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APRESENTAÇÕES

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AN OVERVIEW OF APPLICATION AND RADIATION SAFETY ASPECTS OF LINEAR ACCELERATORS IN BRAZILIAN INDUSTRY

M J M LOURENÇO; F C A DA SILVA

Instituto de Radioproteção e Dosimetria - IRD
Comissão Nacional de Energia Nuclear – CNEN
Av. Salvador Allende, s/n – Barra da Tijuca
22780-160 - Rio de Janeiro - RJ - Brasil
e-mail: manuel@ird.gov.br ; dasilva@ird.gov.br

ABSTRACT

This work presents a brief description of the situation of Brazilian Regulatory Authority about safety control on Industrial Linear Accelerators Installations. It shows the national regulatory infrastructure responsible for radiation safety inspections, the regulation infrastructure, the national inventory of industrial installations, the national system of inspection and enforcement and the national system for qualifying the radiation protection officer. Some results of regulatory safety inspections are also showed in this work [1].

GENERAL ASPECT

The Brazilian Regulatory Authority is the National Nuclear Energy Commission (Comissão Nacional de Energia Nuclear–CNEN) that is responsible for all activities related to nuclear or radioactivity materials. The CNEN has an infrastructure for controlling industrial radioactive installations that is constituted of a Director of Radiation Protection and Nuclear Safety with two General Coordinators: the Coordinator of Licensing and Control–SLC, responsible for the national system of licensing, and the Institute of Radiation Protection and Dosimetry-IRD, responsible for the national system of radiation safety inspections.

The Brazilian regulation infrastructure related to Industrial Linear Accelerators Installations is constituted of a general guideline and three specific guidelines. The General Guideline is the “Basic Guideline of Radiation Protection, NE3.01-CNEN, 1988” [2] and the Specifics Guidelines are “Radiation Protection Service, NE3.02-CNEN, 1988” [3], “Certification of Qualification for Radiation Protection Officer, NE3.03-CNEN, 1999” [4] and “Licensing of Radioactive Installations, NE6.02-CNEN, 1998” [5].

All industrial installations that use radiation sources and equipment must be licensed at Regulatory Authority -National Nuclear Energy Commission, CNEN- and subjected to the regulatory inspection. The License methodology to Industrial Linear Accelerators Installations is based in the following aspects: a) Registry; b) Previous Authorization, Location and Construction; c) License; d) Authorization for Acquisition; e) Authorization for Operation, Renovation and Alteration; f) Authorization for Modification; g) Operation Retreat and h) Cancellation of Registry. The main aspects that the Licensee must inform to the CNEN are: a) General Information, such as Organization Infrastructure; Responsible representative of the legal person; Staff: *qualified expert*, radiation protection officer and operator; and Proposed date for commissioning of the facility and equipment; b) Technical Information, such as Location; Layout; and Safety assessments; c) Radiation Protection and Safety Programme, such as Workplace monitoring; area classification; individual monitoring; Local rules and supervision; Quality assurance; Emergency procedures; and System of records.

RESULT

The CNEN has a data base programme with the national inventory and there are 536 industries that use radioactive sources as work tool. Those facilities were jointed, for ends of inspection

management, in the following areas: Linear Accelerator, Industrial Radiography, Well Logging Petroleum, Industrial Irradiator Plant and Nuclear Gage.

Related to the national inventory, Brazil has nowadays 14 Industrial Linear Accelerators Installations, with 06 active installations, 05 inactive installations and 03 in licensing process. Figure 1 shows a Brazilian geographic distribution of the installation.

The Industrial Linear Accelerators Installations have 18 Linac machines with energy range between 60keV to 1,500keV and 50mA to 600mA. Tables 1 and 2 show main technical aspects of these machines.

Based on regulations, all industrial installations that use radiation sources must have at least a Radiation Protection Officer as responsible for Radiation Protection Service. Table 3 shows the number of technical staff.

The national system of inspection is based on IAEA documents mainly TECDOC 1113 that presents the safety assessment plans and the checklist for commissioning and regular inspection of electron irradiation facilities [6]. Figure 2 shows the main technical aspects of the routine inspection of the regulatory safety inspection.

CONCLUSION

The national inspection program is now being reactivated and it is intended to increase year by year the number of inspections to adapt to the IAEA frequency of inspections recommendation for Linear Accelerators Industrial Installations.

REFERENCE

1. IRD/CNEN: "Reports of Safety Inspection in Linear Accelerators Industrial Installations", 2000.
2. CNEN: "Basic Guideline of Radiation Protection", NE3.01-CNEN, 1988.
3. CNEN: "Radiation Protection Service", NE3.02-CNEN, 1988.
4. CNEN: "Certification of Qualification for Radiation Protection Officer", NE3.03-CNEN, 1999".
5. CNEN: "Licensing of Radioactive Installations", NE6.02-CNEN, 1998".
6. IAEA TECDOC-1113: "Safety Assessment Plans for Authorization and Inspection of Radiation Sources", IAEA, 1999.

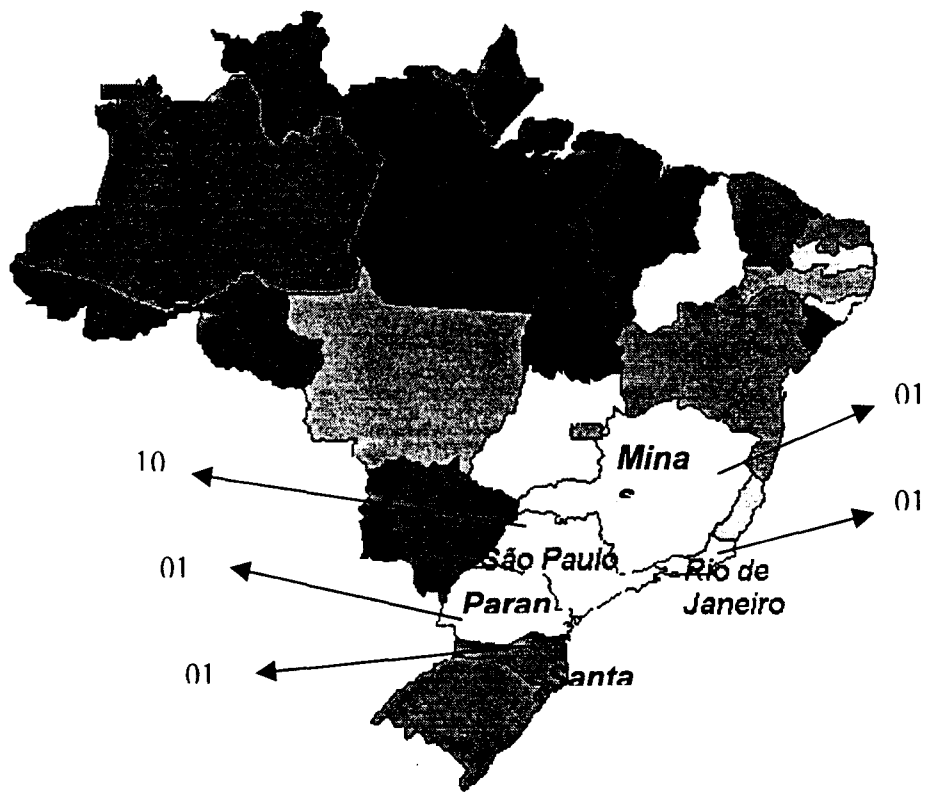


Figure 1: Brazilian Geographic Distribution of Industrial Linear Accelerators

Table 1: National Inventory – LINAC Machines

Application	Manufacturer	Model	Operating Voltage kV	Current mA
Crosslinking	Energy Sciencs Inc	EC/300	300	500
	Energy Sciencs Inc	CB200/060	210	168
	Cryovac	ECLU	500	50
	RPC	BROAD REAM	300	600
Welding	Leybold Heraenf	ESW-55-60	60	250
	Pravisions Technik	EB-P2	60	125
	Torvac Limited	CVE-68D	60	13 0
X Ray Diffraction	Fasstress Metro Inc	1500 AEGFK	35	10
NDT Industrial	Varian	838049	4000	* 300 Rad/m

Table 2: National Inventory – Nuclear Radiation Detector

Type	Manufacturer	Model	Measurement
Ionization Chamber	Victoreen	450 P	X Ray
	Bicron	R50-S	X Ray
	Nardeux	B 81	X Ray
	Dosimeter	8L2L	X Ray
Geiger Muller Counter	Xetex	501 A	Electrons
	SE Instruments	4/4 EC	Electrons
	Dosimeter	3100	Electrons
	MRA	61	Electrons

Table 3: National Inventory – Technical Staff

Industrial Classification Occupational Exposure Individual	Number
Radiation Protection Service (RPO)	06
Operation - Operator and Assistant	54
Maintenance Service	29
Quality Control Service	09
Others	08
Total	106

REGULATORY SAFETY INSPECTION Routine Inspection

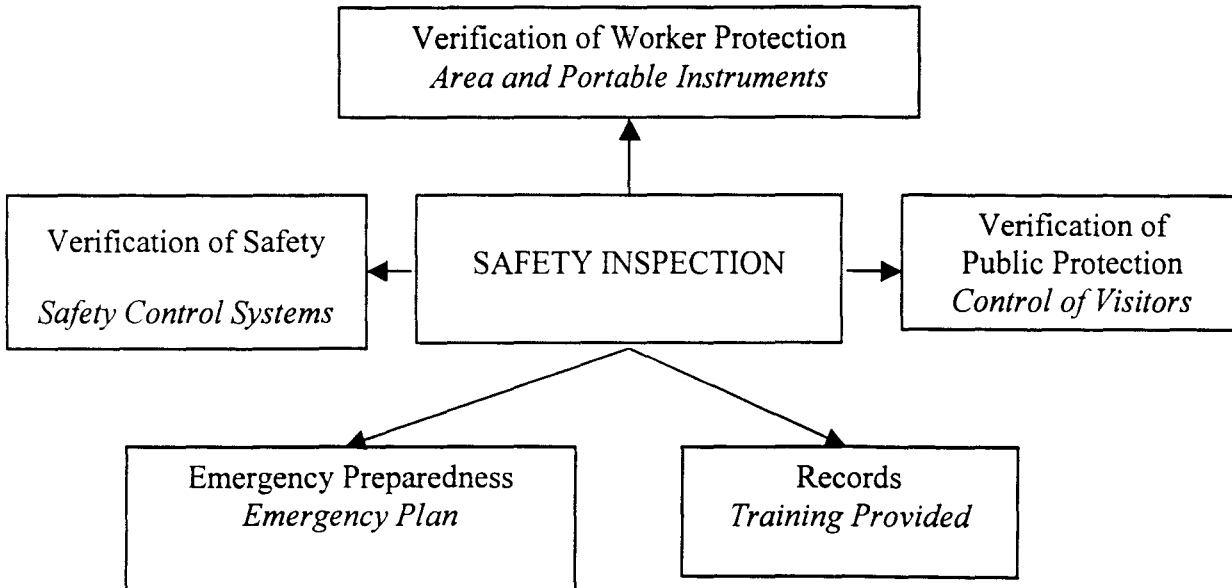


Figure 2: Main aspects of the routine inspection