DEVELOPMENT OF WEB BASED SYSTEM FOR INTERNAL MONITORING PROGRAMME

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ABSTRACT

The purposes of monitoring in general are to verify and to document that each worker is protected adequately against risks from radionuclide intakes and the protection complies with legal requirements. Therefore, it forms part of the overall radiation protection programme, which starts with an assessment to identify work situations in which there is a risk of internal contamination of workers and to quantify the likely intake of radioactive material and the resulting committed effective dose. As a part of a continuous improvement of the monitoring programme for occupationally exposed workers at IPEN, it is being developed a Web based system to access the internal dosimetry database. The system was implemented using Hypertext Preprocessor, PHP, and a PostgreSQL database. This system will introduce a new paradigm in the routine of the internal dosimetry service, providing a fast access to the information among the measurement laboratories staff, dose evaluation group and the radiation protection supervisor. The database maintains information about worker identification, physical and chemical characteristics of the radionuclide, type of monitoring, measurement data and the dose. Moreover, this information will be readily available to provide support for regulatory compliance and quality control requirements.

1. INTRODUCTION

The assessment of exposure due to intake of radionuclide in the workplace is an integral part of the occupational radiation protection programme [1, 2]. In practice, this programme is conducted by the radioprotection staff of the installations with the participation of the internal dosimetry laboratory service. Therefore, it forms part of the overall radiation protection programme, which starts with an assessment to identify work situations in which there is a risk of internal contamination of workers and to quantify the likely intake of radioactive material and the resulting committed effective dose.

In general, the dosimetry service has limited direct contact with workers and facility management. Usually, the communications of any relevant dosimetry data are made through the radioprotection staff of the facility. Monitoring results are, however, often used by management to advise operational radiation protection personnel when worker intervention, such as follow-up sampling or work restriction, is necessary. Consequently, close co-operation is needed between those involved in different parts of the monitoring and protection program.

The internal dosimetry service at IPEN is operated by the In Vivo Measurement Laboratory, In Vitro Measurement Laboratory and the Dose Evaluation Group. Currently, all the dosimetric data are kept independently in each laboratory with their own data base. In order to manage the common information related to the facilities, workers, measurements and dose evaluation, it is being proposed an integrated internal dosimetry system.

This paper aims to show the development of a Web based system prototype called "IntDosWeb" to access the internal dosimetry database, as a part of a continuous improvement of the monitoring programme for occupationally exposed workers at IPEN.

2. METHODOLOGY

Among the installations at IPEN that require an internal monitoring programme for the workers are pointed out the radioisotope production plant, fuel cycle facilities, waste management installations, cyclotron and the reactor facility. In all these installations an operational radiation protection officer is in charge to establish a routine, task related or a special monitoring of the workers. For each installation, the type of radionuclide, its physical and chemical form is clearly identified and the method of individual internal monitoring could be established for the workers. Then, a direct or indirect measurement results are obtained to evaluate the committed effective dose according to the intake pattern. All these data are recorded in a database during each step of this monitoring programme.

2.1. Requirements to Develop the System

The initial step was the specification of the functional requirements for the development of the system to internal monitoring programme at IPEN. These requirements are related to the identification of the installations and of the workers, information about the physical and chemical nature of the radionuclide to be monitored, handled activity, risk of internal contamination, intake pathways, the measurement methodology and also the security and privacy of the information.

The assessment of doses to workers, routinely or potentially exposed to radiation through intakes of radioactive material follow the ICRP methodology [3]. Then, the measurement can be used to calculate the intake of a radionuclide, which, when multiplied by the appropriate dose coefficient, leads to an estimate of committed effective dose.

3. SYSTEM PROTOTYPE

The internal monitoring programme at IPEN is a very complex system with several requirements to be considered in the design. The proposed work is to keep all the relevant dosimetric information integrated and provide a fast access among the users of this system. In order to allow the users to simultaneously execute operations of data consulting and manipulation, a Web based systems was planned. Such system is supported under Windows and Linux operating systems with PHP Hypertext Preprocessor language[4] PostgreSQL database [5] and Apache Server [6].

3.1. Software Environment

The development of the "IntDosWeb" is based in Free Software. An open software object-relational database management system, PostgreSQL [5], was chosen based in several benefits it could offer. This software supports most of major features to work with large amount of information and allowing simultaneous access.

The programming language is the Hypertext Preprocessor, PHP [4], which is a widely used and general purpose scripting language that is especially suited for Web development and can be embedded into HTML.

The "IntDosWeb" is developed to use in IPEN intranet with web-browser, therefore it makes necessary a Web server, being used the Apache Server [6].

3.2. System Functional Requirements

The "IntDosWeb" as presented in figure 1, is based on six sets of distinct functional categories, according to the user login permissions. Basically, these functional categories are the Administrator of the System, person in charge of Dose Evaluation Group, person in charge of In Vivo Monitoring Laboratory, person in charge of In Vitro Monitoring Laboratory, Radiation Protection Officer of the facility and the Worker.

Figure 1. Web based system called "IntDosWeb" to access the internal dosimetry database.

To assure the system security and privacy, it is required the username and the password for each access, according to the distinct functional categories as presented in figure 2. The levels of information for these categories are:

- Administrator: this person has full access to the system and the responsibility to keep the entire database;
- Dose Evaluation Group: this person is responsible for inserting the intake and the committed effective dose data and has full access to the system;
- In Vivo Measurement Laboratory: this person is responsible for the in vivo measurement data input and has permission to access the worker's register data sheet;
- In Vitro Measurement Laboratory: this person is responsible for the in vitro measurement data input and has permission to access the worker's register data sheet;
- Radiation Protection Officer: this person is responsible for the workers register data input of specified facility and has permission to see the monitoring and internal dose data;
- Worker: this category has limited access to his own register data only.
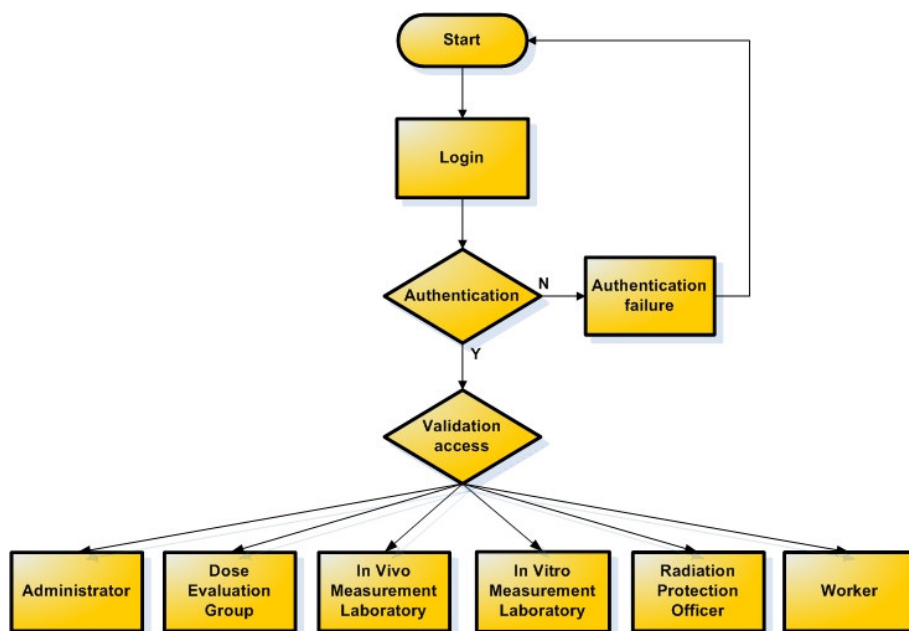
Figure 2. Flowchart of Authentication – Distinct functional category according to user access level.

3.3. Data Input to the System

All the input data to the system is made in the "IntDosWeb" first page, figure 1. This process starts with the registration of the worker in the system. The step is to provide the identification of the workers, to characterize the workplace and the handled radionuclides.

The next step is related to the internal monitoring of the workers. Here, the results of the measurements are introduced to the system from In Vivo and In Vitro Laboratory according to the methods of detection. The basic input data are: measured radionuclide, monitored

organ or biological sample, time when the monitoring has occurred, frequency of monitoring, measured activity and the laboratory report identification.

3.4. Individual Dose Assessment

The individual dose assessment is made by an independent program called "Activity and Internal Dose Estimation" – AIDE [7]. This program is used to reproduce the original predicted value of the measured quantities following single intake and the dose coefficients from ICRP. Then, the estimated value of intake and the committed effective dose are inserted to the "IntDosWeb" by the Dose Evaluation Group, according to the figure 3. The parameters included in this form are: intake pathway, intake pattern, lung absorption type for particulates, activity median aerodynamic diameter and time after intake.

Cód. da Monitoração: 11
Relatório: REL_0307
Freqüência: Mensal
Data da Monitoração: 18/03/2007
Tipo de Monitoração: Rotineira
Radionuclídeo: 131-I
Órgão: Tireoide
Atividade: 0 ± 0
LD: 90 Bq
Obs:

Modo de Incorporação:
Inalação

Forma de Incorporação:
Agudo

Classe:
F

AMAD:

Tempo depois da incorporação:

Intake (Bq):
±

Cáculo da Dose (Bq):
±

Voltar   Gravar

Figure 3. Form to insert the value of intake and committed effective dose to "IntDosWeb".

4. CONCLUSIONS

The presented system is at final stage of development and the operational evaluation is on course. Several simulation cases have been put into effect to check the software functional capabilities. The users can access the dosimetric information according to following database field: monitoring period, monitoring type, intake pattern, radionuclides type and also

monitoring data from workers for specific installation or monitoring data of each worker. It has been accessed from several computers by distinct functional categories of users at same time to ensure accessibility to the database and the security of the information.

This system will allow an integrated and ready evaluation of the monitoring data, report emission, data presentation in a graphic interface and subsequent considerations on data analysis. The implementation of this work will greatly help the users involved in the internal monitoring programme of IPEN.

ACKNOWLEDGMENTS

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