied to determine the number of the project sites/CPA sites required to be visited by DOE should be specified.

1.2.4 The applicability of Acceptance Sampling for DOE

y: probability of acceptance

Figure   Operating   Characteristic Curve
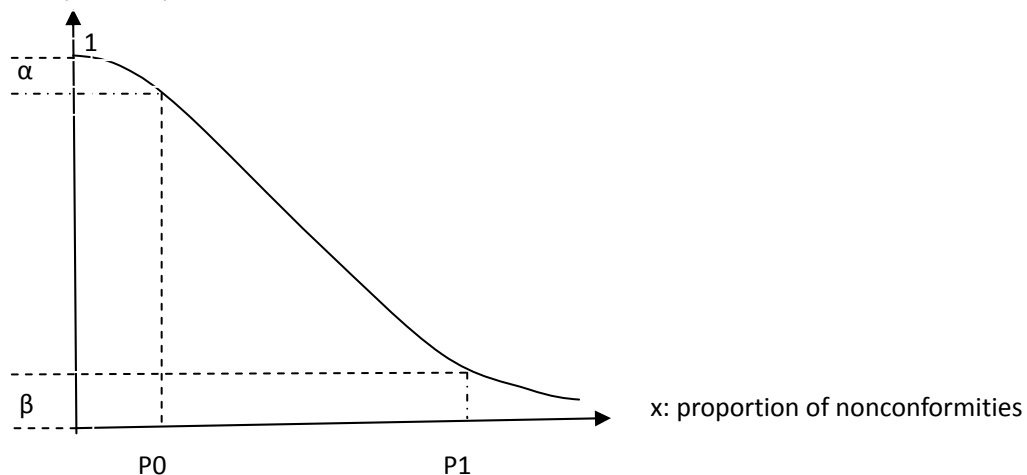
As per Manual of Acceptance Sampling National Standards[/Ref7/], the following can be concluded.

● α is the producer's risk, which should comply with para 25 (i) of Sampling Standard, i.e. 5%

● β is the consumer's risk, which should comply with para 25 (ii) of Sampling Standard, i.e. 5%

● p0 is the producer's risk quality level, corresponding to para 24 (i) of Sampling Standard,

- p1 is the consumer's risk quality level, corresponding to para 24 (ii) of Sampling Standard,

However, the strict requirements stipulated in paras 24 and 25 of Sampling Standard can not be met by Chinese relevant national standards of Acceptance Sampling, which were sourced from the relevant international standards of Acceptance Sampling. Thus, the paras 24 and 25 of Sampling Standard are impractical for Chinese CDM projects. The same was verified through checking all the relevant sampling inspection national standards by attributes, including but not limited to GB/T 13262, GB/T 13264 and GB/T 15239 as follows:

- GB/T 13262 stipulates that α is 5% and β is 10%. Thus, it is not applicable.

- GB/T 13264 stipulates that α is 5% and β is 10%. Thus, it is not applicable.

- GB/T 15239 does not fix α and β, but is still not applicable, as illustrated by the following two examples,

Example 1:

Assuming that a lot has the size of 10,100, there is only one applicable sampling plan recommended by GB/T 15239, which complies with α of 5% and β of 5% required in the para 25, as follows:

> n: the size of the sample is 80
> c: the acceptance number is 18.
> α: 4.1%
> β: 5%
> P0: 16.1%
> P1: 32.0%

But, based on my professional judgment, P0=16.1% and P1= 32.0% are not acceptable for CDM projects.

Example 2: Assuming that a lot has the size of 10,100, there is another sampling plan recommended by GB/T 15239, which does not comply with β of 5% required in the para 25 but most complies with characteristics of CDM projects, as follows:

> n: the size of the sample is 500
> c: the acceptance number is 0.
> α: 4.0%
> β: 8%
> P0: 0.009%
> P1: 0.5%

Based on my professional judgment, this sampling plan is acceptable for CDM projects. However, this sampling plan is not compliant with β of 5% required in the para 25. More importantly, even though EB increases α/β in the future, this sampling plan is thus accepted by EB. However, the sample size 500 cannot be implemented by DOE as this size is too big.

Furthermore, according to the professional book (page154) of "*Acceptance Sampling Procedure and Implementation*"[/ref9/,] published by China Metrology Publishing House in 2004-06, simultaneously keeping both α and β lower is very difficult and is not advisable and allowable in the actual application; and generally in the practice, α has a lower value but β has a relatively higher value. Based on this principle(i.e. lower α and higher β), It can be concluded based on the result of Acceptance Sampling:

● If the result of Acceptance Sampling is rejection, it can be confirmed with much high level of confidence that the quality level of the inspection lot does not meet the requirement.

● If the result of Acceptance Sampling is acceptance, this acceptance does not mean that the inspection lot does not have the quality problem and only mean that no proof is found to doubt the quality problem.

Thus, Re-definition of the values for α and β is suggested.

My suggestion is as follows:
The obsolete **Percent Sampling** should be used by DOE to conduct the acceptance sampling, although the **Percent Sampling** is not rational/reasonable in comparison with current applied acceptance sampling standards. But, the **Percent Sampling** is practicable and reasonable for DOE with regard to the DOE's efforts and costs. The following is suggested by me:

Lot size	Sample size
<100	Using the minimum of 10
100-500	5% of lot size
500-1,000	2.5% of lot size
>1,000	Using the minimum of 50

2. Best Sampling Examples version 01.0

2.1 Formulae and its variables

The formulae applied for Sample Size calculation in the Best Sampling Examples version 01.0[/Ref5/] are not clearly defined in most cases. Thus, it is difficult for PP and DOE to understand how to apply these formulae considering that the most authoritative sampling books[/Ref2/ /Ref3/] only provided the formula of sample size calculation for Sample Random Sampling.

The formulae of sample size calculation with detailed description of its variables are welcome.

2.2 A mistake in one formula

The formula (1) at page 3 of the Best Sampling Examples version 01.0[Ref5], is incorrect. The correct formula is V=p*(1-p).

2.3 Distribution of sample among the strata/clusters/phases

How to distribute the selected sample among different strata/clusters/phases is very important for confidence and precision. Thus, a guideline about this distribution is welcome.

2.4 Design effect value

As per a professional paper[Ref8], the design effect value (raised by L. Kish in his book of "Sampling Survey" in 1965) can also be used to calculate the sample size of different sampling approach, which is more simple in comparison with the sample size calculations recommended in Best Sampling Examples version 01.
n=k*B
where,
k is the sample size of sample random sampling
B is the design effect value of specific sampling approach.

Thus, a guideline about the design effect value is welcome.

3. References

/Ref1/, *Clarifications regarding applications of AMS-I.I v02, AMS-III.R v02 and AMS-III.D v18*, submitted by TUV-NORD and responded by SSC WG 35 dated 30 January–02 February 2012.

http://cdm.unfccc.int/methodologies/SSCmethodologies/clarifications/15659

/Ref2/, Mr. Huang LiangWen, book of *"Sampling Survey Principle"*, published by the press of Open University of China in 1984-07

http://book.chaoxing.com/ebook/read_10851628.html

/Ref3/, Statistical Office of the United Nations: book of *"Elements of Sample Survey Theory"*, New York 1972.

/Ref4/, Sampling Standard version 02.0 (EB65 annex2)

/Ref5/, Best Sampling Examples version 01.0 (EB67 annex 6)

/Ref6/, Wikipedia website: Introduction on Gansu province

   http://en.wikipedia.org/wiki/Gansu_province

/Ref7/, China standard press: Manual of Acceptance Sampling National Standards, 2005-02

/Ref8/, Mr. Huang SaiNan, A research on sample size, journal of South-Central University of Nationalities, 2004 Vol 24, page121-122

/ref9/ Mr. Yuan Jian Guo, Book of "Acceptance Sampling Procedure and Implementation", published by China Metrology Publishing House in 2004-06