

**WAC 246-225-010 Definitions.** As used in this chapter, the following definitions apply:

(1) "Accessible surface" means the external surface of the enclosure or housing provided by the manufacturer.

(2) "Accidental radiation exposure incident" means an exposure to a patient, an operator, or a member of the public that was unintentional.

(3) "Added filter" means the filter added to the inherent filtration.

(4) "Aluminum equivalent" means the thickness of aluminum (type 1100 alloy) affording the same attenuation, under specified conditions, as the material in question. (The nominal chemical composition of type 1100 aluminum alloy is 99.00 percent minimum aluminum, 0.12 percent copper.)

(5) "Assembler" means any person engaged in the business of assembling, replacing, or installing one or more components into an X-ray system or subsystem. An assembler may be the practitioner, his/her employee, an outside contractor, or an employee of an outside firm.

(6) "Attenuation block" means a block or stack, having dimensions 20 cm by 20 cm by 3.8 cm, of type 1100 aluminum alloy or other aluminum alloys having equivalent attenuation.

(7) "Automatic exposure control" means a device which automatically controls one or more technique factors in order to obtain at a preselected location(s) a required quantity of radiation (see also "phototimer").

(8) "Barrier" (see "protective barrier").

(9) "Beam axis" means a line from the source through the centers of the X-ray fields.

(10) "Beam-limiting device" means a device which provides a means to restrict the dimensions of the X-ray field.

(11) "Beam monitoring system" means a system designed to detect and measure the radiation present in the useful beam.

(12) "C-arm X-ray system" means an X-ray system in which the image receptor and X-ray tube housing assembly are connected by a common mechanical support system in order to maintain a desired spatial relationship. This system is designed to allow a change in the projection of the beam through the patient without a change in the position of the patient.

(13) "Cephalometric device" means a device intended for the radiographic visualization and measurement of the dimensions of the human head.

(14) "Certified components" means components of X-ray systems which have been certified by the manufacturer as meeting the requirements of the federal performance standard for X-ray equipment.

(15) "Certified system" means any X-ray system which has one or more certified component(s).

(16) "Changeable filters" means any filter, exclusive of inherent filtration, which can be removed from the useful beam through any electronic, mechanical or physical process.

(17) "Coefficient of variation (C)" means the ratio of the standard deviation to the mean value of a population of observations. It is estimated using the following equation:

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

where

s = Estimated standard deviation of the population.

X = Mean value of observations in sample.

X(i) = i<sup>th</sup> observation sampled.

n = Number of observations in sample.

(18) "Contact therapy system" means an X-ray system wherein the X-ray tube port is put in contact with or within 5 centimeters of, the surface being treated.

(19) "Control panel" means that part of the X-ray control upon which are mounted the switches, knobs, pushbuttons, and other hardware necessary for manually setting the technique factors.

(20) "Cooling curve" means the graphical relationship between heat units stored and cooling time.

(21) "Date of transfer." See installation date.

(22) "Dead-man switch" means a switch so constructed that a circuit closing contact can be maintained only by continuous pressure on the switch by the operator.

(23) "Department" means the department of health which has been designated as the state radiation control agency.

(24) "Detector" (see "radiation detector").

(25) "Diagnostic source assembly" means the tube housing assembly with a beam-limiting device attached.

(26) "Diagnostic X-ray system" means an X-ray system designed for irradiation of any part of the human or animal body for the purpose of recording or visualization for diagnostic purposes.

(27) "Direct scattered radiation" means that scattered radiation which has been deviated in direction only by materials irradiated by the useful beam (see also "scattered radiation").

(28) "Electronic product defect" means an error in design, manufacture, or performance of an X-ray system such that unintentional radiation exposure to a patient, an operator, or a member of the public has occurred.

(29) "Entrance exposure rate" means the exposure measured free-in-air per unit time where the useful beam enters the patient.

(30) "Equipment" (see "X-ray equipment").

(31)\* "Exposure" means the quotient of dQ divided by dm where dQ is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass dm are completely stopped in air. (The special unit of exposure is the roentgen.)

Note: \*When the word, exposure, is used in this part to mean one or more irradiations of a person for a healing arts purpose, or in a more general sense, it will not be underlined.

(32) "Field emission equipment" means equipment which uses an X-ray tube in which electron emission from the cathode is due solely to the action of an electric field.

(33) "Filter" means material placed in the useful beam to absorb preferentially selected radiations.

(34) "Fluoroscopic imaging assembly" means a component which comprises a reception system in which X-ray photons produce a fluoroscopic image. It includes equipment housings, electrical interlocks if any, the primary protective barrier, and structural material providing linkage between the image receptor and the diagnostic source assembly.

(35) "Focal spot" means the area on the anode of the X-ray tube bombarded by the electrons accelerated from the cathode, and from which the useful beam originates.

(36) "Full beam detector" means a radiation detector of such size that the total cross section of the maximum size useful beam is intercepted.

(37) "General purpose radiographic X-ray system" means any radiographic X-ray system which, by design, is not limited to radiographic examination of specific anatomical regions.

(38) "Gonad shield" means a protective barrier for the testes or ovaries.

(39) "Half-value layer (HVL)" means the thickness of specified material which attenuates the beam of radiation to an extent such that the exposure rate is reduced to one-half of its original value. In this definition the contribution of all scattered radiation, other than any which might be present initially in the beam concerned, is deemed to be excluded.

(40) "Healing arts screening" means the testing of an asymptomatic population using X-ray machines for the detection or evaluation of health indications when such tests are not specifically and individually ordered by a licensed practitioner of the healing arts legally authorized to prescribe such X-ray tests for the purpose of diagnosis or treatment.

(41) "Heat unit" means a unit of energy equal to the product of the peak kilovoltage, miliamperes, and seconds, i.e., kVp x mA x second.

(42) "Image intensifier" means a device consisting of an image intensifier tube installed in its housing which instantaneously converts an X-ray pattern into a light image of higher energy density.

(43) "Image receptor" means any device, such as a fluorescent screen or radiographic film, which transforms incident X-ray photons either into a visible image or into another form which can be made into a visible image by further transformations.

(44) "Image receptor support" means that part of a mammographic system designed to support the image receptor in a plane perpendicular to the X-ray beam during mammography.

(45) "Inherent filtration" means the filtration of the useful beam provided by the permanently installed components of the tube housing assembly.

(46) "Installation date" means the earliest date that a machine, accessory, or component is able to be used by a registrant or transferee but no later than the date of the first human exposure made using the machine, accessory, or component that has been installed.

(47) "Interlock" means a device arranged or connected such that the occurrence of an event or condition is required before a second event or condition can occur or continue to occur.

(48) "Irradiation" means the exposure of matter to ionizing radiation.

(49) "Kilovolts peak (kVp)" (see "peak tube potential").

(50) "kV" means kilovolts.

(51) "kWs" means kilowatt second which is equal to the product of peak kilovolts, amperes, and seconds or  $10^{-3} \times \text{kV} \times \text{mA} \times \text{sec}$ .

(52) "Lead equivalent" means the thickness of lead affording the same attenuation, under specified conditions, as the material in question.

(53) "Leakage radiation" means radiation emanating from the diagnostic or therapeutic source assembly except for:

(a) The useful beam and

(b) Radiation produced when the exposure switch or timer is not activated.

(54) "Leakage technique factors" means the technique factors associated with the tube housing assembly which are used in measuring leakage radiation. They are defined as follows:

(a) For capacitor energy storage equipment, the maximum rated peak tube potential and the maximum rated number of exposures in an hour for operation at the maximum rated peak tube potential with the quantity of charge per exposure being 10 milliamperere seconds, or the minimum obtainable from the unit, whichever is larger.

(b) For field emission equipment rated for pulsed operation, the maximum rated peak tube potential and the maximum rated number of X-ray pulses in an hour for operation at the maximum rated peak tube potential.

(c) For all other equipment, the maximum rated peak tube potential and the maximum rated continuous tube current for the maximum rated peak tube potential.

(55) "Light field" means that area of the intersection of the light beam from the beam-limiting device and one of the set of planes parallel to and including the plane of the image receptor, whose perimeter is the locus of points at which the illumination is one-fourth of the maximum in the intersection.

(56) "Line-voltage regulation" means the difference between the no-load and the load line potentials expressed as a percent of the load line potential; that is,

Percent

$$\text{line-voltage} = 100 (V_n - V_l) / V_l$$

regulation

where:

$V_n$ ) = No-load line potential

$V_l$ ) = Load line potential

(57) "mA" means tube current in milliamperes.

(58) "mAs" means milliamperere second or the product of the tube current in milliamperes and the time of exposure in seconds.

(59) "Maximum line current" means the root mean squared current in the supply line of an X-ray machine operating at its maximum rating.

(60) "Mobile equipment" (see "X-ray equipment").

(61) "Modified installation" means a room, building, office, or facility in which structural parameters which affect radiation safety are being changed; these parameters include such things as reconstruction or moving of walls, replacement of the X-ray machine with one of higher kVp or mA, a change in the direction of the beam, replacement of the control panel so that operator protection is adversely affected, a change in occupancy of adjacent areas, workload changes, etc.

(62) "New installation" means a room, building, office, or facility newly built, or in which previously there has been no radiation machine.

(63) "Peak tube potential" means the maximum value of the potential difference across the X-ray tube during an exposure.

(64) "Phantom" means a volume of material similar to tissue with respect to attenuation and scattering of X-ray photons. This requires that the atomic number (Z) and the density of the material be similar to those of tissue.

(65) "Phototimer" - means a device which controls radiation exposure to the image receptor by detecting the total amount of radiation reaching the device. The radiation monitoring device(s) is part of an electronic circuit which controls the time the tube is activated (see also "automatic exposure control").

(66) "Portable equipment" (see "X-ray equipment").

(67) "Position indicating device (PID)" means a device, on dental X-ray equipment which indicate the beam position and establishes a definite source-surface (skin) distance. The device may or may not incorporate or serve as a beam-limiting device.

(68) "Positive beam limitation" means the automatic or semi-automatic adjustment of an X-ray beam to the selected image receptor size, whereby exposures cannot be made without such adjustment.

(69) "Primary protective barrier" (see "protective barrier").

(70) "Protected area" means a shielded area in which attenuation of x-radiation is sufficient to meet the exposure limits of WAC 246-221-010 and the principles of WAC 246-220-007 and "ALARA" for individuals in that area.

(71) "Protective apron" means an apron made of radiation absorbing materials, used to reduce radiation exposure.

(72) "Protective barrier" means a barrier of radiation absorbing material(s) used to reduce radiation exposure.

(a) "Primary protective barrier" means the material, excluding filters, placed in the useful beam, to protect anyone other than the patient from radiation exposure.

(b) "Secondary protective barrier" means a barrier sufficient to attenuate the stray radiation to the required degree.

(73) "Protective glove" means a glove made of radiation absorbing materials used to reduce radiation exposure.

(74) "Quality assurance" is a program designed to produce high quality radiographs at minimal cost and minimal patient exposure.

(75) "Quality control" is the routine measurement of the performance of the diagnostic X-ray imaging system, from X-ray beam output to the viewing of radiographs, and the continual adjustment of that performance to an optimal and consistent level.

(76) "Radiation detector" means a device which in the presence of radiation provides by either direct or indirect means, a signal or other information suitable for use in measuring one or more quantities of incident radiation.

(77) "Radiation safety" means efforts directed at occupational exposure reduction, patient exposure reduction, image quality improvement, diagnostic imaging system quality assurance, radiation measurements, dose evaluations, compliance with state and federal regulations, and related issues.

(78) "Radiation therapy simulation system" means a fluoroscopic or radiographic X-ray system intended for localizing the volume to be exposed during radiation therapy and confirming the position and size of the therapeutic irradiation field.

(79) "Radiograph" means an image receptor on which the image is created directly or indirectly by an X-ray pattern and results in a permanent record.

(80) "Radiographic imaging system" means any system whereby a permanent or temporary image is recorded on an image receptor by the action of ionizing radiation.

(81) "Rating" means the operating limits of an X-ray system or subsystem as specified by the component manufacturer.

(82) "Recording" means producing a permanent form of an image resulting from X-ray photons (e.g., film, video tape).

(83) "Response time" means the time required for an instrument system to reach 90 percent of its final reading when the radiation-sensitive volume of the instrument system is exposed to a step change in radiation flux from zero sufficient to provide a steady state mid-scale reading.

(84) "Scattered radiation" means radiation that, during passage through matter, has been deviated in direction (see also "direct scattered radiation").

(85) "Secondary protective barrier" (see "protective barrier").

(86) "Shutter" means a device attached to the tube housing assembly which can totally intercept the entire cross sectional area of the useful beam and which has a lead equivalency at least that of the tube housing assembly.

(87) "SID" (see "source-image receptor distance").

(88) "Source" means the focal spot of the X-ray tube.

(89) "Source-image receptor distance (SID)" means the distance from the source to the center of the input surface of the image receptor.

(90) "Source-to-skin-distance (SSD)" means the distance between the source and the skin entrance plane of the patient.

(91) "Special purpose X-ray equipment" means that which is designed for radiographic examination of one specific area of the body.

(92) "Spot check" means an abbreviated calibration procedure which is performed to assure that a previous calibration continues to be valid.

(93) "Spot film device" means a device intended to transport and/or position a radiographic image receptor between the X-ray source and fluoroscopic image receptor, including a device intended to hold a cassette over the input end of an image intensifier for the purpose of making a radiograph.

(94) "Spot film" means a radiograph which is made during a fluoroscopic examination to record permanently conditions which exist during that fluoroscopic procedure.

(95) "Stationary equipment" (see "X-ray equipment").

(96) "Stray radiation" means the sum of leakage and scattered radiation.

(97) "Technique factors" means the conditions of operation. They are specified as follows:

(a) For capacitor energy storage equipment, peak tube potential in kV and quantity of charge in mAs.

(b) For field emission equipment rated for pulsed operation, peak tube potential in kV and number of X-ray pulses.

(c) For all other equipment, peak tube potential in kV and:

(i) Either tube current in mA and exposure time in seconds,

(ii) Or the product of tube current and exposure time in mAs.

(98) "Transmission detector" means a radiation detector through which the useful beam or part of the useful beam passes.

(99) "Treatment volume" means the region, in the patient, to which a specified dose is to be delivered.

(100) "Tube" means an X-ray tube, unless otherwise specified.

(101) "Tube housing assembly" means the tube housing with tube installed. It includes high-voltage and/or filament transformers and other appropriate elements when they are contained within the tube housing.

(102) "Tube rating chart" means the set of curves which specify the rated limits of operation of the tube in terms of the technique factors.

(103) "Useful beam" means the radiation which passes through the tube housing port and the aperture of the beam-limiting device when the exposure switch or timer is activated.

(104) "Variable-aperture beam-limiting device" means a beam-limiting device which has capacity for stepless adjustment of the X-ray field size.

(105) "Visible area" means that portion of the input surface of the image receptor over which incident X-ray photons produce a visible image.

(106) "Wedge filter" means an added filter with changing radio-opacities used to achieve more uniform optical densities on the image receptor when a body part of varying absorption characteristics is radiographed.

(107) "X-ray control" means a device which controls input power to the X-ray high-voltage generator and/or the X-ray tube. It includes equipment which controls the technique factors of an X-ray exposure.

(108) "X-ray equipment" means an X-ray system, subsystem, or component thereof. Types of X-ray equipment are as follows:

(a) 'Mobile' means X-ray equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled.

(b) 'Portable' means X-ray equipment designed to be hand-carried.

(c) 'Stationary' means X-ray equipment which is installed in a fixed location.

(109) "X-ray field" means that area of the intersection of the useful beam and any one of the set of planes parallel to and including the plane of the image receptor, whose perimeter is the locus of points at which the exposure rate is one-fourth of the maximum in the intersection.

(110) "X-ray high-voltage generator" means a device which transforms electrical energy from the potential supplied by the X-ray control to the tube operating potential. The device may also include means for transforming alternating current to direct current, filament transformers for the X-ray tube(s), high-voltage switches, electrical protective devices, and other appropriate elements.

(111) "X-ray system" means an assemblage of components for the controlled production of x-rays. It includes minimally an X-ray high-voltage generator, an X-ray control, a tube housing assembly, a beam-limiting device, and the necessary supporting structures. Additional components which function with the system are considered integral parts of the system.

(112) "X-ray subsystem" means any combination of two or more components of an X-ray system for which there are requirements specified in this part.

(113) "X-ray tube" means any electron tube which is designed to be used primarily for the production of X-rays.

[Statutory Authority: RCW 70.98.050 and 70.98.080. WSR 91-15-083 (Order 183), § 246-225-010, filed 7/23/91, effective 8/23/91. Statutory Authority: RCW 43.70.040. WSR 91-02-049 (Order 121), recodified as § 246-225-010, filed 12/27/90, effective 1/31/91. Statutory Authority: RCW 70.98.080. WSR 83-19-050 (Order 2026), § 402-28-020, filed 9/16/83. Statutory Authority: RCW 70.98.050. WSR 81-01-011 (Order 1570), § 402-28-020, filed 12/8/80; Order 1084, § 402-28-020, filed 1/14/76; Order 1, § 402-28-020, filed 1/8/69; Rules (part), filed 10/26/66.]