NEBRASKA DEPARTMENT OF HEALTH AND HUMAN SERVICES
DIVISION OF PUBLIC HEALTH
X-RAY PROGRAM

DENTAL EQUIPMENT PERFORMANCE EVALUATION

Evaluation Date: _____

Registrant: _____ Registration Number: _____

Service Company: _____ Registration Number: **RS-**_____

Survey Instrument: _____ Calibration Date: _____

Ion Chamber: ☐ Within A Housing ☐ External Probe

Control Panel Information

Manufacturer: _____ Model Number: _____

Serial Number: _____ Location: _____

TIMER ☐ PASS ☐ FAIL

The accuracy of the timer must meet the manufacturer's specifications. If the manufacturer specifications are not obtainable, the timer accuracy must be ±10% of the indicated time with the testing performed at 0.5 second.

Manufacturer's Specifications: _____ OR ±10%

Time Used for Testing: _____ ☐seconds ☐ milliseconds ☐ pulses

Measured:				
Deviation:	%	%	%	%

EXPOSURE REPRODUCIBILITY ☐ PASS ☐ FAIL

When all technique factors are held constant, the coefficient of variation of exposures for both manual and automatic exposure control systems must not exceed 0.05. This requirement applies to clinically used techniques.

$$C = \frac{s}{\bar{x}} = \frac{1}{\bar{x}}\left[\frac{\sum_{i=1}^{n}(x_1 - \bar{x})^2}{n-1}\right]^{1/2}$$

s = estimated standard deviation of the population
X = mean value of observations in sample
Xi= ith observation in sample
n = number of observations in sample.

Technical Factors Selected: _____ kVp _____ mA / mAs _____ seconds / milliseconds / pulses

Measured:	mR	mR	mR	mR

Coefficient of Variation:_____

Manufacturer:_____ **Serial Number:** _____

KILOVOLT PEAK ☐ PASS ☐ FAIL

If the registrant possesses documentation of the appropriate manufacturer's kilovolt peak specifications, the radiation machine must meet those specifications. If the registrant does not possess documentation of the appropriate manufacturer's kilovolt peak specifications, the indicated kilovolt peak must be accurate to within ±10% of the indicated setting(s). For dental radiation generating equipment with fewer than three fixed kilovolt peak settings, the radiation machine will be checked at those settings.

Manufacturer's Specifications: _____ OR ±10%

Kilovolt Peak Used for Testing: _____

Measured:				
Deviation:	%	%	%	%

TUBE STABILITY ☐ PASS ☐ FAIL

The tube must remain physically stable during exposures. In cases where tubes are designed to move during exposure, the registrant must assure proper and free movement of the unit.

COLLIMATION ☐ PASS ☐ FAIL

Field limitation must meet the requirements of 180 NAC 21-007.07 or 21-007.08

Intraoral:
Source-to-Skin Distance (SSD): _____ cm Greater than 18 cm: ☐ Yes ☐ No
AND
Beam limited to a diameter of 7 cm at minimum SSD: ☐ Yes ☐ No

Panoramic:
Transverse axis: x-ray beam restricted to 0.0 inches of the imaging slit: ☐ Yes ☐ No
AND
Vertical axis: x-ray beam restricted to no more than 0.5 inches larger than the imaging slit: ☐ Yes ☐ No

Cephalometric:
Rectangular collimation: x-ray field does not exceed 2.0% of the source-to-image receptor distance for the length or the width of the image receptor: ☐ Yes ☐ No
OR
Circular or polygon collimation: x-ray field does not exceed 2.0% of the source-to-image distance for the diagonal of the image receptor: ☐ Yes ☐ No

IN-AIR EXPOSURE MEASUREMENT

For use on dental intraoral systems on an average adult patient thickness in routine bitewing radiography

Technique Factors: _____ kVp _____ mA / mAs _____ seconds / milliseconds / pulses

For Calculated Measurement only
Source to Skin Distance (SSD): _____cm Source to Detector Distance (SDD): _____cm

Measured: _____ mR ☐ Calculated Measurement ☐ Direct Measurement

Surveyor Name: _____ Surveyor Signature: _____

DETERMINING IN-AIR EXPOSURE MEASUREMENT FOR INTRAORAL DENTAL EXAMINATIONS

A. CALCULATION

Note: Ion chambers may be located within the instrument housing rather than within an external probe. In this situation, the distance from the top surface of the housing to the ion chamber below must be known. If this type of instrument is used for the measurements, the inverse square law must be utilized for accurate results.

$IAE = Measured \times (SDD \div SSD)^2$

Where: IAE = in-air exposure
Measured = indicated exposure on measuring instrument
SDD = source (target) to detector (ion chamber) distance in centimeters
SSD = source (target) to skin distance in centimeters

1. Place the tip of the cone within ½ inch from the housing of the measuring instrument.
2. Measure the distance from the source to the entrance/tube side surface of the housing. This is the SSD.
3. Determine the distance from the source to the ion chamber within the housing. This is the SDD.
4. Select the kVp, mA(s), and time normally used for an average adult patient thickness in routine bitewing radiography at that facility.
5. Make an exposure and document the radiation output in millirem.
6. Using the above formula, calculate the in-air exposure.

B. DIRECT MEASUREMENT

Note: Use this procedure only if an external probe (ion chamber) is available for the measurements.

1. Position the tube so the end of the cone is not greater than ½ inch from the probe. Do not put the probe inside the cone or allow the cone to have direct contact with the probe.
2. Select the kVp, mA(s), and time normally used for an average adult patient thickness in routine bitewing radiography at that facility.
3. Make an exposure and document the radiation output in millirem. This direct measurement is the in-air exposure.

EXPOSURE REPRODUCIBILITY

$$C = \frac{s}{\bar{x}} = \frac{1}{\bar{x}}\left[\frac{\sum_{i=1}^{n}\left(x_1 - \bar{x}\right)^2}{n-1}\right]^{1/2}$$

Where:

s = Estimated standard deviation of the population.
$\bar{x}$ = Mean value of observations in sample.
X_i = i^{th} observation in sample.
n = Number of observations in sample.

Example:

The four *(n)* exposures *(X_i)* measured 409 mR, 387 mR, 391 mR, and 410 mR

STEP 1 Determine the mean value *($\bar{x}$)* of the four exposures taken

(409 mR + 387 mR + 391 mR + 410 mR) ÷ 4 = 399.25 mR

STEP 2 Find the difference between each exposure and the mean value *($\bar{x}$)* (disregard sign)

409.00 mR	387.00 mR	391.00 mR	410.00 mR
-399.25 mR	-399.25 mR	-399.25 mR	-399.25 mR
9.75 mR	12.25 mR	8.25 mR	10.75 mR

STEP 3 Square each of the differences

$(9.75)^2$ = 95.06 *$(12.25)^2$ = 150.06*
$(10.75)^2$ = 115.56 *$(8.25)^2$ = 68.06*

STEP 4 Divide each number by 3 *(n-1)* and add the results

95.06 ÷ 3 = 31.69
150.06 ÷ 3 = 50.02
68.06 ÷ 3 = 22.69
115.56 ÷ 3 = 38.52
142.92

STEP 5 For *s*, determine the square root of the above number

$\sqrt{142.92} = 11.95$

STEP 6 Divide *s* by the mean value *($\bar{x}$)*

11.95 ÷ 399.25 = .0299 = the coefficient of variation *(C)*

STEP 7 If *C* ≤ 0.05, the exposures are considered to be reproducible