INSPECTION EFFORT AT A CANDU REACTOR

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ABSTRACT

The evolution of the inspection effort spent by ABACC in the CANDU 600 Nuclear Power Plant at EMBALSE is presented. The Plant includes a dry storage for spent fuel bundles. Actions for optimising the inspection manpower during PIV and interim inspections are described. At present most of the inspection effort at the facility arise from the activities for safeguarding transfers of spent fuel bundles from the pond to the dry storage. Alternatives for a further optimisation of manpower in this area are presented.

INTRODUCTION

The EMBALSE Nuclear Power Plant is a 600 Mwe CANDU Reactor situated at Embalse, Argentina. Nuclear Safeguards are applied at the EMBALSE Nuclear Power Plant under two agreements. The Agreement between Brazil and Argentina for the Exclusively Peaceful Use of the Nuclear Energy (Bilateral Agreement) entered into force in December 1991, and the Agreement between Argentina, Brazil, ABACC and the IAEA for the Application of Safeguards (Quadripartite Agreement) entered into force in March 1994. The plant was since its construction under IAEA safeguards pursuant an INFCIRC/66 safeguards agreement.

In 1994, and particularly in 1995, the inspection effort expended at EMBALSE was very high, even higher than the previous ones under INFCIRC/66 safeguards. The main reasons for this situation were the IAEA requirement to re-verify 100% of sealed canisters in every inspection due to a diversion scenario of tunnels (or false concrete walls) and intensive transfers campaigns of spent fuel bundles to the dry storage.

By the end of 1995, ABACC and the IAEA agreed to create a Working Group (WG) to investigate methods in order to improve the effectiveness and efficiency of the applied safeguards. It was intended to embrace in the analysis both the current safeguards practices and activities as well as the possible application of new safeguards technologies, such as Unattended and Remote Monitoring Systems. The implementation of the recommendations of the EMBALSE WG has been having relevant impact on the inspection effort, whose evolution is presented in this paper.

THE EMBALSE NUCLEAR POWER PLANT

The EMBALSE Nuclear Power Plant started operating in 1983. The main features and characteristics of a typical CANDU 600 Reactor are well known/1/. In addition, the EMBALSE NPS produces Co-60 for medical and industrial applications. In 1993 a dry storage was built to extend the storage capacity of spent fuel bundles at the facility. The dry storage consists of concrete shielded canisters, each canister capable of containing up to 9 baskets. The basket design is such that up to 60 spent fuel bundles can be loaded and, therefore, each canister can safely store up to 540 spent fuel bundles, with a cooling time usually of more than five years. Of the planned 240 canisters, 80 have already been constructed.

THE EVOLUTION OF THE INSPECTION EFFORT

The inspection effort in Person-Days of Inspection (PDIs) spent by ABACC at EMBALSE in the last four years is presented in Table 1. Similar figures apply to the PDIs spent by the IAEA, therefore the total number of PDIs spent by both organizations are approximately twice the values indicated in Table 1.

Table 1: ABACC Inspection Effort at Embalse, 1995 –1998

	PDIs/YEAR			
ACTIVITY	1995	1996	1997	1998
Timeliness Inspection	64	91	35	31
PIV Inspection	55	18	14	10
Spent Fuel Bundles Transfer Campaign	183	181	144	113
Cobalt Transfer	21	2	21	18
TOTAL	323	292	214	172

In the first column, one can observe the high inspection effort expended in 1995. The reasons for this situation were:

- In every inspection, the sealed canisters should be 100% re-verified because of a diversion scenario of tunnels or false concrete walls. (this was an IAEA requirement due to outstanding design verification of half of the storage canisters)
- The verification of the initial inventory under the Quadripartite Agreement; and
- A peak situation in spent fuel bundle transfer campaigns to the dry storage, covered by two inspectors of each agency by shift.

Regarding the design verification of the canisters, radar tests carried out during 1995 by the IAEA with the support of a Member State and the collaboration of Argentina concluded that the canisters were acceptable for the application of dual C/S measures. The full implementation of the dual C/S system on the dry storage canisters permitted a strong reduction of PDIs in 1996 during PIVs (from 55 to 18 PDIs) and interim inspections in 1997 (from 91 to 35 PDI).

The 1996 Physical Inventory Verification (PIV) was the first one carried out with the canister dual C/S system fully implemented. The implementation of the dual C/S system was the main reason for the reduction of the inspection effort at that time. In addition, the surveillance tape review using the newly implemented MORE review station had significantly reduced the time necessary to carry out this activity.

In 1997 ABACC and the IAEA agreed on the Guidelines for Coordination of Ad-hoc and Routine Inspections that have the potential for improving the overall inspection efficiency. The inspection teams of both organizations coordinated their inspection activities using the same facility-specific instruments and equipment. Procedures for the common use at EMBALSE of the following equipment have been agreed upon: COBRA seals, VACOSS seals, MUX Surveillance System, Portable Multi-channel Analyzer (TeCd) for verification in the pool and

canister, MORE Review Station, MUX Surveillance System, Hungarian Telescope and Spent Fuel Verifier.

In 1999, using one inspector per organization per shift, a further reduction of the total PDIs spent by each organization at the facility during transfer campaigns is expected. This is possible because the Operator accepted not to overlap safeguards-related activities. In addition, if by chance an inspector becomes unavailable the transfer campaign must be interrupted until a replacement arrived at the facility. The time limit to replace an inspector was established up to two working days.

During the spent fuel bundle transfer campaign carried out between April and June of 1999, one inspector of each organization satisfactorily performed the safeguard's activities. That means an additional saving of about 40 PDIs. This campaign is foreseen to continue from September until November of 1999. It is expected to reduce significantly the figures showed in Table 1 for inspection effort expended by transfer campaigns.

FUTURE DEVELOPMENTS

Procedures for the common use of equipment were agreed between ABACC and the IAEA, as describe above. In the next future is foreseen the full implementation of all such procedures. This requires training of ABACC inspectors, especially in relation to the use of MUX Surveillance System and Bundle Counter, with the cooperation of the IAEA.

Further improvements of the current practice are still possible. The safeguard's activities related to discharge and transfers of Co-60 were not analyzed and that could be an area where improvements may also be possible.

The application of Remote Monitoring System (RMS) is considered the area where significant reductions of safeguards manpower can be achieve. Argentina jointly with the USA DOE started in 1995 the development of a RMS for the canisters that later was extended to the transfer campaign. In this context, the EMBALSE WG prepared performance requirements for a RMS, which was used for a preliminary evaluation of the design status of the RMS as of April 1998. The evaluation was done considering only the functional part of the performance requirements and was aimed at a preliminary appreciation of the basic conceptual design. The results indicated that system improvements were necessary. This process assisted the designers in the design development, the problems identified are now addressed by the RMS project, solutions have been proposed and corresponding activities included in the project schedule.

CONCLUSIONS

The cooperation between ABACC, the IAEA, the Argentinean National Authority and the Operator led to a rationalization of the safeguard's activities at EMBALSE Nuclear Power Plant, in particular for the spent fuel bundles transfer to the dry storage. As consequence, the inspection effort expended at this facility could be strongly reduced. Some safeguard's activities offer potential for further reduction of safeguards manpower.

REFERENCES

/1/ Safeguards Technical Report STR-208 (“Safeguarding Nuclear Material at CANDU 600 Reactors”, February 1986)