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"RADAR": EURATOM'S STANDARD UNATTENDED DATA ACQUISITION SYSTEM

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The physical verification of nuclear material is an essential part of Euratom's inspection activities. Industrial plants handling large amounts of bulk material typically require large numbers of measurements. Modern plants, particularly plutonium-handling facilities, are normally automated and make it difficult for the inspector to access the material. Adapting to the plant requirements with respect to safety and security as well as economics (throughput), safeguards instrumentation is today often integrated into the plant. In order to optimize scarce inspection resources, the required measurements as well as the data analysis have to be done automatically as far as feasible.

For automatic measurements Euratom has developed a new unattended data acquisition system, called RADAR (Remote Acquisition of Data and Review), which has been deployed to more than a dozen installations, handling more than 100 sensors (neutron and gamma radiations detectors, balances, seals, identity readers, switches, etc.). RADAR is the standard choice for new systems but is also replacing older automatic data systems slowly as they become outdated. RADAR and most of the associated analysis tools are the result of an in-house development, with the support of external software contractors where appropriate. Experience with turn-key systems led, in 1997, to the conclusion that in-house development would be a more effective use of resources than to buy third party products.

RADAR has several layers, which will be discussed in detail in the presentation. The inner core of the package consists of services running under Windows NT. This core has watchdog and logging functions, contains a scheduler and takes care of replicating files across a network. Message and file exchange is based on TCP/IP. The replicator service contains compression and encryption facilities, the encryption is based on PGP. With the help of routers, e.g. from CISCO, network connections to remote locations can be easily established. *Remote transmission* of files to headquarters via public networks has been started in some cases on a field test basis.

The sensor control is done with a fully modular layer of Data Acquisition Modules (DAM). They have been developed for many different device types, new ones can easily be added as required. A dedicated DAM handles all control commands for a given sensor. Data are stored in data files, alarms can be created as necessary and relevant technical information, including device settings, is stored in logging files.

For the analysis of the files, several tools have been developed. For the **technical review**, the *Global Surveyor* package is being developed and tested. It allows the concerned inspector or technician to quickly get an overview of the status of the system. The Global Surveyor checks the completeness of data files with periodic entries and it compiles messages contained in the log files. A filtering tool allows to concentrate on particular messages.

The analysis of the data files can be done with a variety of software tools.

Raw data review can be done with *ViewDAM*, which allows to visualize the contents of data files. For quantitative analysis for the first RADAR implementation in a MOX facility, a tailored system was developed (ref. 1). It allows the analysis of measurement data from a neutron coincidence collar and the comparison with operator declarations.

For **general data review applications**, a data evaluation package is being developed, *CRISP* (Central RADAR Inspection Software Package). By design, this is a powerful data base system which will allow the inspector to handle complex multi sensor systems. In big automated Pu handling facilities, the number of relevant material movements and measurements can be very large and manual analysis of the data is time consuming and sometimes hardly feasible. CRISPs aim is to help the inspector by doing a fully automatic data analysis and comparison with operator declarations, thus optimizing inspection resources. Typically quantitative measurements are done not only with one single sensor but with a combination of sensors. An example is the measurement of a can with PuO2 powder. At the measurement point one will often find an identity reader, a gamma spectrometer and a neutron coincidence counter, sometimes also a balance, switches and other sensors. At such a Point of Interest (POI) a large number of files are created and the task of CRISP is to do data reduction, correlate the data from the different sensors, check for completeness, analyze the data (e.g. with MGA for the Pu isotopic analysis) and compare them with the operator declaration. Under ideal conditions, the inspector will then receive a completed report with a comparison between operator declarations and measurements and will be alarmed if moves happened which were not declared or if declared moves did not happen.

CRISP has an XML interface for the introduction of operator declarations, which come in a variety of formats and also allows for the application of external algorithms to analyze the data. This widens the possible scope so that practically all sensors can be analyzed if analysis algorithms exist.

One user *interface* of CRISP will be demonstrated.

REFERENCES

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