Implementation Guide to Standard on Audit (SA) 530 Audit Sampling

The Institute of Chartered Accountants of India
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Foreword

Standards on Auditing are critical in ensuring and enhancing quality in audits of financial statements and thus bridging the expectation gap. It is therefore necessary that the auditors properly understand and implement these Standards in their audit engagements. Implementation Guides to Standards are an important tool in the hands of the practitioners to appropriately understand the exacting requirements of these Standards and help them implement the Standards in real life audit scenarios.

I am happy to note that the Auditing and Assurance Standards Board is conscious of the fact that the mission of convergence with the International Standards on Auditing having been already achieved, focus is now required on taking these Standards to the common practitioners through various proactive awareness initiatives such as conferences/ seminars, training workshops, and more importantly, technical publications such as Implementation Guides to Standards. This Implementation Guide to Standard on Audit (SA) 530, 'Audit Sampling' is one such Guide.

I complement CA. Abhijit Bandyopadhyay, Chairman, Auditing and Assurance Standards Board who has been actively driving these awareness initiatives. I also keenly look forward to more such Implementation Guides and other technical publications from the Auditing and Assurance Standards Board.

December 28, 2011
New Delhi

CA. G. Ramaswamy
President, ICAI

Preface

Collection of audit evidence is an extremely crucial and sensitive phase of an audit since the ultimate opinion of the auditor hinges on the audit evidence obtained and auditor's evaluation thereof. Given the fact that it is neither possible nor practicable for an auditor to check each and every transaction or record or detail, especially, in contemporary modern businesses where the volume and geographical spread of transactions are incredibly enormous, test checking has been an acceptable method of evidence collection and evaluation all along.

Audit sampling is an established technique that removes *adhocism* and provides scientific and logical foundation and credence to the "test check" approach followed by the auditors in demanding situations. It allows the auditors to draw inference from testing a smaller sample and extrapolating the results to a much larger population.

The Institute of Chartered Accountants of India had issued a Standard on Audit dealing with audit sampling as back as in 1998. The Standard was revised in 2007 under the Clarity Project. The Standard deals with the auditor's use of statistical and non-statistical sampling when designing and selecting the audit sample, performing tests of controls and tests of details, and evaluating the results from the sample.

As a part of its efforts to create awareness among the members on methods to further improve the quality of their audit by encouraging their understanding and compliance with the various Standards on Audit, the Auditing and Assurance Standards Board has been bringing out Implementation Guides on auditing standards. This Implementation Guide on SA 530, Audit Sampling is one such Guide. It provides practical implementation guidance on important aspects relating to audit sampling in an easy and lucid language, covering matters such as need for audit sampling, its appropriateness and sufficiency, sampling foundation and sampling process, sampling techniques, performing audit procedures and evaluating results of audit sampling, computerised audit sampling, etc.

I am extremely grateful to CA. Paratha S De, Kolkata for preparing the preliminary draft of the Implementation Guide. I am also grateful to CA. Ganesh Balakrishnan, Hyderabad and his team *viz.,* Ms. Swati Naik, Mr. Sriraman Parthasarthy and Mr. T.S. Venkateswaran for reviewing and giving the Implementation Guide its final shape.

At this juncture, I also wish to express my sincere thanks to CA. G. Ramaswamy, President, ICAI as well as CA. Jaydeep N. Shah, Vice President, ICAI whose vision, guidance and support I have been privileged to receive in the activities of the Board.

Many thanks are also due to my Council colleagues at the Board, *viz.*, CA. Rajkumar S Adukia, Vice Chairman, CA. Amarjit Chopra, CA. Naveen N.D. Gupta, CA. Sanjeev K. Maheshwari, CA. M. Devaraja Reddy, CA. Rajendra Kumar P., CA. J. Venkateswarlu, CA. Sumantra Guha, CA. Anuj Goyal, CA. Pankaj Tyagee, CA. Jayant P. Gokhale, CA. S. Santhanakrishnan, CA. Mahesh P. Sarda, CA. Vijay Kumar Garg, CA. V. Murali, CA. Nilesh S. Vikamsey and the Central Government nominees, Shri Prithvi Haldea and Smt. Usha Sankar and also to the co-opted members at the Board, *viz*., CA. David Jones, CA. Sanjay Vasudeva, CA. Raviprasad, CA. P.R. Vittel, CA. C.N. Srinivasan, CA. Ramana Kumar B., for their dedication and support to the work plan of the Board and bringing them to fruition. I also wish to place on record my thanks to the special invitees to the Board, viz., CA. Vinod Chandiok, Prof. A. Kanagaraj, CA. Amit Roy, Shri Sunil Kadam, CA. Raj Agrawal, CA. Bhavani Balasubramanian, CA. K. Rajasekhar, CA. Harinderjit Singh, CA. N. Venkatram, CA. B. Padmaja, CA. L. Kamesh for their support to the Board.

I am confident that this Implementation Guide would be well received by members and other interested readers.

December 20, 2011
Kolkata

CA. Abhijit Bandyopadhyay
Chairman,
Auditing & Assurance Standards Board

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Chapter 1

Need of Audit Sampling, Its Appropriateness and Sufficiency

1.1 Auditors require reliable audit evidence from which they can draw robust conclusions. An auditor can apply sampling in carrying out both compliance procedures to review and evaluate the effectiveness of the internal Control System and substantive procedures to obtain evidence regarding the completeness, accuracy and validity of the data.

Need for Sampling

1.2 Audit sampling refers to the application of audit procedures to less than 100% of items within a population of audit relevance such that all sampling units have a chance of selection in order to provide the auditor with a reasonable basis on which to draw conclusions about the entire population.

1.3 An auditor is required to formulate and express an overall opinion on financial statements based on an examination of the records of transactions and other relevant information. The audit evidence enables the auditor to form an opinion on the financial statements. In forming such an opinion, the auditor may obtain audit evidence on a selective basis by way of judgmental or statistical sampling.

1.4 It is often necessary to draw a sample of information from the whole population to enable a more focused examination to take place. For instance, if the auditor of a bank checks each of the transactions of the bank, it would not be feasible to do so without incurring enormous cost and expending lot of time.

1.5 Sampling is an important auditing technique since it enables the auditor to select some transactions out of a large mass of similar transactions data in a manner that results in

drawing valid conclusions about the entire data after a thorough examination of the selected transaction.

1.6 In this back drop, the extent of checking has undergone a progressive change in favour of more focus on the principals and controls with a curtailment of non-consequential routine checking and with a shift in favour of formal internal control in the management of affairs of organizations, where the possibilities of routine error and frauds have greatly diminished.

1.7 **"**An effective sample test provides appropriate audit evidence to an extent that, taken with other audit evidence obtained or to be obtained, will be sufficient for the auditor's purposes. In selecting items for testing, the auditor is required to determine the relevance and reliability of information to be used as audit evidence; the other aspect of effectiveness (sufficiency) is an important consideration in selecting items to test. The means available to the auditor for selecting items for testing are:

(a) Selecting all items (100% examination);

(b) Selecting specific items.

1.8 The application of any one or combination of these means may be appropriate depending on the particular circumstances, for example, the risks of material misstatement related to the assertion being tested, and the practicality and efficiency of the different means.**"**

(Para A52 of SA 500 (Revised) Audit Evidence)

1.9 "When designing tests of controls and tests of details, the auditor shall determine means of selecting items for testing that are effective in meeting the purpose of the audit procedure."

(Para A10 of SA 500 (Revised)) Audit Evidence)

Consideration in the Evaluation of Sample and Basic Categories of Sampling

1.10 The extent of checking to be undertaken is primarily a matter of judgment of the auditor. There are generally, no statutory requirements specifying what work is to be done, how it

is to be done and to what extent. It is also not obligatory that the auditor must adopt the sampling technique. The ultimate objective of the auditor is to express his opinion and become bound by that.

1.11 Generally, the evaluation of a sample is based upon a "judgmental selection" of transactions for review, with little statistical foundation or mathematical reasoning behind the sample. For certain audit objectives, where statistically correct samples are impractical, this approach is acceptable as long as conclusions are fairly represented.

1.12 Audit sampling plays an important role in the auditor's ability to evaluate both internal control and account balances. Sampling techniques attempt to establish conclusions, or an inference, about a population of data based upon a smaller amount of information. The purpose of audit sampling is to obtain information or determine some characteristic about a population represented in an account balance or class of transaction types.

1.13 There are two basic categories of audit sampling i.e., statistical and non-statistical. The significance of the sample to an overall audit objective will affect the sample design, as will the auditor's knowledge of the area under consideration. For example, sampling could be used in substantive testing to collect evidence regarding account balances, transactions or disclosures. Samples can be selected non- statistically for known high-risk items or statistically for specific attributes or monetary coverage. Statistical sampling measures results with confidence intervals for sample reliability concerning the population. This foundation, free of bias, supports audit analysis grounded in mathematical principle.

1.14 As mentioned in SA 530 (Revised), an auditor may decide to use audit sampling in performing audit procedures. If it is so decided then SA 530 (Revised), Audit Sampling, applies. The SA 530 (Revised) deals with the auditor's use of statistical and non statistical sampling when:

- designing and selecting the audit sample,
- performing test of controls, test of details, and
- evaluating the results from the sample

Limitations of Sampling

1.15 Sampling can provide a valid, defensible methodology but it is important to match the type of sample needed to the type of analysis required. The auditor should also take care to check the quality of the information from which the sample is to be drawn. If the quality is poor, sampling may produce reliable results.

Chapter 2

Sampling Foundation and Sampling Process

Sampling Foundation

2.1 During audit planning for areas with a high number of transactions or large quantities of evidence for evaluation, the auditor should consider the use of sampling techniques. Since there are many variations to audit sampling, only a few common types are being discussed in this Implementation Guide along with the procedures for determining the right sample size to adequately represent the target population and develop conclusions. However, a discussion of sampling risks and concepts will precede the details of sampling types since this understanding is important for developing an appropriate sampling technique.

2.2 A risk is, no doubt, involved in selecting and checking only some items in order to reach a conclusion about all of them. Sampling risk arises from the possibility that the auditor's conclusion, based on a sample may be different from the conclusion auditor would reach if the entire population were subjected to the same audit procedure.

2.3 Auditors should, therefore, be careful about extrapolating audit findings or drawing broad conclusions across a population of activities or transactions. Extrapolating results that exceed the statistical significance of judgmental sampling activities can unintentionally increase audit risk. Conclusions based upon judgmental sampling should be limited to those items actually examined since subsequent events could contradict the conclusions -- especially when performed using a non-statistical approach. Conversely, many variations of statistical sampling provide a strong basis for conclusions about audit evidence.

2.4 A sampling approach should be consistent with audit objectives and testing programmes including the accurate interpretation of results (evidential matter) as in any audit reporting. Substantiation of significant findings may rely upon the statistical grounding of the sampling approach. Simply put, audit sampling establishes the objectivity and credibility of audit results and gives more meaning to recommendations, particularly when a mathematical approach is incorporated.

2.5 **Sampling Risk** arises in carrying out both the compliance procedure and the substantive procedures. When an auditor evaluates an internal control system through compliance procedure, auditor assumes the risk of under reliance or over reliance on internal controls. Thus, the sample results may show the auditor should not rely on a particular internal control whereas the actual position might have warranted such reliance. This is termed as the risk of under reliance. In such a situation, the auditor would, on the basis of the result of his sample test, extend his substantive test even though the additional work was not required. The risk of over reliance on the other hand, is a risk that the sample results support the auditor's reliance on a particular control, when actually auditor should not have so relied. Risk of over reliance is more serious since by wrongly relying on the result of the sample, auditor may reduce the extent of substantive test and may thereby reach erroneous conclusion.

2.6 Judgmental and statistical sampling types include sampling risk and require professional judgment to minimize this risk. Inherent in every sampling procedure is the risk that the sample is not representative and that the auditor would have drawn different conclusions from procedures that include examining 100% of the population.

2.7 Regarding substantive test and tests of controls, there are two basic sampling risk attributes. First, the risk of incorrect acceptance occurs when the sample leads the auditor to conclude that there is no material misstatement when, in fact, there is. In tests of the related controls, the sample would suggest that control is effective since sample results indicate a lower deviation rate

than actually exists in the true operating effectiveness of the control. Thus, the auditor has the risk of assessing control risk too low. In both instances, the sample does not detect the issues as intended by the related audit objective. On the other hand, a sampling error occurs when, for substantive tests, there exists a condition of incorrect rejection. In this situation, the sample leads the auditor to conclude that a material misstatement exists when, in fact, it does not. For tests of controls, the sample results indicate a greater deviation rate than actually exists, which leads to the risk of assessing control risk too high.

2.8 These erroneous conditions will have an impact on both the efficiency and effectiveness of the overall audit. The efficiency is compromised by performing more work than required because of incorrect rejection and assessing control risk too high. The effectiveness is compromised by not identifying misstated balances or ineffective controls because of incorrect acceptance and assessing control risk too low.

2.9 Auditors may be 90 or 95 per cent confident that a sample is representative of the population tested. As a corollary, the risk of not being correct, or sampling risk, would be 5% or 10% depending upon the confidence interval chosen. The risk of being ineffective + confidence level = 100%. The confidence level is the complement of the risk of sampling error.

Behind the Numbers

2.10 The probability theory is used to analyse events or processes with uncertain outcomes. Probability models quantify the risk of sampling error (the uncertainty caused by random chance in the selection process). In a random sample all data points should have the same probability of being picked. The value of statistical sampling is its ability to use probability theory to calculate the risk of sampling error.

2.11 One important assumption in understanding statistical sampling is that most populations follow a normal distribution on both sides of a mean or simple average. This type of distribution, if graphically represented, would be a **bell-shaped curve**. Although

populations can be skewed representing a concentration of higher or lower values, most populations, statistically speaking, are measured around the standard deviation.

2.12 The **standard deviation** is a measure of how far items within a population are distributed from the central point or mean point. Statistical standards show that about 68% of items in a "normal" population will be one standard deviation from the mean and over 95% of the same population will be two standard deviations (+/-). Therefore, if one sample is taken at random from a large population with a known standard distribution, the probability can be estimated of the sample items falling between a certain ranges (i.e., 95% chance of falling in a range between plus/minus 1.96 standard deviations).

2.13 The **confidence level** describes the reliability of the sample results and expresses the probability of achieving accuracy in estimating the population value. The precision level expresses the accuracy of the sample to estimate the population (usually on both sides since the population value is to land in between). The precision level is commonly referred to as the error limits or upper and lower boundaries. Both of these measures are interdependent, relating (as opposites) the reliability and accuracy of a statistical sample. Together they describe the risk of sampling error.

2.14 Once a statistical sample is evaluated, the results are extended to generate an estimated value or point estimate of the actual population. This point estimate is the base for estimating error as a range, plus or minus. So, these two parameters used as guidelines accompanied with probability constants will allow an auditor to form the statistical inference statement. This statement describes a 'n%' probability that a particular attribute or monetary value either exists or falls within a range, respectively.

Reliability of a Sample

2.15 Statistical foundations assist auditors to prove that a sample is quantitatively representative of the population tested. Therefore, when testing large data sets, any auditor can

subsequently conclude and report with confidence the results of audit objectives. In short, successful sampling techniques will result in technically supported conclusions and lend traction to auditor's recommendations for action.

2.16 Sampling, however, does not in any way reduce an auditor's liability. Auditor cannot use it as a cover for negligence. The auditor's responsibility for reasonable care and skill is applicable in all cases and one should see whether the extent of sampling was reasonable so as to enable the auditor to form an opinion. If the results of sampling indicate requirement of further probe, the auditor should consider modifying the nature, timing and extent of his audit procedures accordingly.

2.17 The need for more substantiated audit results, especially in high-risk and variable operations, can exert pressure on auditors performing reviews. It is of utmost importance that a complete record of the extent of the various tests carried out in reaching the audit conclusion and the supporting evidence is kept to justify the process and rationale behind it for any review in future.

Sampling Process

2.18 The sampling process comprises of:

- Defining the population
- Sample Design, Size and Selection of Items for Testing

Population Selection

2.19 Population in the context of an audit of financial statements could include:

- Whole mass of transactions
- Information contained in the accounting records underlying the financial statements and other information
- Other records or documents whether internal or external supporting the information contained in the accounting

records underlying the financial statements and other information

- Physical existence of tangible assets
- Existence of identifiable non –monetary asset, without physical substance, held for use in the production or supply of goods or services for rental to others, or for administrative purposes
- Authority or valid ownership of both tangible & intangible assets
- Confirmation obtained from external sources
- System and procedure for entering into and processing a transaction right from the beginning to the end
- System of internal control in the area of accounts and finance transaction or document
- Such others as relevant.

Sample Design, Size and Selection of Items for Testing

2.20 When designing an audit sample, the auditor should consider:

- the purpose of the audit procedure, and
- the characteristics of the population from which the audit sample will be drawn

2.21 For any sample design, deciding upon the appropriate **sample size** will depend on **key factors** discussed below. It is important to consider these factors together to achieve the right balance and ensure that the sample objectives are met.

(i) ***Margin of Error -*** No estimate taken from a sample is expected to be exact. Inference to the population will have an attached margin of error. The better the design, the less the

margin of error and the tighter the precision but in most cases will require larger sample size.

(ii) ***Amount of Variability*** -The amount of variability in the population, i.e., the range of values or opinions, will also affect accuracy and, therefore, the size of sample required when estimating a value. The more the variability the less accurate the estimate and the larger the sample size required.

(iii) ***Confidence Level*** - The confidence level is the likelihood that the results obtained from the sample lie within the associated precision. The higher the confidence level, that is the more certain one wishes that the results are not atypical, the larger the sample size. Normally 95% confidence may be used to provide forceful conclusions. However, if one is only seeking an indication of the likely population value a lower level such as 90% may be acceptable.

2.22 **Population size** normally does not affect sample size. In fact, the larger the population sizes, the lower the proportion of that population that needs to be sampled to be representative. The effect is to slightly reduce the required sample size.

Chapter 3

Sampling Techniques

Statistical Sampling

3.1 It is important to understand that statistical sampling techniques do not replace the judgment of an auditor. They only enable the auditor quantify the degree of risk that he would take in a particular case. As the Committee on Statistical Sampling of the American Institute of Certified Public Accountants (AICPA) states:

> *"Although statistical sampling furnishes the auditor with a measure of precision and reliability, statistical techniques do not define for the auditor, the values of each to provide audit satisfaction. Specification of the precision and reliability necessary in a given test is an auditing function and must be based upon judgment in the same way as is the decision as to audit satisfaction required when statistical sampling is not used. The use of statistical sampling does not reduce the use of judgment by the auditor, but provides certain statistical measurements as to the results of audit tests, which measurements may not otherwise be available."*

3.2 How, then, does an auditor take a decision regarding the degree of risk that auditor can take in a given situation? This question is closely related to the basic objectives of the audit itself. All standard auditing procedures are designed to help the auditor in formulating a reasonable basis for an opinion on the propositions under examination. In an independent financial statement audit, for example, the auditor has to state whether the financial statements are fairly presented or not (in other words, give a true and fair view). As the AICPA Committee points out, "Materiality is implicit in the concept of fair presentation. Similarly, some degree of uncertainty is implicit in the concept of a

reasonable basis for an opinion". This implies that the sample size should be such that the more material an item is the lower should be the sampling risk. Therefore, an auditor should first decide as to how material an item is. The auditor's decision as to the monetary amount or frequency of errors that would be considered material should be based on his judgment in the circumstances of a particular case. What is material in one set of circumstances may not be so in another. It is the auditor's judgment as to how material an item is that will determine the level of sampling risk which auditor can take.

3.3 Similarly, an auditor relies on a number of procedures for reaching a reasonable opinion regarding all transactions. The procedures on which auditor decides to rely more shall have a larger sample size as compared to the sample size for those procedures on which auditor relies less. The degree of reliance that an auditor may place on a certain set of internal control procedures would also depend upon the circumstances of the case and the auditor's assessment of the same.

3.4 Random sampling gives only the probability that items having representative characteristics will be included in the sample. It cannot replace the judgment of the auditor regarding the treatment of the sample result or the degree of materiality auditor attaches to particular transactions. It is however, a useful tool in the hands of the auditor since it provides a measure of risk.

Statistical sampling methods include:

a) Random sampling

b) Systematic random sampling

c) Stratified sampling

d) Value-weighted Selection

a) Simple random sampling

3.5 In a simple random sample ('SRS') of a given size, all such subsets of the frame are given an equal probability. Each element of the frame, thus, has an equal probability of selection. The frame

is not subdivided or partitioned. Furthermore, any given *pair* of elements has the same chance of selection as any other such pair (and similarly for triples, and so on). This minimises bias and simplifies analysis of results. In particular, the variance between individual results within the sample is a good indicator of variance in the overall population, which makes it relatively easy to estimate the accuracy of results.

3.6 However, SRS can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. For instance, a simple random sample of ten people from a given country will *on average* produce five men and five women, but any given trial is likely to over represent one sex and under represent the other. Systematic and stratified techniques, discussed below, attempt to overcome this problem by using information about the population to choose a more representative sample.

3.7 SRS may also be cumbersome and tedious when sampling from an unusually large target population.

Example: Assume an office with 500 employees, divided equally into men and women, and 75 employees are to be selected for sampling. One could put all their names in a bucket and pull out 75 names. Not only does each person have an equal chance of being selected, one can also easily calculate the probability of a given person being chosen, since the sample size (n) and the population (N) is known and it becomes a simple matter of division:

n/N or 75/500 = 0.15 (15%)

This means that every employee in the office has a 15% or 1.5 in 10 chances of being selected using this method. Further, all combinations of 75 employees have the same probability of selection.

b) Systematic Random Sampling

3.8 One method of selection of random sample could be to select every *n*th item out of a series of entries using a random

start. If auditors wish to select a random sample of 100 items out of a total population of 1200, he may, for example, select every 12th item beginning from one or any other digit. Thus, if auditor begins from 3, he would select the 3rd, 15th, 27th, 39th, and 51st items and so on. The method is known as systematic random sampling. Thus, where, for example, an auditor wishes to check 68 debtors out of 475 accounts auditor may just take up the 2nd, 9th, 16th, 23rd, 30th, accounts and so on. In other words, the auditor may start from the digit 2 and selects every 7th item therefrom. The selection of 2 as the starting item is just random and the auditor can as well select any other digit (from 1 to 7) as the starting point. To keep the sample free from bias one can decide about the starting point also by the following procedures.

3.9 Divide the total population by the sample size to reach the value of the *n*th item. Thus, if the total number of debtors, as in the given example, is 475 and the auditor wishes to have a sample size of 68, the value of the *n*th item would be 7. Seven slips, identical in size and bearing numbers from one to seven may be prepared and a slip picked up blindly. The number given on that slip may be used as the random start.

3.10 Sometimes bias may vitiate a sample chosen under this method. If the transactions are in a definite pattern, the sample would consist of only a particular type of account/population which appears after regular intervals. Thus, if in sampling payroll, every 7th item is that of a supervisor, entries chosen under this method would certainly not represent the population as a whole. Systematic random sampling can be useful only where the transaction do not follow any regular pattern.

3.11 Today, the development of easy-to-use data analysis software tools such as Audit Command Language (ACL) allows auditors to incorporate audit sampling techniques into field work without use of cumbersome manual statistical tables and formulas. The challenge of audit sampling is to ensure the sample is selected properly to be representative of the population, especially if the objectives include development of meaningful conclusions about thousands of transactions (error rates,

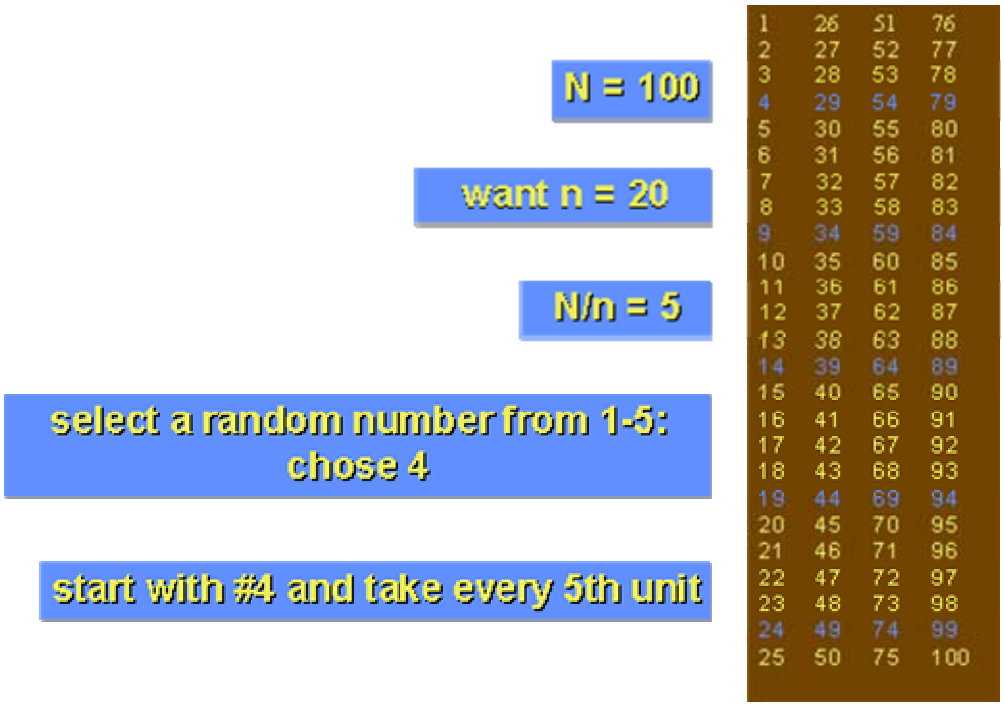
misstatements). Of course, data analysis tools may be configured to test 100% of the applicable data points, thereby assessing the entire population rather than a sample or a subset.

3.12 An understanding of audit sampling techniques can help an auditor properly select test sample sizes and develop conclusions for various audit tasks. This Guide describes basic sampling concepts, provides guidance on developing a sampling plan and reviews the common approaches to audit sampling. However, the auditors would need additional resources, training and tools for technical sampling to be incorporated into overall sampling initiatives in their audit(s). Computer Assisted Audit Tools (CAATs) make audit sampling a powerful integrated audit technique. Technical proficiency and adequate supervision, as always, are required.

3.13 Steps to be followed:-

- number the units in the population from 1 to N
- decide on the n (sample size) that you want or need
- k = N/n = the interval size
- randomly select an integer between 1 to k
- then take every kth unit

Example: Assume that auditor has a population that only has N=100 people in it and wants to take a sample of n=20. To use systematic sampling, the population must be listed in a random order. The sampling fraction would be f = 20/100 = 20%. In this case, the interval size, k, is equal to N/n = 100/20 = 5. Now, select a random integer from 1 to 5. In our example, suppose the auditor chooses integer 4. Now, to select the sample, start with the 4th unit in the list and take every k-th unit (every 5th, because k=5). The auditor would be sampling units 4, 9, 14, 19, and so on to 100 and would end up with 20 units in the sample.



c) Stratification

3.14 Stratification is the process of dividing a population into sub populations each of which is a group of sampling units having similar characteristics. Dictionary meaning of Stratification is as under:

- Process by which strata are formed;
- An arrangement is strata or layers;
- Any hierarchical division of society according to income culture or other characteristic stratify

For example, 20% of the items in a Population may make up 90% of the value of an account balance. One can decide to examine a sample of these items, and then evaluate the results of this sample and reach a conclusion on the 90% of value separately from the remaining 10% (on which a further sample or other means of gathering audit evidence will be used, or which may be considered immaterial).

3.15 Another common variation of variables sampling is stratified sampling. Like monetary unit, stratified sampling allows for a weighted selection on larger items with inherently more risk of material misstatement. Auditors can place more emphasis on larger items segregated into their own strata, dividing the population by type for more efficient testing (100% coverage in one group may be desired if problems are detected). Stratification is a common sampling technique and can be used in attribute testing as well. Also, where enough strata are created, usually two to five, the sampling risk is reduced while still applying random selection.

3.16 Other advantages of stratification include using smaller sample sizes. Each stratum's sample items are analyzed, and results are combined to understand the entire population. Strata can be created on any common characteristic, although large Rupee value items are often the criterion since they may be tested differently. For example, inventory items such as large finished goods versus parts and the corresponding accounts receivable would be natural stratum as many accounting populations will reflect. Stratification can also be used to test controls in attribute sampling, for example, by creating strata for different processing locations.

3.17 The basic steps in conducting a variables sampling procedure, although they are usually more complex for stratified sampling and better conducted utilising statistical software, include:

1. **Establish the Audit Objective** – there may be two sets of audit objectives including the overall audit to be completed by sampling combined with other tests, etc. and the sampling application objective.

2. **Develop a Sample** – (see above) the sample can be generated through use of tables with the confidence level and sampling error (derived from a random preliminary sample's average group ranges, divided by a statistical d_2 factor; it equals the estimated standard deviation used to divide the average sampling error to arrive at the stipulated

sampling error). The auditor, taking into consideration confidence intervals and sampling error, may reevaluate the appropriateness of the sample size.

3. **Examine the Sample** – evaluate the details and calculate revamped sampling error. Audit procedures are applied although they do not depend on the sampling approach. The results are usually summarized and may include a listing of error, their projection in the population and an inference statement.

4. **Extrapolate to Population and Evaluate Results** – the inference can be mathematical (based upon a point estimate) or non-mathematical (a judgment of overall reasonableness).

   Example: The additions to the Fixed Assets of the Company during the year is Rs. 10 Crores and the physical number of assets added is 250. Out of the 250 assets, 35 assets represent Rs. 9.7 crores out of the Rs. 10 crores. Therefore, these 35 assets may be used for audit sampling instead of the entire 250 and the remaining 215 can either be considered immaterial or further samples can be selected, depending upon the materiality, using other methods of sampling.

d) Value-Weighted Selection

3.18 When performing Tests of Details it may be efficient to identify the Sampling Unit as the individual monetary units that make up the population. For example, having selected specific monetary units from within the population of the accounts receivable balance; the auditor may then examine the particular items, such as individual balances, that contain those monetary units.

3.19 One benefit of this approach to defining the Sampling Unit is that the audit effort is directed to the larger value items because they have a greater chance of selection, and can result in smaller sample sizes. This approach may be used in conjunction with the

systematic method of sample selection (described in Appendix 4) and is most efficient when selecting items using random selection.

Example: The accounts receivable balance contains a balance of Rs. 100 Crores and the overall materiality of the audit is decided as Rs. 10 crores. Individual Accounts (debtors) having a balance of above Rs. 10 crores can be selected as samples. Let us assume that the company has total of 30 individual debtors out of which 6 accounts have an individual balance of above Rs. 10 crores totaling to Rs. 76 crores. These 6 accounts can be selected as samples and then further audit sampling can be done on the remaining 24 accounts depending upon the materiality using other methods of sampling.

3.20 Since the result of only representatives and unbiased sample can be statistically interpreted, an auditor should select his sample carefully. The selection procedures should ensure that each element in the population has an equal chance of being selected. In other words, the sample should be selected at random, i.e., in such a manner that each transaction has an equal chance of being included in the sample.

3.21 There are a number of methods by which random sample can be selected. The age old method of mixing various slips (containing numbers of different elements of population) in a bag and picking out a few may give us a random sample if adequate care is exercised.

3.22 A variety of sampling methods can be employed, individually or in combination. Factors commonly influencing the choice between these designs include:

- Nature and quality of the Population
- Availability of auxiliary information about units of the population
- Accuracy requirements, and the need to measure accuracy
- Whether detailed analysis of the sample is expected
- Cost/operational concerns

3.23 Specific sampling techniques are chosen based upon the type of sampling (attribute or variable) and the sample selection method (stratification, random number, interval or cluster). Both the type and sample selection **method would be driven by the overall audit objective and/or characteristics of the data examined**. For example, the inventory may be composed of small parts and of large unit finished goods. The audit team may decide to segregate these characteristics into groups prior to applying analysis. This sample is considered a stratified sample since different characteristics may generate various audit considerations. As stated above, one sample can be used for several sampling plans to support various conclusions.

3.24 The two common approaches to sampling presented below include attribute and variable (monetary unit and stratified applications) with guidance on usage, characteristics and application in the audit plan. An auditor should keep in mind that statistical analysis is a widely applied discipline with many types of uses including the few detailed here.

Attribute Sampling

3.25 This type of sampling assists auditors to **evaluate internal controls over many transaction items**. It can help to assess compliance with policy and procedures, standards or operational requirements. Attribute sampling usually will determine a range or percent of occurrence of either “yes” or “no” attribute. For example, does the purchase order have an approval signature: yes or no? This allows the auditor to make inferences about the status of the control condition and the extent to which the control is followed.

3.26 The basic steps for audit attribute sampling include the following:

1. Understand the items being sampled.
2. Establish parameters for the test.
3. Select the sample and perform procedures.
4. Evaluate the results and form conclusions.

3.27 First, develop an expected error rate or estimate how many errors will be tolerated recognizing that most operations contain errors regardless of controls and procedures. Although management may claim “zero errors,” error rates as a percent of transactions may be as minimal as 0.01% or as excessive as 10% or more. Developing an error rate estimate may be difficult if management has a “zero error rate” policy that precludes any management estimation. A good example is the control systems in diamond retail operations where inventory “shrinkage” is unacceptable. Their control procedures can include camera surveillance, double verification and checking employees. Still, a small amount of inventory is, normally, lost.

3.28 The sampling parameters will be established by carefully defining the types of tests planned along with acceptance or rejection rules. The attribute test, or estimation of expected error rate, infers an upper and lower limit to be determined within a particular confidence interval.

3.29 The basic sampling parameters include, as stated above, the maximum tolerable error (upper precision limit), confidence interval (recommended 95% or 98%) and estimate of overall population errors. These three parameters will determine the actual sample size that can be established through guidance from statistical tables. Statistical sample software will also provide correlated sample sizes. Then, by modifying the parameters, different sample sizes are generated that satisfy overall testing objectives such as management’s confidence in the testing results. A smaller estimated population error rate and/or lower confidence level will reduce the sample size. Further, a bigger gap between the estimated population error rate and the maximum tolerable error rate will naturally reduce the sample size. Population error rates are usually in the 1-2% range and should not exceed 5% since, depending upon subject matter; this would render controls inadequate beyond reasonable exception items. Understanding and working with these relationships is important to ensure quality results and valid conclusions.

Potential Characteristics of Audit Interest for Certain Classes of Transactions and Account Balances

3.30 The following is an illustrative list of potential characteristics of audit interest for certain classes of transactions and account balances.

Inventory

3.31 Examples of potential characteristics of audit interest for Inventory include:

- Inventory balances over Rs.[X]
- Inventory transactions over Rs.[X]
- Duplicate inventory items
- Inventory items listed with no count tags
- Duplicate inventory count tags
- Inventory items with negative quantities
- Inventory items with negative price
- Inventory items with negative cost
- Inventory items in which quantity is not zero and price is zero
- Inventory items in which cost is greater than retail price
- Inventory items with a profit margin below [X]
- Inventory items that have not moved in the last [X] days
- Inventory items which have a date last counted before [X]
- Inventory items with no recorded location
- Transactions before start of period
- Transactions after period end.

Accounts Receivable

3.32 Examples of potential characteristics of audit interest for Accounts receivable include:

- Accounts with credit balances
- Receivable balances over Rs.[X]
- Credit notes over Rs.[X]
- Invoices over Rs.[X]
- Accounts outstanding for greater than [X] days
- Accounts in excess of credit limit
- Total of items invoiced in last month of period
- Total of items invoiced in first month of next period
- Credit notes issued after period end
- Invoices in which the credit period taken exceeds [X] days
- Customers whose discount exceeds [X] percentage
- Gaps in sequence of orders
- Duplicates in sequence of orders
- Gaps in sequence of invoices and credit notes
- Duplicates in sequence of invoices and credit notes
- Gaps in sequence of delivery documents
- Duplicates in sequence of delivery documents
- Orders without invoices
- Invoices without orders
- Accounts that have had no activity since [date].

Fixed Assets

3.33 Examples of potential characteristics of audit interest for Fixed Assets include:

- Fixed Assets balances over Rs.[X]

- Fixed Assets transactions over Rs.[X]
- Fixed Assets items with negative net book values
- Fixed Assets items with nil net book values
- Transactions before start of period
- Transactions after period end
- Duplicate asset numbers
- Assets without a location

Accounts Payable

3.34 Examples of potential characteristics of audit interest for Accounts Payable include:

- Accounts payable balances over Rs.[X]
- Accounts payable transactions over Rs.[X]
- Accounts with debit balances
- Transactions before start of period
- Transactions after period end
- Payments over Rs.[X]
- Payments made before due date
- Payments made after due date
- Gaps in sequence of purchase orders
- Duplicates in sequence of purchase orders
- Gaps in sequence of receiving documents
- Duplicates in sequence of receiving documents
- Debts with a due date more than 12 months ahead
- Accounts that have had no activity since [date]
- Invoices without purchase order.

Salaries and Wages

3.35 Examples of potential characteristics of audit interest for Salaries and Wages include:

- Duplicate employees
- Transactions before start of period
- Transactions after period end
- Pay rates exceeding Rs.[X]
- Pay rates exceeding [X] percentage above the average pay rate
- Normal hours/days worked exceeding [X] hours/days
- Overtime hours/days worked exceeding [X] hours/days
- Total deductions are a “negative” amount.

Variable (Monetary and Stratified) Sampling

3.36 In general, variable sampling techniques are used to review an account balance to determine whether it is fairly stated. Variable sampling is focused on testing detailed items that support an account total and is divided into monetary and traditional stratified sampling. Both techniques give greater weight to items with larger values (monetary sampling also is known as a form of probability-proportional to size [PPS] selection). In fact, most types of sampling are defined by the characteristics of the population and development of a sample for testing. Monetary or PPS, random selection and systematic selection sampling are all considered random-based selection techniques that assure each sampling unit has an equal chance of being selected, which is important to prevent unintended bias.

3.37 Monetary Unit Sampling, also known as Rupee Unit Sampling, uses every Rupee or currency unit in the account under consideration as an individual sampling unit. In other words, the sample is selected based upon individual Rupees that, depending upon an established interval, will be part of various transaction

balances that add up to the summary account balance under review.

3.38 Each Rupee has an equal chance of being selected throughout all the transactions in a group. Only transactions that include the Rupee units selected are examined for accuracy and ultimately make up the group of transactions in the "sample."

3.39 Monetary sampling, because of its selection nature, is limited to only determining when overall balances are overstated and will not catch zero balance transactions. Also, this type of sampling does not handle credit or negative balance amounts, and these should be removed from the overall population under examination. The selection interval is determined by dividing the total value of all transactions in the account under review by the number of transactions. Monetary unit sampling applications are especially valuable for auditors primarily interested in evaluating large Rupee items along with a mix of all amounts in the population.

3.40 However, the first step to performing a monetary sampling test, as listed below, is to determine the sample of "Rupees" (e.g. how many 760^{th} Rupees in sample) for selection. Developing a sample size includes the following:

1) Determine the tolerable error or desired level of precision. In order to consider internal controls effective, a small percentage is often utilized such as 2-3%. (Same as attribute testing above.)

2) Establish the estimated confidence level 95- 98%. This will instill confidence in procedures rather than something lower that can be rejected by management.

3) Calculate the error rate for sampling – likelihood of incorrect acceptance/rejection.

4) Define population size or total value of the account under consideration.

3.41 Additional factors that may influence the sample size in variable sampling:

- High expected value or occurrence of misstatement will increase the sample.
- High overall risk assessment by the auditor will increase the sample.
- High standard deviation or variability of the population will decrease the sample.
- High level of tolerable misstatement will decrease the sample.

3.42 Based upon the unit sampling procedures above, an auditor may compare the balances tested to the balances recorded on the system of record. At this point, the auditor may consider developing an upper precision limit for each overstated account to establish an adjustment as required. However, this test would likely corroborate previous testing results.

3.43 Because monetary unit sampling ensures selection proportional to Rupee values there is a better chance of identifying material misstatements. All items larger than the calculated interval (e.g., 760) are selected. If the auditor establishes a very low tolerable error and no errors are found in the sample, then a small sample size is usually sufficient. As described above, the sample selection is comparatively easy and it is possible to rely on a simple calculator rather than using statistical software or employing specialized IT auditors. Conversely, monetary unit sampling does not detect zero balances, cannot utilize credit items, and is therefore precluded from extrapolating population understatements. Regardless of these limitations, internal auditors can use monetary unit sampling in attribute testing for picking samples where Rupee values are recorded.

Non Statistical Sampling

3.44 It is a sampling approach that does not have characteristics of:

a) Random selection of the sample items

b) Use of probability theory to evaluate sample results including measurement of sampling risk, is considered non-statistical sampling.

3.45 The problem arises when auditors reference samples, draw their conclusions and make recommendations with little or no statistical foundation to their tests. Such tests are considered a judgmental sample and any related reporting should be clear about the limitations of the conclusions. This does not mean that judgmental sampling cannot be a useful procedure. Non-statistical or judgmental sampling may serve the purpose of collaborating evidence with other tests in a secondary capacity. However, failure to explicitly describe sampling parameters such as confidence and precision intervals or sample and population sizes may mislead report readers. The mathematical foundation is the bridge between evidence and conclusion.

3.46 Non-statistical sampling is useful for many audit situations and can be an effective means of evaluating evidence. Again, any auditor should be careful not to overstate judgmental sampling results and to clearly explain the derivation of conclusions. Typically, management may not be interested in statistical support as long as it seems to represent the population under scrutiny.

3.47 In judgmental sampling, audit decisions to exclude remote locations for logistical or cost reasons are usually acceptable as long as the sample still represents the population and audit objectives. For example, if retail outlets are examined to determine whether inventory and daily cash count procedures are followed, then a close-to-random selection may suffice -- especially if it is representative of the outlet network (e.g., small/large locations; good geographical coverage). However, extrapolation across the entire population (e.g., of the percent of inventory shrinkage) would not be accurate unless statistical attributes are applied. The recommended management action to improve controls and performance across the retail network is the same. Judgmental sampling may lead to additional audit testing techniques or give reasonable confidence if it corroborates other positive testing results.

3.48 Generally, different auditors use standard judgmental sample sizes of 25, 50 or 100 to provide ample evidence to establish an adequate conclusion or understanding of existing conditions. If it appears based on the judgmental sample that significant weaknesses may exist, then the auditor should develop a formal statistical basis for an additional sample based on probability.

3.49 **Non-Statistical techniques include**

a) Haphazard sampling

b) Block selection

c) Judgment selection

a) Haphazard sampling

3.50 In haphazard sampling technique, the auditor selects the sample without following any structured methodology. Since no structured technique is used, the auditor should take steps to avoid any conscious bias or predictability (for example, avoiding difficult to locate items, or always choosing or avoiding the first or last entries on a page) and thus attempt to ensure that all items in the population have an equal chance of selection. Haphazard selection is not appropriate when using statistical sampling.

Example: In a population of 100 items, where 9 samples are to be selected (which is determined through materiality), the auditor can randomly select the 2nd, 11th, 13th, 25th, 33rd, 47th, 65th, 70th, 80th samples. There is no defined procedure for the selection of the number.

b) Block selection

3.51 Block selection involves selection of a block(s) of contiguous items from within the population. Block selection cannot ordinarily be used in audit sampling because most populations are structured such that items in a sequence can be expected to have similar characteristics to each other, but different characteristics from items elsewhere in the population. Although in some circumstances it may be an appropriate audit procedure to examine a block of items, it would rarely be an appropriate sample

selection technique when the auditor intends to draw valid inferences about the entire population based on the sample.

Example: In a population of 100, where 30 samples are to be selected (which is determined through materiality), blocks of say 6 samples can be selected after an interval of 4 samples. Thus leaving the first four samples the 5^{th}, 6^{th}, 7^{th}, 8^{th}, 9^{th}, 10^{th} sample is selected and then again after an interval of four samples the 15^{th}, 16^{th}, 17^{th}, 18^{th}, 19^{th}, 20^{th} sample is selected. Next the 25^{th}, 26^{th}, 27^{th}, 28^{th}, 29^{th}, 30^{th} sample is selected. This procedure is followed till 30 samples have been selected.

c) Judgment Sampling

3.52 This approach is used when a sample is taken based on certain judgements about the overall population. The underlying assumption is that the auditor will select units that are characteristic of the population. The critical issue here is objectivity, i.e., how much can judgment be relied upon to arrive at a typical sample. *Judgement sampling* is subject to the auditor's biases and is perhaps even more biased than haphazard sampling. Since any preconceptions the auditor may have are reflected in the sample, large biases can be introduced if these preconceptions are inaccurate. One advantage of judgement sampling, however, is the reduced cost and time involved in acquiring the sample.

Example: An auditor decides which population members to include in the sample for testing of receivables/payables based on his or her judgment. For example, if in the previous year, there has been a misstatement in the account balance of a certain debtor, the auditor may use his professional judgment in picking the same debtor for sampling in the current year even though the same has not been selected according to the statistical sampling methods adopted. The auditor may provide some alternative justification for the representativeness of the sample.

Chapter 4

Performing Audit Procedures and Evaluating Results of Audit Sampling

Performing Audit Procedures

4.1 The Revised SA 530 requires the auditor to perform audit procedures, appropriate to the purpose, on each item selected. If, however, the audit procedure is not applicable to the selected item, the auditor should perform the procedure on a replacement item.

4.2 An example of when it is necessary to perform the procedure on a replacement item is when a cancelled cheque is selected while testing for evidence of payment authorization. If the auditor is satisfied that the cheque has been properly cancelled such that it does not constitute a deviation, an appropriately chosen replacement is examined.

4.3 If the auditor is unable to apply the designed audit procedures, or suitable alternative procedures, to a selected item, the auditor should treat that item as a:

- deviation from the prescribed control, in the case of tests of controls, or
- A misstatement, in the case of tests of details (substantive procedures).

Nature and Cause of Deviations and Misstatements

4.4 The Revised SA 530 also requires the auditor to investigate the nature and cause of any deviations or misstatements identified, and evaluate their possible effect on the purpose of the audit procedure and on other areas of the audit. In analysing the deviations and misstatements identified, the auditor may observe that many have a common feature, for example, type

of transaction, location, product line or period of time. In such circumstances, the auditor may decide to identify all items in the population that possess the common feature, and extend audit procedures to those items. In addition, such deviations or misstatements may be intentional, and may indicate the possibility of fraud.

4.5 Normally, sample results are considered in conjunction with all other tests and evidence prior to making final conclusions about account balances, transactions, etc. Sample results would be considered favorable if the total misstatements and known exceptions do not exceed the tolerable error or original expectations about the population. A mathematical inference may state “that balance is overstated by an estimated 14%” versus a non-mathematical inference such as “the results show the balance is not significantly overstated.” Also, any likely errors or best estimates resulting from substantive tests including both listed exceptions (non-mathematical) and quantified misstatement amounts – even if not considered material – should be included.

4.6 In extremely rare circumstances when the auditor considers a misstatement or deviation discovered in a sample to be an anomaly, the auditor should obtain a high degree of certainty that such misstatement or deviation is not representative of the population. The auditor would obtain this degree of certainty by performing additional audit procedures to obtain sufficient appropriate audit evidence that the misstatement or deviation does not affect the remainder of the population.

Projecting Misstatement

4.7 For tests of details, the auditor should project misstatements found in the sample to the population. The auditor is required to project misstatements for the population to obtain a broad view of the scale of misstatement but this projection may not be sufficient to determine an amount to be recorded.

4.8 When a misstatement has been established as an anomaly, it may be excluded when projecting misstatements to the population. However, the effect of any such misstatement, if

uncorrected, still needs to be considered in addition to the projection of the non-anomalous misstatements.

4.9 For tests of controls, no explicit projection of deviations is necessary since the sample deviation rate is also the projected deviation rate for the population as a whole. SA 330, 'The Auditor's Responses to Assessed Risks' provides the following guidance when deviations from controls upon which the auditor intends to rely are detected:

"Para 17

When deviations from controls upon which the auditor intends to rely are detected, the auditor shall make specific inquiries to understand these matters and their potential consequences, and shall determine whether:

(a) The tests of controls that have been performed provide an appropriate basis for reliance on the controls;

(b) Additional tests of controls are necessary; or

(c) The potential risks of misstatement need to be addressed using substantive procedures.

Para A41

The concept of effectiveness of the operation of controls recognises that some deviations in the way controls are applied by the entity may occur. Deviations from prescribed controls may be caused by such factors as changes in key personnel, significant seasonal fluctuations in volume of transactions and human error. The detected rate of deviation, in particular in comparison with the expected rate, may indicate that the control cannot be relied on to reduce risk at the assertion level to that assessed by the auditor."

Tolerable Misstatement

4.10 It is a monetary amount set by the auditor in respect of which the auditor seeks to obtain an appropriate level of assurance that the monetary amount set by the auditor is not exceeded by the actual misstatement in the population.

Tolerable Rate of Deviation

4.11 It is a rate of deviation from prescribed internal control procedures set by the auditor in respect of which the auditor seeks to obtain an appropriate level of assurance that the rate of deviation set by the auditor is not exceeded by the actual rate of deviation in the population.

4.12 In mathematics and statistics, **Deviation** is a measure of difference for interval and ratio variables between the observed value and the mean. The sign of deviation (+/-), reports the direction of that difference (it is larger when the sign is positive, and smaller if it is negative). The magnitude of the value indicates the size of the difference.

4.13 Deviations are known as errors or residual - deviations from the population mean are error, while deviations from the sample mean are residuals. The sum of the deviations across the entire set of observations from the mean is always zero, and the average deviation is zero. Variation among the value of a data set when compared with a measure of central tendency such as the mean, median or mode.

Evaluating Results of Audit Sampling

4.14 Revised SA 530 requires the auditor to evaluate the results of the sample; and also whether the use of audit sampling has provided a reasonable basis for conclusions about the population that has been tested. For the tests of controls, an unexpectedly high sample deviation rate may lead to an increase in the assessed risk of material misstatement unless further audit evidence substantiating the initial assessment is obtained. For tests of details, an unexpectedly high misstatement amount in a sample may cause the auditor to believe that a class of transactions or account balance is materially misstated, in the absence of further audit evidence that no material misstatement exists.

4.15 In the case of tests of details, the projected misstatement plus anomalous misstatement, if any, is the auditor's best estimate of misstatement in the population. When the projected misstatement plus anomalous misstatement, if any, exceeds

tolerable misstatement, the sample does not provide a reasonable basis for conclusions about the population that has been tested. The closer the projected misstatement plus anomalous misstatement is to the tolerable misstatement, the more likely it is the actual misstatement in the population may exceed tolerable misstatement. Also if the projected misstatement is greater than the auditor's expectations of misstatement used to determine the sample size, the auditor may conclude that there is an unacceptable sampling risk that the actual misstatement in the population exceeds the tolerable misstatement. Considering the results of other audit procedures helps the auditor to assess the risk that actual misstatement in the population exceeds tolerable misstatement, and the risk may be reduced if additional audit evidence is obtained.

4.16 If the auditor concludes that audit sampling has not provided a reasonable basis for conclusions about the population that has been tested, the auditor may:

- Request management to investigate misstatements that have been identified and the potential for further misstatements and to make any necessary adjustments;

Or

- Tailor the nature, timing and extent of those further audit procedures to best achieve the required assurance. For example, in the case of tests of controls, the auditor might extend the sample size, test an alternative control or modify related substantive procedures.

Chapter 5

Computerised Audit Sampling

5.1 Exploratory Data Analysis(EDA) is a Computer Assisted Auditing Technique that allows the auditors to perform automated audit routines on information stored in computer files. The Exploratory Data Analysis software that is globally supported is Audit Command Language (ACL). Assistance from an Exploratory Data Analysis specialist (“EDA specialist”) may be appropriate when using Exploratory Data Analysis software.

5.2 Exploratory Data Analysis can be used to analyze large volumes of data efficiently. Exploratory Data Analysis may be used to examine all records in a data file that meet the specified criteria, or reformat, aggregate, stratify, and report data in a variety of ways. This supports electronic preparation of the analyses required to perform planned audit procedures.

5.3 Exploratory Data Analysis encompass a number of generic types of processing that are used in a variety of ways and combinations to accomplish a wide range of audit objectives. In general terms, Exploratory Data Analysis can assist in performing the following audit tasks:

- Confirm the accuracy of calculations and make computations
- Identify gaps or duplicates in a sequence
- Search for unusual or exceptional items
- Compare data in separate files
- Perform statistical sampling
- Capture entity data.

5.4 The procedures performed by the entity's data processing systems can also be simulated using EDA, which allows the auditors to test the reasonableness of the entity's information.

5.5 Exploratory Data Analysis may provide more extensive audit evidence than manual audit procedures because of the following:

- Audit Tests can be performed on the entire population and not just on a sample. Certain audit procedures may be difficult to perform manually and might not be able to be readily performed on the whole population.
- Certain significant risks can be more effectively addressed by Exploratory Data Analysis as opposed to selection of an audit sample.
- Analyses of data that would not have been available using manual techniques can help the auditors identify significant risks.

5.6 Thus, Exploratory Data Analysis can significantly enhance audit efficiency as the time spent gathering and documenting information is reduced. Selection of a MUS sample can be performed in minutes instead of hours. For example, the speed, accuracy, and repetitive nature of the technique allow the auditors to test some populations in total in less time than it would take to manually select and test a sample.

5.7 Sampling methods used by the auditors have evolved over the years. A non-statistical approach to audit sampling though cheaper than statistical sampling is generally less capable of detecting material error than a statistical approach such as probability-proportional-to-size (PPS).

5.8 The use of qualitative analysis that documents the nature and cause of each misstatement found in a sample can mitigate some of the risk associated with sampling. The use of a statistical approach, such as PPS, can further reduce this risk, and, at the same time, permit the use of a smaller sample.

5.9 The downside of statistical sampling is its complexity when performed manually. However, the use of an Excel-based software programs such as, Audit Aid, enable an auditor to use PPS and thereby gain greater efficiency and reliability from sampling operations in financial statement audits.

Appendix 1

Stratification and Value-Weighted Selection

In considering the characteristics of the population from which the sample will be drawn, the auditor may determine that stratification or value-weighted selection is appropriate. This Appendix provides guidance to the auditor on the use of stratification and value-weighted sampling techniques.

Stratification

1. Audit efficiency may be improved if the auditor stratifies a population by dividing it into discrete sub-populations which have an identifying characteristic. The objective of stratification is to reduce the variability of items within each stratum and therefore allow sample size to be reduced without increasing sampling risk.

2. When performing tests of details, the population is often stratified by monetary value. This allows greater audit effort to be directed to the larger value items, as these items may contain the greatest potential misstatement in terms of overstatement. Similarly, a population may be stratified according to a particular characteristic that indicates a higher risk of misstatement, for example, when testing the allowance for doubtful accounts in the valuation of accounts receivable, balances may be stratified by age.

3. The results of audit procedures applied to a sample of items within a stratum can only be projected to the items that make up that stratum. To draw a conclusion on the entire population, the auditor will need to consider the risk of material misstatement in relation to whatever other strata make up the entire population. For example, 20% of the items in a population may make up 90% of the value of an account balance. The auditor may decide to examine a sample of these items. The auditor evaluates the results of this sample and reaches a conclusion on

the 90% of value separately from the remaining 10% (on which a further sample or other means of gathering audit evidence will be used, or which may be considered immaterial).

4. If a class of transactions or account balance has been divided into strata, the misstatement is projected for each stratum separately. Projected misstatements for each stratum are then combined when considering the possible effect of misstatements on the total class of transactions or account balance.

Value-Weighted Selection

5. When performing tests of details it may be efficient to identify the sampling unit as the individual monetary units that make up the population. Having selected specific monetary units from within the population, for example, the accounts receivable balance, the auditor may then examine the particular items, for example, individual balances, that contain those monetary units. One benefit of this approach to defining the sampling unit is that audit effort is directed to the larger value items because they have a greater chance of selection, and can result in smaller sample sizes. This approach may be used in conjunction with the systematic method of sample selection (described in Appendix 4 as reproduced in the subsequent paras here) and is most efficient when selecting items using random selection.

The decision whether to use a statistical or non-statistical sampling approach is a matter for the auditor's judgment; however, sample size is not a valid criterion to distinguish between statistical and non-statistical approaches.

Developing a Sampling Approach or 'Application'

The sampling approach chosen will depend on the designated audit objectives, the characteristics of the elements tested (sometimes judgmental sampling is enough), and the agreed-upon approach or sampling type selected. More specifically, regarding development of a sample application (sampling program), there are three basic steps:

1. Determine what items to analyze and the **selection method** – derived from audit objectives.

2. Determine the **sample size** that will achieve the required degree of confidence and precision for the population that is judgmentally reasonable.

3. **Interpret results** – evaluate the sample for potential error rates and form conclusions, being careful to avoid misleading reporting beyond statistical support.

The auditor needs to determine a sample size sufficient to reduce sampling risk to an acceptably low level.

Paragraphs A10 and A11 of Revised SA 530 state as follows:

"A10

The level of sampling risk that the auditor is willing to accept affects the sample size required. The lower the risk the auditor is willing to accept, the greater the sample size will need to be.

A11

The sample size can be determined by the application of a statistically-based formula or through the exercise of professional judgment. Appendices 2 and 3 indicate the influences that various factors typically have on the determination of sample size. When circumstances are similar, the effect on sample size of factors such as those identified in Appendices 2 and 3 will be similar regardless of whether a statistical or non-statistical approach is chosen."

Appendix 2

Examples of Factors Influencing Sample Size for Tests of Controls

The following are factors that the auditor may consider when determining the sample size for tests of controls. These factors, which need to be considered together, assume the auditor does not modify the nature or timing of tests of controls or otherwise modify the approach to substantive procedures in response to assessed risks.

FACTOR	**EFFECT ON SAMPLE SIZE**	
1. An increase in the extent to which the auditor's risk assessment takes into account relevant controls	Increase	The more assurance the auditor intends to obtain from the operating effectiveness of controls, the lower the auditor's assessment of the risk of material misstatement will be, and the larger the sample size will need to be. When the auditor's assessment of the risk of material misstatement at the assertion level includes an expectation of the operating effectiveness of controls, the auditor is required to perform tests of controls. Other things being equal, the greater the reliance the auditor places on the

		operating effectiveness of controls in the risk assessment, the greater is the extent of the auditor's tests of controls (and therefore, the sample size is increased).
2. An increase in the tolerable rate of Deviation	Decrease	The lower the tolerable rate of deviation, the larger the sample needs to be
3. An increase in the expected rate of deviation of the population to be tested	Increase	The higher the expected rate of deviation, the larger the sample size needs to be so that the auditor is in a position to make a reasonable estimate of the actual rate of deviation. Factors relevant to the auditor's consideration of the expected rate of deviation include the auditor's understanding of the business (in particular, risk assessment procedures undertaken to obtain an understanding of internal control), changes in personnel or in internal control, the results of audit procedures applied in prior periods and the results of other audit procedures. High expected control deviation rates ordinarily warrant little, if any, reduction of the assessed risk of material misstatement.

4. An increase in the auditor's desired level of assurance that the tolerable rate of deviation is not exceeded by the actual rate of deviation in the population	Increase	The greater the level of assurance that the auditor desires that the results of the sample are in fact indicative of the actual incidence of deviation in the population, the larger the sample size needs to be.
5. An increase in the number of sampling units in the population	Negligible effect	For large populations, the actual size of the population has little, if any, effect on sample size. For small populations however, audit sampling may not be as efficient as alternative means of obtaining sufficient appropriate audit evidence.

Appendix 3

Examples of Factors Influencing Sample Size for Tests of Details

The following are factors that the auditor may consider when determining the sample size for tests of details. These factors, which need to be considered together, assume the auditor does not modify the approach to tests of controls or otherwise modify the nature or timing of substantive procedures in response to the assessed risks.

FACTOR	**EFFECT ON SAMPLE SIZE**	
1. An increase in the auditor's assessment of the risk of material misstatement	Increase	The higher the auditor's assessment of the risk of material misstatement, the larger the sample size needs to be. The auditor's assessment of the risk of material misstatement is affected by inherent risk and control risk. For example, if the Auditor does not perform tests of controls; the auditor's risk assessment cannot be reduced for the effective operation of internal controls with respect to the particular assertion. Therefore, in order to reduce audit risk to an acceptably low level, the

		auditor needs a low detection risk and will rely more on substantive procedures. The more audit evidence that is obtained from tests of details (that is, the lower the detection risk), the larger the sample size will need to be.
2. An increase in the use of other substantive procedures directed at the same assertion	Decrease	The more the auditor is relying on other substantive procedures (tests of details or substantive analytical procedures) to reduce to an acceptable level the detection risk regarding a particular population, the less assurance the auditor will require from sampling and, therefore, the smaller the sample size can be.
3. An increase in the auditor's desired level of assurance that tolerable misstatement is not exceeded by actual misstatement in the population	Increase	The greater the level of assurance that the auditor requires that the results of the sample are in fact indicative of the actual amount of misstatement in the population, the larger the sample size needs to be.
4. An increase in tolerable misstatement	Decrease	The lower the tolerable misstatement, the larger the sample size needs to be.

5. An increase in the amount of misstatement the auditor expects to find in the population	Increase	The greater the amount of misstatement the auditor expects to find in the population, the larger the sample size needs to be in order to make a reasonable estimate of the actual amount of misstatement in the population. Factors relevant to the auditor's consideration of the expected misstatement amount include the extent, to which item values are determined subjectively, the results of risk assessment procedures, the results of tests of control, the results of audit procedures applied in prior periods, and the results of other substantive procedures.
6. Stratification of the population when appropriate	Decrease	When there is a wide range (variability) in the monetary size of items in the population, it may be useful to stratify the population. When a population can be appropriately stratified, the aggregate of the sample sizes from the strata generally will be less than the sample size that would have been required to attain a given level of sampling risk, had one sample been drawn from the whole population.
7. The number of	Negligible	For large populations, the

sampling units in the population	effect	actual size of the population has little, if any, effect on sample size. Thus, for small populations, audit sampling is often not as efficient as alternative means of obtaining sufficient appropriate audit evidence. (However, when using monetary unit sampling, an increase in the monetary value of the population increases sample size, unless this is offset by a proportional increase in materiality for the financial statements as a whole (and, if applicable, materiality level or levels for particular classes of transactions, account balances or disclosures).

The size of the sample should be determined carefully before one can generalize. It should not be so small that it is not representatives of the population as a whole. On the other hand, it must not be so large that it involves undue cost and time. An optimum sample size is therefore required to be worked out precisely and carefully.

The size of the sample is related directly to the sampling risk which an auditor is prepared to take. Whatever sampling technique an auditor chooses to employ, auditor has to make a judgment about the extent of sampling risk justified in the circumstances of the case.

Appendix 4

Sample Selection Methods

The principal methods of selecting samples are the use of random selection, systematic selection and haphazard selection. Each of these methods is discussed in Appendix 4 of Revised SA 530. This is reproduced below.

Sample Selection Methods

There are many methods of selecting samples. The principal methods are as follows:

(a) Random selection (applied through random number generators, for example, random number tables).

(b) Systematic selection, in which the number of sampling units in the population is divided by the sample size to give a sampling interval, for example 50, and having determined a starting point within the first 50, each 50th sampling unit thereafter is selected. Although the starting point may be determined haphazardly, the sample is more likely to be truly random if it is determined by use of a computerised random number generator or random number tables. When using systematic selection, the auditor would need to determine that sampling units within the population are not structured in such a way that the sampling interval corresponds with a particular pattern in the population.

(c) Monetary Unit Sampling is a type of value-weighted selection (as described in Appendix 1) in which sample size, selection and evaluation results in a conclusion in monetary amounts.

(d) Haphazard selection, in which the auditor selects the sample without following a structured technique. Although no structured technique is used, the auditor would nonetheless avoid any conscious bias or predictability (for

example, avoiding difficult to locate items, or always choosing or avoiding the first or last entries on a page) and thus attempt to ensure that all items in the population have a chance of selection. Haphazard selection is not appropriate when using statistical sampling.

(e) Block selection involves selection of a block(s) of contiguous items from within the population. Block selection cannot ordinarily be used in audit sampling because most populations are structured such that items in a sequence can be expected to have similar characteristics to each other, but different characteristics from items elsewhere in the population. Although in some circumstances it may be an appropriate audit procedure to examine a block of items, it would rarely be an appropriate sample selection technique when the auditor intends to draw valid inferences about the entire population based on the sample.