

ABACC's SYSTEM FOR ACCOUNTING NUCLEAR MATERIALS

Rubén Osvaldo Nicolás

Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials, (ABACC)
Rio de Janeiro, Brazil

ABSTRACT

In July 1992, when ABACC began operating, it started to develop its automated accounting system for PC. The software was considered fully implemented in the second semester of 1992. Many improvements were incorporated since then and others should be incorporated in the near future. The program developed has shown satisfactory to fulfill the objective of ABACC, as far as nuclear material accountancy is concerned.

ABACC started to receive from the National Authorities and to send to the IAEA accounting reports in electronic media, via diskette, in 1997, and to use encrypted e-mail since November 1999, allowing the IAEA to receive accounting reports on the same day that the National Authorities sends them to ABACC.

Statistics of the reports received since 1994 are showed.

1. INTRODUCTION

In December 1991, the Agreement between Brazil and Argentina for the Exclusively Peaceful Use of Nuclear Energy entered into force [1]. The agreement, determines the control over all nuclear materials in all nuclear activities in both countries. To verify this commitment, the Common System of Accounting and Control of Nuclear Materials (SCCC) was established and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) was created to administer and apply the SCCC [2].

The Quadripartite Agreement (INFCIRC/435), signed among Argentina, Brazil, the International Atomic Energy Agency (IAEA) and ABACC, entered into force on 4 March 1994 [3].

The Secretariat of ABACC, which started its operations in July 1992, is structured in four technical areas (Technical Support, Operations, Planning and Evaluation and Accounting), each of them consisting of two professionals.[4,5] The main functions of the Accounting Area are:

- to receive the accounting reports from the National Authorities (NA) and then process, evaluate and send them to the IAEA,
- to evaluate the results of the inspection activities referred to the auditing of records and its comparison with reports [6],
- to follow-up on discrepancies that results from reports evaluations and from inspection auditing activities,
- to develop the software associated with the activities listed above.

2. AUTOMATED ACCOUNTING SYSTEM

From the beginning of its operations, ABACC started the development and immediate implementation of its automated accounting system for Personal Computers, since accounting reports were received from the States almost simultaneously with the implementation of ABACC itself. Taking into account that the human resources of ABACC are very limited, the development of the system was absolutely necessary to fulfill the objectives of the Accounting area. The system had to comply with the following requirements:

- be structured in accordance with the reporting system established in Annex I of the SCCC's General Procedures, that is compatible with Code 10 of the Quadripartite Agreement's Subsidiary Arrangements;
- be sufficiently flexible to allow the processing of data in other different formats (ABACC initially received reports in five different formats);
- be able to provide in an effective and fast manner the information requested by other units of ABACC;
- be able to match shipments to and receipts from the Material Balances Areas (MBAs);
- be rapidly implemented, since ABACC began to receive the accounting reports from the States almost simultaneously with its establishment.

Based on these premises, the first version of ABACC's nuclear material accounting software was completed in September 1992 using DBase III Plus. In 1995 the migration to Fox Pro for Windows started and was completed in the second semester of 1996. Many improvements were incorporated to the program since 1992 with the main objective of automating as much as possible the processing and evaluation of the accounting data received from the National Authorities. At present, the main functions of this program are:

- inputting data in electronic media or manually;
- matching the shipments and receipts from the MBAs of the SCCC;
- checking the consistency between:
 - the data reported and the provision of Code 10
 - the data reported and the data from the inspection activities (auditing and comparison of reports with records);
 - the Material Balance Report (MBR) and the Physical Inventory List (PIL);
 - the MBR reported and the Material Balance generated by the system based on the Inventory Change Reports (ICRs).
- calculating the nuclear material inventory for a selected MBA and date, based on the data reported (it is possibly to consider each state as an unique

MBA);

- listing and totaling the inventory changes (all or a specific type) for a given MBA and period, ordered by date and grouped by element category;
- generating the ICRs, MBRs, PILs and Concise Notes in the proper format for transmission to the IAEA by electronic media;
- giving complete statistics of the accounting reports received from the National Authorities and sent to the IAEA, including the promptness from the point of view of the SCCC and INFIRC/435 deadlines.

The main improvement to be incorporated in the future is the checking of consistency between the data reported and the provisions of both Design Information Questionnaires and Facility Attachments.

3. ABACC's NUCLEAR SYSTEM

Table 1 shows the number of Facilities and Locations Outside Facilities (LOFs), grouped by type or

area, that are under ABACC safeguards. From this table it is interesting to observe that both countries nuclear systems are approximately of equal size and development status. It is important to point out:

- around 30 % of these facilities were not under IAEA safeguards before the Bilateral Agreement entered into force, in particular, the facilities of the Enrichment Research Area;
- the facilities of the nuclear power generation area are only about 9% of the total facilities but their inventory is more than 99.5 % of the total inventory of nuclear material under ABACC's safeguards;
- only 30 % of the facilities have a nuclear material inventory of more than 1 effective kilogram and almost 50 % have less than 0.1 effective kilogram.

TYPE/AREA	ARGENTINA	BRAZIL	ABACC
Nuclear Power Generation Area			
▪ Conversion Plants	1		1
▪ Fuel Fabrication Plants	1	1	2
▪ Power Reactors	2	2	4
Total	4	3	7
Enrichment Research Area			
▪ Conversion Plants	1	1	2
▪ Fuel Fabrication Plants	1	2	3
▪ Enrichments Facilities	1	2	3
▪ Storage	0	1	1
Total	3	6	9
Research Reactor Area			
▪ Conversion Plants	3	1	4
▪ Fuel Fabrication Plants	3	2	5
▪ Reactor/Critical/Subcritical	6	6	12
▪ Storage	3	1	4
Total	15	10	25
Other Research Facilities	2	1	3
Other LOFs			
▪ Analytical Laboratories	7	2	9
▪ Others	10	9	19
Total	17	11	28
TOTAL	41	31	72

TABLE 1: Number of Facilities and Locations Outside Facilities (LOFs)

4. REPORTING ACTIVITIES AND STATISTICS

The first activities in nuclear material accounting began with the reception, in the beginning of September 1992, of the Initial Declaration on the inventories of nuclear material (as of 30 June 1992) present in all nuclear activities of each State Party.

Since then and until the entry into force of the Quadripartite Agreement (from September 1992 to

March 1994), ABACC processed 3170 lines of records, concerning inventory changes informed by Brazil and Argentina through its accounting reports. From this total, 1916 lines referred to nuclear material subject exclusively to the ABACC's safeguards.

Once the Quadripartite Agreement entered into force, ABACC sent the Initial Report (as of 31 March 1994) to the IAEA on 30 April 1994. Figure 1 and 2 show the number of reports and entry lines received from Argentina and Brazil and sent to the IAEA from

April 1994 to December 2000, respectively. Figure 3 shows the number of report entry lines discriminated by

type of report for the same period.

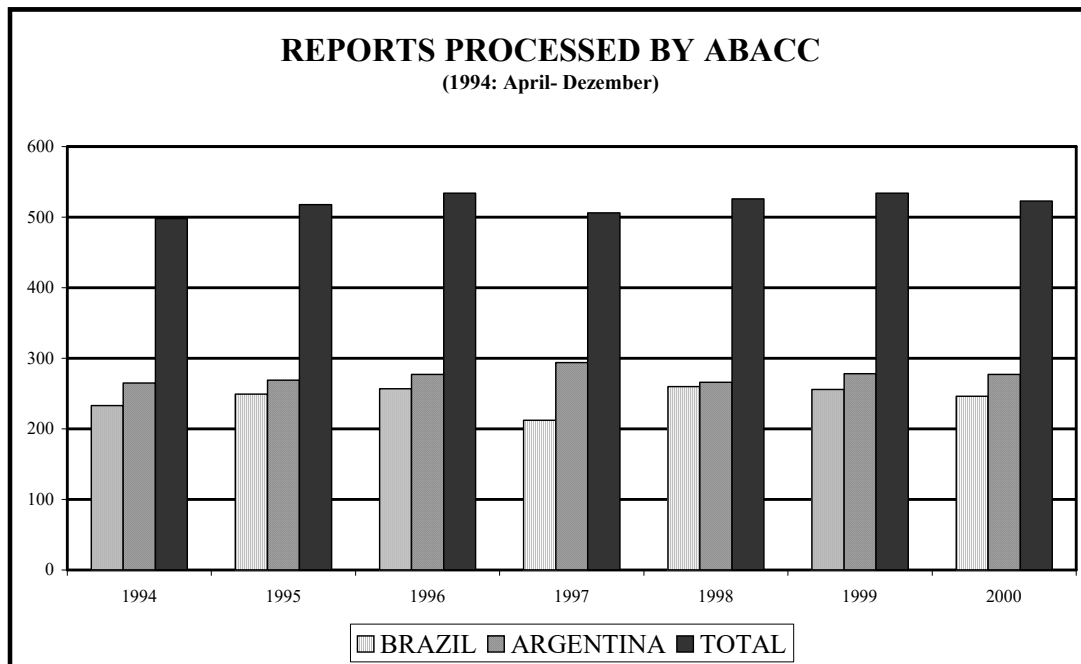


FIGURE 1: Number of reports received from Argentina and Brazil and sent to the IAEA since the Quadripartite Agreement entered into force until December of 2000.

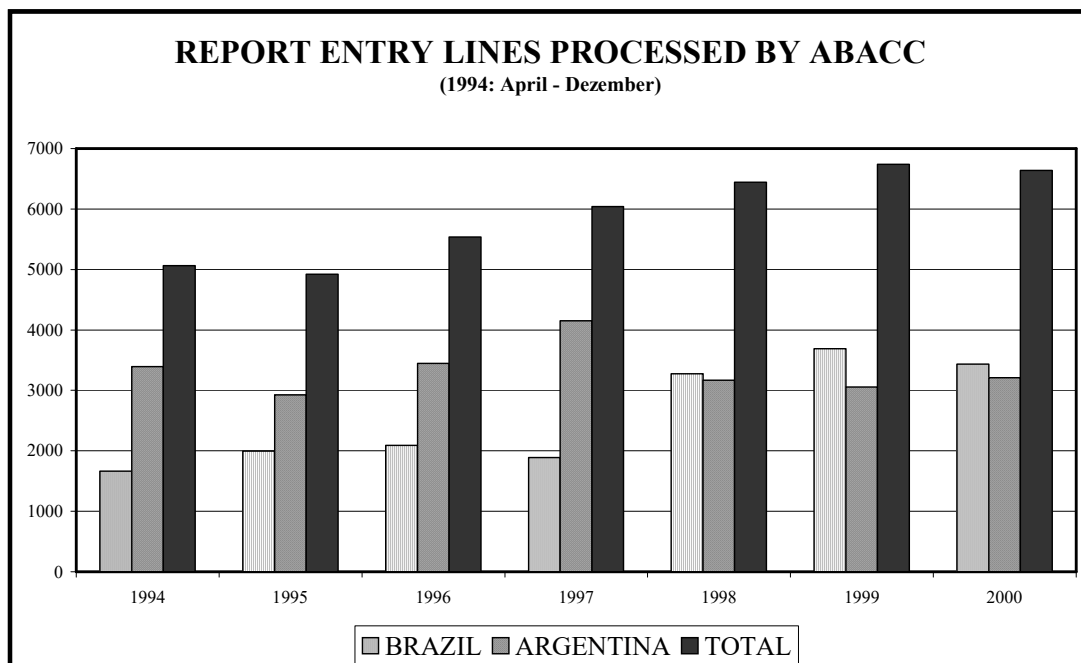


FIGURE 2: Number of report entry lines received from Argentina and Brazil and sent to the IAEA since the Quadripartite Agreement entered into force until December of 2000.

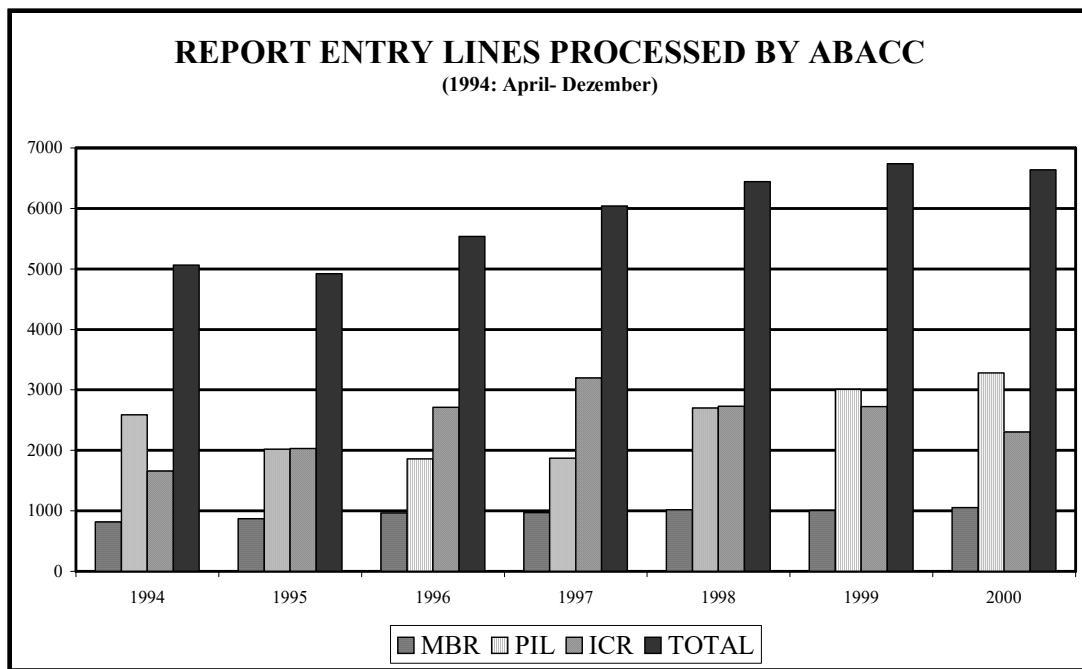


FIGURE 3: Number of report entry lines processed by ABACC since the Quadripartite Agreement entered into force until December of 2000 discriminated by type of report.

From these figures it is possible to remark:

- the number of reports and entry lines are very similar for both countries;
- ABACC processes around 500 reports annually (this value has been practically constant since the quadripartite entered into force);
- ABACC processes around 6500 report entry lines annually (this value is about 30 % greater than the initial values due, essentially, to change in batch definition for some MBAs upon entry into force of the Facility Attachment);
- about 40% of the entry lines correspond to inventory changes (it is interesting to point out that more than 95% of these inventory changes are domestic transfers of which almost 70% are transfers of less than 0.01 effective kilogram and only 2.4 % of more than 1 effective kilogram).

5. CORRECTNESS AND TRANSMISSION OF THE REPORTS

Before the Quadripartite Agreement entered in to force (from July 92 to March 94), ABACC began to receive the reports in 4 different formats:

- formats established in the INFCIRC/66 type agreements applicable to facilities under IAEA safeguards (the formats were different for Argentina and Brazil),
- formats established by the National Systems applicable to facilities previously subject only to national safeguards (also, the formats were different for Argentina and Brazil).

During this period, ABACC programmed a gradual transition (by groups of facilities) from the reporting formats in use until then in the countries, to that foreseen in the SCCC (equivalent to Code 10). At the end of 1993, all MBAs subject only to SCCC safeguards were reporting according to the new system, the whole process being completed by March 1994. This proved to be of great importance, since as early as from the month following the entry into force of the Quadripartite Agreement, the Agency could receive the accounting reports in the format foreseen in Code 10. In these reports, no important mistakes were observed (about 2% of the total report entry lines sent to IAEA from April 1994 to March 1995), notwithstanding the great difference in respect to the previous system used in both countries.

According to the provisions of the SCCC, the NA must send the ICRs to ABACC within 20 days of the end of the month in which the inventory change occurred. In the Quadripartite Agreement, it is ABACC that sends the ICRs to the IAEA, only this time within 30 days, instead of 20, of the end of the month in which the inventory change occurred. The MBRs and PILs have the same time limits but with respect to the completion of the physical inventory taking. This means that ABACC has, in the best of the cases, a maximum of 8 working days to process, evaluate and send the accounting reports to the IAEA without introducing an extra delay. It must be considered that the report evaluation includes the detection of mistakes in order to

make, whenever possible and with the approval of the respective NA, the necessary correction before sending it to the IAEA. In those cases where a correction can not be introduced by ABACC, the NA is requested to include the correction in the next report.

For this purpose, in the beginning of each month ABACC sends to the respective NA:

- a report with the promptness of the accounting reports received in the previous month taking into account the SCCC and INFCIRC/435 deadlines,
- a list of pending accounting problems containing the inconsistencies found in the accountancy reports and also the results of the inspection activities referred to the auditing of records and its comparison with reports. The inconsistency remain in the list until being solved.

With the objective of accelerating and automating this process, ABACC encouraged both NA to implement a software to send the reports in electronic media. These software were implemented with the collaboration of ABACC, specially in the case of Argentina. ABACC started to receive the reports via diskette in the beginning of 1997. This permitted that the reports sent to the IAEA since then had practically no mistakes. Also, the delay between the receipt of reports by ABACC and the shipment to the IAEA was reduced from about 8 working days in 1994 to 2 in 1997. Nevertheless, considering that

- the diskettes were sent to ABACC by diplomatic mail and to the IAEA by special courier, introducing a delay between six and twelve days since the reports left the National Authority and arrived in Vienna,
- the security of the information transmitted is based essentially in the confidence of the mailing system used not to mention that with this procedure, the diskettes are manipulated by a number of persons greater than it would be advisable

ABACC decided to progressively replace the conventional means of correspondence by using encrypted e-mail in order to reduce practically to zero the time spent in transporting the information and, also, improving its security level. ABACC selected the software Pretty Good Privacy (PGP) for authentication and encryption of electronic mail. The PGP is one of the most popular software for secure e-mail that use the concept of Public Key Cryptography [7]. It is easy to use and the key size is not limited by the United States' export regulations allowing the use of 128-bit encryption technology, which is practically impossible to decipher. In the first quarter of 1999, ABACC defined with the National Authorities of both countries the procedures that would be used for the transmission of safeguards accounting information. The methodology started to be tested in June 1999 and was fully implemented in September of the same year.

To complete the process, ABACC proposed the

IAEA to send the accounting reports by encrypted e-mail. The Agency agreed and the procedure was implemented also using the PGP. In November 1999, the tests started and in January 2000, the methodology was finally adopted as the only way to send safeguards accounting information to the IAEA [8]. It is important to point out that:

- the IAEA is receiving accounting reports on the same day, or in the worse case, one day after the National Authority sends them to ABACC,
- the accounting reports are encrypted with the use of a very powerful tool and manipulated by very few people in the organizations involved, thus increasing considerably the security of this information.

6. CONCLUSIONS

The development of an automated accounting system of nuclear material for Personal Computers was possible in a considerable short time and has been permanently improved, in order to increase the automation of reports processing and evaluation, as well as the detection of mistakes. The software developed has shown to be highly satisfactory to fulfill the objective of ABACC, as far as nuclear material accountancy is concerned.

The reception of the accounting reports in electronic format made it possible that the reports sent to the IAEA since 1997 practically contained no mistakes. The monthly delivery of the list of pending accounting problems containing reports evaluation and inspection auditing findings also contributes to this fact, as well as the immediate communication with the NA when an inconsistency is found.

From the third quarter of 1999 on, the security increased considerably with the use of encryption for transmission of safeguards accounting information, and the AIEA received the reports not later than 24 hours after the NA had sent them to ABACC.

ACKNOWLEDGMENTS

I would like to thank L. Palhares, and A. Raffo for their comments and suggestions, which have undoubtedly contributed to enrich the content of this paper.

REFERENCES

- [1] Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy. INFCIRC/395. IAEA. Vienna, November 1991.
- [2] Procedimientos Generales del Sistema Comun de Contabilidad y Control de Materiales Nucleares (SCCC). ABACC, June 1994. (also available in Portuguese).
- [3] Agreement between the Republic of Argentina, the Federative Republic of Brazil, The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic

- Energy Agency for the Application of Safeguards. INFCIRC/435. IAEA. Vienna (1994)..
- [4] Biaggio A., Mafra O., Marzo M., R. Nicolás, "A Good Nuclear Neighbors Relationship", Proceedings of the 15th ESARDA Annual Symposium, Rome (1993), EUR 15214, p 163.
 - [5] Palhares L., "The Brazilian-Argentine Agency for Accounting and Control of Nuclear Material – ABACC", Presented at Seminar on Safeguards Accounting Data and Reporting, IAEA, Vienna (1994).
 - [6] Nicolás, R. "ABACC's Records Auditing Procedures", Proceedings of the 19th ESARDA Annual Symposium, Montpellier (1997), EUR 17665, p 723.
 - [7] W. Diffie and M.E. Hellman, New Directions in Cryptography. IEEE Transactions on Information Theory, IT-22: 644-654, 1976.
 - [8] Ruben Nicolas,, "The experiences of ABACC in the uses of encrypted e-mail for transmission of safeguards information and documents", Presented at International Seminar on Integrated Information System , Vienna (2000)