ISPO-7
PNL-2418

FINAL REPORT

ISPO TASK C.3
INTEGRAL EXERCISE — LOW-ENRICHED
URANIUM FUEL FABRICATION FACILITY

INDEPENDENT VERIFICATION OF A
MATERIAL BALANCE AT A
LEU FUEL FABRICATION PLANT

NOVEMBER 1977

USA

**PROGRAM FOR
TECHNICAL ASSISTANCE
TO IAEA SAFEGUARDS**

IAEA

**Department of Energy
Safeguards & Security**

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PACIFIC NORTHWEST LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
Under Contract EY-76-C-06-1830

Printed in the United States of America
Available from
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22151

Price: Printed Copy \$____*; Microfiche \$3.00

*Pages	NTIS Selling Price
001-025	\$4.50
026-050	\$5.00
051-075	\$5.50
076-100	\$6.00
101-125	\$6.50
126-150	\$7.00
151-175	\$7.75
176-200	\$8.50
201-225	\$8.75
226-250	\$9.00
251-275	\$10.00
276-300	\$10.25

INDEPENDENT VERIFICATION OF A MATERIAL
BALANCE AT A LEU FUEL FABRICATION PLANT

to
International Safeguards Project Office
Program for USA Technical Assistance to
the International Atomic Energy Agency

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ABSTRACT

This report describes the application of methodology for planning an inspection according to the procedures of the International Atomic Energy Agency (IAEA), and an example evaluation of data representative of low-enriched uranium fuel fabrication facilities. Included are the inspection plan test criteria, the inspection sampling plans, the sample data collected during the inspection, acceptance testing of physical inventories with test equipment, material unaccounted for (MUF) evaluation, and quantitative statements of the results and conclusions that could be derived from the inspection. The analysis in this report demonstrates the application of inspection strategies which produce quantitative results. A facility model was used that is representative of large low-enriched uranium fuel fabrication plants with material flows, inventory sizes, and compositions of material representative of operating commercial facilities. The principal objective was to determine and illustrate the degree of assurance against a diversion of special nuclear materials (SNM) that can be achieved by an inspection and the verification of material flows and inventories. This work was performed as part of the USA program for technical assistance to the IAEA.

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INDEPENDENT VERIFICATION OF A MATERIAL BALANCE AT A LEU FUEL FABRICATION PLANT

INTRODUCTION

This report develops a data base for planning an integrated safeguards exercise for the International Atomic Energy Agency (IAEA) at typical operating low-enriched uranium (LEU) fuel fabrication facilities. Specifically, it provides information needed to design an inspection strategy, including the sampling plan for verifying the correctness of the material balance by inspecting for the presence of special nuclear material (SNM).

The overall study is a joint effort by the Technical Support Organization (TSO) at Brookhaven National Laboratories (BNL), and Battelle, Pacific Northwest Laboratories (PNL). A Design Information Questionnaire (DIQ),⁽⁷⁾ which will initiate an inspection was prepared by TSO. This information explains the process, the material flows, and the accounting practices used at the facility to be inspected. The analysis of the inspection data is given in this report. These studies are currently a part of the U.S. program for providing technical assistance to the IAEA on safeguarding nuclear material. The U.S. program is managed by the International Safeguards Project Office (ISPO) at BNL. The overall objective of the program is to help strengthen international safeguards by providing technical assistance to the IAEA.

The inspection approaches and techniques⁽¹⁻⁶⁾ developed for the IAEA have not been evaluated for newer and larger facilities. The implementation of this methodology at such typical facilities is addressed in this report. Thus, this analysis of a larger facility provides a basis for testing the effectiveness of the inspection plan and ultimately provides a basis for its implementation. Studies such as these provide both information for determining the limitations and the difficulties in the application of the techniques and valuable guidance and direction for attaining both near and long-term goals.

The structure needed for evaluating safeguards inspection activities related to materials flow, inventory, and accounting has been developed by research studies in recent years.⁽¹⁻⁶⁾ The following aspects of this structure have been defined:

- inspection activities fall under three levels: capability, performance, and independent assurance
- diversion activities fall under two general classes: biasing and diversion into MUF^(a)
- assurance that material does not leave the system by the examination of the key or primary and secondary measurement points
- statistics that test for material loss under honest accounting ability and an intentionally biased MUF
- statistics that test for operator bias.

In addition, specific inspection sampling plans and statistical techniques for analysis have been developed that provide, when the results are satisfactory, an overall assurance at a specified probability level that a loss of a substantiation goal quantity of material has not occurred. Sampling design and statistical analysis techniques⁽¹⁾ have been illustrated using a small-scale fuel element fabrication facility. Specific subjects described in this report are:

1. structure of the inspection strategies,
2. development of the sampling plans,
3. testing of statistical techniques, and
4. providing assurance statements

using operating data obtained from the DIQ for a large production facility. The ultimate goal is to develop a basis for future improvements in the effectiveness of IAEA inspection strategies.

a. See the glossary for the definitions of terms and abbreviations used in this report.

SUMMARY

The objectives and principles of IAEA inspection activities, outlined in the IAEA's Safeguards Technical Manuals (STM) have been applied to material accounting data typical for LEU fuel fabrication facilities. This report describes the development of the inspection plan for attributes and variables testing based on IAEA goals and objectives, and then demonstrates the practical feasibility of implementing various phases of the plan.

The inspection strategy could be designed to look at just the inventory items or it could look at inventory plus shipments to and from the facility. The latter is more complete and therefore more desirable, but logistics sometimes prohibit inspection on the required fraction of the receipts and shipments.

If the inspector only considers inventory items, the inspection plan is based on the inventories of new, ending, and static materials. Static inventory is that material carried over from the previous inventory as sealed items. For the complete inspection it is assumed that the previous inspection included the beginning inventory and the current inspection just considers shipments to and from the facility and new ending inventory items. A tag inventory and seal check would be performed on the static inventory. This approach is employed in this report and the inspection of the inventory terms for these two cases will be considered in detail.

Table 1 shows the number of items subject to inspection based on the data provided in the DIQ for this analysis. Table 2 summarizes the results for the inspection of only inventory terms and Table 3 summarizes the results for inspecting the entire material balance. The entire material balance includes new ending inventory, shipments to, and shipments from the facility during the last six months. In both Table 2 and Table 3 the technical feasibility was evaluated.

The order of items presented in Table 2 and Table 3 is based on a hierarchy of inspection activities. In the Inspection Requirement column, a range of numbers of items which must be evaluated is given. The lowest value corresponds to a 50% probability of detecting the absence of 10,000 kg of uranium from the facility. The highest value corresponds to a 95% probability of detecting the

TABLE 1. Typical Number of Items in an Inventory Category During a Recent Inventory Period

<u>Inventory Category</u>	<u>Number of Items</u>
New Ending Inventory	74,304
Static Inventory	43,255
Process Holdup	99
Additions to Facility	1,216
Removals from Facility	125,949 ^(a)
MUF	201,568 ^(b)

-
- a. Assures rods are removable from assemblies for inspection.
b. Total of items contributing to MUF does not include static inventory.

absence of 1000 kg of uranium. In this report the analysis is presented for goal quantities ranging from 300 to 10,000 kg for detection probabilities ranging from 50 to 95%. If the broader range of goal quantities had been used in Table 2, the corresponding span of detection probabilities would have increased by a factor of about four. The number of inspections increases as the goal quantity is reduced and increases as the detection probability increases.

The number of items on inventory at the facility is very large. This is caused by the inclusion of individual rods as discrete items rather than as assemblies. Approximately 50,000 of the 74,000 items indicated as new inventory in Table 1 are rods present in assemblies. These 50,000 rods represent approximately 800 assemblies. If there is concern about concealment of diversion by using dummy rods, then rods should be inspected. However, if the diversion strategy is assemblies, then assemblies should be inspected. The effect on the number of items to be inspected is essentially unchanged for goal quantities above 1000 kg. If the attributes inspection plan specified that 150 rods in assemblies should be inspected, the alternative plan would call for inspecting approximately 150 assemblies.

TABLE 2. Technical Feasibility of Carrying Out Specific Components of an Integrated Inspection Plan for the Entire Inventory (new and static items)

Inspection Activity	Inspection Technique	Inspection Requirement						Technical Feasibility
		Goal Quantity 1000 kg; Detection Probability 95%			Goal Quantity 10,000 kg; Detection Probability 50%			
		Number of Items	Man-days	Cost \$	Number of Items	Man-days	Cost \$	
Records accuracy	Verify agreement between inventory records and source data	400	<1	--	17	<1	--	yes
Static inventory		1096	15	--	49	1	--	yes
New inventory		2	<1	--	1	<1	--	yes
Process holdup								
Item check	Verify existence of items listed on records and vice versa	400	<1	--	17	<1	--	yes
Static inventory		1096	<1	--	49	<1	--	yes
New inventory		2	<1	--	1	<1	--	yes
Process holdup								
Weight check	Weigh selected items							Special scales required to weigh assemblies, would have to use facility scales
Static inventory		400	2	--	17	<1	--	
New inventory		1096	6	--	49	<1	--	
NDA check	NDA selected items							Special equipment needed to NDA rods, assemblies, UF ₆ feed cylinders, holdup. Need representative standards
Static inventory	NDA selected equipment	400	5	1600	17	<1	70	
New inventory		1096	15	4400	49	1	200	
Process holdup		2	<1	10	1	<1	--	
Destructive analysis	Weigh, sample, analyze selected items	45	<1	9000	45	<1	9000	Since destructive analysis of assemblies is not permitted, reliance must be placed on retention samples and records. Technically feasible for most other systems
Static inventory		360	3	72,000	360	3	72,000	
New inventory	Sample, analyze holdup	14	<1	2800	14	<1	2800	
Process holdup								

a. An item check does not protect against understating or overstating the number of items in an inventory stratum.

TABLE 3. Technical Feasibility of Carrying Out Specific Components of an Integrated Inspection Plan for Additions, Removals and New Ending Inventory for a Six-Month Verification Period

Inspection Activity	Inspection Technique	Inspection Requirement						Technical Feasibility
		Good Quantity 1,000 kg; Detection Probability 95%			Good Quantity 10,000 kg; Detection Probability 50%			
		Number of Items	Inspection Time	Cost	Number of Items	Inspection Time	Cost	
Records accuracy	Verify agreement between inventory records and source data.	1096	12 days		49	<1 day		By tracing data through records, can verify correct values used for inventory statements, additions and removal calculations. MUF check is possible using facility records.
New inventory		201	13 visits		20	<1 day		
Additions		1596	26 visits		37	<1 day		
Removals		2	<1 day		1	<1 day		
Process holdup		small			small	<1 day		
MUF								
Item check (a)	Verify existence of items listed on records or vice versa	1096	<1 day		49	<1 day		New inventory - yes; for balance, must rely on shipping documents. Only 1 UF ₆ cylinder in ending inventory and only 10% of assemblies are present. Process holdup item can be verified.
New inventory		201	13 visits		20	<1 day		
Additions		1596	26 visits		37	<1 day		
Removals		2	<1 day		1	<1 day		
Process holdup								
Weight check	Weight selected items	1096	6 days		49	<1 day		Special scales required. Most removals for process not present in inventory, most additions to next period not present in inventory.
New inventory		201	13 visits		20	<1 day		
Additions		1596	26 visits		37	<1 day		
Removals								
NDA check	NDA selected items	1096	15 days	4,400	49	<1 day	200	Specialized equipment needed to NDA UF ₆ cylinders, rods, holdup not available; need representative standards.
New inventory	NDA selected equipment	201	13 visits	800	20	<1 day	100	
Additions		1596	26 visits	6,400	37	<1 day	150	
Removals		2	<1 day	10	1	<1 day	--	
Process holdup								
Destructive analysis	Weigh, sample, and analyze selected items. Sample, analyze holdup	320	7 days	64,000	320	7 days	64,000	Specialized sampling equipment is required for UF ₆ cylinders. Since destructive analysis of assemblies not permitted, reliance must be placed on retention samples. Technically feasible for most other systems.
New inventory		39	<12 visits	7,800	23	<12 visits	4,600	
Additions		210	26 visits	42,000	210	26 visits	42,000	
Removals		13	<1 day	2,600	13	<1 day	2,600	
Process holdup								

a. An item check does not protect against understating or overstating the number of items in an inventory stratum.

The column titled Technical Feasibility states whether the inspection activity is possible at the present time. In several cases, special pieces of equipment would be required before the activity could be included in the inspection plan.

In Table 2 no credit is taken for the presence of IAEA seals on static inventory items when inspecting the entire inventory. For static inventory strata, a reduced inspection plan giving credit for these seals could be used. Table 2 also separates the item check, the weight check, and the nondestructive analysis (NDA) check into separate activities; they could be done simultaneously. Where the NDA check is performed, the weight check need not be performed since the NDA check is more inclusive. The NDA check could also supplant the item check requirement. Since the item check is a dual check of accuracy and completeness of the records, substitution of the NDA check is not proposed. One possible inspection strategy is to perform a 100% item check. This strategy would easily uncover a diversion due to an inaccurate records system.

The results shown in Table 3 are for a companion case where both additions and removals from the plant are added to the inspection plan. Static inventory is excluded. This inspection plan enables the inspector to investigate all the terms in the material balance. The most notable difference between the two plans is the requirement for the inspector to be present whenever a shipment takes place; his presence is required because sources of supply and receivers of finished assemblies and scrap are not part of the inspection effort.

The evaluation of Technical Feasibility of various Inspection Techniques in Tables 2 and 3 shows that the inspector presently does not have NDA instruments or standards to do the attributes testing. Since destructive analysis techniques (weighing, sampling, and chemical analysis) can be used to detect all classes of falsification and also evaluate the measurement program, reliance on destructive analysis techniques would be suggested for the near term.

A comparison of the Technical Feasibility columns in Tables 2 and 3 shows that it is presently more technically feasible to inspect inventory strata. The inability of the inspector to verify shipments and receipts makes the material balance inspection plan shown in Table 3 less feasible. When the sample sizes and detection probabilities for the two inspection strategies are compared the

results appear similar. This is really a fallacy. If receipts or removals are not inspected, as is the case when just inventory is inspected, the probability of detecting a falsification in such strata is zero. Thus when the probability of detecting a falsification in inventory strata is high, conclusions relative to the entire facility cannot be made. The ultimate goal of the inspection plan should be to include all components of the facility's material balance as shown in Table 3.

THE INSPECTION VERIFICATION METHODOLOGY

The International Atomic Energy Agency (IAEA) conducts safeguard inspections aimed at meeting the provisions of agreements concluded under the terms of INFCIRC-66 and INFCIRC-153.⁽⁸⁾ These agreements are developed for both specific facilities and states. These IAEA inspections are thus the cornerstone of the international system of safeguards which implements the verification effort. The Safeguards Technical Manual (STM)⁽⁹⁾ delineates the objectives, criteria, requirements, and procedures for the inspection and verification effort.

Part A of the STM describes the structure of the inspection and verification activities. Specific inspection details are a function of the state agreements and also "the category and quantity of material, the combination of the other measures available to the state, and the manner in which accounting and control responsibilities are distributed among the organizations concerned." Based on these criteria, it is difficult to develop a plan which could apply to a generic class of facilities. The approach incorporated in this report was to develop alternate inspection plans which provide varying degrees of assurance. The IAEA is then able to derive the desired degree of assurance based on such factors as resources, state agreements, personnel, and other factors relevant to a particular inspection.

FACILITY DESIGN AND OPERATING INFORMATION REQUIRED

The development of an inspection plan depends on the collection and verification of a large quantity of facility design and operating information and data. Included in this data are detailed descriptions of the facility, the process, the details of the material accounting system, and the results of any prior state and agency inspections.

The flowsheets, flow rates, quantities of material on inventory, equipment, measurement points, measurement methods, sampling plans, operating procedures, and other process knowledge that form this data base were obtained from the Design Information Questionnaire (DIQ)⁽⁷⁾ prepared by TSO. The information contained in the DIQ is as follows:

- the identification of the facility by stating its purpose, nominal capacity, geographic location, and the name and address to be used for routine business purposes
- a description of the general arrangement of the facility including, to the extent feasible, the form, location, and flow of nuclear material and the general layout of important items of equipment which use, produce, or process nuclear material
- a description of features of the facility relating to material accountability containment, and surveillance
- a description of the existing and proposed procedures at the facility for nuclear material accountancy and control, with special reference to material balance areas established by the licensee, procedures for measurements of flow, and procedures for taking physical inventory.

Initially the data is accepted as being an accurate representation of facility operations. The inspection plan is developed from the data obtained. Then, based on the inspection results, the IAEA is in a position to independently judge the adequacy and correctness of the facility data. Through such an iterative process the IAEA develops confidence in the data base. The desired degree of assurance for a facility is attained from the inspection, and the quality and robustness of assurance about later verifications thus strongly depend upon the data contained in the DIQ.

DESIGNING THE INSPECTOR'S SAMPLING PLAN

Since it is not practical to duplicate the material accounting procedures and measurements of the facility, the inspection plan consists of stratifying the flow and inventory items and then applying a sampling procedure that allows the inspector to test the validity of the licensees' accounts and to detect a specified discrepancy of SNM. With regard to the operator's stated MUF, the inspector desires to know:

1. Does the operator's MUF exceed the limit of error of MUF (LEMUF)?
2. If the operator's MUF is below LEMUF, is there any indication that the MUF has been understated?

3. If the MUF has been understated, how can an unbiased MUF be formed using the operator's and inspector's data, and how can this bias-adjusted MUF be assessed?
4. In addition, the inspector desires to know if and where biases exist.

The inspection procedures are designed to protect against many classes of concealment. Some of the ways in which concealment may be attempted are:

- concealment by falsification
- removal of an item or whole container
- removal of the contents of a container or removal of an item and replacement by a dummy
- removal of part of the contents of one or more containers with replacement by other material
- removal of material in amounts below the detection limits of the available NDA methods.

An important part of the inspection is to detect falsification for the purpose of concealment. For example, the records and reports may be falsified for the purposes of:

- understating or overstating the number of items in an inventory stratum
- introducing gross defects, partial defects, and/or bias
- diversion into MUF.

The sample plan in this report does not protect against the first and third items; understating or overstating the number of items in an inventory stratum or diversion into MUF. Only a 100% item-count and identification (tag inventory) will provide the necessary protection.

To combat the various strategies that the diverter might use for removing material, the inspector employs two types of measurement methods. The first is a simple go/no-go measurement to check individual items or groups of items for medium-sized to gross discrepancies. This type of test will be called an attributes test for gross defects. Such tests include visual and weight checks. A highly automated NDA system could also be designed to perform as a go/no-go measurement. The second method is used to detect the removal of part of the

contents of one or more containers followed by replacement by inert material. It is assumed that the quantity removed cannot be detected by any simple go/no-go test available to the inspector. In this case, weighing and sampling, followed by destructive analysis of the sample is frequently the only measurement technique which meets the inspector's requirement. This type of test will be called a variables test. An important function of the variables test is to detect bias in measurement methods. A summary of the diversion strategies and inspection plans is shown in Table 4.

Because of the very large number of items in the inventory of a manufacturing and/or processing facility, it is practicable for an inspector to sample only a small percentage of the items. If the sample plan is properly designed, it can be inferred by statistical techniques from the results of sample measurements and tests whether the material balance calculated for the whole facility is correct within some specified limits. If defects are found in a sample set, additional testing is expected to be required. An occasional defective sample

TABLE 4. Adversary and Inspectorate Strategies

Adversary Strategy ^(a)		Inspectorate Strategy	
Item ^(c)	Container	Technique	Frequency
1. Removal	No replacement	Item check	100%
2. Removal	Replace with empty	Weight check Attributes test	Attributes plan
3. Removal	Replace with dummy (inert material)	Attributes test	Attributes plan
4. Partial removal ($<30\%$)	Replace with inert material	Variables instru- ment	Attributes plan
5. Shaving item. Both all and some ($< 30\%$)	No replacement	Weight check	Attributes plan
6. Shaving item. Both all and some ($<30\%$)	Replace with inert material	Chemical analysis ^(b)	Variables plan

a. Listed in order of increasing sophistication of diverter and inspector strategies.

b. Lacking in NDA instruments, except for relative change (require absolute standards).

c. Removal may include either falsifying the records to conceal the absence of material or the fact that material is absent.

does not necessarily imply diversion because defects can occur from random error in measurements. The significance of a defect that is not a gross defect becomes an administrative problem that will have to be evaluated based on information specific to each defect.

The first step in preparing an inspection plan to detect the above forms of diversion is to stratify the flow and inventory components of the material balance. The criteria which should be applied to stratify the material balance components and the actual inspection plans for the strata are developed in the following sections.

Stratification of Inventories for Inspection Sampling

A listing of a licensee's inventory of record ("book" inventory) will normally be by groups that are logical from the standpoint of taking a physical inventory. The groups may be by material location, such as a material balance area (MBA) or inventory control area (ICA), and subgrouped by type of material. Such a listing will be useful to inspectors for making item checks, i.e., verifying that all items on the book inventory are present and that the book inventory is complete. However, a stratification of the inventory is needed to prepare a sampling plan for an inventory verification. Inventory listings are typically long and may be grouped in ways that add complexity to the sampling plan. They will be available for both inventory reporting periods and material balance accounting periods. Often the inventory is stratified by a contract number. Grouping by MBA/ICA is not useful because the same kinds of material will often reside in two or more MBAs and ICAs. The licensee's material type code may be a suitable basis for stratification, but considerable economy in sampling can be achieved by reducing the number of sampling strata as much as possible. Often, licensees' material type codes differentiate materials by such parameters as process variations, material quality or purity, additives, physical form, and even job or contract. Some of the parameters may not significantly affect SNM accounting measurement capabilities and, therefore, some material types can be combined into one sampling stratum.

Stratification Criteria

The specific stratification requirements for designing and applying the IAEA program for an independent verification of license material accounting

data may be summarized by saying that variables sampling plans require stratification by the standard deviation of measurement and the attributes sampling plans require stratification by the amount of material per item. This is discussed in greater detail in the following sections.

Gross Defects Inspection

The items in a stratum should have about the same amounts of material per item for the element or element isotope of interest in order to design the gross defects and partial defects sampling plans. A conservative way of planning the experiment when the item amounts are not all the same is to assume that the largest values in the stratum are typical of the strata. Since this assumption implies fewer defects to attain a goal quantity of the size M , more samples are then required in order to be $100(1 - \beta)\%$ sure of detecting at least one gross defect in the sample. Another possibility, if the range of the quantity of material is large, is to reconstitute the overall strata into a number of substrata where amount values of relatively the same size are found within one substratum. Within a particular substratum the percentage of items to be randomly sampled is $100(1 - \beta^{1/z})\%$ where z is the largest integer in M/x and x is the largest amount value in the substratum. The process of making substrata in this manner will require fewer samples than assuming all items to be at the maximum size for the overall class and will assure an adequate probability of detecting at least one defect.

Partial Defects

Similar considerations pertain to the partial defects (or crossover) sampling situation, i.e., assuming that the maximum partial amount is taken per item implies a smaller number of defects. This in turn requires a larger size for the random sample to be able to detect at least one partial defect with the desired probability.

It is natural to classify according to material type even when the variable controlled is the amount of some ingredient, such as ^{235}U . The material type makes no difference to these sampling plans if

- for the variables test, the absolute standard deviations are the same
- for the defects sampling, the total ^{235}U amounts are the same.

The preceding ideas are explained in the following examples. These considerations apply when inspection is for a variable not normally considered in classifying materials.

Variables Inspection

The items in a stratum should all have the same random error measurement standard deviation. For planning a verification by variables inspection and evaluation, either the standard deviation or the relative standard deviation is of constant magnitude. Generally the stratification is based on relative standard deviations, as in the analysis in this report. This is needed for planning, data analysis, and the making of assurance statements. If the magnitudes of the amounts per item have a small range, it is not important which standard deviation criterion is used. Otherwise, the decision should be based on whether the measurement standard deviation or the relative standard deviation is constant for the different items in the stratum.

Variables Testing

Consider that the ^{235}U amounts are being verified. If there are N_i and N_j items in classes i and j , and if the estimates of ^{235}U in the classes have the same percent standard deviations, the sample sizes in the classes should be proportional to the product of the number of items and the random error measurement standard deviation, thus

$$n_i \propto N_i \sigma \text{ and } n_j \propto N_j \sigma$$

so that,

$$n_i + n_j \propto (N_i + N_j) \sigma$$

and for the variables sampling purposes the strata may be combined or treated separately. This may make no difference to the inspector but the ability to separate the classes may make it easier for the licensee.

Attributes Testing

Suppose there are two classes of material that are dissimilar except for the amount of ^{235}U per item, and this is the SNM to be verified. Then in the i th class the number needed is

$$n_i = N_i (1 - \beta^{1/u})$$

where $u = [M/x]$ and x is the amount of ^{235}U per item. In class j the number needed is

$$n_j = N_j (1 - \beta^{1/u})$$

since the amount of ^{235}U per item is the same as in class i . Then the total number required is the same as if the two classes were combined, i.e.,

$$n = n_i + n_j = (N_i + N_j)(1 - \beta^{1/u}).$$

This implies that if control is based on an amount, different kinds of items having equal amounts of material per item may be combined into a stratum. These results on variables and attributes sampling indicate that some flexibility is possible in defining strata as long as certain underlying criteria are met.

As a simple but extreme example in the attributes case, suppose that the overall population contains 100 items with tag value amounts $S = 1, 2, \dots, 100$. Let $\beta = 0.10$, $M = 200$. Then the most conservative approach is to test $100 (1 - \beta^{1/z}) = 68$ items, where $z = 200/100$. If there are two substrata $S_1 = 1, 2, \dots, 50; S_2 = 51, 52, \dots, 100$, then randomly sample $50 (1 - 0.10^{1/(200/50)}) = 22$ from S_1 and $50 (1 - 0.10^{1/(200/100)}) = 34$ from S_2 for a total of 56 items. For three substrata one has

$$34 (1 - 0.10^{1/7}) + 33 (1 - 0.10^{1/3}) + 33 (1 - 0.10^{1/2}) = 10 + 18 + 23 = 51 \text{ items.}$$

By selecting more substrata in the sampling plan the number of samples required can be reduced.

Attributes Sampling for Gross Defects

A gross defect has occurred when enough material has been removed to allow detection by an attributes test. The falsification of SNM may have been

concealed by replacement with degraded or inert material. The detection of the removal depends upon the probability that the defective item will be in the sample and not upon the probability of detection once the item is in the sample. Let M denote a substantial goal quantity and $\bar{X}$ the average amount per item in a relatively homogeneous stratum. Then it takes $M/\bar{X}$ items to accrue to the goal quantity. Let $z = [M/\bar{X}]$ items where the symbol $[]$ denotes that z is the largest integer less than $[M/\bar{X}]$ but always 1 or greater. It is shown⁽¹⁾ that a random sample of size

$$n_a = N(1 - \beta^{1/z})$$

will provide a $100(1 - \beta)\%$ assurance or higher of containing one or more defective items in the sample. When this plan is used, one gross defect calls for rejection of the population and for investigation into the possible cause. As an example, let

$M = 5$ kg of SNM, the goal quantity

$\bar{X} = 1$ kg of SNM/container or item

$z = 5$

$\beta = 0.05$, the nondetection probability

$N = 100$ items or containers of SNM

Then $n = 100(1 - 0.05^{1/5}) = 45$ samples. This means that if 45 containers out of a total of 100 were checked, there is a 95% (or better) chance of detecting at least one defective container among the 45 tested when the number of defectives (empties) in the stratum of 100 is 5.

Partial Defects Sample Sizes - Variables Measurements

A second set of samples is needed to combat a strategy of falsifying part of the contents (a range of 5% to 50%) of a container rather than the entire contents. A measurement called a variables measurement will be used that can identify partial falsifications.

For example, assume a variables measurement method is used which is more precise than the attributes method, and which will detect the removal of the amount $\gamma\bar{X}$ ($\gamma < 1$) with essentially 100% assurance. First, select the largest partial defect (crossover point) where the testing device will not detect the

removal with 100% assurance. If M is obtained by accruing amounts $\gamma\bar{X}$, it will take $M/\gamma\bar{X}$ such amounts to accrue a goal quantity. The number of samples required here is

$$n_{v_1} = N(1 - \beta^{1/u}),$$

where u is the greatest integer in $M/\gamma\bar{X}$. This gives a $100(1 - \beta)\%$ assurance or higher of including at least one intermediate (crossover) partial defect in the random sample. As in the gross defect case, one defect (depending on significance) may be enough to reject the population and to require investigation. Measurements by the variables instrument will, of course, also detect gross defects. The crossover point should be sufficiently high to require enough samples and to avoid cases due simply to measurement errors.

The following results can also be shown:⁽¹⁾

1. If amounts between $\gamma\bar{X}$ and $\bar{X}$ are used to accrue to M , more item removals will be required than if the amounts $\bar{X}$ are taken and, as a result, the sampling probabilities will exceed the $100(1 - \beta)\%$ probability required.
2. If M is partitioned among gross and partial defects such that the total accrues to M , the probability is $100(1 - \beta)\%$ or higher of detecting at least one of these two types of defects.
3. If $n'_a = n_a - n_{v_1}$ attributes samples are taken, the probability of detection is about $100(1 - \beta)\%$ if the M is partitioned among gross and partial defects.

An example of the calculation of a crossover sample size follows: using the data in the example given previously for detecting gross defects, let $\gamma = 0.2$, i.e., the operator can remove up to 20% of the SNM in a container without detection under the assumed test procedure. Then,

$$n = 100(1 - 0.05^{[1.0/(5/0.2)]}) = 11.3 \text{ samples.}$$

The number of samples is less than in the previous case because the diverter now removes only 0.2 kg from each container ($5/0.2 = 25$ containers versus 5 before). Therefore inspecting 11 containers allows a 95% probability of detecting one defective container from a group of 100 containers that includes

25 that are defective (only 80% full). These partial defects measurements therefore protect against concealment by removal of part of one or more containers.

The Overall MUF Bias Test - Sample Sizes Required

There are also other possibilities for a diverter to take amounts in the 0 to $\gamma\bar{X}$ range and/or to bias results by amounts in this range in order to disguise diversion elsewhere by overstating amounts here. An inspection for these kinds of defects is performed with a bias test.^(1,2) A bias of size M over the whole material balance can be detected in the presence of systematic error with the use of a term called the D statistic ($\hat{D}$). The $\hat{D}$ is an estimate of the inspector MUF bias minus the operator MUF bias. The inspector component of $\hat{D}$ is usually based on a random, fractional sample of all possible item amount measurements in the MUF. The result is extrapolated to include all items. The creation of this statistic is possible since $\hat{D}$ is based on the amount differences of individual items. The process variation in item amounts is thus eliminated.

First it is determined whether $1 - \beta$, the desired power (probability) of detecting a bias of the amount M, a substantiation goal quantity, can be attained without making the random error standard deviation of $\hat{D}$ under the alternative hypothesis, $\sigma_{\hat{D}_r|H_1}$, less than $1/2 \sigma_{\hat{D}_s}$ where $\sigma_{\hat{D}_s}^2$ is the $\hat{D}$ variance component due to systematic errors. For the case where $\alpha = \beta = 0.05$, $M/\sigma_{\hat{D}_s} > 3.53$,⁽¹⁾ the equation

$$\frac{M}{1.645} = \sqrt{\sigma_{\hat{D}_s}^2 + \sigma_{\hat{D}_r|H_1}^2} + \sqrt{\frac{\sigma_{\hat{D}_s}^2 + \sigma_{\hat{D}_r|H_1}^2}{4}}$$

is solved for $\sigma_{\hat{D}_r|H_1}^2$ where $\sigma_{\hat{D}_r|H_1}^2$ will be larger than $\sigma_{\hat{D}_s}^2/4$. If $M/\sigma_{\hat{D}_s} > 3.53$; $\sigma_{\hat{D}_r|H_1}^2$ is set equal to $\sigma_{\hat{D}_s}^2/4$. Then n, the total number of measurements is determined from

$$n = \frac{4 \left(\sum N_i \sigma_{dr_i} \right)^2}{\sigma_{\hat{D}_r|H_1}^2}$$

and apportioned according to the formula

$$n_{v_i} = n \left(\frac{N_i \sigma_{dr_i}}{\sum N_i \sigma_{dr_i}} \right),$$

where F is the error variance inflation factor that may be introduced by the operation and which is guarded against. See Reference 1, pp. 82-92 for a thoroughly explained example of this procedure.

The value of n_{v_i} calculated above is called $n_{v_{2_i}}$. These samples are sometimes allocated in a slightly different proportion by incorporating terms for effort or costs.⁽¹¹⁾

The diverter may also be able to inflate the standard deviation (decrease the stated measurement precision) to enhance the possibility for diversion. This can be checked by outlier tests or χ^2 tests.⁽¹⁾

The number of variables measurements to be taken in the i th stratum is the maximum of $n_{v_{1_i}}$ and $n_{v_{2_i}}$ where these variables sample numbers originated from measurements to detect partial removals and measurements to detect bias, respectively.

Alternative Approaches

If the facility is flow-dominated, many of the items in MUF may not be readily available for population sampling and measurement. In that case, the inspector may audit the records of the receiver of the facility's material for the data used in the estimate of $\hat{D}$ and MUF. This technique may not be very useful to the IAEA if the independence of shipper-receiver measurements cannot be demonstrated.

The statistics may prove useful even when the items for population sampling and measurement are no longer available. The isotopic correlation⁽¹²⁾ techniques may be used to form part of an independent MUF statistic in a separations facility but their application is limited in a LEU fabrication plant.

It is possible that the substantiation goal quantity requires more sampling and measurement to achieve the desired Type I and II error levels than is possible. Some ways to reduce the number of samples are:

- The substantiation goal quantity can be increased. This reduces the power of the test.
- The critical value for acceptance can be increased. This increases the frequency of Type I errors when no diversion has occurred.
- Larger β values may be used. The effect is pretty much tantamount to increasing the substantiation goal quantity.
- A hierarchy of diversion possibilities can be structured and the power of the test graded accordingly. The most likely possibilities are then matched by specific detection activities and tests of lower power used for more unlikely diversion strategies. The lessened effort in the least credible diversion areas are based on the judgment that these diversion activities require more access time and greater technical, removal, and camouflage capabilities than a diverter would attempt.

DESCRIPTION OF THE UO_2 FUEL FABRICATION FACILITY

The facility as described in the DIQ⁽⁷⁾ manufactures low-enriched uranium (LEU) fuel cores for light water reactors. Material accounting data for a six-month interval were provided in the DIQ for use in this analysis and are summarized in Table 5. A simplified flowsheet for the process is shown in Figure 1. All of the processes shown in the figure make up one material balance area (MBA). A more detailed diagram of the key manufacturing steps is shown in Figure 2.

Both fuel-grade UO_2 and UF_6 are received as major process feeds. UO_2 powder is received in 2-1/2 gal metal containers or fiber packs, each holding about 15 kg of UO_2 powder. The UF_6 is received in cylinders containing about 1500 kg of uranium with a specified ^{235}U enrichment. Uranium in the form of uranyl nitrate (UNH) is also received as feed to the scrap recovery process. The completed fuel rods, each containing about 3.3 kg of UO_2 pellets, are assembled into fuel bundles (elements) before shipment to customers. At any particular time, the inventory of product quality material will exist in the form of finished UO_2 pellets, rods, and fuel bundles in addition to some UO_2 powder. UO_2 pellets, both green and sintered, are stored on trays containing about 15 kg of pellets each. The total number of loaded trays in the plant can approach 15,000.

Intermediate high-grade material in process and on inventory consists of batches of broken pellets, lowly contaminated UO_2 powder, ammonium diuranate, various sludges, and incinerator ash. These materials are generally stored in five-gallon buckets with uranium content varying downward from about 31 kg depending on the net weight and uranium percentage of the compound. An inventory will usually contain approximately 5000 to 8000 buckets of such material.

This facility has a material recycle system for high-grade, moderately contaminated discrepant materials. The recycle process operates daily and may contain up to a maximum of approximately 1000 kg of uranium. The process consists of the following steps:

- dissolution in acid
- centrifugation to remove particulate matter
- precipitation of uranium as UO_4 with hydrogen peroxide

FIGURE 1. Process Flow Schematic

TABLE 5. Typical Six-Month Material Balance

Stratum	kg U	Number of Items (a)	% TP (b)
<u>Beginning Inventory</u>	647,203.4	120,165	196.2
<u>Additions to Plant</u>	260,832.3	1,216	79.1
Full UF ₆ cylinders	246,992.1	170	74.9
Fuel rods	621.5	194	0.2
UNH products	12,710.4	488	3.9
Samples	15.1	257	~0.0
Other	493.2	107	0.1
<u>Removals from Plant</u>	537,752.1	125,949	163.0
UF ₆ cylinder heels	519.9	224	0.2
Vendor UO ₂	194,128.1	9,609	5.9
Fuel rods	19.8	11	~0.0
Assemblies	329,902.8	111,970	100.0
Scrap for shipment	9,789.0	990	3.0
Samples	9.7	149	~0.0
Liquid discards	2,155.9	363	0.6
Solid discards	1,226.9	2,633	0.4
<u>Ending Inventory</u>	372,505.9	74,403	112.9
<u>Static Inventory</u>	134,318.5	43,255	40.7
<u>Inventory MUF</u>			

$$\text{MUF} = \text{BI} + \text{A} - \text{R} - \text{EI} = -2222.3 \text{ kg U}$$

- a. For assemblies (in Beginning and Ending Inventories and Removals from Plant), item counts of the individual fuel rods are given. The actual number of items will depend on the number of fuel rods assembled into fuel bundles.
- b. Percent of throughput based on shipments of Assemblies (329,903 kg of uranium). See Section E of the appendix for a detailed listing of the uranium in each strata.

UF₆ TO UO₂ CONVERSION PROCESS

(Ammonium Diuranate Process)

PELLET PRODUCTION

* SCRAP RECOVERY AND MEASURED DISCARDS AT A NUMBER OF POINTS IN THE PELLET PRODUCTION

FUEL ELEMENT FABRICATION

FIGURE 2. Low Enriched Uranium Fuel Processing Steps

- centrifugation to collect UO_4
- reduction of UO_4 to UO_2

Lower concentration and/or highly contaminated materials are held and processed through recycle processes (solvent extraction, fluorination) at other sites. Shipments are made approximately quarterly and the quantities are generally less than 2% of throughput.

APPLICATION OF INSPECTION CONCEPTS TO A URANIUM FABRICATION PLANT

Inspection plans are designed to detect diversions of a goal quantity, M , kilograms of special nuclear material with a selected high degree of confidence. Development of the sampling plan will be based not only on the facility's inventory scheduling, but also on the selection of a goal quantity of material. The goal quantity of material can be chosen to be of any size, but the impact of this quantity on the inspection requirements will be determined by and related to the quality of the measurements and the statistical parameters described earlier.

ESTIMATION OF THE OPERATOR'S MUF AND LEMUF

Material balance accounting is done to assure that adequate control of SNM has been accomplished over some time frame. It involves either the item accounting of material or the measurement of material in inventory as receipts or as removals from a defined area or process. Algebraically, the Material Unaccounted For (MUF) can be expressed as

$$MUF = I_{n-1} + A_n - R_n - I_n,$$

where

- I_{n-1} is the measured ending inventory for the $(n-1)$ th accounting period
- A_n is the sum of all additions (feeds) made during the n th period
- R_n is the sum of all removals made during the n th period
- I_n is the measured ending inventory for the n th accounting period.

Each term in the preceding equation has an associated measurement uncertainty. The total uncertainty in MUF formulated as a standard deviation (σ_{MUF}) is a measure of whether the difference in MUF (from zero) is statistically significant. The value of σ_{MUF} is calculated by adding the systematic and random error components of all feed, removal, and inventory terms. Unchanged material present on both the beginning and ending inventories and which is not remeasured does not contribute to σ_{MUF} .

The measurement errors used in the calculations are based on typical data based on industry capability. The summary of these data are shown in

Appendix Section C. The discussion at the beginning of Section C explains how the data was reduced to form the strata described in the tables of the Section. Based on these data the MUF and LEMUF calculations are shown in Table 6. A LEMUF estimate may differ slightly from that reported by a facility because of the effects of the stratification on the measurement error assignments. In the calculation shown here, if two strata of similar materials had different systematic error estimates the larger was used for each stratum.

Based upon the total feed for the period, the relative standard deviation of MUF was found to be 0.269%. Based upon the sum of feed and the beginning inventory, the relative standard deviation was 0.077%. The fact that MUF exceeded LEMUF for this case is considered atypical.

SELECTION OF AN ATTAINABLE VERIFICATION GOAL QUANTITY

Before a sampling plan can be prepared, a detection goal must be selected. The goal quantity is the quantity of material loss that should be detected within some stated probability limits. Several criteria can be used to select the goal quantity. For enriched uranium or plutonium, the goal quantity is often set in relation to the amount of material needed for a crude nuclear explosive. The approach chosen herein is to set a verification goal quantity based on the limits of the inspector's ability to estimate material quantities. By the latter approach, an attainable goal quantity can be written as follows:

$$M = \sqrt{2} \left(Z_{1-\alpha} + Z_{1-\beta} \right) \sigma_{MUF}$$

In this equation, M is the estimated goal quantity, σ_{MUF} is the facilities standard deviation of the material balance, and $Z_{1-\alpha}$ and $Z_{1-\beta}$ are the 100(1- α) and 100(1- β) percentile points in the normal distribution with zero mean and unit variance. For $\alpha = \beta = 0.05$, $Z_{1-\alpha}$ and $Z_{1-\beta} = 1.645$, the equation becomes

$$M = 4.653 \sigma_{MUF}$$

which for this study amounts to

$$M = (4.653) (703.02) = 3271 \text{ kg of uranium,}$$

where both the beginning and ending inventory measurement errors are included in σ_{MUF} .

TABLE 6. Summary of MUF and LEMUF Calculations for Six-Month Material Balance Period

Material Balance			Operator Error Variance		
Category	Weight	Number of Items	Random	Systematic	TOTAL
Additions to Plant	260832.264	1216	833.1349	12.7365	845.8714
Removals from Plant	537752.135	125949	372700.6670	454197.1420	826897.8090
New Ending Inventory	372505.877	74403	42047.6947	100280.7710	142328.4657
Beginning Inventory ^(a)	647203.471	120165	188572.0000	287269.0100	475841.0100
TOTALS	-2222.277	321733	227009.4966	267221.6395	494231.1361

MUF Based on Data Provided = -2222.28

LEMUF Based on Data Provided = 1406.03

(a) Beginning Inventory Variances are removed from totals for the continuous inspection plan

The 95% detection goal for an international standard of accountability⁽¹⁾ is:

$$M = (2) (1.645) (0.3\%) (\text{Feed}) = 2574 \text{ kg of uranium.}$$

Any goal quantity is somewhat arbitrary. It should be realized that smaller goal quantities lead to larger inspection efforts or to a decreased probability of detection. Inspection strategies based on too large a goal quantity allow the diversion of a part of that goal quantity with a decreased probability of detection.

In this report, calculations were made using goal quantities of 300, 500, 1000, 2000, 3000, 4000, 6500, and 10,000 kg. The results permitted a quantitative study of the effects produced by changing this variable. The results of these calculations are given in the tables in the Appendix; however, to reduce the bulk of the tables, the results for 500, 2000, and 3000 kg were not included. The results of the calculations for these intermediate quantities were included in the analysis described later.

DEVELOPMENT OF SAMPLING PLANS

Sampling plans were developed for the two model cases. A statistical analysis was then performed with the computer code QUEST.⁽¹⁰⁾ The first case provides for inspection of the facility inventory and the second case assumes the beginning inventory had been inspected previously, and the inspection team is to inspect the ending inventory and all flow that occurred in the interim six-month period.^(a) In the second case the static inventory need not be inspected^(b) because these items were present when the previous inspection occurred. In addition the variance of $\hat{D} + \text{MUF}$ for the beginning inventory is added to the calculated $\hat{D} + \text{MUF}$ for additions, removals, and ending inventory to take credit for inspecting the entire material balance.

Both cases, have been evaluated, thereby providing data on two types of inspections which the IAEA could carry out. The tables in Sections A and B of

a. The period was set at 6 months because detailed data was provided for that period.

b. Inspection of selected items to insure that no IAEA seals had been broken could be required.

the Appendix provide detailed results for the variables inspection plan for the first and the second cases, respectively. Table F provides the detailed results for the attributes inspection plan for various inventories used in the two cases.

The facility data were divided into five strata categories: Beginning Inventory, Additions to Facility, Removals from Facility, New Ending Inventory, and Static Inventory. The measurement error data used in the calculations are based on data provided by the facility. These data are shown in the tables in Section C. In order to reduce the number of types of material (stratum) in each category, various items with similar material types were combined. Section D contains the error variance tables for each of the categories used in Section C. Section E contains the LEMUF calculation tables for each of the categories. The tables in Section F provide the results of the calculation of the number of attributes tests for each of the five categories at the three nondetection probabilities considered. The tables in Sections A and B provide the results of the calculation of the number of variables tests for the two cases evaluated in this report. The calculations are described in the various sections in the Appendix.

Prior to developing a plan for an independent safeguards verification of a facility, it is necessary to collect and verify a large quantity of background data. The collection and verification of such data were discussed in the previous section entitled the Inspection Verification Methodology.

The formulation of a sampling schedule follows the completion of:

- collection and eventual verification of the background data previously discussed under Levels I and II
- calculation or a check of plant calculations related to MUF and LEMUF
- the establishment of a goal quantity.

As a first step, it is essential to check all the items in the inventory against the written records (book inventory) for those items and vice versa. This serves to identify clerical errors and falsifications in the records and reports and to determine that there are no missing containers.

A check also can be made of the records pertaining to "flow" material, i.e., receipts, shipments, etc. Such records in isolation are, however, probably impossible to validate simply because the material is no longer present in its original form. When both shipper and receiver records are available and when they can be considered to be independent of each other, most of the "flow" material can be accounted for. But there is almost always a small percentage of the total material that has been discarded as waste and, therefore MUF cannot be entirely validated using only shipper/receiver and inventory values. Thus, when a sampling schedule is developed that includes "flow" material, it is assumed that an inspector is present during the material balance period to observe and verify receipts and removals. Some form of independent verification is needed and this would be one method possible. Depending upon the specific facility involved, an inspector may have to be present on a continuous basis.

The item checks of nuclear material, including checking flow components against the book inventory, should detect the removal of complete items. Further checks, including a calculation of MUF, are required to validate the quantity values appearing in the book inventory.

The first test is a check for substituted containers that are present but the SNM has been removed. In this use the SNM may or may not have been replaced with another material. The number of samples required for this test for whole items is given by the equation

$$n_a = N \left(1 - \beta^{\bar{X}/M} \right)$$

where

n_a = number of samples required for attributes inspection plan

N = number of items in a stratum or lot

β = probability of nondetection (set equal to 0.05, 0.25, and 0.5 in these calculations to illustrate three levels)

$\bar{X}$ = average item weight

M = goal quantity, the amount of material assumed diverted, set equal to 300, 1000, 4000, 6500, and 10,000 kg in these calculations to illustrate five levels of falsification.

This equation defines the number of samples required for an attributes test (present or not present) of an inventory for selected goal quantities, M , and non-detection probability, β . Further discussion of this approach is given in References 1,2. The tables in Section F of the Appendix show the results of the computer calculations for the attributes inspection plan for the five strata categories and each of the three non-detection probabilities given above. By summing the number of the attributes tests from Section F for the strata of interest for a particular inspection plan, the number of measurements to detect total removals reported on the second page of each table in Sections A and B can be generated.

By examining the number of samples calculated from the equation, an inspector can detect the substitution of an empty container at stated detection probability limits $(1 - \beta)$. Consider the absence of the goal quantity of material brought about by a sufficient number of full containers to sum the total. It is assumed that the inspector can distinguish between a falsified and a full container by a simple test. Generally a minimal weight check should suffice. Following an examination for empty containers, the next test is a check to detect partially filled containers, i.e., containers from which part of the contents has been diverted. If the diverter replaces weight equal to that absent, then an additional check for the identity of the contents of each container in the sample is needed. An NDA method is frequently used for detection of the absent material and it is considered sufficient to confirm SNM content. This detector, an NDA instrument, is used as a go/no-go device. Such a device determines that material is either missing or not missing. In the first computer calculation it was arbitrarily assumed that the method has a standard deviation of 7.5% and that a 4σ significance limit is used.

The cutoff point for the detection of partial defects and bias, X , in the computer analysis was set to 0.3. This is also referred to as the nonacceptance limit or a performance coefficient, in this case for the NDA equipment. The number of samples required for this test for partial removals is given by the equation

$$n_{v1} = N \left(1 - \beta^{\gamma \bar{X}/M} \right)$$

where $n_{\gamma 1}$ is the number of samples required for the first part of the variables inspection plan, γ is defined above, and the other parameters are as defined for the equation for the attributes inspection plan, n_a , which was discussed earlier.

The main reason for the wide limits, i.e., 4σ , for the partial removals detection alarm point is that the standard samples used for calibration by the inspector in many cases will not duplicate samples taken in the facility. Narrow limits will trigger too many false alarms. In an actual inspection, the standard deviation and limits will vary depending upon the instrument used and the items being inspected. Thus, for these calculations it is assumed that if 70% or more of the nuclear material is present, the instrument will indicate an acceptance; if less than 70% is present, the instrument will register a rejection. Since there can only be a discrepancy of 30% of each container without detection, there must be 3.33 times more container substitutions than in the previous, full/empty situation. The same formula is used as previously except that $\bar{X}$ is replaced by $0.3\bar{X}$, i.e., the maximum amount concealed per container. The number of samples required to achieve the same probability of detection is roughly 1/3 of the previous case.

For comparison, sample sizes were also calculated for a nonacceptance limit for NDA equipment of 10%, i.e., $\bar{X}$ is replaced by $0.1\bar{X}$. The change had little effect on the total number of samples required.

Some ambiguity may occur when the equation is applied to strata that contain less than the goal quantity. When the calculated number of samples is less than one (say 0.4 to D.9), a conservative approach is to take one sample. If the calculated number of samples is even smaller (<0.5), it is suggested that a sample be randomly taken from a combination of such small strata.

The final test is a check for bias detection. The first step in the procedure is to calculate the random error standard deviation of an individual difference (operator and inspector's values) for the amount of element in an individual item. These individual standard deviations, designated by σ_{dri} (dri signifies difference, random, ith class), are multiplied by the number of items in each stratum to obtain $N_i\sigma_{dri}$. The values are summed over all strata to give

a total $\sum N_i \sigma_{dri}$ for the facility. In the simplest case, where both the operator and inspector take single measurements, their measurements have the same random error variance,

$$\sigma_{dri}^2 = 2\bar{X}_i^2 (\sigma_w^2 + \sigma_s^2 + \sigma_a^2)$$

where $\bar{X}_i^2$ is the average item weight and σ_w^2 , σ_s^2 , and σ_a^2 are the random error variance terms for weighing, sampling, and analysis. The factor of two accounts for the sum of operator and inspector errors.

Many of the individual error standard deviations calculated for a facility are more complex. Where, as an example, the plant operator withdraws five samples from a lot, composites them, and then performs duplicate chemical analysis, the random error standard deviation for sampling (operator's) is reduced by the square root of 5 and the analytical term by the square root of 2. The inspector's random errors are not reduced since it is assumed that a single sample is taken. Thus an exact calculation of the σ_{dri} requires knowledge of the sampling procedure used in a facility. Fortunately, the range in σ_{dri} is only from $(\sqrt{2})$ (constant) to (1) (constant), i.e., the inspector's random error only. A probable source of error in the calculation of σ_{dri} arises where the inspector's measurement accuracy is different (less than) than that of the facility operator. The measurement capabilities of the facility and the inspection team were assumed to be identical for the calculations made in this report. The number of samples required for this test for bias is given by the equation

$$n_{v2} = \frac{n \left(\sum N_i \sigma_{dri} \right)}{\sum N_i \sigma_{dri}}$$

where n_{v2} is the number of samples for the second part of the variables inspection plan and n is the computed sample size for the whole material balance using the minimum variance formula.⁽¹⁾ The sample size, n , is calculated for a given strata and n_{v2} distributes the number of samples for inspection over the individual stratum.

The final sampling schedule to be calculated is designed to detect, over the whole material balance, a bias of size M in the material balance in the presence of systematic error variance. The calculation is a three-step process. First, a goal is established for the random error standard deviation of $\hat{D}$, where $\hat{D}$ is an estimate of the inspector's MUF minus the operator's MUF. The goal random error variance $\sigma_{\hat{D}}^2$ is then used in a minimum variance formula to determine a necessary sample size for the facility material balance. The total number of samples is then divided into sample sizes for each strata.

The estimation of the desired value for $\sigma_{\hat{D}}^2$ is complicated by the effects of the variance of the estimated systematic errors in the measurements. If M is small relative to plant through-put, it is often not possible to reach the desired probability of detection because of the dominance of the effects of the systematic error term. In the first calculation the random error variance under the alternate hypothesis was set equal to one-half of the systematic error variance components of $\hat{D}$. Two additional calculations are provided for comparison. In the second calculation the ratio is 1.0 and in the third calculation the ratio is 2.0.

Numerical Input and Calculations

The input data for the computer calculations using the QUEST⁽¹⁰⁾ code are listed in Section C. Included with the DIQ⁽⁷⁾ was a table of data that was already a summation of items for a batch, contract, or some other relating factor. Due to the large number of entries in this summary, the data was reduced based on similar composition and form. The stratification formed is the stratum line of each entry in Table C. These lines make up the strata for each strata category of interest. The five strata categories group the input to QUEST⁽¹⁰⁾ for the following:

- Beginning Inventory
- Additions to Facility
- Removals from Facility
- New Ending Inventory
- Static Inventory.

Besides this input data there are various parameters that are input to QUEST to control the program calculations. The significance ^(1,2) of these parameters is assumed understood; therefore only their values are given here.

The calculations were performed for goal quantities of 300, 500, 1000, 2000, 3000, 4000, 6500, and 10,000 kilograms of material. The tables in this section show the results for all goal quantities. The tables in the Appendix were limited to five goal quantities, so the results of the calculations at 500, 1000, and 2000 were not included. Three levels of the non-detection probability, β , were evaluated; 0.05, 0.25, and 0.50. They correspond to goal detection probabilities or confidence limits, $100(1-\beta)\%$, of 95%, 75%, and 50%, respectively. This information is sufficient to calculate the number of samples, n_a , required for either of the inspection plans discussed earlier to detect gross defects (attributes sampling plan). The results are shown in the tables in Section F; each table describes one strata and one of the non-detection probabilities.

Two cutoff points were used for the detection of partial defects and bias, γ in the computer analysis; 0.1 and 0.3 as discussed in the previous section. The number of samples required for detecting partial removals, n_{v1} , were then calculated.

Additional input parameters were needed for the remaining calculations. The probability of a Type I error was set at 0.050. The $100(1-\alpha)$ percentile point of the $N(0,1)$ distribution, $Z_{1-\alpha}$, and $Z_{1-\beta}$ were both set at 1.645. The ratio of the variance of the random error under the alternative hypothesis to the variance of random error under the null hypothesis was set to 4.0. Three ratios of the variance of the random error under the alternate hypothesis to systematic error of the $\hat{D}$ (statistics), $\sigma_{\hat{D}_r|H_1}^2 / \sigma_{\hat{D}_s}^2$, were used to estimate $\hat{D}$ sampling requirements for detection of bias as discussed in the previous section. The factor by which the variance of the inspector's and operator's random error for moving inventory is multiplied to estimate the variance of $\hat{D}$ was set to 1.0. The estimate of long-term systematic error as applied to the determination of the SNM in any stratum was set to 1.0. The number of samples required for bias detection, n_{v2} , was then calculated. The number of samples required for the detection of bias and partial removals, n_v , is the maximum value of the samples n_{v1} and n_{v2} and these are the number of samples required in the variables inspection plan.

Sections D and E of the Appendix contain the results of the error variance calculations and the LEMUF calculations, respectively. The output for the variables inspection plan is presented in a different format than for the attributes inspection plan. The results for the strata of interest in the two inspection plans discussed earlier are presented together in the tables in Sections A and B. The 18 tables in each section show the results of the calculations for the three ratios of $\sigma_{\hat{D}_r|H_1}^2 / \sigma_{\hat{D}_s}^2$, the three non-detection probabilities, β , and the two cutoff points, γ , as discussed above. On the second (continued) page of each of these tables, a summary table is presented for each of the calculations.

A selected part of Tables A1 through A18, showing total sample measurement requirements and the probabilities of detection, are shown in Tables 7-9 for the total inventory inspection. Similarly, selected parts of Tables B1 through B18 are shown in Tables 10-12 for the consecutive inspection plan.

Note that the total number of samples shown in Tables 10-12 listed above does not include a beginning or static inventory. This is the situation when inspections cover consecutive periods. The samples in the inventory taken at the end of one time period become the samples for the beginning inventory in the next period. The elimination of the beginning inventory samples may amount to roughly a 25% reduction in the total number of cases studied. The total sample load shown in Tables 10-12 represents the incremental sampling load for each six-month interval with continuous inspection.

In Tables 10-12, the numbers of measurements to detect total removals and also bias and partial removals are tabulated for the continuous inspection plan by not including the beginning and static inventories. It should be noted that data from both the beginning and ending inventories are needed to calculate MUF and the $\hat{D}$ statistic and that is why both inventories are included in the tables forming the Appendix Sections D, E, and F.

A summary of the numbers of variables measurements is given in Table 13 for both inspection of the new ending plus static inventories and also the continuous inspection plan (inspection of the entire material balance). Some additional results of calculations are shown which were not included in the Appendix but will be explained.

TABLE 7. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility^(a)

$$(\sigma_{D_r}^2 = 1/2\sigma_{D_s}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection %
$\beta = 0.05, \gamma = 0.10$			
300	4,903	823	11.3
500	2,961	823	17.9
1,000	1,498	824	42.3
2,000	755	826	81.3
3,000	502	823	92.1
4,000	376	822	93.9
6,500	231	822	94.8
10,000	149	822	95.2
$\beta = 0.05, \gamma = 0.30$			
300	4,903	829	11.3
500	2,961	829	17.9
1,000	1,498	832	42.3
2,000	755	842	81.4
3,000	502	827	92.1
4,000	376	824	93.9
6,500	231	822	94.8
10,000	149	822	95.2
$\beta = 0.25, \gamma = 0.10$			
300	2,334	823	11.3
500	1,391	823	17.9
1,000	698	824	42.3
2,000	348	822	70.7
3,000	233	822	74.1
4,000	173	822	75.4
6,500	105	822	76.2
10,000	66	822	76.2
$\beta = 0.25, \gamma = 0.30$			
300	2,334	829	11.3
500	1,391	829	17.9
1,000	698	832	42.3
2,000	348	826	70.7
3,000	233	822	74.1
4,000	173	822	75.4
6,500	105	822	76.2
10,000	66	822	76.2
$\beta = 0.50, \gamma = 0.10$			
300	1,182	823	11.3
500	700	823	17.9
1,000	349	824	41.4
2,000	173	822	50.8
3,000	115	822	52.5
4,000	86	822	52.5
6,500	52	822	52.5
10,000	31	822	52.5
$\beta = 0.50, \gamma = 0.30$			
300	1,182	829	11.3
500	700	829	17.9
1,000	349	831	41.4
2,000	173	822	50.8
3,000	115	822	52.5
4,000	86	822	52.5
6,500	52	822	52.5
10,000	31	822	52.5

a. Measurements for the new ending inventory plus static inventory.

TABLE 8. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility (a)

$$(\sigma_{D_r}^2 = \sigma_{D_s}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection
$\beta = 0.05, \gamma = 0.10$			
300	4,303	421	10.2
500	2,961	421	15.5
1,000	1,498	422	34.9
2,000	755	423	70.9
3,000	502	422	89.2
4,000	376	420	93.2
6,500	231	419	94.7
10,000	149	419	95.1
$\beta = 0.05, \gamma = 0.30$			
300	4,903	427	10.2
500	2,961	426	15.5
1,000	1,498	429	34.9
2,000	755	439	71.1
3,000	502	430	89.3
4,000	376	423	93.2
6,500	231	420	94.7
10,000	149	419	95.1
$\beta = 0.25, \gamma = 0.10$			
300	2,334	421	10.2
500	1,391	421	15.5
1,000	698	422	34.9
2,000	348	421	68.3
3,000	233	419	73.4
4,000	173	419	74.9
6,500	105	419	76.2
10,000	66	419	76.2
$\beta = 0.25, \gamma = 0.30$			
300	2,334	427	10.2
500	1,391	426	15.5
1,000	698	429	34.9
2,000	348	428	68.9
3,000	233	421	73.4
4,000	173	419	74.9
6,500	105	419	76.2
10,000	66	419	76.2
$\beta = 0.50, \gamma = 0.10$			
300	1,182	421	10.2
500	700	421	15.5
1,000	349	422	34.9
2,000	173	419	49.7
3,000	115	419	52.3
4,000	86	419	52.5
6,500	52	419	52.5
10,000	31	419	52.5
$\beta = 0.50, \gamma = 0.30$			
300	1,182	427	10.2
500	700	426	15.5
1,000	349	429	34.9
2,000	173	420	49.7
3,000	115	419	52.3
4,000	86	419	52.5
6,500	52	419	52.5
10,000	31	419	52.5

a. Measurements for the new ending inventory plus static inventory.

TABLE 9. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility (a)

$$(\sigma_{D_r}^2 = 2\sigma_{D_s}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection
$\beta = 0.05, \gamma = 0.10$			
300	4,903	222	9.1
500	2,961	221	12.9
1,000	1,498	222	26.9
2,000	755	224	59.5
3,000	502	224	79.8
4,000	376	222	90.3
6,500	231	220	94.7
10,000	149	220	94.9
$\beta = 0.05, \gamma = 0.30$			
300	4,903	231	9.1
500	2,961	227	12.9
1,000	1,498	231	27.1
2,000	755	247	50.3
3,000	502	256	81.3
4,000	376	235	90.5
6,500	231	222	94.7
10,000	149	220	94.9
$\beta = 0.25, \gamma = 0.10$			
300	2,334	222	9.1
500	1,391	221	12.9
1,000	698	222	26.9
2,000	348	224	59.5
3,000	233	221	73.3
4,000	173	220	74.1
6,500	105	220	75.8
10,000	66	220	76.2
$\beta = 0.25, \gamma = 0.30$			
300	2,334	231	9.1
500	1,391	227	12.9
1,000	698	231	27.1
2,000	348	247	50.3
3,000	233	225	73.3
4,000	173	221	74.1
6,500	105	220	75.8
10,000	66	220	76.2
$\beta = 0.50, \gamma = 0.10$			
300	1,182	222	9.1
500	700	221	12.9
1,000	349	222	26.9
2,000	173	221	48.2
3,000	115	220	51.2
4,000	86	220	52.5
6,500	52	220	52.5
10,000	31	220	52.2
$\beta = 0.50, \gamma = 0.30$			
300	1,182	231	9.1
500	700	227	12.9
1,000	349	231	27.1
2,000	173	224	48.3
3,000	115	220	51.2
4,000	86	220	52.5
6,500	52	220	52.5
10,000	31	220	52.5

a. Measurements for the new ending inventory plus static inventory.

TABLE 10. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility (a)

$$(\sigma_{Dr}^2 = 1/2\sigma_{Ds}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection %
$\beta = 0.05, \gamma = 0.10$			
300	9,128	561	8.6
500	5,580	553	11.9
1,000	2,895	560	23.6
2,000	1,541	566	55.3
3,000	1,051	570	70.8
4,000	821	562	89.0
6,500	513	554	94.2
10,000	342	554	94.8
$\beta = 0.05, \gamma = 0.30$			
300	9,128	585	8.6
500	5,580	587	11.9
1,000	2,895	589	23.7
2,000	1,541	610	55.4
3,000	1,051	624	76.9
4,000	821	598	89.0
6,500	513	561	94.2
10,000	342	554	94.8
$\beta = 0.25, \gamma = 0.10$			
300	4,401	561	8.6
500	2,676	558	11.9
1,000	1,404	560	23.6
2,000	767	566	55.3
3,000	511	557	71.2
4,000	402	554	73.3
6,500	244	554	75.5
10,000	160	554	76.2
$\beta = 0.25, \gamma = 0.30$			
300	4,401	595	8.6
500	2,676	587	11.9
1,000	1,404	589	23.7
2,000	767	610	55.4
3,000	511	580	71.2
4,000	402	558	73.3
6,500	244	554	75.5
10,000	160	554	76.2
$\beta = 0.50, \gamma = 0.10$			
300	2,251	561	8.6
500	1,371	558	11.9
1,000	725	560	23.6
2,000	403	556	46.5
3,000	262	554	50.5
4,000	208	554	52.2
6,500	124	554	52.5
10,000	80	554	52.5
$\beta = 0.50, \gamma = 0.30$			
300	2,251	585	8.6
500	1,371	587	11.9
1,000	725	589	23.7
2,000	403	572	46.5
3,000	262	554	50.5
4,000	208	554	52.2
6,500	124	554	52.5
10,000	80	554	52.5

a. Measurements for the entire material balance.

TABLE 11. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility (a)

$$(\sigma_{D_r}^2 = \sigma_{D_s}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection %
$\beta = 0.05, \gamma = 0.10$			
300	9,128	292	7.8
500	5,580	290	10.3
1,000	2,895	289	18.9
2,000	1,541	294	45.3
3,000	1,051	296	64.7
4,000	821	299	79.6
6,500	513	286	93.0
10,000	342	282	94.0
$\beta = 0.05, \gamma = 0.30$			
300	9,128	319	7.9
500	5,580	314	10.3
1,000	2,895	313	18.9
2,000	1,541	336	46.0
3,000	1,051	353	65.7
4,000	821	362	80.7
6,500	513	304	93.0
10,000	342	285	94.7
$\beta = 0.25, \gamma = 0.10$			
300	4,401	292	7.8
500	2,676	290	10.3
1,000	1,404	289	18.9
2,000	767	294	45.3
3,000	511	296	64.7
4,000	402	287	73.1
6,500	244	282	74.8
10,000	160	282	76.2
$\beta = 0.25, \gamma = 0.30$			
300	4,401	319	7.9
500	2,676	314	10.3
1,000	1,404	313	18.9
2,000	767	336	46.0
3,000	511	348	65.5
4,000	402	304	73.1
6,500	244	283	74.8
10,000	160	282	76.2
$\beta = 0.50, \gamma = 0.10$			
300	2,251	292	7.8
500	1,371	290	10.3
1,000	725	289	18.9
2,000	403	294	45.3
3,000	262	283	49.0
4,000	208	282	51.1
6,500	124	282	52.5
10,000	80	282	52.5
$\beta = 0.50, \gamma = 0.30$			
300	2,251	319	7.9
500	1,371	314	10.3
1,000	725	313	18.9
2,000	403	336	46.0
3,000	262	291	49.0
4,000	208	283	51.1
6,500	124	282	52.5
10,000	80	282	52.5

a. Measurements for the entire material balance.

TABLE 12. Inspector's Measurement Requirements to Achieve Stated Probability of Detection at Model Fuel Fabrication Facility (a)

$$(\sigma_{Dr}^2 = 2\sigma_{Ds}^2)$$

Goal Quantity kg U	No. of Measurements to Detect Total Removals	No. of Measurements to Detect Bias and Partial Removals	Probability of Detection
$\beta = 0.05, \gamma = 0.10$			
300	9,128	159	7.1
500	5,580	157	8.9
1,000	2,895	156	14.7
2,000	1,541	156	32.5
3,000	1,051	159	53.1
4,000	821	150	65.7
6,500	513	158	88.3
10,000	342	151	94.2
$\beta = 0.05, \gamma = 0.30$			
300	9,128	230	7.2
500	5,580	186	9.0
1,000	2,895	172	14.9
2,000	1,541	190	33.4
3,000	1,051	208	54.3
4,000	821	210	67.3
6,500	513	206	89.1
10,000	342	159	94.2
$\beta = 0.25, \gamma = 0.10$			
300	4,401	159	7.1
500	2,676	157	8.9
1,000	1,404	156	14.7
2,000	767	156	32.5
3,000	511	169	53.1
4,000	402	159	65.7
6,500	244	150	74.3
10,000	150	148	75.5
$\beta = 0.25, \gamma = 0.30$			
300	4,401	200	7.2
500	2,676	186	9.0
1,000	1,404	178	14.9
2,000	767	190	33.4
3,000	511	208	54.3
4,000	402	210	67.1
6,500	244	156	74.3
10,000	160	148	75.5
$\beta = 0.50, \gamma = 0.10$			
300	2,251	159	7.1
500	1,371	157	8.9
1,000	725	156	14.7
2,000	403	156	32.5
3,000	262	156	48.4
4,000	202	149	49.5
6,500	124	148	52.5
10,000	80	148	52.5
$\beta = 0.50, \gamma = 0.30$			
300	2,251	200	7.2
500	1,371	186	9.0
1,000	725	178	14.9
2,000	403	190	33.4
3,000	262	180	48.4
4,000	202	156	49.5
6,500	124	148	52.5
10,000	80	148	52.5

a. Measurements for the entire material balance.

The summary shown in Table 13 is for a 300 kg goal quantity. A small goal quantity was chosen because the number of measurements required for detection of partial removals, n_{v1} , is greatly reduced for large goal quantities. Additional calculations are shown for higher ratios of the random error variance under the alternate hypothesis to the systematic error variance of the $\hat{D}$ statistics, i.e., $\sigma_{D_r|H_1}^2 / \sigma_{D_s}^2 = 4$ and 8. The Appendix contains all of the results for ratios of 1/2, 1, and 2.

An analysis of the results shown in Table 13 and in the Appendix indicate that at higher goal quantities the number of measurements required to detect partial removals is reduced. Further, the number of measurements required to detect bias as shown in Table 13 is the same for all goal quantities as would be expected from the calculations. The number of measurements to detect partial removals and bias, however, only decreases slightly with lower goal quantities.

TABLE 13. Number of Variables Measurements
for a 300 kg Goal Quantity

Minimum Allowed Ratio(a)	Gamma (b) = 0.1			Gamma = 0.3		
	(c) n_{v1}	(d) n_{v2}	(e) n_v	n_{v1}	n_{v2}	n_v
Inspection of the New Ending Plus Static Inventory						
1/2	28	822	823	73	822	829
1	25	419	421	66	419	427
2	23	220	222	59	220	231
4	20	122	123	53	122	141
8	18	76	78	48	76	99
Inspection of the Entire Material Balance						
1/2	43	554	561	109	554	585
1	39	282	292	99	282	319
2	37	148	159	91	148	200
4	35	86	99	83	86	141
8	31	54	70	77	54	108

- Ratio of random to systematic error variance of $\hat{D}$ ($\sigma_{D_r|H_1}^2 / \sigma_{D_s}^2$).
- Cutoff point for detection of partial defects and bias, γ .
- Total number of measurements to detect partial removals, n_{v1} .
- Total number of measurements to detect bias, n_{v2} .
- Total number of measurements to detect partial removals and bias, n_v .

An analysis of the results shown in Table 13 and in the Appendix can also be done for the two cutoff points for detection of partial defects and bias, γ , which were used, i.e. 0.1 and 0.3. The number of n_{v1} measurements more than double for the larger value of gamma. The number of n_{v2} measurements again are the same in Table 13 and at the higher goal quantities as expected. And, the number of n_v measurements increase slightly for the larger value of gamma.

It was indicated above that additional calculations, not included in the Appendix, were included in Table 13 for larger ratios of the random to system-
ation error variance. It is significant to compare the results of the n_{v2} calculations at different ratios. For both inspection plans the required number of n_{v2} measurements are almost inversely proportional to this ratio. These results indicate the sensitivity of n_{v2} in these calculations and the importance of a knowledge and understanding of the systematic error in the selection of the ratio of the random to systematic error variance for an inspection plan. The error variance ratio controls the dominance of the systematic error when the goal quantity is small. As it is discussed in the Appendix Section C, the systematic errors for the data contained in this study may be sufficiently low to justify use of larger values of this ratio than applied in the calculations shown in the Appendix. These systematic errors are also smaller than those discussed in Reference 1. For this report, the values of the ratio were chosen because they were close to the point of diminishing return⁽¹⁾. At this point this ratio is 0.25.

In addition, n_{v1} and n_{v2} were calculated at the same probability levels in each of the individual variable measurement tables; here it is likely that the n_{v1} inspections represent a minimal practical probability level. Thus differences in the n_{v1} and corresponding n_{v2} inspection levels are greater than it would normally be expected.

The total measurements needed to detect total removals are shown as a function of goal quantity in Figures 3 and 4. Figure 3 is for the new ending plus static inventories and Figure 4 is for the continuous inspection plan. Both figures show dependency on β , the non-detection probability for gross defects. The probability of detection is shown as a function of goal quantity

in Figures 5 through 10. Figures 5, 6, and 7 describe the new ending plus static inventories and Figures 8, 9, and 10 describe the continuous inspection plan. These figures also show dependency on β . An analysis of the data in these figures shows that the removal of larger goal quantities is easier to detect (fewer measurements), than the smaller goal quantities. Also, a lower detection probability generally requires fewer measurements than the higher detection probabilities.

COSTS OF SAMPLE MEASUREMENTS

Legitimate considerations must be given to the following approach, simply because it is felt that a general audience will not agree on what dollar equivalents are to be used. Optimum sampling plans were constructed using one set of dollar equivalents. It would seem highly desirable, however, that an inspection team collect data related to their cost and time as required for various sample types. These data could be subsequently used to provide optimum (e.g., minimum cost or inspection time) sampling plans for the Agency at related plants.

Measurements were converted into an approximate dollar equivalent and are included here as reference material. This allowed the summation of both attributes and variables measurements in terms of dollars. With other parameters held constant, it was shown that optimum (minimum cost) sample plans can be derived by changing the number and type (attributes or variables) of measurements made.

The number of measurements listed in Tables 10-12 was converted into approximate dollar equivalents. The cost of the attributes measurements, n_a , was taken as \$4 per measurement and the cost of the measurement for bias detection (wet chemical, n_{v2}) was taken as \$200 per measurement. It is not unlikely that these costs will vary by factors of two or three depending upon their specific application, but they do provide a basis for selecting a final sampling plan.

It is quite evident from an examination of the data in Tables 10-12 and Appendix F, that the cost of measuring n_{v2} samples far exceeds that for the n_a samples at the assumed cost per sample. The easiest method of reducing cost appeared to be a reduction in the number of n_{v2} measurements.

FIGURE 3. Number of Measurements to Detect Total Removals for New Ending Plus Static Inventory

FIGURE 4. Number of Measurements to Detect Total Removals for the Continuous Inspection Plan

FIGURE 5. Probability of Detection versus Goal Quantity for New Ending Plus Static Inventory for Ratio of Random to Systematic Error Variance of $\hat{D} \geq 1/2$

FIGURE 6. Probability of Detection versus Goal Quantity for New Ending Plus Static Inventory for Ratio of Random to Systematic Error Variance of $\hat{D} \geq 1$

FIGURE 7. Probability of Detection versus Goal Quantity for New Ending Plus Static Inventory for Ratio of Random to Systematic Error Variance of $\hat{D} \geq 2$

FIGURE 8. Probability of Detection versus Goal Quantity for the Continuous Inspection Plan for Ratio of Random to Systematic Error Variance $\hat{D} \geq 1/2$

FIGURE 9. Probability of Detection versus Goal Quantity for the Continuous Inspection Plan for Ratio of Random to Systematic Error Variance $\hat{D} \geq 1$

FIGURE 10. Probability of Detection versus Goal Quantity for the Continuous Inspection Plan for Ratio of Random to Systematic Error Variance $\hat{D} \geq 2$

In a preceding discussion, it was shown that the total sample size for the $\hat{D}$ statistic was derived using the criteria that the random error variance of $\hat{D}$ should never be set at less than 0.5 times the systematic error variance of $\hat{D}$, i.e.:

$$\sigma_{\hat{D}}^2 \text{ random} \geq 1/2 \sigma_{\hat{D}}^2 \text{ systematic}$$

Obviously, if the acceptable random error is allowed to increase, fewer measurements will be needed. For this reason, two additional calculations were made using the criteria that

$$\sigma_{\hat{D}}^2 \text{ random} \geq \sigma_{\hat{D}}^2 \text{ systematic}$$

and

$$\sigma_{\hat{D}}^2 \text{ random} \geq 2\sigma_{\hat{D}}^2 \text{ systematic,}$$

as summarized in Tables 8, 9, 11, and 12.

The number of measurements required under these assumptions from Appendix Tables A and B is shown in Tables 7 through 12. The costs of the bias measurements shown in Table 14 are independent of β , γ , and the goal quantity.

The costs shown in Table 14 are reasonable estimates based on the technical knowledge and data that is available. Differences in analytical cost are to be expected among facilities. They are, however, internally consistent and they do provide a basis for developing and selecting a sampling plan for the facility. An optimum sampling plan will depend upon the imposed constraints. Major factors include the availability of funds, the probability chosen for detecting a falsification, and the goal quantity selected. As may be expected, lower costs can be traded for lower detection limits or for larger goal quantities. Finally, advantages that accrue in domestic inspections such as the use of independent shipper/receiver measurements or improved operator measurements have not been applied in this report. If these items become applicable under an IAEA inspection program, they should be factored into the selected sampling plan.

TABLE 14. Approximate Cost of Inspection Measurements^(a)

Random/Systematic Variance Cutoff for Inspection(b)	Probability of Detection %	1977 Dollars		
		Goal Quantities, kg		
		4,000	6,500	10,000
0.5	95	--	114,000	112,000
	75	113,000	112,000	111,000
	50	112,000	111,000	111,000
1.0	95	--	63,000	58,000
	75	62,000	58,000	57,000
	50	57,000	57,000	57,000
2.0	95	--	--	32,000
	75	--	32,000	30,000
	50	32,000	30,000	30,000

- a. Based on \$4/attribute measurement (N_a), and \$200/wet-chemical measurement (N_{v2} , bias).
- b. Controls the dominance of systematic error when the goal quantity is small.

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GLOSSARY

The meaning of the following list of symbols was generally defined in the text when first used. They are repeated here for the convenience of the reader. Some of the symbols may have additional subscripts when used, but this will be understood in the context of use.

<u>Symbol</u>	<u>Meaning</u>
SNM	Special nuclear material. Generally refers to the isotopes U-233, U-235, and Pu-239. In this report, it denotes low-enriched uranium.
MUF	The operator's estimate of the amount of material missing in a material balance area during an accountability period.
LEMUF	Limit of error of MUF. Specifically, twice the standard deviation of MUF.
M	The quantity used by the inspector in designing attributes and variables sample sizes so that a diversion of the amount M will be detected at a preassigned probability level.
MBA	Material balance area.
ICA	Item control area.
N_i	The number of items in the <u>i</u> th class.
Class	The terms class and stratum are used interchangeably.
$\bar{X}_i$	The nominal amount per item in the <u>i</u> th stratum where the amounts per item over the different items are relatively constant.

Symbol	Meaning
γ	γ (gamma) is the proportion of the total removal of $\bar{X}$ from an item such that removals below $\gamma\bar{X}$ would not be detected by the attribute instrument. $\gamma\bar{X}$ is treated as a point on a continuum for design purposes but in fact there is a range of values where the attribute instrument does not give an unequivocal signal. The crossover point $\gamma\bar{X}$ is chosen, however, so that the sample size indicated will be in the direction of requiring at least enough samples.
β	The cutoff point for detection of partial defects and bias. Commonly referred to as the nonacceptance limit or a performance coefficient.
d_{ij}	The difference between the inspector's amount value and the operator's stated amount in the j th item within the i th class.
σ_{dr}	The standard deviation of the difference in the operator's and inspector's amount values for an individual item due to random errors of measurement.
$\hat{D}$	An estimate of the inspector's MUF minus the operator's MUF, where the inspector's estimate is generally based on fractional sampling.
$(\hat{D} + MUF)$	The statistic formed by adding the operator's MUF statistic to the $\hat{D}$ statistic. It is essentially a MUF statistic adjusted for operator bias since $-\hat{D}$ estimates the bias in MUF when the inspector's bias is zero or negligible. If the inspector's bias is not negligible, $(\hat{D} + MUF)$ replaces operator bias with inspector bias.
$\sigma^2(\hat{D} + MUF)$	These symbols all denote the same parameter, the variance in the statistic $(\hat{D} + MUF)$ including both the systematic and random error variance components.
Var $(\hat{D} + MUF)$	
Variance $(\hat{D} + MUF)$	

Symbol	Meaning
$\sigma_{\hat{D} H_0}^2$	The variance of $\hat{D}$ under the null hypothesis of material control. Written in this form, the variance in $\hat{D}$ is the sum of the random and systematic variance components.
$\sigma_{\hat{D} H_1}^2$	The variance of $\hat{D}$ under the alternative hypothesis of material diversion of the goal quantity M. The random variance component in this situation may include the induced process variance in addition to the natural sources of variation. The variance in $\hat{D}$ under H_1 is the sum of the random and systematic variance components.
$\sigma_{\hat{D}_r H_0}^2$	The random variance component in the $\hat{D}$ statistic under the null hypothesis that the material is in control.
$\sigma_{\hat{D}_r H_1}^2$	The random variance component in $\hat{D}$ under the alternative hypothesis.
n_{v1} or NV1	The number of samples required by the variable measurement in order to be 100(1- β) percent sure of detecting the removal of at least one defect if $r_2 = M/(\gamma\bar{X})$ removals of the amount $\gamma\bar{X}$ are taken.
n_{v2} or NV2	The number of items needed to detect a significant bias, where Δ is the bias and $N = M$, where it is also assumed that an induced process variance by the operator exists.
n_a	The number of samples to be taken in a stratum for the attributes test. (Computer printout - Appendix uses NA)
n_v	The number of samples to be taken in a stratum by the variables instrument. (Computer printout - Appendix uses NV)
NTL	Estimated number of measurements to detect bias as specified in BNWL-1852. (1)

Symbol	Meaning
NV1TL	Sum of all the $NV1_i$ samples.
NV2TL	Sum of all the $NV2_i$ samples.
NVTL	Sum of all the NV_i samples.
CERROR	An indicator of the level of random error used in a test to call subroutine PROX if CERROR is greater than the operator's variance of random error moving inventory (random part of the MUF).
Subroutine PROX	Computes the value of $\sigma_{\hat{D}_r} H_0$
VARDRHO, VARDR20, and VARDR30	Estimates of the variance of $\hat{D}$ random under the null hypothesis.
VARDSTL	Total variance of systematic error; operator plus inspector.
VARDHO, VARDH1	Total variance (random + systematic) under the H_0 and H_1 hypothesis.
VDMUFHO, VDMUFH1	Variance of $(\hat{D} + \text{MUF})$ under the null and alternate hypothesis.
SDMUFHO, SDMUFH1	Standard Deviation of $(\hat{D} + \text{MUF})$ under the null and alternate hypothesis.
VARMUF	Variance of MUF; σ_{MUF}^2 .

APPENDIX

FORMULATION OF INPUT INVENTORY DATA AND CALCULATED RESULTS FOR THE INSPECTION

The data supporting the analyses in this report are presented here in seven sections. Each section contains tables for each of the following strata categories:

- Beginning Inventory
- Additions to Facility
- Removals from Facility
- New Ending Inventory
- Static Inventory

The DIQ⁽⁷⁾ amassed the data and supplied PML with item summaries. At PNL the data was further reduced. The listing of the inventory broke the items into 120 strata, using 59 measurement classifications. This number of strata and measurement classes was felt to be too large to be manageable. By combining similar materials, the number of strata in the inventory was reduced to less than 40. The reduction required combining some strata having unequal measurement errors. When such a situation occurred, the largest reported measurement error was used in order to always be conservative. Such a procedure does not severely affect the inspection planning but it could affect LEMUF. Accordingly, estimates from the DIQ of the random error standard deviations were used in the LEMUF calculation and the results incorporated in the estimates of the variance of D+MUF. However, the largest systematic error standard deviation of the individual items (summary items) that was combined to make a single stratum was used in each case because the standard deviations in the DIQ were considered to be unrealistically low in many cases (for many measurement procedures the given systematic error standard deviation was zero).

Following the development of the inspection strategy, the LEMUF estimate using maximum error combinations was compared with the estimate using standard techniques. The random error variance components differed by less than 10%. The systematic error variance component was a factor of two to three times larger when the maximum errors were used. However the maximum error case was thought to be more realistic and was therefore used in the final calculations.

Further details and description of the data in the Appendix are given with each section. The following description will detail the flow of information from the raw data through the calculated results. The raw data summary items were combined to form a stratum representing similar materials. A listing of these stratum, formed from combined items, is given in Section C for each strata category. Sections D and E show the results of the error variance and LEMUF calculations, respectively. The required numbers of tests for goal quantities of 300, 1000, 4000, 6500, and 10,000 kilograms of material are given in Section F for the attributes inspection plan and in Sections A and B for the variables inspection plan. In all sections, except A and B where the results of the variables inspection plan are given, results are reported by one of the particular strata categories mentioned earlier. This is done because the calculations are not a function of the inspection program (i.e., which inventories are to be included in the inspection program). The Tables in Sections A and B show the effect of varying the detection of partial defects and bias, while the Tables in Sections A, B, and F show the effect of varying the nondetection probability. All calculations are based on a six-month (two inspections per year) accounting period.

SECTION A

RESULTS OF THE VARIABLES INSPECTION PLAN FOR INVENTORY TERMS

This section shows the estimates of the number of required variable measurements in the inspection plan. These calculations and those of Section B are affected by the inspection program. Two inspection programs are considered in the report. The calculations reported in this section are for the inspection of the inventory terms only; this includes the new ending inventory and the static inventory. Section B presents results for inspection of the entire material balance. The calculations are given for the ratio of the random error variance under the alternate hypothesis component of the $\hat{D}$ statistic, $\sigma_{\hat{D}_r}^2$, to the systematic error variance component of the $\hat{D}$ statistic, $\sigma_{\hat{D}_s}^2$, equal to 1/2, 1, and 2.

For each of these ratios the calculations are further given for non-detection probabilities for gross defects of 0.05, 0.25, and 0.50. And, for each of the nondetection probabilities the calculations are finally broken down for the detection of partial defects and bias with gamma of 0.3 and 0.1. Definitions of variables used in the output are given in the Glossary.

TABLE A-1

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = 1/2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2+0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR BAHMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	6	142	142	8	142	142	3	142	142	1	142	142	1	142	142
UPS RECYCLE	2	40	40	3	40	40	1	40	40	1	40	40	0	40	40
ADU/UPS CROSS	1	9	9	1	9	9	1	9	9	0	9	9	0	9	9
GECO CONVERSION	1	31	31	1	31	31	1	31	31	0	31	31	0	31	31
VENDOR UO ₂	1	17	17	1	17	17	1	17	17	0	17	17	0	17	17
UO ₂ FOR SHIPMENT	9	2	9	12	2	12	4	2	4	1	2	2	1	2	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	273	273	2	273	273	1	273	273	0	273	273	0	273	273
FUEL RODS	4	5	5	5	5	5	2	5	5	1	5	5	0	5	5
POISON RODS	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
ASSEMBLIES	14	54	54	26	54	54	7	54	54	2	54	54	1	54	54
PRESS SCRAP	1	11	11	1	11	11	0	11	11	0	11	11	0	11	11
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	49	49	1	49	49	1	49	49	0	49	49	0	49	49
RESIDUE/SLUDGE	1	58	58	1	58	58	0	58	58	0	58	58	0	58	58
SOLID WASTE	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	29	29	1	29	29	0	29	29	0	29	29	0	29	29
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
UPS RECYCLE	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	5	5	1	5	5	0	5	5	0	5	5	0	5	5
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	15	42	42	20	42	42	6	42	42	2	42	42	1	42	42
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	4	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	73			97			32			9			4		
NV2TL =		822			822			822			822			822	
NV3L =			829			832			824			822			822

TABLE A-1 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{Dr}^2 = 1/2 \sigma_{Ds}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.887	.887	11.3	822	829	4903
1000.0	0.0	1.000	.577	.577	42.3	822	832	1498
4000.0	2972.6	.108	.561	.061	93.9	822	824	376
6500.0	5970.8	.064	.810	.052	94.8	822	822	231
10000.0	9829.3	.053	.919	.048	95.2	822	822	149

CERROR = 158334.856

THE RANDOM COMPONENT OF VARMUF = 0.

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .158E+06
FOR A GOAL QUANTITY OF 300.0 NTL = 812
FOR A GOAL QUANTITY OF 1000.0 NTL = 812
FOR A GOAL QUANTITY OF 4000.0 NTL = 812
FOR A GOAL QUANTITY OF 6500.0 NTL = 812
FOR A GOAL QUANTITY OF 10000.0 NTL = 812

VARDH30	VARD5TL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
158103.2512	316669.7121	474772.9632	474772.9632	689.0377	974.2088	0.0000	300.0000
158075.0119	316669.7121	474744.7239	474744.7239	689.0172	974.1508	0.0000	1000.0000
158244.4470	316669.7121	474914.1596	474914.1596	689.1402	974.4986	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	10000.0000

TABLE A-2

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma^2 = 1/2 \sigma_r^2 + 1/2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			8500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FILL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	142	142	3	142	142	1	142	142	1	142	142	0	142	142
UPS RECYCLE	1	40	40	1	40	40	1	40	40	0	40	40	0	40	40
ADU/UPS CROSS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
GECO CONVERSION	1	31	31	1	31	31	0	31	31	0	31	31	0	31	31
VENDOR UO ₂	0	17	17	1	17	17	0	17	17	0	17	17	0	17	17
UO ₂ FOR SHIPMENT	3	2	3	4	2	4	1	2	2	1	2	2	0	2	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	4	273	273	1	273	273	1	273	273	0	273	273	0	273	273
PELLETS	1	6	6	1	6	6	1	6	6	0	6	6	0	6	6
FUEL RODS	2	5	5	2	5	5	1	5	5	0	5	5	0	5	5
POISON RODS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ASSEMBLIES	1	54	54	9	54	54	3	54	54	1	54	54	1	54	54
PHESH SCRAP	0	11	11	0	11	11	0	11	11	0	11	11	0	11	11
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	49	49	1	49	49	0	49	49	0	49	49	0	49	49
RESIDUE/SLUDGE	0	58	58	0	58	58	0	58	58	0	58	58	0	58	58
SOLID WASTE	0	8	8	0	8	8	0	8	8	0	8	8	0	8	8
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UPS RECYCLE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	42	42	7	42	42	2	42	42	1	42	42	1	42	42
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	28			35			11			4			2		
NV2TL =		822			824			822			822			822	
NVTL =			823			824			822			822			822

TABLE A-2 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\frac{\sigma^2}{\hat{\sigma}_r^2} = 1/2 \frac{\sigma^2}{\hat{\sigma}_s^2}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.887	.887	11.3	822	823	4903
1000.0	0.0	1.000	.577	.577	42.3	822	824	1498
4000.0	2971.7	.108	.561	.061	93.9	822	822	376
6500.0	5970.8	.064	.810	.052	94.8	822	822	231
10000.0	9829.3	.153	.919	.048	95.2	822	822	149

VARDR30	VARDSL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARHUF	GOAL QUANTITY
158329.1654	316669.7121	474998.8775	474998.8775	689.2016	974.6724	0.0000	300.0000
158244.4676	316669.7121	474914.1596	474914.1596	689.1402	974.4986	0.0000	1000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	10000.0000

TABLE A-3
 NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
 OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
 NEW ENDING PLUS STATIC INVENTORY

$$\sigma^2 = \frac{1}{2} \sigma_r^2 + \frac{1}{2} \sigma_s^2$$

 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250 NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30																
STRATUM	GOAL QUANTITY															
	300.0			1000.0			4000.0			6500.0			10000.0			
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	
NEW ENDING INVENTORY																
FULL UF6 CYLINDERS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
UF6 CYLINDER REELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
ADU CONVERSION	0	142	142	0	142	142	1	142	142	1	142	142	0	142	142	
UPS RECYCLE	2	40	40	3	40	40	1	40	40	0	40	40	0	40	40	
ADU/UPS CROSS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9	
GECO CONVERSION	1	31	31	1	31	31	0	31	31	0	31	31	0	31	31	
VENDOR UO2	1	17	17	1	17	17	0	17	17	0	17	17	0	17	17	
UO2 FOR SHIPMENT	9	2	9	12	2	12	1	2	2	1	2	2	1	2	2	
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
INTERMED. PROD. PELLETS	1	273	273	2	273	273	0	273	273	0	273	273	0	273	273	
FUEL RODS	4	6	6	3	6	6	1	6	6	0	6	6	0	6	6	
POISON RODS	4	5	5	5	5	5	1	5	5	0	5	5	0	5	5	
ASSEMBLIES	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2	
PRESS SCRAP	1	54	54	26	54	54	2	54	54	1	54	54	1	54	54	
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
DIRTY POWDER	1	49	49	1	49	49	0	49	49	0	49	49	0	49	49	
RESIDUE/SLUDGE	1	58	58	1	58	58	0	58	58	0	58	58	0	58	58	
SOLID WASTE	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8	
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
PROCESS HOLDUP	0	29	29	1	29	29	0	29	29	0	29	29	0	29	29	
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
STATIC INVENTORY																
UF6 CYLINDER REELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
ADU CONVERSION	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5	
UPS RECYCLE	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2	
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
GECO CONVERSION	0	5	5	1	5	5	0	5	5	0	5	5	0	5	5	
UO2 FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
INTERMED. PROD. PELLETS	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5	
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	
ASSEMBLIES	19	42	42	20	42	42	1	42	42	1	42	42	1	42	42	
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4	
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	
NV1TL =	73			97			8			4			3			
NV2TL =		822			822			822			822			822		
NVTL =			829			832			822			822			822	

TABLE A-3 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = 1/2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR O+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1400	.887	.887	11.3	822	829	2334
1000.0	0.0	.1400	.577	.577	42.3	822	832	698
4000.0	3715.1	.276	.891	.246	75.4	822	822	173
6500.0	6500.0	.250	.950	.238	76.2	822	822	105
10000.0	10000.0	.250	.950	.238	76.2	822	822	66

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
158103.2512	316669.7121	474772.9632	474772.9632	689.0377	474.2088	0.0000	300.0000
158075.0119	316669.7121	474744.7239	474744.7239	689.0172	474.1508	0.0000	1000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	475.0201	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	475.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	475.0201	0.0000	10000.0000

TABLE A-4

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma^2 = 1/2 \sigma^2$$

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	142	142	3	142	142	1	142	142	0	142	142	0	142	142
UPS RECYCLE	1	40	40	1	40	40	0	40	40	0	40	40	0	40	40
ADU/UPS CROSS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
GECCO CONVERSION	1	31	31	1	31	31	0	31	31	0	31	31	0	31	31
VENDOR UO2	0	17	17	1	17	17	0	17	17	0	17	17	0	17	17
UO2 FOR SHIPMENT	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	273	273	1	273	273	0	273	273	0	273	273	0	273	273
PELLETS	1	6	6	1	6	6	0	6	6	0	6	6	0	6	6
FUEL RODS	2	5	5	2	5	5	0	5	5	0	5	5	0	5	5
POISON RODS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ASSEMBLIES	1	54	54	1	54	54	1	54	54	1	54	54	0	54	54
PRESS SCRAP	0	11	11	0	11	11	0	11	11	0	11	11	0	11	11
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	49	49	1	49	49	0	49	49	0	49	49	0	49	49
RESIDUE/SLUDGE	0	58	58	0	58	58	0	58	58	0	58	58	0	58	58
SOLID WASTE	0	8	8	0	8	8	0	8	8	0	8	8	0	8	8
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UPS RECYCLE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECCO CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UO2 FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	42	42	7	42	42	1	42	42	0	42	42	0	42	42
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	28			35			4			1			0		
NV2TL =		522			522			522			522			522	
NVTL =			523			524			522			522			522

TABLE A-4 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.887	.887	11.3	822	823	2334
1000.0	0.0	1.000	.577	.577	42.3	822	824	698
4000.0	3715.1	.276	.891	.246	75.4	822	822	173
6500.0	6500.0	.250	.950	.238	76.2	822	822	105
10000.0	10000.0	.250	.950	.238	76.2	822	822	66

VARDR30	VARDSL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
158329.1654	316669.7121	474998.8775	474998.8775	689.2016	974.6724	0.0000	300.0000
158244.4476	316669.7121	474914.1596	474914.1596	689.1402	974.4986	0.0000	1000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	10000.0000

TABLE A-5

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{D_r}^2 = 1/2 \sigma_{D_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL H ₂ O CYLINDERS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	6	142	142	6	142	142	1	142	142	1	142	142	0	142	142
UPS RECYCLE	2	40	40	3	40	40	0	40	40	0	40	40	0	40	40
ADU/UPS CROSS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
GECO CONVERSION	1	31	31	1	31	31	0	31	31	0	31	31	0	31	31
VENDOR UO ₂	1	17	17	1	17	17	0	17	17	0	17	17	0	17	17
UO ₂ FOR SHIPMENT	9	2	9	11	2	11	1	2	2	1	2	2	1	2	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	273	273	1	273	273	0	273	273	0	273	273	0	273	273
PELLETS	2	6	6	3	6	6	0	6	6	0	6	6	0	6	6
FUEL RODS	4	5	5	5	5	5	1	5	5	0	5	5	0	5	5
POISON RODS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ASSEMBLIES	19	54	54	23	54	54	1	54	54	1	54	54	1	54	54
PRESS SCRAP	1	11	11	1	11	11	0	11	11	0	11	11	0	11	11
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	49	49	1	49	49	0	49	49	0	49	49	0	49	49
RESIDUE/SLUDGE	1	58	58	1	58	58	0	58	58	0	58	58	0	58	58
SOLID WASTE	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	29	29	1	29	29	0	29	29	0	29	29	0	29	29
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
UPS RECYCLE	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	19	42	42	18	42	42	1	42	42	1	42	42	1	42	42
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	73			89			5			4			3		
NV2TL =		822			822			822			822			822	
NVTL =			829			831			822			822			822

TABLE A-5 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\frac{\sigma_r^2}{\hat{D}_r} = \frac{1}{2} \frac{\sigma_s^2}{\hat{D}_s}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.887	.887	11.3	822	829	1182
1000.0	61.1	.959	.611	.586	41.4	822	831	349
4000.0	4000.0	.500	.950	.475	52.5	822	822	86
6500.0	6500.0	.500	.950	.475	52.5	822	822	52
10000.0	10000.0	.500	.950	.475	52.5	822	822	31

VARDR30	VAROSTL	VAROH0	VDMUFH0	SDMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
158103.2512	316669.7121	474772.9632	474772.9632	689.0377	974.2088	0.0000	300.0000
158082.7135	316669.7121	474752.4256	474752.4256	689.0228	974.1666	0.0000	1000.0000
158498.6011	316669.7121	475166.3131	475166.3131	689.3245	975.0201	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	10000.0000

TABLE A-6

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = 1/2 \sigma_s^2$$

UD₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	142	142	3	142	142	0	142	142	0	142	142	0	142	142
UPS RECYCLE	1	40	40	1	40	40	0	40	40	0	40	40	0	40	40
ADU/UPS CROSS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
GECO CONVERSION	1	31	31	1	31	31	0	31	31	0	31	31	0	31	31
VENDOR UO2	0	17	17	1	17	17	0	17	17	0	17	17	0	17	17
UD2 FOR SHIPMENT	3	2	3	4	2	4	0	2	2	0	2	2	0	2	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	273	273	1	273	273	0	273	273	0	273	273	0	273	273
PELLETS	1	6	6	1	6	6	0	6	6	0	6	6	0	6	6
FUEL RODS	4	5	5	2	5	5	0	5	5	0	5	5	0	5	5
POISON RODS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
ASSEMBLIES	7	54	54	8	54	54	1	54	54	1	54	54	0	54	54
PRESS SCRAP	0	11	11	0	11	11	0	11	11	0	11	11	0	11	11
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	49	49	1	49	49	0	49	49	0	49	49	0	49	49
RESIDUE/SLUDGE	0	58	58	0	58	58	0	58	58	0	58	58	0	58	58
SOLID WASTE	0	8	8	0	8	8	0	8	8	0	8	8	0	8	8
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UPS RECYCLE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
UD2 FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	42	42	6	42	42	1	42	42	0	42	42	0	42	42
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	26			33			2			1			0		
NV2TL =		822			822			822			822			822	
NVTL =			823			824			822			822			822

TABLE A-6 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\frac{\sigma_r^2}{\hat{\sigma}_r} = 1/2 \frac{\sigma_s^2}{\hat{\sigma}_s}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.000	.887	.887	11.3	822	823	1182
1000.0	60.6	.959	.611	.586	41.4	822	824	349
4000.0	4000.0	.500	.950	.475	52.5	822	822	86
6500.0	6500.0	.500	.950	.475	52.5	822	822	52
10000.0	10000.0	.500	.950	.475	52.5	822	822	31

VARDPR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
158329.1654	316669.7121	474998.8775	474998.8775	689.2016	974.6724	0.0000	300.0000
158244.4476	316669.7121	474914.1596	474914.1596	689.1402	974.4986	0.0000	1000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	4000.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	6500.0000
158498.6011	316669.7121	475168.3131	475168.3131	689.3245	975.0201	0.0000	10000.0000

TABLE A-7

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma^2 = \sigma^2$$

$$\sigma_F^2 = \sigma_S^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	71	71	3	71	71	1	71	71	1	71	71	0	71	71
UPS RECYCLE	1	20	20	1	20	20	1	20	20	0	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
GECO CONVERSION	1	16	16	1	16	16	0	16	16	0	16	16	0	16	16
VENDOR UO ₂	0	6	6	1	6	6	0	6	6	0	6	6	0	6	6
UO ₂ FOR SHIPMENT	3	1	3	4	1	4	2	1	2	1	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	136	136	1	136	136	1	136	136	0	136	136	0	136	136
FUEL RODS	1	3	3	2	3	3	1	3	3	1	3	3	0	3	3
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	6	27	27	7	27	27	4	27	27	1	27	27	1	27	27
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	4	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	6	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	21	21	5	21	21	3	21	21	1	21	21	1	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	25			31			19			9			2		
NV2TL =		419			419			419			419			419	
NVTL =			421			422			420			419			419

TABLE A-7 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.898	.898	10.2	419	421	4903
1000.0	0.0	1.000	.651	.651	34.9	419	422	1498
4000.0	2417.4	.164	.414	.068	93.2	419	420	376
6500.0	5652.8	.074	.719	.053	94.7	419	419	231
10000.0	9670.3	.055	.891	.049	95.1	419	419	149

CEPROR = 316669.712 THE RANDOM COMPONENT OF VARMUF = 0.

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .317E+06
FOR A GOAL QUANTITY OF 300.0 NTL = 406
FOR A GOAL QUANTITY OF 1000.0 NTL = 406
FOR A GOAL QUANTITY OF 4000.0 NTL = 406
FOR A GOAL QUANTITY OF 6500.0 NTL = 406
FOR A GOAL QUANTITY OF 10000.0 NTL = 406

VARDR30	VARDSTL	VARDMD	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
315970.4777	316669.7121	632540.1897	632540.1897	795.3240	1257.0408	0.0000	300.0000
315785.7598	316669.7121	632455.4719	632455.4719	795.2707	1256.9060	0.0000	1000.0000
316039.9134	316669.7121	632709.6254	632709.6254	795.4305	1257.3104	0.0000	4000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-8

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_D^2 = \sigma_{\hat{D}_S}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	6	71	71	7	71	71	4	71	71	1	71	71	1	71	71
UPS RECYCLE	2	20	20	2	20	20	1	20	20	1	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	1	4	4	0	4	4	0	4	4
GECO CONVERSION	1	16	16	1	16	16	1	16	16	0	16	16	0	16	16
VENDOR UO ₂	1	8	8	1	8	8	1	8	8	0	8	8	0	8	8
UO ₂ FOR SHIPMENT	4	1	8	10	1	10	5	1	5	2	1	2	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	136	136	1	136	136	1	136	136	1	136	136	0	136	136
FUEL RODS	4	3	4	4	3	4	2	3	3	1	3	3	1	3	3
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ASSEMBLIES	17	27	27	20	27	27	11	27	27	3	27	27	1	27	27
PRESS SCRAP	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	25	25	1	25	25	1	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	1	29	29	1	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	1	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	13	21	21	14	21	21	4	21	21	2	21	21	1	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	68			78			42			12			5		
NV2TL =		419			419			419			419			419	
NV3TL =			427			429			423			428			419

TABLE A-8 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR O+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.898	.898	10.2	419	427	4903
1000.0	0.0	1.000	.651	.651	34.9	419	429	1498
4000.0	2418.5	.163	.414	.068	93.2	419	423	376
6500.0	5653.8	.074	.719	.053	94.7	419	420	231
10000.0	9670.3	.055	.691	.049	95.1	419	419	149

VAR _{DR30}	VAR _{DSTL}	VAR _{DH0}	VAR _{MUFH0}	SD _{MUFH0}	SD _{MUFH1}	VAR _{MUF}	GOAL QUANTITY
315174.6932	316669.7121	631844.4052	631844.4052	794.8864	1255.9333	0.0000	300.0000
315149.2778	316669.7121	631818.9899	631818.9899	794.8704	1255.8928	0.0000	1000.0000
315734.9291	316669.7121	632404.6412	632404.6412	795.2387	1256.8251	0.0000	4000.0000
316039.9134	316669.7121	632709.6254	632709.6254	795.4305	1257.3104	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-9

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	71	71	0	71	71	0	71	71	0	71	71	0	71	71
UPS RECYCLE	1	20	20	1	20	20	0	20	20	0	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
GECD CONVERSION	1	16	16	1	16	16	0	16	16	0	16	16	0	16	16
VENDOR UO2	0	8	8	1	8	8	0	8	8	0	8	8	0	8	8
UO2 FOR SHIPMENT	3	1	3	4	1	4	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	136	136	1	136	136	0	136	136	0	136	136	0	136	136
FUEL RODS	1	3	3	2	3	3	1	3	3	0	3	3	0	3	3
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	4	27	27	7	27	27	1	27	27	1	27	27	0	27	27
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECD CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO2 FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	21	21	5	21	21	1	21	21	0	21	21	0	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	25			31			5			1			0		
NV2TL =		419			419			419			419			419	
NVTL =			421			422			419			419			419

TABLE A-9 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_T}^2 = \sigma_{\hat{D}_S}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1000	.898	.898	10.2	419	421	2334
1000.0	0.0	.1000	.651	.651	34.9	419	422	698
4000.0	3506.5	.297	.647	.251	74.9	419	419	173
6500.0	6500.0	.250	.950	.238	76.2	419	419	105
10000.0	10000.0	.250	.950	.238	76.2	419	419	66

VARDR30	VARDSL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
315470.4777	316669.7121	632540.1897	632540.1897	795.3240	1257.0408	0.0000	300.0000
315765.7598	316669.7121	632455.4719	632455.4719	795.2707	1256.9060	0.0000	1000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	4000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-10

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_D^2 = \sigma_D^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STATION	GOAL QUANTITY														
	300.0			1000.0			4000.0			8500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	71	71	2	71	71	1	71	71	1	71	71	0	71	71
UPS RECYCLE	2	20	20	2	20	20	1	20	20	0	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
BECD CONVERSION	1	16	16	1	16	16	0	16	16	0	16	16	0	16	16
VENDOR UO ₂	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
UO ₂ FOR SHIPMENT	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	136	136	1	136	136	0	136	136	0	136	136	0	136	136
FUEL RODS	4	3	4	4	3	4	1	3	3	0	3	3	0	3	3
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	17	27	27	20	27	27	2	27	27	1	27	27	1	27	27
PRESS SCRAP	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	25	25	1	25	25	0	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	1	29	29	1	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	1	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
BECD CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	13	21	21	16	21	21	2	21	21	1	21	21	1	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	66			78			9			4			3		
NV2TL =		419			419			419			419			419	
NVTL =			427			429			419			419			419

TABLE A-10 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.898	.898	10.2	419	427	2334
1000.0	0.0	1.000	.651	.651	34.9	419	429	698
4000.0	3506.5	.297	.847	.251	74.9	419	419	173
6500.0	6500.0	.250	.950	.238	76.2	419	419	105
10000.0	10000.0	.250	.950	.238	76.2	419	419	66

VARPM30	VAROSTL	VARPH0	VOMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
315174.6932	316669.7121	631844.4052	631844.4052	794.8864	1255.9333	0.0000	300.0000
315149.2778	316669.7121	631818.9899	631818.9899	794.8704	1255.8928	0.0000	1000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	4000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-11

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STATION	GOAL QUANTITY														
	100.0			1000.0			4000.0			4500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	71	71	0	71	71	0	71	71	0	71	71	0	71	71
UPS RECYCLE	1	20	20	1	20	20	0	20	20	0	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
BECCO CONVERSION	1	16	16	1	16	16	0	16	16	0	16	16	0	16	16
VENDOR UO ₂	0	8	8	1	8	8	0	8	8	0	8	8	0	8	8
UO ₂ FOR SHIPMENT	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	136	136	1	136	136	0	136	136	0	136	136	0	136	136
FUEL RODS	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	0	27	27	0	27	27	1	27	27	1	27	27	0	27	27
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	0	29	29	0	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
BECCO CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	0	21	21	0	21	21	1	21	21	0	21	21	0	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	20			31			2			1			0		
NV2TL =		419			419			419			419			419	
NVTL =			421			422			419			419			419

TABLE A-11 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{Dr}^2 = \sigma_{Ds}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.898	.898	10.2	419	421	1182
1000.0	0.0	1.000	.851	.851	34.9	419	422	349
4000.0	4000.0	.500	.750	.475	52.5	419	419	86
6500.0	6500.0	.500	.950	.475	52.5	419	419	52
10000.0	10000.0	.500	.950	.475	52.5	419	419	31

VARDR10	VARDS1L	VARDR0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
315870.4777	316669.7121	632540.1897	632540.1897	795.3240	1257.0408	0.0000	300.0000
315785.7598	316669.7121	632455.4719	632455.4719	795.2707	1256.9060	0.0000	1000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	4000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-12

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{Dr}^2 = \sigma_{Ds}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR SAMMA = .30

STRATUM	GOAL QUANTITY														
	100.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	71	71	7	71	71	1	71	71	1	71	71	0	71	71
UPS RECYCLE	2	20	20	2	20	20	0	20	20	0	20	20	0	20	20
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
BECD CONVERSION	1	16	16	1	16	16	0	16	16	0	16	16	0	16	16
VENDOR UO ₂	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
UO ₂ FOR SHIPMENT	0	1	1	10	1	10	1	1	1	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	136	136	1	136	136	0	136	136	0	136	136	0	136	136
PELLETS	2	3	3	2	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	0	3	4	4	3	4	1	3	3	0	3	3	0	3	3
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	17	27	27	20	27	27	1	27	27	1	27	27	1	27	27
PRESS SCRAP	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	25	25	1	25	25	0	25	25	0	25	25	0	25	25
RESIDUE/SLUDGE	1	29	29	1	29	29	0	29	29	0	29	29	0	29	29
SOLID WASTE	0	4	4	1	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	14	14	0	14	14	0	14	14	0	14	14	0	14	14
STANDARDS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
UPS RECYCLE	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
BECD CONVERSION	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	3	3	0	3	3	0	3	3	0	3	3	0	3	3
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	13	21	21	16	21	21	1	21	21	1	21	21	1	21	21
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
RESIDUE/SLUDGE	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	56			78			5			6			3		
NV2TL =		419			419			419			419			419	
NVTL =			427			429			419			419			419

TABLE A-12 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\frac{\sigma_r^2}{\hat{D}_r} - \frac{\sigma_s^2}{\hat{D}_s}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.898	.898	10.2	419	427	1182
1000.0	0.0	1.000	.651	.651	34.9	419	429	349
4000.0	4000.0	.500	.950	.475	52.5	419	419	86
6500.0	6500.0	.500	.950	.475	52.5	419	419	52
10000.0	10000.0	.500	.950	.475	52.5	419	419	31

VARDR30	VARPSTL	VARQIU	VARMUF0	S0MUFH0	S0MUFH1	VARMUF	GOAL QUANTITY
315174.6932	316669.7121	631844.4052	631844.4052	794.8864	1255.9333	0.0000	300.0000
315149.2778	316669.7121	631814.9899	631814.9899	794.8704	1255.8928	0.0000	1000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	4000.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	6500.0000
316548.2204	316669.7121	633217.9325	633217.9325	795.7499	1258.1187	0.0000	10000.0000

TABLE A-13
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\hat{\sigma}_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	36	36	2	36	36	2	36	36	1	36	36	1	36	36
UPS RECYCLE	1	10	10	1	10	10	1	10	10	1	10	10	0	10	10
ADU/UPS CROSS	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
GECO CONVERSION	1	8	8	1	8	8	1	8	8	0	8	8	0	8	8
VENDOR UO2	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO2 FOR SHIPMENT	3	1	3	3	1	3	3	1	3	1	1	1	1	1	1
POWDER/PELLETS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
INTERMED. PROD.	1	68	68	1	68	68	1	68	68	0	68	68	0	68	68
PELLETS	1	2	2	1	2	2	1	2	2	1	2	2	0	2	2
FUEL RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	0	14	14	0	14	14	0	14	14	2	14	14	1	14	14
PRESS SCRAP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	12	12	0	12	12	0	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	0	15	15	0	15	15	0	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO2 FOR SHIPMENT	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	4	10	10	4	10	10	4	10	10	2	10	10	1	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	23			23			24			9			4		
NV2TL =		220			220			220			220			220	
NVTL =			222			222			222			220			220

TABLE A-13 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = 2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.909	.909	9.1	220	222	4903
1000.0	0.0	1.000	.731	.731	26.9	220	222	1498
4000.0	1288.9	.581	.254	.097	90.3	220	222	376
6500.0	4958.0	.102	.524	.053	94.7	220	220	231
10000.0	4257.3	.062	.811	.051	94.9	220	220	149

CERROR = 633339.424 THE RANDOM COMPONENT OF VARMUF = 0.

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .633E+06
FOR A GOAL QUANTITY OF 300.0 NTL = 203
FOR A GOAL QUANTITY OF 1000.0 NTL = 203
FOR A GOAL QUANTITY OF 4000.0 NTL = 203
FOR A GOAL QUANTITY OF 6500.0 NTL = 203
FOR A GOAL QUANTITY OF 10000.0 NTL = 203

VARDP30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	300.0000
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	1000.0000
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	4000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	6500.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	10000.0000

TABLE A-14

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{D_r}^2 = 2\sigma_{D_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT 0.050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	G O A L Q U A N T I T Y														
	340.0			1000.0			4000.0			8500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
FULL UO ₂ CYLINDERS	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	36	36	5	36	36	5	36	36	2	36	36	1	36	36
UPS RECYCLE	2	10	10	2	10	10	2	10	10	1	10	10	0	10	10
ADU/UPS CROSS	1	2	2	1	2	2	1	2	2	1	2	2	0	2	2
GECO CONVERSION	1	8	8	1	8	8	1	8	8	1	8	8	0	8	8
VENDOR UO ₂	1	4	4	1	4	4	1	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	7	1	7	7	1	7	8	1	8	3	1	3	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	68	68	1	68	68	1	68	68	1	68	68	0	68	68
PELLETS	2	2	2	2	2	2	2	2	2	1	2	2	1	2	2
FUEL RODS	1	1	3	1	1	3	1	1	4	1	1	1	1	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
ASSEMBLIES	15	14	15	15	14	15	16	14	16	5	14	14	1	14	14
PRESS SCRAP	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	12	12	1	12	12	1	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	1	15	15	1	15	15	1	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PELLETS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	12	10	12	12	10	12	13	10	13	4	10	10	1	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	59			60			64			62			6		
NV2TL =		220			220			220			220			220	
NVTL =			231			231			235			222			220

TABLE A-14 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{D_r}^2 - 2\sigma_{D_r D_s}^2 + \sigma_{D_s}^2$$

UQ₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR COMUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.909	.909	9.1	220	231	4903
1000.0	0.0	1.000	.729	.729	27.1	220	231	1498
4000.0	1352.1	.163	.261	.095	90.5	220	235	376
6500.0	4959.5	.102	.524	.053	94.7	220	222	231
10000.0	9257.3	.062	.611	.051	94.9	220	220	149

VARDF30	VARDF1L	VARDFH0	VARDFH0	SDMDFH0	SDMDFH1	VARDFH0	GOAL QUANTITY
616508.7220	316669.7121	933178.4340	933178.4340	966.0116	1668.1441	0.0000	300.0000
616508.7220	316669.7121	933178.4340	933178.4340	966.0116	1668.1441	0.0000	1000.0000
611449.6937	316669.7121	928119.3957	928119.3957	963.3895	1662.0675	0.0000	4000.0000
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	6500.0000
629411.6006	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	10000.0000

TABLE A-15
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\hat{D}_T^2 = 2 \hat{D}_S^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .450
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	36	36	2	36	36	1	36	36	0	36	36	0	36	36
UPS RECYCLE	1	10	10	1	10	10	1	10	10	0	10	10	0	10	10
ADU/UPS CROSS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
BECCO CONVERSION	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
VENDOR UO ₂	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	3	1	3	3	1	3	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	68	68	1	68	68	0	68	68	0	68	68	0	68	68
PELLETS	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
FUEL RODS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	14	14	5	14	14	2	14	14	1	14	14	0	14	14
PRESS SCRAP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	12	12	0	12	12	0	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	0	15	15	0	15	15	0	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
BECCO CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	4	10	10	4	10	10	1	10	10	1	10	10	0	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL *	23			23			8			2			0		
NV2TL *		220			420			220			220			220	
NVTL *			222			422			220			220			220

TABLE A-15 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = 2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.909	.909	9.1	220	222	2334
1000.0	0.0	1.000	.731	.731	26.9	220	222	698
4000.0	3006.4	.357	.734	.259	74.1	220	220	173
6500.0	6280.2	.262	.922	.242	75.8	220	220	105
10000.0	10000.0	.250	.950	.238	76.2	220	220	66

VAPOR30	VAROSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	300.0000
628433.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	1000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	4000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	6500.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	10000.0000

TABLE A-16
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\frac{2}{D_r} = 2 \frac{2}{D_s}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT 0.050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = 0.30

STRATUM	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
AOU CONVERSION	5	36	36	5	36	36	2	36	36	1	36	36	0	36	36
UPS RECYCLE	4	10	10	2	10	10	1	10	10	0	10	10	0	10	10
ADU/UPS CROSS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
GECO CONVERSION	1	6	6	1	6	6	1	6	6	0	6	6	0	6	6
VENDOR UO2	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
UO2 FOR SHIPMENT	7	1	7	7	1	7	2	1	2	1	1	1	1	1	1
POWDER/PELLETS	6	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	68	68	1	68	68	1	68	68	0	68	68	0	68	68
PELLETS	2	2	2	2	2	2	1	2	2	0	2	2	0	2	2
FUEL RODS	3	1	3	3	1	3	1	1	1	1	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	10	14	15	15	14	15	4	14	14	1	14	14	1	14	14
PRESS SCRAP	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	12	12	1	12	12	0	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	1	15	15	1	15	15	0	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
AOU CONVERSION	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO2 FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	12	10	12	12	10	12	3	10	10	1	10	10	1	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	59			60			17			5			3		
NV2TL =		220			220			220			220			220	
NVTL =			231			231			221			220			220

TABLE A-16 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = 2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.909	.909	9.1	220	231	2334
1000.0	0.0	1.000	.729	.729	27.1	220	231	698
4000.0	3007.3	.353	.734	.259	74.1	220	221	173
6500.0	6240.2	.262	.922	.242	75.8	220	220	105
10000.0	10000.0	.250	.950	.250	75.2	220	220	66

VARDEF0	VARDEF1	VARDEF2	VARDEF3	SOMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
616508.7220	316669.7121	933178.4340	933178.4340	966.0116	1068.1441	0.0000	300.0000
616508.7220	316669.7121	933178.4340	933178.4340	966.0116	1068.1441	0.0000	1000.0000
629103.3816	316669.7121	945773.0936	945773.0936	972.5087	1083.1765	0.0000	4000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1083.7804	0.0000	6500.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1083.7804	0.0000	10000.0000

TABLE A-17
 NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
 OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
 NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{Dr}^2 = 2\sigma_{Ds}^2$$

BASED ON VERIFICATION 240 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UFG CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UFG CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	36	36	0	36	36	0	36	36	0	36	36	0	36	36
UPS RECYCLE	1	10	10	1	10	10	0	10	10	0	10	10	0	10	10
ADU/UPS GROSS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
GECD CONVERSION	1	8	8	1	8	8	0	8	8	0	8	8	0	8	8
VENDOR UO ₂	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	3	1	3	3	1	3	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	1	68	68	1	68	68	0	68	68	0	68	68	0	68	68
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	14	14	5	14	14	1	14	14	1	14	14	0	14	14
PRESS SCRAP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	12	12	0	12	12	0	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	0	15	15	0	15	15	0	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UFG CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS GROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECD CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD. PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	4	10	10	4	10	10	1	10	10	0	10	10	0	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	23			23			2			1			0		
NV2TL =		226			220			220			220			220	
NVTL =			222			222			220			220			220

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

TABLE A-17 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.909	.909	9.1	220	222	1102
1000.0	0.0	1.000	.731	.731	26.9	220	222	349
4000.0	4000.0	.500	.550	.475	52.5	220	220	86
6500.0	6500.0	.500	.450	.475	52.5	220	220	52
10000.0	10000.0	.500	.450	.475	52.5	220	220	31

VARMUFG	VARMUFL	VARMUFD	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
628933.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	300.0000
628933.9459	316669.7121	945603.6579	945603.6579	972.4215	1682.9752	0.0000	1000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	4000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	6500.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	10000.0000

TABLE A-18

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_D^2 = 2 \sigma_D^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .000
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4600.0			6600.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	5	36	36	5	36	36	1	36	36	1	36	36	0	36	36
UPS RECYCLE	2	10	10	2	10	10	0	10	10	0	10	10	0	10	10
ADU/UPS CROSS	4	2	2	1	2	2	0	2	2	0	2	2	0	2	2
GECO CONVERSION	1	6	6	1	6	6	0	6	6	0	6	6	0	6	6
VENDOR UO ₂	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	7	1	7	7	1	7	1	1	1	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	68	68	1	68	68	0	68	68	0	68	68	0	68	68
PELLETS	2	2	2	2	2	2	0	2	2	0	2	2	0	2	2
FUEL RODS	3	1	3	3	1	3	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	15	14	15	15	14	15	1	14	14	1	14	14	1	14	14
PRESS SCRAP	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	12	12	1	12	12	0	12	12	0	12	12	0	12	12
RESIDUE/SLUDGE	1	15	15	1	15	15	0	15	15	0	15	15	0	15	15
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STATIC INVENTORY															
UO ₂ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UPS RECYCLE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ FOR SHIPMENT	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	14	14	12	12	10	12	1	10	10	1	10	10	1	10	10
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
RESIDUE/SLUDGE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	54			60			5			4			1		
NV2TL =		220			220			220			220			220	
NVTL =			231			231			220			220			220

TABLE A-18 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
NEW ENDING PLUS STATIC INVENTORY

$$\sigma_{\hat{D}_r}^2 = 2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION ON 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.904	.900	9.1	220	231	1182
1000.0	0.0	1.000	.729	.729	27.1	220	231	349
4000.0	4000.0	.700	.950	.475	52.5	220	220	86
6500.0	6500.0	.500	.950	.475	52.5	220	220	52
10000.0	10000.0	.700	.950	.475	52.5	220	220	31

VARH130	VARH12L	VARH10	VDMUFH0	SDMUFH0	SDMUFH1	VARHUF	GOAL QUANTITY
616508.7220	316669.7121	933178.4346	933178.4340	966.0116	1668.1441	0.0000	300.0000
616508.7220	316669.7121	933178.4346	933178.4340	966.0116	1668.1441	0.0000	1000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	4000.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	6500.0000
629611.6886	316669.7121	946281.4007	946281.4007	972.7700	1683.7804	0.0000	10000.0000

SECTION B

RESULTS OF THE VARIABLES INSPECTION PLAN FOR THE ENTIRE MATERIAL BALANCE

This section shows the estimates of the number of required variable measurements in the inspection plan. These estimates and the results in Section A encompass the inspection variables program discussed in this report. The calculations reported in this section are for the inspection of the entire material balance, which includes the new ending inventory, shipments to, and shipments from the facility during the last six-month inventory period. The beginning inventory was inspected as the ending inventory of the previous inspections. The calculations are given for the ratio of the random error variance component under the alternate hypothesis of the $\hat{D}$ statistic, $\sigma_{\hat{D}_r}^2$, to the systematic error variance component of the $\hat{D}$ statistic, $\sigma_{\hat{D}_s}^2$, equal to 1/2, 1, and 2. For each of these ratios the calculations are further given for non-detection probabilities for gross defects of 0.05, 0.25, and 0.50. For each of the non-detection probabilities the calculations are finally broken down for the detection of partial defects and bias with gamma of 0.3 and 0.1. Definitions of the variables used in the output are included in the Glossary.

TABLE B-1

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 1/2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.4 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	15	6	15	22	6	22	24	6	24	8	6	8	2	6	6
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	4	13	13	1	13	13	2	13	13	1	13	13	0	13	13
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	16	3	16	16	3	16	20	3	20	6	3	6	2	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	10	50	50	27	50	50	34	50	50	10	50	50	3	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	1	109	109	1	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	36	36	1	36	36	1	36	36	0	36	36	0	36	36
SOLID DISCARDS	1	2	2	0	2	2	1	2	2	0	2	2	0	2	2
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	5	62	62	4	62	62	5	62	62	2	62	62	1	62	62
UPS RECYCLE	2	17	17	2	17	17	2	17	17	1	17	17	1	17	17
ADU/UPS CROSS	1	4	4	1	4	4	1	4	4	1	4	4	0	4	4
GECO CONVERSION	1	14	14	1	14	14	1	14	14	1	14	14	0	14	14
VENDOR UO ₂	1	7	7	1	7	7	1	7	7	0	7	7	0	7	7
UO ₂ FOR SHIPMENT	7	1	7	6	1	6	8	1	8	3	1	3	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	119	119	1	119	119	1	119	119	1	119	119	0	119	119
PELLETS	2	3	3	2	3	3	2	3	3	1	3	3	1	3	3
FUEL RODS	3	2	3	3	2	3	4	2	4	1	2	2	1	2	2
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
ASSEMBLIES	12	24	24	13	24	24	16	24	24	5	24	24	2	24	24
PRESS SCRAP	1	5	5	1	5	5	1	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	21	21	1	21	21	1	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	1	25	25	1	25	25	1	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	109			107			129			43			14		
NV2TL =	554			554			554			554			554		
NVTL =	585			589			598			561			554		

TABLE B-1 (continued)
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.914	.914	8.6	554	585	9128
1000.0	0.0	1.000	.763	.763	23.7	554	589	2895
4000.0	1142.2	.425	.258	.110	89.0	554	598	821
6500.0	4788.4	.110	.524	.058	94.2	554	561	513
10000.0	9079.5	.066	.786	.052	94.8	554	554	342

CERROR = 554490.650 THE RANDOM COMPONENT OF VARMUF = .227E+06

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .554E+06
FOR A GOAL QUANTITY OF 300.0 NTL = 543
FOR A GOAL QUANTITY OF 1000.0 NTL = 543
FOR A GOAL QUANTITY OF 4000.0 NTL = 543
FOR A GOAL QUANTITY OF 6500.0 NTL = 543
FOR A GOAL QUANTITY OF 10000.0 NTL = 543

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
546685.8961	1108981.3001	1655667.1962	1161436.0601	1077.6994	1073.7663	494231.1361	300.0000
545994.7944	1108981.3001	1654976.0946	1160744.9585	1077.3787	1072.9403	494231.1361	1000.0000
545240.2574	1108981.3001	1654221.5579	1159990.4218	1077.0285	1072.0380	494231.1361	4000.0000
550766.5706	1108981.3001	1659747.8707	1165516.7346	1079.5910	1078.6353	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	10000.0000

TABLE B-2
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UO ₂ CYLINDERS	0	6	0	0	6	0	9	6	9	3	6	6	1	6	6
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	13	13	1	13	13	1	13	13	1	13	13	0	13	13
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	0	3	6	0	3	6	7	3	7	2	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	10	50	50	9	50	50	12	50	50	4	50	50	1	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	1	109	109	0	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	36	36	0	36	36	0	36	36	0	36	36	0	36	36
SOLID DISCARDS	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
NEW ENVIING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	62	62	2	62	62	2	62	62	1	62	62	1	62	62
UPS RECYCLE	1	17	17	1	17	17	1	17	17	1	17	17	0	17	17
ADU/UPS CROSS	1	4	4	0	4	4	1	4	4	0	4	4	0	4	4
DECO CONVERSION	1	14	14	1	14	14	1	14	14	0	14	14	0	14	14
VENDOR UO ₂	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
UO ₂ FOR SHIPMENT	3	1	3	2	1	2	3	1	3	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	119	119	1	119	119	1	119	119	0	119	119	0	119	119
PELLETS	1	3	3	1	3	3	1	3	3	1	3	3	0	3	3
FUEL RODS	1	2	2	1	2	2	1	2	2	1	2	2	0	2	2
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	0	24	24	0	24	24	6	24	24	2	24	24	1	24	24
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	21	21	0	21	21	0	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	43			40			48			17			6		
NV2TL =		554			554			554			554			554	
NVTL =			561			560			563			554			554

TABLE B-2 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.914	.914	8.6	554	561	9128
1000.0	0.0	1.000	.764	.764	23.6	554	560	2895
4000.0	1125.1	.431	.256	.110	89.0	554	563	821
6500.0	4781.0	.110	.022	.058	94.2	554	554	513
10000.0	9079.5	.066	.086	.052	94.8	554	554	342

VAROR30	VARDSTL	VAROHO	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
550766.5706	1108981.3001	1659747.8707	1165516.7346	1079.5910	1978.6353	494231.1361	300.0000
550936.0063	1108981.3001	1659917.3064	1165686.1793	1079.6695	1678.8372	494231.1361	1000.0000
550090.4992	1108981.3001	1659072.1993	1164841.0532	1079.2780	1677.8361	494231.1361	4000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	10000.0000

TABLE B-3

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	15	6	15	22	6	22	7	6	7	2	6	6	1	6	6
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	4	13	13	1	13	13	1	13	13	0	13	13	0	13	13
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	14	3	18	16	3	16	5	3	5	1	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	30	50	50	27	50	50	9	50	50	2	50	50	1	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	1	109	109	0	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	36	36	1	36	36	0	36	36	0	36	36	0	36	36
SOLID DISCARDS	1	2	2	0	2	2	0	2	2	0	2	2	0	2	2
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	5	62	62	4	62	62	2	62	62	1	62	62	0	62	62
UPS RECYCLE	2	17	17	2	17	17	1	17	17	0	17	17	0	17	17
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
GECO CONVERSION	1	14	14	1	14	14	1	14	14	0	14	14	0	14	14
VENDOR UO ₂	1	7	7	1	7	7	0	7	7	0	7	7	0	7	7
UO ₂ FOR SHIPMENT	7	1	7	6	1	6	2	1	2	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PRODU.	1	119	119	1	119	119	1	119	119	0	119	119	0	119	119
PELLETS	4	3	3	2	3	3	1	3	3	0	3	3	0	3	3
FUEL RODS	3	2	3	3	2	3	1	2	2	1	2	2	0	2	2
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	15	24	24	13	24	24	4	24	24	1	24	24	1	24	24
PRESS SCRAP	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	21	21	1	21	21	0	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	1	25	25	1	25	25	0	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	109			107			37			9			5		
NV2TL =		554			554			554			554			554	
NVTL =			585			589			550			554			554

TABLE B-3 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.914	.914	8.6	554	585	4401
1000.0	0.0	1.000	.763	.763	23.7	554	589	1404
4000.0	2832.6	.375	.714	.267	73.3	554	558	402
6500.0	5101.9	.272	.899	.245	75.5	554	554	244
10000.0	10000.0	.250	.950	.238	76.2	554	554	160

VAROR30	VAROSTL	VAROHO	VOMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
546685.8961	1108981.3001	1655667.1962	1161436.0601	1077.6994	1073.7663	494231.1361	300.0000
545994.7944	1108981.3001	1654976.0946	1160744.9585	1077.3787	1072.9403	494231.1361	1000.0000
551824.6207	1108981.3001	1660805.9208	1166574.7847	1080.0809	1079.8954	494231.1361	4000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	10000.0000

TABLE B-4
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UO ₂ CYLINDERS	8	6	8	8	6	8	3	6	6	1	6	6	1	6	6
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNH PRODUCTS	1	13	13	1	13	13	1	13	13	0	13	13	0	13	13
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	6	3	6	6	3	6	2	3	3	1	3	3	0	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	10	50	50	9	50	50	3	50	50	1	50	50	1	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	0	109	109	0	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	36	36	0	36	36	0	36	36	0	36	36	0	36	36
SOLID DISCARDS	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	62	62	2	62	62	1	62	62	0	62	62	0	62	62
UPS RECYCLE	1	17	17	1	17	17	1	17	17	0	17	17	0	17	17
ADU/UPS CROSS	1	4	4	0	4	4	0	4	4	0	4	4	0	4	4
BECO CONVERSION	1	14	14	1	14	14	0	14	14	0	14	14	0	14	14
VENDOR UO ₂	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
UO ₂ FOR SHIPMENT	3	1	3	2	1	2	1	1	1	1	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	119	119	1	119	119	0	119	119	0	119	119	0	119	119
PELLETS	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
FUEL RODS	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	9	24	24	5	24	24	2	24	24	1	24	24	0	24	24
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	21	21	0	21	21	0	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	42			40			16			5			2		
NV2TL =		554			554			554			554			554	
NVTL =			561			560			554			554			554

TABLE B-4 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.914	.914	8.6	554	561	4401
1000.0	0.0	1.000	.764	.764	23.6	554	560	1404
4000.0	2828.9	.375	.713	.267	73.3	554	554	402
6500.0	6101.9	.272	.899	.245	75.5	554	554	244
10000.0	10000.0	.250	.950	.238	76.2	554	554	160

VARDR30	VARDSL	VARDH0	VDMUFH0	SOMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
550766.5706	1108981.3001	1659747.8707	1165516.7346	1079.5910	1078.6353	494231.1361	300.0000
550936.0063	1108981.3001	1659917.3064	1165686.1703	1079.6695	1078.8372	494231.1361	1000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	4000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1082.6826	494231.1361	10000.0000

TABLE B-5

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 1/2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	15	6	15	22	6	22	2	6	6	1	6	6	1	6	6
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNH PRODUCTS	1	13	13	1	13	13	0	13	13	0	13	13	0	13	13
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	14	3	16	16	3	16	1	3	3	1	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	30	50	50	27	50	50	2	50	50	1	50	50	1	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	0	109	109	0	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	36	36	1	36	36	0	36	36	0	36	36	0	36	36
SOLID DISCARDS	1	2	2	0	2	2	0	2	2	0	2	2	0	2	2
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	5	62	62	4	62	62	1	62	62	1	62	62	0	62	62
UPS RECYCLE	2	17	17	2	17	17	0	17	17	0	17	17	0	17	17
ADU/UPS CROSS	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
GECD CONVERSION	1	14	14	1	14	14	0	14	14	0	14	14	0	14	14
VENDOR UO2	1	7	7	1	7	7	0	7	7	0	7	7	0	7	7
UO2 FOR SHIPMENT	1	1	1	6	1	6	1	1	1	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	119	119	1	119	119	0	119	119	0	119	119	0	119	119
PELLETS	2	3	3	2	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	3	2	3	3	2	3	1	2	2	0	2	2	0	2	2
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	1	24	24	13	24	24	1	24	24	1	24	24	1	24	24
PRESS SCRAP	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	21	21	1	21	21	0	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	1	25	25	1	25	25	0	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	109			107			9			6			5		
NV2TL =		554			554			554			554			554	
NVTL =			585			589			554			554			554

TABLE B-5 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\frac{\sigma^2}{\hat{D}_r} = 1/2 \frac{\sigma^2}{\hat{D}_s}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.914	.914	8.6	554	585	2251
1000.0	0.0	1.000	.763	.763	23.7	554	589	725
4000.0	3886.1	.510	.938	.478	52.2	554	554	208
6500.0	6500.0	.500	.950	.475	52.5	554	554	124
10000.0	10000.0	.500	.950	.475	52.5	554	554	80

VARDR30	VARDSL	VARDH0	VOMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
546685.8961	1108981.3001	1655667.1962	1161436.0601	1077.6994	1673.7663	494231.1361	300.0000
545994.7944	1108981.3001	1654976.0946	1160744.9585	1077.3787	1672.9403	494231.1361	1000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	4000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	10000.0000

TABLE B-6

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{Dr}^2 = 1/2 \sigma_{Ds}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	8	0	8	8	0	8	1	0	6	1	0	6	1	0	6
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	13	13	1	13	13	0	13	13	0	13	13	0	13	13
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
REMOVALS FROM PLANT															
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	6	3	6	6	3	6	1	3	3	1	3	3	0	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	10	50	50	9	50	50	1	50	50	1	50	50	1	50	50
SCRAP FOR SHIPMENT	1	109	109	1	109	109	0	109	109	0	109	109	0	109	109
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	36	36	0	36	36	0	36	36	0	36	36	0	36	36
SOLID DISCARDS	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	62	62	2	62	62	0	62	62	0	62	62	0	62	62
UPS RECYCLE	1	17	17	1	17	17	0	17	17	0	17	17	0	17	17
ADU/UPS CROSS	1	4	4	0	4	4	0	4	4	0	4	4	0	4	4
GECO CONVERSION	1	14	14	1	14	14	0	14	14	0	14	14	0	14	14
VENDOR UO ₂	0	7	7	0	7	7	0	7	7	0	7	7	0	7	7
UO ₂ FOR SHIPMENT	3	1	3	2	1	2	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	119	119	1	119	119	0	119	119	0	119	119	0	119	119
PELLETS	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
FUEL RODS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	24	24	5	24	24	1	24	24	1	24	24	0	24	24
PRESS SCRAP	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	21	21	0	21	21	0	21	21	0	21	21	0	21	21
RESIDUE/SLUDGE	0	25	25	0	25	25	0	25	25	0	25	25	0	25	25
SOLID WASTE	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	43			40			5			4			2		
NV2TL =		554			554			554			554			554	
NVTL =			561			560			554			554			554

TABLE B-6 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 1/2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SLT AT 4500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1000	.914	.914	8.6	554	561	2251
1000.0	0.0	.1000	.764	.764	23.6	554	560	725
4000.0	3886.1	.510	.938	.478	52.2	554	554	208
6500.0	5500.0	.500	.950	.475	52.5	554	554	124
10000.0	10000.0	.500	.950	.475	52.5	554	554	80

VAROR30	VAROSTL	VARDH0	VOMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
550766.5706	1108981.3001	1659747.8707	1165516.7346	1079.5910	1678.6353	494231.1361	300.0000
550936.0063	1108981.3001	1659917.3064	1165686.1703	1079.6695	1678.8372	494231.1361	1000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	4000.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	6500.0000
554167.6185	1108981.3001	1663148.9186	1168917.7825	1081.1650	1682.6826	494231.1361	10000.0000

TABLE B-7

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	14	3	14	17	3	17	20	3	20	12	3	12	4	3	4
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	6	6	1	6	6	2	6	6	1	6	6	1	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	16	1	16	13	1	13	23	1	23	10	1	10	3	1	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	27	25	27	21	25	25	39	25	39	16	25	25	5	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	2	54	54	1	54	54	1	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	10	10	1	10	10	1	10	10	1	10	10	0	10	10
SOLID DISCARDS	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	31	31	3	31	31	6	31	31	3	31	31	1	31	31
UPS RECYCLE	2	9	9	1	9	9	2	9	9	1	9	9	1	9	9
ADU/UPS CROSS	1	2	2	1	2	2	1	2	2	1	2	2	0	2	2
GECO CONVERSION	1	7	7	1	7	7	1	7	7	1	7	7	0	7	7
VENDOR UO2	1	4	4	1	4	4	1	4	4	1	4	4	0	4	4
UO2 FOR SHIPMENT	6	1	6	5	1	5	9	1	9	4	1	4	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	1	59	59	1	59	59	0	59	59
PELLETS	4	1	2	1	1	1	2	1	2	1	1	1	1	1	1
FUEL RODS	3	1	3	2	1	1	4	1	4	2	1	1	1	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
ASSEMBLIES	13	12	13	10	12	12	19	12	19	8	12	12	3	12	12
PRESS SCRAP	1	2	2	0	2	2	1	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	11	11	1	11	11	1	11	11	1	11	11	0	11	11
RESIDUE/SLUOGE	1	13	13	0	13	13	1	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	1	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	99			82			148			96			22		
NV2TL =		202			202			202			202			202	
NVTL =			319			313			362			304			265

TABLE B-7 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.921	.921	7.9	282	319	9128
1000.0	0.0	1.000	.811	.811	18.9	282	313	2895
4000.0	0.0	1.000	.193	.193	80.7	282	362	821
6500.0	3578.2	.192	.365	.070	93.0	282	304	513
10000.0	8301.2	.083	.637	.053	94.7	282	285	342

THE RANDOM COMPONENT OF VARMUF = .227E+06

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .111E+07
FOR A GOAL QUANTITY OF 300.0 NTL = 271
FOR A GOAL QUANTITY OF 1000.0 NTL = 271
FOR A GOAL QUANTITY OF 4000.0 NTL = 271
FOR A GOAL QUANTITY OF 6500.0 NTL = 271
FOR A GOAL QUANTITY OF 10000.0 NTL = 271

VARDR30	VARDSTL	VARDH0	VDMUFH0	SOMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
1077397.6554	1108981.3001	2186378.9553	1692147.8192	1300.8258	2219.0856	494231.1361	300.0000
1093380.9914	1108981.3001	2202362.2916	1708131.1555	1306.9549	2233.4445	494231.1361	1000.0000
1031821.4397	1108981.3001	2140802.7398	1646571.6037	1283.1881	2177.6216	494231.1361	4000.0000
1094485.7129	1108981.3001	2203467.0131	1709235.8770	1307.3775	2234.4335	494231.1361	6500.0000
1105877.2097	1108981.3001	2214858.5101	1720627.3740	1311.7269	2244.6066	494231.1361	10000.0000

TABLE B-8
NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\hat{D}_r^2 = \hat{D}_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.9 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	7	3	7	6	3	6	10	3	10	4	3	4	2	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNH PRODUCTS	1	6	6	1	6	6	1	6	6	1	6	6	0	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	6	1	6	4	1	4	8	1	8	3	1	3	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	9	25	25	7	25	25	14	25	25	6	25	25	2	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	1	54	54	1	54	54	0	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	18	18	0	18	18	0	18	18	0	18	18	0	18	18
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	31	31	1	31	31	2	31	31	1	31	31	1	31	31
UPS RECYCLE	1	9	9	1	9	9	1	9	9	1	9	9	0	9	9
ADU/UPS CROSS	0	2	2	0	2	2	1	2	2	0	2	2	0	2	2
BECCO CONVERSION	1	7	7	0	7	7	1	7	7	0	7	7	0	7	7
VENDOR UO2	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO2 FOR SHIPMENT	2	1	2	2	1	2	3	1	3	2	1	2	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	1	59	59	1	59	59	0	59	59
PELLETS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ASSEMBLIES	5	12	12	4	12	12	7	12	12	3	12	12	1	12	12
PRESS SCRAP	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	11	11	0	11	11	1	11	11	0	11	11	0	11	11
RESIDUE/SLUDGE	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	39			31			55			29			9		
NV2TL =		282			282			242			252			282	
NV3TL =			292			289			299			286			282

TABLE B-8 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\hat{D}_r^2 = \hat{D}_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.922	.922	7.8	282	292	9128
1000.0	0.0	1.000	.811	.811	18.9	282	289	2895
4000.0	0.0	1.000	.204	.204	79.6	282	299	821
6500.0	3553.7	.194	.363	.070	93.0	282	286	513
10000.0	8289.7	.083	.635	.053	94.7	282	282	342

VARDR30	VARDSL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARHUF	GOAL QUANTITY
1100280.9182	1108981.3001	2209262.2183	1715031.0822	1309.5920	2239.6147	494231.1361	300.0000
1101750.0562	1108981.3001	2210731.3564	1716500.2203	1310.1527	2240.9262	494231.1361	1000.0000
1095355.1256	1108981.3001	2204336.4257	1710105.2896	1307.7099	2235.2115	494231.1361	4000.0000
1105368.9029	1108981.3001	2214350.2030	1720119.0669	1311.5331	2244.1537	494231.1361	6500.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6202	494231.1361	10000.0000

TABLE B-9

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977- 1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	14	3	14	17	3	17	12	3	12	3	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	6	6	1	6	6	1	6	6	1	6	6	0	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	16	1	16	13	1	13	10	1	10	2	1	2	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	27	25	27	21	20	25	17	25	25	3	25	25	1	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	1	54	54	0	54	54	0	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	18	18	1	18	18	1	18	18	0	18	18	0	18	18
SOLID DISCARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	31	31	3	31	31	3	31	31	1	31	31	0	31	31
UPS RECYCLE	2	9	9	1	9	9	1	9	9	1	9	9	0	9	9
ADU/UPS CROSS	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
GECO CONVERSION	1	7	7	1	7	7	1	7	7	0	7	7	0	7	7
VENDOR UO2	1	4	4	1	4	4	1	4	4	0	4	4	0	4	4
UO2 FOR SHIPMENT	6	1	6	5	1	5	4	1	4	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	1	59	59	0	59	59	0	59	59
PELLETS	2	1	2	1	1	1	1	1	1	1	1	1	0	1	1
FUEL RODS	3	1	3	2	1	2	2	1	2	1	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	13	12	13	10	12	12	8	12	12	2	12	12	1	12	12
PRESS SCRAP	1	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	11	11	1	11	11	1	11	11	0	11	11	0	11	11
RESIDUE/SLUDGE	1	13	13	0	13	13	0	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	99			62			67			16			5		
NV2TL =		202			202			202			202			202	
NVTL =			319			313			304			283			282

TABLE B-9 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.921	.921	7.9	282	319	4401
1000.0	0.0	1.000	.811	.811	18.9	282	313	1404
4000.0	1932.3	.512	.525	.269	73.1	282	304	402
6500.0	5595.5	.303	.831	.252	74.8	282	283	244
10000.0	9943.4	.252	.945	.238	76.2	282	282	160

VARDR30	VAROSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
1077397.6552	1108981.3001	2186378.9553	1692147.8192	1300.8258	2219.0856	494231.1361	300.0000
1093380.9914	1108981.3001	2202362.2916	1708131.1555	1306.9549	2233.4445	494231.1361	1000.0000
1094485.7129	1108981.3001	2203467.0131	1709235.8770	1307.3775	2234.4335	494231.1361	4000.0000
1110105.3111	1108981.3001	2219086.6113	1724855.4792	1313.3375	2248.3708	494231.1361	6500.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6202	494231.1361	10000.0000

TABLE B-10

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\hat{\sigma}_r^2 = \hat{\sigma}_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA .10

STRATUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	7	3	7	6	3	6	4	3	4	1	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	6	6	1	6	6	1	6	6	0	6	6	0	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	6	1	6	4	1	4	4	1	4	1	1	1	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	9	25	25	7	25	25	6	25	25	1	25	25	1	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	1	54	54	0	54	54	0	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	18	18	0	18	18	0	18	18	0	18	18	0	18	18
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	31	31	1	31	31	1	31	31	1	31	31	0	31	31
UPS RECYCLE	1	9	9	1	9	9	1	9	9	0	9	9	0	9	9
ADU/UPS CROSS	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GECO CONVERSION	1	7	7	0	7	7	0	7	7	0	7	7	0	7	7
VENDOR UO2	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO2 FOR SHIPMENT	2	1	2	2	1	2	2	1	2	1	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	1	59	59	0	59	59	0	59	59
PELLETS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	0	12	12	0	12	12	0	12	12	1	12	12	0	12	12
PRESS SCRAP	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	11	11	0	11	11	0	11	11	0	11	11	0	11	11
RESIDUE/SLUDGE	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL *	39			31			24			6			3		
NV2TL *		282			282			282			282			282	
NVTL *			292			289			287			282			282

TABLE B-10 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1000	.922	.922	7.8	282	292	4401
1000.0	0.0	.1000	.811	.811	18.9	282	289	1404
4000.0	1914.9	.515	.522	.269	73.1	282	287	402
6500.0	5591.9	.303	.830	.252	74.8	282	282	244
10000.0	9943.4	.252	.945	.238	76.2	282	282	160

VARDR30	VAROSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
1100280.9182	1108981.3001	2209262.2183	1715031.0822	1309.5920	2239.6147	494231.1361	300.0000
1101750.0562	1108981.3001	2210731.3564	1716500.2203	1310.1527	2240.9262	494231.1361	1000.0000
1104759.6483	1108981.3001	2213740.9485	1719509.8124	1311.3008	2243.6107	494231.1361	4000.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6262	494231.1361	6500.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6262	494231.1361	10000.0000

TABLE B-11

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
FULL UF ₆ CYLINDERS	14	3	14	17	4	17	2	3	3	1	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	6	6	1	6	6	1	6	6	0	6	6	0	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF ₆ CYLINDER NEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	16	1	16	13	1	13	2	1	2	1	1	1	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	27	25	27	21	25	25	3	25	25	1	25	25	1	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	0	54	54	0	54	54	0	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	18	18	1	18	18	0	18	18	0	18	18	0	18	18
SOLID DISCARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF ₆ CYLINDER NEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	31	31	3	31	31	1	31	31	1	31	31	0	31	31
UPS RECYCLE	2	9	9	1	9	9	1	9	9	0	9	9	0	9	9
ADU/UPS CROSS	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
GECO CONVERSION	1	7	7	1	7	7	0	7	7	0	7	7	0	7	7
VENDOR UO ₂	1	4	4	1	4	4	0	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	0	59	59	0	59	59	0	59	59
PELLETS	4	1	2	1	1	1	1	1	1	0	1	1	0	1	1
FUEL RODS	3	1	3	2	1	2	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	13	12	13	10	12	12	2	12	12	1	12	12	1	12	12
PRESS SCRAP	1	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	11	11	1	11	11	0	11	11	0	11	11	0	11	11
RESIDUE/SLUDGE	1	13	13	0	13	13	0	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	99			82			15			6			5		
NV2TL =		282			282			282			282			282	
NVTL =			319			313			283			282			282

TABLE B-11 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.921	.921	7.9	282	319	2251
1000.0	0.0	1.000	.811	.811	18.9	282	313	725
4000.0	3524.7	.543	.900	.489	51.1	282	283	208
6500.0	6500.0	.500	.950	.475	52.5	282	282	124
10000.0	10000.0	.500	.950	.475	52.5	282	282	80

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
1077397.6552	1108981.3001	2186378.9553	1692147.8192	1300.8258	2219.0856	494231.1361	300.0000
1073380.9914	1108981.3001	2202362.2916	1708131.1555	1306.9549	2233.4445	494231.1361	1000.0000
1110105.3111	1108981.3001	2219086.6113	1724855.4792	1313.3375	2248.3708	494231.1361	4000.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6202	494231.1361	6500.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2251.6202	494231.1361	10000.0000

TABLE B-12

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			8500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	1	3	7	6	1	6	1	3	3	1	3	3	1	3	3
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	6	6	1	6	6	0	6	6	0	6	6	0	6	6
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	6	1	6	4	1	4	1	1	1	1	1	1	0	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	9	25	25	7	25	25	1	25	25	1	25	25	1	25	25
SCRAP FOR SHIPMENT	1	54	54	1	54	54	0	54	54	0	54	54	0	54	54
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	18	18	0	18	18	0	18	18	0	18	18	0	18	18
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW EQUINOX INVENTORY															
FULL UF6 CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	31	31	1	31	31	1	31	31	0	31	31	0	31	31
UPS RECYCLE	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
ADU/UPS CROSS	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GECO CONVERSION	1	7	7	0	7	7	0	7	7	0	7	7	0	7	7
VENDOR UO ₂	0	4	4	0	4	4	0	4	4	0	4	4	0	4	4
UO ₂ FOR SHIPMENT	4	1	2	2	1	2	1	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	59	59	1	59	59	0	59	59	0	59	59	0	59	59
PELLETS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	5	12	12	4	12	12	1	12	12	1	12	12	0	12	12
PRESS SCRAP	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	11	11	0	11	11	0	11	11	0	11	11	0	11	11
RESIDUE/SLUDGE	0	13	13	0	13	13	0	13	13	0	13	13	0	13	13
SOLID WASTE	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	6	6	6	0	6	6	0	6	6	0	6	6	0	6	6
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	39			31			6			4			2		
NV2TL =	282			282			282			282			282		
NVTL =		292			289			282			282			282	

TABLE B-12 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.922	.922	7.8	282	292	2251
1000.0	0.0	1.000	.811	.811	18.9	282	289	725
4000.0	3522.0	.543	.900	.489	51.1	282	282	208
6500.0	6500.0	.400	.950	.475	52.5	282	282	124
10000.0	10000.0	.500	.950	.475	52.5	282	282	80

VAROR30	VAROSTL	VAROH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
1100280.9182	1108981.3001	2209262.2183	1715031.0822	1309.5920	2439.6147	494231.1361	300.0000
1101750.0562	1108981.3001	2210731.3564	1716500.2203	1310.1527	2440.9262	494231.1361	1000.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2451.6202	494231.1361	4000.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2451.6202	494231.1361	6500.0000
1113760.8385	1108981.3001	2222742.1386	1728511.0025	1314.7285	2451.6202	494231.1361	10000.0000

TABLE B-13

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma^2 = \sigma_r^2 + \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .30

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	13	1	13	13	1	13	19	1	19	19	1	19	7	1	7
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNM PRODUCTS	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	15	1	15	10	1	10	16	1	16	15	1	15	5	1	5
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	25	13	25	16	13	16	27	13	27	25	13	25	9	13	13
SCRAP FOR SHIPMENT	1	27	27	1	27	27	1	27	27	1	27	27	1	27	27
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	9	9	1	9	9	1	9	9	1	9	9	0	9	9
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1
UF ₆ CYLINDER HEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	15	15	3	15	15	4	15	15	4	15	15	2	15	15
UPS RECYCLE	2	4	4	1	4	4	2	4	4	2	4	4	1	4	4
ADU/UPS CROSS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
GECO CONVERSION	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3
VENDOR UO ₂	1	2	2	1	2	2	1	2	2	1	2	2	0	2	2
UO ₂ FOR SHIPMENT	6	1	6	4	1	4	6	1	6	6	1	6	2	1	2
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	30	30	1	30	30	1	30	30	1	30	30	1	30	30
PELLETS	2	1	2	1	1	1	2	1	2	2	1	2	1	1	1
FUEL RODS	3	1	3	2	1	2	3	1	3	3	1	3	1	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ASSEMBLIES	12	6	12	8	6	8	13	6	13	12	6	12	4	6	6
PRESS SCRAP	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	5	5	1	5	5	1	5	5	1	5	5	0	5	5
RESIDUE/SLUDGE	0	6	6	0	6	6	1	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	91			67			104			78			37		
NV2TL =		148			148			148			148			148	
NVTL =			200			170			210			206			189

TABLE B-13 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D-MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.928	.928	7.2	148	200	9128
1000.0	0.0	1.000	.851	.851	14.9	148	178	2895
4000.0	0.0	1.000	.327	.327	67.3	148	210	821
6500.0	1450.7	.7512	.212	.109	89.1	148	206	513
10000.0	6673.3	.135	.427	.058	94.2	148	159	342

THE RANDOM COMPONENT OF VARQUF = .227E+06

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .222E+07
FOR A GOAL QUANTITY OF 300.0 NTL = 135
FOR A GOAL QUANTITY OF 1000.0 NTL = 135
FOR A GOAL QUANTITY OF 4000.0 NTL = 135
FOR A GOAL QUANTITY OF 6500.0 NTL = 135
FOR A GOAL QUANTITY OF 10000.0 NTL = 135

VARORJO	VAROSTL	VAROHO	VDUFH0	SDMUFH0	SDMUFH1	VARQUF	GOAL QUANTITY
2044249.1704	1108981.3001	3153230.4709	2658999.3348	1630.6438	2465.0880	494231.1361	300.0000
2131964.9907	1108981.3001	3240946.2909	2746715.1548	1457.3217	3123.6749	494231.1361	1000.0000
2031949.3615	1108981.3001	3140930.6616	2646699.5255	1626.8680	2456.7799	494231.1361	4000.0000
2043371.8800	1108981.3001	3152353.1809	2658124.0448	1630.3748	2464.4962	494231.1361	6500.0000
2199700.8491	1108981.3001	3308682.1493	2814451.0132	1677.6326	3168.1515	494231.1361	10000.0000

TABLE B-14

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GOOSE DEFECTS IS SET AT .050
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	1	1	7	5	1	5	7	1	7	6	1	6	3	1	3
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNH PRODUCTS	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER HEELS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	3	1	5	4	1	4	6	1	6	5	1	5	2	1	2
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	13	13	13	6	13	13	10	13	13	8	13	13	3	13	13
SCRAP FOR SHIPMENT	27	27	27	1	27	27	1	27	27	1	27	27	0	27	27
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	9	9	9	0	9	9	0	9	9	0	9	9	0	9	9
SOLID DISCARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER HEELS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	15	15	1	15	15	2	15	15	2	15	15	1	15	15
UPS RECYCLE	4	4	4	1	4	4	1	4	4	1	4	4	1	4	4
ADU/UPS CROSS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GEICO CONVERSION	3	3	3	0	3	3	1	3	3	1	3	3	0	3	3
VENDOR UO2	2	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO2 FOR SHIPMENT	1	2	2	1	1	2	2	1	2	2	1	2	1	2	2
POWDER/PELLETS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	30	30	30	1	30	30	1	30	30	1	30	30	0	30	30
PELLETS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	6	6	6	3	6	6	5	6	6	4	6	6	2	6	6
PRESS SCRAP	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GRINDER RESIDUE	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	5	5	5	0	5	5	0	5	5	0	5	5	0	5	5
RESIDUE/SLUDGE	6	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	3	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	37			27			40			35			16		
NV2TL =		148			148			148			148			148	
NVTL =			159			156			160			158			151

TABLE B-14 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1000	.929	.929	7.1	148	159	9128
1000.0	0.0	.1000	.853	.853	14.7	148	156	2895
4000.0	0.0	.1000	.343	.343	65.7	148	160	821
6500.0	1100.3	.1802	.195	.117	88.3	148	158	513
10000.0	6658.9	.1136	.426	.058	94.2	148	151	342

VAROR30	VARDSTL	VARDMO	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
2199700.8491	1108981.3001	3308682.1493	2814451.0132	1677.6326	3068.1515	494231.1361	300.0000
2202130.1222	1108981.3001	3311111.4223	2816880.2862	1678.3564	3069.7346	494231.1361	1000.0000
2199457.1473	1108981.3001	3308438.4475	2814207.3114	1677.5599	3067.9926	494231.1361	4000.0000
2200560.7326	1108981.3001	3309542.0327	2815310.8966	1677.8888	3068.7120	494231.1361	6500.0000
2209281.5403	1108981.3001	3318262.8404	2824031.7043	1680.4856	3074.3904	494231.1361	10000.0000

TABLE B-15

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.8 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR SAMMAP .30

STRUTUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	13	1	13	13	1	13	19	1	19	5	1	5	1	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UHM PRODUCTS	1	3	3	1	3	3	1	3	3	1	3	3	0	3	3
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	13	1	15	10	1	10	16	1	16	4	1	4	1	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	23	13	25	16	13	16	27	13	27	7	13	13	2	13	13
SCRAP FOR SHIPMENT	1	27	27	1	27	27	1	27	27	1	27	27	0	27	27
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	9	9	1	9	9	1	9	9	0	9	9	0	9	9
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	15	15	3	15	15	4	15	15	1	15	15	1	15	15
UPS RECYCLE	2	4	4	1	4	4	2	4	4	1	4	4	0	4	4
ADU/UPS CROSS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
DECO CONVERSION	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
VENDOR UO ₂	1	2	2	1	2	2	1	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	6	1	6	4	1	4	4	1	4	2	1	2	1	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	30	30	1	30	30	1	30	30	1	30	30	0	30	30
PELLETS	2	1	2	1	1	1	2	1	2	1	1	1	0	1	1
FUEL RODS	3	1	3	2	1	2	3	1	3	1	1	1	1	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
ASSEMBLIES	12	6	12	8	6	8	13	6	13	3	6	6	1	6	6
PRESS SCRAP	0	1	1	0	1	1	1	1	1	0	1	1	0	1	1
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	5	5	1	5	5	1	5	5	0	5	5	0	5	5
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	94			67			104			69			6		
NV2TL =		148			148			148			148			148	
NVTL =			200			178			210			186			148

TABLE B-15 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_D^2 = 2 \sigma_D^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.928	.928	7.2	148	200	4401
1000.0	0.0	1.000	.851	.851	14.9	148	178	1404
4000.0	324.6	.894	.368	.329	67.1	148	210	402
6500.0	4459.7	.386	.666	.257	74.3	148	156	244
10000.0	4274.8	.276	.888	.245	75.5	148	148	160

VARDR30	VARDSTL	VARDMO	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
2044249.1768	1108981.3001	3153230.4709	2658999.3348	1630.6438	2965.0880	494231.1361	300.0000
2131964.9907	1108981.3001	3240946.2909	2746715.1548	1657.3217	3023.6749	494231.1361	1000.0000
2031949.3615	1108981.3001	3140930.6616	2648699.5255	1626.8680	2956.7799	494231.1361	4000.0000
2202130.1224	1108981.3001	3311111.4223	2816880.2862	1678.3564	3069.7346	494231.1361	6500.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9683	1688.7167	3092.3786	494231.1361	10000.0000

TABLE B-16

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	800.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF ₆ CYLINDERS	7	1	7	5	1	5	7	1	7	2	1	2	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNK PRODUCTS	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	5	1	5	4	1	4	5	1	5	2	1	2	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	9	13	13	6	13	13	9	13	13	2	13	13	1	13	13
SCRAP FOR SHIPMENT	1	27	27	1	27	27	1	27	27	0	27	27	0	27	27
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	0	9	9	0	9	9	0	9	9	0	9	9	0	9	9
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF ₆ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF ₆ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	2	15	15	1	15	15	2	15	15	1	15	15	0	15	15
UPS RECYCLE	1	4	4	1	4	4	1	4	4	0	4	4	0	4	4
ADU/UPS CROSS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
BECO CONVERSION	1	3	3	0	3	3	1	3	3	0	3	3	0	3	3
VENDOR UO ₂	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	2	1	2	2	1	2	2	1	2	1	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	30	30	1	30	30	1	30	30	0	30	30	0	30	30
PELLETS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
POISON RODS	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	4	6	6	3	6	6	4	6	6	1	6	6	1	6	6
PRESS SCRAP	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	37			27			37			10			4		
NV2TL =		140			140			140			140			140	
NVTL =			159			154			159			150			140

TABLE B-16 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_T}^2 = 2 \sigma_{\hat{D}_S}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	.1000	.929	.929	7.1	148	159	4401
1000.0	0.0	.1000	.853	.853	14.7	148	156	1404
4000.0	36.3	.987	.347	.343	65.7	148	159	402
6500.0	4445.6	.387	.664	.257	74.3	148	150	244
10000.0	9274.8	.276	.888	.245	75.5	148	148	160

VARDR30	VAROSTL	VAROHO	VOMUFH0	SOMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
2199700.8491	1108981.3001	3308682.1493	2814451.0132	1677.6326	3068.1515	494231.1361	300.0000
2202130.1222	1108981.3001	3311111.4223	2816880.2862	1678.3564	3069.7346	494231.1361	1000.0000
2199700.8491	1108981.3001	3308682.1493	2814451.0132	1677.6326	3068.1515	494231.1361	4000.0000
2215300.7245	1108981.3001	3324282.0246	2830050.8885	1682.2755	3078.3036	494231.1361	6500.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9685	1688.7167	3092.3786	494231.1361	10000.0000

TABLE B-17

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR BIAS .30

STRUTUM	G O A L Q U A N T I T Y														
	300.0			1000.0			4000.0			9500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UO ₂ CYLINDERS	13	1	13	13	1	13	5	1	5	1	1	1	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNH PRODUCTS	1	3	3	1	3	3	1	3	3	0	3	3	0	3	3
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO ₂	15	1	15	10	1	10	4	1	4	1	1	1	1	1	1
FUEL RODS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	25	13	25	16	13	16	6	13	13	1	13	13	1	13	13
SCRAP FOR SHIPMENT	1	27	27	1	27	27	1	27	27	0	27	27	0	27	27
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	1	9	9	1	9	9	0	9	9	0	9	9	0	9	9
SOLID DISCARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UO ₂ CYLINDERS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UO ₂ CYLINDER MEELS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	4	15	15	3	15	15	1	15	15	1	15	15	0	15	15
UPS RECYCLE	2	4	4	1	4	4	1	4	4	0	4	4	0	4	4
ADU/UPS CROSS	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1
GECD CONVERSION	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
VENDOR UO ₂	1	2	2	1	2	2	0	2	2	0	2	2	0	2	2
UO ₂ FOR SHIPMENT	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	1	30	30	1	30	30	1	30	30	0	30	30	0	30	30
PELLETS	2	1	2	1	1	1	1	1	1	0	1	1	0	1	1
FUEL RODS	3	1	3	2	1	2	1	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
ASSEMBLIES	14	6	12	6	6	6	3	6	6	1	6	6	1	6	6
PRESS SCRAP	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GRINDER RESIDUE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIRTY POWDER	1	5	5	1	5	5	0	5	5	0	5	5	0	5	5
RESIDUE/SLUDGE	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	91			67			28			9			5		
NV2TL =		148			148			148			148			148	
NVTL =			200			178			156			140			140

TABLE B-17 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_{\hat{D}_r}^2 = 2 \sigma_{\hat{D}_s}^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .30)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.928	.928	7.2	148	200	2251
1000.0	0.0	1.000	.851	.851	14.9	148	178	725
4000.0	2639.4	.633	.798	.505	49.5	148	156	208
6500.0	5477.0	.501	.949	.475	52.5	148	148	124
10000.0	10000.0	.500	.950	.475	52.5	148	148	80

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
2044249.1708	1108981.3001	3153230.4709	2658499.3348	1630.6438	2465.0880	494231.1361	300.0000
2131964.9907	1108981.3001	3240946.2909	2746715.1548	1657.3217	3023.6749	494231.1361	1000.0000
2202130.1222	1108981.3001	3311111.4223	2816880.2862	1678.3564	3069.7346	494231.1361	4000.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9685	1688.7167	3092.3786	494231.1361	6500.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9685	1688.7167	3092.3786	494231.1361	10000.0000

TABLE B-18

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma^2 = 2 \sigma^2 \frac{\sigma_r^2}{\sigma_s^2}$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
NUMBER OF VERIFICATIONS FOR DETECTION OF BIAS AND VARIABLE SAMPLING PLAN FOR GAMMA = .10

STRATUM	GOAL QUANTITY														
	300.0			1000.0			4000.0			6500.0			10000.0		
	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV	NV1	NV2	NV
ADDITIONS TO PLANT															
FULL UF6 CYLINDERS	7	1	7	5	1	5	2	1	2	1	1	1	1	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UNM PRODUCTS	1	3	3	1	3	3	0	3	3	0	3	3	0	3	3
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
OTHER	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
REMOVALS FROM PLANT															
UF6 CYLINDER MEELS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
VENDOR UO2	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	13	13	13	0	13	13	2	13	13	1	13	13	1	13	13
SCRAP FOR SHIPMENT	1	27	27	1	27	27	0	27	27	0	27	27	0	27	27
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
LIQUID DISCARDS	9	9	9	0	9	9	0	9	9	0	9	9	0	9	9
SOLID DISCARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NEW ENDING INVENTORY															
FULL UF6 CYLINDERS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
UF6 CYLINDER MEELS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ADU CONVERSION	15	15	15	1	15	15	1	15	15	0	15	15	0	15	15
UPS RECYCLE	4	4	4	1	4	4	0	4	4	0	4	4	0	4	4
ADU/UPS CROSS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GECO CONVERSION	3	3	3	0	3	3	0	3	3	0	3	3	0	3	3
VENDOR UO2	2	2	2	0	2	2	0	2	2	0	2	2	0	2	2
UO2 FOR SHIPMENT	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POWDER/PELLETS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
INTERMED. PROD.	30	30	30	1	30	30	0	30	30	0	30	30	0	30	30
PELLETS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
FUEL RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
POISON RODS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
ASSEMBLIES	6	6	6	3	6	6	1	6	6	1	6	6	0	6	6
PRESS SCRAP	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
GRINDER RESIDUE	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
DIATY POWDER	5	5	5	0	5	5	0	5	5	0	5	5	0	5	5
RESIDUE/SLUDGE	6	6	6	0	6	6	0	6	6	0	6	6	0	6	6
SOLID WASTE	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
SAMPLES	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
PROCESS HOLDUP	3	3	3	0	3	3	0	3	3	0	3	3	0	3	3
STANDARDS	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1
NV1TL =	31			27			9			4			2		
NV2TL =		146			146			146			146			146	
NVTL =			159			156			149			148			148

TABLE B-18 (continued)

NUMBER OF VERIFICATIONS FOR DETECTING THE DIVERSION OF GOAL QUANTITIES
OF URANIUM FOR A SIX MONTH INVENTORY PERIOD
CONTINUOUS INSPECTION PLAN

$$\sigma_r^2 = 2 \sigma_s^2$$

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
SUMMARY OF CALCULATIONS FOR THE DETECTION OF PARTIAL DEFECTS AND BIAS (GAMMA = .10)

GOAL QUANTITY	AMOUNT TAKEN AS GROSS DEFECTS	NON-DETECTION PROBABILITY FOR TOTAL REMOVALS	NON-DETECTION PROBABILITY FOR D+MUF STRATEGY	TOTAL NON-DETECTION PROBABILITY	PROBABILITY OF DETECTION (PERCENT)	TOTAL MEASUREMENTS TO DETECT BIAS	MEASUREMENTS TO DETECT BIAS AND PARTIAL REMOVALS	MEASUREMENTS TO DETECT TOTAL REMOVALS
300.0	0.0	1.000	.929	.929	7.1	148	159	2251
1000.0	0.0	1.000	.853	.853	14.7	148	156	725
4000.0	2625.1	.835	.796	.505	49.5	148	149	208
6500.0	6477.0	.501	.949	.475	52.5	148	148	124
10000.0	10000.0	.500	.950	.475	52.5	148	148	80

VARDR30	VARDSTL	VARDH0	VDHUFH0	SDHUFH0	SDHUFH1	VARMUF	GOAL QUANTITY
2199700.8491	1108981.3001	3308692.1493	2814451.0122	1677.6326	3068.1515	494231.1361	300.0000
2202130.1222	1108981.3001	3311111.4223	2816880.2862	1678.3564	3069.7346	494231.1361	1000.0000
2218956.2518	1108981.3001	3327937.5520	2833706.4159	1683.3616	3080.6777	494231.1361	4000.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9685	1688.7167	3092.3786	494231.1361	6500.0000
2237013.8045	1108981.3001	3345995.1046	2851763.9685	1688.7167	3092.3786	494231.1361	10000.0000

SECTION C

LISTING OF THE INDIVIDUAL STRATUM FOR THE FIVE CATEGORIES

Each line in Tables C-1 through C-10 describes an individual stratum resulting from combining raw data summary items from the DIQ⁽⁷⁾. A hypothetical error structure was used based on the DIQ which contained data for over 400 items and batches.

To reduce the number of strata in the five strata categories, various inventory raw data summary items that were of the same or of a similar material composition were combined. The object of the combination was to produce new strata with the total number of batches, total weight, and number of items equal to the sum of the individual raw data summary items. This greatly reduced the number of strata in each of the five strata categories and subsequent computer output in this report. Other data had to be combined, however. The total number of weighings, samples, and analyses per batch for the new stratum was calculated by first summing the product of the individual number of batches with each individual component number per batch and then dividing the sum for each component by the total number of batches. Fraction results were rounded off and a minimum of one was assumed. Several methods were considered for combining the error terms. One method was the use of the maximum value of any individual component. Another method used an apportioning technique based on the square root of the sum of the squares of the random error times the item weight. These factors were also weighted by the component numbers per batch discussed earlier. The maximum value method was always used for the systematic errors since the apportioning technique was not applicable. The combination of random errors was done with both methods.

Each group of items in the tables of this section includes the individual inventory raw data summary items selected to make up a stratum. The last line of each individual grouping is the representative stratum for that group. This line gives the results of the summation of the errors and is the stratum that appears in the summary of input listings that appear in this Section for each of the five strata categories.

In Tables C-1 through C-5 the representative stratum was generated with the "maximum" random error and the "maximum" systematic error. In Tables C-6 through C-10 the representative stratum was generated with the "apportioned" random error and the "maximum" systematic error. It is interesting to compare the results of the combination of random errors by the two methods and their subsequent effect on the error variances and the LEMUF calculations. This can be done by comparing the results of the calculations using apportioned random errors included in Tables 6 through 10 of Sections C, D, and E with the results of the "maximum" errors shown in Tables 1 through 5. Strata for each of the five strata categories listed at the beginning of the Appendix were generated for each of the two combination methods.

TABLE C-1
 BEGINNING INVENTORY MEASUREMENT ERROR DATA FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
FULL UO ₂ CYLINDERS	1391.7	69	96032.7	46	1	.0	0.00	1	.0	1	.0	0.00
UO ₂ CYLINDER HEELS	3.4	121	418.1	75	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	24.8	2333	57944.3	178	13	2.2	.04	1	1.9	1	.9	.00
UO ₂ RECYCLE	26.0	947	24682.0	65	11	2.2	.04	1	2.1	1	.1	.00
ADU/UPS CROSS	26.0	109	2835.9	23	4	2.2	.04	1	1.1	1	.1	.00
GECO CONVERSION	24.2	1000	24269.9	38	25	3.8	.04	1	5.7	1	.3	.00
VENDOR UO ₂	25.0	2	50.0	8	1	2.2	.04	1	.0	1	.0	.00
UO ₂ FOR SHIPMENT	18.7	4526	84632.3	408	11	.0	.02	1	.0	1	.0	.00
POWDER/PELLETS	16.2	128	2073.8	28	4	5.3	.08	1	1.1	1	.4	.00
INTERMED. PROD.	20.4	84	1755.2	55	1	5.3	.09	1	35.8	1	9.3	.01
PELLETS	14.9	1097	16446.7	36	30	.3	.02	1	0.0	1	.0	.00
FUEL RODS	2.9	13881	40576.9	95	146	.1	.01	1	0.0	1	.0	.00
POISON PELLETS	10.8	164	1788.0	19	16	.1	0.00	1	.0	1	.0	.00
POISON RODS	2.8	2864	8152.6	30	95	.0	.20	1	.2	1	.1	.01
ASSEMBLIES	2.9	88529	263147.7	561	149	.1	.20	1	.2	1	.1	.01
PRESS SCRAP	15.8	216	3425.8	213	1	8.3	.13	1	6.9	1	4.4	.01
GRINDER RESIDUE	18.6	183	3041.8	19	9	2.7	.11	1	.8	1	.4	.01
DIRTY POWDER	19.8	207	4108.7	73	2	8.3	.13	1	12.7	1	9.3	.01
RESIDUE/SLUDGE	9.9	442	4404.9	437	1	2.5	.12	1	38.4	1	24.7	.01
SOLID WASTE	1.9	1788	3463.3	1788	1	.5	.02	1	3.0	1	8.8	.44
SAMPLES	.3	818	328.8	818	1	4.7	.13	1	11.7	1	2.7	.01
PROCESS HOLDUP	3.1	294	938.3	291	1	3.8	.07	1	36.4	1	10.9	.01
STANDARDS	2.2	261	882.1	259	1	.1	0.00	1	0.0	1	.0	.00

TABLE C-2
 ADDITIONS TO FACILITY (FEED) MEASUREMENT ERROR DATA FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
FULL UF6 CYLINDERS	1452.8	170	246992.1	110	1	.0	0.00	1	.0	1	.0	0.00
FUEL RODS	3.2	194	621.4	9	38	.1	.20	1	.2	1	.1	.01
UNH PRODUCTS	26.0	488	12710.3	121	4	.4	.02	1	0.0	1	2.2	.01
SAMPLES	.0	257	15.0	257	1	0.0	0.00	1	.0	1	0.0	0.00
OTHER	4.6	107	493.1	72	1	5.3	.00	1	5.5	1	.3	.00

TABLE C-3
 REMOVALS FROM FACILITY (SHIPMENTS) MEASUREMENT ERROR DATA FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	DESCRIPTION	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSHAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSHAT ERROR ANALYSIS
UF ₆ CYLINDER HEELS		2.3	224	519.8	147	1	.0	0.00	1	.0	1	.0	0.00
VENDOR UO ₂		20.2	9609	194128.1	909	10	.0	.03	1	.0	1	.0	.00
FUEL RODS		1.8	11	19.8	1	11	.1	0.00	1	0.0	1	.0	.00
ASSEMBLIES		2.9	111970	329902.7	732	148	.1	.20	1	.2	1	.1	.01
SCRAP FOR SHIPMENT		9.8	990	9789.0	913	1	2.7	.03	1	3.0	1	24.7	.44
SAMPLES		.0	149	0.0	149	1	0.0	0.00	1	.0	1	0.0	0.00
LIQUID DISCARDS		5.9	363	2155.0	13	27	1.4	.12	1	36.4	1	10.3	.01
SOLID DISCARDS		.4	2633	1226.0	2633	1	0.0	0.00	1	0.0	1	3.4	.44

TABLE C-4
 NEW ENDING INVENTORY MEASUREMENT ERROR DATA FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSTAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSTAT ERROR ANALYSIS
FULL UF6 CYLINDERS	1428.8	1	1428.8	1	1	.0	0.00	1	.0	1	.0	0.00
UF6 CYLINDER HEELS	2.1	83	179.6	60	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	25.5	1911	48901.2	196	9	2.2	.04	1	1.5	1	.9	.00
UPS RECYCLE	26.5	594	15791.5	57	10	2.2	.04	1	1.1	1	.1	.00
ADU/UPS CROSS	26.1	131	3431.6	29	5	2.2	.04	1	1.1	1	.0	.00
GECO CONVERSION	25.9	172	4461.8	21	8	3.8	0.00	1	5.7	1	.3	.00
VENDOR UO2	26.3	91	2398.7	1	91	3.8	0.00	1	5.7	1	.1	.00
UO2 FOR SHIPMT	21.6	3342	72389.6	340	9	.0	.03	1	.0	1	.0	.00
POWDER/PELLETS	11.6	35	408.4	19	2	2.8	.05	1	1.1	1	.4	.00
INTERMED. PROD.	17.0	420	7178.7	326	1	5.3	.09	1	35.9	1	9.3	.01
PELLETS	14.7	1083	15989.3	45	24	.3	.02	1	0.0	1	.0	.00
FUEL RODS	2.9	10360	30488.6	129	82	.1	.01	1	0.0	1	.0	.00
POISON RODS	2.8	2079	5945.4	22	94	.0	.20	1	.2	1	.1	.01
ASSEMBLIES	2.9	52537	155026.3	351	149	.1	.20	1	.2	1	.1	.01
PRESS SCRAP	16.0	79	1268.4	79	1	1.0	.13	1	6.9	1	4.4	.00
GRINDER RESIDUE	15.2	23	351.1	10	2	1.0	.11	1	.8	1	.4	.00
DIRTY POWDER	17.0	159	2710.7	36	4	8.3	.13	1	12.7	1	9.3	.01
RESIDUE/SLUDGE	7.9	164	1304.0	161	1	2.5	.07	1	36.4	1	24.7	.01
SOLID WASTE	1.4	581	852.7	581	1	.5	.02	1	3.0	1	8.8	.44
SAMPLES	2.7	188	521.4	188	1	0.0	0.00	1	.0	1	0.0	0.00
PROCESS HOLDUP	6.9	99	683.4	98	1	4.8	.07	1	36.4	1	19.9	.01
STANDARDS	2.9	271	793.6	160	1	.1	0.00	1	6.0	1	.0	.00

TABLE C-5
 STATIC INVENTORY MEASUREMENT ERROR DATA FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSTAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSTAT ERROR ANALYSIS
UO ₂ CYLINDER HEELS	23.6	1	1752.8	1	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	22.2	74	843.9	49	1	2.2	.04	1	1.5	1	.9	.00
UPS RECYCLE	21.7	38	65.2	28	1	2.2	.04	1	1.1	1	.1	.00
ADU/UPS CROSS	21.9	3	650.0	12	1	2.2	.04	1	1.1	1	.0	.00
GECO CONVERSION	20.1	166	3341.2	20	8	3.8	0.00	1	5.7	1	.3	.00
UO ₂ FOR SHIPMENT	9.3	7	65.6	7	1	5.3	.08	1	.0	1	.0	.00
POWDER/PELLETS	13.1	11	144.9	11	1	1.5	.09	1	35.9	1	5.8	.01
INTERMED. PROD.	9.4	138	1300.4	30	4	.3	.02	1	0.0	1	.0	.00
PELLETS	2.0	1464	4197.2	16	91	.1	.01	1	0.0	1	.0	.00
FUEL RODS	2.0	584	1666.3	6	97	.0	.20	1	.2	1	.1	.01
POISON RODS	2.9	40439	118805.3	271	149	.1	.20	1	.2	1	.1	.01
ASSEMBLIES	23.5	2	47.1	2	1	2.7	.03	1	.2	1	.1	.01
GRINDER RESIDUE	21.9	11	241.1	11	1	5.3	.08	1	12.6	1	9.3	.01
DIRTY POWDER	8.4	17	143.9	14	1	1.4	.07	1	36.4	1	19.9	.01
RESIDUE/SLUDGE	1.3	109	146.2	109	1	.5	.02	1	3.0	1	0.0	.44
SOLID WASTE	4.3	80	351.8	80	1	0.0	0.00	1	.0	1	0.0	0.00
SAMPLES	6.7	81	946.8	77	1	0.0	0.00	1	0.0	1	0.0	0.00
STANDARDS												

TABLE C-6
 BEGINNING INVENTORY MEASUREMENT ERROR DATA FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSTAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSTAT ERROR ANALYSIS
FULL UF6 CYLINDERS	1391.7	69	96032.7	48	1	.0	0.00	1	.0	1	.0	0.00
UF6 CYLINDER HEELS	3.4	121	418.1	76	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	24.8	2333	57944.5	178	13	5.2	.04	1	.9	1	.4	.00
UPS RECYCLE	26.0	947	24682.0	65	11	3.0	.04	1	1.1	1	.0	.00
ADU/UPS CROSS	26.0	109	2835.9	23	4	.9	.04	1	1.5	1	.0	.00
QECO CONVERSION	24.2	1000	24269.9	39	25	11.5	.04	1	6.2	1	.3	.00
VENOOR UO2	25.0	2	50.0	2	1	2.2	.04	1	.8	1	.0	.00
UO2 FOR SHIPMT	18.7	4626	86652.3	408	11	.0	.03	1	.0	1	.0	.00
POWDER/PELLETS	16.2	128	2073.8	24	4	2.8	.08	1	1.3	1	.4	.00
INTERMED. PROD.	20.4	86	1755.2	65	1	1.7	.09	1	40.6	1	3.7	.01
PELLETS	14.9	1097	16446.7	38	30	.3	.02	1	0.0	1	.0	.00
FUEL RODS	2.9	13881	40676.9	95	146	1.1	.01	1	0.0	1	.0	.00
POISON PELLETS	10.8	164	1786.8	18	16	.1	0.00	1	.0	1	.0	.00
POISON RODS	2.8	2864	8152.0	30	95	.6	.20	1	.2	1	.2	.01
ASSEMBLIES	2.9	88529	263147.7	591	149	.9	.20	1	.0	1	.0	.01
PRESS SCRAP	15.8	216	3425.8	213	1	2.8	.13	1	5.0	1	3.6	.01
GRINDER RESIDUE	18.6	183	3041.9	19	9	1.1	.11	1	.8	1	.4	.01
DIRTY POWDER	19.8	207	4108.7	73	2	4.0	.13	1	18.7	1	3.7	.01
RESIDUE/SLUDGE	9.9	442	4404.9	439	1	1.3	.12	1	7.0	1	21.7	.01
SOLID WASTE	1.9	1788	3463.3	1788	1	.1	.02	1	1.1	1	4.2	.44
SAMPLES	.3	818	320.8	618	1	.1	.13	1	.3	1	.0	.01
PROCESS HOLDUP	3.1	294	930.3	291	1	5.7	.07	1	98.1	1	27.6	.01
STANDARDS	2.2	261	582.1	258	1	.1	0.00	1	0.0	1	.0	.00

TABLE C-7
 ADDITIONS TO FACILITY (FEED) MEASUREMENT ERROR DATA FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	DESCRIPTION	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
FULL UO ₂ CYLINDERS		1952.8	178	246992.1	118	1	0.0	0.00	1	0.0	1	0.0	0.00
FUEL RODS		3.2	194	621.4	9	38	1.3	0.20	1	0.0	1	0.0	0.01
UHM PRODUCTS		26.0	488	12710.3	121	4	0.5	0.02	1	0.0	1	0.0	0.01
SAMPLES		0.0	257	15.0	257	1	0.0	0.00	1	0.0	1	0.0	0.00
OTHER		4.6	107	493.1	78	1	1.4	0.08	1	1.0	1	0.1	0.00

TABLE C-8
 REMOVALS FROM FACILITY (SHIPMENTS) MEASUREMENT ERROR DATA FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
UF ₆ CYLINDER HEELS	2.3	224	519.8	147	1	.0	0.00	1	.0	1	.0	0.00
VENDOR UO ₂	20.2	9689	194128.1	9689	10	.0	.03	1	.0	1	.0	.00
FUEL RODS	1.8	11	19.8	1	11	.1	0.00	1	0.0	1	.0	.00
ASSEMBLIES	2.9	111970	329902.7	752	148	.9	.20	1	.0	1	.0	.01
SCRAP FOR SHIPMENT	9.8	990	9789.0	913	1	3.9	.03	1	.0	1	14.8	.44
SAMPLES	.0	149	9.6	140	1	0.0	0.00	1	.0	1	0.0	0.00
LIQUID DISCARDS	5.9	363	2155.8	12	27	20.1	.12	1	97.8	1	27.6	.01
SOLID DISCARDS	.4	2633	1228.9	2633	1	0.0	0.00	1	0.0	1	3.7	.44

TABLE C-9
 NEW ENDING INVENTORY MEASUREMENT ERROR DATA FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
FULL UO ₂ CYLINDERS	1928.8	1	1428.8	1	1	.0	0.00	1	.0	1	.0	0.00
UO ₂ CYLINDER HEELS	2.1	83	179.6	60	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	25.5	1911	48901.2	190	9	5.4	.04	1	1.5	1	1.0	.00
UPS RECYCLE	26.5	594	15791.5	57	10	3.5	.04	1	1.5	1	.0	.00
ADU/UPS CROSS	26.1	131	3431.6	20	8	1.3	.04	1	1.3	1	.0	.00
SECO CONVERSION	25.9	172	4461.8	21	8	7.2	0.00	1	0.3	1	.3	.00
VENDOR UO ₂	26.3	91	2398.7	1	91	3.8	0.00	1	5.7	1	.1	.00
UO ₂ FOR SHIPMENT	21.6	3342	72389.6	340	9	.0	.03	1	.0	1	.0	.00
POWDER/PELLETS	11.6	35	408.6	19	2	2.8	.05	1	1.2	1	.4	.00
INTERMED. PROD.	17.0	420	7178.7	326	1	2.5	.09	1	10.8	1	6.0	.01
PELLETS	14.7	1083	15989.3	10	24	.3	.02	1	0.0	1	.0	.00
FUEL RODS	2.9	10360	30488.8	120	82	.6	.01	1	0.0	1	.0	.00
POISON RODS	2.8	2079	5945.6	22	94	.3	.20	1	.2	1	.2	.01
ASSEMBLIES	2.9	52537	155026.3	381	149	.3	.20	1	.5	1	.0	.01
PRESS SCRAP	16.0	79	1268.6	70	1	1.0	.13	1	3.3	1	2.1	.00
GRINDER RESIDUE	19.2	23	351.1	19	2	1.0	.11	1	1.8	1	.4	.00
DIRTY POWDER	17.0	159	2710.7	30	4	4.6	.13	1	15.7	1	3.7	.01
RESIDUE/SLUDGE	7.9	164	1304.0	151	1	1.5	.07	1	5.7	1	23.4	.01
SOLID WASTE	1.4	581	852.7	551	1	.9	.02	1	3.1	1	0.9	.44
SAMPLES	2.7	188	521.4	180	1	0.0	0.00	1	.0	1	0.0	0.00
PROCESS HOLDUP	6.9	99	683.4	90	1	4.6	.07	1	37.8	1	15.8	.01
STANDARDS	2.9	271	793.6	150	1	.2	0.00	1	0.0	1	.0	.00

TABLE C-10
 STATIC INVENTORY MEASUREMENT ERROR DATA FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

STRATUM	AVERAGE	NUMBER	TOTAL WEIGHT	TOTAL NO. OF BATCHES	TOTAL NO. OF WEIGHINGS / BATCH	RANDOM ERROR WEIGHING	SYSMAT ERROR WEIGHING	TOTAL NO. OF SAMPLES / BATCH	RANDOM ERROR SAMPLING	TOTAL NO. OF ANALYSES / BATCH	RANDOM ERROR ANALYSIS	SYSMAT ERROR ANALYSIS
UF ₆ CYLINDER NEELS	.6	1	.6	1	1	.0	0.00	1	.0	1	.0	0.00
ADU CONVERSION	23.6	74	1752.5	29	1	1.4	.04	1	1.3	1	.7	.00
UPS RECYCLE	22.2	38	843.5	29	1	1.7	.04	1	.7	1	.0	.00
ADU/UPS CROSS	21.7	3	65.2	3	1	1.3	.04	1	1.1	1	.0	.00
GECO CONVERSION	21.9	38	658.0	18	2	3.1	0.00	1	12.8	1	.3	.00
UO ₂ FOR SHIPMENT	20.1	166	3341.2	28	8	.0	.03	1	.0	1	.0	.00
POWDER/PELLETS	9.3	7	65.6	7	1	5.3	.00	1	.0	1	.0	.00
INTERMED. PROD.	13.1	11	144.9	11	1	1.0	.09	1	19.3	1	4.5	.01
PELLETS	9.4	138	1300.4	38	4	.4	.02	1	0.0	1	.0	.00
FUEL RODS	2.8	1464	4197.2	16	91	.6	.01	1	0.0	1	.0	.00
POISON RODS	2.8	584	1666.3	8	97	.0	.20	1	.2	1	.2	.01
ASSEMBLIES	2.9	40439	118805.3	271	149	1.4	.20	1	.0	1	.0	.01
GRINDER RESIDUE	23.5	2	47.1	2	1	2.7	.03	1	.1	1	.1	.01
DIRTY POWDER	21.9	11	241.1	11	1	3.7	.08	1	7.1	1	5.3	.01
RESIDUE/SLUDGE	8.4	17	143.9	14	1	2.2	.07	1	46.8	1	29.1	.01
SOLID WASTE	1.3	109	146.2	108	1	.1	.02	1	.0	1	.0	.00
SAMPLES	4.3	80	351.8	80	1	0.0	0.00	1	.0	1	0.0	0.00
STANDARDS	6.7	81	546.8	77	1	0.0	0.00	1	0.0	1	0.0	0.00

SECTION D

RESULTS OF ERROR VARIANCE CALCULATION

Tables D-1 through D-10 contain the error variance calculations as performed by the computer code QUEST.⁽¹⁰⁾ These tables correspond directly with the input data given in Tables C-1 through C-10 for the five strata categories given in the beginning of the Appendix. The operator and inspector errors are assumed to be the same for this analysis. Also, the moving inventory error variances reported are the same as measurement error variances for the calculations in this report. The paired differences in the random error for the operator and the inspector are the variances of random error for an individual measurement for the operator and the inspector.

TABLE D-1
 BEGINNING INVENTORY ERROR VARIANCE CALCULATIONS FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR OPERATOR INSPECTOR		SYSTEMATIC ERROR OPERATOR INSPECTOR		MOVING INVENTORY FOR MUF CALCULATION RANDOM SYSTEMATIC		PAIRED DIFFERENCES IN RANDOM ERROR OPERATOR INSPECTOR		STD DEVIATION OF D HAT (MINIMUM)	
BEGINNING INVENTORY									
59.3	59.3	0.	0.	59.34	0.	.5734	.5734	10.89	FULL UO ₂ CYLINDERS
.681E-03	.681E-03	0.	0.	.6810E-03	0.	.3535E-03	.3535E-05	.3690E-01	UO ₂ CYLINDER HEELS
.710E+04	.710E+04	691.7	691.7	7096.	691.7	.5082	.5082	180.2	ADU CONVERSION
.369E+04	.369E+04	125.5	125.5	3689.	125.5	.6492	.6492	118.1	UPS RECYCLE
91.5	91.5	1.657	1.657	91.53	1.657	.4234	.4234	20.99	ADU/UPS CROSS
.505E+05	.505E+05	121.3	121.3	.5046E+05	121.3	2.808	2.808	379.8	GECO CONVERSION
.690	.690	.5167E-02	.5167E-03	.6904	.5167E-03	.3452	.3452	1.176	VENDOR UO ₂
.330	.330	938.6	938.6	.3296	938.6	.3403E-03	.3403E-04	43.37	UO ₂ FOR SHIPMENT
132.	132.	2.877	2.877	131.6	2.877	.7804	.7804	30.31	POWDER/PELLETS
.668E+04	.668E+04	3.050	3.050	6685.	3.050	58.75	58.75	115.7	INTERMEDI PROD.
4.03	4.03	17.04	17.04	4.026	17.04	.3463E-02	.3463E-02	16.30	PELLETS
.771	.771	18.20	18.20	.7705	18.20	.2683E-04	.2683E-04	12.05	FUEL RODS
.141	.141	.3193E-02	.3193E-02	.1406	.3193E-02	.4254E-03	.4254E-03	1.915	POISON PELLETS
19.6	19.6	273.3	273.3	19.63	273.3	.7821E-04	.7821E-04	24.28	POISON RODS
.104E+04	.104E+04	.2847E+06	.2847E+06	1040.	.2847E+06	.1056E-03	.1056E-03	756.5	ASSEMBLIES
757.	757.	21.52	21.52	757.3	21.52	3.457	3.457	39.47	PRESS SCRAP
80.2	80.2	12.98	12.98	80.22	12.98	.2277	.2277	28.79	GRINDER RESIDUE
.614E+04	.614E+04	30.29	30.29	6139.	30.29	11.01	11.01	114.0	DIRTY POWDER
.866E+04	.866E+04	28.74	28.74	8662.	28.74	19.38	19.38	131.8	RESIDUE/SLUDGE
58.9	58.9	239.1	239.1	58.90	239.1	.3294E-01	.3294E-01	24.41	SOLID WASTE
2.12	2.12	.1847	.1847	2.124	.1847	.2597E-02	.2597E-02	2.149	SAMPLES
432.	432.	.5444	.5444	431.9	.5444	1.454	1.454	29.41	PROCESS HOLDUP
.420E-02	.420E-02	.3389E-02	.3389E-03	.4201E-02	.3389E-03	.1554E-03	.1554E-04	.9920E-01	STANDARDS
.854E+05	.854E+05	.2873E+06	.2873E+06	.8541E+05	.2873E+06	.1406E+05		2081.	SUBTOTALS
.854E+05	.854E+05	.2873E+06	.2873E+06	.8541E+05	.2873E+06	.1406E+05		2081.	TOTALS

TABLE D-2
 ADDITIONS TO FACILITY (FEED) ERROR VARIANCE CALCULATIONS FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR OPERATOR INSPECTOR		SYSTEMATIC ERROR OPERATOR INSPECTOR		MOVING INVENTORY FOR MUF CALCULATION RANDOM SYSTEMATIC		PAIRED DIFFERENCES IN RANDOM ERROR OPERATOR INSPECTOR		STD DEVIATION OF D HAT (MINIMUM)	
ADDITIONS TO PLANT									
164.	164.	0.	0.	164.2	0.	.6248	.6248	18.12	FULL UO ₂ CYLINDERS
.690	.690	1.588	1.588	.6901	1.588	.1227E-03	.1227E-03	2.641	FUEL RODS
661.	661.	10.99	10.99	661.1	10.99	.3449	.3449	37.14	UNH PRODUCTS
.884E-20	.884E-20	0.	0.	.8840E-20	0.	.3440E-22	.3440E-22	.1330E-09	SAMPLES
19.9	19.9	.1627	.1627	19.90	.1627	.1252	.1252	6.335	OTHER
146.	846.	12.74	12.74	845.8	12.74	651.9		63.84	SUBTOTALS
146.	846.	12.74	12.74	845.8	12.74	651.9		63.84	TOTALS

TABLE D-3
 REMOVALS FROM FACILITY (SHIPMENTS) ERROR VARIANCE CALCULATIONS FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY FOR MUF CALCULATION		PAIRED DIFFERENCES IN RANDOM ERROR		STD DEVIATION OF D HAT (MINIMUM)	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	RANDOM	SYSTEMATIC	OPERATOR	INSPECTOR		
REMOVALS FROM PLANT									
.544E-03	.544E-03	0.	0.	.5443E-03	0.	.1595E-03	.1595E-05	.3299E-01	UF6 CYLINDER WHEELS
.775	.775	4711.	4711.	.7753	4711.	.3959E-04	.3959E-04	97.11	VENDOR UO2
.120E-03	.120E-03	.3943E-06	.3943E-06	.1202E-03	.3943E-06	.1018E-04	.1018E-04	.4964E-01	FUEL RODS
.128E+04	.128E+04	.4475E+06	.4475E+06	1284.	.4475E+06	.1038E-03	.1038E-03	947.9	ASSEMBLIES
.661E+04	.661E+04	1917.	1917.	6608.	1917.	6.156	6.156	130.6	SCRAP FOR SHIPMENT
.629E-20	.629E-20	0.	0.	.6294E-20	0.	.4224E-22	.4224E-22	.1122E-09	SAMPLES
.514E+05	.514E+05	6.883	6.883	.5139E+05	6.883	5.077	5.077	320.8	LIQUID DISCARDS
.695	.695	29.93	29.93	.6947	29.93	.2639E-03	.2639E-03	7.826	SOLID DISCARDS
.593E+05	.593E+05	.4542E+06	.4542E+06	.5928E+05	.4542E+06	6390.		1504.	SUBTOTALS
.593E+05	.593E+05	.4542E+06	.4542E+06	.5928E+05	.4542E+06	6390.		1504.	TOTALS

TABLE D-4
NEW ENDING INVENTORY ERROR VARIANCE CALCULATIONS FOR "MAXIMUM"
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY		PAIRED DIFFERENCES		STD DEVIATION OF D HAT (MINIMUM)	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	FOR MUF RANDOM	CALCULATION SYSTEMATIC	IN RANDOM OPERATOR	ERROR INSPECTOR		
NEW ENDING INVENTORY									
.604	.604	0.	0.	.6043	0.	.6043	.6043	1.099	FULL UO ₂ CYLINDERS
.159E-03	.159E-03	0.	0.	.1592E-03	0.	.1387E-05	.1387E-05	.1784E-01	UO ₂ CYLINDER HEELS
.479E+04	.479E+04	492.6	492.6	4792.	492.6	.5395	.5395	145.2	ADU CONVERSION
427.	427.	51.37	51.37	826.8	51.37	.4421	.4421	74.67	UPS RECYCLE
111.	111.	2.426	2.426	110.8	2.426	.4277	.4277	24.33	ADU/UPS CROSS
.329E+04	.329E+04	.1991E-01	.1991E-01	3287.	.1991E-01	3.208	3.208	95.07	GECO CONVERSION
.189E+05	.189E+05	.5754E-02	.5754E-02	.1892E+05	.5754E-02	3.305	3.305	234.0	VENDOR #02
.303	.303	655.0	655.0	.3031	655.0	.4551E-04	.4551E-04	36.24	UO ₂ FOR SHIPWY
6.19	6.19	.4588E-01	.4588E-01	6.186	.4588E-01	.1309	.1309	4.634	POWDER/PELLETS
.223E+05	.223E+05	51.02	51.02	.2230E+05	51.02	41.20	41.20	211.4	INTERMED. PROD.
3.77	3.77	16.11	16.11	3.773	16.11	.3359E-02	.3359E-02	14.40	PELLETS
.452	.452	10.23	10.23	.4523	10.23	.2706E-04	.2706E-04	8.180	FUEL RODS
14.2	14.2	145.4	145.4	14.24	145.4	.7895E-04	.7895E-04	17.94	POISON RODS
608.	608.	.9882E+05	.9882E+05	607.5	.9882E+05	.1041E-03	.1041E-03	446.4	ASSEMBLIES
139.	139.	2.917	2.917	139.2	2.917	1.762	1.762	16.86	PRESS SCRAP
1.73	1.73	.1704	.1704	1.726	.1704	.4607E-01	.4607E-01	2.484	GRINDER RESIDUE
.549E+04	.549E+04	13.18	13.18	5489.	13.18	9.347	9.347	114.7	DIRTY POWDER
.206E+04	.206E+04	1.070	1.070	2061.	1.070	12.33	12.33	64.21	RESIDUE/SLUDGE
11.0	11.0	14.49	14.49	10.99	14.49	.1891E-01	.1891E-01	7.138	SOLID WASTE
.145E-16	.145E-16	0.	0.	.1446E-16	0.	.7692E-19	.7692E-19	.5378E-08	SAMPLES
936.	936.	.2938	.2938	835.9	.2938	8.358	8.358	40.89	PROCESS HOLOUP
.123E-01	.123E-01	.6300E-03	.6300E-03	.1230E-01	.6300E-03	.2680E-04	.2680E-04	.1608	STANDARDS
.594E+05	.594E+05	.1003E+06	.1003E+06	.5940E+05	.1003E+06	.1032E+05		1560.	SUBTOTALS
.594E+05	.594E+05	.1003E+06	.1003E+06	.5940E+05	.1003E+06	.1032E+05		1560.	TOTALS

TABLE D-5
 STATIC INVENTORY ERROR VARIANCE CALCULATIONS FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY		PAIRED DIFFERENCES		STD DEVIATION OF D HAT (MINIMUM)	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	FOR MUF	CALCULATION	IN RANDOM ERROR			
				RANDOM	SYSTEMATIC	OPERATOR	INSPECTOR		
STATIC INVENTORY									
.111E-06	.111E-06	0.	0.	.111E-06	0.	.111E-06	.111E-06	.471E-03	UO6 CYLINDER HEELS
51.6	51.6	.6327	.6327	51.65	.6327	.4621	.4621	10.23	ADU CONVERSION
17.8	17.8	.1466	.1466	17.81	.1466	.3083	.3083	5.992	UPS RECYCLE
.886	.886	.8783E-03	.8783E-03	.8858	.8783E-03	.2953	.2953	1.332	ADU/UPS CROSS
145.	145.	.4331E-03	.4331E-03	145.2	.4331E-03	2.294	2.294	18.55	GECO CONVERSION
.117E-01	.117E-01	1.395	1.395	.1165E-01	1.395	.3930E-04	.3930E-04	1.703	UO2 FOR SHIPMT
1.74	1.74	.2884E-02	.2884E-02	1.737	.2884E-02	.2482	.2482	1.866	POWDER/PELLETS
254.	254.	.2080E-01	.2080E-01	254.2	.2080E-01	23.11	23.11	22.55	INTERMED. PROD.
.218	.218	.1065	.1065	.2181	.1065	.1368E-02	.1368E-02	1.397	PELLETS
.628E-01	.628E-01	.1938	.1938	.6284E-01	.1938	.2568E-04	.2568E-04	2.686	FUEL RODS
4.10	4.10	11.42	11.42	4.100	11.42	.7859E-04	.7859E-04	5.636	POISON RODS
462.	462.	.5804E+05	.5804E+05	462.1	.5804E+05	.1032E-03	.1032E-03	342.3	ASSEMBLIES
.834	.834	.3154E-03	.3154E-03	.8338	.3154E-03	.4169	.4169	1.292	GRINDER RESIDUE
146.	146.	.4012E-01	.4012E-01	145.8	.4012E-01	13.25	13.25	17.08	DIRTY POWDER
256.	256.	.1303E-01	.1303E-01	256.4	.1303E-01	12.42	12.42	22.65	RESIDUE/SLUDGE
1.72	1.72	.4265	.4265	1.724	.4265	.1581E-01	.1581E-01	2.074	SOLID WASTE
.155E-16	.155E-16	0.	0.	.1547E-16	0.	.1934E-18	.1934E-18	.5562E-08	SAMPLES
0.	0.	0.	0.	0.	0.	0.	0.	0.	STANDARDS
.134E+04	.134E+04	.5805E+05	.5805E+05	1343.	.5805E+05	1017.		457.6	SUBTOTALS
.134E+04	.134E+04	.5805E+05	.5805E+05	1343.	.5805E+05	1017.		457.6	TOTALS

TABLE D-6
 BEGINNING INVENTORY ERROR VARIANCE CALCULATIONS FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR OPERATOR INSPECTOR		SYSTEMATIC ERROR OPERATOR INSPECTOR		MOVING INVENTORY FOR MUF CALCULATION RANDOM SYSTEMATIC		PAIRED DIFFERENCES IN RANDOM ERROR OPERATOR INSPECTOR		STD DEVIATION OF $\hat{\sigma}$ HAT (MINIMUM)	
BEGINNING INVENTORY									
61.1	61.1	0.	0.	61.11	0.	.5905	.5905	11.06	FULL UF ₆ CYLINDERS
.807E-03	.807E-03	0.	0.	.8066E-03	0.	.4187E-05	.4187E-05	.4016E-01	UF ₆ CYLINDER WHEELS
.597E-04	.597E-04	691.7	691.7	5969.	691.7	1.771	1.771	331.2	ADU CONVERSION
.154E-04	.154E-04	125.5	125.5	1537.	125.5	.7301	.7301	125.1	UPS RECYCLE
87.5	87.5	1.657	1.657	87.48	1.657	.2179	.2179	15.11	ADU/UPS CROSS
.666E-05	.666E-05	121.3	121.3	.6662E+05	121.3	10.12	10.12	720.7	GECO CONVERSION
.690	.690	.5167E-03	.5167E-03	.6904	.5167E-03	.3452	.3452	1.176	VENDOR H02
.863	.863	938.6	938.6	.8628	938.6	.1458E-03	.1458E-03	43.50	UO ₂ FOR SHIPMENT
63.0	63.0	2.877	2.877	63.04	2.877	.2707	.2707	17.96	POWDER/PELLETS
.791E-04	.791E-04	3.050	3.050	7907.	3.050	69.49	69.49	122.8	INTERMED. PROD.
4.07	4.07	17.04	17.04	4.070	17.04	.3498E-02	.3498E-02	16.37	PELLETS
16.2	16.2	18.20	18.20	16.17	18.20	.1135E-02	.1135E-02	68.12	FUEL RODS
.141	.141	.3193E-08	.3193E-02	.1406	.3193E-02	.4254E-03	.4254E-03	1.215	POISON PELLETS
20.9	20.9	273.3	273.3	20.85	273.3	.3833E-03	.3833E-03	27.50	POISON RODS
164.	164.	.2847E+06	.2847E+06	164.5	.2847E+06	.8805E-03	.8805E-03	770.0	ASSEMBLIES
255.	255.	21.52	21.52	254.7	21.52	1.163	1.163	23.50	PRESS SCRAP
55.9	55.9	12.98	12.98	55.86	12.98	.6374E-01	.6374E-01	15.83	GRINDER RESIDUE
.865E-04	.865E-04	30.29	30.29	8650.	30.29	15.06	15.06	133.2	DIRTY POWDER
.233E-04	.233E-04	28.74	28.74	2331.	28.74	5.213	5.213	68.69	RESIDUE/SLUDGE
13.2	13.2	239.1	239.1	13.20	239.1	.7383E-02	.7383E-02	22.46	SOLID WASTE
.195E-02	.195E-02	.1847	.1847	.1946E-02	.1847	.2378E-05	.2378E-05	.6110	SAMPLES
.310E-04	.310E-04	.5444	.5444	3102.	.5444	10.44	10.44	78.77	PROCESS HOLDUP
.468E-02	.468E-02	.3389E-03	.3389E-03	.4675E-02	.3389E-03	.1730E-04	.1730E-04	.1001	STANDARDS
.969E+05	.969E+05	.2873E+06	.2873E+06	.9686E+05	.2873E+06	.2045E+05		2618.	SUBTOTALS
.969E+05	.969E+05	.2873E+06	.2873E+06	.9686E+05	.2873E+06	.2045E+05		2618.	TOTALS

TABLE D-7
 ADDITIONS TO FACILITY (FEED) ERROR VARIANCE CALCULATIONS FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY FOR MUF CALCULATION		PAIRED DIFFERENCES IN RANDOM ERROR		STD DEVIATION OF $\hat{O}$ HAT (MINIMUM)	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	RANDOM	SYSTEMATIC	OPERATOR	INSPECTOR		
ADDITIONS TO PLANT									
164.	164.	0.	0.	164.2	0.	.6248	.6248	18.12	FULL UO ₂ CYLINDERS
.389	.389	1.588	1.588	.3693	1.588	.1921E-02	.1921E-02	5.666	FUEL RODS
667.	667.	10.99	10.99	666.7	10.99	.3546	.3546	37.66	UNH PRODUCTS
.164E-19	.164E-19	0.	0.	.164E-19	0.	.6381E-24	.6381E-22	.1811E-09	SAMPLES
1.93	1.93	.1627	.1627	1.926	.1627	.1211E-01	.1211E-01	2.044	OTHER
833.	833.	12.74	12.74	833.1	12.74	622.7		63.48	SUBTOTALS
833.	833.	12.74	12.74	833.1	12.74	622.7		63.48	TOTALS

TABLE D-8
 REMOVALS FROM FACILITY (SHIPMENTS) ERROR VARIANCE CALCULATIONS FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY		PAIRED DIFFERENCES		STD DEVIATION OF D MAT (MINIMUM)	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	FOR MUF RANDOM	CALCULATION SYSTEMATIC	IN RANDOM OPERATOR	ERROR INSPECTOR		
REMOVALS FROM PLANT									
.674E-03	.674E-03	0.	0.	.6736E-03	0.	.1973E-03	.1973E-05	.3670E-01	UO ₂ CYLINDER HEELS
1.73	3.73	4711.	4711.	3.725	4711.	.3300E-03	.3300E-03	97.41	VENDOR UO ₂
.120E-03	.120E-03	.3943E-06	.3943E-06	.1202E-03	.3943E-06	.1018E-04	.1018E-04	.4964E-01	FUEL RODS
196.	196.	.4475E+06	.4475E+06	196.1	.4475E+06	.8549E-03	.8549E-03	961.0	ASSEMBLIES
.247E+04	.247E+04	1917.	1917.	2474.	1917.	2.304	2.304	93.71	SCRAP FOR SHIPMENT
.287E-18	.287E-18	0.	0.	.2967E-18	0.	.1924E-20	.1924E-20	.7573E-09	SAMPLES
.370E+06	.370E+06	6.883	6.883	.3700E+06	6.883	37.88	37.88	876.3	LIQUID DISCARDS
.797	.797	29.93	29.93	.7972	29.93	.3028E-03	.3028E-03	7.039	SOLID DISCARDS
.373E+06	.373E+06	.4542E+06	.4542E+06	.3727E+06	.4542E+06	.1923E+05		2036.	SUBTOTALS
.373E+06	.373E+06	.4542E+06	.4542E+06	.3727E+06	.4542E+06	.1923E+05		2036.	TOTALS

TABLE D-9
NEW ENDING INVENTORY ERROR VARIANCE CALCULATIONS FOR APPORTIONED
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
ERROR VARIANCES

RANDOM ERROR OPERATOR INSPECTOR		SYSTEMATIC ERROR OPERATOR INSPECTOR		MOVING INVENTORY FOR MUF CALCULATION RANDOM SYSTEMATIC		PAIRED DIFFERENCES IN RANDOM ERROR OPERATOR INSPECTOR		STD DEVIATION OF O HAT (MINIMUM)	
NEW ENDING INVENTORY									
.604	.604	0.	0.	.6043	0.	.6043	.6043	1.099	FULL UO ₂ CYLINDERS
.159E-03	.159E-03	0.	0.	.1592E-03	0.	.1387E-03	.1387E-05	.1784E-01	UO ₂ CYLINDER HEELS
.831E+04	.831E+04	492.6	492.6	8311.	492.6	2.165	2.165	285.8	AQU CONVERSION
688.	688.	51.37	51.37	688.0	51.37	.8929	.8929	105.6	UPS RECYCLE
102.	102.	2.426	2.426	101.9	2.426	.2443	.2443	18.48	ADU/UPS CROSS
.445E+04	.445E+04	.1991E-01	.1991E-01	4453.	.1991E-01	6.254	6.254	132.7	BECO CONVERSION
.189E+05	.189E+05	.5754E-02	.5754E-02	.1892E+05	.5754E-02	3.305	3.305	234.0	VENDOR UO ₂
.420	.420	655.0	655.0	.4200	655.0	.7754E-04	.7754E-04	36.27	UO ₂ FOR SHIPMENT
.66	.66	.4588E-01	.4588E-01	6.664	.4588E-01	.1380	.1380	4.757	POWDER/PELLETS
.254E+04	.254E+04	51.02	51.02	2538.	51.02	4.691	4.691	71.97	INTERMEDIATE PROD.
3.82	3.82	16.11	16.11	3.818	16.11	.3369E-02	.3369E-02	14.42	PELLETS
4.06	4.06	10.23	10.23	4.064	10.23	.3711E-03	.3711E-03	25.65	FUEL RODS
16.1	16.1	145.4	145.4	16.14	145.4	.1853E-03	.1853E-03	19.67	POISON RODS
41.6	41.6	.9882E+05	.9882E+05	41.60	.9882E+05	.9130E-04	.9130E-04	446.2	ASSEMBLIES
34.6	34.6	2.917	2.917	34.65	2.917	.4386	.4386	8.668	PRESS SCRAP
1.73	1.73	.1704	.1704	1.726	.1704	.4607E-01	.4607E-01	2.284	GRINDER RESIDUE
.549E+04	.549E+04	13.18	13.18	5492.	13.18	8.301	8.301	108.1	DIRTY POWDER
619.	619.	1.070	1.070	618.6	1.070	3.703	3.703	35.21	RESIDUE/SLUDGE
13.7	13.7	14.49	14.49	13.70	14.49	.2359E-01	.2359E-01	7.509	SOLID WASTE
.282E-16	.282E-16	0.	0.	.2815E-16	0.	.1498E-18	.1498E-18	.7504E-08	SAMPLES
.803.	.803.	.2938	.2938	802.5	.2938	8.024	8.024	40.07	PROCESS HOLDUP
.170E-01	.170E-01	.6300E-03	.6300E-03	.1700E-01	.6300E-03	.3703E-04	.3703E-04	.1878	STANDARDS
.420E+05	.420E+05	.1003E+06	.1003E+06	.4205E+05	.1003E+06		9873.	1598.	SUBTOTALS
.420E+05	.420E+05	.1003E+06	.1003E+06	.4205E+05	.1003E+06		9873.	1598.	TOTALS

TABLE D-10
 STATIC INVENTORY ERROR VARIANCE CALCULATIONS FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 ERROR VARIANCES

RANDOM ERROR		SYSTEMATIC ERROR		MOVING INVENTORY		PAIRED DIFFERENCES		STD DEVIATION	
OPERATOR	INSPECTOR	OPERATOR	INSPECTOR	FOR MUF CALCULATION		IN RANDOM ERROR		OF D NAT	
				RANDOM	SYSTEMATIC	OPERATOR	INSPECTOR	(MINIMUM)	
STATIC INVENTORY									
.111E-06	.111E-06	0.	0.	.1112E-06	0.	.1112E-06	.1112E-06	.4717E-03	U6 CYLINDER WHEELS
27.1	27.1	.6327	.6327	27.13	.6327	.2428	.2428	7.452	ADU CONVERSION
10.9	10.9	.1466	.1466	10.87	.1466	.1882	.1882	4.694	UPS RECYCLE
.433	.433	.8783E-03	.8783E-03	.4332	.8783E-03	.1444	.1444	.9317	ADU/UPS CROSS
616.	616.	.4331E-03	.4331E-03	615.8	.4331E-03	8.451	8.451	35.60	GECO CONVERSION
.223E-01	.223E-01	1.395	1.395	.2234E-01	1.395	.9323E-04	.9323E-04	1.746	UO ₂ FOR SHIPMENT
1.74	1.74	.2884E-02	.2884E-02	1.737	.2884E-02	.2482	.2482	1.866	POWDER/PELLETS
77.0	77.0	.2080E-01	.2080E-01	76.99	.2080E-01	6.999	6.999	12.41	INTERMED. PROD.
.265	.265	.1065	.1065	.2651	.1065	.1639E-02	.1639E-02	1.514	PELLETS
.957	.957	.1938	.1938	.9566	.1938	.6249E-03	.6249E-03	12.95	FUEL RODS
4.84	4.84	11.42	11.42	4.842	11.42	.9183E-04	.9183E-04	5.768	POISON RODS
102.	102.	.5804E-05	.5804E-05	102.4	.5804E-05	.1737E-02	.1737E-02	370.2	ASSEMBLIES
.834	.834	.3154E-03	.3154E-03	.8340	.3154E-03	.4170	.4170	1.292	GRINDER RESIDUE
49.5	49.5	.4012E-01	.4012E-01	49.47	.4012E-01	4.497	4.497	9.950	DIRTY POWDER
386.	386.	.1303E-01	.1303E-01	385.6	.1303E-01	18.68	18.68	27.77	RESIDUE/SLUDGE
.126	.126	.4265	.4265	.1258	.4265	.1154E-02	.1154E-02	1.051	SOLID WASTE
.155E-16	.155E-16	0.	0.	.1547E-16	0.	.1934E-18	.1934E-18	.5562E-08	SAMPLES
0.	0.	0.	0.	0.	0.	0.	0.	0.	STANDARDS
.128E+04	.128E+04	.5805E+05	.5805E+05	1278.	.5805E+05	2843.		495.2	SUBTOTALS
.128E+04	.128E+04	.5805E+05	.5805E+05	1278.	.5805E+05	2843.		495.2	TOTALS

SECTION E

RESULTS OF THE LEMUF CALCULATIONS

Tables E-1 through E-10 contain the LEMUF calculations as performed by the computer code QUEST.⁽¹⁰⁾ These tables correspond directly with the computer input data and the error variance calculations given in Sections C and D, respectively. A comparison of the effect on the results of these calculations of combining the inventory measurement error data by "maximum" error versus apportioned errors can be made. For the purposes of this report there are no surprises (no significant differences) in the differences in the results of the QUEST calculations. Therefore, the data generated by the "maximum" combination method was used and reported for the remaining calculations. These calculations include the inspector's number of attributes tests reported in Section F and the number of variables tests reported in Sections A and B.

TABLE E-1
 BEGINNING INVENTORY LEMUF CALCULATION FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM	WEIGHT	NUMBER	OPERATOR ERROR VARIANCE		TOTAL	
			RANDOM	SYSTEMATIC		
BEGINNING INVENTORY						
1 FULL UF6 CYLINDERS	1391.77	69	59.34	0.00	59.34	
2 UF6 CYLINDER HEELS	3.45	121	.00	0.00	.00	
3 ADU CONVERSION	24.83	4333	7095.54	691.65	7787.20	
4 UPS RECYCLE	26.06	947	3688.65	126.49	3814.15	
5 ADU/UPS CROSS	26.01	109	91.52	1.65	93.18	
6 GECO CONVERSION	24.26	1000	50458.36	121.34	50579.70	
7 VENDOR WGT	25.04	2	.64	.00	.64	
8 UO ₂ FOR SHIPMENT	18.73	4626	.32	938.57	938.90	
9 POWDER/PELLETS	16.20	126	131.59	2.87	134.46	
10 INTERMED. PROD.	20.40	86	6684.83	3.05	6687.88	
11 PELLETS	14.99	1097	4.02	17.04	21.06	
12 FUEL RODS	2.93	13881	.77	16.20	16.97	
13 POISON PELLETS	10.89	164	.14	.00	.14	
14 POISON RODS	2.84	2864	19.62	273.26	292.89	
15 ASSEMBLIES	2.97	88529	1039.61	284742.53	285782.14	
16 PRESS SCRAP	15.86	216	757.31	21.52	778.84	
17 GRINDEN RESIDUE	16.62	183	40.22	12.98	53.20	
18 DIRTY POWDER	19.84	207	6138.82	30.28	6169.11	
19 RESIDUE/SLUDGE	9.96	442	8661.94	28.73	8690.67	
20 SOLID WASTE	1.93	1788	58.89	239.05	297.95	
21 SAMPLES	.39	818	2.12	.18	2.30	
22 PROCESS HOLDUP	3.16	294	431.93	.54	432.47	
23 STANDARDS	2.23	261	.00	.00	.00	
SUBTOTALS	647203.41	120165	85406.32	287269.01	372675.33	
TOTALS	647203.41	120165	85406.32	287269.01	372675.33	

ERROR = 287269.012 THE RANDOM COMPONENT OF VARMUF = .854E+05

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .287E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 688
 FOR A GOAL QUANTITY OF 1000.0 NTL = 688
 FOR A GOAL QUANTITY OF 4000.0 NTL = 688
 FOR A GOAL QUANTITY OF 6500.0 NTL = 688
 FOR A GOAL QUANTITY OF 10000.0 NTL = 688

VARDR30	VARD51L	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
285095.1198	574538.0232	859633.1436	486957.8073	697.8236	1158.5522	372675.3357	300.0000
284114.7015	574538.0232	858652.7247	485977.3890	697.1208	1156.8585	372675.3357	1000.0000
285432.9579	574538.0232	859970.9811	487295.6484	698.0656	1159.1352	372675.3357	4000.0000
286373.4850	574538.0232	860911.5082	488236.1725	698.7390	1160.7560	372675.3357	6500.0000
286373.4850	574538.0232	860911.5082	488236.1725	698.7390	1160.7560	372675.3357	10000.0000

TABLE E-2
 ADDITIONS TO FACILITY (FEED) LEMUF CALCULATION FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM DESCRIPTION			OPERATOR ERROR VARIANCE			
STRATUM	WEIGHT	NUMBER	RANDOM	SYSTEMATIC	TOTAL	
ADDITIONS TO PLANT						
1 FULL UF6 CYLINDERS	1452.89	170	164.15	0.00	164.15	
2 FUEL RODS	3.20	194	1.69	1.58	2.27	
3 UNH PRODUCTS	26.04	488	661.09	10.98	672.07	
4 SAMPLES	.05	257	.00	0.00	.00	
5 OTHER	4.60	107	19.90	.16	20.06	
SUBTOTALS	260832.26	1216	845.84	12.73	858.58	
TOTALS	260832.26	1216	845.84	12.73	858.58	

CERDOR = 12.737 THE RANDOM COMPONENT OF VARMUF = .846E+03

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .127E+02
 FOR A GOAL QUANTITY OF 300.0 NTL = 115
 FOR A GOAL QUANTITY OF 1000.0 NTL = 10
 FOR A GOAL QUANTITY OF 4000.0 NTL = 0
 FOR A GOAL QUANTITY OF 6500.0 NTL = 0
 FOR A GOAL QUANTITY OF 10000.0 NTL = 0

VDMUFH1(I) = -782.1628398814 VARMUF1 SET TO 0.
 VDMUFH1(I) = -782.1628398814 VARMUF1 SET TO 0.
 VDMUFH1(I) = -782.1628398814 VARMUF1 SET TO 0.
 VDMUFH1(I) = -782.1628398814 VARMUF1 SET TO 0.
 VDMUFH1(I) = -782.1628398814 VARMUF1 SET TO 0.

VARDR30	VARDS1L	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
3188.7659	25.4730	3214.2389	2355.6571	48.5351	109.1877	858.5819	300.0000
31058.7942	25.4730	31084.2672	30225.6853	173.8554	351.2863	858.5819	1000.0000
169938.8827	25.4730	169964.3557	169105.7738	411.2247	823.9675	858.5819	4000.0000
171675.1858	25.4730	171700.6588	170842.0769	413.3305	828.1713	858.5819	6500.0000
173179.9818	25.4730	173205.4549	172346.8720	415.1468	831.7973	858.5819	10000.0000

TABLE E-3
 REMOVALS FROM FACILITY (SHIPMENTS) LEMUF CALCULATION FOR "MAXIMUM"
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM DESCRIPTION						
STRATUM	WEIGHT	NUMBER	OPERATOR ERROR VARIANCE		TOTAL	
			RANDOM	SYSTEMATIC		
REMOVALS FROM PLANT						
1 UF6 CYLINDER HEELS	2.32	224	.00	0.00		.00
2 VENDOR UO ₂	20.20	9609	.77	4710.70		4711.48
3 FUEL RODS	1.80	11	.00	.00		.00
4 ASSEMBLIES	2.94	111970	1284.16	447532.91		448817.08
5 SCRAP FOR SHIPMENT	9.88	990	6608.39	1916.70		8525.10
6 SAMPLES	.06	149	.00	0.00		.00
7 LIQUID DISCARDS	5.93	363	51388.57	6.88		51395.45
8 SOLID DISCARDS	.46	2633	.69	29.92		30.62
SUBTOTALS	537752.13	125949	59282.60	454197.14		513479.74
TOTALS	537752.13	125949	59282.60	454197.14		513479.74

CERROR = 454197.142 THE RANDOM COMPONENT OF VARMUF = .593E+05

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .454E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 89
 FOR A GOAL QUANTITY OF 1000.0 NTL = 89
 FOR A GOAL QUANTITY OF 4000.0 NTL = 89
 FOR A GOAL QUANTITY OF 6500.0 NTL = 89
 FOR A GOAL QUANTITY OF 10000.0 NTL = 89

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SOMUFH1	VARMUF	GOAL QUANTITY
417891.0123	908394.2842	1326285.2964	812805.5483	901.5573	1437.5252	513479.7481	300.0000
415572.0909	908394.2842	1323966.3751	810486.6269	900.2703	1434.2953	513479.7481	1000.0000
432034.6870	908394.2842	1340428.9712	826949.2231	909.3675	1457.0701	513479.7481	4000.0000
458409.3337	908394.2842	1366803.6179	853323.8898	923.7553	1492.8335	513479.7481	6500.0000
464258.1775	908394.2842	1372652.4616	859172.7135	926.9157	1500.6489	513479.7481	10000.0000

TABLE E-4

NEW ENDING INVENTORY LEMUF CALCULATION FOR "MAXIMUM"
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION

BASED ON VERIFICATION 2.0 TIMES PER YEAR		OPERATOR ERROR VARIANCE			
STRATUM DESCRIPTION		RANDOM		SYSTEMATIC	
STRATUM	WEIGHT	NUMBER			TOTAL
NEW ENDING INVENTORY					
1 FULL UFA CYLINDERS	1428.87	1	.60	0.00	.60
2 UFA CYLINDER MEELS	2.16	83	.00	0.00	.00
3 ADU CONVERSION	25.58	1911	4791.81	492.61	5284.42
4 UPS RECYCLE	26.58	594	826.83	51.37	878.20
5 ADU/UPS CROSS	26.19	131	110.79	2.42	113.21
6 GECO CONVERSION	25.94	172	3286.78	.01	3286.80
7 VENDOR UO ₂	26.35	91	18918.05	.00	18918.05
8 UO ₂ FOR SHIPMENT	21.66	3342	.30	655.03	655.33
9 POWDER/PELLETS	11.66	39	6.18	.04	6.23
10 INTERMED. PROD.	17.09	420	22295.38	51.01	22346.40
11 PELLETS	14.76	1083	3.77	16.10	19.87
12 FUEL RODS	2.94	10360	.45	10.22	10.67
13 POISON RODS	2.85	2079	14.23	145.35	159.58
14 ASSEMBLIES	2.95	52537	607.52	98824.42	99431.95
15 PRESS SCRAP	16.05	79	139.23	2.91	142.14
16 GRINDER RESIDUE	15.26	23	1.72	.17	1.89
17 DIRTY POWDER	17.04	159	5488.72	13.18	5501.90
18 RESIDUE/SLUDGE	7.95	164	2060.59	1.06	2061.66
19 SOLID WASTE	1.46	581	10.98	14.49	25.47
20 SAMPLES	2.77	188	.00	0.00	.00
21 PROCESS HOLDUP	6.90	99	835.85	.29	836.14
22 STANDARDS	2.92	271	.01	.00	.01
SUBTOTALS	372505.87	74403	59399.86	100280.77	159680.63
TOTALS	372505.87	74403	59399.86	100280.77	159680.63

ERROR = 100280.771 THE RANDOM COMPONENT OF VARMUF = .594E+05

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .100E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 1062
 FOR A GOAL QUANTITY OF 1000.0 NTL = 1062
 FOR A GOAL QUANTITY OF 4000.0 NTL = 1062
 FOR A GOAL QUANTITY OF 6500.0 NTL = 1062
 FOR A GOAL QUANTITY OF 10000.0 NTL = 1062

VARDR30	VARDSTL	VARDH0	VOMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
100053.0098	200561.5430	300614.5527	140433.9139	375.4117	664.1483	159680.6388	300.0000
99783.7441	200561.5430	300345.3271	140864.6883	375.0529	663.3370	159680.6388	1000.0000
100328.3428	200561.5430	300889.8857	141209.2469	375.7782	664.9769	159680.6388	4000.0000
100328.3428	200561.5430	300889.8857	141209.2469	375.7782	664.9769	159680.6388	6500.0000
100328.3428	200561.5430	300889.8857	141209.2469	375.7782	664.9769	159680.6388	10000.0000

TABLE E-5

STATIC INVENTORY LEMUF CALCULATION FOR "MAXIMUM"
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM DESCRIPTION						
STRATUM	WEIGHT	NUMBER	OPERATOR ERROR VARIANCE		TOTAL	
			RANDOM	SYSTEMATIC		
STATIC INVENTORY						
1 UFA CYLINDER HEELS	.61	1	.00	0.00	.00	
2 ADU CONVERSION	23.68	74	51.64	.63	52.27	
3 UPS RECYCLE	22.19	38	17.80	.14	17.95	
4 ADU/UPS CROSS	21.76	3	.88	.00	.88	
5 GECO CONVERSION	21.93	30	145.21	.00	145.21	
6 UO ₂ FOR SHIPMENT	20.12	166	.01	1.39	1.40	
7 POWDER/PELLETS	9.37	7	1.73	.00	1.74	
8 INTERMED. PROD.	13.17	11	254.16	.02	254.18	
9 PELLETS	9.42	138	.21	.10	.32	
10 FUEL RODS	2.86	1464	.06	.19	.25	
11 POISON RODS	2.85	584	4.10	11.41	15.51	
12 ASSEMBLIES	2.93	40439	492.12	58039.68	58501.81	
13 GRINDER RESIDUE	23.56	2	.83	.00	.83	
14 DIRTY POWDER	21.92	11	145.79	.04	145.83	
15 RESIDUE/SLUDGE	8.46	17	256.39	.01	256.40	
16 SOLID WASTE	1.34	109	1.72	.42	2.15	
17 SAMPLES	4.39	80	.00	0.00	.00	
18 STANDARDS	6.75	81	0.00	0.00	0.00	
SUBTOTALS	134318.49	44255	1342.73	58054.08	59396.81	
TOTALS	134318.49	44255	1342.73	58054.08	59396.81	

ERROR = 58054.085 THE RANDOM COMPONENT OF VARMUF = .134E+04

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .581E+05
 FOR A GOAL QUANTITY OF 300.0 NTL = 17
 FOR A GOAL QUANTITY OF 1000.0 NTL = 17
 FOR A GOAL QUANTITY OF 4000.0 NTL = 17
 FOR A GOAL QUANTITY OF 6500.0 NTL = 17
 FOR A GOAL QUANTITY OF 10000.0 NTL = 17

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
37569.6790	116108.1691	153677.8481	94281.0318	307.0522	454.9616	59396.8163	300.0000
32548.6012	116108.1691	148656.7703	89259.9540	298.7640	432.3260	59396.8163	1000.0000
60427.5912	116108.1691	176535.7603	117138.9441	342.2557	546.2799	59396.8163	4000.0000
60427.5912	116108.1691	176535.7603	117138.9441	342.2557	546.2799	59396.8163	6500.0000
60427.5912	116108.1691	176535.7603	117138.9441	342.2557	546.2799	59396.8163	10000.0000

TABLE E-6
 BEGINNING INVENTORY LEMUF CALCULATION FOR APPORTIONED
 RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM	WEIGHT	NUMBER	OPERATOR ERROR VARIANCE		TOTAL	
STRATUM DESCRIPTION			RANDOM	SYSTEMATIC		
BEGINNING INVENTORY						
1 FULL UF ₆ CYLINDERS	1391.77	69	91.11	0.00	61.11	
2 UF ₆ CYLINDER REELS	3.45	121	.00	0.00	.00	
3 ADU CONVERSION	24.83	2333	5969.01	691.65	6660.67	
4 UPS RECYCLE	26.06	947	1537.39	125.49	1662.88	
5 ADU/UPS CROSS	26.01	109	87.48	1.65	89.14	
6 GECO CONVERSION	24.26	1000	66622.18	121.34	66743.52	
7 VENDOR UO ₂	25.04	2	.69	.00	.69	
8 UO ₂ FOR SHIPMENT	18.73	4626	.86	938.57	939.44	
9 POWDER/PELLETS	16.20	128	63.03	2.67	65.91	
10 INTERMED. PROD.	20.40	86	7906.55	3.05	7909.60	
11 PELLETS	14.99	1097	4.06	17.04	21.11	
12 FUEL RODS	2.93	13881	16.16	18.20	34.36	
13 POISON PELLETS	10.89	164	.14	.00	.14	
14 POISON RODS	2.84	2864	20.85	273.26	294.11	
15 ASSEMBLIES	2.97	88529	164.45	284742.53	284906.99	
16 PRESS SCRAP	15.86	216	254.68	21.52	276.21	
17 GRINDER RESIDUE	16.62	183	55.86	12.98	68.84	
18 DIRTY POWDER	19.84	207	8649.50	30.28	8679.79	
19 RESIDUE/SLUDGE	9.96	442	2330.68	28.73	2359.42	
20 SOLID WASTE	1.93	1788	13.20	239.05	252.25	
21 SAMPLES	.39	818	.00	.18	.18	
22 PROCESS HOLDUP	3.16	294	3102.17	.54	3102.72	
23 STANDARDS	2.23	261	.00	.00	.00	
SUBTOTALS	647203.41	129169	96890.14	287269.01	384129.16	
TOTALS	647203.41	129169	96890.14	287269.01	384129.16	

ERROR = 287269.012 THE RANDOM COMPONENT OF VARMUF = .969E+05

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .287E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 1455
 FOR A GOAL QUANTITY OF 1000.0 NTL = 1455
 FOR A GOAL QUANTITY OF 4000.0 NTL = 1455
 FOR A GOAL QUANTITY OF 6500.0 NTL = 1455
 FOR A GOAL QUANTITY OF 10000.0 NTL = 1455

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
286375.1579	574538.0232	860913.1811	476754.0201	690.4955	1155.8155	384129.1610	300.0000
285851.8775	574538.0232	860389.8607	476260.6997	690.1164	1154.9096	384129.1610	1000.0000
287082.0961	574538.0232	861620.1193	477490.9584	691.0072	1157.0381	384129.1610	4000.0000
287269.5063	574538.0232	861807.5295	477678.3688	691.1428	1157.3620	384129.1610	6500.0000
287269.5063	574538.0232	861807.5295	477678.3688	691.1428	1157.3620	384129.1610	10000.0000

TABLE E-7

ADDITIONS TO FACILITY (FEED) LEMUF CALCULATION FOR APPORTIONED
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION STRATUM DESCRIPTION			2.0 TIMES PER YEAR		OPERATOR ERROR VARIANCE	
STRATUM	WEIGHT	NUMBER	RANDOM	SYSTEMATIC	TOTAL	
ADDITIONS TO PLANT						
1 FULL UO ₂ CYLINDERS	1452.89	170	164.15	0.00	164.15	
2 FUEL RODS	3.20	194	.38	1.58	1.97	
3 UNH PRODUCTS	26.04	488	666.66	10.98	677.64	
4 SAMPLES	.05	257	.00	0.00	.00	
5 OTHER	4.60	107	1.92	.16	2.08	
SUBTOTALS	260832.26	1216	833.13	12.73	845.87	
TOTALS	260832.26	1216	833.13	12.73	845.87	

CERROR = 12.737 THE RANDOM COMPONENT OF VARMUF = .833E+03

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .127E+02
 FOR A GOAL QUANTITY OF 300.0 NTL = 107
 FOR A GOAL QUANTITY OF 1000.0 NTL = 9
 FOR A GOAL QUANTITY OF 4000.0 NTL = 0
 FOR A GOAL QUANTITY OF 6500.0 NTL = 0
 FOR A GOAL QUANTITY OF 10000.0 NTL = 0
 VDMUFH(1) = -769.4523979174 VARMUF1 SET TO 0.
 VDMUFH(1) = -769.4523979174 VARMUF1 SET TO 0.
 VDMUFH(1) = -769.4523979174 VARMUF1 SET TO 0.
 VDMUFH(1) = -769.4523979174 VARMUF1 SET TO 0.
 VDMUFH(1) = -769.4523979174 VARMUF1 SET TO 0.

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
3124.9279	25.4730	3150.4009	2304.5295	48.0055	108.0709	845.8714	300.0000
29375.8596	25.4730	29401.3326	28555.4612	168.9836	341.5890	845.8714	1000.0000
172108.0559	25.4730	172133.5289	171287.6575	413.8691	829.2236	845.8714	4000.0000
173844.3590	25.4730	173869.8320	173023.9666	415.9615	833.4009	845.8714	6500.0000
175349.1551	25.4730	175374.6281	174528.7567	417.7664	837.0043	845.8714	10000.0000

TABLE E-8

REMOVALS FROM FACILITY (SHIPMENTS) LEMUF CALCULATION FOR APPORTIONED
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS
UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION					
BASED ON VERIFICATION 2.0 TIMES PER YEAR			OPERATOR ERROR VARIANCE		
STRATUM	WEIGHT	NUMBER	RANDOM	SYSTEMATIC	TOTAL
REMOVALS FROM PLANT					
1 UF6 CYLINDER HEELS	2.32	224	.00	0.00	.00
2 VENDOR UO ₂	20.20	4609	3.72	4710.70	4714.43
3 FUEL RODS	1.80	11	.00	.00	.00
4 ASSEMBLIES	2.94	111970	196.05	447532.91	447728.97
5 SCRAP FOR SHIPMENT	9.88	990	2473.61	1916.70	4390.32
6 SAMPLES	.06	149	.00	0.00	.00
7 LIQUID DISCARDS	5.93	363	370026.47	6.88	370033.35
8 SOLID DISCARDS	.46	2633	.79	29.92	30.72
SUBTOTALS	537752.13	125949	372700.66	454197.14	826897.80
TOTALS	537752.13	125949	372700.66	454197.14	826897.80

CERPOR = 454197.142 THE RANDOM COMPONENT OF VARMUF = .373E+06

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .454E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 230
 FOR A GOAL QUANTITY OF 1000.0 NTL = 230
 FOR A GOAL QUANTITY OF 4000.0 NTL = 230
 FOR A GOAL QUANTITY OF 6500.0 NTL = 230
 FOR A GOAL QUANTITY OF 10000.0 NTL = 230

VARDR30	VARD5TL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
447655.7014	908394.2842	1356049.9856	529152.1765	727.4285	1368.2541	826897.8091	300.0000
447107.4920	908394.2842	1355501.7761	528603.9671	727.0516	1367.4525	826897.8091	1000.0000
449068.8636	908394.2842	1357463.1477	530565.3386	728.3992	1370.3182	826897.8091	4000.0000
455163.1253	908394.2842	1363557.4094	536659.6004	732.5705	1379.1842	826897.8091	6500.0000
455163.1253	908394.2842	1363557.4094	536659.6004	732.5705	1379.1842	826897.8091	10000.0000

TABLE E-9

NEW ENDING INVENTORY LEMUF CALCULATION FOR APPORTIONED
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM	WEIGHT	NUMBER	OPERATOR ERROR VARIANCE		TOTAL	
			RANDOM	SYSTEMATIC		
NEW ENDING INVENTORY						
1 FULL UO ₂ CYLINDERS	1428.87	1	.60	0.00	.60	
2 UO ₂ CYLINDER HEELS	2.16	83	.00	0.00	.00	
3 ADU CONVERSION	25.58	1911	8311.48	492.61	8804.09	
4 UPS RECYCLE	26.58	594	687.98	51.37	739.35	
5 ADU/UPS CROSS	26.19	131	181.85	2.42	184.28	
6 GECO CONVERSION	25.94	172	4453.10	.01	4453.12	
7 VENDOR UO ₂	26.35	91	18918.05	.00	18918.05	
8 UO ₂ FOR SHIPMENT	21.66	3342	.42	655.03	655.45	
9 POWDER/PELLETS	11.65	35	4.66	.04	4.71	
10 INTERMED. PROD.	17.09	420	2538.48	51.01	2589.50	
11 PELLETS	14.76	1083	3.81	16.10	19.92	
12 FUEL RODS	2.94	18360	4.06	10.22	14.28	
13 POISON RODS	2.85	2079	16.13	145.35	161.49	
14 ASSEMBLIES	2.95	52537	41.59	98824.42	98866.02	
15 PRESS SCRAP	16.05	79	24.64	2.91	27.56	
16 GRINDING RESIDUE	15.26	23	1.72	.17	1.89	
17 DIRTY MUDDER	17.04	159	5492.17	13.10	5505.35	
18 RESIDUE/SLUDGE	7.95	164	618.63	1.06	619.70	
19 SOLID WASTE	1.46	581	13.70	14.49	28.19	
20 SAMPLES	2.77	188	.00	0.00	.00	
21 PROCESS HOLDUP	6.90	99	802.51	.29	802.81	
22 STANDARDS	2.92	271	.01	.00	.01	
SUBTOTALS	372505.87	74403	42047.69	100280.77	142328.46	
TOTALS	372505.87	74403	42047.69	100280.77	142328.46	

CERROR = 100280.771 THE RANDOM COMPONENT OF VARMUF = .420E+05

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .100E+06
 FOR A GOAL QUANTITY OF 300.0 NTL = 972
 FOR A GOAL QUANTITY OF 1000.0 NTL = 972
 FOR A GOAL QUANTITY OF 4000.0 NTL = 972
 FOR A GOAL QUANTITY OF 6500.0 NTL = 972
 FOR A GOAL QUANTITY OF 10000.0 NTL = 972

VARDR30	VARDSTL	VARDMD	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
99924.5301	200561.5430	300486.0731	158157.6009	397.6903	676.7061	142328.4662	300.0000
99975.6777	200561.5430	300437.2207	158100.7546	397.6289	676.5617	142328.4662	1000.0000
100242.0704	200561.5430	300803.6136	158475.1475	398.0894	677.6440	142328.4662	4000.0000
100242.0706	200561.5430	300803.6136	158475.1475	398.0894	677.6440	142328.4662	6500.0000
100242.0706	200561.5430	300803.6136	158475.1475	398.0894	677.6440	142328.4662	10000.0000

TABLE E-10

STATIC INVENTORY LEMUF CALCULATION FOR APPORTIONED
RANDOM ERRORS AND "MAXIMUM" SYSTEMATIC ERRORS

UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

LEMUF CALCULATION						
BASED ON VERIFICATION 2.0 TIMES PER YEAR						
STRATUM	STRATUM DESCRIPTION	WEIGHT	NUMBER	RANDOM	OPERATOR ERROR VARIANCE SYSTEMATIC	TOTAL
STATIC INVENTORY						
1	UF6 CYLINDER NEELS	23.61	1	.00	0.00	.00
2	ADU CONVERSION	23.68	74	27.13	2.63	27.76
3	UPS RECYCLE	22.19	38	10.86	2.14	11.01
4	ADU/UPS CROSS	21.76	3	.43	2.00	.43
5	BECO CONVERSION	21.93	30	615.81	2.00	615.81
6	UO ₂ FOR SHIPMENT	20.12	166	.02	1.39	1.41
7	POWDER/PELLETS	9.37	7	1.73	2.00	1.74
8	INTERMED. PROD.	13.17	11	76.98	.02	77.00
9	PELLETS	9.42	138	.26	1.10	.37
10	FUEL RODS	2.86	1464	.95	1.19	1.15
11	POISON RODS	2.85	584	4.84	11.41	16.25
12	ASSEMBLIES	2.93	40439	102.42	58039.68	58142.11
13	GRINDER RESIDUE	23.56	2	.83	2.00	.83
14	DIRTY POWDER	21.92	11	49.46	2.04	49.50
15	RESIDUE/SLUDGE	8.46	17	385.63	2.01	385.64
16	SOLID WASTE	1.34	109	.12	2.42	.55
17	SAMPLES	4.39	80	.00	0.00	.00
18	STANDARDS	6.75	81	0.00	0.00	0.00
SUBTOTALS		134318.49	42255	1277.53	58054.08	59331.62
TOTALS		134318.49	42255	1277.53	58054.08	59331.62

ERROR = 58054.085 THE RANDOM COMPONENT OF VARMUF = .128E+04

THE ESTIMATE OF RANDOM ERROR VARIANCE IS .581E+05
 FOR A GOAL QUANTITY OF 300.0 NTL = 139
 FOR A GOAL QUANTITY OF 1000.0 NTL = 139
 FOR A GOAL QUANTITY OF 4000.0 NTL = 139
 FOR A GOAL QUANTITY OF 6500.0 NTL = 139
 FOR A GOAL QUANTITY OF 10000.0 NTL = 139

VARDR30	VARDSTL	VARDH0	VDMUFH0	SDMUFH0	SDMUFH1	VARMUF	GOAL QUANTITY
57143.3283	116108.1691	173251.4973	113919.8784	337.5202	534.1815	59331.6219	300.0000
57140.7592	116108.1691	173248.9282	113917.3083	337.5164	534.1719	59331.6219	1000.0000
57143.3283	116108.1691	173251.4973	113919.8784	337.5202	534.1815	59331.6219	4000.0000
57143.3283	116108.1691	173251.4973	113919.8784	337.5202	534.1815	59331.6219	6500.0000
57143.3283	116108.1691	173251.4973	113919.8784	337.5202	534.1815	59331.6219	10000.0000

SECTION F

RESULTS OF THE ATTRIBUTES INSPECTION PLAN

The inspectors' required number of attributes tests for each of the five strata categories given at the beginning of the Appendix are given in this Section. These calculations are neither a function of the error variance nor LEMUF calculations, nor are they affected by the inspection program (i.e., which material inventories are to be included in the inspection). These calculations are reported for various non-detection probabilities as a function of gross defects. For each of the five inventory strata, the calculations are shown for non-detection probabilities of 0.05, 0.25, and 0.50. These probabilities represent goal detection probabilities of 95%, 75%, and 50%.

TABLE F-1

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION		G O A L Q U A N T I T I E S					
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
BEGINNING INVENTORY							
1 FULL UF6 CYLINDERS	1391.77914	69	66	66	54	36	24
2 UF6 CYLINDER HEELS	3.45570	121	4	1	0	0	0
3 ADU CONVERSION	24.83692	2333	515	168	43	27	17
4 UPS RECYCLE	26.06337	947	226	72	18	11	7
5 ADU/UPS CROSS	26.01760	100	26	8	2	1	1
6 GECO CONVERSION	24.26998	1000	221	70	18	11	7
7 VENDOR UO2	25.04100	2	0	0	0	0	0
8 UO2 FOR SHIPMNT	18.73160	4626	790	254	65	40	26
9 POWDER/PELLETS	16.20234	128	20	6	2	1	1
10 INTERMED. PROD.	20.40969	86	17	5	1	1	1
11 PELLETS	14.99246	1097	153	49	12	8	5
12 FUEL RODS	2.93040	13881	402	121	30	19	12
13 POISON PELLETS	10.89562	164	17	5	1	1	1
14 POISON RODS	2.84638	2864	81	24	6	4	2
15 ASSEMBLIES	2.97245	88529	2613	786	197	121	79
16 PRESS SCRAP	15.86045	216	33	10	3	2	1
17 GRINDER RESIDUE	16.62257	183	28	9	2	1	1
18 DIRTY POWDER	19.84898	207	37	12	3	2	1
19 RESIDUE/SLUDGE	9.96606	442	42	13	3	2	1
20 SOLID WASTE	1.93599	1788	34	10	3	2	1
21 SAMPLES	.39228	818	3	1	0	0	0
22 PROCESS HOLDUP	3.16450	294	9	3	1	0	0
23 STANDARDS	2.23034	261	6	2	0	0	0
TOTALS		120165	5343	1695	464	290	188

TABLE F-2

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			QUAL QUANTITIES				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
BEGINNING INVENTORY							
1 FULL UF ₆ CYLINDERS	1391.77914	69	52	52	35	20	12
2 UF ₆ CYLINDER HEELS	3.45570	121	2	1	0	0	0
3 ADU CONVERSION	24.83692	2333	255	79	20	12	8
4 UPS RECYCLE	26.06337	947	112	34	9	5	3
5 ADU/UPS CROSS	26.01760	109	13	4	1	1	0
6 GECO CONVERSION	24.26998	1000	109	33	8	5	3
7 VENDOR UO ₂	25.04100	2	0	0	0	0	0
8 UO ₂ FOR SHIPMENT	18.73160	6626	384	119	30	18	12
9 POWDER/PELLETS	16.20234	128	9	3	1	0	0
10 INTERMED. PROD.	20.40969	86	8	2	1	0	0
11 PELLETS	14.99246	1097	73	23	6	4	2
12 FUEL RODS	2.93040	13881	187	56	14	9	6
13 POISON PELLETS	10.89562	164	8	2	1	0	0
14 POISON RODS	2.84638	2864	38	11	3	2	1
15 ASSEMBLIES	2.97245	88529	1219	365	91	56	36
16 PRESS SCRAP	15.86045	216	16	5	1	1	0
17 GRINDER RESIDUE	16.62257	183	14	4	1	1	0
18 DIRTY POWDER	19.84898	207	18	6	1	1	1
19 RESIDUE/SLUDGE	9.96606	442	20	6	2	1	1
20 SOLID WASTE	1.93699	1788	16	5	1	1	0
21 SAMPLES	.39228	818	1	0	0	0	0
22 PROCESS HOLDUP	3.16450	294	4	1	0	0	0
23 STANDARDS	2.23034	261	3	1	0	0	0
TOTALS		120165	2561	812	226	137	85

TABLE F-3

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM	STRATUM DESCRIPTION	WEIGHT	NUMBER	G U A L Q U A N T I T I E S				
				300.0	1000.0	4000.0	6500.0	10000.0
BEGINNING INVENTORY								
1	FULL UF6 CYLINDERS	1391.77914	69	35	35	20	11	7
2	UF6 CYLINDER HEELS	3.45570	121	1	0	0	0	0
3	ADU CONVERSION	24.83692	2333	131	40	10	6	4
4	UPS RECYCLE	26.06337	947	58	17	4	3	2
5	ADU/UPS CROSS	26.01760	109	7	2	0	0	0
6	GECO CONVERSION	24.26998	1000	56	17	4	3	2
7	VENDOR UO2	25.04100	2	0	0	0	0	0
8	UO2 FOR SHIPMNT	18.73160	4626	196	60	15	9	6
9	POWDER/PELLETS	16.20234	128	5	1	0	0	0
10	INTERMED. PROD.	20.40969	88	4	1	0	0	0
11	PELLETS	14.99246	1097	37	11	3	2	1
12	FUEL RODS	2.93040	13881	94	28	7	4	3
13	POISON PELLETS	10.89562	164	4	1	0	0	0
14	POISON RODS	2.84638	2864	19	6	1	1	1
15	ASSEMBLIES	2.97245	88529	612	182	46	28	18
16	PRESS SCRAP	15.86045	216	8	2	1	0	0
17	GRINDER RESIDUE	16.62257	183	7	2	1	0	0
18	DIRTY POWDER	19.84898	207	9	3	1	0	0
19	RESIDUE/SLUDGE	9.96606	442	10	3	1	0	0
20	SOLID WASTE	1.93699	1788	8	2	1	0	0
21	SAMPLES	.39228	818	1	0	0	0	0
22	PROCESS HOLDUP	3.16450	294	2	1	0	0	0
23	STANDARDS	2.23034	261	1	0	0	0	0
TOTALS			120165	1305	414	115	67	44

TABLE F-4

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
ADDITIONS TO PLANT							
1 FULL UO ₂ CYLINDERS	1452.89504	170	161	161	132	90	67
2 FUEL RODS	3.20342	194	6	2	0	0	0
3 UNH PRODUCTS	26.04588	488	116	37	9	6	4
4 SAMPLES	.05865	257	0	0	0	0	0
5 OTHER	4.60921	107	5	1	0	0	0
TOTALS		1216	288	201	141	96	71

TABLE F-5

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G U A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
ADDITIONS TO PLANT							
1 FULL UFG CYLINDERS	1452.89504	170	128	128	85	50	35
2 FUEL RODS	3.20342	194	3	1	0	0	0
3 UNH PRODUCTS	26.04588	488	58	17	4	3	2
4 SAMPLES	.05865	257	0	0	0	0	0
5 OTHER	4.60921	107	2	1	0	0	0
TOTALS		1216	191	147	89	53	37

TABLE F-6

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
ADDITIONS TO PLANT							
1 FULL UO ₂ CYLINDERS	1452.89504	170	85	85	50	27	19
2 FUEL RODS	3.20342	194	1	0	0	0	0
3 UNH PRODUCTS	26.04588	489	30	9	2	1	1
4 SAMPLES	.05865	257	0	0	0	0	0
5 OTHER	4.60921	107	1	0	0	0	0
TOTALS		1216	117	94	52	28	20

TABLE F-7

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
REMOVALS FROM PLANT							
1 UF6 CYLINDER HEELS	2,32096	224	5	2	0	0	0
2 VENDDR UD2	20,20274	9609	1851	570	145	89	58
3 FUEL RODS	1,80509	11	0	0	0	0	0
4 ASSEMBLIES	2,94635	111970	3272	985	247	152	99
5 SCRAP FOR SHIPMENT	9,88795	990	94	29	7	5	3
6 SAMPLES	.06499	149	0	0	0	0	0
7 LIQUID DISCARDS	5,93904	363	21	6	2	1	1
8 SOLID DISCARDS	.46598	2633	12	4	1	1	0
TOTALS		125949	5255	1596	402	248	161

TABLE F-8

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
REMOVALS FROM PLANT							
1 UF6 CYLINDER WHEELS	2.32096	224	2	1	0	0	0
2 VENDOR UO2	20.20274	9609	906	268	67	41	27
3 FUEL RODS	1.80509	11	0	0	0	0	0
4 ASSEMBLIES	2.94635	111970	1526	457	114	70	46
5 SCRAP FOR SHIPMENT	9.88795	990	45	13	3	2	1
6 SAMPLES	.06499	149	0	0	0	0	0
7 LIQUID DISCARDS	5.93604	363	10	3	1	0	0
8 SOLID DISCARDS	.46598	2633	6	2	0	0	0
TOTALS		125949	2495	744	185	113	74

TABLE F-9

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
REMOVALS FROM PLANT							
1 UF ₆ CYLINDER HEELS	2.32096	224	1	0	0	0	0
2 VENDOR UO_2	20.20274	9609	464	135	34	21	13
3 FUEL ROOS	1.80509	11	0	0	0	0	0
4 ASSEMBLIES	2.94635	111970	766	229	57	35	23
5 SCRAP FOR SHIPMENT	9.88795	990	23	7	2	1	1
6 SAMPLES	.06499	149	0	0	0	0	0
7 LIQUID DISCARDS	5.93904	363	5	1	0	0	0
8 SOLID DISCARDS	.46598	2633	3	1	0	0	0
TOTALS		125949	1262	373	93	57	37

TABLE F-10

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G U A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
NEW ENDING INVENTORY							
1 FULL UF ₆ CYLINDERS	1428.87100	1	1	1	1	1	0
2 UF ₆ CYLINDER HEELS	2,16437	83	2	1	0	0	0
3 ADU CONVERSION	25.58933	1911	456	141	36	22	15
4 UPS RECYCLE	26.58508	594	142	46	12	7	5
5 ADU/UPS CROSS	26.19616	131	31	10	3	2	1
6 GECO CONVERSION	25.94077	172	41	13	3	2	1
7 VENDOR UO ₂	26.35960	91	22	7	2	1	1
8 UO ₂ FOR SHIPMNT	21.66058	3342	688	211	54	33	22
9 POWDER/PELLETS	11.66980	35	4	1	0	0	0
10 INTERMED. PROD.	17.09228	420	68	21	5	3	2
11 PELLETS	14.76394	1083	151	47	12	7	5
12 FUEL RODS	2.94292	10360	303	91	23	14	9
13 POISON RODS	2.85977	2079	59	18	4	3	2
14 ASSEMBLIES	2.95080	52537	1535	464	116	71	46
15 PRESS SCRAP	16.05646	79	12	4	1	1	0
16 GRINDER RESIDUE	15.26722	23	3	1	0	0	0
17 DIRTY POWDER	17.04873	159	26	8	2	1	1
18 RESIDUE/SLUDGE	7.95176	164	13	4	1	1	0
19 SOLID WASTE	1.46765	581	8	3	1	0	0
20 SAMPLES	2.77346	188	5	2	0	0	0
21 PROCESS HOLDUP	6.90359	99	7	2	1	0	0
22 STANDARDS	2.92878	271	8	2	1	0	0
TOTALS		74403	3585	1098	278	169	110

TABLE F-11

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
NEW ENDING INVENTORY							
1 FULL UF ₆ CYLINDERS	1428.87100	1	1	1	1	0	0
2 UF ₆ CYLINDER WHEELS	2.16437	83	1	0	0	0	0
3 ADU CONVERSION	25.58933	1911	226	67	17	10	7
4 UPS RECYCLE	26.58506	594	70	22	5	3	2
5 ADU/UPS CROSS	26.19616	131	16	5	1	1	0
6 GECO CONVERSION	25.94077	172	20	6	2	1	1
7 VENDOR UO ₂	26.35960	91	11	3	1	1	0
8 UO ₂ FOR SHIPMENT	21.66058	3342	338	99	25	15	10
9 POWDER/PELLETS	11.66980	35	2	1	0	0	0
10 INTERMED. PROD.	17.09228	420	33	10	2	2	1
11 PELLETS	14.76394	1083	73	22	6	3	2
12 FUEL RODS	2.94292	10360	141	42	11	7	4
13 POISON RODS	2.85977	2079	28	8	2	1	1
14 ASSEMBLIES	2.95080	52537	716	215	54	33	21
15 PRESS SCRAP	16.05646	79	6	2	0	0	0
16 GRINDER RESIDUE	15.26722	23	2	0	0	0	0
17 DIRTY POWDER	17.04873	159	12	4	1	1	0
18 RESIDUE/SLUDGE	7.95176	164	6	2	0	0	0
19 SOLID WASTE	1.46765	581	4	1	0	0	0
20 SAMPLES	2.77346	188	2	1	0	0	0
21 PROCESS HOLDUP	6.90359	99	3	1	0	0	0
22 STANDARDS	2.92878	271	4	1	0	0	0
TOTALS		74403	1715	513	128	78	49

TABLE F-12

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
NEW ENDING INVENTORY							
1 FULL UFA CYLINDERS	1428.87100	1	1	1	0	0	0
2 UFA CYLINDER MEELS	2.16437	83	0	0	0	0	0
3 ADU CONVERSION	25.58933	1911	117	34	8	5	3
4 UPS RECYCLE	26.58506	594	36	11	3	2	1
5 ADU/UPS CROSS	26.19616	131	8	2	1	0	0
6 GECO CONVERSION	25.94077	172	11	3	1	0	0
7 VENDOR UO2	26.35960	91	6	2	0	0	0
8 UO2 FOR SHIPMENT	21.66058	3342	174	50	13	8	5
9 POWDER/PELLETS	11.66980	35	1	0	0	0	0
10 INTERMED. PROD.	17.09228	420	17	5	1	1	0
11 PELLETS	14.76394	1083	37	11	3	2	1
12 FUEL RODS	2.94292	10360	71	21	5	3	2
13 POISON RODS	2.85977	2079	14	4	1	1	0
14 ASSEMBLIES	2.95080	52537	359	108	27	17	11
15 PRESS SCRAP	16.05646	79	3	1	0	0	0
16 GRINDER RESIDUE	15.26722	23	1	0	0	0	0
17 DIRTY POWDER	17.04873	159	6	2	0	0	0
18 RESIDUE/SLUDGE	7.95176	164	3	1	0	0	0
19 SOLID WASTE	1.46765	581	2	1	0	0	0
20 SAMPLES	2.77346	188	1	0	0	0	0
21 PROCESS HOLDUP	6.90359	99	2	0	0	0	0
22 STANDARDS	2.92878	271	2	1	0	0	0
TOTALS		74403	872	258	63	39	23

TABLE F-13

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .050
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
STATIC INVENTORY							
1 UF6 CYLINDER HEELS	.61300	1	0	0	0	0	0
2 ADU CONVERSION	23.68327	74	16	5	1	1	1
3 UPS RECYCLE	22.19974	38	8	2	1	0	0
4 ADU/UPS CROSS	21.76600	3	1	0	0	0	0
5 GECO CONVERSION	21.93547	30	6	2	0	0	0
6 UO2 FOR SHIPMENT	20.12804	166	32	10	2	2	1
7 POWDER/PELLETS	9.37943	7	1	0	0	0	0
8 INTERMED. PROD.	13.17618	11	1	0	0	0	0
9 PELLETS	9.42375	138	13	4	1	1	0
10 FUEL RODS	2.86696	1464	42	13	3	2	1
11 POISON RODS	2.85329	584	16	5	1	1	0
12 ASSEMBLIES	2.93789	40439	1170	355	89	55	36
13 GRINDER RESIDUE	23.56400	2	0	0	0	0	0
14 DIRTY POWDER	21.92227	11	2	1	0	0	0
15 RESIDUE/SLUDGE	8.46800	17	1	0	0	0	0
16 SOLID WASTE	1.34212	109	1	0	0	0	0
17 SAMPLES	4.39754	80	3	1	0	0	0
18 STANOARDS	6.75091	81	5	2	0	0	0
TOTALS		43255	1318	400	98	62	39

TABLE F-14

NUMBER OF ATTRIBUTE TESTS
 UO_2 FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .250
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
STATIC INVENTORY							
1 UF6 CYLINDER HEELS	.61300	1	0	0	0	0	0
2 ADU CONVERSION	23.68327	74	8	2	1	0	0
3 UPS RECYCLE	22.19974	38	4	1	0	0	0
4 ADU/UPS CROSS	21.76600	3	0	0	0	0	0
5 GECO CONVERSION	21.93547	30	3	1	0	0	0
6 UO_2 FOR SHIPMNT	20.12804	166	16	5	1	1	0
7 POWDER/PELLETS	9.37943	7	0	0	0	0	0
8 INTERMED. PROD.	13.17618	11	1	0	0	0	0
9 PELLETS	9.42375	138	6	2	0	0	0
10 FUEL RODS	2.86696	1464	19	6	1	1	1
11 POISON RODS	2.85329	584	8	2	1	0	0
12 ASSEMBLIES	2.93789	40439	546	165	41	25	16
13 GRINDER RESIDUE	23.56400	2	0	0	0	0	0
14 DIRTY POWDER	21.92227	11	1	0	0	0	0
15 RESIDUE/SLUDGE	8.46800	17	1	0	0	0	0
16 SOLID WASTE	1.34212	109	1	0	0	0	0
17 SAMPLES	4.39754	80	2	0	0	0	0
18 STANDARDS	6.75091	81	3	1	0	0	0
TOTALS		43255	619	185	45	27	17

TABLE F-15

NUMBER OF ATTRIBUTE TESTS
 UO₂ FUEL FABRICATION FACILITY MATERIAL ACCOUNTING DATA FOR IAEA VERIFICATION 1977-1

BASED ON VERIFICATION 2.0 TIMES PER YEAR
 THE NON-DETECTION PROBABILITY FOR GROSS DEFECTS IS SET AT .500
 INSPECTION REQUIREMENTS FOR THE DETECTION OF GROSS DEFECTS

STRATUM DESCRIPTION			G O A L Q U A N T I T I E S				
STRATUM	WEIGHT	NUMBER	300.0	1000.0	4000.0	6500.0	10000.0
STATIC INVENTORY							
1 UF6 CYLINDER HEELS	.61300	1	0	0	0	0	0
2 ADU CONVERSION	23.68327	74	4	1	0	0	0
3 UPS RECYCLE	22.19974	38	2	1	0	0	0
4 ADU/UPS CROSS	21.76600	3	0	0	0	0	0
5 GECO CONVERSION	21.93547	30	2	0	0	0	0
6 UO2 FOR SHIPMNT	20.12804	166	8	2	1	0	0
7 POWDER/PELLETS	9.37943	7	0	0	0	0	0
8 INTERMED. PROD.	13.17618	11	0	0	0	0	0
9 PELLETS	9.42375	138	3	1	0	0	0
10 FUEL RODS	2.86696	1464	10	3	1	0	0
11 POISON RODS	2.85329	584	4	1	0	0	0
12 ASSEMBLIES	2.93789	40439	274	82	21	13	8
13 GRINDER RESIDUE	23.56400	2	0	0	0	0	0
14 DIRTY POWDER	21.92227	11	1	0	0	0	0
15 RESIDUE/SLUDGE	8.46800	17	0	0	0	0	0
16 SOLID WASTE	1.34212	109	0	0	0	0	0
17 SAMPLES	4.39754	80	1	0	0	0	0
18 STANDARDS	6.75091	81	1	0	0	0	0
TOTALS		43255	310	91	23	13	8

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