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A SYSTEM OF NUCLEAR MATERIAL ACCOUNTANCY IN THE JAERI

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A SYSTEM OF NUCLEAR MATERIAL ACCOUNTANCY IN THE JAERI

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Pursuant to the domestic law and regulations revised in 1978 as to be conformed to the requirements specified in the Safeguards Agreement under the Non-Proliferation Treaty (NPT), the JAERI's system of nuclear material accountancy has been effectively developed.
The system of accountancy in the JAERI is based on the information treatment by the computer. The data of nuclear material are retained batchwisely together with their complicate history reflected the inventory changes and other transactions. The reports represented these data are prepared and submitted to the IAEA through the Government every month.
The inspections are frequently conducted to the JAERI to verify the material appeared in the reports. Item counting, item identification and non-destructive assay technique are brought to the verification.
In some cases, seals of the Government and the IAEA are applied to the nuclear material at the inspections, as their containment measures.
The surveillance camera is also installed in the facility to look whole view of reactor room and spent fuel pond.
In this paper, the general safeguards application and its corresponding accountancy system on JAERI's nuclear facility are described.

Keywords: Nuclear Material Accountancy, Non-Proliferation Treaty, Safeguards, Physical Inventory Taking, Containment and Surveillance, Computer Program, Inspection Activity.

原研における核物質の計量管理システム

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核不拡散条約（NPT）の締結とこれに基づく保障措置協定の発効により，1978年に関係国内法令の改正が行われた。このため原研においても，従来の核物質計量管理システムが大巾に変更された。

原研における計量管理システムは，電算機による効率的な情報処理により実施され，この処理では核物質のバッチ毎の履歴が当該バッチの在庫変動として記録される。これらの在庫変動状況は，既定の報告書の形でまとめられ政府を通じ毎月IAEAに送られる。

報告書に記載のバッチデータは，その後の査察により実際に検認され，検認には員数勘定，非破壊測定等があてられる。また，当該核物質の封じ込め及び監視手段として政府及びIAEAの封印が取り付けられ，原子炉施設には監視用カメラが置かれる。本稿では，NPT下のこれらの保障措置の概要に触れるとともに，原研における核物質計量管理システムの開発状況を詳述した。

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1. INTRODUCTION

The term of safeguards means a system of technical measures entrusted to the IAEA under the Non-Proliferation Treaty (NPT).
The authority to establish such a system is provided by Article III. A. 5 of the Statute of IAEA, which authorizes the IAEA "to establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose" [1][2].

Japan has ratified the NPT on 8 June, 1976. By the provision of its Article III. 1 and 4, the relevant Safeguards Agreement between the IAEA and Japanese Government was concluded and came into force on 2 December, 1977 [3][4]. The domestic law and regulations have been continuously revised conforming to the requirements specified in the Safeguards Agreement.

Generally, safeguards upon the nuclear materials should be applied at strategic points of the nuclear fuel cycle, and their procedures are strictly kept up in accordance with the definition of the Agreement.
On the other hand, for reducing the resources and manpower to control of the system, it must be taken into accounts that the system should be maintained in rational. The conbination of these two demands for the safeguards application to the nuclear materials is too difficult.
Nevertheless, in the recent nuclear arena, the accomplishment of safeguards requirement should be considered in the first. This concept has been conducted into the safeguards application in Japan.

The Japan Atomic Energy Research Institute (JAERI) has been operating the system of nuclear material accountancy for its reactors and research facilities during these twenty years. The system is applying to both of Tokai and Oarai research establishments of the JAERI.

The nuclear materials used in the pre-NPT type safeguards were controlled conforming to INFCIRC/66 which was published in 1965 (provisionally extended in 1966 and 1968) by the IAEA as the safeguards document to standardize as far as possible the content of safeguards agreement with the IAEA.

In the course of that time, the report and record system were simply treated because the assigned system to the facility being allowed the closing within 6 months for material balance, and not controlled batchwisely. The latter allowances mean that a few assemblies delivered from the manufacturer in a same contract were recorded and reported as one batch.

In the NPT type safeguards, the above batch definition and other control elements of the nuclear materials such as classification of facility, record and report system, containment and surveillance measures and procedures of inspection were revised as to be conformed to the specified system in Facility Attachment of Subsidiary Arrangement to the Agreement. The JAERI's material accountancy are executed with those assignments. The structure of the safeguards applications to the JAERI is shown in Fig. 1.

The JAERI's nuclear material accountancy system is based on the information treatment by the computer. Thus, the batch data of about 5,000 are controlled batchwisely with their transfer history.
The book inventory calculated is confirmed with performance of Physical Inventory Taking (PIT). The PIT is the important verification activity of nuclear material, and the inspections by the national and the IAEA's inspectorates are usually conducted to the PIT. The verification of nuclear material is a fundamental concept of safeguards implementation.
The accounting data of nuclear material are retained as records for each facility defined as Material Balance Area (MBA). The accounting report on those transactions prepared by the JAERI are submitted to the IAEA through Japanese Government. The IAEA analyzes the data from the State to determine the Material Unaccounted For (MUF), and evaluates the cause of the MUF. The JAERI makes the report on inventory change of nuclear material once a month for each facility, and preparing material balance report including its inventory listing after the completion of PIT.
The routine inspections are conducted to the JAERI at the frequency of more than 100 days a year under the NPT type safeguards.

In this paper, the general safeguards applications to the JAERI's facility and the corresponding system of accounting for and control of nuclear materials under the NPT type safeguards are described.

2. CLASSIFICATION OF NUCLEAR FACILITY

2.1 Facility categorization and material balance area (MBA)

The facilities in the JAERI are distinguished into two categories according to the facility design. One is reactor including research reactor and critical assembly, and the other is research and development facility. They consist of 6 research reactors, 4 critical assemblies and 2 R & D facilities.

All these nuclear facilities in the JAERI are further identified as item facilities in safeguards concept. Item facility is specified as a nuclear facility where the nuclear materials are retained in identifiable items.
Identifiable items are: fuel assemblies in the reactor, and fuel elements in the critical assembly, though it is remaining the question as to applying the same definition to the small samples in the R & D facility. The nuclear materials in the R & D facility are loose form of liquid, powder and particle depending upon the purposes in chemical and physical experiments. However all these nuclear materials are identified in the bottle or suitable containers, so that it is understood that there is no bulk handling facility, such as reprocessing plant and enrichment plant, in the JAERI at present.

The nuclear facilities in the JAERI are defined as an independent Material Balance Area (MBA).
The characteristics of the MBAs in the JAERI are summarized in Table 1 with their MBA codes.

MBA is specified as an area to account of the balance of nuclear material, at which the nuclear material is shipped or received.
The MBAs are agreed between Japanese Government and the IAEA, and are described in the Subsidiary Arrangement to the Safeguards Agreement which defines the safeguards applications in detail.

2.2 Key measurement point of MBA

2.2.1 Component of research reactor

Typical Key Measurement Points (KMPs) of the research reactor's MBA are shown in Fig. 2. Numeral description is for flow KMP, and being the letter for inventory KMP.
These standardized definitions are following to the IAEA safeguards.
The KMP is a location where the material flow or inventory is determined, e.g. receipt of nuclear material is examined at flow KMP and the material transferred is verified at inventory KMP, respectively.

As the fresh fuel is delivered into the JAERI's research reactor facility, it is received at KMP-1 as flow KMP, and stored at the storage KMP-A as inventory KMP. The rejected fuel in the examination on receipt by the facility operator is directly returned to the manufacturer through KMP-3.

At the refuelling, the fresh fuel is moved from KMP-A to reactor core KMP-B, or via KMP-D as temporary storage. At the same time, the spent fuel is transferred from the core to the pool KMP-C in the facility.
The spent fuel assemblies in the pool are usually dispatched to the reprocessing plant through KMP-3 as flow KMP, and the other location KMP-D is used as the place to keep the shipping cask temporary.

2.2.2 Component of critical assembly

Typical key measurement points of critical assembly are shown in Fig. 3. There are two inventory KMPs in the MBA, i.e. as a storage and as a reactor room, respectively. The nuclear materials in such installation are treated as a fresh fuel, in despite of being irradiated ones, because of their negligible operation power on the calculation of nuclear loss and production. This is the definition only applied to the safeguards implementations.

Flow KMPs are defined as the points of receipt of nuclear materials into the MBA, and of shipment from the MBA.
The transfer of nuclear material including measured discard or transfer

to retained waste should be caused in the research and development MBA, and not in the reactor MBA. The crashed fuel element which is no longer to use in the critical assembly should be once transferred to the R & D facility and then the material is treated in the type of inventory change of measured discard or transfer to retained waste.

The Strategic Point (SP) of the MBA is defined to include any location at which key measurements related to material balance accountancy are made and at which surveillance measures are executed [4].
Besides the KMPs, SP is described in the Subsidiary Arrangement depending upon the necessity of safeguards approach by the national and the IAEA's inspectorates, i.e. for application of containment and surveillance measures or other safeguards approach, SP is actually specified to FCA.
They are: SP 1 Storage locations
SP 2 Working area for making up drawers (fuel rods), and semi-hot cell
SP 3 Reactor room; working area for making up core
SP 4 Temporary storage in reactor room.
Same approach is applied to reactor MBA with strategic point for installing containment and surveillance devices.

2.2.3 Component of R & D facility

Typical key measurement points of R & D facility are shown in Fig. 4. There are many inventory KMPs depending upon the organizational reasons of the JAERI. The definition of the inventory KMP is applied to each research laboratory in the JAERI.
Flow KMP-1 is used for receipt of the nuclear material and retansfer from retained waste, and KMP-2, for shipment of the nuclear material and transfer to retained waste.
For measured discard, KMP-3 is exclusively used in the R & D MBA.
All these KMP codes described above are appeared in the Inventory Change Report or Physical Inventory Listing (see 3.4.2).

The nuclear materials in the laboratory are generally controlled by the facility operators in safety, and each facility has the handling license of nuclear material issued by the national Authority.

Strategic point is also specified in the R & D MBA for application of containment and surveillance measures.

The full definition of key measurement points for each MBA including reactor and critical assembly MBAs is noted in Table 2.

2.3. Change of component of facility

2.3.1 Procedures

The changes of Design Information,and Facility Attachment of the Subsidiary Arrangement are brought by the revision of the MBA and its KMP following to the JAERI's organizational purposes.
The Design Information is an information document concerning nuclear material subject to safeguards under the Safeguards Agreement and the features of facilities relevant to safeguarding such material, and it is provided by Japanese Government to the IAEA.
The Facility Attachment is a document which is a part of the Subsidiary Arrangement. It is containing the accountancy measures for the facility and a description of the mode and the scope of the IAEA's inspection activities. The Subsidiary Arrangement is a document containing a set of technical and administrative procedures to execute the safeguards procedures in the Safeguards Agreement.
The format of Design Information is specified by the IAEA as the questionnaire, in which the items of general information, general facility data, nuclear material description, nuclear material flow, nuclear material handling for each accountability area, protection and safety measures and the system of nuclear material accountancy and control are included.

For the negotiation on the revision of the documents between Japanese Government and the IAEA, it needs preliminary periods, so that the facility operator to be reconstruct the facility must announce to the Government in advance of the event.
To codify the contents of the documents to be revised, JAERI's Nuclear Fuel Division (NFD) undertakes the related assignment.
NFD contacts with the Authority to accommodate the codification to

the circumstances of the facility.

2.3.2 Applications

In the JAERI, the revision of the documents was recently caused to the JRR-3 MBA (research reactor), to establish a dry storage facility of spent fuel as its inventory KMP.
There are about 1,800 spent fuel rods of natural uranium in JRR-3, as the metal form, and to avoid the corrosion of their cladding materials in the pool, it was decided to transfer the rods to the dry storage facility.
Prior to the transfer, the spent fuel rods are once shipped to R & D facility to make canning into a storage container, and then re-transferred to the dry storage facility in JRR-3. The transportation of the spent fuel is carried out under the verification by the national and the IAEA's inspectorates.
The newly designed dry storage facility is identified as KMP-E of inventory KMP in JRR-3 MBA.

For other research reactors in the JAERI, JRR-2, JRR-4 and JMTR, the fuel description will be changed from high enriched uranium to middle enriched uranium in the near future.
On the critical assembly in the JAERI, SHE (Semi-Homogeneous Experimental Assembly) has also its plan to change the fuel description.
The fuel is substituted with coated particles.
The Design Informations and Facility Attachments of the research reactors and SHE should be revised before the events.

The aspects of laboratories (as KMPs) in the R & D MBA are changed in accordance with expansion of their experimental purposes.
The Waste Safety Testing Facility and No. 4 Research Laboratory in the R & D MBA were started up its operation recently, and were revised the corresponding Design Information, Facility Attachment and relative JAERI's regulation of nuclear material accountancy and control.

3. ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIALS

3.1 Inventory change and internal movement

3.1.1 Receipt from other MBA

In Japan, the nuclear materials received from other MBA are controlled by the domestic law and regulations of nuclear safety. Especially, regarding to the materials in research and development facility, the quantity to be maintained is restricted in handling licenses.

3.1.1.1 <u>Document for receipt and its treatment</u>

The accountancy for the nuclear material to be received into the JAERI is carried out by using the specified document sheet (see Table 3). In this receiving document sheet, batch data such as weight of nuclear materials, number of items are noted. The batch is defined by a single set of specification or measurement, under the NPT type safeguards.

Almost all the nuclear materials are received from a manufacturer based on the contract of manufacturing (as purchase). Borrowing the nuclear material and being entrusted to keep that are also appeared in the type of receiving. At the transfer, the shipper's data in the document are brought to the Nuclear Fuel Division (NFD) in the JAERI.
NFD is assigned the execution of nuclear material accountancy and a part of safeguards implementation to the JAERI's facility, following the assignment of organizational and custodial responsibilities in the JAERI's regulation on the accountancy which need the approval of the Government. The flow diagram of the receiving document sheet is shown in Fig. 5.

After the sanction of the document sheet, it is stored in NFD as the ledger, and one of the sheet is sent back to the consigner as an evidence of receipt. The data appeared in the document sheet are directly used for the computer treatment.
The items of the data appeared are as follows:

- receiving date
- shipper's MBA code

- receiver's MBA code, KMP code, number of job, and number of room at which the nuclear material is stored
- type of inventory change
- transporter
- batch name
- number of items
- material description (physical form, chemical form, container and irradiation status/quality of the nuclear material)
- origin of the nuclear material
- element code
- weight of element
- weight of fissile isotopes
- enrichment of enriched uranium and fissile ratio of plutonium
- weight of plutonium produced
- isotope code
- measurement basis
- owner of the material transferred
- storing container of the material in the facility

The codes such as MBA code are mainly defined in the Subsidiary Arrangement to the Safeguards Agreement (see 3.1.3.4).

The shipper's data including their batch name are continuously used in the JAERI as described above, though the material description of the received material is always changed to suitable one.
As it is possible, the JAERI offers to the shipper to take the facility name into the batch name, e.g. the batch of R2ONB100 means a fuel assembly used in JRR-2.
A fuel assembly or a fuel element is defined as single batch under the NPT type safeguards, so that the total numbers of batch in the JAERI are reached up to 5,000 at present.

Before the event of these inputs of nuclear materials into the MBA, the JAERI should submit to the Government a document noted the quantities of nuclear material in detail, and before the starting point of next half year, the JAERI should consolidate all the plans of inventory changes and report them to the Authority. These are the definition in the domestic law and regulations. The execution of such procedures is made by NFD as their assignment.

3.1.1.2 Tracking and multi-national labeling of nuclear materials
It is the requirement specified in the domestic law and regulations to control the nuclear material by its supplier's origin.

Especially, pursuant to the bilateral agreement between Japan and Canada, or Japan and Australia, Japan has to track the nuclear material through all the nuclear fuel cycle steps in the state, and report the accounting data to the supplier's Government.

In these arrangements, the nuclear material which is mined in Canada and then enriched in USA is specified as the material with duplicate origin of Canada-USA. As the nuclear material is mixed with another origin's, the product is designated to each country based on a pro-rata principle according to feed contribution.

In the JAERI, the spent fuel with the duplicate origin has been transferred from a power reactor for post irradiation examinations. These spent fuel assemblies are recorded and reported as duplicate origin's material with the label of Canada-USA etc.

3.1.2 Shipment to other MBA

3.1.2.1 Document for shipment and its treatment
The shipping document sheet (see Table 4) is attached to the nuclear materials transferred to other MBA, e.g. as return of borrowed material and keeping material, and supplying, lending and entrusting of nuclear materials.
The right of property of the materials to be contributed is abandoned by the JAERI before the shipment.
As it needs the approval of the Japanese Authority of transfer on the contranct, the JAERI submits the corresponding application.
For the transfer of nuclear material supplied from the nation under bilateral co-operation agreement, the approval of the Government should be gained before the shipment to the third nation. The form of MB No. 10 is

used for this application.

The items of the data appeared in the shipping document sheet made by the JAERI are as follows:

- shipping date
- shipper's MBA code, KMP code, number of job, and number of room at which the nuclear material is shipped
- receiver's MBA code
- type of inventory change
- transporter
- batch name
- number of items
- material description
- origin of the nuclear material
- element code
- weight of element
- weight of fissile isotopes
- enrichment of enriched uranium and fissile ratio of plutonium
- weight of plutonium produced
- isotope code
- measurement basis
- owner of the material
- shipping container

The flow diagram of the shipping document sheet is shown in Fig. 6.

3.1.2.2 Shipment of spent fuel

At the shipment of spent fuel to a reprocessing plant, the shipping flask is usually sealed by the national and the IAEA's inspectorates for the safeguards purposes. Actually, the shipping flasks containing spent fuel to be reprocessed, generated in JRR-2, JRR-4 and JMTR, are sealed after the completion of item counting and verification of serial number of the assemblies.

In JMTR, the shipment to the reprocessing plant is carried out at the frequency of 3 times per 2 years.

3.1.3 Internal movement

The nuclear materials to be moved in the MBA are controlled by using the internal transfer document sheet (see Table 5).
For the transfer between MBAs in the JAERI, same kind of sheet is used for material accountancy, though the transfer between JAERI Tokai research establishment and Oarai research establishment is treated by using receiving or shipping document sheet, respectively.
Internal movement is frequently caused, and the document sheet on the transfer should be immediately submitted to Nuclear Fuel Division (NFD) in the JAERI for their treatment. Flow of the document is shown in Fig. 7.
The common elements controlled as an internal movement are described in the following paragraghs.

3.1.3.1 Inter-MBA movement

The transfer of nuclear material between MBAs in the JAERI is treated by using the internal transfer document sheet. This treatment is made separately in Tokai and Oarai research establishments.
Principally, the nuclear material to be transferred should be accounted in appropriate measurements.

3.1.3.2 Inter-KMP movement

Inter-KMP movement, i.e. the transfer of nuclear material from one experimental area to the other area within the MBA, is caused very frequently at each facility.
The transfer between KMPs is recorded in the JAERI but not reported to the Government as inventory change. The results on the transfer are reported only in a physical inventory listing made after the completion of physical inventory taking.

3.1.3.3 Nuclear loss and production

Nuclear loss and production are generated in fuel discharged from the reactor core. The absolute figures are noted in the document sheet to present to NFS, though the operational data such as the integrated thermal power of the reactor in the period are retained in the facility.

3.1.3.4 Measured discard and transfer to retained waste

Measured discard is applied to the materials, which were changed to actually unsuitable one on its further nuclear use because of dilution in the experiments, contamination or some other reasons.

Waste of nuclear material is treated in the specification of transfer to retained waste.

The nuclear materials to be transferred to retained waste, are defined as real waste with such material description of TOOE, TOOM, UOOE and UOOM. The code of material description is understanding by code No. 10 of the Subsidiary Arrangement, to physical form, chemical form, container and quality/irradiation status (see Table 6).

The inventory changes of measured discard and transfer to retained waste are the definition only to apply to the materials in R & D MBA, and the quantities on measured discard are restricted within 0.1 effective kilogram (see 3.1.5) a month.

3.1.3.5 Change of material description

Under the NPT type safeguards, the nuclear material is defined together with its properties, i.e. as the material is dissolved in the experiment, facility operator should submit the internal transfer document sheet to NFD on the changes of the physical form and relative material descriptions. The results on the change of material description are reported to the Government only in a physical inventory listing.

3.1.3.6 Change of category

Category means the result of classification of material to natural, depleted or enriched uranium etc. The small quantity of natural uranium mixed with large quantity of high enriched uranium is treated as that of enriched uranium, thus the result of the experiment is defined as category change in the nuclear material accountancy.

In this case, the change of enrichment of the material is also noted to the document sheet.

Burn-up in research reactors degrades natural or even enriched uranium to depleted uranium, so that the category change is usually generated at the shipment of the spent fuel from the reactor MBA. This procedure is specified in the Facility Attachment of the JRR-3 MBA in the JAERI.

Records, reports and material balance closing are to be set up for each element (category), before and after the category change.

3.1.3.7 Rebatching

When some batches are merged into one batch, following to the purpose of experiments, this change (or contrary case) is treated as rebatching. Rebatching is generally caused in the critical assembly as its composition or decomposition of the fuel element in the core.

3.1.3.8 Termination of safeguards

The termination of safeguards to the nuclear material denotes an inventory decrease, which means the transfer of the material to non-nuclear activities. The nuclear materials in termination of safeguards become irrecoverable ones. This procedure was applied to the nuclear materials used in AHCF (Aqueous Homogeneous Critical Facility) in the JAERI, as the critical facility came to decomposition on 23 February, 1979.

3.1.3.9 Shipper-receiver differences

The differences between the quantities of nuclear material measured in the JAERI and other MBA are treated as shipper-receiver differences. Though the result on shipper-receiver differences is distinguished from usual inventory change data as same as that of rebatching, it is recorded in the JAERI and reported to the Government.

3.1.3.10 Change of the organization

Re-arrangement of department or division of the JAERI brings the change of control structure for the nuclear materials. The results on change of number of job are announced by using the internal transfer document sheet. Except for inter-KMP movement, change of material description and change of organization, the items of internal transfer are reported to the IAEA through the Government as Inventory Change Report (see 3.4.2).

The accounting data of receipt, shipment and internal transfer generated in Oarai research establishment are treated in Accounts Division which has the same duty as Nuclear Fuel Division.

3.1.4 Quantity and time data

The minimum accounting limits of the nuclear materials are 0.01g for enriched uranium, plutonium and U-233, and 1g for natural uranium, depleted uranium and thorium.
The mixtures of enriched and natural uranium are accounted in the limit by each category.

The movements of material with the quantity of less than the minimum accounting limits are controlled with manual treatment by Nuclear Fuel Division.

Inventory change is occurred either at defined point of time as the receipt or shipment of the nuclear material, or over a whole period as in the case of burn-up of the fuel in a reactor. For the latter case, the event is treated as if they occurred intermittently, and the results of the nuclear loss and production calculated are recorded with the date of refuelling.

The date on the correction should be noted with that of finding out the error, as the correction to an inventory change previously conducted were generated.
The results of correction are recorded with appropriate document, and reported to the Government.

3.1.5 Effective kilogram in safeguards

The quantity of nuclear material is specified as an effective kilogram (Ekg) in the domestic law and regulations.
This is based on the definition by the IAEA safeguards, i.e. as special unit used in safeguarding nuclear material, reflecting its strategic value.

Before the event, the JAERI should report to the Government the plans of receipt and shipment of nuclear materials which have the value of greater than 0.1Ekg (as described in 3.1.1.1). And on the import or export of nuclear material with above 1Ekg, another more detailed report is needed.

The procedures of calculation to obtain effective kilogram are as follows [4]:

(1) For plutonium;
its weight in kilograms.
(2) For uranium with an enrichment of 0.01 (1%) and above;
its weight in kilograms multiplied by the square of enrichment of the material.
(3) For uranium with an enrichment below 0.01 (1%) and above 0.005 (0.5%);
its weight in kilograms multiplied by 0.0001.
(4) For depleted uranium with an enrichment of 0.005 (0.5%) or below, and for thorium;
its weight in kilograms multiplied by 0.00005.

In the JAERI, the above calculation is made to nuclear material to be discarded, because the quantity of measured discard for one month is limited within 0.01 Ekg of total of plutonium and enriched uranium and/or 0.01 Ekg of natural and depleted uranium and thorium. In case of discarding the nuclear material with quantities exceeding the limit in one month for a R & D MBA, Japanese Government and the IAEA consult on such discarding. These calculations on Ekg are executed by the computer in the JAERI as being described in the following section.

3.2 Information treatment

Information treatment on nuclear material accountancy is made by using the computer with direct input of data presented in the document sheet. The reports to the Government and various lists available for internal use to the material control are continuously prepared in the computer treatment.

3.2.1 Composition of program

In order to treat the accountancy data presented in the documents described in 3.1, the large computer (FACOM M200) is used.
The batch data are fed into the computer together with the MBA codes of shipper/receiver and with other codes such as inventory change code. Almost all the codes used in the information treatment are specified in code No. 10 of the Subsidiary Arrangement to the Agreement (see Table 6), though some codes such as description of owner of the nuclear material are defined for internal use only.

The program is written by Cobol language.
The composition of the program of the JAERI's nuclear material accountancy system is as follows:

(1) PROGRAM 1 (composed of 587 steps);
Renewing the master code file by correcting the previous specifications, depending upon the change and modification of Facility Attachment to each facility (though almost all the codes in the master file are including in the following programs).

(2) PROGRAM 2 (composed of 2,778 steps);
Renewing all data by incorporating the monthly data generated into the computer as punched cards obediently reflected the information in the receiving, shipping and internal transfer documents.
The program also includes the function to correct the error of individual accountancy data previously treated. PROGRAM 2 is used in connection with PROGRAM 3.

(3) PROGRAM 3 (composed of 3,821 steps);

This program has the following functions of data treatment.

- Reading the ending all data of the month treated by PROGRAM 2, and expelling the error data to be corrected. To cancel the error message in the list, the treatment is repeated.
  Thus the ending all data are confirmed with output of the final proof list.
  In this time, the list of effective kilogram of nuclear material discarded in the month is prepared to secure the nuclear material accountancy in the JAERI.
  The Ekg list is made by each category of the nuclear material.
- The summary file is set for the month or for the year by PROGRAM 3 with the input of optional date interval.
  Records of physical inventory and inventory changes of the month or of optional date interval are confirmed by the summary file.
- The summary file with all new data prepared are copied to a magnetic tape by PROGRAM 3.
- Dump list is also prepared by this program.

(4) PROGRAM 4 (composed of 5,362 steps);

Making various lists which include the records of physical inventory and inventory changes. The summary file with all new data for the month or optional date interval prepared by PROGRAM 3 makes it possible to output these lists.

(5) PROGRAM 5 (composed of 2,472 steps);

Making reports such as ICR, MBR and PIL. These reports are submitted to the IAEA through Japanese Government.

(6) PROGRAM 6 (composed of 5,419 steps);

Making optional list such as restricted quantity list of nuclear material for each R & D facility in the JAERI, and lists written by Japanese which correspond to the lists made by PROGRAM 4.

3.2.2 Sample output

The samples of report to the Government prepared by the treatment with PROGRAM 5 are shown in Table 7 — 9 as ICR, MBR and PIL.

The sample output of master by PROGRAM 1 is shown in Table 10 as list No. 1 (L-01). The error and proof lists of input data to every receipt, shipment and internal transfer made by PROGRAM 2 and 3 are also shown in Table 10 as L-02 and 03.
The lists made by using the PROGRAM 4 are useful in an internal nuclear material accountancy, e.g. the inventory lists of the material distributed to each MBA, KMP and organizational section are shown in Table 11 as L-06 — L-11.

As shown in Table 12, the nuclear material transferred from or shipped to other MBA is rearranged to every contract (see L-13, 14, 20, 21 and 22), material description (L-60 and 61), its owner (L-66), its origin (L-72) and enrichment of the material (L-73).

By the PROGRAM 4, other lists are also made as shown in Table 13, e.g. effective kilogram list for each MBA (see L-29) and historical records (L-40) are optionally prepared.
The historical records are important to make it easy to follow the batch of each nuclear material in the JAERI.
The sample output made by PROGRAM 6 is shown in Table 14 as restricted quantity list of nuclear material for each facility (L-28).

3.2.3 Characteristics of the processing system

The hierarchies of the processing system of accounting data are shown in Fig. 8. In the figure, "MASTER" is including the specifications of code defined in Facility Attachment of Subsidiary Arrangement to each MBA.
The number of batch data treated by the system in the JAERI is about 500 entries a month.

The representative special programs to treat the data are as follows:

(1) The history of a batch is kept in the computer file to enable the batch follow-up.
(2) The input procedures are simplified by applying special program. The data of nuclear loss and production generated upon the discharge of the reactor fuel from the core are treated by using only one input code of inventory change, LN, i.e. the calculation of nuclear loss and production is made by using the code of LN only to the relative batch unless the input of code of NP (nuclear production).
(3) In the JAERI, the fissile weight of plutonium generated in the fuel by the irradiation is controlled as same data to that of element weight. So that the weight of plutonium produced is transmitted to the column of weight of fissile in the treatment. The enrichment of the spent fuel is calculated by the computer depending upon the weight of element and fissile isotopes inputted (the calculation of burn-up is made by facility operator of the reactor with independent program).
(4) The procedure noted in (2) item is also applied to the treatment of rebatching and category change. Rebatching is treated with the code of RM (rebatching minus), and category change is calculated by using ND etc. In the latter, ND means degradation of natural uranium to depleted uranium and the category change is treated together with the inventory change of shipment from the reactor MBA.
(5) The batch name of the nuclear material delivered from other facility is checked by the JAERI's computer system on its duplicate use in the JAERI, thus the double accounting of the material is avoided.

3.3 Physical inventory taking

3.3.1 General procedures

The verification of the nuclear material is a fundamental concept in safeguards implementation.
As the procedures of Physical Inventory Taking (PIT) by the JAERI, item counting, identification of serial number, non-destructive assay and check of seal number and its integrity are generally applied to the nuclear materials.
The inspections by the national and the IAEA's inspectorates are usually conducted to the PIT as their observation.

The fresh fuel assembly and rod in the storage of the research reactor and the critical assembly are thoroughly counted for each item, and identified with their serial numbers. In this case, the nuclear materials are checked by the inspectorates with the stabilized assay meter, SAM, which is a device to determine the enrichment with a sodium iodide detector and an electronic module.

To verify the loaded fuel in JRR-3, the upper shielding of the core is removed, and item counting and examination of serial number to each fuel assembly are executed. For JMTR, the verification is taken place at the top of the pressure vessel. For the loaded fuel in JRR-4 and NSRR, the under-water TV camera set is used to identify the serial number.
As it has no direct measures to verify the status of loaded fuel in JRR-2, the PIT is conducted coincident with the time of refuelling. The fuel rods discharged from the core at the refuelling are identified in the spent fuel pool.

The spent fuel assemblies or rods in the pool of each reactor are identified with their serial numbers by the under-water TV camera.
The spent fuel which had no serial number is verified by applying the non-destructive assay technique to measure the γ-spectra showing the characteristics of used material in the reactor. This procedure was applied to the non-identified spent fuel in JRR-3.
The results of the measurement by the facility operator are shown in Fig. 9

and 10. The measured fuel is sealed by the inspectorates after the confirmation of their position in the storage container in the spent fuel pool.

The fuel rods in the reactor room of critical assembly are directly verified with item counting. In particular, NDA is applied for the nuclear material in both of fresh fuel storage and reactor room at FCA.

The nuclear materials in R & D facility are verified in physical for their status of storing and using. The label on the bottle of nuclear material is identified and the items are thoroughly counted.
Internal movement of nuclear material should be reduced during the period of PIT to the barest minimum, and ideally not to be caused at all.

The PIT is carried out twice a year for all the facilities in the JAERI. One case is executed as independent examinations by facility operator, and the other is taken coincident with the inspections to accommodate the inspector's thoroughly verifications. For FCA, PIT is additionally conducted at the time of major core change. In the following paragraph, the method of the physical inventory taking for FCA, in which retaining a large quantities of plutonium of Al - alloy and enriched uranium is noted in detail.

3.3.2 Method of the PIT at FCA

The method conducted to the physical inventory taking at FCA consists of item counting and non-destructive assay technique, i.e. about 30,000 coupons of plutonium and enriched uranium, and about 90,000 coupons/blocks of natural uranium and depleted uranium are counted, and the samples picked up by random sampling basis are measured.

3.3.2.1 Sampling size

The sampling size calculated is about 170 samples for plutonium and enriched uranium and about 40 samples for NU and DU samples, in physical inventory taking at FCA.

The formulas to conduct the sampling size (number of samples to be measured) are as follows:

Attribute test: $n_a = N(1 - \beta^{\frac{x}{M}})$

where n_a is the sampling size, N is the total number of items in the stratum, M is a goal quantity (see 3.3.2.4), x is the mean value of the item and β is non-detection probability (say 0.05). Stratum is defined to the material with same specification of its fabrication.

Variable test: $n_v = N(1 - \beta^{\frac{\gamma x}{M}})$

where n_v is the sampling size (attribute mode) and γ is lower limit of the detection which is detected in the attribute test. Others are same above.

The formula to conduct the sampling size by variable mode is more complicate.

It is an interest to the inspector, to examine the diversion of nuclear material caused by the facility operator. So that, in the PIT, the facility operator should confirm the fact that there has been no diversion in the facility.

There are two types of diversion:
one is to divert large amounts of nuclear material in a short time period (abrupt diversion) and the other is to divert small amount of it in a long time period (protracted diversion).
An attribute test is effective to detect the abrupt diversion, and variable test is for protracted diversion.

In this time, the attribute sampling plan is usually conducted to the materials in FCA.

3.3.2.2 Measurement of weight

All NDA samples are weighed by calibrated scales, i.e. with Mettler PK16 for the block and Mettler PL200 for the coupon.
It is confirmed that the differences between the measured and the book data are less than 5% to all NDA samples (95% confidence).
The confidence limit is set in 4σ (σ: standard deviation of the measuring device, 5%), for evaluating the diversion taken place.

The representative measured data are as follows; and it was concluded that there has been no diversion.

Category	Size of material (inch)	Book value	Measured value
Pu 92%	2-4-1/16	92.129 g	92.131 g
Pu 92%	2-2-1/16	46.260	46.258
Pu 81%	2-2-1/16	51.690	51.693
Pu 75%	2-2-1/16	54.470	54.471
EU 93%	2-2-1/16	73.884	74.000
EU 20%	2-2-1/8	148.480	148.703
NU	2-2-8	9,822.000	9,824.800
DU	2-2-4	4,929.000	4,929.500

3.3.2.3 Measurement of fissile ratio

Fissile ratio of the NDA samples is measured by computerized pulse height analyzer with a germanium detector.
Plutonium samples are measured without collimator, by different distances between the detector and sample depending upon the radioactivity of the material.
The fissile ratio of samples is calculated by multiplying the fissile ratio of the standard of same size of material with the ratio of the 414KeV peak area of samples to that of the standard.

Uranium samples are measured with a lead collimator of different hole diameter depending upon the radioactivity and the size of the material.
The enrichment of samples is calculated by multiplying the enrichment of the standard with the ratio of the 185KeV peak area of samples to that of the standard.

On the results obtained by NDA, it is analyzed that the differences between the measured and the book data of the fissile ratio are less than 5% for all NDA samples. The confidence limit is set in 4σ (σ= 5%), for the evaluation of the results.

The representative data obtained are as follows; and no diversion was concluded.

Category	Size of material (inch)	Book value	Measured value
Pu 92%	2-4-1/16	91.968 %	91.891 %
Pu 92%	2-2-1/16	92.000	92.056
Pu 81%	2-2-1/16	81.300	81.300
Pu 75%	2-2-1/16	75.690	75.682
EU 93%	2-2-1/16	92.860	93.546
EU 20%	2-2-1/8	19.921	20.078
NU	2-2- 8	0.720	0.728
DU	2-2- 4	0.210	0.210

3.3.2.4 <u>Significant quantity</u>

Significant quantity is the approximate quantity of nuclear material which could manufacture a nuclear explosive device. This is used in the IAEA to select accountancy verification goals.

In the calculation of the sampling size of the nuclear materials, the significant quantity was used as the quantity on verification goal at the physical inventory taking of FCA.

They are:

(1) 8 Kg for total element of plutonium which is containing above 20% of fissile isotopes.

(2) 8 Kg for total isotope of U-233.

(3) 25 Kg of U-235 for enriched uranium of above 20% of enrichment.

(4) 75 Kg of U-235 for enriched uranium of less than 20% of enrichment.

(5) 75 Kg for total element of natural uranium and depleted uranium.

(6) 20 t for thorium.

A set of parameters of significant quantities, detection times to the diversion and detection probabilities is used in the IAEA safeguards as their detection goals [2].

Detection time is defined as the maximum time that may elapse between diversion and its detection by the IAEA safeguards. Relating to the detection time, the conversion time is considered as the time required to convert different forms of nuclear material to the metallic components of a nuclear explosive device.
The conversion time is estimated for each material and for its beginning form, in IAEA safeguards.

Detection probability is defined with the formula of $(1 - \beta)$, where β is non-detection probability described in the prior paragraph, i.e. the probability of failing to conclude from using accountancy that a diversion has taken place as in fact it has occurred.
Detection probability is the reliability of safeguards measures such as the material accountancy, and containment and surveillance to the nuclear material used in planning an IAEA's inspection or series of inspections.

3.4 Records and reports

3.4.1 Records in the facility

3.4.1.1 Accounting records

The accounting records on inventory changes represented in the document sheet are retained as facility records at Nuclear Fuel Division (NFD) in the JAERI.
The documents are specified as supporting documents for each accounting transaction.
Supporting documents are records which contain identity data, source data and batch data. Identity data consist of serial number, MBA code, element code, material description code and type and date of inventory change to the nuclear material. Source data include conversion factor to obtain the weight of element, and the isotopic composition of enriched uranium or plutonium. Data conducted from source data are batch data.
Accounting records are represented by all these records.

When the shipper/receiver difference, adjustment and correction to the nuclear material are associating with the accounting data, the results are also recorded.
The document sheet is stored in NFD for 10 years.
The book inventory for each MBA and KMP is conducted by the computer treatment described in 3.2, and the figures are retained in NFD as hard copies (see Table 11), to accommodate the examination of the facility records by the inspectorates.

3.4.1.2 Operating records

Operating records include the data on the operation of the facility in regarding to the use or handling of nuclear materials. For the reactors, the integrated thermal power produced by each reactor for a given period (one of the source data) is also included to the operating records.
Operating records are stored in each facility for 10 years.

3.4.1.3 Records system specified

Records system for the research reactor specified in Facility Attachment of Subsidiary Arrangement to the Agreement is as follows:

(1) Inventory change data are recorded,
- for receipt foreign, receipt domestic, shipment foreign and shipment domestic; upon the receipt or shipment.
- for nuclear loss and production; after discharge of irradiated fuel from the reactor core.
- for category change; upon the shipment of the spent fuel (natural uranium) from the JRR-3 MBA.

(2) Measurement results used for the determination of the physical inventory are recorded upon identification and counting of items during the physical inventory taking.

(3) Operating data used to establish changes in the quantities and composition of nuclear material are recorded, as the relevant source data with respect to nuclear loss and production including the integrated thermal power produced by the reactor and the burn-up (in MWD/t) for each fuel assembly; upon discharge.

For the critical assmbly, the record of inventory change on nuclear loss and production is eliminated in the specification, though the Pu-241 decay at FCA is conducted as the item of the record. The operating history of the experimental core is also recorded on the critical assembly.

The items of inventory change data in records of R & D facility are: receipt foreign, receipt domestic, shipment foreign and shipment domestic, and also included de-exemption and exemption, accidental loss and gain, measured discard, transfer to retained waste and retransfer from retained waste, in the category.

The results of shipper-receiver difference, material unaccounted for and correction on the accounting data are also recorded for each MBA.

3.4.2 Reports to the Government

The reports such as ICR, MBR and PIL specified in Facility Attachment are made by NFD as their assignment.
ICR is short for Inventory Change Report, as well as MBR is for Material Balance Report and PIL is for Physical Inventory Listing.
These reports are treated as accounting reports, which are statements on the status of nuclear material in each MBA.

3.4.2.1 ICR

ICR noted changes in the inventory of nuclear material is dispatched from Japanese Government to the IAEA as soon as possible and in any event within 30 days after the end of the month in which the inventory changes occurred or were established. The JAERI should submit the ICR to the Government within 15 days after the end of that month.
The inventory changes in the ICR are represented in terms of batches. These data must coincide with the shipper's data.

3.4.2.2 MBR and PIL

MBR is dispatched to the IAEA as soon as possible and in any event within 30 days after the physical inventory has been taken. So that the JAERI should submit the MBR to the Government within 15 days after the completion of physical inventory taking.
MBR represents the material balance of each element in a given period for each MBA.

Generally, the report of material balance includes the following entries to each element:

(1) Beginning physical inventory (PB)

(2) Inventory changes (IC);
   - the accumulated quantity for each type of inventory change such as foreign receipt, domestic receipt, nuclear production, foreign shipment, domestic shipment, nuclear loss, measured discard, transfer to retained waste, and termination of safeguards etc.

(3) Ending book inventory (BE);
   - the algebraic sum of the beginning inventory and the inventory changes,

not including any rounding adjustments reported in the MBR.

(4) Shipper/receiver differences (DI);
- SRDs are the differences between quantities of nuclear material as stated by the shipper and that of the same material as measured by the receiver.

(5) Adjusted ending book inventory (BA);
- the inventory adjusted with shipper/receiver differences.

(6) Ending physical inventory (PE);
- the sum of all measured and derived batch quantities of the material confirmed at physical inventory taking.

(7) Material unaccounted for (MF);
- MUF is calculated as the difference between adjusted ending book inventory and ending physical inventory.

(8) Rounding adjustment to (not appeared in JAERI's accountancy);
- rounding adjustment is made to an entry at the MBR in order to bring it to agree with the corresponding figure at ICR, e.g. as two items (1,300g U in each item) were received from domestic MBA (RD) in the material balance period, the appeared figure in the ICR is 1Kg for each entry, though the figure in the MBR is 3Kg reflecting the rounding treatment of the algebraic sum 2,600g. In this case, "RARD" entry is reported with the figure of -1Kg at the MBR.

  In the case of BE, BA and MF, the following formulas are used to calculate the rounding adjustment, respectively.

  adjustment to BE (RABE); $PB + IC_{MBR} - BE$

  adjustment to BA (RABA); $PB + IC_{MBR} - DI - BA$

  adjustment to MF (RAMF); $BA - PE - MF$

  where the figures used in the calculation are those of in the MBR.

When the inventory change did not occur to the element in the period, the MBR of the element is prepared with the entries of (1), (5) and (6) described above.

The closing time of MBR is defined as the last date of the continued physical inventory taking.

The PIL is a list including all batch data in the MBA, and being attached to each material balance report.

The physical inventory listings as initial reports prepared by the JAERI were submitted to the IAEA through Japanese Government at starting point of the NPT type safeguards. The initial reports reflect the situation as of the last day of the month in which the Agreement entered into force.

The reports including ICR are conducted by computer treatments, and the hard copies and magnetic tapes are submitted to Japanese Government within a term.
The reports system was widely changed under the NPT type safeguards, and such system including records system is supplementary specified in the JAERI's nuclear material accountancy regulation conforming to the domestic law. Examples for ICR with concise note, MBR and PIL are shown in Table 7 — 9. The concise note is attached to each report, to explain the entry as appropriate.

3.4.2.3 Special report

In the Safeguards Agreement [4], Japanese Government has been assigned to make a special report immediately at the following cases:

(1) If any unusual incident or circumstances lead Japanese Government to believe that there is or may have been loss of nuclear material that exceeds the limits specified for this purpose in the Subsidiary Arrangement; or
(2) If the containment has unexpectedly changed from that specified in the Subsidiary Arrangement to the extent that unauthorized removal of nuclear material has become possible.

So that the JAERI should announce to the Government about any event considered as circumstances relating to the special report.

4. INSPECTIONS

4.1 Definition of inspections

The inspections are carried out to examine the Design Information in its effectiveness, record and report consistency, and material flow and physical inventory, and to install the containment and surveillance devices to the facility.
These activities are periodically conducted by the national and the IAEA's inspectorates, with specified procedures [5].

The purposes of inspections are defined as follows [4]:

(1) Ad hoc inspections
Ad hoc inspections are carried out by the inspectorates to verify the information contained in the initial report (PIL) on the nuclear material subject to safeguards under the Agreement, and identify and verify changes in the situation which have occurred between the date of the initial report and the date of the entry into force of the Subsidiary Arragement in respect of a given facility.
Ad hoc inspections are also conducted before the shipment of spent fuel to be reprocessed to other nations or upon the transfer of nuclear material into Japan to identify and if possible verify the quantity and composition of the material.

(2) Routine inspections
The nuclear materials subject to safeguards are verified by the inspectorates, periodically.
In the routine inspections, the inconsistency of reports and records is examined, and the location, identity, quantity and composition of all nuclear materials are verified. The information on the possible causes of material unaccounted for, shipper/receiver differences and uncertainties in the book inventory are also verified in the inspections.

(3) Special inspections
Special inspections are conducted to verify the information contained in special reports, or if the IAEA considers that information made available by Japanese Government and information obtained from routine

inspections, is not adequate for the IAEA to fulfil its responsibilities under the Safeguards Agreement.
An inspection will be defined to be special when it is either additional to the routine inspection effort or involves access to information and/or locations in addition to the specified access in the Agreement for ad hoc and routine inspections.

4.2 Inspections to the JAERI

In accordance with definition of each Facility Attachment (see Table 15), the inspection activities are conducted to the facilities in the JAERI. Under the NPT type safeguards, inspections are principally carried out by Japanese Government, and independent verifications are simultaneously executed by the IAEA.

To the JAERI's research reactors retaining nuclear materials of high effective kilograms or large quantities of plutonium produced, the routine inspection is conducted at the frequency of once or twice a month [6].

Other research reactors retaining the nuclear materials of less than the IAEA's significant quantity are verified by the inspectorates at the frequency of once a year.
For the critical assembly in the JAERI, the same approaches are conducted, though the inspection to FCA is carried out every two weeks by the completion of non-destructive assay technique.
The inspection to the research and development facility is executed every two or three months.

Generally, the inspections are performed with the procedures of item counting, identification of serial number on the fuel assembly, non-destructive assay, check and exchange of the seals and examination of surveillance cameras.
Almost all the seals applied to JAERI's nuclear material are double seal by Japanese Government and the IAEA. The surveillance cameras to look the nuclear facility retaining nuclear materials subject to safeguards are always installed in JMTR, and also in JRR-3 for the observation of

transfer on its spent fuel from the pool to the dry storage facility in the MBA. In the case of JRR-3, the fuel is shipped once to R & D MBA to seal it into the storage container and then brought back to the dry storage facility, so that in a KMP of R & D MBA the surveillance camera is also installed temporary.

These films of the surveillance camera are changed in the routine inspections.

The routine inspections conducted as usual are considered as verification of flow key measurement point on its inventory change. On the other hand, the inspections executed in physical inventory taking are understood as verification of inventory key measurement point.

The examination of record and report consistency is also carried out at the inspections. Record audit is specified in Facility Attachment as in scope of routine inspection activities.

The inspection man-days in the last 6 years are shown in Table 15. Under the NPT type safeguards, the inspection activities have been intensified to JRR-3, JMTR and FCA by taking into account of the definition such as IAEA's significant quantities, though the inspection efforts had been mainly applied to JRR-2 and JMTR retaining high enriched uranium before the NPT.

5. CONCLUSION

The JAERI has been assigned the technology assistance to the Government in research and development of the safeguards application. They are including R & D of destructive assay and non-destructive assay techniques, containment and surveillance technology and pretreatment method of inspection samples. The MUF evaluation technique is also important element to be developed. Japanese Government has consolidated all these co-operations in Japan, and concluded JASPAS (Japan Support Program for the Agency Safeguards) with the IAEA regarding to the main theme of safeguards applications. Part of safeguards framework in Japan has been established with results of these developments.

The JAERI's nuclear material accountancy is improved by using computer on its information treatment.
There has been no inconsistency on records and reports, and no tampering to containment and surveillance measures at the verification of the inspections.
Thus, it could be concluded that the JAERI's item facilities are safeguarded efficiently and confidently, under the NPT type safeguards. One of the remaining problem in the safeguards implementation for the JAERI's nuclear facility is the application manner of containment and surveillance measures, especially in regard to their integrity check, though it is judged by the international safeguards concept.
These measures are applying to critical assembly and being set in the storage of spent fuel to be reprocessed.

The safeguards approaches by the national Authority and the IAEA have been well achieved through the NPT type safeguards. The inspections are conducted every month, and assigned implementation of the inspectorates [7] are completely carried out in each JAERI's facility. The physical inventory is also taken twice a year in strict measures.

Despite of the problem described above, for the inspection effort, it would be expected that the high development of containment and surveillance measures to the nuclear material subject to safeguards brings the purposeful reduction of such approaches to the facility by means of direct verification as inspections. The combination of these measures to the nuclear material accountancy will save the efforts of safeguards implementations to the facility, and conduct the minimum intrusion into the routine operation of the facility. In the JAERI, the RECOVER (Remote Continuous Verification tel-communication) system is in developing. This system gives information to the IAEA about containment and surveillance status of the facility by a tel-communication. Also the TRANSEAVER (Transport by Sea Verification) project is planning in connection with surveillance measures. This system could verify the nuclear material under sea transport.

The system of JAERI's nuclear material accountancy will be further developed with reflecting the transition of these technical and political affairs.

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Table 1 Characteristics of JAERI's nuclear facility.

Item \ Research reactor	JMTR*	JPDR	JRR-2	JRR-3	JRR-4	NSRR
MBA code	JE-A	JE-C	JE-D	JE-E	JE-F	JE-J
Thermal output (MW)	50	90	10	10	3.5	0.3 (steady) 23000 (pulse)
Maximum neutron flux ($n/cm^2 \cdot sec$)	5×10^{14}	8.6×10^{13}	2×10^{14}	3×10^{13}	7×10^{13}	1.9×10^{12}
Moderator	H_2O	H_2O	D_2O	D_2O	H_2O	H_2O
Fuel to be safeguarded	93% EU ETR-type	2.6% EU	93% EU ETR-type	NU and 1.5% EU	93% EU ETR-type	~20% EU -ZrH
Fuel No. in core (assembly)	27	72	24	243	25	157
Weight of U-235 in a assembly (g)	277	1460	195	104	167	52
Operation mode	24 days x 5 cycles	–	12 days x 13 cycles	12 days x 13 cycles	daily operation	daily and pulse operation

Table 1 (continued)

Item \ Critical assembly	FCA	JMTRC *	SHE	TCA
MBA code	JC-B	JC-C	JC-F	JC-G
Type	Slit table type, horizontal machine	Pool type, tight water modetated	Graphite moderated, horizontal half machine type	Tight water moderated, heterogeneous tank type
Thermal out put (w)	2000	100	10	200
Fuel to be safeguarded	~20%, 93% EU Pu, NU, DU	~ 93% EU	~ 20% EU	1 - 3.2% EU, Pu, Th
Operation mode	daily operation	daily operation	daily operation	daily operation

Item \ R & D facility	JAERI Tokai	JAERI Oarai *
MBA code	JH-I	JH-H
Nuclear material to be safeguarded	EU, Pu, NU, DU, Th U-233	EU, Pu, NU, DU, Th
Description of the use	1. Basic research of fuel material 2. Reactor physics experiments 3. Post-irradiation examination 4. Separation of fission products from irradiated fuel 5. Basic research for dry reprocessing 6. Mechanical work for irradiation capsules 7. Mock-up tests and subcritical experiments	

* in Oarai research establishment

Table 2 Structure of JAERI's nuclear facility

Material Balance Area	Key Measurement Point
JMTR (JE-A)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss/production in fuel discharged from the core KMP 3 - Shipment and exemption of nuclear material, accidental loss KMP A - Fresh fuel storage KMP B - Reactor core KMP C - Spent fuel storage
JPDR (JE-C)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss/production in fuel discharged from the core KMP 3 - Shipment and exemption of nuclear material, accidental loss KMP A - Fresh fuel storage KMP B - Reactor core KMP C - Fuel assembly storage pool KMP D - Spent fuel storage pool
JRR-2 (JE-D)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss/production in fuel discharged from the reactor core KMP 3 - Shipment and exemption of nuclear material, accidental loss KMP A - Fresh fuel storage KMP B - Reactor KMP C - Spent fuel storage KMP D - Other locations (shipping casks used temporarily)

Table 2 (continued)

Material Balance Area	Key Measurement Point
JRR-3 (JE-E)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss/production in fuel discharged from the core KMP 3 - Shipment and exemption of nuclear material, accidental loss, category change KMP A - Fresh fuel storage room KMP B - Reactor core KMP C - Spent fuel storage KMP D - VB-1 and VB-2 (other fuel storage positions) KMP E - Dry storage facility
JRR-4 (JE-F)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss in fuel discharged from the core KMP 3 - Shipment and exemption of nuclear material, accidental loss KMP A - Fresh fuel storage KMP B - Reactor KMP C - Spent fuel storage KMP D - Other locations of nuclear material at the facility
NSRR (JE-J)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Nuclear loss and production in fuel discharged from the core KMP 3 - Shipment and exemption of nuclear material, accidental loss KMP A - Fresh fuel storage KMP B - Reactor pool KMP C - Spent fuel storage

Table 2 (continued)

Material Balance Area	Key Measurement Point
FCA (JC-B)	KMP 1 - Receipt and de-exemption of nuclear material, de-exemption, accidental gain KMP 2 - Shipment of nuclear material, exemption, accidental loss, Pu-241 decay KMP A - Fuel storage KMP B - Critical assembly room
JMTRC (JC-C)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Shipment of nuclear material, exemption, accidental loss KMP A - Fresh fuel storage KMP B - Reactor room
SHE (JC-F)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Shipment of nuclear material, exemption, accidental loss KMP A - Fuel storage KMP B - Assembly room
TCA (JC-G)	KMP 1 - Receipt and de-exemption of nuclear material, accidental gain KMP 2 - Shipment of nuclear material, exemption , accidental loss KMP A - Fuel storage room KMP B - Critical assembly hall

Table 2 (continued)

Material Balance Area	Key Measurement Point
JAERI Tokai (JH-I)	KMP 1 - Receipt of nuclear material, de-exemption, accidental gain, retransfer of nuclear material from the retained waste KMP 2 - Shipment of nuclear material, exemption, accidental loss, transfer of nuclear material to the retained waste KMP 3 - Measured discard KMP A - New Fuel Storage KMP B - No. 1 Research Laboratory No. 2 Research Laboratory No. 3 Research Laboratory No. 4 Research Laboratory Bioassay Laboratory Radiation Standards Facility KMP C - Machine Shop Van de Graaff Tandem Van de Graaff KMP D - Metallurgy Laboratory Ceramic Fuel Laboratory Non-destructive Measuring Laboratory KMP E - Linear Accelerator Co-60 Irradiation Facility Japan Research Reactor No. 1 KMP F - Reactor Physics Development Laboratory Hot Laboratory Mock-up Laboratory KMP G - Japan Research Reactor No. 2 Radioisotope Production Laboratory Japan Research Reactor No. 3 Japan Research Reactor No. 4 KMP H - No. 1 Plutonium Laboratory Reprocessing Research Laboratory KMP I - Reprocessing Examination Laboratory No. 2 Plutonium Laboratory Uranium Enrichment Laboratory Fluorine Chemistry Laboratory Decontamination Facility KMP J - Fast Critical Assembly

Table 2 (continued)

Material Balance Area	Key Measurement Point
(continued)	KMP K - Tank-type Critical Assembly Japan Power Demonstration Reactor Fusion Neutronics Source Facility KMP L - Nuclear Safety Research Reactor Reactor Fuel Examination Facility Reactor Container Model KMP M - Waste Treatment Facility KMP N - Waste Safety Testing Facility
JAERI Oarai (JH-H)	KMP 1 - Receipt of nuclear material, de-exemption, accidental gain, retransfer of nuclear material from the retained waste KMP 2 - Shipment of nuclear material, exemption, accidental loss, transfer of nuclear material to the retained waste KMP 3 - Measured discard KMP A - Japan Material Testing Reactor, including hot laboratory KMP B - Plutonium Laboratory KMP C - Radioisotope Laboratory KMP D - Health Physics Laboratory KMP E - Waste Treatment Facility

Expression for a same kind of KMP should be unified through MBAs, at the earliest opportunity.

Table 3 Receiving document sheet.

RECEIVING DOCUMENT SHEET

Date shipped		
Shipper		Signature
Name and Address		
Title of contract		
MBA code (from)	Transportation	Transporter

Date received				
Receiver (JAERI)		JOB	M B A	KMP
Division				
Signature				
Type				Facility
☐ Purchase ☐ Borrowing ☐ Being trusted	☐ Return of provided material ☐ Return of lended material ☐ Contribution	☐ Return of entrusted material ☐ Transfer between JAERI's establishments		☐ Reactor ☐ R & D ☐

1	No.of Sheet (2 – 4)	Receiving date (5 – 10)	(Correction date) (11 – 16)	17	J O B (18 – 20)	M B A (21 – 24)	KMP (25 26)	Type of IC (27 – 32)	33 34	MBA (from) (35 – 38)
A										

Shipper's data (1)	No.of Sheet (2 – 4)	No.of line (5 – 8)	Batch name (9 – 16)	No.of Item (17 – 19)	Description (20 – 23)	Origin (24 – 26)	27	Element weight (28 – 37) kg g	Fissile weight (38 – 47) kg g	Enrich. (48 – 51)	Pu prod. weight (52 – 61) kg g	62	63	64	65	RoomNo. (to) (66 – 69)
B																
B																
B																
B																
B																
B																
B																
B																
B																
B																

Note:
(1) Document No. A column 17: Classification of facility, 33-34: Transporter.
(2) Document No. B column 27: Element, 62: Isotope, 63: Measure.basis, 64: Owner, 65: Storing container
(3) This document sheet could use for receipt of nuclear materials, by 10 batches in a same contract.
(4) Data in the line of A and B are directly used for inforamtion treatment.

Table 4 Shipping document sheet.

SHIPPING DOCUMENT SHEET

Date shipped				
Shipper	JOB	MBA	KMP	Signature
Division				

Title of contract	Transportation	Transporter

Type			Facility
☐ Disrtibution of stand. material	☐ Return of keeping mat.	☐ Contribution	☐ Reactor
☐ Return of borrowed mat.	☐ Supplying	☐ Entrusting	☐ R & D
	☐ Lending	☐ Btwn. JAERI's	☐

Date received	
Receiver	Signature
Name and Address (MBA code ☐☐☐☐)	

1	No. of Sheet 2 – 4	Shipping date 5 – 10	(Correction date) 11 – 16	17	JOB 18 – 20	MBA 21 – 21	KMP 25 26	Type 27 – 30 31 32	33 34	MBA (to) 35 – 38
C										

Shipping data

1	No. of Sheet 2 – 4	No. of line 5 – 8	Batch name 9 – 16	No. of Item 17 – 19	Description 20 21 22 23	Origin 24 - 26	27	Element weight 28 – 37 (kg, g)	Fissile weight 38 – 47 (kg, g)	Enrich. 48 – 51	Pu prod. weight 52 – 61 (kg, g)	62	63	64	65	RoomNo. (from) 66 – 69
D																
D																
D																
D																
D																
D																
D																
D																
D																
D																

Note:

(1) Document No. C
column 17: Classification of facility, 33-34: Transporter.

(2) Document No. D
column 27: Element, 62: Isotope, 63: Measure. basis, 64: Owner, 65: Shipping container.

Table 5 Internal transfer document sheet.

INTERNAL TRANSFER DOCUMENT SHEET

Date shipped				
Shipper	JOB	MBA	KMP	ROOM
Division				
Signature				

Facility
☐ Reactor
☐ R & D
☐
Transport.

Type	
☐ Transfer: MBAs	☐ Change of material descrip.
☐ KMPs	☐ Change of enrichment
☐ in KMP	☐ Change of measurement basis
☐ Retained waste	☐ Change of category
☐ Measured discard	☐ Change of JOB
☐ Nuclear loss	☐ Rebatching
☐ Production	

Date received				
Receiver	JOB	MBA	KMP	ROOM
Division				
Signature				

	No. of Sheet	Transfer date	(correction date)		Shipper JOB	Shipper MBA	Shipper KMP	Shipper ROOM	Receiver JOB	Receiver MBA	Receiver KMP	Receiver ROOM	Type
1	2 – 4	5 – 10	11 – 16	17	18 – 20	21 – 24	25 26	27 – 29	30 – 32	33 – 36	37 38	39 – 41	42 – 45 46 47
E													

Transfer data

	No. of Sheet	No. of line	Batch name	No. of Item	Description	Origin		Element weight	Fissile weight	Enrich.	PuP weight				
1	2 – 4	5 – 8	9 – 16	17 – 19	20 21 22 23	24 – 26	27	28 – 35	36 – 43	44 – 47	48 – 52	53	54	55	56
F								kg g	kg g		g				
F															
F															
F															
F															
F															
F															
F															
F															
F															

Item changed											
57	58	59	60	Batch name 61 – 68	69	70	71	72	73	74	75

Note:
(1) Document No. E
column 17: Classification of facility, 42-45: Change code used in the JAERI, 46-47: Change code in Code No. 10.
(2) Document No. F
Column 20-23: Material description, 27: Element code, 53: Measurement basis, 54: Owner code, 55: Shipping container, 56: Room No. (from), 57: Room No. (to), 58: Classification of sheet, 59: Calssification of facility, 60: Element code, 69-72: Material description, 73: Isotope code, 74: Measurement basis, 75: Owner code.

Table 6 Codes used in nuclear material accountancy.

[Type of inventory change]

Keyword	Code No.10	Internal code
Receipt foreign	RF	01
Receipt domestic	RD	02
Nuclear production	NP	04
Accidental gain	GA	06
Shipment foreign	SF	21
Shipment domestic	SD	22
Transfer to retained waste	TW	24
Measured discard	LD	25
Nuclear loss	LN	26
Accidental loss	LA	27
Termination of safeguards	TU	35
Rebatching	RM, RP	33, 09
Shipper / receiver difference	DI	05
Category change	ND etc.	12
Change of origin	UD etc.	36

Table 6 (continued)

[Material description]

Physical form

Keyword	Code No. 10	Keyword	Code No. 10
Fuel element	B	Solids, other	O
Fuel component	D	Liquids	N
Powder	F	Residues/scrap	R
Powder ceramic	G	Sealed sources	Q S
Formed, green (green pellet)	H	Waste, solid	T
Ceramics	J	Waste, liquid	U
Coated particles	K	Small samples	V

Chemical form

Keyword	Code No. 10	Keyword	Code No. 10
Elemental	D	Carbide / C	Y
Fluoride	E	Nitride	Z
Hexafluoride	G	Organic	1
Nitrate	J	Other compounds	2
Ammonium diuranate	K	Al alloys	3
Dioxide	Q	Si alloys	4
Trioxide	T	Zr alloys	5
Oxide with formula M_3O_8	U	Mo and Ti alloys	6
Other oxide	V	Other alloys	7
Carbide	W	Miscellaneous	0
Oxide / C	X		

Table 6 (continued)

Containment

Keyword	Code No. 10
Uncontained (in the pond)	1
Fuel units (in shipping or storage container)	2
Flask (in shielded container)	3
In core	4
Vessel, calibrated	5
Vessel, uncalibrated	6
Tray	7
Birdcage	8

Keyword	Code No. 10
Containers: $< 0.5\ \ell$	A
$0.5 - 1\ \ell$	E
$> 1 - 5\ \ell$	G
$> 5 - 10\ \ell$	H
$> 10 - 15\ \ell$	J
$> 15 - 20\ \ell$	K
$> 20 - 50\ \ell$	L
$> 50 - 100\ \ell$	M
$> 100 - 200\ \ell$	N
$> 200 - 500\ \ell$	Q
UF_6 cylinders:	
2t, $> 500 - 1000\ \ell$	R
10, 14t, $> 1000 - 5000\ \ell$	U
Large container: $> 5000\ \ell$	V
Other containers	0

Irradiation status/quality

Keyword		Code No. 10	
		Non - Irrad.	Irrad.
Fuel	Fresh fuel	F	
	Irradiated fuel		G
Other materials	Manufactured (product)	A	H
	Pure, stable (intermediate product)	B	J
	Pure (clean scrap)	C	K
	Heterogeneous (most scrap)	D	L
	Variable composition (dirty scrap, waste)	E	M

Table 6 (continued)

[Origin of nuclear material]

Origin	Code No. 10	Internal code
America	U	10
Canada	CN	20
England	Q	30
France	F	50
Australia	AS	60
Canada - America	CNU	61
Canada - France	CNF	62
Canada - England	CNQ	63
Japan	O	96
(IAEA)	IA	40
Other	O	99

[Category]

Category	Code No. 10	Internal code*
Natural uranium	N	01
Depleted uranium	D	02
Thorium	T	03
Enriched uranium	E	04
Plutonium	P	05
Uranium - 233	A	06

* Internal codes represent the classification of categories in the batch name, e.g. 6<u>04</u>-0001 means enriched uranium.

Table 6 (continued)

[Isotope]

Isotope	Code No. 10
for fissile isotope content of ^{235}U only	G
for fissile isotope content of ^{235}U and ^{233}U	J
for fissile isotope content of ^{233}U only	K

[Measurement basis]

Measurement basis*	Code No. 10
Measured at the MBA	M
Measured elsewhere	N
Tagged (data are based on the measurement at the MBA, and have been reported in an ICR or a PIL)	T
Labeled (data are based on the measurement at another MBA, and have been reported in an ICR or a PIL)	L

* measurement basis to the weight of nuclear material appeared in the report

Table 7 Inventory Change Report.

INVENTORY CHANGE REPORT

R. 01. 1/1

ORGANIZATION: JAPAN ATOMIC ENERGY RESEARCH INSTITUTE TOKAI RESEARCH ESTABLISHMENT FACILITY: JAERI TOKAI MBA: JAERI TOKAI	PERIOD COVERED BY REPORT FROM 1982.11.01 TO 1982.11.30 REPORT NO. 510 SIGNATURE

ORGANIZATION (1–4)	FACILITY (5–8)	MBA (9–12)	PERIOD COVERED BY REPORT FROM (13–18)	PERIOD COVERED BY REPORT TO (19–24)	REPORT No. (25–28)	NO. OF LINE ENTRIES: ACCOUNTANCY DATA (29–30)	NO. OF LINE ENTRIES: ISOTOPE DATA (31–32)	NO. OF LINE ENTRIES: CONCISE NOTE DATA (33–34)		SIGNATURE (83)	(77–80)
JAERI	JHI-	JH-I	821101	821130	510	10		2			1

MBA (1–4)	REPORT No. (5–8)	ENTRY No. (9–10)	CONTINUATION (11)	DATE OF INVENTORY CHANGE (12–17)	MBA/COUNTRY FROM (18–21)	MBA/COUNTRY TO (22–25)	TYPE OF INVENTORY CHANGE (26–29)	KMP (30)	NAME OR NUMBER OF BATCH (31–38)	NUMBER OF ITEMS IN BATCH (39–42)	MATERIAL DESCRIPTION (43–46)	ACCOUNTANCY DATA: ORIGIN OF MATERIAL (47–50)	ELEMENT (51)	WEIGHT OF ELEMENT (53–60)	UNIT (61)	WEIGHT OF FISSILE ISOTOPES (63–70)	ISOTOPE CODE (71)	MEASURE BASIS (72)	CONCISE NOTE (73)	CORRECTION TO: REPORT NO. (74–77)	CORRECTION TO: ENTRY NO. (78–79)	(80)
JH-I	510	1		821104	JH-I	JH-H	SD	2	JAERI-01	10	JQAB	U	E	2482.81	G	154.14	G	L				2
JH-I	510	2		821105	JH-H	JH-I	RD	1	JAERI-02	2	FQAB	U	E	182.73	G	24.13	G	N				2
JH-I	510	3		821110	JH-H	JH-I	RD	1	JAERI-03	1	JQAB	U	N	25.000	K			N				2
JH-I	510	4		821125	Q	JH-I	RF	1	JAERI-04	1	JQAB	Q	N	0.534	K			N				2
JH-I	510	5		821125	JH-I	JH-H	SD	2	JAERI-05	1	FQAB	U	E	71.27	G	7.13	G	L				2
JH-I	510	6		821125	JH-I	JH-I	RM	*	JAERI-06	1	JQAB	U	D	0.352	K			L				2
JH-I	510	7		821125	JH-I	JH-I	RP	*	JAERI999	2	JQOJ	U	D	0.352	K			L				2
JH-I	510	8		821130	JH-I		LD	3	LD821130	2	OOOM	U	N	0.005	K			M				2
JH-I	510	9		821130	JH-I	O	SF	2	JAERI888	1	JQOA	O	N	1.200	K			L				2
JH-I	510	10		821022	JH-H	JH-I	RD	2	JAERI-07	1	JQAB	U	E	0.51	G	0.05	G	N	X	508	15	2
																						2
																						2
																						2
																						2
																						2
																						2
																						2
																						2
																						2
																						2

Table 7 (continued)

☒ ICR
☐ PIL
☐ MBR

CONCISE NOTE

ORGANIZATION	JAPAN ATOMIC ENERGY RESEARCH INSTITUTE TOKAI RESEARCH ESTABLISHMENT
FACILITY	JAERI TOKAI
MBA	JAERI TOKAI
PERIOD COVERED BY REPORT	FROM 1982.11.01 TO 1982.11.30
REPORT No.	510
SIGNATURE	

	MBA	REPORT No.	ENTRY No.	CONCISE NOTE	
1	2 3 4 5	6 7 8 9	10 11	12 … 79	80
C	JH-I	510	10	CORRECTION OF MATERIAL DESCRIPTION DUE TO MISTRANSCRIPTION FROM	2
C	JH-I	510	10	SOURCE DATA.	2
C					
C					
C					
C					
C					
C					
C					
C					

Table 8 Material Balance Report.

MATERIAL BALANCE REPORT

R. 03/J

ORGANIZATION JAPAN ATOMIC ENERGY RESEARCH INSTITUTE
OARAI RESEARCH ESTABLISHMENT
FACILITY JAERI OARAI
MBA JAERI OARAI

PERIOD COVERED BY : FROM 1981.11.29
TO 1982.11.30
REPORT No. 251
SIGNATURE

ORGANIZATION (1–4)	FACILITY (5–8)	MBA (9–12)	PERIOD COVERED BY REPORT FROM (13–18)	PERIOD COVERED BY REPORT TO (19–24)	REPORT No. (25–28)	NO. OF LINE ENTRIES: ACCOUNTANCY DATA (29–30)	NO. OF LINE ENTRIES: CONCISE NOTE DATA (33–34)	SIGNATURE (63–77)	80
JAER	JHH-	JH-H	811129	821130	251	8	0		6

MBA (1–4)	REPORT No. (5–8)	ENTRY No. (9–10)	CONTINUATION (11)	ENTRY NAME (26–29)	ACCOUNTANCY DATA: ORIGIN OF MATERIAL (47–50)	ELEMENT (51)	WEIGHT OF ELEMENT (53–60)	UNIT (61)	WEIGHT OF FISSILE ISOTOPES (63–70)	ISOTOPE CODE (71)	CONCISE NOTE (73)	CORRECTION TO: REPORT NO. (74–77)	CORRECTION TO: ENTRY NO. (78–79)	80
JH-H	251	1		PB		N	758.201	K						7
JH-H	251	2		RD		N	1.503	K						7
JH-H	251	3		BA		N	759.704	K						7
JH-H	251	4		PB		N	759.704	K						7
JH-H	251	5		PB		E	8579.87	G	840.83	G				7
JH-H	251	6		SD		E	250.01	G	22.01	G				7
JH-H	251	7		BA		E	8329.86	G	818.82	G				7
JH-H	251	8		PE		E	8329.86	G	818.82	G				7
														7
														7
														7
														7
														7
														7
														7
														7
														7
														7
														7
														7

Table 9 Physical Inventory Listing.

PHYSICAL INVENTORY LISTING

R 02/J

ORGANIZATION	JAPAN ATOMIC ENERGY RESEARCH INSTITUTE	DATE OF PIT	1982.11.30
	OARAI RESEARCH ESTABLISHMENT	REPORT No.	252
FACILITY	JAERI OARAI	SIGNATURE	
MBA	JAERI OARAI		

ORGANIZATION 1-4	FACILITY 5-8	MBA 9-12		DATE OF PIT 19-24	REPORT NO. 25-28	NO. OF LINE ENTRIES: ACCOUNTANCY DATA 29-30	NO. OF LINE ENTRIES: CONCISE NOTE DATA 33-34	SIGNATURE 63-77	80
JAER	JHH-	JH-H		821130	252	6	0		4

MBA 1-4	REPORT No. 5-8	ENTRY No. 9-10	CONTI-NUATION 11	KMP 30	NAME OR NUMBER OF BATCH 31-38	NUMBER OF ITEMS IN BATCH 39-42	MATERIAL DE-SCRIPTION 43-46	ACCOUNTANCY DATA: ORIGIN OF MATERIAL 47-50	ELE-MENT 51	WEIGHT OF ELEMENT 53-60	UNIT 61	WEIGHT OF FISSILE ISOTOPES 63-70	ISOTOPE CODE 71	MEASURE BASIS 72	CONCISE NOTE 73	CORRECTION TO: REPORT NO. 74-77	CORRECTION TO: ENTRY NO. 78-79	80
JH-H	252	1		A	JAERI-10	1	JQAB	U	N	7.135	K			L				5
JH-H	252	2		A	JAERI-11	10	DQAB	U	N	587.622	K			L				5
JH-H	252	3		B	JAERI-12	2	JQAB	U	N	164.947	K			L				5
JH-H	252	4		C	JAERI-13	5	FQAB	U	E	1538.25	G	169.21	G	L				5
JH-H	252	5		D	JAERI-14	10	JQAB	U	E	6428.86	G	617.17	G	L				5
JH-H	252	6	C			0		Q	E	362.75	G	32.44	G	L				5
																		5
																		5
																		5
																		5
																		5
																		5
																		F
																		5
																		5
																		5
																		5
																		5
																		5
																		5

Table 10 Sample output of master and error/proof lists.

ORIGIN MASTER LIST

L01

MASTERNO	CODENO		CODE 10
07	10	USA	U
07	20	CAN	CN
07	30	UK	Q
07	40	IAEA	IA
07	50	FR	F
07	60	AUS	AU
07	70	WG	0
07	91	BEL	0
07	93	NOR	0
07	94	SAF	0
07	95	IND	0
07	96	JPN	0
07	99	OTH	0

INPUT DATA PROOF AND ERROR LIST

(/ ESTABLISHMENT=2 / PROCESS=82.11-0) (82.11.16) L02

RECEIPT (A)

NO.OF SHEET	RECEIVING DATE	CORR. DATE	FACILITY	TO JOB	TO MBA	TO KMP	CHANGE FOR	TRANSPORTER		FROM MBA
001	821101		6	455	JH-I	D1	0203	RD	00	JH2N
002	821101		6	455	JH-I	D1	0203	RD	00	JH2N
003	821101		6	455	JH-I	D1	0203	RD	00	JH2N
004	821104		6	482	JH-I	B1	0201	RD	13	JM2C
005	821105		6	482	JH-I	H2	0206	RD	00	JT-S

RECEIPT (B)

NO.OF LINE	BATCH NAME	NO. OF ITEM	DE-SCRIP-TION	ORIGIN	ELEMENT CODE	WEIGHT OF ELEMENT	WEIGHT OF FISSILE	EN-RICH-MENT	PLUTONIUM PRODUCED	ISOTOPE CODE	MEASUREMENT BASIS	OWNER	STORING CONTAINER	TO ROOM
0001	BATCH001		KQAB	U	E	5.60	1.10	19.71	0.00	G	N	4	A	016
0002	BATCH002		JQAB	U	E	1.76	0.35	19.71	0.00	G	N	4	A	016
0003	BATCH003		KQAB	U	E	11.20	0.45	3.99	0.00	G	N	4	A	016
0004	BATCH004		JQAB	U	E	1.76	0.07	3.99	0.00	G	N	4	A	016
0005	BATCH005		KQAB	U	E	72.00	14.19	19.71	0.00	G	N	4	A	016
0006	BATCH006		KQAB	U	E	0.04	0.00	3.99	0.00	G	N	4	A	016
0007	BATCH007	1	VOAB	U	E	0.00	0.00	93.15	0.00	G	N	2	A	048
0008	BATCH008	1	VOAB	U	P	0.00	0.00	3.52			N	2	A	108
0009	BATCH009		VOAB	U	A	0.01	0.01	99.54		K	N	2	A	108

Document No. A and B are identified as No.2 in the following list (similarly, No.C and D are as No. 5, No.E and F are as No.3 and 4). Establishment=2 means Tokai establishment (4 is Oarai establishment). Facility=6 means R&D and 3 is reactor.

Table 10 (continued)

INPUT DATA PROOF AND ERROR LIST

(/ ESTABLISHMENT=2 / PROCESS=82.11-0) (82.11.16) L02

SHIPMENT (C)

NO. OF SHEET	SHIPPING DATE	CORR. DATE		FROM JOB	FROM MBA	FROM KMP	CHANGE FOR			TO MBA
001	821101		6	455	JH-I	D1	2223	SD	00	JH1N
002	821108		6	218	JH-I	A	2231	SD	00	JH-H
003	821121		6	218	JH-I	A	2231	SD	00	JH-H

FACILITY TRANSPORTER

SHIPMENT (D)

NO. OF LINE	BATCH NAME	NO. OF ITEM		WEIGHT OF ELEMENT	WEIGHT OF FISSILE	EN-RICH-MENT	PLUTONIUM PRODUCED		FROM ROOM
0001	BATCH001		E	0.04	0.00	3.99	0.00	A	016
0002	BATCH002	1	E	10.00	1.00	10.00	0.00	A	100
0003	BATCH003	1	E	20.00	2.00	10.00	0.00	A	100
0004	BATCH004	1	E	10.00	1.00	10.00	0.00	A	100
0005	BATCH005	2	N	1000.00			0.00	A	100
0006	BATCH006	1	N	50.00			0.00	A	101
0007	BATCH007	1	D	100.00			0.00	A	101

ELEMENT CODE SHIPPING CONTAINER

INPUT DATA PROOF AND ERROR LIST

(/ EATABLISHMENT=2 / PROCESS=82.11-0) (82.11.16) L02

INTERNAL TRANSFER (E)

NO. OF SHEET	TRANSFER DATE	CORR. DATE	FA-CILITY	FROM JOB	FROM MBA	FROM KMP	FROM ROOM	TO JOB	TO MBA	TO KMP	TO ROOM	CHANGE FOR	
001	821105		6	487	JH-I	H2	109	487	JH-I	H2	101		
002	821108		6	941	JH-I	L1	F13	941	JH-I	L1	R21		
003	821109		6	941	JH-I	L1	F13	941	JH-I	L1	R21		
004	821110		6	313	JH-I	C1	001					3331	RM
005	821110		6	313	JH-I	C1	001					3331	RM

INTERNAL TRANSFER (F)

NO. OF LINE	BATCH NAME	NO. OF ITEM		WEIGHT OF ELEMENT	WEIGHT OF FISSILE	EN-RICH-MENT	PLUTONIUM PRODUCED		ITEM CHANGED	REBATCH	DE-SCRIP-TION
0001	BATCH001		P	7.43	6.83			A	W		GQ
0002	BATCH002	1	E	83.17	8.32	10.00	0.00				J 7J
0003	BATCH003		N	12.00			0.00				7J
0004	BATCH004	1	E	71.18	7.12	10.00	0.00				7J
0005	BATCH005		N	0.00			0.000	0		U424	O
0006	BATCH006	1	T	1.00			0.000	0		U424	O
0007	BATCH007		N	1.00			0.000	0		U425	O
0008	BATCH008	1	T	2.00			0.000	0		U425	O
0009	BATCH009		N	0.00			0.000	0		U426	O
0010	BATCH010	1	T	1.00			0.000	0		U426	O
0011	BATCH011		N	1.00			0.000	0		U427	O
0012	BATCH012	1	T	1.00			0.000	0		U427	O
0013	BATCH013		N	1.00			0.000	0		U428	O
0014	BATCH014	1	T	1.00			0.000	0		U428	O
0015	BATCH015	1	N	0.00			0.000	0		U429	O

ELEMENT CODE

CONTAINER
FROM ROOM
TO ROOM
CLASSIFICATION OF SHEET
FACILITY
ELEMENT CODE

ISOTOPE
MEASUREMENT
OWNER

Table 10 (continued)

ALLDATA
82.10.01-82.10.31

MAINTENANCE ERROR LIST

(82.11. 2) L03

ESTABLISHMENT	2	2	2	2	2	2	2	2	2	2	ESTABLISHMENT
BATCH-NAME	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	SHR00001	BATCH-NAME
FACILITY	3	3	3	3	3	3	3	3	3	3	FACILITY
MATERIAL	04	04	04	04	04	04	04	04	04	04	MATERIAL
	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	
CODE10	E	E	E	E	E	E	E	E	E	E	CODE10
MBA	JC-F	JC-F	JC-F	JC-F	JC-F	JC-F	JC-F	JC-F	JC-F	JC-F	MBA
KMP	A	A	A	A	A	A	A	A	A	A	KMP
JOB	434	434	434	434	434	434	434	434	434	434	JOB
ROOM	025	025	025	025	025	025	025	025	025	025	ROOM
DATE	72.12.31	79.04.09	79.04.11	79.04.17	79.04.17	79.07.26	80.03.21	80.04.28	80.04.28	80.08.26	DATE
DATE-BRANCH											DATE-BRANCH
DOCUMENT-NO	1*	4	3	2	2	2	4	3	3	3	DOCUMENT-NO
CORR-DATE											CORR-DATE
CHANGE-FOR	0202			0911	0911	0911		3331	3331		CHANGE-FOR
CODE10				RP	RP	RP		RM	RM		CODE10
OWNER	2	2	2	2	2	2	2	2	2	2	OWNER
ORIGIN	10	10	10	10	10	10	10	10	10	10	ORIGIN
	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	
DESCRIPTION	B	B	B	B	B	B	B	B	B	B	DESCRIPTION
CHEMICAL	X	X	X	X	X	X	X	X	X	X	CHEMICAL
CONTAINER	2	2	2	2	2	2	2	2	2	2	CONTAINER
IRRADIATION	F	F	F	F	F	F	F	F	F	F	IRRADIATION
MEASUREMENT	L	L	L	L	L	L	L	L	L	L	MEASUREMENT
ISOTOPE	G	G	G	G	G	G	G	G	G	G	ISOTOPE
CONTAINER2		0	0	2	2	2	0	2	2	0	CONTAINER2
ITEM	0004	0018	0016		0007	0002	0002	0001		0003	ITEM
WEIGHT-1	0000119180	0000536310	0000476720	0000001296	0000207269	0000059589	0000059590	0000006736	0000023059	0000089385	WEIGHT-1
WEIGHT-2	0000023657	0000106452	0000094624	0000000255	0000041143	0000011828	0000011829	0000001337	0000004577	0000017743	WEIGHT-2
RATIO	19.85	19.85	19.85	19.68	19.85	19.85	19.85	19.85	19.85	19.85	RATIO
WEIGHT-3	0000000000	0000000000	0000000000	0000000000	0000000000	0000000000	0000000000	0000000000	0000000000	0000000000	WEIGHT-3
WEIGHT-4											WEIGHT-4
CHG-MBA		JC-F	JC-F	JC-F	JC-F	JC-F	JC-F			JC-F	CHG-MBA
CHG-KMP		B	B				B			B	CHG-KMP
CHG-JOB		434	434				434			434	CHG-JOB
CHG-ROOM		000	000				000			000	CHG-ROOM
CHG-BATCH								SHR00002	SHB00002		CHG-BATCH
CHG-FACILITY											CHG-FACILITY
CHG-MATERIAL											CHG-MATERIAL
CHG-CODE10											CHG-CODE10
SHEET-NO		0012	0044	0023	0022	0277	0038	0039	0038	0055	SHEET-NO
PROCESS-DATE	79.03-0	79.04-0	79.04-0	79.04-0	79.04-0	79.07-0	80.03-0	80.04-0	80.04-0	80.08-0	PROCESS-DATE
ERROR MESSAGE	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	DATA-KEY WEIGHT ITEM	ERROR MESSAGE

* In document No.1, the beginning inventory of the batch is included.

Table 11 Sample output of inventory lists for MBA, KMP and JOB No.

6 RESEARCH
JH-I JAERI TOKAI

MONTHLY MATERIAL BALANCE RECORD FOR MBA

(82. 9. 1-82. 9.30) L06

MATE-RIAL	BATCH NAME	MBA	KMP	JOB	ROOM		ORIGIN	FROM/TO MBA	FROM/TO KMP	DATE OF INVENTORY CHANGE	CHANGE FOR	BEGINNING INVENTORY ITEM	BEGINNING INVENTORY WEIGHT	INVENTORY CHANGE ITEM	INVENTORY CHANGE WEIGHT	ENDING INVENTORY ITEM	ENDING INVENTORY WEIGHT	EN-RICH-MENT	REMARKS
604EU	BATCH001	JH-I	D1	455	016	KQOBLGA2	10USA	JH-I	L1	81. 1.23			20.01 0.80				20.01 0.80	4.01	
			D1	455	012	KQAJLGO2	10USA	JH-I	G1	81. 3. 5			5.88 0.24				5.88 0.24	4.01	
604EU	BATCH002	JH-I	D1	455	000	DQ7JLG72	10USA	JH1I	D	79. 2. 1	0211RD		51.64 6.20				51.64 6.20	12.00	
			D1	455	015	KQOBLGO2	10USA	JH1I	D	79. 2. 1	0211RD		38.26 4.59				38.26 4.59	12.00	
			D1	455	000B	KQAJLGE2	10USA	JH-I	L1	79. 6. 1			37.96 4.56				37.96 4.56	12.00	
604EU	BATCH003	JH-I	D1	455	000W	DXAALGA2	10USA	JH1I	D	79. 2. 1	0211RD	10	122.01 4.88			10	122.01 4.88	4.00	
604EU	BATCH004	JH-I	D1	455	000X	KQAALGA2	10USA	JH1I	D	79. 2. 1	0211RD	1	15.26 0.61			1	15.26 0.61	4.00	
604EU	BATCH005	JH-I	D1	455	014	KQAALGA2	10USA	JH1I	D	79. 2. 1	0211RD	1	19.98 2.39			1	19.98 2.39	11.99	

— transporter
— owner
— container used in the transfer
— isotope code
— measurment basis
— material description

6 RESEARCH
JH-I JAERI TOKAI
B6 No. 4 RESEARCH LAB.

MONTHLY MATERIAL BALANCE RECORD FOR KMP

(82. 9. 1-82. 9.30) L07

MATE-RIAL	BATCH NAME	MBA	KMP	JOB	ROOM		ORIGIN	FROM/TO MBA	FROM/TO KMP	DATE OF INVENTORY CHANGE	CHANGE FOR	BEGINNING INVENTORY ITEM	BEGINNING INVENTORY WEIGHT	INVENTORY CHANGE ITEM	INVENTORY CHANGE WEIGHT	ENDING INVENTORY ITEM	ENDING INVENTORY WEIGHT	EN-RICH-MENT	REMARKS
601NU	BATCH001	JH-I	B6	482	420	FUABL 02	10USA	JH-I	B1	82. 7.22			20.00				20.00		
601NU	BATCH002	JH-I	B6	482	420	FUABL 02	10USA	JH-I	B1	82. 7.22			86.00				86.00		
601NU	BATCH003	JH-I	B6	482	420	FUABL 02	96JPN	JH-I	B1	82. 7.22			152.00				152.00		
601NU	BATCH004	JH-I	B6	482	420	FUOBL 02	10USA	JH-I	B1	82. 7.22			172.00				172.00		
601NU	BATCH005	JH-I	B6	482	000	OUABL 02	96JPN	JH-I	B1	82. 9.29			0.00		205.00		205.00		
601NU	BATCH006	JH-I	B6	482	000	OUOBL 02	96JPN	JH-I	B1	82. 9.29			0.00		51.00		51.00		
601NU	BATCH007	JH-I	B6	482	000	OUOBL 02	96JPN	JH-I	B1	82. 9.29			0.00		197.00		197.00		
601NU	BATCH008	JH-I	B6	482	420	OUABL 02	96JPN	JH-I	B1	82. 7.22			15.00				15.00		
601NU	BATCH009	JH-I	B6	482	420	FUABL 02	96JPN	JH-I	B1	82. 7.22			17.00				17.00		
604EU	BATCH010	JH-I	B6	482	420	OJEBL 02	10USA	JH-I	B1	82. 7.22			15.88 1.59				15.88 1.59	10.00	

Table 11 (continued)

6 RESEARCH
JH-I JAERI TOKAI
B1 No. 1 RESEARCH LAB.
482 ANALYTICAL CHEMISTRY LAB.

MONTHLY MATERIAL BALANCE RECORD FOR JOB

(82. 9. 1-82. 9.30) L08

MATE-RIAL	BATCH NAME	MBA	KMP	JOB	ROOM		ORIGIN	FROM/TO MBA	FROM/TO KMP	DATE OF INVENTORY CHANGE	CHANGE FOR	BEGINNING INVENTORY ITEM	BEGINNING INVENTORY WEIGHT	INVENTORY CHANGE ITEM	INVENTORY CHANGE WEIGHT	ENDING INVENTORY ITEM	ENDING INVENTORY WEIGHT	EN-RICH-MENT	REMARKS
603TH	BATCH001	JH-I	B1	482	001A	FQABL 02	10USA	JH2N		82. 9.29	0201RD		0.00		85.00				
			B1	482	001A	FQABL 02	1 0USA	JH-I	B6	82. 9. 30					85.00 -		0.00		
604EU	BATCH002	JH-I	B1	482	048	NJABLGA2	10USA	JH-I	B1	79. 3.29			283.00 2.26					0.80	
			B1	482	001A	FUABLGO2	10USA	JH-I	B6	82. 9.29					283.00- 2.26-		0.00 0.00	0.80	
604EU	BATCH003	JH-I	B1	482	048	NJABLGA2	10USA	JH-I	B1	79. 3.29			51.64 0.77					1.50	
			B1	482	001A	FUABLGO2	10USA	JH-I	B6	82. 9.29					28.35- 0.43-		23.29 0.34	1.50	
604EU	BATCH004	JH-I	B1	482	048	NJABLGA2	10USA	JH-I	B1	79. 3.29			20.63 0.53					2.56	
			B1	482	001A	FUABLGO2	10USA	JH-I	B6	82. 9.29					20.63- 0.53-		0.00 0.00	2.56	
604EU	BATCH005	JH-I	B1	482	048	NJABLGA2	10USA	JH-I	B1	79. 3.29			0.83 0.03					3.60	
			B1	482	001A	FUABLGO2	10USA	JH-I	B6	82. 9.29					0.83- 0.03-		0.00 0.00	3.60	
604EU	BATCH006	JH-I	B1	482	048	NJABLGA2	10USA	JH-I	B1	79. 3.29			0.86 0.04					4.50	
			B1	482	001A	FUABLGO2	10USA	JH-I	B6	82. 9.29					0.86- 0.04-		0.00 0.00	4.50	

Decrease is identified by the minus sign (e.g. 999.00-).

Table 11 (continued)

Monthly Material Balance Record for MBA

6 RESEARCH
JH-I JAERI TOKAI

(SUMMARY FOR EACH MATERIAL AND ITS ORIGIN)

(82. 9. 1-82. 9.30) L09

Material Origin	Beginning Inventory	Import	Domestic Receipt	Nuclear Production	Other Increase	Export	Domestic Shipment	Disposal & Consumption	Nuclear Loss	Accident. Loss	Other Decrease	Ending Inventory
NU												
CAN	17883.00				1598.00		792.00				1598.00	17091.00
UK	186.00											186.00
IAEA	4547.00											4547.00
FR	10.00											10.00
CAUS	2.00											2.00
WG	27.00											27.00
BEL	343505.00						339987.00					3518.00
SAF	43.00											43.00
JPN	500689.00		7.00		1457.00						1457.00	500696.00
OTH	558.00											558.00
DU												
CAN	2577.00											2577.00
UK	44274.00											44274.00
FR	8286.00		7.00									8293.00
WG	28.00											28.00
JPN	9637.00		1000.00									10637.00

Table 11 (continued)

6 RESEARCH
JH-I JAERI TOKAI
E1 LINEAR ACCELERATOR

Monthly Material Balance Record for KMP
(SUMMARY FOR EACH MATERIAL AND ITS ORIGIN)

(82. 9. 1-82. 9.30) L10

Material	Origin	Beginning Inventory	Import	Domestic Receipt	Nuclear Production	Other Increase	Export	Domestic Shipment	Disposal & Consumption	Nuclear Loss	Accident. Loss	Other Decrease	Ending Inventory
NU	USA	158.00		51.00									209.00
	CAN	521.00						31.00					490.00
	JPN	85.00											85.00
***		764.00		51.00				31.00					784.00
DU	USA	1038.00	1.00			80.00		180.00					939.00
	JPN	98.00				28.00							126.00
***		1136.00	1.00			108.00		180.00					1065.00
TH	JPN	0.00		78.00									78.00
***		0.00		78.00									78.00
EU	USA	87.20 17.50											87.20 17.50
	UK	5.88 0.65		0.86 0.17									6.74 0.82
***		93.08 18.15		0.86 0.17									93.94 18.32

Table 11 (continued)

6 RESEARCH
JH-I JAERI TOKAI
A NUCLEAR FUEL STORAGE
218 NUCLEAR FUEL DIVISION

Monthly Material Balance Record for JOB
(SUMMARY FOR EACH MATERIAL AND ITS ORIGIN)

(82. 9. 1-82. 9.30) L11

Material	Origin	Beginning Inventory	Import	Domestic Receipt	Nuclear Production	Other Increase	Export	Domestic Shipment	Disposal & Consumption	Nuclear Loss	Accident. Loss	Other Decrease	Ending Inventory
NU	USA	20.00		158.00									178.00
	CAN	1582.00						192.00					1390.00
	JPN	998.00		251.00									1249.00
***		2600.00		409.00				192.00					2817.00
DU	USA	15800.00							250.00				15550.00
	JPN	0.00		81.00									81.00
***		15800.00		81.00					250.00				15631.00
TH	JPN	4826.00				85.00						56.00	4855.00
***		4826.00				85.00						56.00	4855.00
EU	USA	380.54 40.05											380.54 40.05
	UK	0.00 0.00	2.51 2.30										2.51 2.30
***		380.54 40.05	2.51 2.30										383.05 42.35

Table 12 Sample output of inventory lists for each type of contract, material description, owner, origin and enrichment.

RECEIPT RECORD

RESEARCH
JH-I (JAERI TOKAI) (82. 9. 1-82. 9.30) L13

CHANGE FOR		MATERIAL	ORIGIN	DATE		BATCH NAME	ELEMENT WEIGHT	F.ISOTOPE WEIGHT	PRODUCTION WEIGHT	FISS RATIO	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE. CONTAINER OWNER	FROM MBA	KMP	TRANS.	ITEM
0201	RD	DU	JPN	82. 9.28	602	BATCH001	62.00				JH-I	D1	455	016	JQAB	N A 2	JH2N			
		DU	JPN	82. 9.28	602	BATCH002	85.00				JH-I	D1	455	016	KQAB	N A 2	JH2N			
		DU	JPN				147.00			*										
		DU					147.00			**										
		EU	USA	82. 9.14	604	BATCH003	102.10	95.10		93.14	JH-I	B1	482	048	VOAB	N G A 2	JM2C		13	1
		EU	USA	82. 9.30	604	BATCH004	15.62	0.44		2.80	JH-I	C1	313	001	DQ2B	N G 2 2	JH2N		01	
		EU	USA				117.72	95.54		*										1
		EU					117.72	95.54		**										1
0203	RD	NU	JPN	82. 9.21	601	BATCH005	86.00				JH-I	C1	313	001	JQAB	N A 4	JZ-T			
		NU	JPN	82. 9.21	601	BATCH006	88.00				JH-I	C1	313	001	JQAB	N A 4	JZ-T			

SHIPMENT RECORD

RESEARCH
JH-I (JAERI TOKAI) (82. 9. 1-82. 9.30) L14

CHANGE FOR		MATERIAL	ORIGIN	DATE		BATCH NAME	ELEMENT WEIGHT	F.ISOTOPE WEIGHT	PRODUCTION WEIGHT	FISS RATIO	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE. CONTAINER OWNER	TO MBA	KMP	TRANS.	ITEM
2221	SD	NU	CAN	82. 9.17	601	BATCH001	5.00				JH-I	B6	482	000	DDUB	L 0 2	JZ-A		13	
		NU	CAN				5.00			*										
		NU					5.00			**										
2223	SD	EU	USA	82. 9. 6	604	BATCH002	2.86	0.56		19.71	JH-I	D1	455	016	JQAB	L G A 4	JH1N			
		EU	USA	82. 9. 6	604	BATCH003	3.74	0.74		19.71	JH-I	D1	455	016	KQAE	L G A 4	JH1N			
		EU	USA	82. 9.20	604	BATCH004	3.81	0.75		19.71	JH-I	D1	455	015	KQAB	L G A 4	JH1N			
		EU	USA	82. 9.27	604	BATCH005	6.54	1.29		19.71	JH-I	D1	455	016	KQAB	L G A 4	JH1N			
		EU	USA	82. 9.28	604	BATCH006	8.02	1.58		19.71	JH-I	D1	455	016	KQAB	L G A 4	JH1N			
		EU	USA				24.97	4.92		*										
		EU					24.97	4.92		**										

****Fissile ratio in the list means enrichment of uranium and fissile ratio of plutonium.

Table 12 (continued)

LENDING RECORD RESEARCH JH-I (JAERI TOKAI) (82. 1. 1-82. 9.30) L20

TO MBA	DATE	MATERIAL ORIGIN			BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION		RECEIPT ELEMENT	RECEIPT F.ISOTOPE		SHIPMENT ELEMENT	SHIPMENT F.ISOTOPE		FISS RATIO	ITEM
JZ-C	82. 9.26	EU	USA	604	BATCH001	JH-I	B2	437	120	JUO3	L G O 2				0.15	0.14		93.16	

L G O 2:
- 2 – OWNER
- O – SHIPPING CONTAINER
- G – ISOTOPE CODE
- L – MEASUREMENT BASIS

SUPPLYING RECORD RESEARCH JH-I (JAERI TOKAI) (82. 1. 1-82. 9.30) L21

TO MBA	DATE	MATERIAL ORIGIN			BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION		RECEIPT ELEMENT	RECEIPT F.ISOTOPE		SHIPMENT ELEMENT	SHIPMENT F.ISOTOPE		FISS RATIO	ITEM
JH1N	82. 6.23	EU	USA	604	BATCH001	JH-I	A	218	042	JQA3	L G A 2				0.09	0.00		2.80	
	82. 6.23	EU	USA	604	BATCH002	JH-I	A	213	041	GQA3	L G A 2				0.11	0.00		2.80	

BORROWING RECORD RESEARCH JH-I (JAERI TOKAI) (82. 1. 1-82. 9.30) L22

FROM MBA	DATE	MATERIAL ORIGIN			BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION		RECEIPT ELEMENT	RECEIPT F.ISOTOPE		SHIPMENT ELEMENT	SHIPMENT F.ISOTOPE		FISS RATIO	ITEM
JM5D	82. 2.26	NU	CAN	601	BATCH001	JH-I	G4	516	005	JQOA	L O 3	25.00							1
	82. 2.26	NU	CAN	601	BATCH002	JH-I	G4	516	005	JQOA	L O 3	25.00							1
	82. 2.26	EU	USA	604	BATCH003	JH-I	G4	516	005	JQOA	L G O 3	0.92	0.05					5.48	1
	82. 2.26	EU	USA	604	BATCH004	JH-I	G4	516	005	JQOA	L G O 3	0.97	0.05					5.48	1

Table 12. (continued)

INVENTORY RECORD FOR PHYSICAL FORM RESEARCH
JH-I (JAERI TOKAI)(A) (82. 9.30) L60

PHYSICAL FORM		MATERIAL ORIGIN	FACILITY	BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE.	CONTAINER OWNER	FROM (TU)			ELEMENT WEIGHT	FISSILE WEIGHT	PuP WEIGHT	ENRICHMENT	ITEM
(B)FUEL ELEMENTS	NU	CAN	601	BATCH001	JH-I	A	218	001	BQOB	L	U 3				1.00				
		CAN	601	BATCH002	JH-I	A	218	001	BQOB	L	U 3				84.00				
		CAN	601	BATCH003	JH-I	A	218	181	BQO3	L	U 2				1.00				
		IAEA	601	BATCH004	JH-I	A	218	172	B3KB	L	K 2				2.00				
				4											88.00			*	
(D)FUEL COMPONENTS		USA	601	BATCH005	JH-I	A	218	183	DQ1A	L	U 2				2.00				
		USA	601	BATCH006	JH-I	A	218	173	DOOB	L	U 2				53.00				
		USA	601	BATCH007	JH-I	A	218	151	DOOB	L	U 2				3.00				
		USA	601	BATCH008	JH-I	A	218	141	DOOB	L	U 2				1.00				
		USA	601	BATCH009	JH-I	A	218	141	DCOB	L	U 2				9.00				
		USA	601	BATCH010	JH-I	A	218	141	DOOB	L	U 2				59.00				
		USA	601	BATCH011	JH-I	A	218	141	DOOB	L	U 2				8.00				
		USA	601	BATCH012	JH-I	A	218	172	DOKB	L	K 2				80.00				
		CAN	601	BATCH013	JH-I	A	218	142	DOOB	L	U 2				132.00				
		CAN	601	BATCH014	JH-I	A	218	142	DOOB	L	U 2				880.00				
		CAN	601	BATCH015	JH-I	A	218	172	DOKB	L	K 2				1.00				
				11											1228.00			*	
(F)POWDERS		USA	601	BATCH016	JH-I	A	218	001	FQOB	L	U 2				132.00				
		USA	601	BATCH017	JH-I	A	218	001	FQOB	L	U 2				87.00				

Table 12 (continued)

INVENTORY RECORD FOR CHEMICAL FORM — RESEARCH JH-I (JAERI TOKAI)(83) (82. 9.30) L61

CHEMICAL FORM	MATERIAL	ORIGIN	FACILITY	BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE.	CONTAINER OWNER	FROM (TO)	ELEMENT WEIGHT	FISSILE WEIGHT	PuP WEIGHT	ENRICHMENT	ITEM
(D)ELEMENTAL	NU	USA	601	BATCH001	JH-I	B3	938	315	VDAB	L	A 2		4 .00				
				1									4 .00			*	
(E)FLUORIDE		USA	601	BATCH002	JH-I	83	463	308	FEAB	L	A 2		1 .00				
		CAN	601	BATCH003	JH-I	B2	463	308	FEAB	L	A 2		101 .00				
		CAN	601	BATCH004	JH-I	83	463	308	FEAB	L	A 2		60 .00				
				3									162 .00			*	
(J)NITRATE		USA	601	BATCH005	JH-I	B3	325	203	DJAB	L	A 2		43 .00				
		JPN	601	BATCH006	JH-I	83	963	201	DJAB	L	A 2		47 .00				
		JPN	601	BATCH007	JH-I	83	325	203	DJAB	L	0 2		37 .00				
		JPN	601	BATCH008	JH-I	83	963	201	DJAB	L	A 2		79 .00				
		JPN	601	BATCH009	JH-I	B3	325	203	DJAB	L	A 2		940 .00				
				5									1146 .00			*	
(O)OTHER FORMS		USA	601	BATCH010	JH-I	83	937	310	UOOB	L	O 2		4 .00				
		USA	601	BATCH011	JH-I	83	937	310	UOOB	L	O 2		5 .00				

INVENTORY RECORD FOR OWNER — RESEARCH JH-I (JAERI TOKAI)(A) (82. 9.30) L66

OWNER	MATERIAL	ORIGIN	FACILITY	BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE.	CONTAINER OWNER	FROM (TO)	ELEMENT WEIGHT	FISSILE WEIGHT	PuP WEIGHT	ENRICHMENT	ITEM
(3)PNC (CONTINUED)	NU	CAN	601	BATCH001	JH-I	A	218	001	BQOB	L	O 3		5 .00				
		CAN	601	BATCH002	JH-I	A	218	001	BQOB	L	O 3		15 .00				
		CAN	601	BATCH003	JH-I	A	218	142	VDOB	L	O 3		20 .00				
				33									8579 .00			*	
				163									16838 .00			**	
(2)JAERI	DU	USA	602	BATCH004	JH-I	A	218	184	FQGB	L	G 2		104 .00				
		USA	602	BATCH005	JH-I	A	218	182	OJOB	L	O 2		38 .00				
		USA	602	BATCH006	JH-I	A	218	182	OJOB	L	O 2		6 .00				
		USA	602	BATCH007	JH-I	A	218	182	OJOB	L	O 2		289 .00				
		USA	602	BATCH008	JH-I	A	218	182	OJOB	L	O 2		44 .00				
		USA	602	BATCH009	JH-I	A	218	001	OJOB	L	O 2		315 .00				
		USA	602	BATCH010	JH-I	A	218	182	OJOB	L	O 2		39 .00				
		USA	602	BATCH011	JH-I	A	218	182	OJOB	L	O 2		17 .00				
		USA	602	BATCH012	JH-I	A	218	182	OJOB	L	O 2		73 .00				
		CAN	602	BATCH013	JH-I	A	218	183	OQ1A	L	O 2		39 .00				
				10									964 .00			*	
				10									964 .00			**	
(2)JAERI	TH	USA	603	BATCH014	JH-I	A	932	003	FQEB	L	E 2		57 .00				
		USA	603	BATCH015	JH-I	A	218	143	FQOB	L	O 2		57 .00				

Table 12 (continued)

INVENTORY RECORD FOR ORIGIN RESEARCH
JH-I (JAERI TOKAI)(D1) (82. 9.30) L72

ORIGIN	MATERIAL	ORIGIN	FACILITY	BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE. CONTAINER OWNER	FROM (TO)		WEIGHT WEIGHT	FISSILE WEIGHT	PuP WEIGHT	ENRICHMENT	ITEM
20 CANADA	NU	CAN	601	BATCH001	JH-I	D1	455	014X	KRAB	L A 2			4.00				4
		CAN	601	BATCH002	JH-I	D1	455	014	JRAB	L A 2			2.00				
				2									6.00			*	4
10 U.S.A.		USA	601	BATCH003	JH-I	D1	455	016	JQOB	L L 2			1.00				1
		USA	601	BATCH004	JH-I	D1	455	016	FQAB	L A 2			1.00				
		USA	601	BATCH005	JH-I	D1	455	006	OJGB	L G 2			85.00				
		USA	601	BATCH006	JH-I	D1	455	014	JQOB	L D 2			1.00				
		USA	601	BATCH007	JH-I	D1	455	014	KTEB	L E 2			54.00				
		USA	601	BATCH008	JH-I	D1	455	014	KKEB	L E 2			4.00				
		USA	601	BATCH009	JH-I	D1	455	014	KQEB	L E 2			6.00				
				7									152.00			*	1
70 WEST GERMANY		WG	601	BATCH010	JH-I	D1	455	015	KQAB	L A 2			76.00				
				1									76.00			*	
				10									234.00			**	5
96 JAPAN	DU	JPN	602	BATCH011	JH-I	D1	455	016	KQAB	L A 4	JH2N	JH2N	68.00				
		JPN	602	BATCH012	JH-I	D1	455	016	JQAB	L A 4	JH2N	JH2N	6.00				

INVENTORY RECORD FOR ENRICHMENT RESEARCH
JH-I (JAERI TOKAI)(B6) (82. 9.30) L73

ENRICHMENT	MATERIAL	ORIGIN	FACILITY	BATCH NAME	MBA	KMP	JOB	ROOM NO	DESCRIPTION	MEASURE. ISOTOPE CONTAINER OWNER	FROM (TO)		ELEMENT WEIGHT	FISSILE WEIGHT	PuP WEIGHT	ENRICHMENT	ITEM
5.00--- 5.99	EU	USA	604	BATCH001	JH-I	B6	482	000	FUAB	L G K 2			1.19	0.07		5.87	
		USA	604	BATCH002	JH-I	B6	482	000	FQAB	L G K 2			9.13	0.54		5.87	
		USA	604	BATCH003	JH-I	B6	482	000	JQAB	L G K 2			10.02	0.59		5.90	
		USA	604	BATCH004	JH-I	B6	482	000	FQAB	L G K 2			12.05	0.71		5.90	
				4									32.39	1.91		*	
6.00--- 6.99		USA	604	BATCH005	JH-I	B6	482	000	FQAB	L G K 2			61.58	3.69		6.00	
				1									61.58	3.69		*	
7.00--- 7.99		USA	604	BATCH006	JH-I	B6	482	000	FQAB	L G K 2			63.55	4.45		7.00	
		USA	604	BATCH007	JH-I	B6	482	000	FQAB	L G K 2			1.57	0.11		7.00	
		USA	604	BATCH008	JH-I	B6	462	000	VQAB	L G D 2			1.68	0.13		7.95	
				3									66.80	4.69		*	
8.00--- 8.99		USA	604	BATCH009	JH-I	B6	482	000	FUAB	L G K 2			1.66	0.13		8.00	
		USA	604	BATCH010	JH-I	B6	482	000	FQAB	L G K 2			22.21	1.99		8.98	
				2												*	

Table 13 Sample output of Ekg and historical lists.

INVENTORY LISTING BY EFFECTIVE KG

REACTOR L29

FACILITY		MATERIAL	FISSILE RATIO	EFFECTIVE KG
JC-C (JMTRC)	(A)	U	1.00 ABOVE	0.100
			0.50 --- 1.00	0.000
			0.50 BELOW	0.000
		DU, TH		0.000
		PU		0.000
		PUP		0.000
		EFFECTIVE KG TOTAL		0.100
JC-C (JMTRC)	(B)	U	1.00 ABOVE	0.100
			0.50 --- 1.00	0.000
			0.50 BELOW	0.000
		DU, TH		0.000
		PU		0.000
		PUP		0.000
		EFFECTIVE KG TOTAL		0.100
JC-C (JMTRC)	(*)	U	1.00 ABOVE	0.200
			0.50 --- 1.00	0.000
			0.50 BELOW	0.000
		DU, TH		0.000
		PU		0.000
		PUP		0.000
		EFFECTIVE KG TOTAL		0.200
JE-A (JMTR)	(A)	U	1.00 ABOVE	0.100
			0.50 --- 1.00	0.000
			0.50 BELOW	0.000
		DU, TH		0.000
		PU		0.000
		PUP		0.000
		EFFECTIVE KG TOTAL		0.100
JE-A (JMTR)	(B)	U	1.00 ABOVE	0.100
			0.50 --- 1.00	0.000
			0.50 BELOW	0.000
		DU, TH		0.000
		PU		0.000
		PUP		0.000
		EFFECTIVE KG TOTAL		0.100

Table 13 (continued)

HISTORY RECORD ON BATCH

(79. 4. 1-82. 9.30) L40

BATCH NAME	MBA	KMP	JOB	ROOM	DATE OF INVENTORY CHANGE		CHANGE FOR	FROM/TO MBA	KMP	JOB	ROOM	BATCH NAME	ORIGIN	DESCRIPTION	MEASURE. ISOTOPE. CONTAINER OWNER	WEIGHT OF ELEMENT	WEIGHT OF FISSILE	EN-RICH-MENT	WEIGHT OF Pu PRODUCED	ITEM	NOTE
		L	1941	R21	79. 4.23	4		JH-I	L	1941	F13		10	DQ7J	LGH6	108.80	10.90	10.00		1	
					81. 3.17	3		JH-I	L	1941	R31		10	DQ7J	LGO6	108.80-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R31	81. 3.17	4		JH-I	L	1941	R21		10	DQ7J	LGO6	108.80	10.90	10.00		1	
BATCH001	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.60	10.90	10.00		1	
					79. 6.12	3		JH-I	L	1941	R21		10	DQGB	LGH6	108.60-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21	79. 6.12	4		JH-I	L	1941	F13		10	DQ7J	LGH6	108.60	10.90	10.00		1	
					81. 3.17	3		JH-I	L	1941	R31		10	DQ7J	LGO6	108.60-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R31	81. 3.17	4		JH-I	L	1941	R21		10	DQ7J	LGO6	108.60	10.90	10.00		1	
BATCH002	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.70	10.90	10.00		1	
					79. 9.17	3		JH-I	L	1941	R21		10	DQGB	LGH6	108.70-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21	79. 9.17	4		JH-I	L	1941	F13		10	DQ7J	LGH6	108.70	10.90	10.00		1	
BATCH003	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.80	10.90	10.00		1	
					81.10.26	3		JH-I	L	1941	R21		10	DQGB	LGH6	108.80-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21	81.10.26	4		JH-I	L	1941	F13		10	DQ7J	LGH6	108.80	10.90	10.00		1	
					82. 4.27	3	3331RM	JH-I	L	1941	R21X	LD820430	10	DQ7J	MGO6	13.83-	1.38-	10.00			
					82. 4.27	13		JH-I	L	1941	R21W		10	DQ7J	LG76	94.97-	9.52-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21W	82. 4.27	14		JH-I	L	1941	R21		10	JQ7J	LG76	94.97	9.52	10.00		1	
BATCH004	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.80	10.90	10.00		1	
BATCH005	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.80	10.90	10.00		1	
BATCH006	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	109.00	10.90	10.00		1	
BATCH007	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.40	10.80	10.00		1	
BATCH008	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.60	10.90	10.00		1	
BATCH009	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.60	10.90	10.00		1	
BATCH010	604JH-I	L	1941	R21	79. 2. 8	1		JH-I	L	1941	F13		10	DQ7J	LGG6	108.80	10.90	10.00		1	
					79.12. 8	1*								J		0.00	0.00				
					79.12. 8	3	3331RM	JH-I	L	1941	R21	LD791228	10	JQ7J	LGO6	3.00-	0.30-	10.00			
																105.80*	10.60	10.00		1*	
BATCH011	604JH-I	L	1941	R21	79. 2.20	1		JH-I	L	1941	F13		10	DQ7J	LGG6	108.30	10.80	10.00		1	
					79.12. 8	1*								J		0.00	0.00				
					79.12. 8	3	3331RM	JH-I	L	1941	R21	LD791228	10	JQ7J	LGO6	6.19-	0.62-	10.00			
																102.11*	10.18	10.00		1*	
BATCH012	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.60	10.90	10.00		1	
					79. 4.11	3		JH-I	L	1941	R21		10	DQGB	LGG6	108.60-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21	79. 4.11	4		JH-I	L	1941	F13		10	DQ7J	LGG6	108.60	10.90	10.00		1	
					79.12. 8	3	3331RM	JH-I	L	1941	R21	LD791228	10	JQ7J	LGO6	3.23-	0.32-	10.00			
					79.12. 8	4*								J		0.00	0.00				
					80. 5. 9	3	3331RM	JH-I	L	1941	R21	LD800531	10	JQ7J	TGO6	5.02-	0.50-	10.00			
																100.35*	10.08	10.00		1*	
BATCH013	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.70	10.90	10.00		1	
					79. 4.25	3		JH-I	L	1941	R21		10	DQGB	LGH6	108.70-	10.90-	10.00		1-	
																0.00*	0.00			*	
		L	1941	R21	79. 4.25	4		JH-I	L	1941	F13		10	DQ7J	LGH6	108.70	10.90	10.00		1	
					79.12. 8	3	3331RM	JH-I	L	1941	R21	LD791228	10	JQ7J	LGO6	3.80-	0.38-	10.00			
					79.12. 8	4*								J		0.00	0.00				
					80. 5. 9	3	3331RM	JH-I	L	1941	R21	LD800531	10	JQ7J	TGO6	5.02-	0.50-	10.00			
																99.88*	10.02	10.00		1*	
BATCH014	604JH-I	L	1941	F13	79. 2. 1	1	0211RD	JH1I	V	941	000		10	DQGB	LGG6	108.10	10.80	10.00		1	
					79. 5. 7	3		JH-I	L	1941	R21		10	DQGB	LGH6	108.10-	10.80-	10.00		1-	
																0.00*	0.00			*	

Table 14 Sample output of restricted quantity list.

RESTRICTED QUANTITY FOR FACILITY

JH-I (82. 4. 1-82. 9.30) L28

MBA	KMP	FACILITY AND MATERIAL	QUANTITY RESTRICTED			BEGINNING INVENTORY	INVENTORY CHANGE	ENDING INVENTORY	REMAINING QUANTITY FOR USING
JH-IN		(WASTEF)							
		NU	10000.00						10000.00
		EU(EU≤ 3.50)	10000.00						10000.00
		PU	60.00						60.00

Table 15 Results of inspection to JAERI's facility

	pre-NPT			NPT type safeguards																		Actual Routine inspection efforts	
Year	1977			1978			1979			1980			1981			1982						Man-day	
Facility	Inspection day	Man-day Japan	Man-day IAEA	Inspection day	Man-day Japan	Man-day IAEA	Inspection day	Man-day Japan	Man-day IAEA	Inspection day	Man-day Japan	Man-day IAEA	Inspection day	Man-day Japan	Man-day IAEA	Inspection day	Man-day Japan	Man-day IAEA				Japan	IAEA
JMTR	4	4	4	5	6	5	15	23	16	18	22	18	24	30	21	14	19	24				40	30
JPDR	2	2	2	3	3	4	2	2	1	1	1	1	1	1	1	1	1	1				2	1
JRR-2	4	5	6	4	5	6	1	1	0	2	2	1	3	3	3	1	1	1				2	1
JRR-3	2	2	2	2	5	3	17	25	14	12	13	15	12	14	14	28	31	24				25*	18*
JRR-4	1	1	1	2	3	3	2	2	1	1	1	1	1	1	1	1	1	1				2	1
NSRR	1	1	2	2	2	2	1	1	0	1	1	1	1	1	1	1	1	1				1	1
FCA	8	31	48	10	58	22	45	82	96	52	92	94	41	79	75	50	68	141				200	200
JMTRC	2	2	2	1	2	2	1	2	1	1	1	0	1	2	1	1	1	1				2	1
SHE	1	1	2	2	2	2	1	1	0	1	1	0	1	1	1	1	1	1				2	1
TCA	1	1	1	2	2	2	2	2	1	1	1	0	1	1	1	1	1	1				2	1
R&D Tokai	3	8	8	4	12	8	8	13	5	8	11	8	6	8	8	32	36	19				20*	10*
B&D Oarai	0	0	0	2	2	1	1	1	1	1	1	0	1	2	0	1	1	1				1	1
Total	29	58	78	39	102	60	96	155	136	99	147	139	93	143	127	132	162	216				299	266

* To verify the transportation of JRR-3 spent fuel via R & D Tokai (for sealing the container), extra ARIE of 130 and 100 are applied to JRR-3 and R & D MBA, respectively.

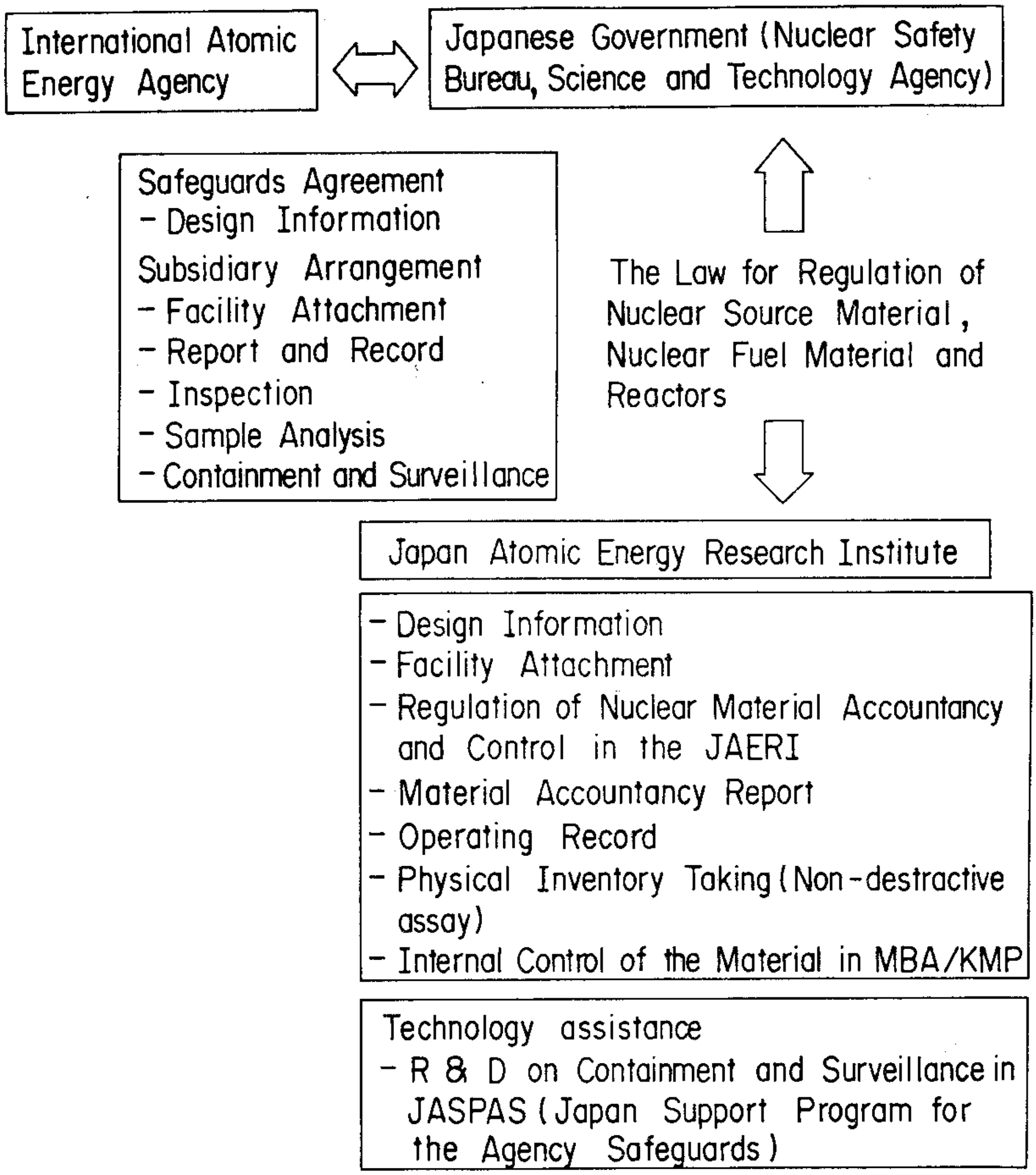
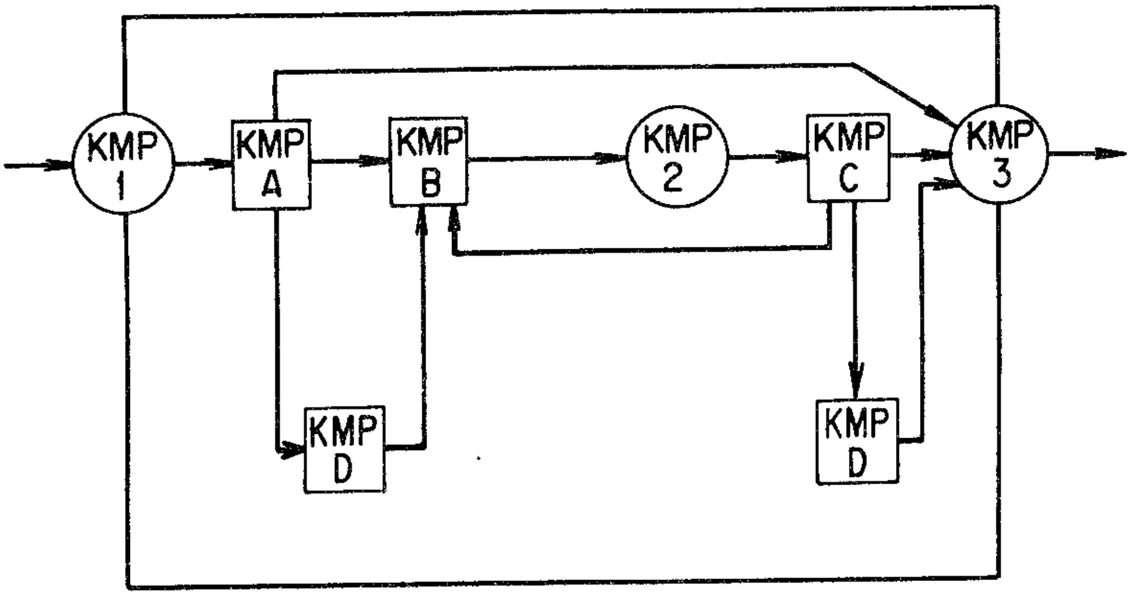


Fig. 1 Structure of safeguards application to the JAERI.



Flow KMPs

KMP 1 : Receipt of fresh fuel from other MBA

KMP 2 : Nuclear loss and production in fuel discharged from the reactor core

KMP 3 : Shipment of fuel to other MBA

Inventory KMPs

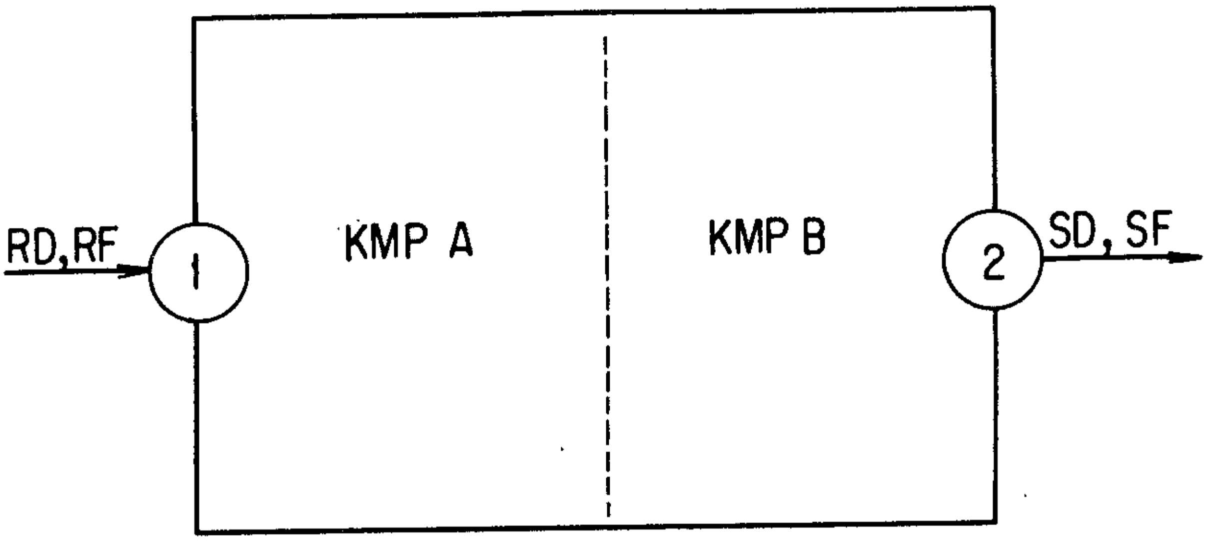
KMP A : Fresh fuel storage

KMP B : Reactor core

KMP C : Spent fuel storage (pool)

KMP D : Other locations

Fig. 2 Component of research reactor's MBA.



Flow KMPs

KMP 1 : Receipt from other MBA

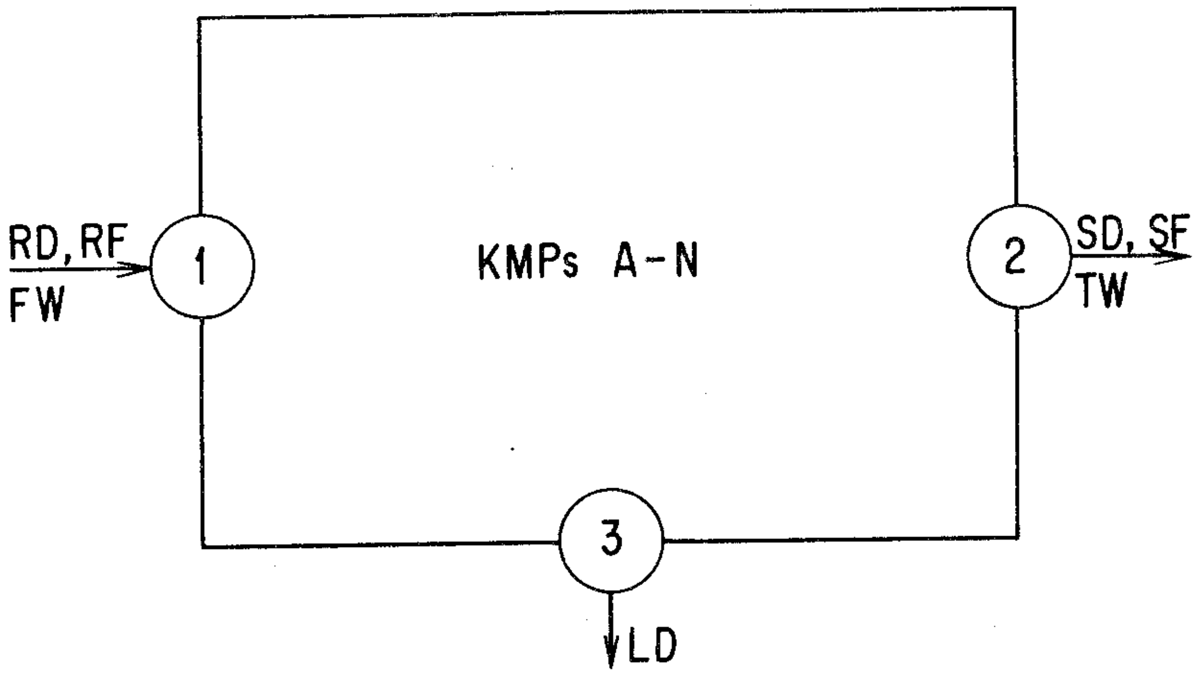
KMP 2 : Shipment to other MBA

Inventory KMPs

KMP A : Fresh fuel storage

KMP B : Reactor room

Fig. 3 Component of critical assembly's MBA.



Flow KMPs

KMP 1 : Receipt, De-exemption, Accidental gain
Retransfer from retained waste

KMP 2 : Shipment, Exemption, Accidental loss
Transfer to retained waste

KMP 3 : Measured discard

Inventory KMPs

KMP A-N : Research laboratories

Fig. 4 Component of Research and development MBA.

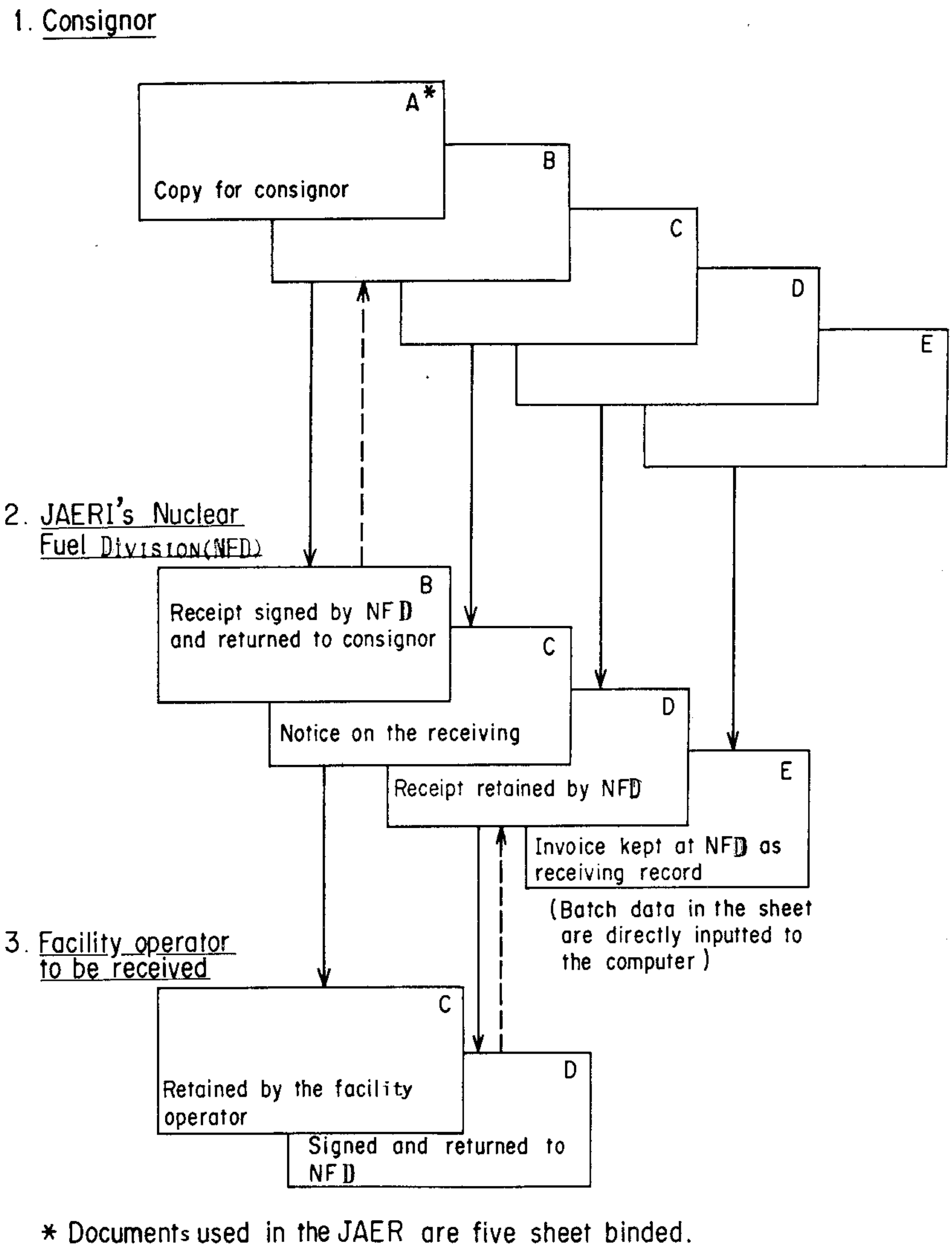


Fig.5 Flow of receiving document sheet for nuclear material delivered from other MBA.

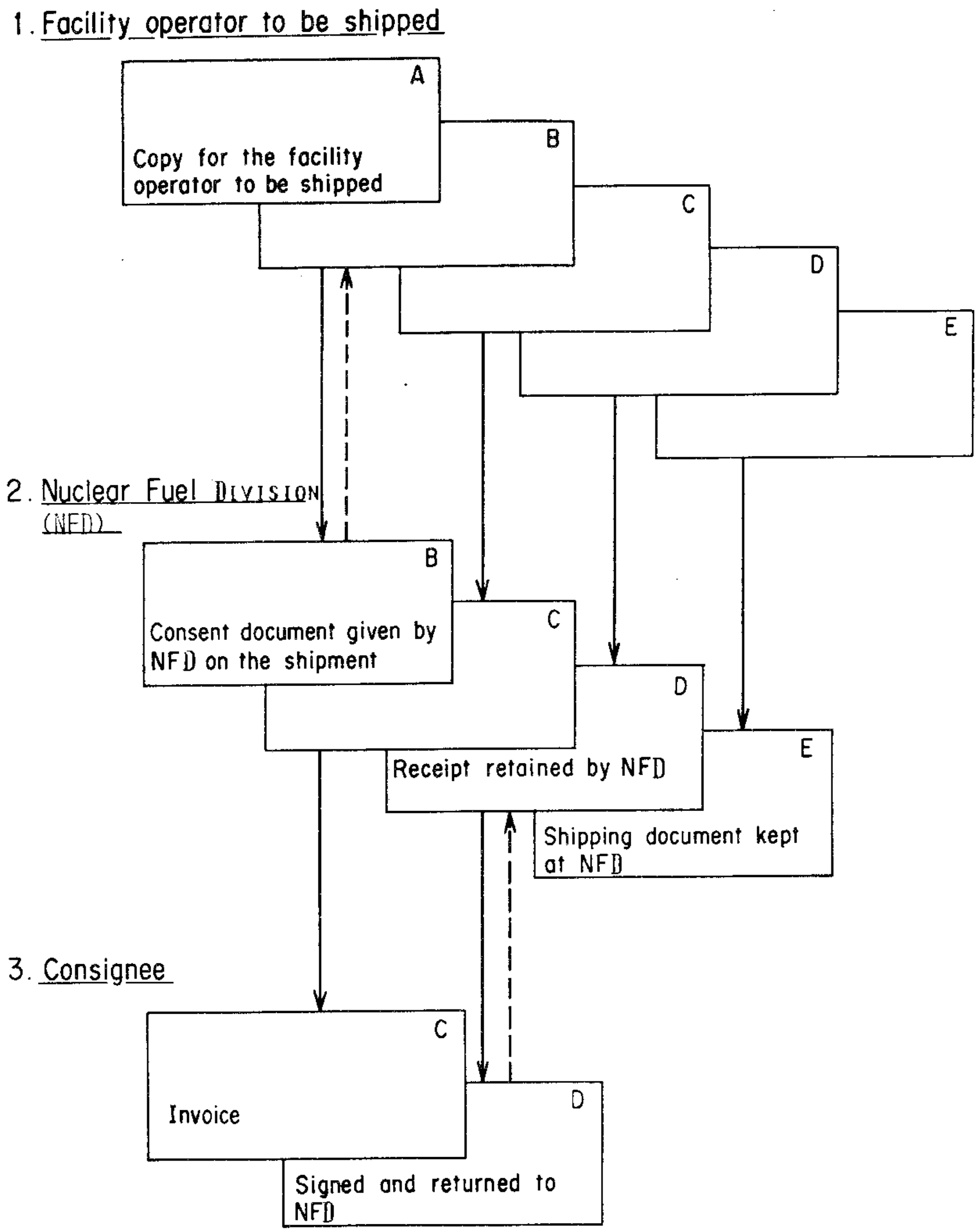


Fig. 6 Flow of shipping document sheet for dispatch of nuclear material.

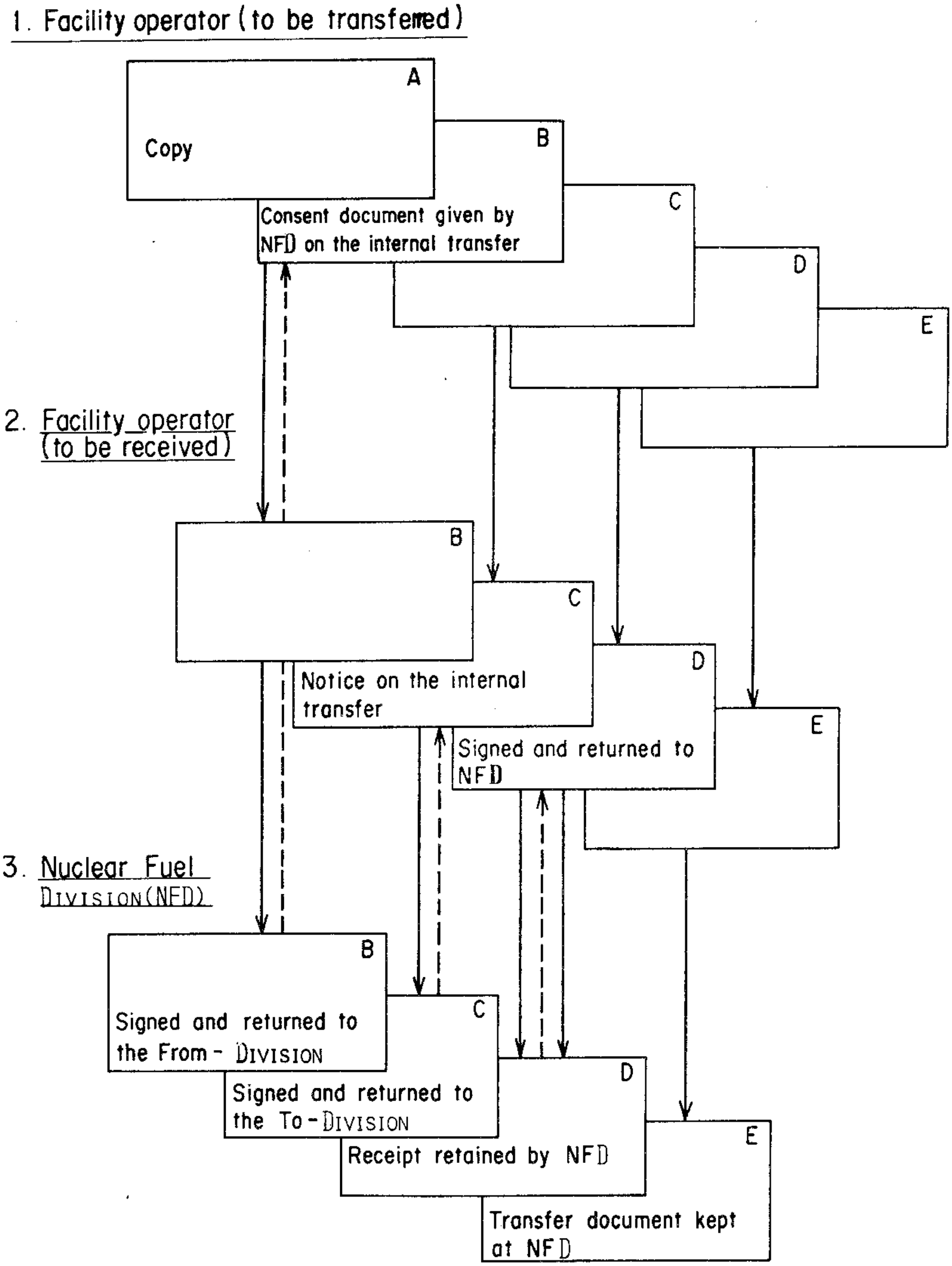


Fig. 7 Flow of internal transfer document sheet.

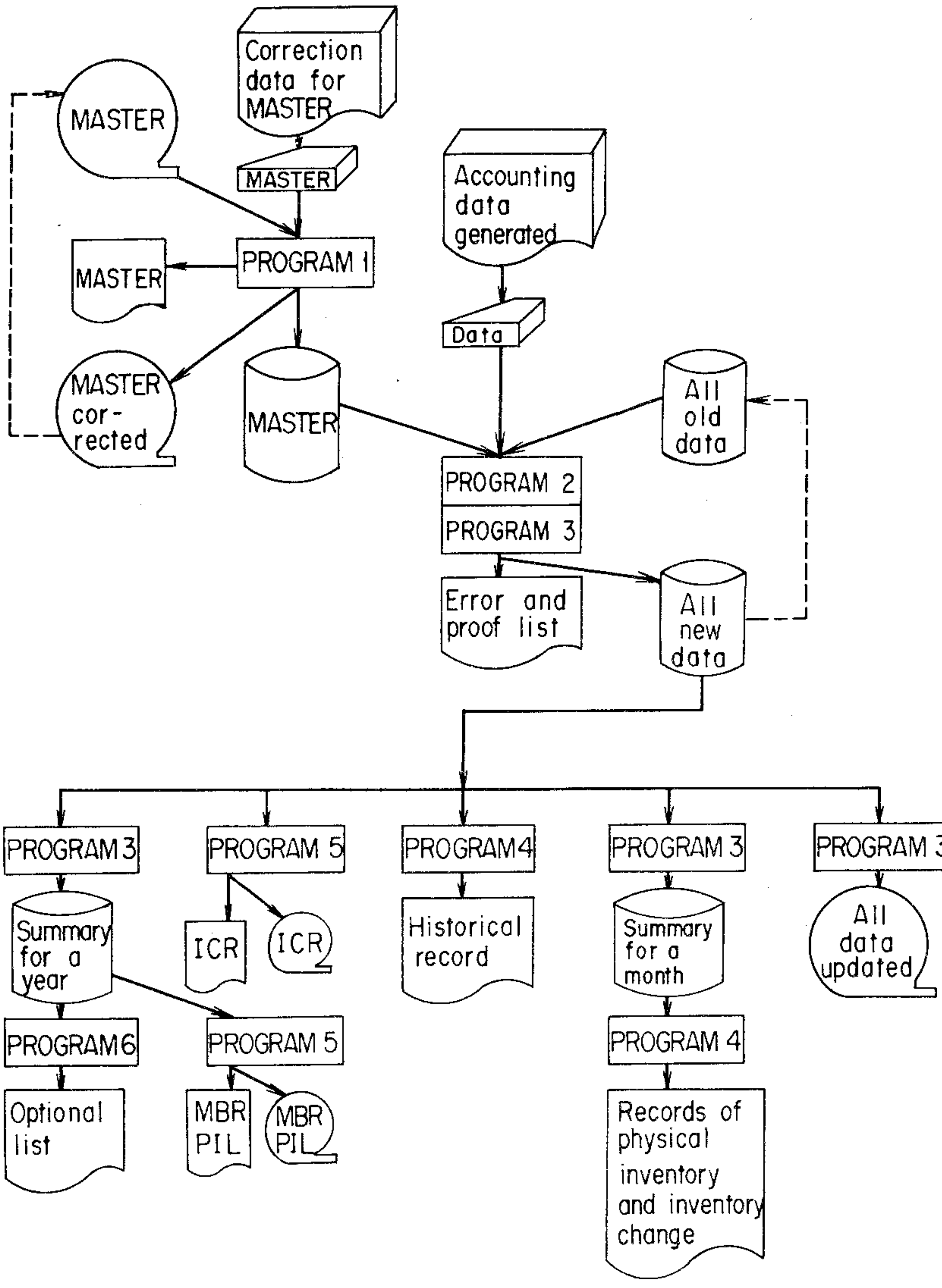


Fig. 8 Information treatment system.

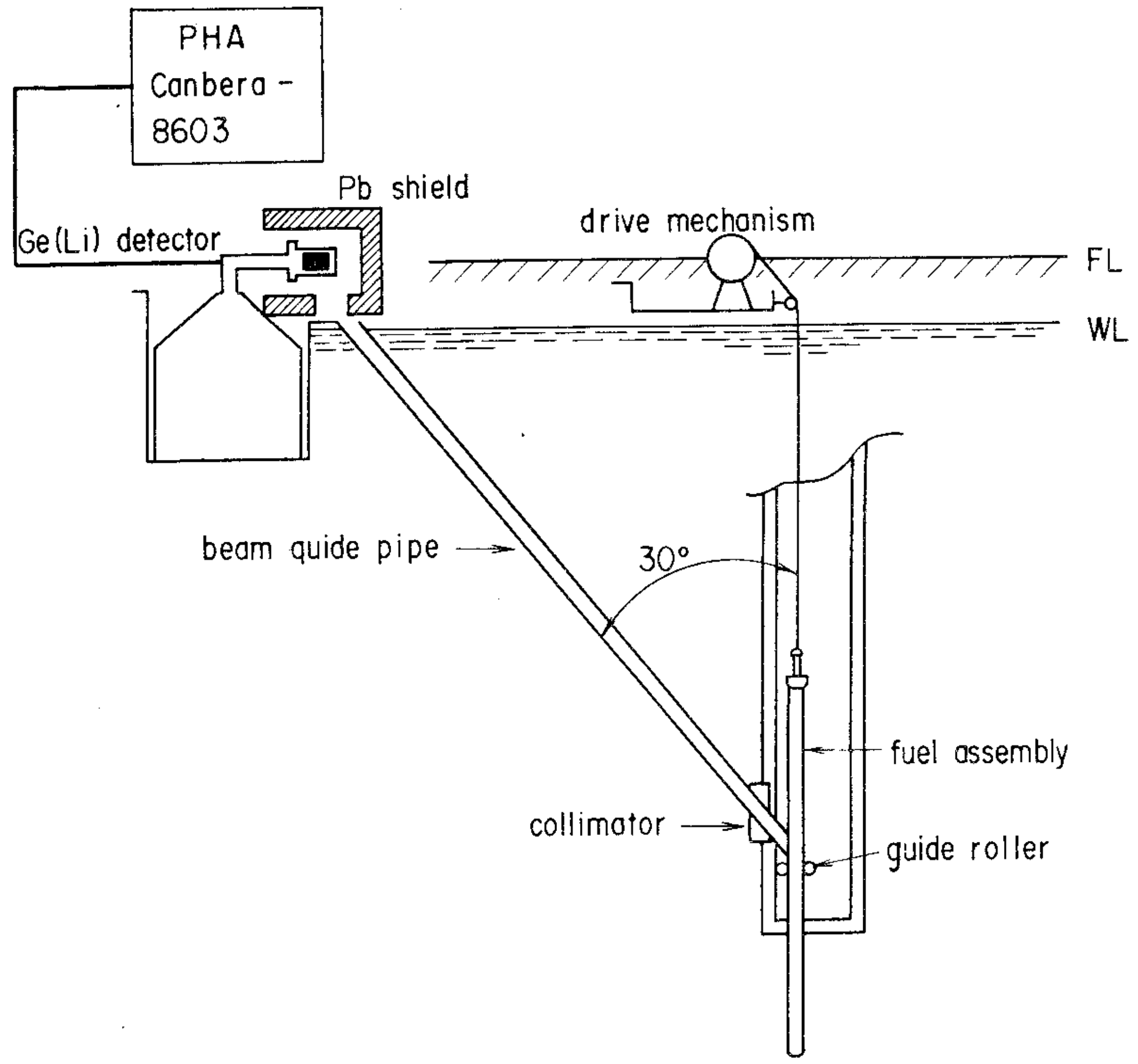
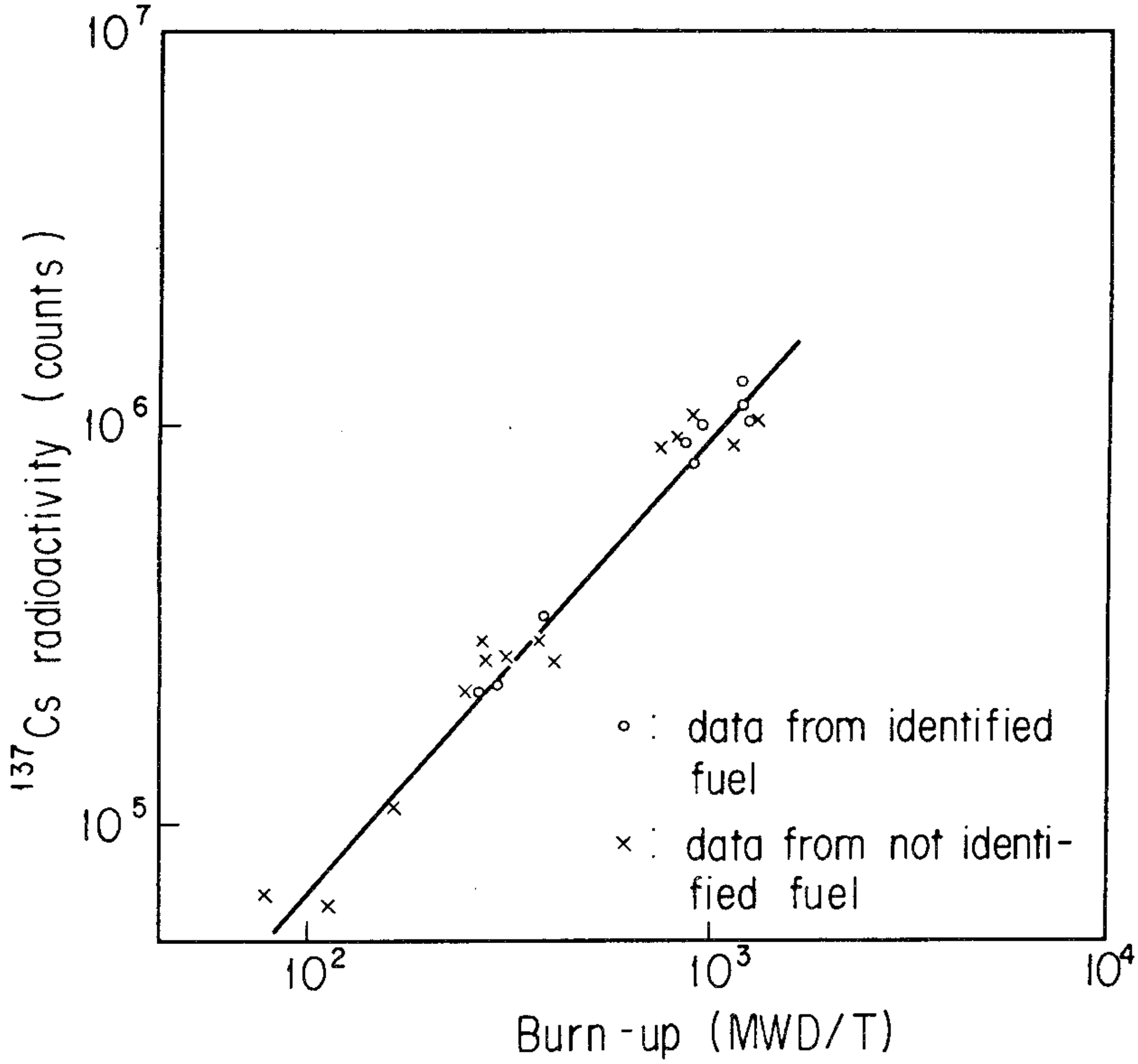


Fig. 9 Installation for measurement of JRR-3 spent fuel.



[Explanation]

When the spent fuel assembly can not be identified by number, the operator's burn-up value and NDA measurement of ^{137}Cs activity can be used to verify the fuel assembly by using this curve.

Fig. 10 Results for measurement of JRR-3 spent fuel.