

SF ACCOUNTABILITY MANUAL
FOR
SOURCE AND FISSIONABLE MATERIALS

PREPARED IN ACCORDANCE WITH
PARAGRAPH 12 OF BULLETIN GM-PRO-2

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PREFACE

This SF Accountability Manual is designed with the view of providing interpretations and detailed instructions for implementation of Bulletin GM-PRO-2, "Accounting for Source and Fissionable Materials." The present three Sections of the Manual will be followed by additional Sections from time to time. Arrangement and numbering have been designed to facilitate references, additions and changes with maximum convenience; for example, all page numbers are prefixed with the letter of the Section to which they belong, thus affording easy reference to subject matter. Also, by this system whole Sections can be added, deleted or altered without affecting the numbering sequence of other Sections.

It is intended that ultimately all generally applicable procedural instructions will be contained in a single Manual; accordingly, a loose-leaf arrangement has been adopted to simplify inclusion of later Sections.

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SECTION A

SF MATERIAL BALANCE REPORTS

REF: Paragraph 12, Bulletin GM-PRO-2, revised July 7, 1952.

SF Material Balance Reports shall be submitted in accordance with Paragraph 9, Bulletin GM-PRO-2 and the details which are presented below:

1. General Arrangement.

a. Material balance reports shall be generally arranged in the form illustrated by Exhibit A-1. Separate material balances shall be reported for: normal uranium; depleted uranium; enriched uranium less than 75 weight percent U-235; enriched uranium greater than 75 weight percent U-235; plutonium; thorium; and U-233.

b. All quantities of SF materials shall be reported in metric units. If pound scales are used, weight totals should be converted for inventory and material balance report purposes on the basis of 0.45359 kilograms per pound. The following units shall be used:

<u>Material</u>	<u>Unit</u>
Plutonium	gram
Enriched Uranium	gram
U-233	gram
Thorium	kilogram
Normal Uranium	kilogram
Depleted Uranium	kilogram

c. Inventory and material balance report terminology and material classifications shall conform to the explanatory notes appended to Exhibit A-1.

2. Material Type Segregation. Material received or shipped and material inventoried as Feed Storage, Material in Process, etc., shall be subdivided to show separately material types. For example, significant quantities of pure SF metal and compounds such as billets, rods, slugs, dioxide, trioxide, etc., shall be reported separately. Material types not involving significant quantities may be grouped as "miscellaneous." Basic or Special Quota material will be inventoried as prescribed in Explanatory Note 26 for Exhibit A-1.

3. Isotopic Content Segregation. Uranium inventoried as Feed Storage, Material in Process, etc., shall be further subdivided to show separately material significantly different in isotopic composition. Uranium receipts, removals, or unaccounted for amounts which are significantly different in isotopic makeup shall also be shown separately. For uranium reporting purposes "significant" isotopic ranges are:

Depleted

Enriched

0.00 to 0.09 wt %
0.10 to 0.19 wt %
0.20 to 0.29 wt %
0.30 to 0.39 wt %
0.40 to 0.49 wt %
0.50 to 0.59 wt %
0.60 to 0.7114 wt %

0.7116 to 24.99 wt %
25.00 to 49.99 wt %
50.00 to 74.99 wt %
75.00 to 100.00 wt %

4. Receipts and Shipments. Receipts and shipments shall also be subdivided to show separately different consignors or consignees, grouped by Operations Offices. However, it is not necessary to list separately different shipments to or receipts from any one Accountability Station unless the material types or isotopic contents differ significantly.
5. Inventory Dates. An inventory of SF material should be taken on the last day of each calendar month. In the event that a physical inventory on the last day of the month is not feasible, an inventory taken within the week preceding or the week following the end of the month and adjusted for intervening receipts and shipments shall be used as a basis for the required month-end inventory.
6. Inventory Basis. The inventory and material balance report shall explain the methods used to determine the various portions of the ending inventory. (e.g., weighed, chemical analysis, etc.). Portions of the inventory not measured shall be described with an explanation of how these quantities were determined.
7. Reliability of Material Balance Report Data. The inventory and material balance report shall indicate the reliability of the various items by showing the probable limits of recognized uncertainty. These limits shall be expressed in the weight unit of the report and not in percentages. If the limits of any component are not available, the limits of those which are available should be reported and designated.
8. Significance of Material Unaccounted For. Material balance reports of each Station shall contain an opinion as to whether the quantities unaccounted for represent measurement uncertainties and normal processing losses, or identifiable pieces or containers of SF materials. The reports shall also include comment as to any action initiated to study or investigate amounts lost or unaccounted for.
9. Report Transmittal. Inventory and material balance reports shall be signed by the Accountability Representative and shall be classified in accordance with existing security regulations. The reports shall be sent to the Manager of Operations having jurisdiction over the Accountability Station, with an information copy to the SF Materials Accountability Branch, Washington Division of Production, Oak Ridge, Tennessee. The information copy may be transmitted directly or through the Operations Office, at the discretion of the Manager of Operations concerned. Inventory reports through the end of each month shall be submitted as soon as possible after the inventory date.

10. Adjustments.

a. General. Items recognized during the current period which correct quantities previously reported should be reflected as part of the current operations. Such corrections should be explained by annotating the material balance report.

b. Exceptions.

(1) When in the opinion of an Accountability Station or an Operations Office, corrections handled as described above would distort the current quantities, an adjustment may be made to the previously reported quantities.

(2) Any item of a non-recurring nature which is materially significant in relation to a station's operations and is clearly not identifiable with or does not result from the usual or typical operations of the period shall result in an adjustment to previously reported quantities.

c. Journal Entry Form. An Adjustment Journal Posting Sheet, Exhibit A-II or similar form, shall be used to record and explain any change in or adjustment to quantities previously reported and shall accompany the report.

11. Consolidated Reports.

a. Each Operations Office shall prepare monthly a consolidated inventory and material balance report covering all SF materials located within its jurisdiction. One copy of the consolidated report shall be submitted to arrive at the SF Materials Accountability Branch, Washington Division of Production, Oak Ridge, Tennessee, not later than 15 working days after the end of the reporting period.

b. The consolidated report shall show the total beginning inventory, total receipts from the jurisdiction of each other Operations Office, other receipts, total shipments to the jurisdiction of each other Operations Office, other removals, the total ending inventory, and the total material lost or unaccounted for. Separate material balances shall be reported for each material specified in paragraph 1 a, above. The quantity of SF material at each Accountability Station and the shipments in transit between stations of the reporting Operations Office shall be listed to indicate the location of the total ending inventory.

c. Material Lost or Unaccounted For.

(1) A discussion of material lost or unaccounted for at Accountability Stations shall be included in the report, including any data which may indicate the significance of the amounts lost or unaccounted for (e.g., comparisons with comparable figures for prior periods, comparisons with quantities of material produced). Each Operations Office shall also state its opinion as to whether these quantities are reasonable, and comment as to any action initiated to study or investigate amounts lost or unaccounted for.

(2) A discussion of shipper-receiver differences on transfers made within jurisdiction of the Operations Office, including a comparison between the discrepancy and transfer totals, shall be included in the report. Each Operations Office shall also state its opinion as to whether differences are reasonable, and comment as to any action initiated to study or investigate discrepancies. (See Section B, paragraph 6).

- d. The nature and amount of each adjustment shall be explained by an Adjustment Journal Posting Sheet (Exhibit A-II or similar form) accompanying the consolidated report.

<u>(1) Material Balance</u>	<u>Material Type (2)</u>	<u>SF Material Weight (3)</u>	<u>Limit of Recognized Uncertainty (33)</u>
Beginning Inventory <u>(4), 19</u>		xxx	xx
Adjustments (5)		xxx	xx
Adjusted Beginning Inventory		xxx	xx
<u>Material Received</u>			
Production (6)	****	xxx	xx
Procurement (7)	****	xxx	xx
Research Returns (8)	****	xxx	xx
Transfers From:			
<u>(9)</u>	****	xxx	
<u>(9)</u>	****	xxx	
Total transfers from <u>(10)</u> Operations Office		xxx	
<u>(9)</u>	****	xxx	
<u>(9)</u>	****	xxx	
Total transfers from <u>(10)</u> Operations Office		xxx	
Total Transfers (11)		xxx	
<u>Total Material Received (12)</u>		xxx	
Beginning Inventory Plus Receipts (13)		xxx	
<u>Material Removed</u>			
Unrecoverable Material-- Measured (14)	****	xxx	xx
Unrecoverable Material-- Estimated (14)	****	xxx	xx
Research Issuances (15)	****	xxx	xx
Measured Losses (16)	****	xxx	xx
Fission Loss (17)	****	xxx	xx
Transfers To:			
<u>(9)</u>	****	xxx	
<u>(9)</u>	****	xxx	
Total Transfers to: <u>(10)</u> Operations Office		xxx	

EXHIBIT A-I

	Material Type (2)	SF Material Weight (3)	Limit of Recognized Uncertainty (33)
<u>Material Removed--Continued</u>			
<u>(9)</u>	****	xxx	
<u>(9)</u>	****	xxx	
<u>Total Transfers to (10)</u> <u> Operations Office</u>		xxx	
<u>Total Transfers (11)</u>		xxx	
<u>Total Material Removed (18)</u>		xxx	
<u>Ending Inventory, (19), 19</u>		xxx	xx
<u>Ending Inventory Plus Material</u> <u> Removed (20)</u>		xxx	
<u>Material Unaccounted For (21)</u>		xxx	xx
<u>(22) Produced</u>	****	xxx	
<u>Fiscal Year-to-Date Material</u> <u> Balance (23)</u>			
<u>Composition of Ending Inventory</u>			
Feed Storage (24)	****	xxx	xx
Material in Process (25)	****	xxx	xx
Material in Research and Development (26)	****	xxx	xx
Scrap Awaiting Recovery (27)	****	xxx	xx
Inactive (28)	****	xxx	xx
Product (29)	****	xxx	xx
Other (30)	****	xxx	xx
<u>Total Ending Inventory (31)</u>		xxx	xx

Explanatory Notes

- (1) Name of the month reported.
- (2) Show separately material types, as explained in Paragraph 2 of this Section, with chemical formulae for compounds. Smaller quantities may be labeled miscellaneous.
- (3) Report in metric units, and specify units (kilograms, grams) used. For uranium depleted or enriched in the U-235 isotope, show in separate columns (a) weight uranium, (b) weight percent U-235, and (c) weight U-235, and show separately amounts which are of significantly different isotopic makeup, as explained in Paragraph 3 of this Section. For all other SF materials only the net weight of contained SF material is required.
- (4) First day of the month reported.

- (5) Adjustments must be supported by Adjustment Journal Posting Sheets, or similar form. (See Paragraph 10 of this Section).
- (6) Show material produced, e. g., plutonium, U-233. Pile-produced SF materials shall be reported as "Production" in the period transmutation in the piles took place. When insignificant quantities of fissionable materials are produced in research reactors, "Production" shall be reported upon discharge from the reactor.
- (7) List all accessions by source, other than as in (6) and (8).
- (8) List all Research Returns by source. See paragraph 11 b. (4) of GM-PRO-2.
- (9) List receipts from and shipments to other SF Accountability Stations, subdivided by Operations Offices. (See Paragraph 4 of this Section). If desirable, this detail may be scheduled separately and attached to the material balance report.
- (10) Subtotal transfers to or from the jurisdiction of each Operations Office.
- (11) The total of the Operations Office subtotals.
- (12) The total of (6), (7), (8), and (11).
- (13) The total of "Adjusted Beginning Inventory" and item (12).
- (14) Material written off in accordance with paragraph 11 a. of Bulletin GM-PRO-2.
- (15) Material issued in accordance with paragraph 11 b. of Bulletin GM-PRO-2.
- (16) This designation shall be applied only to losses (such as SF material contained in flue gases, sewer solutions, and other normal processing losses), the amount of which has been determined either by continuing complete measurement or by occasional measurement of representative batches or flows. To be classified as a Measured Loss a recurrent minor loss need not be continually measured, but it shall be redetermined at intervals appropriate to its magnitude and whenever changes in the process are likely to cause it to change substantially. The designation shall also be used for such items as spills or leakage of measured quantities of SF material.

When the Measured Losses are significant quantities, they shall be itemized on the month and YTD material balance report. When the quantities are minor, they should be described briefly in a footnote.

- The designation "Measured Losses" shall not be used for quantities determined merely by difference between input and output. Such differences shall be reflected as material unaccounted for, Note 21.
- (17) Material lost as a result of fission in a reactor. It is desirable to report the Fission Loss in the month in which it occurs. It must be reported no later than the month of final discharge from the reactor.
 - (18) The sum of (14), (15), (16), (17), and (11).
 - (19) Last day of the month reported.
 - (20) The sum of (18) and (19).
 - (21) This is the amount by which the sum of the beginning inventory plus receipts exceeds the sum of the ending inventory plus removals. It is therefore a balancing figure which includes losses, equipment contamination which cannot be measured and inventoried, and any unexplained differences. If the sum of ending inventory plus removals is greater than the sum of beginning inventory plus receipts--which may occur, for example, if quantities of material previously

unaccounted for are found or recovered during the current period--the balancing figure shall be shown in parentheses.

Amounts reported as Material Unaccounted For shall be explained by footnote. (See Paragraph 7 of this Section).

- (22) Show the SF content and chemical compound or form of the monthly and fiscal YTD production from each process.
- (23) A fiscal year-to-date material balance report will be prepared in the same form as that prescribed for the monthly report. The YTD totals shall be the sum of the prior reported quantities as adjusted by Adjustment Journal Posting Sheets.
- (24) Feed Storage shall include any material available for processing, but on which processing has not begun. This will include unused material at a research laboratory. (See Note (32)).
- (25) Material in process shall include all material in a production process (including routine analytical and assay samples incident to production control and accounting control over material in process) except material otherwise designated by explanatory notes (24), (26), (27), (28), (29), and (30). (See Note (32)).
- (26) Material in Research and Development is that material being actively used or specifically assigned for research including that portion of material in production facilities which has been assigned to research and development or process improvement work as distinguished from production processing. Material on a station's inventory which was received under a "Basic" or "Special" Quota (GM-RES-1) must be itemized by the inventorying station according to the Quota Code Number established by the Director of Research. Material held under each code number must be reported in the following detail:

Pure metal or compound	xx
Alloyed metal (show type of alloy)	xx
Scrap	xx
Irradiated	xx
	<hr/>
Total ABC-SQ-4	xxxx
	<hr/> <hr/>

If material falls in more than one category (it might be irradiated alloy metal) it will be reported in the category furthest removed from production channels.

- (27) Scrap Awaiting Recovery shall include all scrap material immediately available or intended for recovery processing, whether such processing is to be done by the reporting installation or at another location. In general, material shall be inventoried as "Scrap Awaiting Recovery", if there is a recovery process in operation or under construction. (See Note (32)).
- (28) Inactive Material shall include all scrap not inventoried as in Note (27). (See Note (32)).
- (29) Material shall not be designated "Product" until all processing has been completed. This designation shall be used for the product of the particular plant or process reported--"product" material at one plant or process may become "Feed" material when transferred to another plant or another process. "Scrap Awaiting Recovery" at one plant or process may likewise become "Feed" material when trans-

ferred to another plant or process. These designations as applied to particular types of material will therefore depend upon the location at which the materials are inventoried.

- (30) Under this designation include only unusual categories of material for which none of the above designations are suitable. Each category must be reported separately. (See Note (32)).
- (31) The sum of (24) through (30). If must equal the amount reported in (19) for both month and YTD.
- (32) If any of the above categories of inventory include irradiated SF materials, that fact must be clearly indicated. Material in reactors, in cooling basins, and in "hot storage" should be shown separately.
- (33) The limits of the recognized uncertainty shall be reported in the same units as in (3). They shall be shown for each indicated item on both the monthly and YTD material balance reports and combined statistically to arrive at the limits of recognized uncertainty of the material unaccounted for. Limits should also be reported for the "Composition of Ending Inventory."

reasonable time may be placed on the Transfer Form (AEC-101), but such information must not qualify the acceptance of the shipper's SF content.

(2) The receiver's measurements, with the measurement methods, shall be recorded in the "Receiver's Data" space in a manner corresponding to that outlined above for "Shipper's Data."

(3) Receiver's data shall be reported in the units specified in paragraph 1b of Section A. If necessary to convert from pounds to kilograms, a factor of 0.45359 kilograms per pound shall be used.

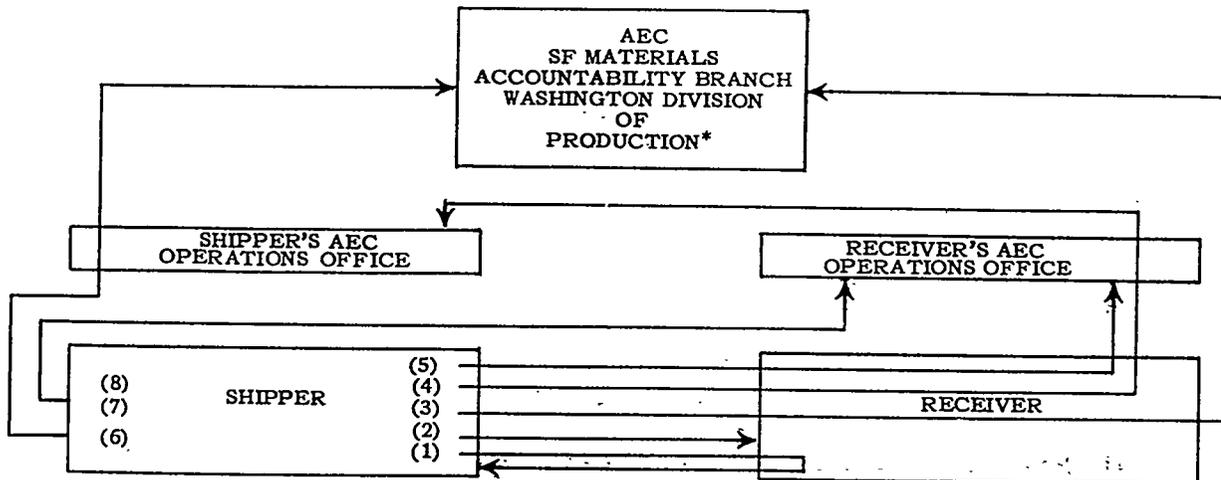
(4) If the receiver accepts the shipper's measurements without verification, the weight columns shall be left blank and the comment "Shipper's SF Content Accepted Without Verification" recorded in the "Measurement Methods" space. By accepting the shipper's measurements the receiver also accepts responsibility and accountability for the quantities shown by shipper.

(5) If receiver's measurements will delay distribution of SF Shipping Forms in excess of seven days after receipt of material, receiver will complete and distribute Form AEC-284 (Exhibit B-II). No classified information shall be placed on these receipts. The Form AEC-284 shall be prepared in quintuplicate and distributed as follows:

- Copy 1 - to shipper
- Copy 2 - to SF Material Accountability Branch (CAB)
- Copy 3 - to Shipper's AEC Operations Office
- Copy 4 - to Receiver's AEC Operations Office
- Copy 5 - retained by Receiver

As soon as final receiver's data are available, copies 1 through 5 of the Form AEC-101 shall be completed and distributed.

2. Distribution of Copies.



*Address: Oak Ridge, Tenn.

a. Distribution of Form AEC-101 is shown above.

b. Instructions to Shipper.

- (1) In the "Distribution of Copies" space in the upper right hand corner of Form AEC-101, insert station symbols of offices to which copies are to be sent. A list showing the contractors, the AEC local offices, and the AEC Operations Offices for each Accountability Station, with their station symbols, may be obtained from the SF Materials Accountability Branch, ORE, Washington Division of Production.
- (2) Send copy 6 through your AEC local office, if any, to your AEC Operations Office. The AEC Operations Office will then forward copy 6 to SF Materials Accountability Branch.
- (3) Send copy 7 direct to the receiver's AEC Operations Office, except as noted in b, (6), below.
- (4) Retain copy 8 for file.
- (5) Send remaining copies (1 or original, 2, 3, 4, 5) to the receiver, except as noted in b, (6), below.
- (6) Exceptions to above:
 - (a) Omit copy 4 if shipper is an AEC Operations Office.
 - (b) Omit copy 5 if receiver is an AEC Operations Office.
 - (c) Omit copies 5 and 7 if both shipper and receiver are under the same AEC Operations Office.
 - (d) Omit copies 4, 5, & 7 if both shipper and receiver are an AEC Operations Office.
 - (e) If the lack of sequence is a document security problem at any Operations Office, there is no objection to shipper retaining copy 5 instead of 8 in the situation where shipper and receiver are under same Operations Office. However, copies 1, 2, 3, 4, and 6 shall be distributed as requested.

c. Instructions to Receiver.

- (1) Receipt copy 1 (original) and return to shipper.
- (2) Retain copy 2 for file.
- (3) Receipt copy 3 and forward directly to the SF Materials Accountability Branch, Washington Division of Production, ORE.
- (4) Receipt copy 4, if any, and forward to the shippers AEC Operations Office.
- (5) Receipt copy 5, if any, and send it through your AEC local office to your AEC Operations Office.

3. Transmittal.

- a. Each Accountability Station shall maintain a record of the distribution of Shipping Forms (whether classified or unclassified).
- b. SF Shipping Forms shall be issued not later than the date of shipment.
- c. Whenever SF material is escorted from shipper to receiver, the escort should carry the appropriate copies of Shipping Form recording the transfer.
- d. It is essential that copies of shipping documents be received and transmitted as promptly as possible.
- e. Shipment and receipt totals shown on monthly inventory and material balance reports shall agree with the transfer data shown on SF Shipping Forms. If changes or adjustments are necessary in shipper's or receiver's data after SF Shipping Forms have been issued, revised copies (labeled "Corrections") shall be distributed.
- f. Prior to submission of monthly inventory and material balance reports, Accountability Stations shall ascertain that the amounts of SF material reported as received from or shipped to each station agree with material transfer data on SF shipping forms.

4. Notice of Shipment. Before transfers of SF material are initiated the Shipper's Operations Office shall be responsible for notifying the Receiver's Operations Office of the probable date that shipments will begin, and for instituting interchange of pertinent information involving SF Accountability aspects.

5. Reliability.

The limits of recognized uncertainty for both the shipper and receiver shall be shown for each line item on the SF Shipping Form, in a manner prescribed for material balance reports in paragraph 7 of Section A.

6. Measurement Differences.

a. Measurements by the receiver should be in reasonable agreement with measurements by the shipper. When consideration of all pertinent factors (e. g., reliability of measurements, value of the material, previous data on like material, etc.) indicates that an important shipper-receiver difference exists the following action shall be taken:

(1) Transfers within an Operations Office. The difference shall be investigated and resolved by the Operations Office. A copy of all relevant data shall be furnished to the SF Materials Accountability Branch, Washington Division of Production, ORE.

(2) Transfers Between Operations Offices. The receiver's Operations Office shall initiate steps to reconcile the difference. The SF Materials Accountability Branch, Washington Division of Production, ORE, will be responsible for guidance in the direction of effort.

7. Transfers of SF Materials Under Basic and Special Quotas. Material transferred under the provisions of Bulletin GM-RES-1 must be identified by the Basic or Special Quota code number set up by the Director of Research.

SF MATERIAL TRANSFER RECEIPT

SF Material on Transfer: _____ to _____ No. _____,
(Station symbols)
shipped on _____, 19____, has been received
on _____, 19____

Material has been verified as follows: (Check one)

Piece Count Container Count Gross Wt. Check

Other: _____

Shipper's weights and SF content are accepted pending final verification measurements and completion of Form AEC-101.

By: _____
(Accountability Representative)

EXHIBIT B-II

SECTION C
DEFINITION OF TERMS

REF: Paragraph 12, Bulletin GM-PRO-2, revised July 7, 1952.

To facilitate uniform application of the general principles outlined in Bulletin GM-PRO-2, the following phrases are defined.

1. Where used in this Bulletin the phrase "major station" shall apply to all stations having an inventory of SF materials worth more than \$5,000,000 or processing more than \$1,000,000 worth of SF materials a month.
2. The phrase "important quantities of SF materials" is defined as those quantities exceeding:

1 gram plutonium
1 gram U-235
100 mg. U-233
50 kg. source materials

3. The term "significant inadequacy" as used in paragraph 3b. (1) (i) of the Bulletin shall be interpreted to mean any inadequacy which gives rise to a formal recommendation as recorded on any survey report.
4. The term "significant quantities" as used in paragraph 2 of section A is interpreted to mean:

Plutonium	100 grams
Enriched Uranium	
> 75% U-235	500 grams
< 75% U-235	1 kg.
U-233	100 grams
Thorium	500 kg.
Normal Uranium	500 kg.
Depleted Uranium	500 kg.

5. The term "probable limits of recognized uncertainty" is defined to mean those confidence limits which are derived from the standard deviation of all measurements and estimates which have been recognized as contributing to the total uncertainty. For purposes of uniformity two sigma (95%) confidence limits are prescribed.