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MANAGEMENT INFORMATION SYSTEM APPLIED TO RADIATION PROTECTION SERVICES

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ABSTRACT

An effective management information system based on technology, information and people is necessary to improve the safety on all processes and operations subjected to radiation risks. The complex and multisource information flux from all radiation protection activities on nuclear organizations requires a robust tool/system to highlight the strengths and weaknesses and identify behaviors and trends on the activities requiring radiation protection programs. Those organized and processed data are useful to reach a successful management and to support the human decision-making on nuclear organization. This paper presents recent improvements on a management information system based on the radiation protection directives and regulations from Brazilian regulatory body. This radiation protection control system is applied to any radiation protection services and research institutes subjected to Brazilian nuclear regulation and is a powerful tool for continuous management, not only indicating how the health and safety activities are going, but why they are not going as well as planned showing up the critical points.

Key words: radiation protection, management information system, nuclear organizations, health and safety.

1. INTRODUCTION

Developing an Information Management System focused on issues of Radiological Protection is essential for the management of activities undertaken in Nuclear Institutes and Research Centers. Such control system shall consist of a network of communicating channels inside the organization in order to support decision making, functional and strategic establishment of relevant goals, monitoring results and performance and evaluation of success rates.

The Geographic Information System is an important incorporated technology, georeferencing information and data to reach a qualified spatial and geographic assessment. The Geoinformation/Geodata offers way of relating information to geographic location such as levels of radioactive aerosols in an environment, positions of sealed sources within laboratories, operational state of the area detectors, personnel traffic in the buildings and several other valuable information.

The objective of this project is to present an Information Management System focused on issues of Radiological Protection Services on Nuclear Institutes and Research Centers. Such kind of distinct knowledge control is valuable aiding management information and the decision-making regarding to health and safety aspects of nuclear organizations.

The presented prototype of the Management Information System developed to Radiation

Protection Services was the result of an extensive assessment of the needed parameters and data and was structured based on the Brazilian regulatory framework for radiation protection services [1] and some other national and international standard and recommendations were also considered [2, 3, 4, 5, 6, 7].

The management information system performs a generic approach to all relevant radiation protection issues and tasks. This radiation protection control system can be implemented on any nuclear organization by reediting the non restricted parameters which could differ considering all facilities and laboratories expected on-site with various applications and technologies.

This system can be regarded as a powerful tool applied on the continuous management of radiation protection activities on nuclear organizations and research institutes as well as for long term planning, not only indicating how the safety activities are going, but why they are not going as planned, showing up the critical points.

2. MANAGEMENT INFORMATION SYSTEM ON RADIATION PROTECTION

The system enables performing and modernize the actions developed in aspects of radiological protection in an optimal and safe way. It includes control and monitoring of radiation protection data, routine procedures, documents, reporting of data and situation. Several interactions points settled by the user allow an easy navigation and data recovery on all database.

To meet the requirements of the Brazilian regulations for radiation protection activities and assure the continuous management of the performed activities, the management information system is structured as bellow:

- Workers Control;
- Restricted Areas Control;
- Environment and Public Radiation Control;
- Radiation Sources Control;
- Radioactive Waste Control;
- Equipment Control;
- Workers Training;
- Registers and Record Keeping.

These main topics are accessed by search tools to reach the sub screens witch previews several interactions for these secondary level and stratified screens. It is also possible add, edit, load, access, actualize, exclude, compare, assess, copy, move and transfer data. The core database system also previews interaction to import and export information from and to other external databases.

Interactive search and editing tools allows an effective and easy interaction of the user with the software database, where the searches and editions can be done in a multidirectional and cross linked way attribution. The data can be managed by a net structure where the same data/information can be reached by several logical ways.

The system is structured as presented below:

Transactional processing

To maintain the Integrity of the database in a known, consistent state, by ensuring that interdependent operations on the system are either all completed successfully or all canceled successfully. It features data storage contemplating basically:
- Collection, standardization, and validation of data entry;
- Storage and retrieval of data;
- Issuance of requests or operational reports.

Analytical Processing

Is characterized by the consolidation of data covering basically:
- Recovery, handling, storage and display of data to a given reality;
- Establishment and analysis of relationships between data and facts occurring;
- Interactive consultations, analysis of procedures and subsequent deepening low levels of detail on a mainstay of specific information.

The Figure 1 presents schematically the flux of information, processing database and the ways to load, edit and recovery the data.

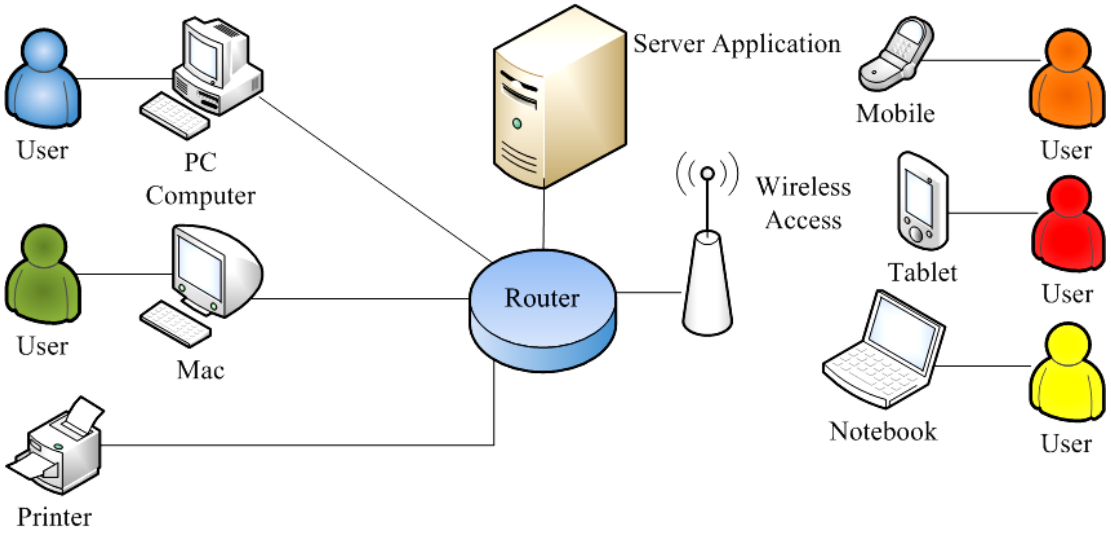

Figure 1. Flux of data and information on the management information system.

Data collection is done through hardware and software that integrate data, people and institutions in order to make possible the storage, processing, analysis and distribution of information increasing the security.

Some examples of parameters assigned for instance to the individual monitoring functions are:

- Records of external exposure (dosimetric film, TLD, daily dosimeter electronic reading, dosimetric rings and bracelets);

- Records of external contamination and internal contamination (fecal count, length, etc.) recording their values, date of completion and when required amounts accumulated dose over a period of 1 year;
- Records of accidents / incidents radiological, description of the event, staff involved, actions taken, observation and indication of a aware supervisor;
- Records of accidents / incidents non-radiological, description of the event, staff involved, corrective / preventive actions taken, observation and indication of a aware supervisor;
- Records of preventive and corrective maintenance performed, maintenance item, description, comments, etc..;
- Records of periodic tests conducted in controlled and restricted areas, containing a list of items to be tested weekly, monthly, semi-annually and annually, indicating compliance or non compliance, date of testing, responsible (Operator and Radiation Safety Officer), observations and comments on the performance of the tests;
- Records visitors and customers accesses containing date, time of entry and exit, the total time of the visit, incorporated dose, justification, company name, name of the visitor.

2.3. The main screens and its contents

In this section will be present the main screens and some of its functionalities and contents.

The Fig. 2 shows the worker editing screen which includes additional links assigning its individual dose and intake monitoring (detailed on Fig. 3), training, areas with authorized access, notes, attachments, health certificates and other relevant information.

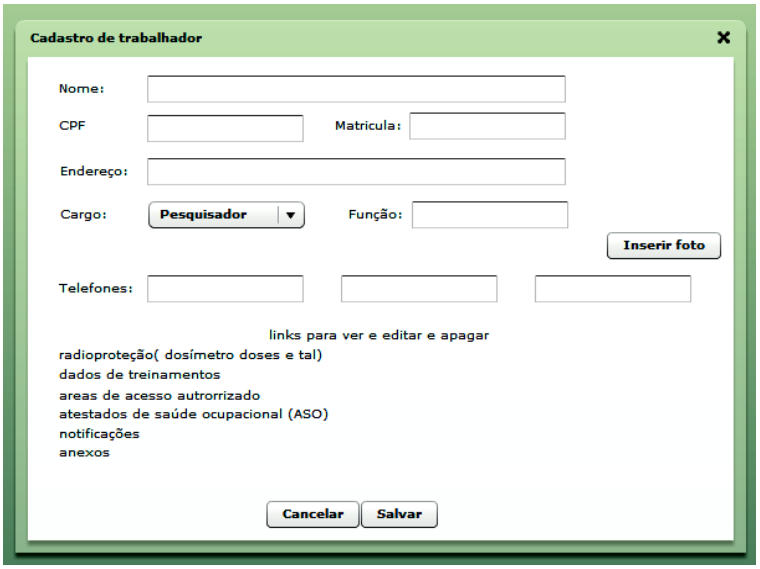

Figure 2. Worker editing screen.

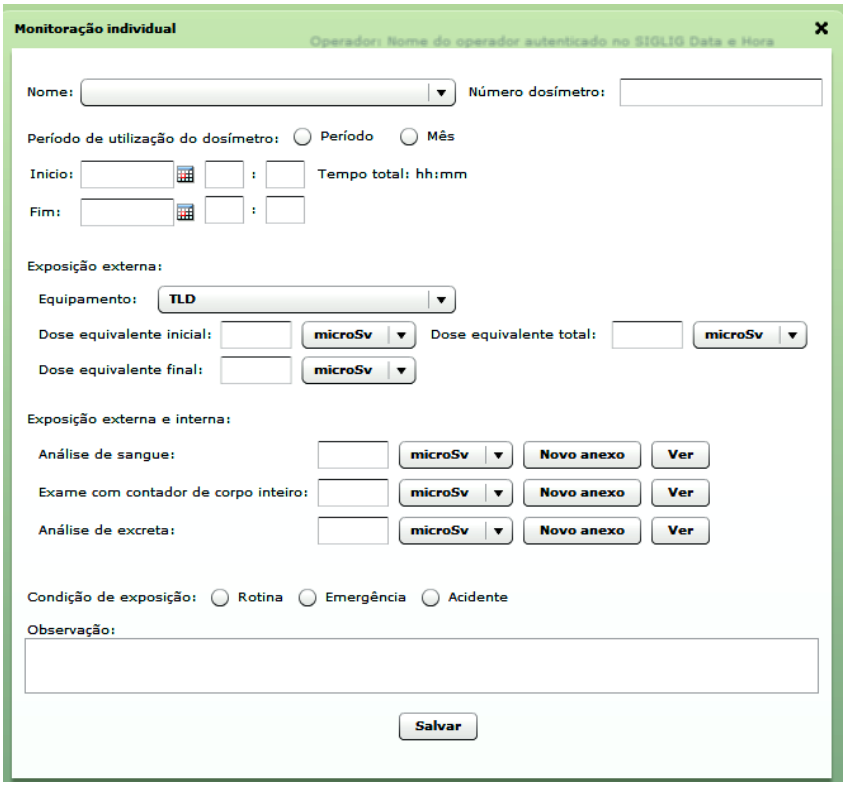

Figure 3. Individual dose and intake monitoring editing screen including reports and record keeping.

The Fig. 4 presents the restricted area control editing screen which includes its identification, assessment of related safety conditions, drawings, maps, radiological survey, attachment of safety related documents as safety assessment report, operating license, list of people with authorized access and responsible radiation safety officer or adviser.

A detailed restricted area access control editing screen is presented on Fig. 5 that includes the registry of individual dose monitoring during the access, total duration and responsible for the access authorization.

The Fig. 6 shows the function points related to radioactive waste management and control, based on the regulatory body requirements [3].

Fig. 7 presents the Radiation Sources Control editing screen.

The equipment, including its main functional characteristics, applications, status, maintenance, calibration and other historical information are presented on Equipment Control editing screen, Figs. 8, 9, 10 and 11.

Environmental and Public Radiation Control is also approached by this management information system. The control of the doses to the public, adopted methodologies, measurement techniques, established limits for releases, surveillance programs and countless related information can be easily accessed and edited by authorized personnel.

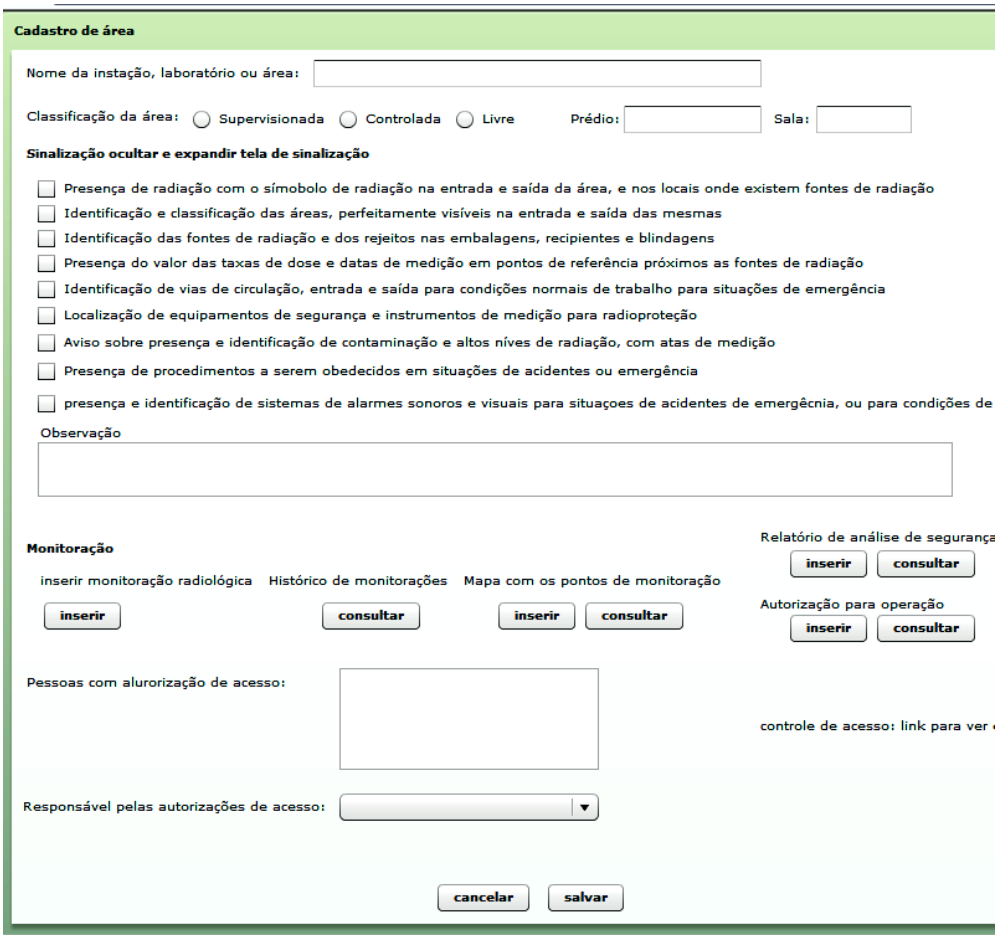

Figure 4. Restrict area control editing screen.

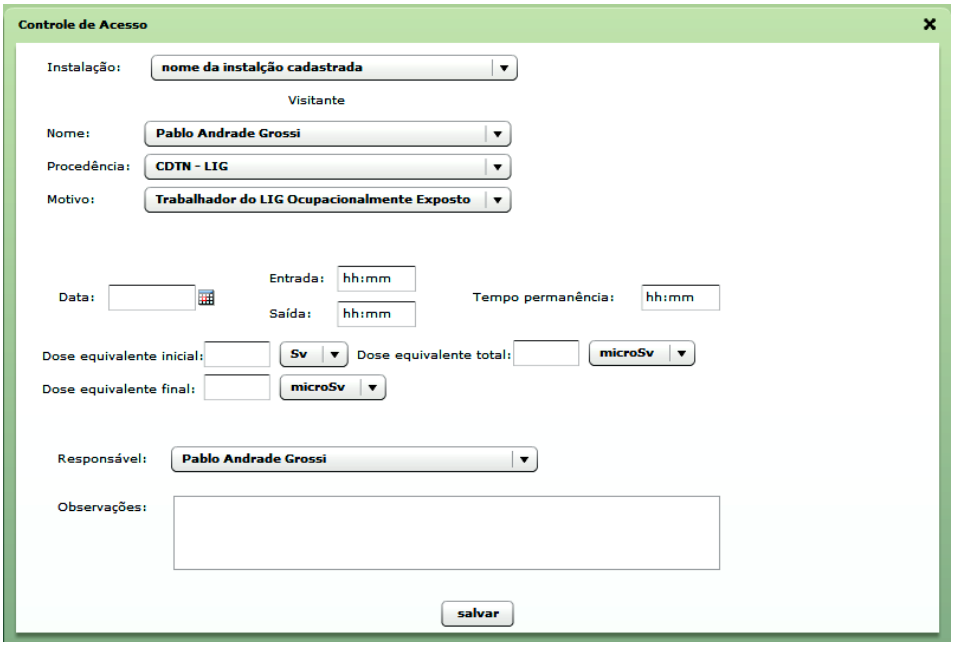

Figure 5. Restrict area access control editing screen.

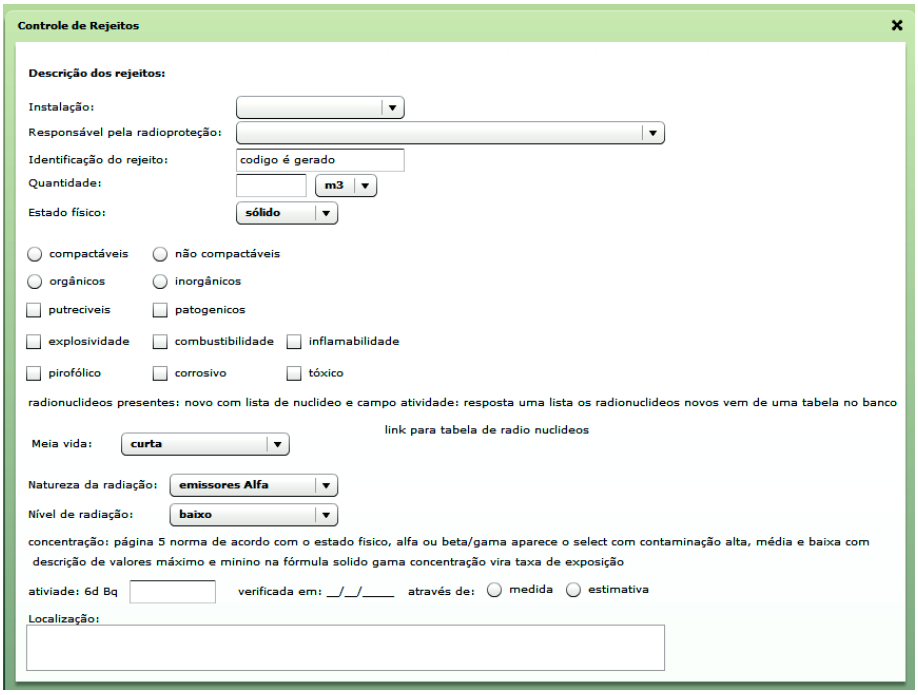

Figure 6. Radioactive waste control editing screen.

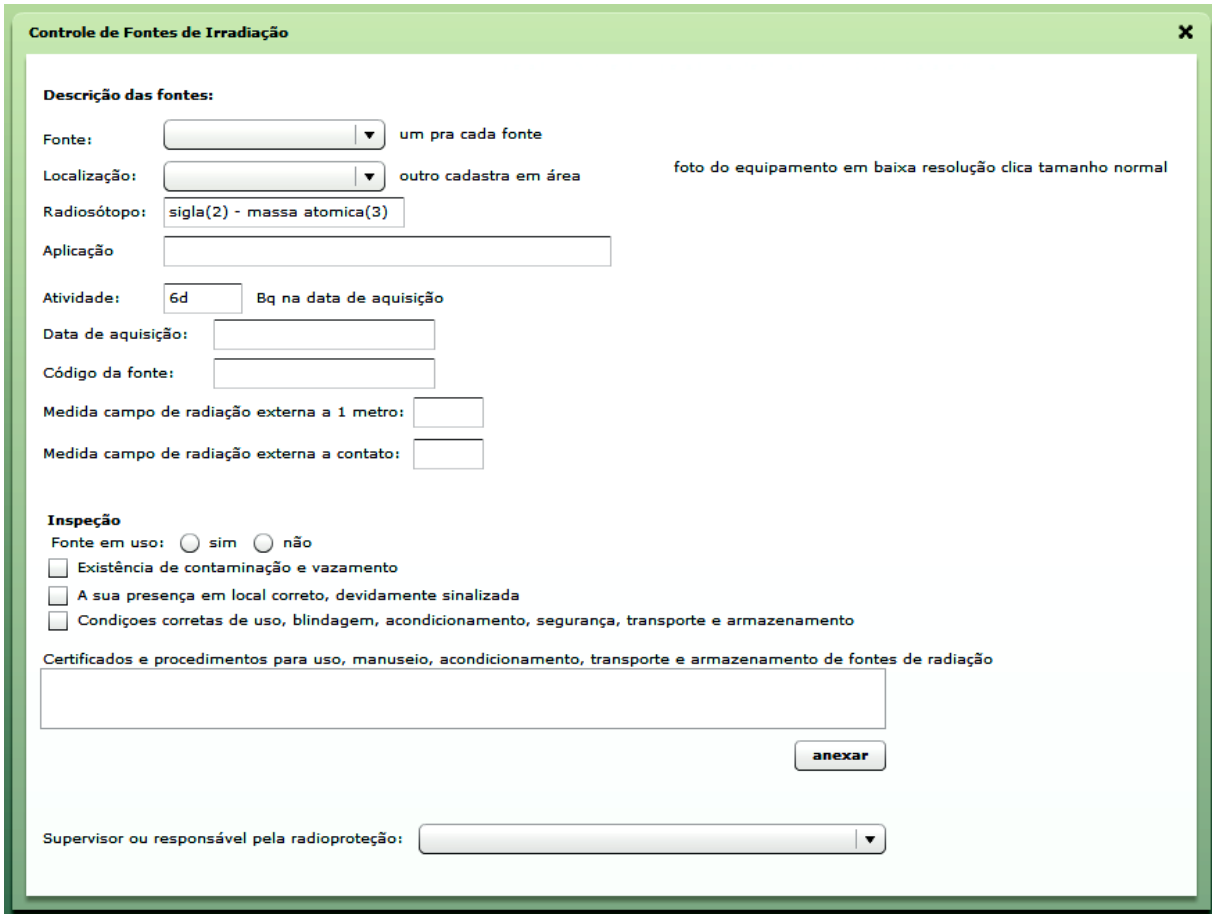

Figure 7. Radiation sources control editing screen.

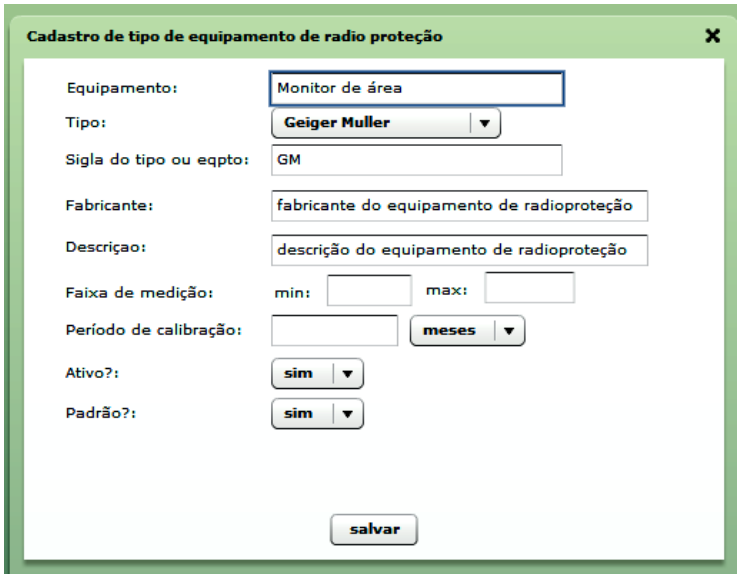

Figure 8. Equipment control editing screen

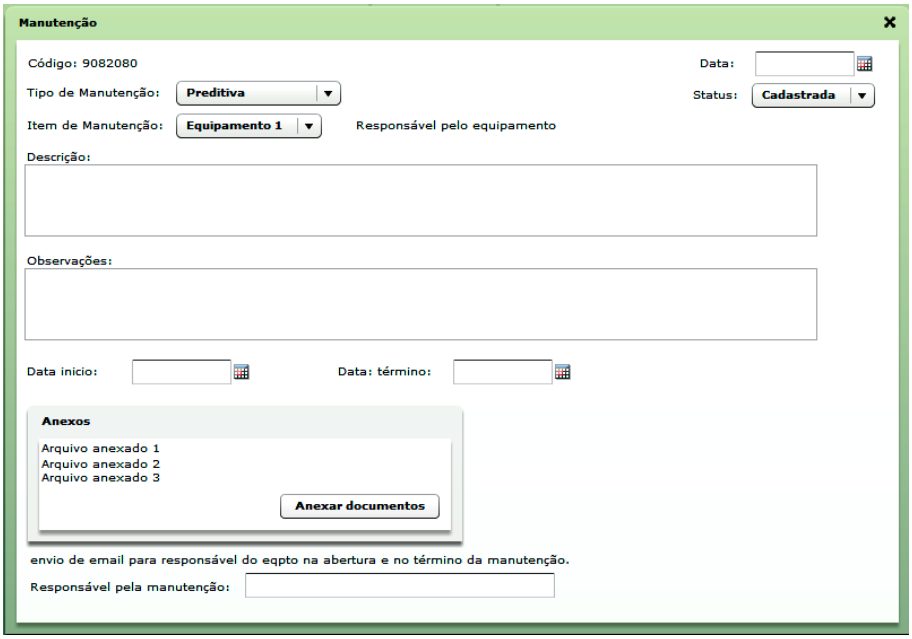

Figure 9. Equipment maintenance screen including record keeping.

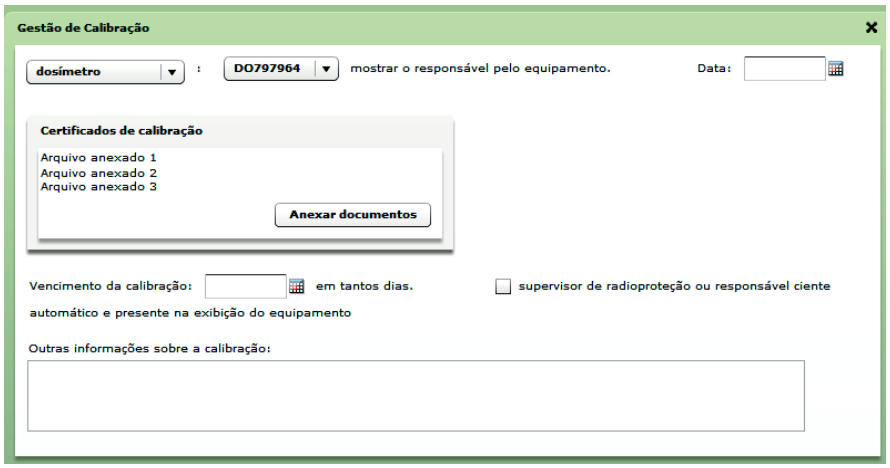

Figure 10. Equipment calibration control editing screen including record keeping.

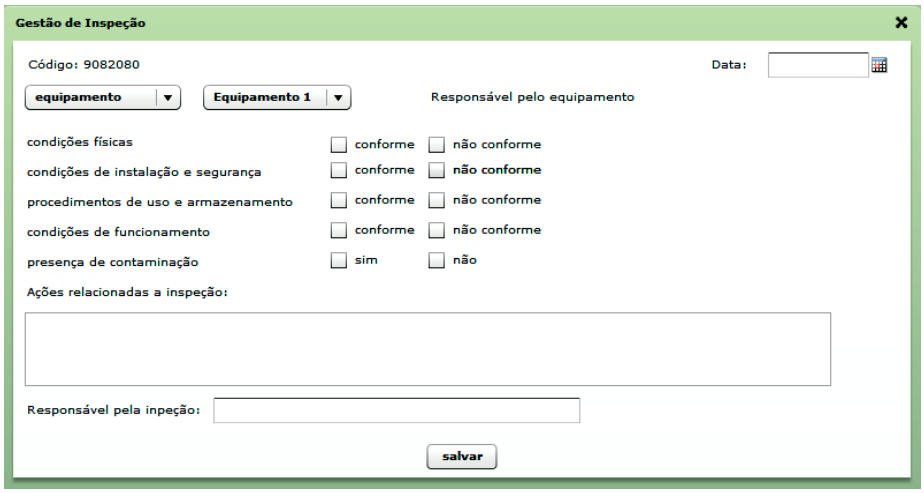

Figure 11. Equipment inspection control editing screen including record keeping.

The workers training control is presented on Fig. 12 that includes the main subjects and training course contents, instructor, duration, description, validity and type of training. Fig. 13 presents the training record keeping including the list of trainees.

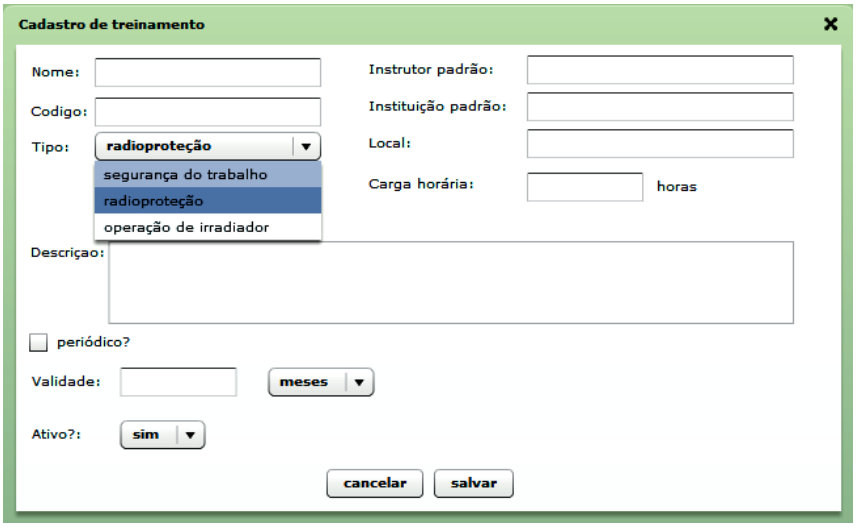

Figure 12. Workers training control editing screen, including registers and record keeping.

Figure 13. Training courses control editing screen, with registers and record keeping.

Fig. 14 presents system screen to deal with incidents and accidents including full assessment, corrective and predictive actions, record keeping and access to related reports.

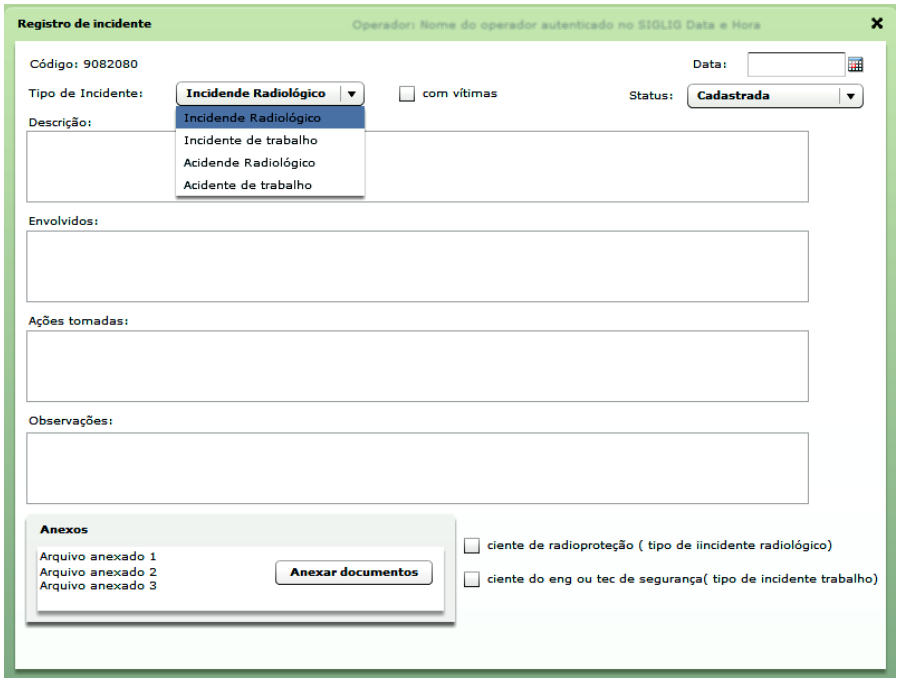

Figure 14. Incidents and accidents control editing screen including full assessment, corrective and predictive actions, record keeping and access to related reports.

3. DISCUSSIONS AND CONCLUSIONS

The intention of this work was to present and share the achievements of this powerful tool to improve and implement an effective operational radiation protection programme considering all relevant parameters and data expected on operational and working situations of nuclear organizations and research institutes.

The Geographic Information System was identified as an important incorporated technology, georeferencing information and data to reach a qualified spatial and geographic assessment.

The developed information system facilitates a continuous management of radiation protection activities as well as for long term planning, not only indicating how the health and safety activities are going, but why they are not going as well as planned showing up the critical points. Such kind of distinct knowledge is useful to reach the managerial objectives and support the decision-making.

This overall view of the regulatory requirements can also make possible internal and external inspections, aiding the identification of weakness points and what is needed to put into action a successful radiation protection control.

REFERENCES

1. CNEN – NE – 3.02 - Serviços de Radioproteção, http://www.cnen.gov.br/seguranca/normas/mostra-norma.asp?op=302 (1988) Access in July 2011.
2. CNEN – NN – 3.01 – Diretrizes Básicas de Radioproteção, http://www.cnen.gov.br/seguranca/normas/pdf/Nrm301.pdf (2005) Access in July 2011.
3. CNEN – NE 6.05 - Gerência de Rejeitos Radioativos em Instalações Radiativas, http://www.cnen.gov.br/seguranca/normas/pdf/Nrm605.pdf (1985) Access in July 2011.
4. INTERNATIONAL ATOMIC ENERGY AGENCY, Basic Standards for Radiation Protection. Safety Series No. 9, IAEA (1982).
5. INTERNATIONAL ATOMIC ENERGY AGENCY, Operational Radiation Protection: A Guide to Optimization. Safety Series No. 101, IAEA (1988).
6. INTERNATIONAL ATOMIC ENERGY AGENCY, Recommendations for the Safe Use and Regulation of Radiation Sources in Industry, Medicine, Research and Teaching. Safety Series No. 102, IAEA (1990).
7. INTERNATIONAL ATOMIC ENERGY AGENCY, International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources. Safety Series No. 1115, IAEA (1996).