



## Annual X-Ray Inspection Report 2015 Radiological Health

108 Cherry Street, PO Box 70, Burlington, VT 05402-0070

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## *Executive Summary*

The Vermont Department of Health performs inspections of facilities around the state that own x-ray equipment. These inspections are performed at different intervals depending on the type of facility. The National Council on Radiation Protection and Measurements (NCRP) recommends that medical facilities, including chiropractic facilities, be inspected every two years. Dental and veterinary facilities are recommended to be inspected every four years. Because podiatric x-ray machines are similar to dental units, podiatric facilities are also inspected every four years.

A total of 56 x-ray facilities were inspected in 2015. Out of the 56 facilities, 39 (70%) were in full compliance at the time of the inspection. Sixteen (94%) of those facilities that were not in compliance came into compliance after the inspection. Overall, 55 out of the 56 facilities (98%) were in compliance after the inspection. Noncompliance items can be related either to the facility (such as film processing and patient shielding) or to radiographic issues (such as patient or public exposure and the condition of the x-ray unit).

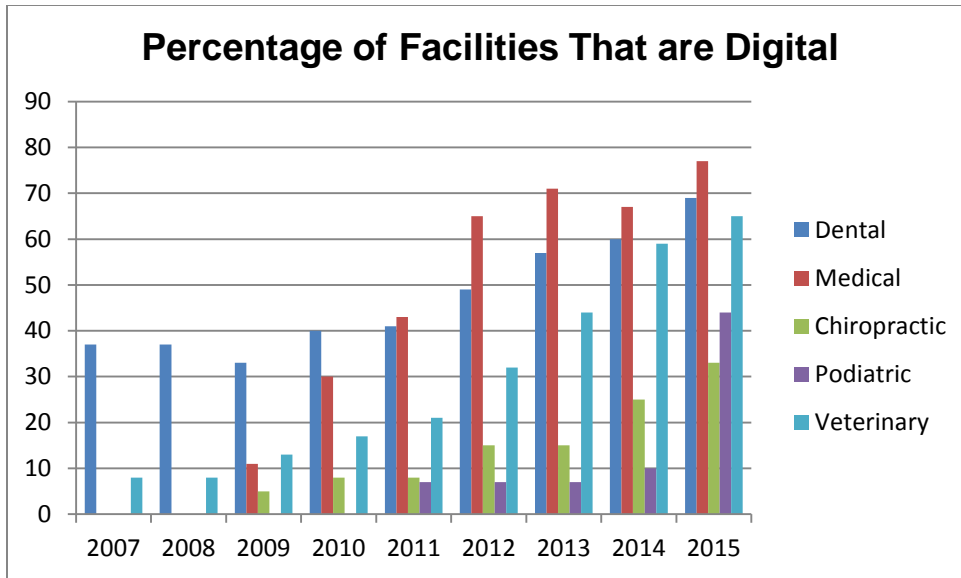
The main area of concern is the lack of satisfactory lead aprons. While lead aprons were available in all of the facilities inspected, some were cracked or torn. The facilities are encouraged to obtain new lead aprons and to check them for holes or tears annually. Other non-compliance items are listed on pages 5 to 8.

Annual dose rates to all x-ray equipment operators at the facilities inspected were less than the maximum allowed limit of 50 mSv (5000 millirem) and in fact were less than 1% of this limit at all inspected facilities. Annual dose rates to the public were less than the maximum allowed limit of 1 mSv (100 millirem).

Radiation doses to patients were less than the Vermont maximum doses for all facilities. Please refer to the charts for each type of facility (“Dose to Patients per Exposure”). Vermont recommended doses and NCRP DRL’s are shown for comparison and as goals for all facilities.

The dose to the patient and the dose to the operator is less for x-ray facilities that use faster speed film. This can be observed most clearly for dental facilities. As the speed of the film increases from “D” to “F,” the average dose per exposure decreases from 0.0036 to 0.0023 mSv (0.36 to 0.23 millirem). The use of digital x-ray instead of film decreases the average dose per exposure from 0.0023 mSv (0.23 millirem) for “F” speed film to 0.0015 mSv (0.15 millirem) for direct digital x-rays.

It is expected that as more digital x-ray systems are used we will see decreases in the total facility noncompliances as darkrooms, safelights, film, and processing are no longer needed. Approximately 69% of dental, 65% of veterinary, 77% of medical, 44% of podiatric, and 33% of chiropractic facilities are using digital x-ray. Sixty-five percent of all facilities are now using digital x-ray.



To be conservative, exposures to the operator and to the public are measured at the configuration of highest exposure. Operator exposures are measured at the position the operator stands when making the exposure, as indicated by the facility. Exposure to the public is measured by aiming the x-ray tube out of the exam room door from approximately the patient position for an x-ray exam and measuring the exposure at the doorway.

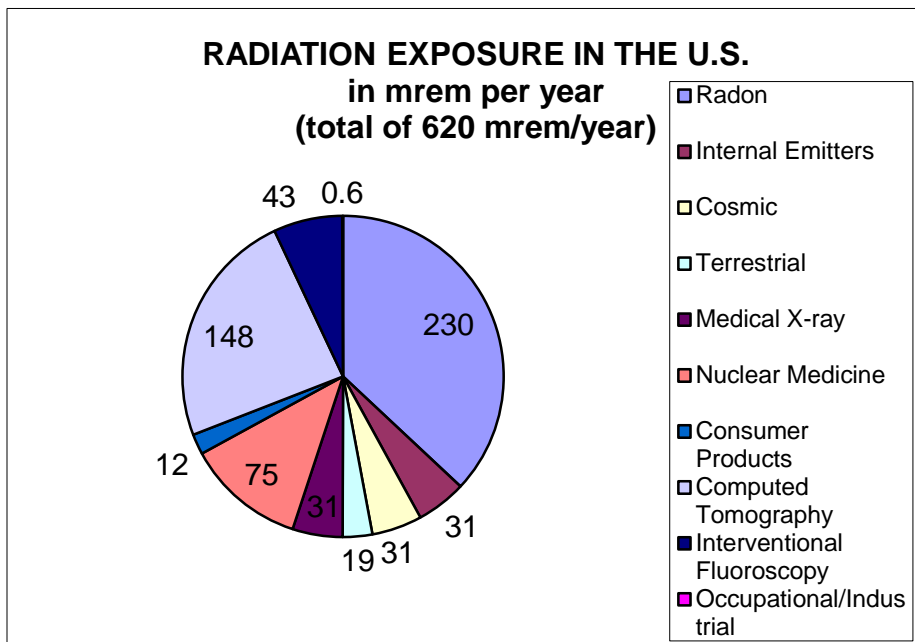
Operator and public exposures are measured in milliroentgen per hour using a Victoreen 471 ion chamber. The exposure per hour is converted to annual dose in millirem using the number of x-rays the facility takes within a given period of time. One milliroentgen is equal to 0.5 millirem (American National Standard Institute 6.1.1-1991) for whole body exposure from scattered radiation for operators and the public.

Patient exposures are measured in milliroentgen using an Unfors Xi detector. Patient exposures are converted from milliroentgen to millirem using the following factors based on the organ of greatest risk. Multiplication of the factor by the number of milliroentgen per exam results in the dose in millirem.

EXAM TYPE	FACTOR	ORGAN
Dental	0.0015	brain
PA (posteroanterior) Chest	0.1044	lung
AP (anteroposterior) Cervical Spine	0.0435	thyroid
AP Thoracic Spine	0.1044	lung
AP Lumbar Spine	0.1044	stomach/colon
AP Abdomen	0.1044	stomach/colon
AP Retrograde	0.1044	stomach/colon
Lateral Skull	0.0218	brain
Hand	0.0087	skin
Wrist	0.0087	skin
Arm	0.1044	bone marrow
Shoulder	0.1044	bone marrow
Leg	0.1044	bone marrow
Knee	0.1044	bone marrow
Ankle	0.0087	skin
DP (dorsal-plantar) Foot	0.0087	skin
Lateral Foot	0.0087	skin

Adapted from National Council on Radiation Protection and Measurements Report No. 116 tissue weighting factors and conversion factor from roentgen to rad of 0.87 rad/roentgen.

The average radiation dose to a member of the U.S. population from both natural and man-made sources is 620 millirem per year. On average, about 300 millirem is from medical uses of radiation.



Adapted from NCRP Report No. 160, 2009, Ionizing Radiation Exposures of the Population of the United States.

## Inspection Items

The following boxed sections indicate the individual items that are specifically checked during an inspection, divided into twelve general groups: the facility items of film/screen, processing, darkroom/safelight, personnel monitoring, and patient shielding; and the radiographic items of collimation, timer, kVp and filtration, patient entrance skin exposure criteria, public exposure criteria, operator conditions, and physical condition (of x-ray unit, shielding, etc.).

Some inspection items may pertain only to specific types of facilities. For example, repeat rate analyses and documentation of last menstrual period (LMP) pertain only to chiropractic facilities, while panoramic units are found only in dental facilities. Other inspection items apply to all facilities, such as the registration of x-ray units.

New facilities are not cited for non-compliant items, but are allowed a period of approximately one month to correct any non-compliant items found in the initial inspection.

<b>Film/screen</b>	<ul style="list-style-type: none"> <li>Dental film is less than E speed</li> <li>X-ray film speed is less than 400</li> <li>Film is not protected from scatter radiation</li> <li>Film is not stored properly</li> <li>Film is exposed to chemicals</li> <li>Out of date film is used</li> <li>Film and screen types not matched</li> <li>No screen installation date is on outside of cassette</li> <li>Screen and cassettes are not of the same type or age</li> <li>Screen cleaning interval is inadequate</li> <li>Screen cleaning solution and lint free wipes are not used per manufacturer instructions</li> <li>Cassette check is inadequate</li> <li>Cassettes are not permanently identified for their type of use</li> <li>Film viewbox is not available</li> <li>Film viewbox is not cleaned periodically</li> <li>Viewbox bulbs are not of the same intensity and color</li> <li>Luminance of viewboxes is not similar</li> <li>Viewbox bulbs are not replaced annually</li> <li>Technique factors are not recorded in the patient log book</li> <li>Technique charts are not available or up to date</li> <li>Left/right markers are not used on clinical radiographs</li> <li>Clinical radiographs are not properly identified</li> </ul>
<b>Processing</b>	<ul style="list-style-type: none"> <li>Thermometer is not available for manual processing</li> <li>Timer is not available for manual processing</li> <li>Floating cover is not present for manual processing</li> <li>Sight development is used</li> <li>No evidence of daily log is kept</li> <li>Developing technique recommended by the manufacturer is not used</li> <li>Developer and fixer temperature are not maintained in limits</li> <li>Processor cleaning interval is inadequate</li> <li>Processor is not operating properly</li> <li>Processor cleaning date is not recorded</li> <li>Clean-up film for processing all x-ray films (except intra-oral) is not run</li> </ul>

<b>Darkroom/Safelight</b>	<p>Safelight bulb is greater than 15 W  Safelight is too close to the work area  Light leaks are detected in the safelight housing  Light leaks are detected in the safelight lens  Safelight is improperly filtered  Darkroom is not light tight  Darkroom is not free of dust and dirt  Daylight processor arm cuffs are not acceptable  Daylight processor is not light tight  Darkroom temperature/humidity are not acceptable  Other light sources are present in the dark room</p>
<b>Personnel Monitoring</b>	<p>Personnel monitoring devices are required  Control dosimeters are not properly used or stored  Employee dosimeters are not properly used  Employee dosimeters are not properly stored  No evidence of employee review of records  Personnel monitoring records are incomplete  No radiation safety officer is designated for large practices  Evidence of personnel holding film during exposure</p>
<b>Personnel/Patient Shielding</b>	<p>Satisfactory lead aprons are unavailable  Satisfactory thyroid shields are unavailable  Satisfactory gonadal shields are unavailable  Lead aprons are improperly stored  Lead aprons are not checked annually for tears and holes (radiographically or visually)  Individuals holding patients are not protected  Mobile equipment exposure switch cord is less than 6 feet long  Non-essential individuals are in the x-ray room during exposure</p>
<b>Collimation</b>	<p>X-ray beam is not restricted to the appropriate area  X-ray beam is not restricted to the appropriate size  Collimator light is not aligned with the x-ray field  Collimation is not used in taking radiographs  Collimator light is not bright enough under normal room lighting  Collimator light problems (e.g. mirror broken, mirror obstructed)  Inadequate collimation is used for clinical radiographs</p>
<b>Timer</b>	<p>Timer does not terminate exposure  Timer activates at zero  Timer is inaccurate  Timer repeatability is unacceptable  No deadman switch is available</p>
<b>kVp and Filtration</b>	<p>kVp is greater than 10% of set value  kVp is non-repeatable  Dental intra-oral x-ray unit is operating at less than 50 kVp or greater than 100 kVp  Filtration in beam is less than required</p>

<b>Patient entrance skin exposure criteria (ESEC)</b>	ESEC in milliroentgen for non-specialty radiographic examinations shall not be exceeded when technical factors for an average adult patient are utilized:																																				
<table border="1"> <thead> <tr> <th>Examination</th> <th>ESEC mR maximum</th> <th>ESEC mR recommended</th> <th>Body part thickness (cm)</th> </tr> </thead> <tbody> <tr> <td>PA Chest</td> <td>30</td> <td>15</td> <td>23</td> </tr> <tr> <td>AP Cervical Spine</td> <td>250</td> <td>175</td> <td>13</td> </tr> <tr> <td>AP Thoracic Spine</td> <td>900</td> <td>600</td> <td>23</td> </tr> <tr> <td>AP Lumbar Spine</td> <td>1000</td> <td>675</td> <td>23</td> </tr> <tr> <td>AP Abdomen</td> <td>750</td> <td>500</td> <td>23</td> </tr> <tr> <td>AP Retrograde Pyelogram</td> <td>900</td> <td>600</td> <td>23</td> </tr> <tr> <td>Lateral Skull</td> <td>300</td> <td>200</td> <td>15</td> </tr> <tr> <td>Dental (bitewing or periapical)</td> <td>700</td> <td>350</td> <td>not applicable</td> </tr> </tbody> </table>		Examination	ESEC mR maximum	ESEC mR recommended	Body part thickness (cm)	PA Chest	30	15	23	AP Cervical Spine	250	175	13	AP Thoracic Spine	900	600	23	AP Lumbar Spine	1000	675	23	AP Abdomen	750	500	23	AP Retrograde Pyelogram	900	600	23	Lateral Skull	300	200	15	Dental (bitewing or periapical)	700	350	not applicable
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<p>Technique factors are not adjusted for minimum patient exposure  ESE for all x-ray units in facility are not within 20 percent of one another  Typical exposure value for the x-ray unit is not posted  Exposure reproducibility is greater than 5%</p>																																					
<b>Public exposure</b>	Public exposure exceeded - 100 millirem per year Public is not protected from scatter radiation																																				
<b>Operator conditions</b>	<p>Operator exposure exceeded - 5000 millirem per year  Operator cannot observe patient during exposure  Operator cannot monitor kVp, mA, time, mAs during exposure  Operator is not protected during exposure  Satisfactory lead gloves are not available  Mobile or stationary exposure switch cord is less than 6 feet long  Exposure switch not located to prevent x-ray activation when operator is outside of the control booth  Untrained personnel are operating the x-ray machines  Individuals less than 18 years old are holding animals and/or film-cassette assembly  Veterinary operator holds x-ray tube during exposure  Dental operator holds film in patient's mouth</p>																																				

<b>Physical condition (x-ray unit, shielding, etc.)</b>	<p>Console does not indicate tubes for multiple setup  Panoramic or 3D unit does not reset before restarting  Motion of panoramic or 3D unit is not smooth or is impeded  X-ray tube head locks into position for panoramic, cephalometric and/or 3D unit  Table locks, tube crane locks, bucky-cassette locks are not functioning  Filters for soft tissue imaging for cephalometric imaging are not available  Focal spot is not indicated on the x-ray tube  Source to image distance is less than 7 7/8 inches for intra-oral x-ray tubes  Source to image distance is less than 40 inches for medical and stationary veterinary x-ray machines  Unit is inaccurate/not calibrated in terms of examination distance (source to image and source to skin distances)  Tube head is unstable (drifts or bounces)  Overhead crane does not move easily  Exposure switch is not labeled  Unit does not have visual indication of kVp, mA, time or mAs  Unit does not have audible/visual indication of exposure  Angulation indicator on x-ray unit is not functioning  Typical exposure for x-ray unit is not posted  Structural shielding is inadequate  Door interlock system is not functioning  Condition of high voltage and other cables is inadequate  X-ray head leaks oil  Wires are exposed on tube head  X-ray exposure button is missing or broken  Wires are exposed on exposure switch  Preventive maintenance records for x-ray machines and processor are not kept  No FDA or manufacturer label on the x-ray machine  Mechanical restraints/anesthesia not used for animals  X-ray warning signs not used for portable veterinary use  Bare sheet lead on walls/doors is not covered</p>
<b>X-ray unit is not registered</b>	
<b>Vermont State licenses are not displayed</b>	
<b>No documentation of LMP (chiropractic)</b>	
<b>Repeat rate analysis is not performed (chiropractic)</b>	

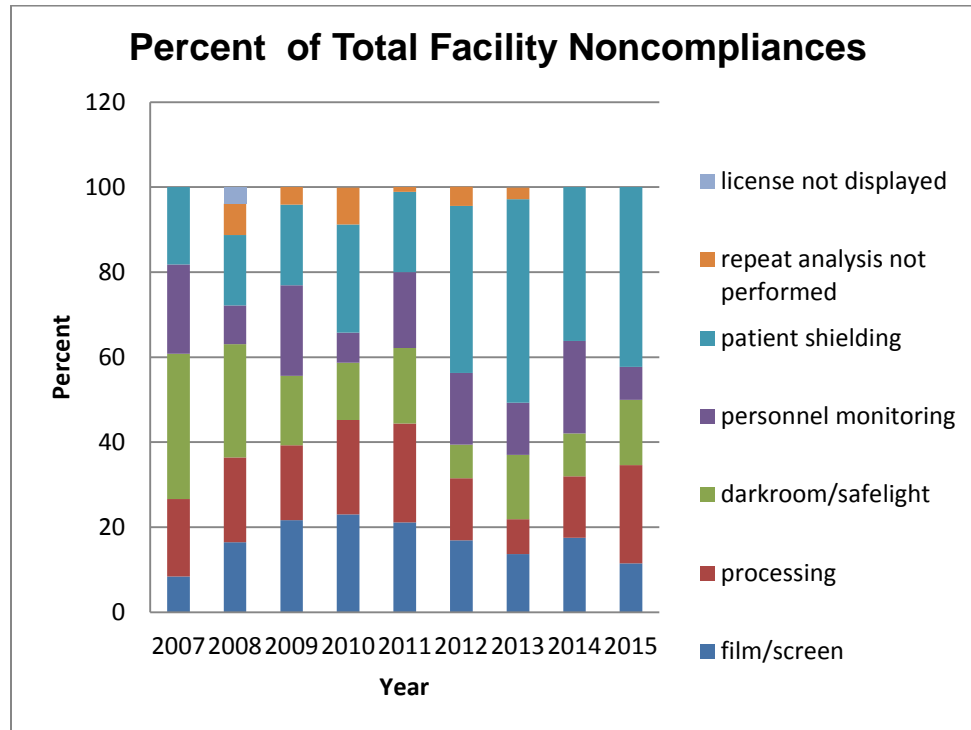


## Summary of All Inspections

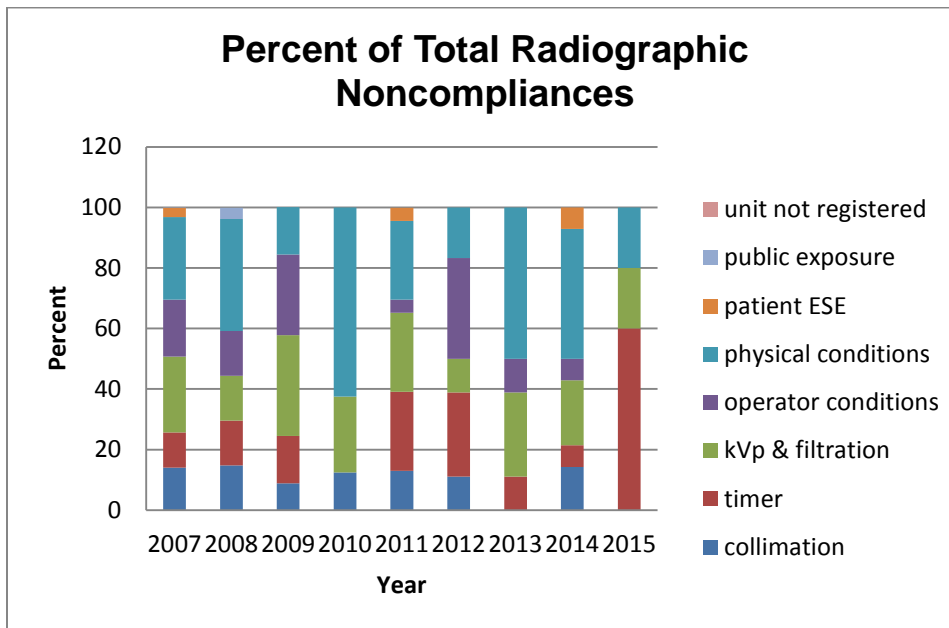
**Total Number of Inspections Performed** 56  
**Total Number of Facilities Not in Compliance** 17

<b>TOTAL NONCOMPLIANCES</b>	31
Average noncompliances per noncompliant facility	1.82
Range of number of noncompliances/facility	0 - 4

<b>TOTAL FACILITY NONCOMPLIANCES</b>		<b>PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES</b>
1 Film/Screen	3	11.5
2 Processing	6	23.1
3 Darkroom/Safelight	4	15.4
4 Personnel Monitoring	2	7.7
5 Patient Shielding	11	42.3
6 License Not Displayed	0	0.0
7 Repeat Analysis Not Performed	0	0.0



TOTAL RADIOGRAPHIC NONCOMPLIANCES	5	PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES
1 Collimation	0	0.0
2 Timer	3	60.0
3 kVp & Filtration	1	20.0
4 Patient entrance skin exposure	0	0.0
5 Public exposure	0	0.0
6 Operator conditions	0	0.0
7 Physical condition (x-ray unit, shielding)	1	20.0
8 Unit not registered	0	0.0



Annual Dose to Occupational Worker			
Type of Facility	Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
Dental	1.2	0.0009 - 17	5000
Medical	6.6	0.001 - 31	5000
Chiropractic	0.02	0.002 - 0.06	5000
Podiatric	0.01	0.003 - 0.02	5000
Veterinary	3.5	0.01 - 27	5000

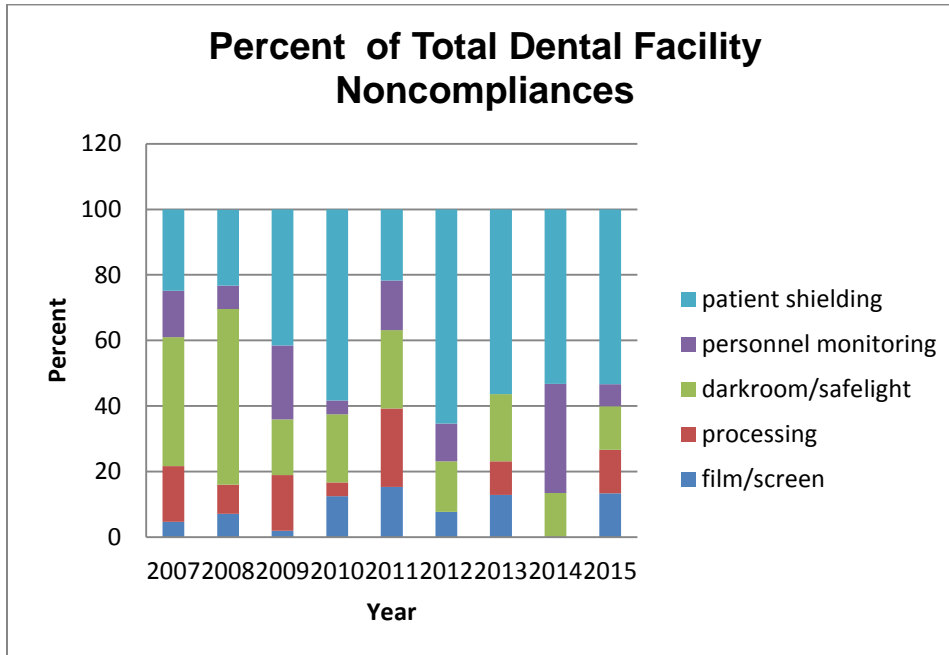
<b>Annual Dose to Public</b>			
<b>Type of Facility</b>	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Dental	4.7	0.006 - 77	100
Medical	2.5	0.0001 - 10	100
Chiropractic	0.17	0.01 - 0.31	100
Podiatric	0.04	0.001 - 0.11	100
Veterinary	3.3	0.02 - 22	100

## Dental Inspections

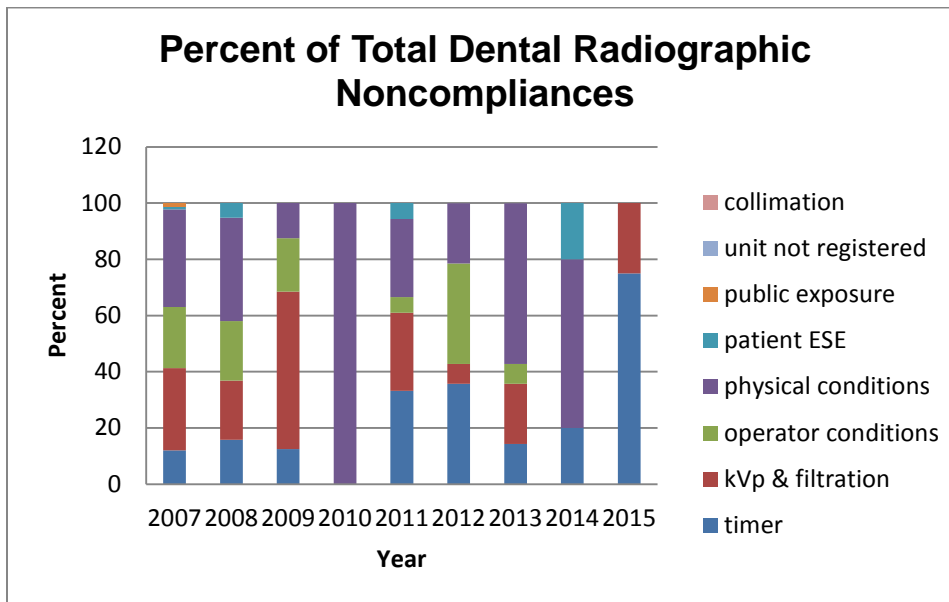
Total Number of Inspections Performed 37  
 Total Number of Facilities Not in Compliance 12

<b>TOTAL NONCOMPLIANCES</b>	19
Average noncompliances per noncompliant facility	1.58
Range of number of noncompliances	0 - 2

TOTAL FACILITY NONCOMPLIANCES		PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES	
	15		
Film/Screen	2		13.3
Processing	2		13.3
Darkroom/Safelight	2		13.3
Personnel Monitoring	1		6.7
Patient Shielding	8		53.4



TOTAL RADIOGRAPHIC NONCOMPLIANCES		PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES
Collimation	0	0.0
Timer	3	75.0
kVp & Filtration	1	25.0
Patient entrance skin exposure	0	0.0
Public exposure	0	0.0
Operator conditions	0	0.0
Physical condition (x-ray unit, shielding)	0	0.0
Unit not registered	0	0.0



### Dose to Patients per Exposure

Exam Type	Average millirem per exposure	Range millirem per exposure	Vermont State maximum dose millirem <sup>1</sup>	Vermont State recommended dose millirem <sup>2</sup>	NCRP DRL millirem <sup>3</sup>
Intra-oral D speed film	0.36	0.16 - 0.59	1.05	0.53	0.28
Intra-oral E speed film	0.16	na <sup>4</sup>	1.05	0.53	0.28
Intra-oral F speed film	0.23	0.12 - 0.42	1.05	0.53	0.28
Intra-oral Portable digital	0.11	0.11 - 0.12	1.05	0.53	0.28
Intra-oral CR digital	0.19	0.08 - 0.47	1.05	0.53	0.28
Intra-oral DR digital	0.15	0.04 - 0.45	1.05	0.53	0.28
Panoramic film	0.92	0.62 - 1.76	NONE	NONE	NONE
Panoramic digital	0.87	0.46 - 1.45	NONE	NONE	NONE
Cephalometric	na	na	NONE	NONE	0.024
Cephalometric digital	0.22	0.150 - 0.300	NONE	NONE	0.024
Cephalometric scanner	na	na	NONE	NONE	0.024
3 Dimensional	0.57	0.23 - 0.3	NONE	NONE	NONE

<sup>1</sup>Calculated from the Radiological Health Rule Part 5. Chapter 3. regulations maximum entrance skin exposure criteria of 700 milliroentgens per radiograph

(700 x 0.0015) for the brain as the organ of greatest risk.

<sup>2</sup>Calculated from the Radiological Health Rule Part 5. Chapter 3. regulations recommended entrance skin exposure criteria of 350 milliroentgens per radiograph

(350 x 0.0015) for the brain as the organ of greatest risk.

<sup>3</sup>DRL = Diagnostic Reference Level (derived from NEXT data) adjusted to millirem, NCRP Report 145, 2003

<sup>4</sup>na = Not applicable

### Annual Dose to Occupational Worker

Exam Type	Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
Intra-oral D speed film	0.67	0.0009 - 2.6	5000
Intra-oral E speed film	1.2	na	5000
Intra-oral F speed film	0.60	0.01 - 2.0	5000
Intra-oral CR digital	0.65	0.009 - 2.6	5000
Intra-oral DR digital	1.0	0.002 - 17	5000
Panoramic film	1.2	0.35 - 2.5	5000
Panoramic digital	1.5	0.18 - 5.0	5000
Cephalometric	na	na	5000
Cephalometric digital	2.4	0.18 - 4.6	5000
Cephalometric scanner	na	na	5000
3 Dimensional	1.8	1.2 - 2.4	5000

**Annual Dose to Public**

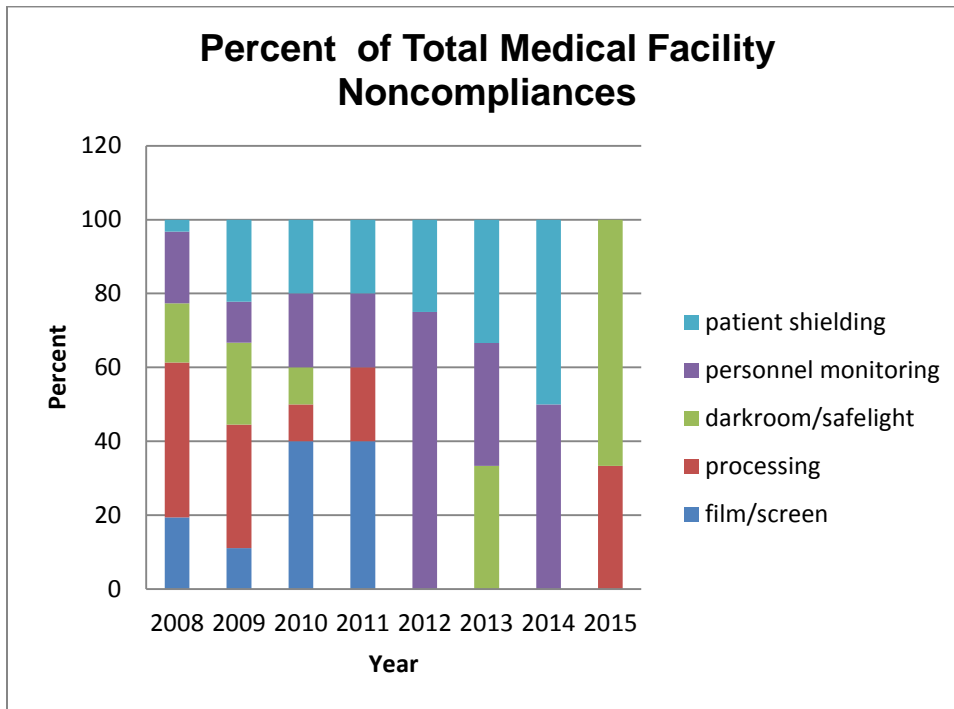
<b>Exam Type</b>	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Intra-oral D speed film	5.1	0.006 - 17	100
Intra-oral E speed film	2.4	na	100
Intra-oral F speed film	4.5	0.07 - 20	100
Intra-oral CR digital	2.0	0.05 - 6.0	100
Intra-oral DR digital	4.2	0.02 - 77	100
Panoramic film	2.0	0.42 - 6.9	100
Panoramic digital	7.5	0.16 - 40	100
Cephalometric	na	na	100
Cephalometric digital	12	0.12 - 23	100
Cephalometric scanner	na	na	100
3 Dimensional	31	22 -40	100

## Medical Inspections

Total Number of Inspections Performed 5  
 Total Number of Facilities Not in Compliance 1

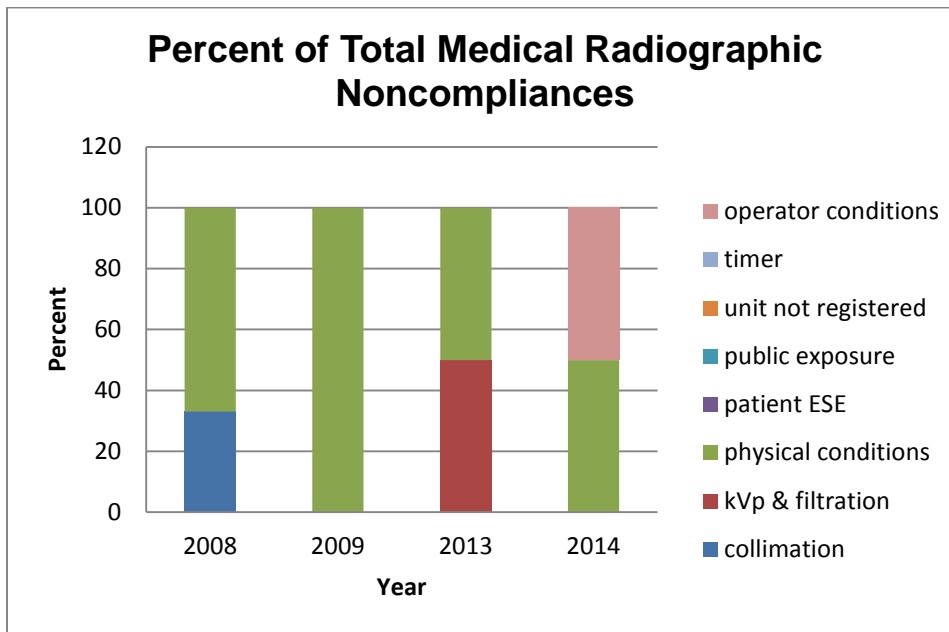
<b>TOTAL NONCOMPLIANCES</b>	<b>3</b>
Average noncompliances per noncompliant facility	3
Range of number of noncompliances	0-3

TOTAL FACILITY NONCOMPLIANCES		PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES	
	3		
Film/Screen	0		0
Processing	1		33.3
Darkroom/Safelight	2		66.7
Personnel Monitoring	0		0.0
Patient Shielding	0		0.0





TOTAL RADIOGRAPHIC NONCOMPLIANCES		PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES
Collimation	0	0
Timer	0	0
kVp & Filtration	0	0
Patient entrance skin exposure	0	0
Public exposure	0	0
Operator conditions	0	0
Physical condition (x-ray unit, shielding)	0	0
Unit not registered	0	0



**Dose to Patients per Exposure**

Type of Exam	Average millirem per exposure	Range millirem per exposure	Vermont State maximum dose millirem <sup>1</sup>	Vermont State recommended dose millirem <sup>2</sup>	NCRP DRL millirem <sup>3</sup>
PA Chest	2.2	1.8 - 2.7	3.13	1.57	1.8
AP Cervical Spine	1.6	na <sup>4</sup>	10.88	7.61	NONE
AP Thoracic Spine	na	na	93.96	62.64	NONE
AP Lumbar Spine	35	21 - 63	104.4	70.47	50
AP Abdomen	na	na	78.3	52.2	41
AP Retrograde	na	na	93.96	62.64	NONE
Lateral Skull	na	na	6.54	4.36	NONE
Hand	0.09	0.08 - 0.11	NONE	NONE	NONE
Wrist	0.04	na	NONE	NONE	NONE
Arm	na	na	NONE	NONE	NONE
Shoulder	2.7	1.5 - 3.8	NONE	NONE	NONE
Leg	na	na	NONE	NONE	NONE
Knee	4.1	2.0 - 6.5	NONE	NONE	NONE
Ankle	0.07	na	NONE	NONE	NONE
DP Foot	na	na	NONE	NONE	NONE
Lateral Foot	na	na	NONE	NONE	NONE
Fluoroscopy					
Arm	na	na	NONE	NONE	NONE
Knee	na	na	NONE	NONE	NONE
Ankle	na	na	NONE	NONE	NONE
AP Cervical	na	na	NONE	NONE	NONE
AP Lumbar	318	na	NONE	NONE	NONE
Fluoroscopy Spot Film	na	na	NONE	NONE	NONE
Sinus	na	na	NONE	NONE	NONE

<sup>1</sup>Calculated from the Radiological Health Rule Part 5. Chapter 3. regulations maximum entrance skin exposure criteria per radiograph

Example: For a PA chest exam the lung is the organ of greatest risk so the maximum dose would be (30 x 0.0015) millirem.

<sup>2</sup>Calculated from the Radiological Health Rule Part 5. Chapter 3. regulations recommended entrance skin exposure criteria per radiograph

Example: For a PA chest exam the lung is the organ of greatest risk so the recommended dose would be (15 x 0.0015) millirem.

<sup>3</sup>DRL = Diagnostic Reference Level (derived from NEXT data) adjusted to millirem, NCRP Report 172, 2012

<sup>4</sup>na = not applicable

**Annual Dose to Occupational Worker**

Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
6.6	0.001 - 31	5000

**Annual Dose to Public**

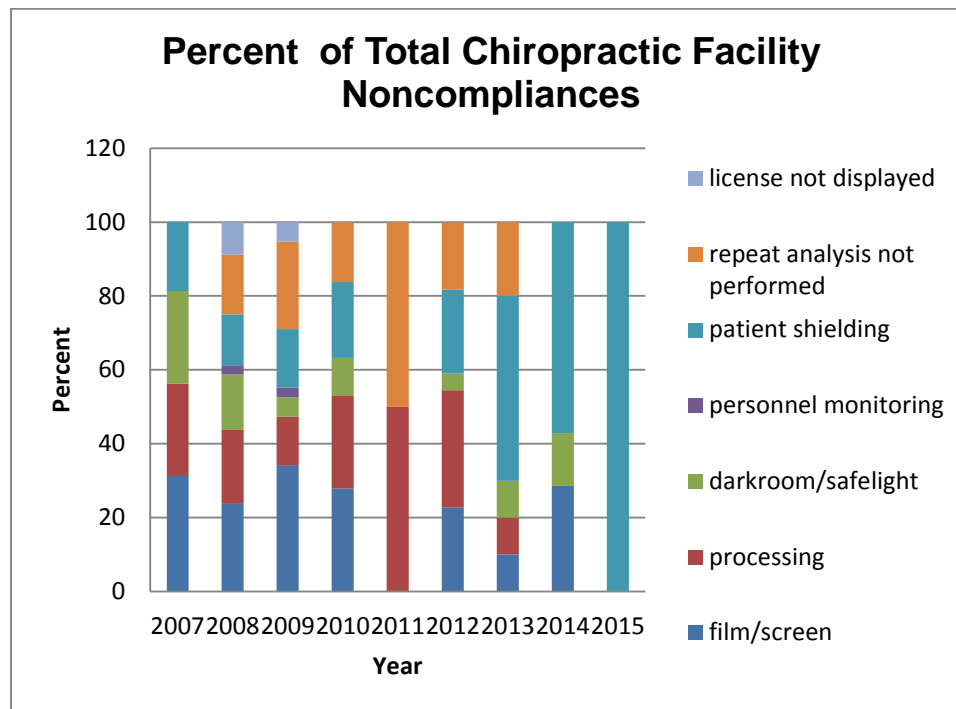
Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
2.5	0.0001 - 10	100

## Chiropractic Inspections

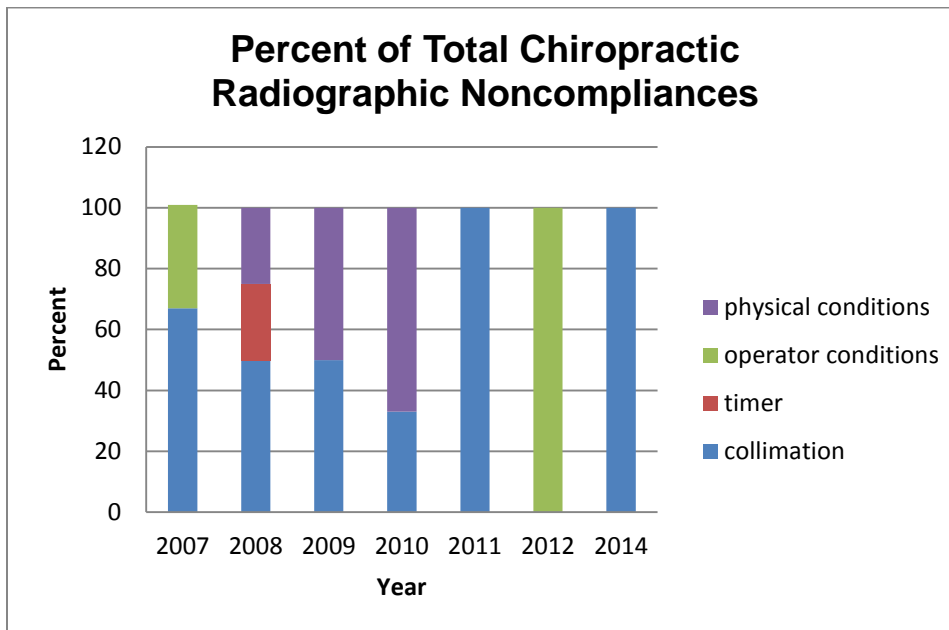
Total Number of Inspections Performed 5  
 Total Number of Facilities Not in Compliance 1

<b>TOTAL NONCOMPLIANCES</b>	1
Average noncompliances per noncompliant facility	1
Range of number of noncompliances	0-1

TOTAL FACILITY NONCOMPLIANCES		PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES	
	1		
Film/Screen	0		0.0
Processing	0		0.0
Darkroom/Safelight	0		0.0
Personnel Monitoring	0		0.0
Patient Shielding	1		100.0
License Displayed	0		0.0
Repeat Analysis	0		0.0



TOTAL RADIOGRAPHIC NONCOMPLIANCES	0	PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES
Collimation	0	0.0
Timer	0	0.0
kVp & Filtration	0	0.0
Patient entrance skin exposure	0	0.0
Public exposure	0	0.0
Operator conditions	0	0.0
Physical condition (x-ray unit, shielding)	0	0.0
Unit not registered	0	0.0



### Dose to Patients per Exposure

Type of Exam	Average millirem per exposure	Range millirem per exposure	Vermont State maximum dose millirem <sup>1</sup>	Vermont State recommended dose millirem <sup>2</sup>	NCRP DRL millirem <sup>3</sup>
PA Chest	na <sup>4</sup>	na	3.13	1.57	1.8
AP Cervical Spine	2.1	0.43 - 4.3	10.88	7.61	NONE
AP Thoracic Spine	14	5.4 - 22	93.96	62.64	NONE
AP Lumbar Spine	27	8.0 - 47	104.4	70.47	50
AP Abdomen	na	na	78.3	52.2	41
AP Retrograde	na	na	93.96	62.64	NONE
Lateral Skull	na	na	6.54	4.36	NONE

<sup>1</sup>Calculated from the Radiological Health Rule Part 5, Chapter 3, regulations maximum entrance skin exposure criteria per radiograph  
Example: For a PA chest exam the lung is the organ of greatest risk so maximum dose would be (30 x 0.0015) millirem.

<sup>2</sup>Calculated from the Radiological Health Rule Part 5, Chapter 3, regulations recommended entrance skin exposure criteria per radiograph

Example: For a PA chest exam the lung is the organ of greatest risk so recommended dose would be (15 x 0.0015) millirem.

<sup>3</sup>DRL = Diagnostic Reference Level (derived from NEXT data) adjusted to millirem, NCRP Report 172, 2012

<sup>4</sup>na = not applicable

**Annual Dose to Occupational Worker**

<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
0.02	0.002 - 0.06	5000

**Annual Dose to Public**

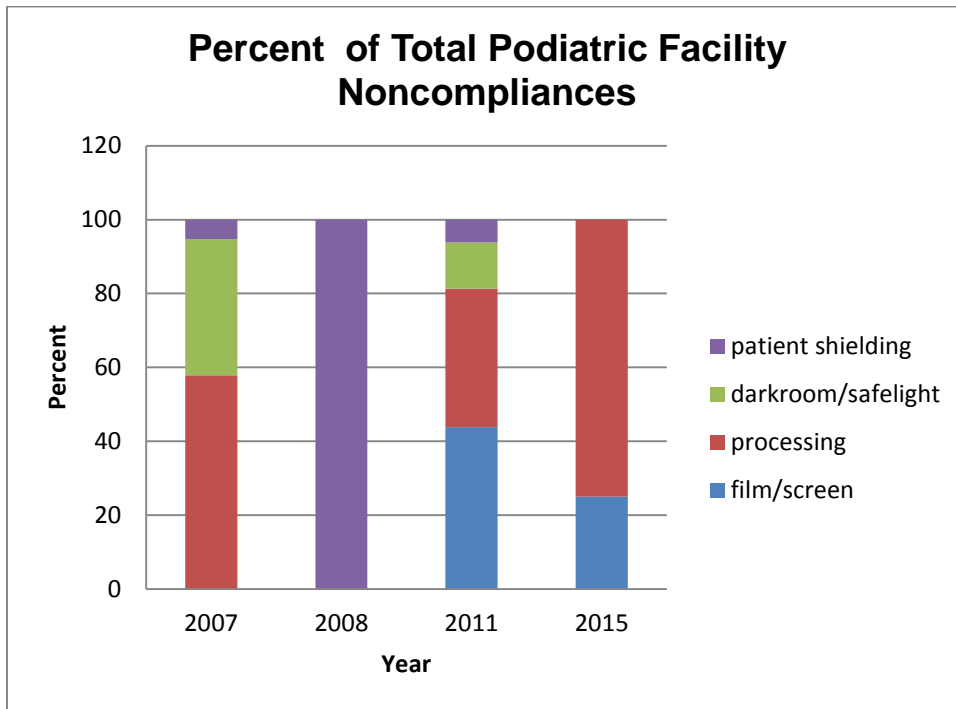
<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
0.17	0.0008 - 0.31	100

## Podiatric Inspections

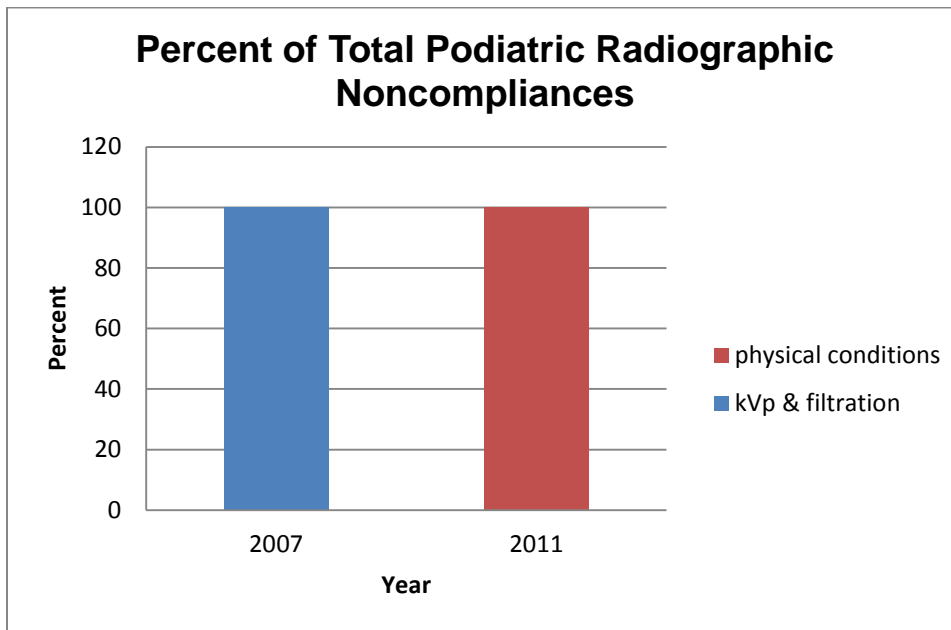
Total Number of Inspections Performed 3  
 Total Number of Facilities Not in Compliance 1

<b>TOTAL NONCOMPLIANCES</b>	4
Average noncompliances per noncompliant facility	4
Range of number of noncompliances	0-4

TOTAL FACILITY NONCOMPLIANCES		PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES	
	4		
Film/Screen	1		25.0
Processing	3		75.0
Darkroom/Safelight	0		0.0
Personnel Monitoring	0		0.0
Patient Shielding	0		0.0



TOTAL RADIOGRAPHIC NONCOMPLIANCES		PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES	
	0		
Collimation	0		0.0
Timer	0		0.0
kVp & Filtration	0		0.0
Patient entrance skin exposure	0		0.0
Public exposure	0		0.0
Operator conditions	0		0.0
Physical condition (x-ray unit, shielding)	0		0.0
Unit not registered	0		0.0



**Dose to Patients per Exposure**

Type of Exam	Average millirem per exposure	Range millirem per exposure	Vermont State maximum dose millirem	Vermont State recommended dose millirem	NCRP DRL millirem
DP Foot	9.7	5.6 - 13	NONE	NONE	NONE
Lateral Foot	13	5.7 - 20	NONE	NONE	NONE

**Annual Dose to Occupational Worker**

Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
0.01	0.003 - 0.02	5000

**Annual Dose to Public**

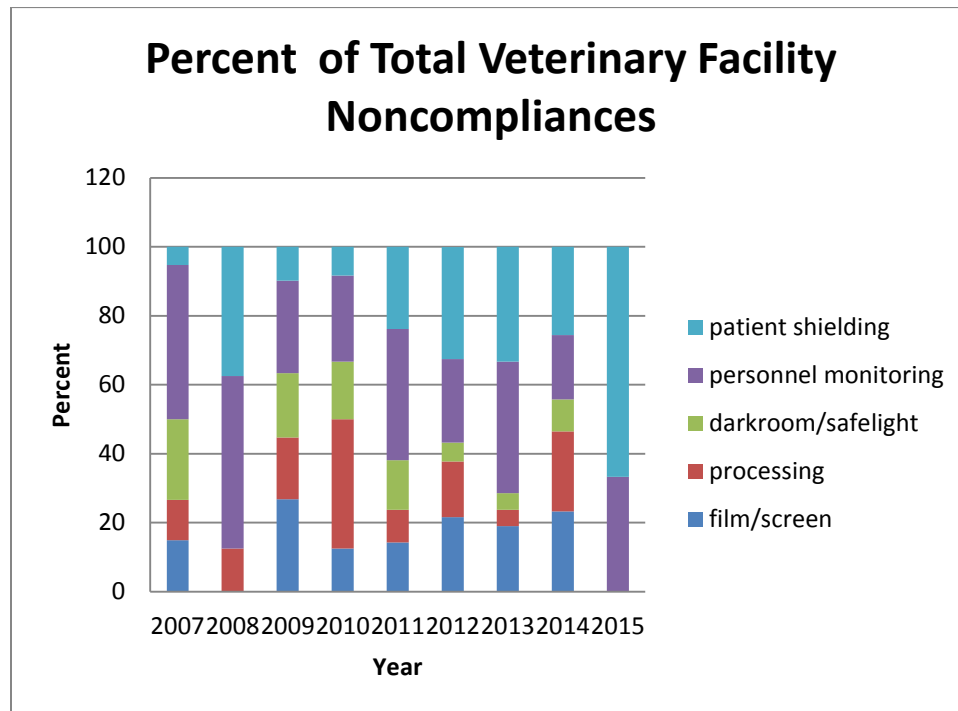
Average millirem per year	Range millirem per year	Maximum Allowable millirem/yr
0.04	0.001 - 0.11	100

## Veterinary Inspections

Total Number of Inspections Performed 5  
 Total Number of Facilities Not in Compliance 2

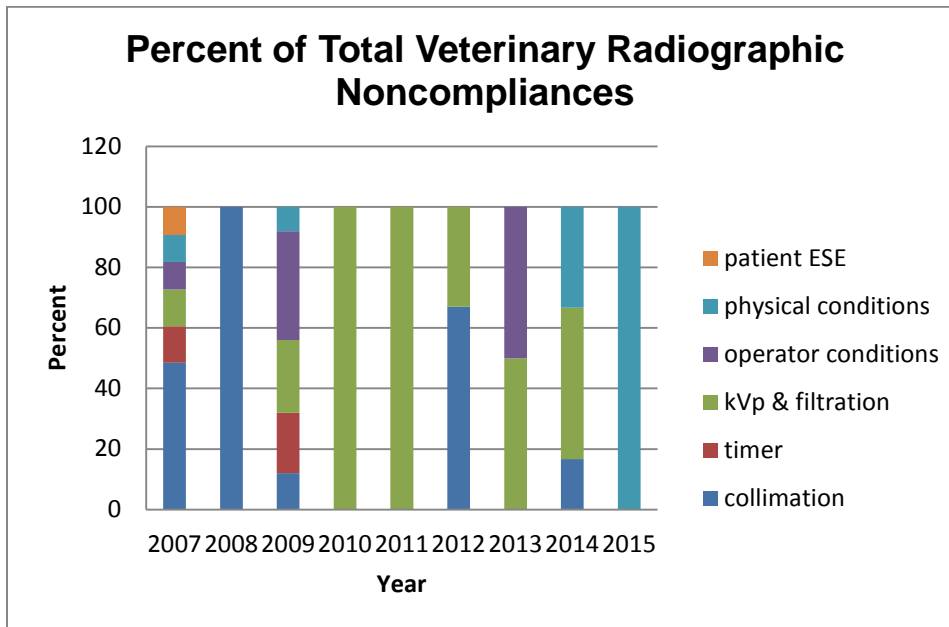
<b>TOTAL NONCOMPLIANCES</b>	4
Average number noncompliances per noncompliant facility	2
Range of number of noncompliances	0 - 3

TOTAL FACILITY NONCOMPLIANCES		PERCENTAGE OF TOTAL FACILITY NONCOMPLIANCES	
	3		
Film/Screen	0		0.0
Processing	0		0.0
Darkroom/Safelight	0		0.0
Personnel Monitoring	1		33.3
Patient Shielding	2		66.7





TOTAL RADIOGRAPHIC NONCOMPLIANCES		PERCENTAGE OF TOTAL RADIOGRAPHIC NONCOMPLIANCES
Collimation	1	0.0
Timer	0	0.0
kVp & Filtration	0	0.0
Patient entrance skin exposure	0	0.0
Public exposure	0	0.0
Operator conditions	0	0.0
Physical condition (x-ray unit, shielding)	1	100.0
Unit not registered	0	0.0



**Exposure to Patient per Exposure**

<b>Type of Exam</b>	<b>Average milliroentgen per exposure</b>	<b>Range milliroentgen per exposure</b>
Dog chest	83	50 - 166
Dog abdomen	94	47 - 200
Dog extremity	32	18 - 60
Dog dental	66	44 - 89
Dog CT scan	17600	na
Cat-o-gram	35	21 - 49
Cat chest/abdomen	33	26 - 40
Cat extremity	na	na
Cat dental	46	44 - 48
Horse hoof	na	na
Horse navicular	na	na
Horse fetlock/pastern/ankle	na	na
Horse carpus/knee	na	na
Horse hock	na	na
Horse gaskin/forearm	na	na
Horse canon	na	na
Horse stifle/hip	54	na
Horse spine	na	na

**Annual Dose to Occupational Worker**

<b>STATIONARY X-RAY Position of Operator</b>	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Operator exposure at edge of table	54	3.0 - 222	5000
Operator exposure at opposite ends of table	39	2.4 - 133	5000
Operator exposure 3 feet from x-ray unit	20	2.9 - 56	5000
Operator exposure 6 feet from x-ray unit	8.3	0.9 - 27	5000
Operator exposure behind shield, wall, or door	0.07	0.01 - 0.14	5000
Extremity exposure	191	60 - 500	50,000

<b>PORTABLE X-RAY Position of Operator</b>	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Operator exposure holding unit	na	na	5000
Operator exposure 3 feet from x-ray unit	2.3	na	5000
Operator exposure 6 feet from x-ray unit	0.5	na	5000
Operator exposure 9 feet from x-ray unit	na	na	5000
Operator exposure at end of exposure cord	na	na	5000
Operator exposure behind shield, wall, or door	na	na	5000
Extremity exposure	na	na	50,000

<b>DENTAL X-RAY Position of Operator</b>	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Operator exposure at edge of table	na	na	5000
Operator exposure 6 feet from x-ray unit	0.51	0.18 - 0.84	5000
Operator exposure at end of exposure cord	0.14	na	5000
Operator exposure behind shield, wall, or door	0.06	na	5000
Extremity exposure	na	na	50,000

**Annual Dose to Public**

	<b>Average millirem per year</b>	<b>Range millirem per year</b>	<b>Maximum Allowable millirem/yr</b>
Stationary X-Ray	0.11	0.05 - 0.19	100
Portable X-Ray	0.02	na	100
Dental X-Ray	11	0.02 - 22	100