

INB's uranium enrichment plant: testing and installation of the DMOSS surveillance system by the ABACC
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Immediately after the first negotiation meeting aimed at establishing the safeguards approach for the isotopic enrichment commercial plant of Indústrias Nucleares do Brasil (INB), the ABACC was in charge of providing the surveillance system to be installed in that facility, following the directions set forth in the "guidelines for the coordination of inspection activities between the ABACC and the IAEA" approved in 1997.

In order to comply with this task, the ABACC had to select the surveillance system, perform the laboratory operational tests and install the system before the start of the routine operation of the first cascade of the plant, whose licensing process had been scheduled for the first semester in 2004.

The selection of the surveillance system was quite complex because, when the negotiations were started, there was not a clear picture of the safeguards measures that would be applied in the facility. The spectrum of possibilities was very broad because it depended on the configuration conditions. On the other hand, there was a need to install the surveillance system at the feed and withdrawal facility, as well as to establish the necessary measures to strengthen unannounced access to the cascade hall. These two situations led to highly different alternatives, such as the implementation of a permanent perimeter, unannounced accesses with transitory perimeter or permanent control of strategic points and/or only restricted to the permanence of the inspectors during unannounced inspections.

In addition to these alternatives, there was a need to consider the fact that, throughout several years, there would be cascades in routine operation parallel to others still in their licensing and construction stages, as well as the probability that, in addition to a permanent feed and withdrawal station, there would be a smaller temporary station operating, simultaneously, with its associated strategic points. Considering that this was an evolving project, some of the operational criteria would remain under discussion in an attempt to find solution to optimize the routine operation through the addition of new cascades.

In spite of the lack of definitions, there were five features of the surveillance system that were neatly clear:

1. the system had to be very reliable because, in this type of facilities, in case of loss of surveillance, the re-verification of the cylinders would not restore knowledge in a way allowing to cover all the deviation scenarios;
2. the system had to be capable for remote transmission of its state of health, as a minimum;
3. the storage capacity had to be appropriate for any of the possible alternatives;
4. the system had to support, at least, five or six cameras set up in different operating modes;
5. the system configuration had to be versatile enough to allow for any of the potential configurations.

In order to select the system, the ABACC chose the hypothesis of a continuous perimeter, including cameras at the main gate to capture, every ten seconds, all entrance and exit movements. At the temporary feed and withdrawal station, two cameras would be installed, while at the main station, VACOSS seals (Variable Coding Seal System) would also be installed as containment devices for process cylinders,

connected to trigger the cameras. Finally, the system would also have cameras connected to VACOOS seals in emergency exits.

The system pre-selected by the ABACC for the most conservative conditions was the Digital Multi-Channel Optical System (DMOS), considering that it included very versatile technical features, such as:

1. the use of DCM-14 (Digital Camera Module 14) type cameras, which are highly reliable and in whose installation and operation ABACC had a five-year experience;
2. high system storage capacity, enough to store, as a minimum, the information corresponding to two consecutive surveillance periods in the server;
3. maximum data redundancy. The system provides storage capacity in the cameras' flash memories, in the redundant disc array, and in two independent DLT (Digital Linear Tapes) tape units;
4. the server is equipped with redundant power supplies. Additionally, each of the camera management modules is connected to different power supply busses, allowing the cameras to remain energized, even in case of UPS (Uninterruptible Power Supply) failure;
5. the system's software allows for remote monitoring applications through the Windows NT's remote access service (RAS), which is compatible with several types of communication hardware and network protocols;
6. the server can generate file and directory structures that allow image storage in different folders, with differentiated periods, so as to satisfy the requirements for both interim and unannounced inspections simultaneously, for those cameras monitoring strategic points;
7. the camera's communication and power wires are electrically isolated from the server;
8. capability to connect a large number of cameras.

Before purchasing the equipment, ABACC asked Sandia National Laboratory personnel to perform tests for a system equipped with nine cameras triggered by a door opening/closing device. It was also requested to test the system with some cameras configured in ten-second and others in three-minute intervals, and also to estimate the time required for their review. The results obtained were satisfactory.

The ABACC purchased the system in 2003 and subjected it to laboratory tests during one year —while the state of health remote data transmission was also tested. At the same time, the negotiation of the safeguards approach continued and evolved until an approach was reached that does not require any perimeter but in which the surveillance system plays a very important role. In this new approach, the purchased system does not imply any limitations to the cameras monitoring the strategic points and will allow their connection with the interface that records the closure and opening of the VACOOS seals at the feed and withdrawal station, complying, simultaneously, with the requirements of both the interim and unannounced inspections; additionally, the number of cameras required for the licensing of new cascades is not limited, while the system is reliable and allows for a simple application of remote data transmission.

The system was installed at the facility in early 2005. By October, the six-month period for field tests, required for its routine use for safeguards purposes, will have elapsed.

On the other hand, in September this year, the first cascade will start its routine operation. The ABACC achieved its initial goal of installing and commissioning the DMOS. Now, the expectations are that, in the future, the results will confirm the virtues of the system.