THE NEW SOFTWARE FOR JOINT AUDITING OF RECORDS ABACC – IAEA

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ABSTRACT

To comply with the provisions of the Agreement between Argentina, Brazil, ABACC and the IAEA for the Application of Safeguards (The Quadripartite Agreement) related to the minimization of duplication activities, ABACC developed in 2001 a first version of the System for Joint Auditing of Records (SJAR). This system was implemented officially in September 2004 and enables the two agencies to perform jointly records auditing during inspections. This unique system has been used routinely by the two agencies for almost twenty years. However, in order to accomplish the rapid changes in technology and support, ABACC started in 2018 the development of a New System for Joint Auditing Records (NSJAR). The conceptual development of NSJAR was presented to the IAEA in April 2018. The first version of the NSJAR was presented to the IAEA, Argentina and Brazil in May 2019. It is noteworthy to say that the NSJAR was born as a result of the cooperation between both agencies.

As a result of the tests of the new software by the IAEA, it was agreed to modify some aspects related to the output of the IAEA reports, and also to reconcile issues related to access privileges to the software by the inspectors that would guarantee the security policies adopted by each agency.

With the implementation of these modifications the NSJAR and the joint audit procedures began to be used in inspections in February 2020 and since then, in all accounting audits as a routine, with very satisfactory results.

This paper describes the stages of development of this project. The main features of NSJAR are presented. The main changes introduced into the system are summarized.

1. INTRODUCTION

On March 4th 1994, the Comprehensive Safeguards Agreement between Argentina, Brazil, ABACC and IAEA [1] (INFCIRC/435) entered into force. This Agreement states that, to the extent possible, ABACC and IAEA shall work jointly and coordinate their work to avoid the duplication of safeguards activities.

In order to comply with this provision, related to the minimization of duplication of activities, ABACC developed in 2001 a first version of the Software for Joint Auditing of Records (SJAR) [2]. This software was implemented officially in September 2004 [3] and enables both agencies to perform jointly records auditing during inspections. This unique system has been used routinely by the two agencies for almost twenty years.

Since September 2004 ABACC and IAEA make use of SJAR, and its associated procedures, during the accounting audits performed in Argentina and Brazil. This software was developed by ABACC in Fox Pro for Windows 2.6a, and it was used until 2019 when it was substituted by the NSJAR.

Basically, SJAR makes inspector´s duty easier during safeguards inspections because it organizes the audit activities to be performed, checks the consistency of the accounting information entered and makes all calculations automatically.

In 2017 ABACC has decided to start a process of modernization of the systems used for nuclear material accounting, in order to keep up with the rapid changes in technology, support and security policies. Thus, in May 2018 ABACC presented to the IAEA a conceptual project to create a new software, the NSJAR, developed in SQL Server Express. The agreed procedures between ABACC and the IAEA to perform the joint audit activities also needed to be updated.

It is the responsibility of ABACC´s Accounting Sector to prepare the file that will be loaded into the NSJAR software during the audits in the field. This file contains the starting data needed to perform each audit that is downloaded from ABACC´s General Accounting System of Nuclear Material [4], hereafter named the General Database. This General Database was also redesigned, from Fox Pro to SQL Server within the framework of the modernization of the accounting systems and compatibility with the NSJAR. When ABACC and the IAEA inspectors return to their headquarters, after the completion of a round of safeguards inspections, the result of these audits is uploaded into the data bases of each agency.

2. DEVELOPMENT STAGES OF NSJAR

The SJAR always worked satisfactorily and that is why ABACC decided to move the system to a modern platform but to make few changes in the way it works related to data validation and verification. It was then intuitive to start the NSJAR project by a detailed study of the SJAR architecture. That was a pre-development stage when many SJAR ideas were incorporated to the NSJAR project.

The NSJAR development was an opportunity to include new functions and queries, and also to redesign the user interface in order to make the software operation friendlier for the inspectors. Also, some validation rules that were written in the programming of the previous software are now incorporated in tables, that can be easily configured in the software by the accounting officers.

This makes NSJAR more versatile when something changes in the configuration of the Material Balance Areas (MBAs), like for example, the average values for nuclear losses and nuclear productions that the software uses to calculate the inventory in the update period for item facilities. Instead of changing these average values in the programming, now these values are imported from ABACC´s General Database. Thus, if these average values happen to change it is possible to easily configure them in the General Database, so the next audit in that particular MBA will run with these average values changed. It is no longer necessary to touch the programming for configuration purposes. Some other parameters that can be configured in the General Database and used in the NSJAR include: category units, kind of facility (bulk or item), alert values for measure discards, etc.

Some of the milestones achieved during the development of NSJAR are:
- May 2018: presentation of the NSJAR conceptual project to the IAEA;
- May 2019: first NSJAR version issued for testing;
- October 2019: presentation of NSJAR to Argentina, Brazil and IAEA – first version for IAEA testing;
- January 2020: training of two IAEA inspectors in the NSJAR operation – first joint training for ABACC/IAEA inspectors for the audits planned for February 2020;
- Year 2020: all accounting audits carried out with NSJAR jointly with IAEA;

- October 2020: issued the Procedures for Joint Use of NSJAR - Sent to the IAEA for comments;
- November 2020: revised version of the procedures sent to the IAEA together with the last version of NSJAR;
- December 2020: formal acceptance of NSJAR and its procedures by the IAEA.

The IAEA has designated one expert to interact with ABACC during the development of NSJAR. This expert tested the software and was also responsible to provide training on the use of NSJAR for the IAEA inspectors.

A few modifications were introduced as the result of ABACC and IAEA interaction during the tests. Some of these modifications were done specifically for IAEA purposes, like access rights for running the software in its notebooks, and modifications to the output reports and files used by IAEA.

The software continues to be updated based on some feedbacks received from ABACC and IAEA inspectors, or when the accounting officers want to make improvements. Every time the software is updated, ABACC agreed to send this new version to IAEA as soon as possible. The IAEA then test and install it in its notebooks used for inspections. This way both agencies are always in conditions to run the software in its own notebooks, which also means a backup machine in case the selected one fails.

3. THE NSJAR

When there is a scheduled audit mission, ABACC´s Accounting Officers are responsible to prepare the data media that will be used by the inspectors during those audits. This media, usually an USB flash drive, contains one file that is downloaded from ABACC´s General Database, with data for each MBA, related to the mission such as: MBA codes, inspection numbers, inspection types and predicted audit dates. Moreover, for each MBA, the file presents data regarding the final inventories verified in the previous inspection, the reported inventory changes for the present audit period that need to be verified against the records and support documentation, and any follow up instruction from previous audit periods to be verified.

At the beginning of the audit activity this media is connected to the selected working notebook of any of the agencies. The inspector starts the NSJAR software and loads the file to the hard disk. Figure 1 shows the audits for each MBA present in the media that are uploaded to the hard disk. There is a color code indicating which nuclear material categories are present for each MBA. This code also appears in other areas of the software. The red color shows that such audits have not started yet. Later, as each audit progresses, the red may turn to yellow indicating the audit has already started but not yet finished, and in the last stage when that audit is completed it will turn to green.
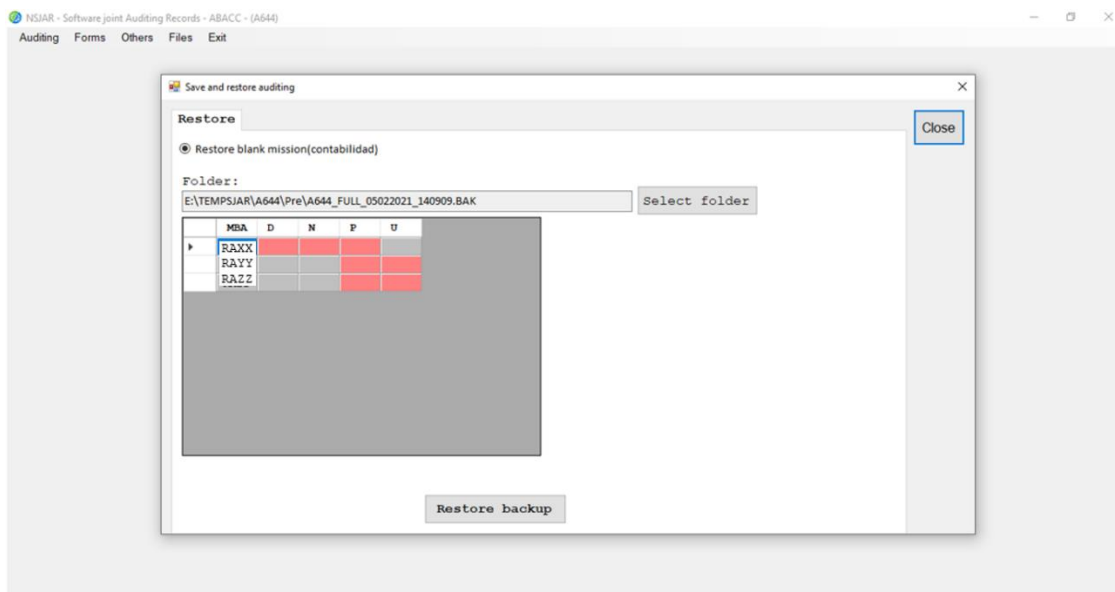
Figure 1. Audit upload from the media to the hard disk

The next step is to close that window and then select the MBA to perform the audit, following the joint procedure. Figure 2 shows the window where the inspector selects which MBA will be audited.
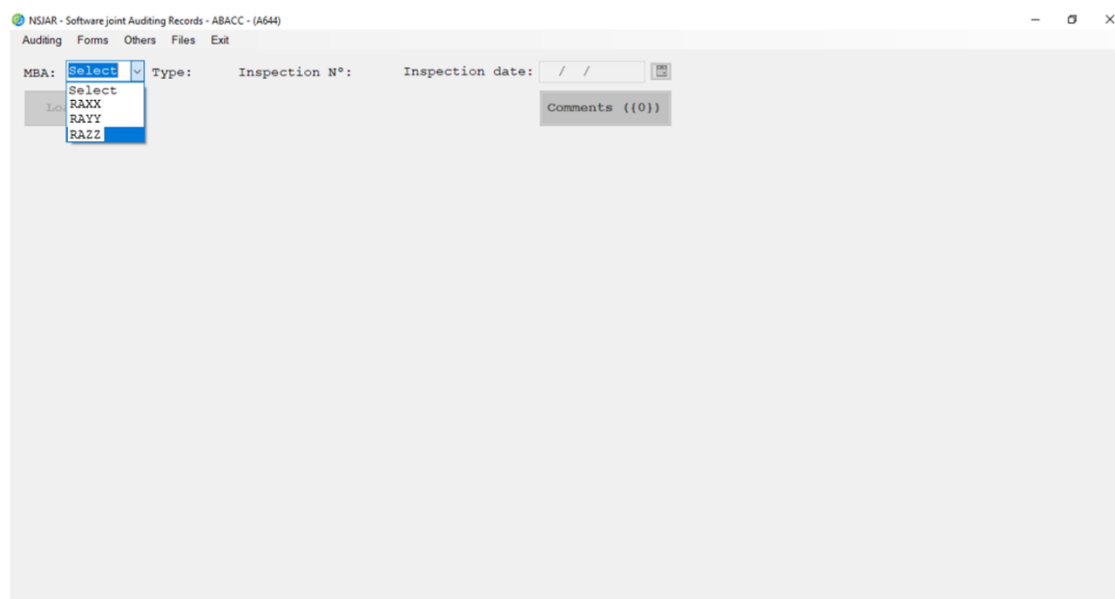

Figure 2. Selection of the MBA to be audited

In the subsection 3.1 the main features of NSJAR are described. As mentioned earlier, the NSJAR user interface is quite different from its predecessor, despite the main features remain similar. This was done on purpose since the previous software always worked satisfactorily, and that is why it was reverse engineered to help create the NSJAR.
In the subsection 3.2, the major differences and improvements introduced with the NSJAR are then described.

3.1 Main Features

After the MBA selection is made the following information is shown as seen in the head of Figure 3:
- "Type" stands for the inspection type (INT for interim inspections and PIV for physical inventory verifications);
- "Inspection nᵒ" is the ABACC inspection number. It is a sequential number for each inspection;
- "Inspection date" is the date the audit is being made and "Book closing" is the finish date for the accounting verification. This last date is calculated by the software based on the inspection date and type.

Below this information line there are some buttons:
- "Load VR-C": This button allows that VR-C information be loaded from a *.txt file when available;
- The category buttons appear to the right side of the Load VR-C button. The inspector clicks on these buttons to start the audit for that category of nuclear material. These buttons can be red in case the audit has not started, yellow if it is in course, or green if the audit is finalized for the category;
- "Comments": This is a button to access an area where the inspectors can make comments related to the audit, or it can be used by ABACC accounting officers to transmit instructions to the inspectors normally related to accounting follow up actions. In case there are pre-loaded comments by the ABACC officers, the comments window will pop up automatically when the nuclear material category is selected to initiate the audit;
- Figure 3 shows a VR-A example for an interim inspection. When the inspection type is a PIV, one button more appears in the right side of the Comments button. This button is the "Load list" button. When clicking this button the inspectors can load an inventory list *.csv file when available. It is highly recommended to load such file because the software automatically checks it for consistency, and its total is automatically transported to VR-A line 7. In case that there are mistakes in the inventory list the system alerts the inspector, and they can be corrected.

The NSJAR audit process is based on the completion of three forms in order to successfully finalize the audit for each nuclear material category:
- **VR-A:** this form is used to record the inventories taken from operator´s ledgers, and the totals transported from the other reports VR-B and VR-C. It is a summary of the accounting audit. Figure 3 shows an example of the VR-A form. This particular example is for a Nuclear Power Plant for which the number of items is controlled. For this kind of MBA, the inventories on the inspection date (line 9 in the VR-A) are calculated, based on the number of items entered in the sub form in the right side of the VR-A (Update Period). So, for example, if irradiated fuel elements happen to be discharged from the core during the update period, the software will calculate the inventory at the inspection date (line 9), based on average values for nuclear losses and nuclear productions stored in the software. It can be noted that the first cell in line 2 is blue. Line 2 will house the inventory values taken from the Operator´s General Ledger at the closing date of the previous inspection. Every time a VR-A cell is blue it means the software is waiting data to be entered. The software itself guides the inspector through the tasks to be completed in the VR-A form. When all inventory values are entered the software enables the VR-B and VR-C buttons on lines 4 and 5. After verifying the data in VR-B and VR-C forms, each total is transported to lines 4 and 5 on the VR-A, respectively. After that line 6 is calculated and compared to

line 7, which is the inventory at the closing date of inspection taken from the Operator´s General Ledger. If lines 6 and 7 match, then the audit for that category is completed.

Figure 3. VR-A form

-   **VR-B:** this form contains all the inventory changes belonging to the audit period that were already reported to ABACC and the IAEA. Each line contains a second blank line in case a correction to any field is required. The inspectors compare this information against the ledger and support documents and click the checkbox "Verified". An audit code is automatically assigned to each inventory change depending on whether this line was corrected or not. Figure 4 shows an example of the VR-B form showing a correction made to the date of line 2 assigned with verification code N2. All codes different than N0 get marked as an accounting follow up action in the Central Database waiting for a correction ICR;

Figure 4. VR-B form

- - **VR-C:** normally this form is empty before the audit starts. It will contain all the inventory changes belonging to the audit period that were not yet reported to ABACC and IAEA. Also, this form is where corrections to inventory changes are recorded if the original line is not included in the VR-B. Figure 5 shows an example of the VR-C form. Normally the verification codes here are M3, in case of an inventory change that is not delayed, or M4 in case it is delayed according to the INFCIRC/435 timeliness for accounting reports time of dispatch. Since all these M3 and M4 lines have not yet been reported through an ICR, they also get marked as an accounting follow up action in the Central Database waiting for the respective ICR.

Figure 5. VR-C form

Figure 6 summarizes the NSJAR audit model for better understanding the VR-B and VR-C forms in the timeline. The auditing period is defined between the book closing dates of the previous and the current inspection. It may contain data that were already reported to ABACC and IAEA on the inventory change reports (ICRs), and data that has not yet been reported. During the audit, the inspectors will have all the informed inventory changes loaded in the VR-B form, and the inventory changes not informed will be entered by the inspector in the VR-C form.
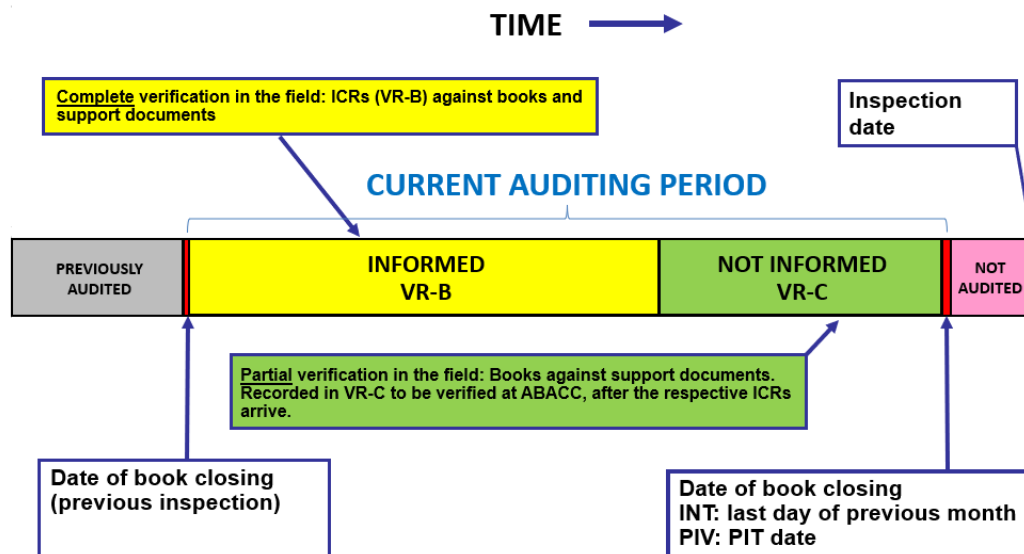
Figure 6. NSJAR audit model

After the audits for all categories finishes, when all category buttons are green, the software automatically generates the databases for the IAEA. This means that a specific folder is created in the media, containing its reports in pdf format and also some txt files, for the IAEA to be able to upload them into its system. After that the inspector can close the software making a backup of the information in the hard drive to the media. Finally, the procedure says to make a complete copy of this media to the media of the other agency. This is the guarantee that both agencies will have the same accounting data at the end of each audit.

When ABACC inspectors return to headquarters, the file containing the results of all audits are uploaded from the data media to the Central Database.

3.2 Major Differences Introduced

By far, the biggest advantage of having a computerized system to perform the accounting audits in the field is the work organization, and the automatization of all accounts, including some data consistency checking. Thus, the following main features could be described:
- Verification of input data – MBA codes, element/isotope mass signals, etc. (VR-B and VR-C);
- Transport of totals and verification of relations between fields (VR-A);
- There is no need for the inspectors to do math (VR-A, VR-B and VR-C);
- The audit cannot be completed in case there is some inconsistency;
- Creates the files to be processed by the software used by IAEA;
- Creates the databases to be processed by the ABACC´s General Accounting System;
- Creates the accounting reports used by ABACC and IAEA (VR-A, VR-B, VR-C, M2/M6 and M5);
- Allows to input accounting data, in electronic format *.txt, to speed up the audit and also avoid typing mistakes (VR-C file);
- Allows to input physical inventory lists, in electronic format *.csv, to check the total and data consistency;

All these features were already present in the previous system. In addition to those, some features that were added to the NSJAR are:

- The audit codes now are automatically entered by the software in the VR-B and VR-C forms;
- All lines in the VR-B and VR-C forms can be seen at the same time;
- Complete view of the VR-A form;
- For item facilities the sub form for the number of items in the update period was redesigned to include the possible movements for the items;
- Generation of alerts in case a measure discard (LD) has an accumulated value greater than the specified in the DIQ or FA;
- MUF values entered in the VR-A form are copied to the VR-C form. No need to repeat this entry in the VR-C;
- Creation of a function that gives an estimate for the material unaccounted for (MUF) evaluation, based on the inventory or the throughput material in the period;
- The inspector can see in table and graphic formats the MUFs of the last 5 years. This way it is possible for the inspector to easily check for MUF tendencies;
- The VR-A forms to printout in pdf format are now generated in a folder in the media;
- The NSJAR generates the IAEA database automatically at the end of each audit.

The new software interface together with these new features allow the software to be friendlier, at the same time that incorporates more tools for the inspector to discuss results obtained in the field. The inspectors, for example, now have tools that allow them to easily see MUF tendencies or be alerted if the accumulated LD is too high and are able to discuss these results in the field.

4. CONCLUSIONS

The main idea behind the development of the NSJAR was to keep up with the rapid changes in the hardware and software available in the market, and also to solve the problem of the lack of support for the elder version. Of course, during the development of the NSJAR some ideas were maintained, mainly the ones related to the validation of data entered.

Others were upgraded like the automated audit codes, or the average values for the inventory calculation in the update period, that now are not any longer written in the programming. Instead, as previously noted, these values are written in tables that are incorporated from the Accounting Central Database, during the preparation of the accounting data for the audits.

There are also some new features introduced in the NSJAR to give more accounting knowledge to the inspectors, such as the alerts for high LD accumulated values or the visualization of MUF tendencies.

When inventory lists are loaded into NSJAR, the system allows the lists to be viewed by some parameters like the nuclear material category, KMP or material code. Using this last view option, the inspectors can have an idea of the stratification of the nuclear material for verification.

One important advantage of this joint auditing ABACC/IAEA system is that it avoids the duplication of activities in the field, and allows both agencies to have an effective software and accurate tool to easily verify the accounting records/reports system during inspections. As a result, the inspectors have a friendlier effective software to work, where they can have a complete view of the task being done, with some tools to support discussions related to accounting issues in the field.

Another aspect is that this system has been routinely used by ABACC and IAEA inspectors since the beginning of 2020, always with positive feed backs from the inspectors. This is particularly good news and highlights the cooperation between ABACC and IAEA.

5. ACKNOWLEDGEMENTS

6. REFERENCES

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