

IMPLEMENTATION OF A COMPUTERIZED SYSTEM FOR THE MANAGEMENT OF RADIOACTIVE LIGHTNING RODS AND SMOKE DETECTORS

Rafael Azevedo do Nascimento, José Claudio Dellamano and Ademar José Potiens Jr.

Instituto de Pesquisas Energéticas e Nucleares (IPEN / CNEN - SP)
Av. Professor Lineu Prestes 2242
05508-000 São Paulo, SP
rnascimento@ipen.br

ABSTRACT

Smoke detectors and lightning rods, after used, are categorized as radioactive wastes and must be submitted to the institutes of the National Nuclear Energy Commission - CNEN. The control and registration of these sources are critical, because they impact the subsequent processes involved in the management of radioactive wastes, as well as all costs incurred. The use of Information Technology as a process tool is an important instrument for ensuring the control and safety of data by enabling real time reports on several variables. This allows for a quick response to inquiries from environmental and regulating authorities. The Nuclear and Energy Research Institute - IPEN, since the nineties, received until the middle of 2013 around 30,000 lightning rods and 20,000 smoke detectors. These devices are received and handled analogically on a daily-basis, with the use of paper forms and delivery scheduled by a phone call. The objective of this work is to describe the methodology used and detail each step of the implementation of a computerized system for the management of these devices by IPEN-CNEN/SP.

1. INTRODUCTION

Radioactive waste is any product of human activity that contains radionuclides in quantities above the exemption limits. For this reason, all radioactive material that is considered waste must be collected, processed and stored properly in specific facilities for this purpose [1]. Radioactive waste can be sorted by various criteria: safety requirements for handling, stage of development of the nuclear industry in a country, regulations and standards transport; physicochemical characteristics and, concentration of radioactive material present in the waste [2].

In 1989, the National Nuclear Energy Commission - CNEN, lifted the authorization for manufacturing, trading and usage of radioactive lightning rods (Resolution n^o 4/89). Since this date, these devices have been replaced for conventional protection systems against electric discharges and have been sent to the institutes subordinated to CNEN, amongst them the Nuclear and Energy Research Institute – IPEN.

Before the cited publication, the Radioactive Waste Management had received about 20,000 units of radioactive lightning rods with an average annual rate of approximately 900 sources [3].

Some types of smoke detectors use radioactive material, Am-241, in their construction and, although the activity concentration be lower than the exemption limit, it is recommended by CNEN that these devices be also sent to the CNEN Institutes.

The reception of radioactive lightning rods and smoke detectors by Waste Management Department – GRR of the IPEN is free, but the conditioning and transport are the responsibility of the users.

According to CNEN instructions, every month a report must be generated describing all devices received. This report is elaborated using the application Microsoft Excel and the main informations are: user (name and complete address), responsible by supply and transportation and date of receipt. This report is finally available online for consultation by CNEN.

Currently the GRR uses a system based on Microsoft Excel, which generates a database in Microsoft Access to control the records about the devices received. In order to generate the report to CNEN are necessary some manual modifications and inputs that spent some time and mainly, can lead to errors. These are the main reasons to develop an automated system to control the records about lightning rods and smoke detectors.

The system was developed in Microsoft Visual Studio 2010, based on the Windows Forms Project, in Microsoft Visual C # with the database in Microsoft SQLServer 2008. This system allows to register all reception data and generate customized reports according to the needs of managers, saving time, reducing manuals errors and to submit to CNEN instantaneously.

2. THE SYSTEM

Since the system was developed in Dot Net platform is possible the interoperability with other programs developed in any Microsoft language. It is a Windows based project and for this reason when is published (finalized) is generated a Setup file that can be installed on other computers. The system was implemented in a local machine, and can be accessed remotely by other users.

In the new system, the receiving process does not change. All the inputted data are recorded in a database and can be constantly consulted on the registration screen. On the main screen, it is possible to change the old data, delete incorrect data and input new data. The report is generated on screen, filtered by date, already customized and with the possibility to convert in Microsoft Excel, Microsoft Word and Adobe PDF document. After registration a personalized document that certifies the radioactive waste reception is automatically generated.

2.1. Database

The database used is Microsoft SQLServer 2008 and supports the ADO.NET Entity Framework and the reporting tools, replication, and data definition that is built around the data model. Using this database was possible to create stored procedures, query methods and to facilitate the change in the data tables. Three equal tables were created, two of them

temporary, but used separately for each type of radioactive waste. It was also created another table with the same informations, to store records that have been deleted. This option was requested by the department manager to get total control on the deleted records. The tables are presented in Figure 1.

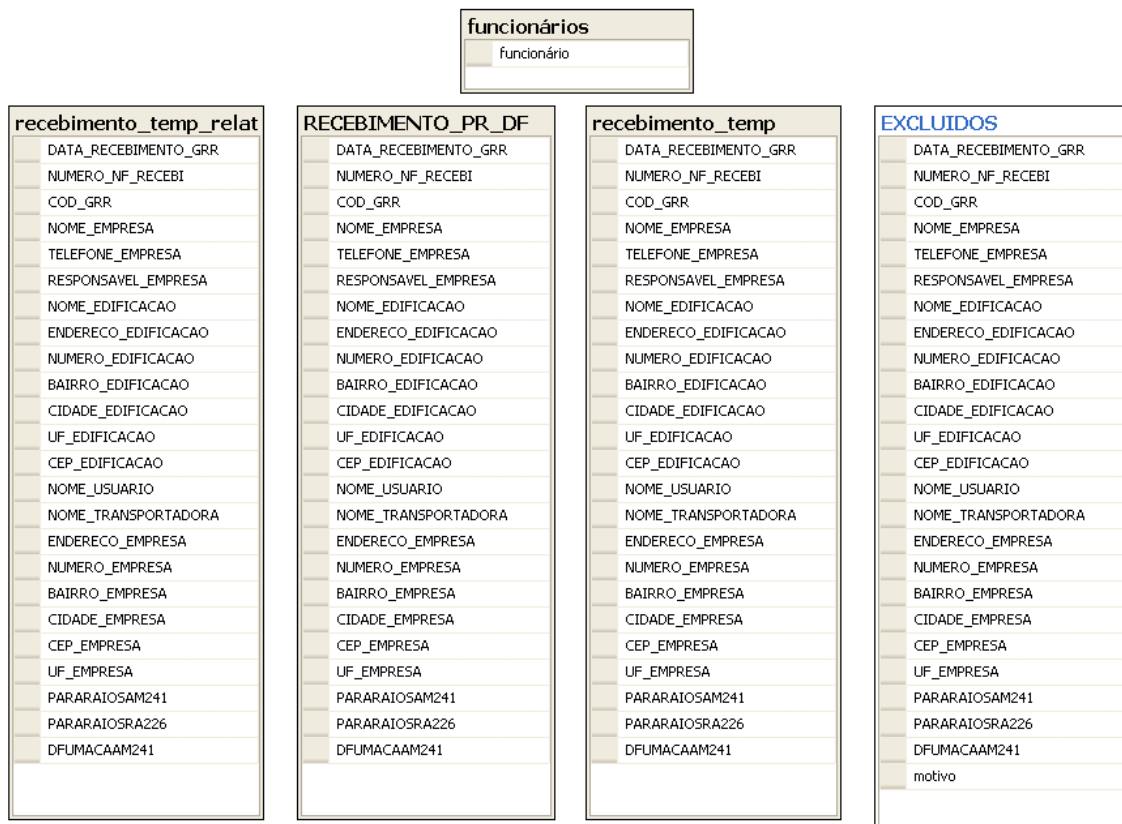


Figure 1: Diagram of data (tables used in the system).

2.2. Tools used in the system.


The Microsoft Visual Studio 2010 contains a number of controls that give the system more consistent. The Controls that were used will be described below.

2.2.1. Reportviewer.

It is used to generate reports in Microsoft Windows application projects. It allows that you process and display the report in the application. It was used to generate reports within a specific period of time with a simple mouse click. This tool has some interesting features, such as export reports to other applications. In Figure 2 is presented a view of the report on screen and Figure 3 shows the document that certifies the radioactive waste reception.

Procedência	Endereço	UF	Telefone
W.J.B. INSTALAÇÃO ELETRICA E AUTOMAÇÃO INDUSTRIAL LTDA. ME	Rua João Chiodi, 96 - Mario Dedini - Piracicaba	SP	(19) 3035-8014
LAPOC - Laboratório de Poços da Caldas	Rod. Poços de Caldas, 13 - Andradas - Poços de Caldas	MG	(35) 2107-3554
LAPOC - Laboratório de Poços da Caldas	Rod. Poços de Caldas, 13 - Andradas - Poços de Caldas	MG	(35) 2107-3554
Eleto Tecnica PEPE Ltda - EPP	Av. Prudente de Moraes, 3052 - Centro - Pirassununga	SP	(19) 3561-3234
Auto Onibus São João Ltda	Rua venezuela, 715 - Vila Barcelona - Sorocaba	SP	(15) 3212-8550
Jorge Luiz Fernandes da Silva	Rua Evaristo Zagovel, 346 - Santa Tereza - Joaçaba	SC	(49) 8815-4727
Jorge Luiz fernandes da Silva	Rua Evaristo Zagovel, 346 - Santa Tereza - Joaçaba	SC	(49) 8815-4727
Jorge Luiz Fernandes da Silva	Rua Evaristo Zagovel, 346 - Santa tereza - Joaçaba	SC	(49) 8815-4727
Jorge Luiz Fernandes da Silva	Rua Evaristo Zagovel, 346 - Santa Tereza - Joaçaba	SC	(49) 8815-4727

Figure 2: Receiving report on screen.


Instituto de Pesquisas Energéticas e Nucleares
 Laboratório de Rejeitos Radioativos

DECLARAÇÃO DE RECEBIMENTO

Declaramos para os devidos fins, que recebemos:

Material - 5 Pára-Raios Am-241

Empresa - Centro Universitário Nossa Senhora do Patrocínio

Endereço - Praça Antonio Vieira Tavares número - 73

Bairro - Centro Cidade - Salto CEP - 13320219 UF - SP

Nota fiscal - CARTA

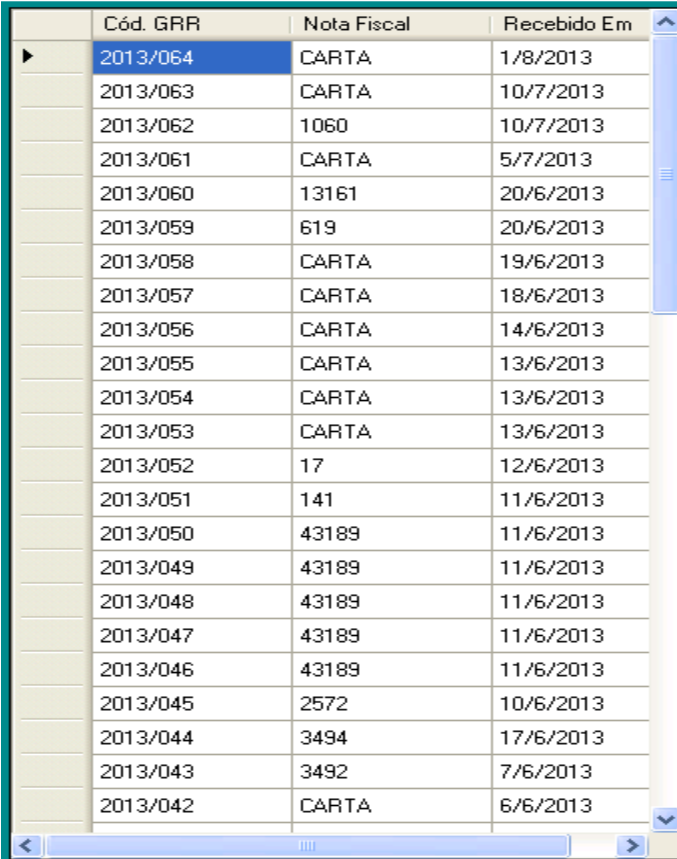
Declaramos ainda que, conforme constante na documentação de envio, este(s) dispositivo(s) estava(m) instalado(s) no(a):

Figure 3: Statement of reception

2.2.2. Datagridview.

The DataGridView control provides a customizable table, such as cells, rows, columns and edges to display data from a table. It was used on the Reception Registry page, with the date filter, order number (GRR code) and invoice, ordering all the registries by date. This tool allows the visualization of the reception records using only a few filters, on the same

receiving screen in a simplified form. Selecting the full record in DataGridView automatically loads the registration screen. Figure 4 shows the DataGridView screen.



	Cód. GRR	Nota Fiscal	Recebido Em
▶	2013/064	CARTA	1/8/2013
	2013/063	CARTA	10/7/2013
	2013/062	1060	10/7/2013
	2013/061	CARTA	5/7/2013
	2013/060	13161	20/6/2013
	2013/059	619	20/6/2013
	2013/058	CARTA	19/6/2013
	2013/057	CARTA	18/6/2013
	2013/056	CARTA	14/6/2013
	2013/055	CARTA	13/6/2013
	2013/054	CARTA	13/6/2013
	2013/053	CARTA	13/6/2013
	2013/052	17	12/6/2013
	2013/051	141	11/6/2013
	2013/050	43189	11/6/2013
	2013/049	43189	11/6/2013
	2013/048	43189	11/6/2013
	2013/047	43189	11/6/2013
	2013/046	43189	11/6/2013
	2013/045	2572	10/6/2013
	2013/044	3494	17/6/2013
	2013/043	3492	7/6/2013
	2013/042	CARTA	6/6/2013

Figure 4: Datagridview on the receiving page.

2.2.3. DataSource.

The DataSource property allows data binding in Windows Forms Controls. This tool gives the possibility to bind to a DataGridView. It was used to insert all of the receiving data in a table and automatically load this data in DataGridView noted above. The data is inserted, deleted, and selected on the same screen, as one can see in Figure 5. The easily of operation of this tool makes the choice of this type of connection should be used in the development of this software to create and delete the records in a table. Only the connection follows the pattern developed by own Microsoft Visual Studio 2010, but the designer of the system was created based on the needs of those people involved in the receipt.

Novo Recebimento

Cód. GRR: 2013/064 Recebido Em: 1/8/2013

Nota Fiscal: CARTA CARTA

Empresa: Centro Universitário Nossa Senhora do Patrocínio

Endereço: Praça Antonio Vieira Tavares N°: 73

Bairro: Centro

Cidade: Salto UF: SP

CEP: 13320-219

Telefone: (11) 4028-8800 com o "9"

Responsável: Elisângela Lourenço de Araujo

Pára-Raios Am-241: 5

Pára-Raios Ra-226: .

Detetor(es) de Fumaça Am-241: .

Transportadora: A MESMA

Edificação: Centro Universitário Nossa Senhora do Patrocí Empresa

Endereço: Praça Antonio Vieira Tavares N°: 73

Bairro: Centro

Cidade: Salto UF: SP

CEP: 13320-219

Recebido Por: Robson Jesus Ferreira

Figure 5: Screen to receive lightning rods and smoke detectors.

3. CONCLUSIONS

In new system, the reports generation of the lightning rods and smoke detectors reception is automated, indicating that is not necessary to customize and retype data in tables. After registration, is possible, in the screen, generate the report and convert it in three different types of reports: Microsoft Excel, Word and Adobe PDF.

Procedência	Endereço	UF	Telefone	Responsável	Nota Fiscal	Data Recebimento
Plásticos Machini Ltda	Rua Forte dos Franceses, 124 - Parque São Lourenço - São Paulo		(11) 2962-6663	Alessandra Pinheiro Emilio	8476	02/05/2013
Ivan Sergio Martinovski	Av. Marques Henrique, 274 - - Vilhena		(71) 3820-2920	Ivan Sergio Martinovski	080763	03/05/2013
JC PARARAIS	RUA BIJUPIRA, 244 - ELDORADO - DIADEMA		(11) 3426-4507	JOÃO CHAGAS	CARTA	07/05/2013
PARA RAIOS COM E SER LTDA	RUA BARTOLOMEU DE GUSMAO, 304 - VL ST RITA - SOROCABA		(15) 3232-3717	LUIZ ANTONIO DE CAMPOS PEREIRA	000604	15/05/2013
Centro de Engenharia e Automação Ltda	Rod. Dom Gabriel Paulino Bueno Couto, km 65, 0 - Medeiros - Jundiá		(11) 4582-8155	Ila Maria Corrêa	s/doc	16/05/2013
O Diário Rádio e Televisão Ltda	Rua Altino Arantes, 922 - Jd. Sumaré - Ribeirão Preto		(16) 4009-1248	Eng. José Mauro Avilla	000033	16/05/2013
CTEEP	Al. Glete, 801 - Saída Cecilia - São Paulo		(11) 5011-1618	Renato F. Oliveira	CARTA	20/05/2013
Clafar Construções e Comércio LTDA	Rua Cristiano Viana, 1454 - Cerqueira César - São Paulo		(11) 2098-3477	Fernando A. Vasconcelos	CARTA	20/05/2013
LAPOC - Laboratorio de Poços de Caldas	Rodovia Poços de Caldas, km 13, 0 - Andradas - Poços de Caldas		(35) 2173-3554	Maria Helana Tirolo Taddei	CARTA	22/05/2013
Engpra Comercio e Serviços Ltda	Rua Golfredo Teixeira da Silva Teles, 1275 - Jd. Paulista - Araras		(19) 3541-4042	Luis Carlos Rovani	CARTA	24/05/2013

Figure 6: Receiving report in excel format.

ACKNOWLEDGMENTS

The authors would like to thanks the CNPq for financial support.

REFERENCES

1. Comissão Nacional de Energia Nuclear, *Gerência de Rejeitos Radioativos em Instalações Radioativas*, CNEN, Rio de Janeiro (1985). CNEN-NE-6.05
2. Goro Hiromoto, Jose Claudio Dellamano, Julio Takehiro Marumo, Laura Sakiko Endo, Roberto Vicente, Tomie Hirayama, *Introdução a Gerência de Rejeitos Radioativos*, IPEN-CNEN/SP, São Paulo, (1999).
3. *Avaliação da contaminação provocada por pára-raios radioativos de amerício-241 descartados em lixões*, Júlio Takehiro Marumo, tese de doutorado, IPEN-USP, 2006.