



Evaluation of the radioprotection documentation of a veterinary imaging diagnosis center in Rio de Janeiro City

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ABSTRACT: Radiation protection is an important management tool to support radiodiagnosis for the veterinary radiology sector, as it offers safety, protects the work environment and guarantees the safety of workers and the public, from the possible deleterious effects of work activity with ionizing radiation. The Resolution of the Collegiate Board of Directors No. 611/22 of ANVISA establishes health requirements for the organization and operation of Medical, Dental and Veterinary Diagnostic and Interventional Radiology Services due to the importance of safety and radiological protection for these sectors. The Veterinary Radiology Service must pay attention to aspects of the protection of workers and the public as recommended by the new ANVISA Resolution for the protection of employees and the general public, since uncontrolled exposure to ionizing radiation is harmful to the health of human beings and their descendants. This work relates the importance of radiological protection for veterinary medicine, aims to evaluate the documentation of the radiology sector of a veterinary clinic in the City of Rio de Janeiro and if it has the minimum documentation necessary for its functioning as established by RDC 611/22 of the ANVISA

Keywords: Small Animal Radiology, Safety, Radiological Protection, Standard.

1. Introduction and development

Clinic X's veterinary radiology service works with conventional radiology and veterinary computed tomography (Figure 1) mainly for the radiological study of small animals as a

complementary diagnostic test to add value and speed in the treatment of its patients. To perform this type of service, it is very important to pay attention to ANVISA's new Resolution (RE), Resolution of the Collegiate Board of Directors, n°. 611 of April 6, 2022 (RDC 611/22 ANVISA), which establishes minimum health requirements for the organization and operation of Medical, Dental and Veterinary Diagnostic and Interventional Radiology Services (MV), under the basic aspects of radiation protection. Because it is necessary to control the risks associated with the practice to ensure the safety of the place, workers and public.

Figure 01 – Imaging Sector, Diagnostic Center for Veterinary Imaging X.



The risk associated with working with diagnostic veterinary radiology and veterinary computed tomography, despite being low, exists, X-rays are penetrating electromagnetic waves capable of ionizing matter and causing undesirable effects, either by the production of free radicals due to energy deposition or with breakdown of deoxyribonucleic acid (TAUHATA et al., 2014). The veterinarian working with ionizing radiation must master this knowledge to decrease the likelihood of such effects occurring to ensure the safety of veterinary, occupational and public exposures. Finally, this work seeks to evaluate the veterinary radiology service X through the consultation of documents necessary for the operation of the service, among them, the shielding calculation, the descriptive memorial of radiological protection, permanent education program, contract with dosimetry company and the radiological protection report according to RDC 611/22 ANVISA, and thus verify if the veterinary clinic complies with the basic requirements of radiological protection necessary for its operation.

2. Objective

Audit the veterinary radiology service at veterinary clinic X using RDC 611/22 ANVISA as a reference to identify possible non-compliances.

3. Materials and methods

The Employer and Technical Manager were asked to access the internal facilities and facilities of the veterinary clinic (X-ray room, computed tomography room, command area) and the documentation related to the imaging sector between the period from July/22 to August/22 for their evaluation.

First, the X-ray room, tomography and command and arrangement of the equipment were visually evaluated. After the inspection of the rooms, the evaluation of the documentation necessary for the operation of the imaging service was carried out, with the main focus on calculating the shielding of the computed tomography and radiology examination room, radiometric survey, descriptive memorial of radioprotection of the veterinary clinic, in the training of annual radiological protection included in the permanent education program, contract with the dosimetry company and radiological protection report.

4. Results and discussion

4.1 Evaluation and Results

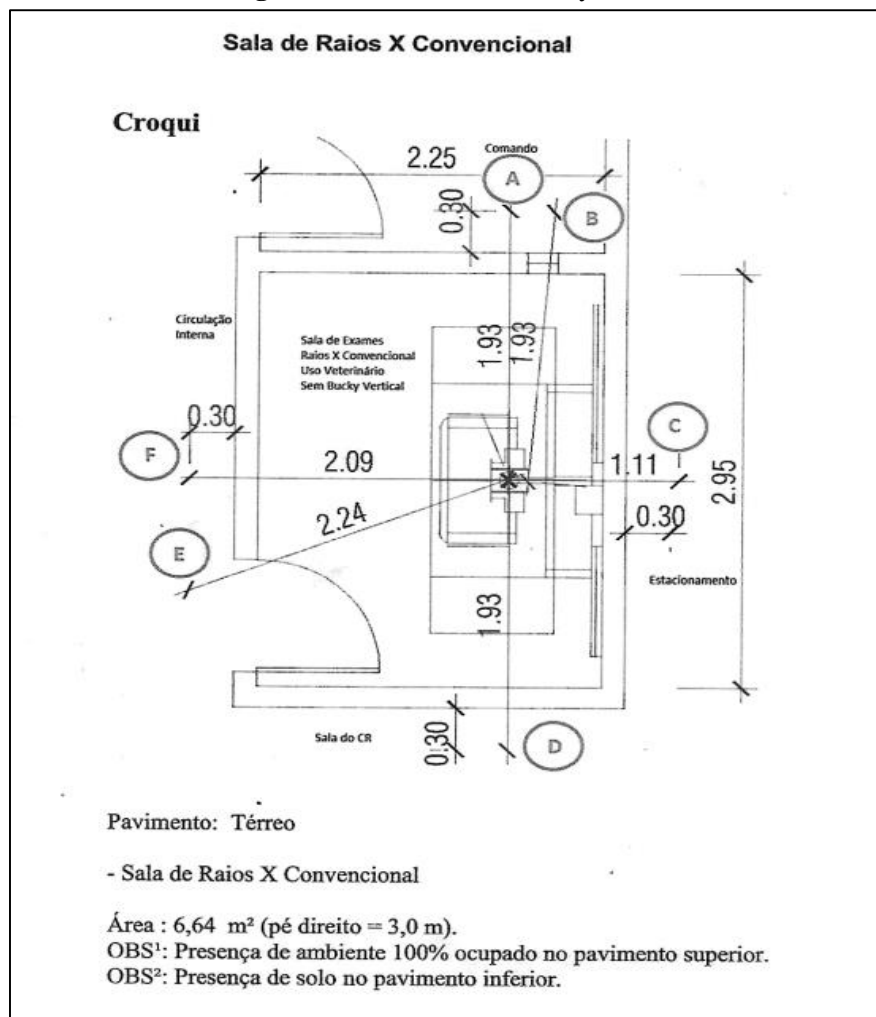
Following ANVISA's RDC 611/22, Chapter 1, Section 1, Sole Paragraph, regarding the protection of workers in Veterinary Radiology, the evaluation of the radiology sector of the Veterinary Clinic X.

In accordance with Chapter 2, Subsection I, of the specific infrastructure requirements, art. 6 regarding the Basic Architecture Project to be submitted to the Health Surveillance must include, in addition to what is required in the other applicable regulations, among others (BRASIL, 2022), the evaluation found that:

X-ray room assessment:

The X-ray room has 6,64 m² (2,95 m x 2,25 m) and it does not have a screen for control, a peculiarity of the veterinarian, the control of the X-ray machine is inside the tomography control room, that is, it is a shared environment for joint X-ray and tomography operations. There is a 10 cm x 10 cm lead viewfinder on site that allows viewing of the examination room (table and access door) and also a video system that allows viewing of the examination room within the site. The equipment used is a 125 kV/300 mA Intecal brand and the triggering system of the equipment allows triggering inside the eating room and also inside the X-ray room, through a trigger pedal allowing the veterinarian, in critical situations, have your hands free to contain the animal. On site there are two lead aprons, two thyroid protectors, two lead goggles, two lead gloves equivalent to 0.5 mm Pb, each (Figure 2).

Figure 2 – Sketch of the X-ray room.



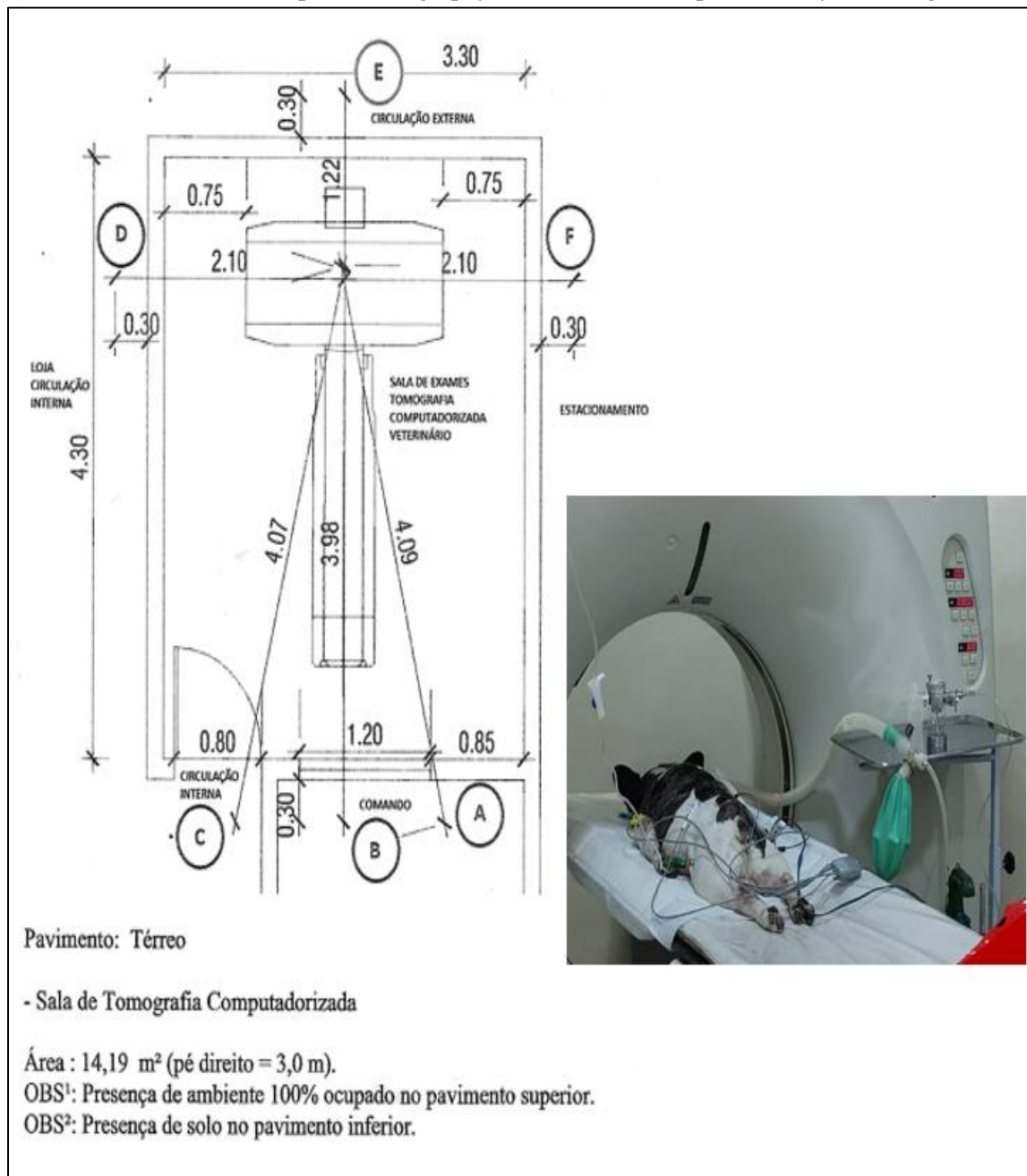
Result: the environment: **presents satisfactory conditions for the proposed activity.**

Computed tomography room assessment:

The computed tomography room has 14.19 m² (3.30 m x 4.30 m). The equipment used is a Toshiba Asteion helical CT scanner with 2 channels.

There are no radiological protection PPE's on site, as all exams are performed with the patient sedated/anesthetized (Figure 3).

Figure 3 – Sketch of the computed tomography room/anesthetized patient ready to undergo the exam.



Result: the environment: presents satisfactory conditions for the proposed activity.

Shared control room assessment:

The control room has 4,5 m² (2,25m x 2m), in it there is the control of the computerized tomograph, the control of the X-ray machine and even the Carestream Veterinary CR system for processing the radiographic images and usually an examination of each time on the spot (Figure 4).

Figure 4 – Integrated control room.



Result: the environment: presents satisfactory conditions for the proposed activity.

Evaluation of the image sector documentation:

Following ANVISA's RDC 611/22, Chapter 1, Section 1, Sole Paragraph, regarding the protection of workers in Veterinary Radiology, the evaluation of the radiology sector of the Veterinary Clinic X was based on a crucial point for the entire service of veterinary imaging, verification of the documentation necessary for the operation of the service, among them: the calculation of shielding, the descriptive memorial of radiological protection, annual training in radioprotection of workers, contract with a dosimetry company and the radiological protection report.

In accordance with Chapter 2, Subsection I, of the specific infrastructure requirements, art. 6 referring to the Basic Architecture Project to be presented to the Health Surveillance must include, in addition to what is required in the other applicable regulations and, also, in accordance with art. 8, approval of the shielding project (BRASIL, 2022), the evaluation found that:

Evaluation of the shielding calculation:

Veterinary clinic X the shielding calculation for X-ray and computed tomography room (figure 5).



Figure 5 – Calculation of barriers in X-ray and tomography rooms.

CÁLCULO DE BLINDAGEM DA SALA DE RAIOS X CONVENCIONAL CR								
Pontos de Interesse	A	B	C	D	E	F	G	H
	Parede	Visor	Parede	Parede	Porta	Parede	Teto	Piso
Aplicação do Ambiente Adjacente	Comando	Comando	Estacionamento sem manobrista	Sala com impressora de filmes	Circulação Interna	Circulação Interna	100% ocupado	Solo
N (Pacientes/semana)	40							
T (Fator de Ocupação)	1	1	0,025	1	0,25	0,25	1	0,001
U (Fator de Uso)	1	1	1	1	1	1	1	0,89
P (Limite) [mGy/sem.]	0,0005	0,0005	0,01	0,01	0,01	0,01	0,01	0,01
d (m)	1,93	1,93	1,11	1,93	2,24	2,09	2,5	2,5
Transmissão	1,4E-03	1,4E-03	3,6E-01	2,7E-02	1,5E-01	1,3E-01	3,2E-02	3,4E-01
Espessura Chumbo [mm]	1,4	1,4	0,1	0,5	0,2	0,2	0,4	NA
Espessura concreto [cm]	10,8	-	0,7	4,1	-	1,8	3,9	NA
Espessura Vidro Plumbífero [mm Pb]	-	1,4	-	-	-	-	-	NA
Espessura Barita [cm]	2,0	-	0,5	1,0	-	1,0	0,9	NA

Equivalente de dose ambiente anual					
Ponto	Área Avaliada	Área Controlada	Leitura Média (nGy)	Fator de Ocupação (T)	H*(d) (mSv/ano)
A	Comando-Parede	Sim	47,9	1	0,66
B	Comando-Visor	Sim	7,2	1	0,10
C	Circulação Interna - Porta	Não	1,3	1/4	<0,01
D	Circulação Interna - Loja	Não	56,7	1/4	0,20
E	Circulação Externa	Não	59,3	1/16	0,05
F	Circulação Externa - Estacionamento	Não	1,3	1/16	<0,01
G	Teto - Residência	Não	20,0	1	0,34
H	Piso	Não	N.A	N.A	N.A

Result: Valid shield calculation was presented: **compliant**.

The shielding calculation is the sum of essential data to optimize the radiation protection of the workplace. X-ray room shielding is a safety measure against the risks of radiological exposure in which the insulation is done on floors, ceiling, wall, among others, of the place where the exam is performed (NCRP 147, 2005).

According to Subsection II, the evaluation of personnel management and the continuing education program, art. 15th, the Diagnostic and Interventional Radiology service must implement a Permanent Education Program for the entire team in accordance with the provisions of the RE and other applicable regulations (BRAZIL, 2022), the evaluation found that:

Evaluation of the continuing education program:

Veterinary clinic X did not present the continuing education program, as it does not have one. The IOE's have outdated radioprotection training, it was suggested to implement the program and train the team to adapt to RDC 611/22 ANVISA.

Result: continuing education program not presented: **non-compliance**.

All workers must receive initial and continuous training (NR 32, MTE, 2005). According to (PADILHA FILHO et al., 1998) and (SOUSA et al., 2021) that in order to comply with the IAEA recommendations and the requirements of Cnen and ANVISA, it is necessary to adequately train the IOE's, but for this it is necessary to implement qualification programs for personnel working with sources of ionizing radiation. For (SOUSA et al., 2021) every Radioactive Facility / Veterinary Clinic must provide annual periodic training in order to establish the basic guidelines for radiological protection.

According to Subsection III, document management, article 17, Diagnostic and Interventional Radiology services must keep the following documents updated and available, in addition to those required in other applicable regulations, the evaluation found that:

Evaluation of the radioprotection descriptive memorial:

Veterinary clinic X did not present the descriptive memorial of radioprotection, as it does not have such documentation, it was suggested to prepare the document for metrological control and traceability of the quality tests performed on the equipment, among others (figure 6).

Figure 6 – Descriptive memorandum of radiological protection.

MEMORIAL DESCRITIVO DE PROTEÇÃO RADIOLÓGICA (MDPR) / PLANO DE PROTEÇÃO RADIOLÓGICA (PPR)	
SERVIÇO DE RADIOLOGIA	
EQUIPAMENTOS EMISSORES DE RADIAÇÃO IONIZANTE	
INDIVÍDUOS OCUPACIONALMENTE EXPOSTOS	
DESIGNAÇÃO DOS RESPONSÁVEIS PELA PROTEÇÃO RADIOLÓGICA	
PROGRAMA DE TREINAMENTO CONTINUADO EM RADIOPROTEÇÃO	
SINALIZAÇÃO E CLASSIFICAÇÃO DE ÁREAS	
PROGRAMA DE MONITORAÇÃO INDIVIDUAL	
PROGRAMA DE GARANTIA DA QUALIDADE	
DESCRIÇÃO DAS VESTIMENTAS DE PROTEÇÃO INDIVIDUAL	
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Result: descriptive memorandum of radioprotection was not presented: non-compliance.

The descriptive memorial is a document that details the entire project to be carried out, where all the items of the building to be built are listed, one by one. Structures, finishes, installations, everything must be informed according to what will be carried out in the work. It is worth remembering that the memorial is not the project itself. The memorial aims to tell in detail the entire development of the project (PAIXÃO, 2015).



In accordance with Section IV of the Radiological Protection Program, art. 42, of the Radiological Protection Program, the evaluation found that:

Evaluation of the Radiological Protection Program:

The Veterinary Clinic X carried out the quality tests for the X-ray and computed tomography equipment mandatory in the State of Rio de Janeiro carried out by the Radiological Sciences Laboratory (LCR) for the operation of the imaging sector (figure 7).

Figure 7 – LCR - Radiological Protection Technical Report.

Identificação do(s) aparelho(s) vistoriado(s) pelo LCR/UERJ					
Data da vistoria: 01/03/2021					
Tomografia Computadorizada	Fabricante	Modelo	Nº de série	Mobilidade	Fase
Gerador	Toshiba	Asteion	A5533081	Fixo	Poll
Tubo	Toshiba	Asteion	A5533081	-	-
Rio de Janeiro, 30/05/2021					

Identificação do(s) aparelho(s) vistoriado(s) pelo LCR/UERJ					
Data da vistoria: 01/03/2021					
Raios X Geral Médico	Fabricante	Modelo	Nº de série	Mobilidade	Fase
Gerador	Casa do Radiologista	Intecal CR 125	081-B	Fixo	Poll
Tubo	Poli-Técnica	Poli-C 90-30/50 150KV	080609	-	-
Rio de Janeiro, 22/06/2021					

Result: radioprotection report was presented: compliant.

It is mandatory to keep the Radiological Protection Plan approved by the Sanitary Surveillance (NR 32 - MTE, 2005) in the workplace and at the disposal of the labor inspection.

According to Subsection IV, surveillance and monitoring measures in Radiological Protection, art. 62 the surveillance and monitoring measures in radiological protection must include, the evaluation found that:

Evaluation of the Dosimetry Contract:

Veterinary clinic X has dosimetry and dosimeters contract for all 5 IOE's. The dosimeters are stored in an appropriate place, used during the workday, and the doses received by the IOE's, until the moment of evaluation, are within compliance, that is, they are relatively low, approximately 3 mSv/year, and are within the limit established by CNEN (figure 8).

Figure 8 – Contract with a dosimetry company.



SAPRA LAMDAUER SERVIÇO DE ASESORIA E PROTEÇÃO RADIOLOGICA LTDA
 Rua: Rua...
 Cidade: ...
 Estado: ...
 CEP: ...
 Telefone: ...
 E-mail: ...

CONDIÇÕES GERAIS

CAMPO I
 Nome: ...
 Profissão: Veterinário
 Endereço: ...
 Cidade: ...
 Estado: ...
 CEP: ...
 Telefone: ...
 E-mail do responsável técnico: ...

CAMPO II
 Número de Monitores Individuais: 5 - Número de Monitores Padrão: 1 - Total de monitores: 6
 Valor Unitário Mensal: R\$ 16,00 (dezesseis reais)
 Valor Total: R\$ 1.152,00 (um mil e cinquenta e dois reais)
 Taxa de envio: Valor do envio incluído, porém a devolução por conta do contratante.
 Taxa de relatório extra (ou segunda via de relatório): R\$ 12,00
 Taxa de reposição de monitor extraviado, perdido ou danificado: R\$ 45,00
 Prazo do Contrato: 12 (doze) meses
 Condição de Pagamento: A prazo, em 4 (quatro) parcelas no valor de R\$ 288,00 cada, Total a pagar R\$ 1.152,00, com vencimento da primeira parcela 10 (dez) dias após o início dos serviços.
 E-mail para envio da NFS: ...
 A ser preenchido após o recebimento do contrato assinado e do link de cadastramento:
 Início dos serviços em: ... e término em: ...

E por estarem lidos e constatados, as partes assinam o presente instrumento em 02 (dois) vias de igual teor e valor, uma delas:

São Carlos, ...
 Nome: ...
 CPF: ...
 Função: ...
 RG: ...

Yvone Maria ...
 SAPRA LAMDAUER LTDA
 CPF: ...
 Função: ...
 RG: ...

Testemunha: Cleonice Ap. Vilari
 RG: 10.610.417 SSPSP

PARA USO EXCLUSIVO DO SAPRA
 Recebido em: ... Por: ... Conteúdo por: ...
 Transferido para: ... Executado em: ... Agente: S4-5 ELEONORA
 Ana Paula Tonello - Departamento comercial

Result: occupational dosimetry contract was presented: compliant.

Every IOE must be monitored, the dosimeters are individual and exclusive to the radiology service and must be used throughout the workday, changed monthly and, when not in use, kept in a box next to the standard dosimeter in a room far from the ionizing radiation (TAUHATA et al., 2014 and XAVIER et al., 2014). According to NE 32, MTE (2005) the use of dosimeters is mandatory and it is the employer's duty to provide them.

The places that employ the use of ionizing radiation for diagnostic purposes are highly complex radioactive installations that require greater control from their legal guardians, as they are unhealthy environments of the highest degree (BRASIL, NR32, 2005).

In order to comply with the current resolution, the RT/SPR/Employer sought external help to correct the non-conformities found at work.

Then, an applied radiological protection training was provided for veterinary radiodiagnosis and to comply with art. 15 of RDC 611/22 ANVISA, a permanent education program was created for the sector that includes the following items of the resolution:

§ 1 The Program referred to in the caput of this article must include:

- I - initial and periodic qualifications and training, with a minimum annual frequency;
- II - theoretical and practical qualifications and training, based on risk approach, whenever new processes, techniques or technologies are implemented, or before new people integrate the processes; and
- III - evaluation methodology in order to demonstrate the effectiveness of qualification and training actions.

§ 2 The periodic qualifications and training referred to in this article must include, in addition to what is established in the other applicable regulations, at least the following topics:

- I - standards, routines, protocols and operating procedures;
- II - patient safety;
- III - management of risks inherent to the technologies used;
- IV - Quality Assurance Program;
- V - Radiological Protection Program, when applicable; and



VI - applicable regulations.

§ 3 The qualifications and training referred to in this article must be registered, containing the date, time, workload, content taught, name and the training or professional qualification of the instructor and workers involved.

And to ensure traceability and comply with art. 16 of RDC 611/22 ANVISA, a sector folder was created to facilitate access to information by the local authority and it was duly archived, for a minimum period of 5 years, as recommended.

As a result, the non-compliance presented in this work was corrected by Clínica Veterinária X and the documentation was filed in a specific folder for the control and traceability of the sector (Figure 9).

Figure 9 - Radioprotection training applied to the veterinary team of veterinarian X.



5. Conclusion

Keeping the documentation of the imaging sector up to date is very important, the employer, the technician in charge and the radioprotection supervisor are responsible for the documentation and safety, within the veterinary clinic/hospital that make use of ionizing radiation, of workers and the public.

This work carried out the evaluation of the basic documentation for the functioning of the radiology sector of the Veterinary Clinic X following the pre-established health requirements of safety and radiological protection present in the new Resolution of the Collegiate Board, No. 611/22 of ANVISA, focusing on the sole paragraph of the same, which cites the diagnostic and interventional veterinary radiology services that address the protection of workers and the public. With this, the work found a non-compliance in the sector, the lack of annual radioprotection training of the veterinary medical team.

An external aid was used to correct the non-compliance and it was remedied with the application of specific training in radiological protection aimed at the veterinary radiodiagnosis

sector, all documents listed were organized in an exclusive folder and filed for traceability for a minimum period of 5 years as recommended by the current resolution.

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