Annex 2

STANDARD FOR SAMPLING AND SURVEYS FOR CDM PROJECT ACTIVITIES AND PROGRAMME OF ACTIVITIES

(Version 02.0)

I. Background

1. The clean development mechanism (CDM) Executive Board (hereinafter referred to as the Board), at its fiftieth meeting approved the "General Guidelines for Sampling and Surveys for Small-Scale CDM Project Activities (sampling guideline)".

2. At its sixtieth meeting, the Board agreed on further work on the task to develop one set of common sampling guidelines and best-practice examples covering large- and small-scale projects and programmes of activities (PoAs). It further agreed that the scope of the guidelines shall include guidance to designated operational entities (DOEs) on how to review sampling and survey designs in Project Design Documents (PDDs) as well as how to apply sampling to validation/verification work.

II. Scope and Applicability

3. This standard is applicable to CDM project participants, Coordinating/Managing Entities (CMEs) of PoAs and DOEs.

4. This document specifies the reliability requirements and describes appropriate sampling methods and what is expected to be provided in a sampling plan. The general requirements shall be applicable to both small-scale and large scale CDM project activities as well as PoAs [1] with any requirements specified in the applicable methodologies having precedence. Sampling-related requirements pertaining to validation and verification are also included. A definition of essential sampling terminology is included in Appendix 1.

5. This document only addresses random errors associated with sampling and does not address systematic (non-random) errors.

III. Sampling Requirements

6. CDM PDDs or CDM Programme of Activities Design Documents (CDM-PoA-DDs, CDM-CPA[2]-DDs) utilizing sampling for the determination of parameter values for calculating emission reductions shall include a *sampling plan* with a description of the sampling approach, important assumptions, and justification for the selection of the chosen approach.

7. The purpose of sampling is to obtain (a) *unbiased* and (b) *reliable estimates*[3] of the mean value of parameters used in the calculations of greenhoouse gas emission reductions.[4]

---

[1] Afforestation/Reforestation (A/R) project activities and A/R PoAs are excluded in the current version.

[2] CPA means Component Project Activity.

[3] See Appendix 1 for essential sampling terminology.

[4] Sampling may also be employed by DOEs to assess compliance with requirements, validity of assumption or other information used within PDDs or monitoring reports (e.g. biomass availability, information on prevailing practice).

8. Requirements for sampling are defined either in the applicable CDM methodology or in paragraphs below, with the applicable methodology having precedence.

9. Where there is no specific guidance in the applicable methodology, project proponents shall use 90/10 confidence/precision as the criteria for reliability of sampling efforts for small-scale project activities and 95/10 for large scale project activities. This reliability specification shall be applied to determine the sampling requirements for each individual parameter value determined through a sampling effort.[5,6]

10. Precision of 10 percent i.e. ±10% in this standard shall be interpreted:

(a) As a *relative* unit *when the parameter of interest is a proportion (or a percentage).* For instance, ±10% in relative units means that the interval around a proportion value of 70% is 63% to 77%. However, since a proportion can describe either of two possible scenarios – for example (i) cook stove still operational or (ii) cook stove no longer operational – project proponents should use the larger of the two proportions in the sample size calculation i.e. p or (1-p).;

(b) As a *relative* term *when the parameter of interest is a mean.* For example, ±10% in relative terms means that the interval around a mean value of 4 is 3.6 to 4.4.

11. When developing a sampling plan, project proponents shall calculate the sample size required to achieve a required level of reliability. The sample size should be determined manually or using appropriate statistical software. The project proponents shall take the minimum sample size of 30[7], provided that none of them will be non-responders. The calculation is dependent on all of the following as well as the target level of confidence and the precision (e.g. 90/10 or 95/10):[8]

(a) The type of parameter of interest, i.e. mean value or proportion value;

(b) The target value, i.e. the expected value of the parameter, which should be determined using the project planner's knowledge and experience;[9]

(c) Expected variance (or standard deviation)[10] for that measure in the sample, based on results from similar studies, pilot studies,[11] or from the project planner's own knowledge of the data.[12]

---

[5] The reliability of a sample-based estimate depends on both the numerical size of the sample and the variability associated with the parameter of interest. The larger the sample size the greater the reliability, whereas the relationship with the variability is the opposite, i.e. the more variable the parameter the less reliable the estimate. If a parameter has a large amount of variability, increasing the sample size will help to increase the reliability. An assessment of the variability will also deliver information on the need for stratification.

[6] If there is more than one parameter to be estimated in a CDM project activity, then a sample size calculation should be done for each of them. Then either the largest number for the sample size is chosen for the sampling effort with one common survey or the sampling effort and survey is repeated for each of the parameters.

[7] This is to avoid having samples which are very small.

[8] It is good practice to employ oversampling at the design stage, not only to compensate for any attrition, outliers or non-response associated with the sample, but also to prevent a situation at the analysis stage where the required reliability is not achieved and additional sampling efforts would be required. This would then be expensive, time-consuming and inconvenient.

[9] For example, 80% of households will still have an operational cooker, the average household size is 4.5.

[10] The variance is denoted by σ^2 (or s^2), and the standard deviation by σ or s. The standard deviation is the square root of the variance.

12. Subject to the two requirements of unbiased estimates and achieving reliability levels for the specific parameter determination, project participants have broad discretion in the sampling approach they propose to use to obtain the estimates. The choice depends on several considerations, including the known characteristics of the population, the cost of information-gathering, and other conditions surrounding the project in question. Some of the most commonly used sampling methods are summarized in Appendix 2, along with typical circumstances where each may be most appropriate to apply.

13. Some CDM methodologies specify minimum required levels of precision and confidence for various categories of variables estimated by sampling. The samples shall be chosen so as to meet or exceed these minimum levels. Project proponents may request a revision of these requirements in the methodology or request a deviation from the approved methodology in accordance with the relevant procedures providing sufficient justifications as to why a lower level is suitable for the planned application.

14. In addition to the parameters specifically indicated in CDM methodologies that are to be determined through sampling, project implementers may propose to obtain estimates of other variables using sampling techniques if that is the only practical or cost-effective means to obtain them. In those instances, project proponents shall request a revision of methodology or request deviation from the methodology or request a clarification using the approved procedures before developing a sampling plan.

15. If the estimates from the actual samples fail to achieve the target minimum levels of precision,[13] project participants shall perform additional data collection that is a supplemental or new sample to reach the required precision level.

16. When sampling is undertaken, unless differently specified in the methodology applied, the sample mean (or proportion) value shall be used for the emissions reduction calculation, not the lower or upper bound of the confidence interval.

17. The recommended outline of a sampling plan is specified in Appendix 3. In all of the approaches, it shall be ensured that the samples are drawn in a manner that avoids any bias and that the data collection minimizes non-sampling (non-random, systematic) errors. In order to achieve these goals, practitioners should observe sound practices in designing samples and administering surveys and field measurements as indicated in Appendix 4.

IV. Sampling Requirements for PoAs

18. This section covers specific sampling requirements for PoAs for application by a CME to estimate parameter values through sampling.

19. Parameter values shall be estimated by sampling in accordance with the requirements in the applied methodology separately and independently for each of the CPAs included in a PoA

[11] Project participants may conduct a sample campaign before the monitoring period to determine the standard deviation.

[12] If the parameter of interest is a proportion, or a percentage, then expected variance can be derived directly from the target value referred under paragraph 11(b) above.

[13] The range of confidence and precision of data collected through sampling should be computed to see if the stipulated requirements in paragraph 9 are met.

except when a single sampling plan covering a group of CPAs[14] is undertaken applying 95/10 confidence/precision[15] for the sample size calculation.

V. Validation and Verification of Sampling plans of Project Activities and PoAs

20. The proposed sampling plans shall be validated by DOEs[16] to determine whether they will provide parameter value estimates in an unbiased and reliable manner including determining:

(a) Whether the proposed sample size and sampling method is adequate to achieve the minimum confidence/precision requirements. DOEs shall be able to reproduce the sample size calculation in order to validate the proposed sample size;

(b) Whether the proposed sampling plan will ensure that samples are randomly selected and are representative of the population.

21. DOEs shall verify whether the project proponents have implemented the sampling effort and surveys according to the validated sampling plans. The verification includes determining:

(a) Whether the required confidence/precision has been met;

(b) Whether the selected sample was representative of the population.

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.

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:

(a) Take a random sample of the PPs sample records;

(b) Check – using own professional judgment – the acceptability (or otherwise) of the data for each record in the PPs sample records, and then;

(c) Based on the number of records where there is agreement, determine if the PPs sample records meet the requirements.

24. In order to determine the size of the sample for field/onsite check, the DOE shall specify in advance, using own professional judgment:

(i) Acceptable quality level or the Level of Assurance, i.e. the proportion of discrepancies between the PPs record and DOE record that are acceptable, e.g. 1%;

[14] That is, the populations of all CPAs are combined together, the sample size is determined and a single survey is undertaken to collect data e.g. if the parameter of interest is the daily usage hours of light bulbs, it may be feasible to undertake a single sampling and survey effort spread across geographic regions of several CPAs when either homogeneity of included CPAs relative to the light usage hours can be demonstrated or the differences among the included CPAs is taken into account in the sample size calculation. Currently PoAs applying large scale CDM methodologies are not included for applying single sampling plan covering a group of CPAs pending further analysis.

[15] This is consistent with the approach in many approved methodologies to aim at higher confidence/precision when the sampling/survey effort is undertaken less frequently e.g. AMS-I.E, AMS-II.G or AMS-I.J.

[16] Recommended evaluation criteria are included in Appendix 5.

(ii) The proportion of discrepancies between the PPs record and DOE record that are unacceptable, e.g. 10%.

25. The maximum errors associated with the determination indicated in paragraph 24 shall remain at levels indicated below:

(i) A 5% chance that the DOE will wrongly reject the PPs records (i.e. reject a set of records of acceptable quality);[17]

(ii) A 5% chance that the DOE will wrongly accept the PPs records (i.e. accept a set of records which is unacceptable).[18]

26. Using provisions under 24 to 25 the DOE shall determine:

- n: the size of the sample;
- c: the acceptance number.

If the DOE observes greater than c discrepant records in the sample then the PPs set of records is not accepted. If the number of discrepant records is equal to or less than c then the PPs set of records is accepted.

[17] This is called the *producer's risk.*
[18] This is called the *consumer's risk.*

Appendix 1: Essential Sampling Terminology

The following definitions are applied in this document:

(a) A *sample* is a subset of a *population*. The population could be, for example, all households included in a CDM project activity; the sample is a subset of these households. A characteristic of the population, such as average number of hours of operating a biogas stove, or proportion of installed refrigerator units still in operation, will be referred to as a *parameter*. The population parameter is unknown unless the whole population is studied, which is often not feasible or possible. A population parameter can, however, be estimated using data collected from a sample. It is therefore important that the sample is *representative* of the population. The correct choice of sample design can help to achieve this;

(b) The distinction regarding different *types of data (mean vs. proportion)* is important when determining the size of the sample. Mean (average) values are derived from data that are often referred to as *continuous variables*, whilst proportion (or percentage) values are derived from data that are described as *attributes, yes/no data or binary data.* The following examples reflect different types of data when determination of emission reductions achieved by a project activity requires sampling:

(i) Mean value for a parameter such as the average annual hours of operation of light bulbs used to estimate energy savings or the average methane content in the biogas recovered from biogas digesters. It can also be the efficiency of replaced equipment, to estimate the characteristics of an equipment or a technology or it may be an output/input of an equipment or technology;

(ii) Proportion value such as the percentage of units still in operation included in a replacement programme for estimating the changes of the operating characteristics of a technology or process.

(c) The parameter estimates that are calculated from the sample data should be (a) *unbiased* and (b) *reliable estimates* of the population parameters since they will be used in the calculations of greenhouse gas emission reductions:

(i) An unbiased estimate is one that does not systematically underestimate or overestimate the parameter value it is representing. Non-sampling errors are a main cause of estimates being biased, but the choice of sampling design can also have a bearing on whether an estimate is biased or unbiased;

(ii) Reliability of a sample-based estimate is typically expressed in terms of the probability that the population parameter value falls within a specified distance from the sample-based estimate. The probability is called the confidence, and the distance is referred to as the precision. Precision can be expressed in absolute units or in relative (percentage) terms, i.e. as a percentage of the anticipated target value. These standards use relative units for a proportion value of parameters as well as for the mean value of parameters used in the calculation. Confidence is the likelihood that the sampling has resulted in the target value within a certain range of values (i.e. precision);

(iii) A high level of confidence is desirable, and levels of 90% and 95% confidence are commonly used. Equally, small margins of error are desirable, and frequently a precision of ± 10% is used. The required reliability (both precision and confidence) determines the sample size.

Appendix 2: Common Types of Sampling Approaches

1. This appendix provides a summary of some of the most common types of sampling approaches and typical situations where each is recommended. Formulas for calculating standard errors of estimates from each sampling technique, confidence intervals and associated sample sizes are provided in the reference texts cited at the end of this report. The provided sampling information primarily relates to determining point estimates of average (mean) values of a parameter.

Simple Random Sampling

2. A *simple random sample* is a subset of a population (e.g. villages, individuals, buildings, pieces of equipment) chosen randomly, such that each element (or unit) of the population has the same probability of being selected. The sample-based estimate (mean or proportion) is an unbiased estimate of the population parameter.

3. Simple random sampling is conceptually straightforward and easy to implement – provided that a sampling frame of all elements of the population exists. Its simplicity makes it relatively easy to analyze the collected data. It is also appropriate when only minimum information of the population is known in advance of the data collection.

4. Simple random sampling is suited to populations that are homogeneous. In many instances a large population size and dispersed nature of population may cause a lack of homogeneity, while in some cases those factors may have relatively low impact on homogeneity (e.g. a large number of biogas digesters located in varying altitudes and temperature zones may be less conducive for simple random sampling to determine the average amount of biogas production per digester, while the usage hours of light bulbs across wide geographic areas and among large populations with similar socioeconomic circumstances connected to a single or similar grid/s may be sufficiently homogeneous for simple random sampling). The costs of data collection under simple random sampling could be higher than other sampling approaches when the population is large and geographically dispersed.

Stratified Random Sampling

5. When the population under study is not homogeneous but instead consists of several sub-populations which are known (or thought) to vary, then it is better to take a simple random sample from each of these sub-populations separately. This is called *stratified random sampling*. The sub-populations are called the strata. When considering stratified random sampling it is important to note that when identifying the strata no population element can be excluded and every element must be assigned to only one stratum. For example, the population of participants in a commercial lighting programme might be grouped according to building type (e.g. restaurants, food stores, and offices).

6. Stratified random sampling is most applicable to situations where there are obvious groupings of population elements whose characteristics are more similar within groups than across groups (e.g. restaurants are likely to be more similar to one another in terms of lighting use than they are to offices or food stores). It requires that the grouping variable be known for all elements in the sampling frame. For example, the sampling frame would require information on the building type for each case in the population to allow stratification by that characteristic.

7. Stratification helps to ensure that estimates of a population characteristic are accurate, especially if there are differences amongst the strata. For example, if lighting use within office buildings tends to be lower (on average) than in food stores then this can be taken into account when estimating the overall average number of hours of operation. Equally, if the cases within each stratum are more homogeneous than across strata, then the estimated number of hours of operation will be more precise than if a simple random sample of the same size had been taken.

Systematic Sampling

8. *Systematic sampling* is a statistical method involving the selection of elements from an ordered sampling frame. The most common form of systematic sampling is an equal-probability method, in which every k^{th} element in the frame is selected, where k, the sampling interval (sometimes known as the "skip"), is calculated as:

k = population size (N) / sample size (n)

9. Using this procedure, each element in the population has a known and equal probability of selection. The project participant shall ensure that the chosen sampling interval does not hide a pattern. Any pattern would threaten randomness. A random starting point must also be selected. Systematic sampling is to be applied only if the given population is logically homogeneous, because systematic sample units are uniformly distributed over the population.

10. Systematic sampling is applicable in a number of situations. If there is a natural ordering or flow of subjects in the population, such as output of bricks in a manufacturing process, then it is typically easier to sample every k^{th} unit to test for quality as they are produced. In all cases, it is important that the list of subjects or the process is naturally random, in the sense that there is no pattern to its order.

Cluster Sampling

11. *Clustered sampling* refers to a technique where the population is divided into sub-groups (clusters), and the sub-groups are randomly selected (sampled), rather than the individual elements which are to be studied. The data are then collected on all the individual elements in the selected sub-groups.

12. Cluster sampling is used when "hierarchical" groupings are evident in a population, such as villages and households within villages, or buildings and appliances within buildings. For example, suppose a project installs high-efficiency motors in new apartment buildings, with several motors typically in each building. In order to estimate the operating hours of the motors, one might take a sample of the buildings instead of the motors, and then meter all of the motors in the selected buildings.

13. In contrast to stratified sampling, where the equipment of interest is grouped into a relatively small number of homogeneous segments, there are many clusters of motors (i.e. apartment buildings), and there is no expectation that the motors in each building are more homogeneous than the overall population of efficient motors.

14. Cluster sampling is useful when there is no sampling frame at the lowest level of the hierarchy but there is one at the cluster level, as in the case above where a ready list of all motors would not be available, but a list of all new apartment buildings would be.

15. In many applications to monitor efficient equipment, the units occur naturally in clusters, with a different number of elements per cluster. For example, a building or plant location might constitute a natural cluster, with varying numbers of pieces of equipment per location.

16. A cluster sampling approach can offer cost advantages. For instance, if a significant component of the cost of data collection is travel time between buildings, but there is minimal cost to collect data on units within a building, then it is more cost-effective to collect data on all units within a sample of buildings than to take a simple random sample across all units in the study. It will, however, usually be necessary to meter more pieces of equipment (sample more clusters) to achieve the same level of precision as the simple random sampling, but the reduction in cost and other benefits may more than offset this apparent increase in effort.

Multi-Stage Sampling

17. Multistage sampling is a more complex form of cluster sampling. Measuring all the elements in the selected clusters may be prohibitively expensive, or not even necessary. In multi-stage sampling, the cluster units are often referred to as primary sampling units and the elements within the clusters secondary sampling units. In contrast to cluster sampling where all of the secondary units are measured, in multi-stage sampling data are collected for only a sample of the secondary units.

For example, in a study of efficient lighting, if the operation hours of motors within any one building are thought likely to be similar across all motors then – especially if the cost of measuring them is relatively high – there is not much to be gained by metering all of them. It might be better to draw a sample of buildings, and then only measure a sample of motors from within each selected building. On the other hand, if the measurements are inexpensive once a technician is on-site, then it may make sense to monitor all of the fixtures.

18. Multi-stage sampling can be extended further to three or more stages. For example, one might group the population into building complexes, then buildings, and finally fixtures.

19. So far, most of the methods above have been based on simple random sampling. Another option is to sample with probability proportional to size, and this is sometimes used in cluster sampling where clusters are of different sizes, or in multi-stage sampling.

20. There are therefore many variations in methods in applying multi-stage sampling. If the number of secondary units in each primary unit is not known in the sampling frame, then one approach is to draw a sample of primary units at random, count the number of secondary units in each selected primary unit, and then take detailed measurements for a sample of secondary units. Another option is to sample the primary units with probability proportional to size, and to draw a random sample of the secondary units in the selected primary units. The relative performance of these alternatives depends on the population characteristics, the costs of data collection, and the availability of information on the primary and secondary units in the sample frame.

Appendix 3: Recommended outline for a Sampling Plan

The sampling plan should contain information relating to: (a) sampling design; (b) data to be collected; and (c) implementation plan.

(a) Sampling Design:

(i) Objectives and Reliability Requirements: Describe the objective of the sampling effort, the timeframe, and the estimated parameter value(s). Identify the sampling requirements (applicable CDM methodology or sampling standards) and the confidence/precision criteria to be met. For example, the objective is determining the mean monthly value of parameter "X" during the crediting period, and with a 90/10 confidence/precision;

(ii) Target Population: Define the target population, and describe any particular features associated with it;

(iii) Sampling Method: Select and describe the sampling method, e.g. simple random sampling, stratified sampling, cluster sampling. Strata or clusters shall be clearly identified if sampling other than simple random sampling is to be used;

(iv) Sample Size: Address and justify the estimated target number of "units" – pieces of equipment, solar cookers, buildings, motors, log-books, etc. – which are to be studied (i.e. the sample size). The justification shall include the parameter of interest, the value it is expected to take and an estimate of the variance associated with the data, as well as the level of confidence and precision (note that if the parameter of interest is a proportion, or a percentage, then there is no need to specify a variance estimate);

(v) Sampling Frame: Identify or describe the sampling frame to be used. This shall agree with the information about the Target Population and Sampling Design above. For instance, if cluster sampling is to be used in a study of equipment in buildings, then the frame should be a listing of the buildings from which the sample will be selected.

(b) Data:

(i) Field Measurements: Identify all the variables to be measured and determine appropriate timing and frequency of the measurements. When the measurements are conducted only during limited time periods and are to be scaled up to the whole year, demonstrate that the parameter of interest is not subject to seasonal fluctuations or the time period selected is conservative or the necessary corrections are applied. Methods of measurement shall be described as appropriate;

(ii) Quality Assurance/Quality Control: Describe how to achieve good quality data, for example describe the procedures for conducting the data collection and/or field measurements including training of field personnel, provisions for maximizing response rates, documenting out-of-population cases, refusals and other sources of non-response, and related issues. An overall quality control and assurance strategy shall be documented in the plan. This shall include a procedure for defining outliers and under what circumstances outlier data/measurements may be excluded and/or replaced;

(iii) Analysis: Describe how the data will be used.

(c) Implementation:

(i) Implementation Plan: Define the schedule for implementing the sampling effort and identify the skills and resources[19] required for data collection and the analyses.

[19] A general description of qualifications and experience of personnel who will be engaged should be provided, not necessarily listing specific names, qualification and experience.

Appendix 4: Recommended practices for unbiased estimates of sampled parameters

Practitioners are expected to observe sound practices in designing samples and administering surveys and field measurements.[20] Those practices include:

(a) **Defining precisely the sampling objectives and target population and the measurements to be taken and/or data collected.** The sampling objectives will, for the most part, be concerned with estimation, i.e. estimating a characteristic (e.g. mean or percentage) of a population. Occasionally, the objective will be one of comparison, for example to compare the uptake in rural areas with that of urban areas:

(i) The target population is the "greater entity" to which the results from the survey sample are to be generalized, for example all new light fittings that are installed in new buildings in country X;

(ii) The information that will be collected will depend on the objectives, for example if a project needs to estimate the average number of hours of operation of a new efficient motor, then the data to be collected on each sampling unit is its number of hours of operation. Other measurements to be taken may relate to the characteristics of the strata, or clusters, or any other variable that may be relevant to the project objectives.

(b) **Deciding on the sampling design and the size of the sample.** This decision is based on the information provided above;

(c) **Developing the sampling frame.** A *sampling frame* is a complete listing of all individual units (elements, members) that can be considered as a representation of the whole population, and which can be used as a basis for selecting a sample, such as a list of all households in an area that have had solar cookers installed.[21] In the case of cluster sampling or multi-stage sampling, the sampling frame is a complete listing of sub-groups of the study area/population[22] which constitutes all the clusters or primary sampling units;

Without such a frame, or its equivalent, methods of sampling with assured properties such as unbiasedness are not available. The implementer of the survey effort shall compile a clear description of the target population, including those characteristics of the population which define membership. From the description and characteristic the implementer can then select a sampling frame.

(d) **Randomizing cases and drawing sample.** The implementer should ensure that the sample is drawn at random from the sampling frame. This can be done using random number tables or using the random number generator of appropriate

[20] For a very comprehensive treatment of issues surrounding sample/survey design, see Household Sample Surveys in Developing and Transition Countries, United Nations, 2005, ISBN 92-1-161481-3.

[21] Such a listing shall be available for check during validation/verification but not necessarily included in the PDD documents.

[22] A suitable map with the sampling units marked on it and properly delineated may also be regarded as a sampling frame and used in drawing samples.

software. If a systematic sampling is chosen, then the ordering of subjects on the sample should be random and free of any trend or cyclical pattern;

(e) **Selecting the most effective information-gathering method.** The implementer should decide on what would be the most reliable and cost-effective method for collecting the data, depending on the variables of interest. Alternative methods include visual inspections, physical measurements, respondent self-reports, and operational logs. For example, equipment retention rates may be determined by inspections or self-reports. Estimates of electric consumption could be based on different metering technologies depending on the characteristics of the equipment. Vehicle travel miles or equipment operating schedules could be drawn from odometers or operation logs;

(f) **Conducting surveys/measurements.** The project implementer is expected to establish and implement procedures to ensure that the field data collection is performed properly and that any potential intentional errors or unintentional errors are minimized and documented. Such procedures include: developing field measurement protocols; training personnel; establishing contact procedures; documenting coverage problems, missing cases, and non-response; minimizing non-sampling measurement errors; and quality control for data coding errors;

(g) **Minimizing non-response and adjusting for its effects**. The project implementer is expected to make all reasonable efforts to minimize non-response, to analyze potential bias arising from non-response, and to correct for any detected biases or losses in precision due to non-response. Field data collection protocols should specify procedures for multiple contacts to minimize non-response, require documentation of reasons for non-response, and prescribe corrective measures to compensate for its occurrence. Corrective measures may include over-sampling, replacing non-respondents with similar subjects, applying “correction factors” and imputing responses.

Appendix 5: Recommended evaluation criteria for DOE Validation

The following questions and evaluation criteria should be utilized by DOEs to validate the proposed sampling plans:

(a) Does the sampling plan present a reasonable approach for obtaining unbiased, reliable estimates of the variables?

(i) In terms of assessing reliability, are the elements of Objectives and Reliability Requirements complete? Do the requirements specified agree with those stated in the appropriate standards? If not, is there a reason why they are not met?

(ii) From all the different elements of the Design, is there any reason to suspect that the results from the activity will be biased? For instance, is the population under consideration only urban households? What about rural households? Might this cause a bias when the data are extrapolated to emission reductions?

(b) Is the population clearly defined, and how well does the proposed approach to developing the sampling frame represent that population?

(i) The population should be clear from the Target Population description. Whether or not the sampling frame is possible or appropriate will depend on the detail and the particular situation, for example if a map is going to be used, a question would be whether a map already exists, and how reliable it is. If a map does not exist, then who is going to create it?

(c) Is the proposed sampling approach clear?

(i) Is it clear which sampling method is being proposed? For example, is it simple random sampling, or some other method of sampling?

(ii) Does the method agree with the description of the population? Are there clusters or strata, and if so does it state what they are? For example, are they buildings, villages, etc.?

(d) Is the proposed sample size adequate to achieve the minimum confidence/precision requirements? Is the *ex ante* estimate of the population variance needed for the calculation of the sample size adequately justified?

(i) All of the information set out in the sampling plans should help answer this question. If not all information is provided then the question cannot be answered;

(ii) Is the target value for the population parameter reasonably anticipated?

(iii) Does the estimate of variability seem reasonable?

(e) Is the sample representative?

(i) Is it clear how the sample is to be selected? For example, is it to be selected randomly?

(ii) Does the Plan indicate that the sampling frame will be kept (e.g. in hard copy or a computer file of screen shot copy), and that random numbers will be generated and these random numbers will then be used to select the sample?

(f) Is the data collection/measurement method likely to provide reliable data given the nature of the parameters of interest and project, or is it subject to measurement errors?

(i) Are the methods of data collection clear and unambiguous? Are there questions which could be subject to respondent error due to sensitivity (e.g. "How much money do you spend on heating?"), lack of recall (e.g. "How many times did you buy fuel last year?"), and the like?

(ii) Are there questions that could be subject to measurement error? For example, is a particular measurement method known to under-record key data, such as the weight of bricks?

(g) Are the procedures for the data measurements well defined and do they adequately provide for minimizing non-sampling errors?

(i) Is the quality control and assurance strategy adequate?

(ii) Are there mechanisms[23] for avoiding bias in the answer?

(h) Does the frame contain the information necessary to implement the sampling approach?

(i) Are the proposed skill sets, qualifications and experience of the personnel to be engaged to conduct sampling adequate?

- - - - -

History of the document

Version	Date	Nature of revision(s)
02.0	EB 65, Annex 2 25 November 2011	To include: • Requirements for large-scale projects and PoAs; • Sampling related specifications on validation/verification of CDM projects and PoAs by a DOE; • Title change due to new content in document. This document supersedes General guidelines for sampling and surveys for SSC project activities (version 01.0) (Annex 30, EB 50 meeting report). Due to the overall modification of the document, no highlights of the changes are provided.
01	EB 50, Annex 30 23 October 2009	Initial adoption.
Decision Class: Regulatory **Document Type:** Standard **Business Function:** Methodology		

[23] Mechanisms for avoiding non-sampling errors (bias) include good questionnaire design, well-tested questionnaires, possibly pilot testing the data collection.