

(A) Quality factors for converting absorbed dose to dose equivalent are as follows:

Type of radiation	Quality factor (Q)	Absorbed dose equal to a unit dose equivalent ^{A/}
X-, gamma, or beta radiation and high-speed electrons	1	1
Alpha particles, multiple-charged particles, fission fragments and heavy particles of unknown charge	20	0.05
Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

^{A/} Absorbed dose in gray equal to one sievert or the absorbed dose in rad equal to one rem.

(B) If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in sievert per hour or rem per hour, as provided in paragraph (A) of this rule, 0.01 sievert (one rem) of neutron radiation of unknown energies may, for purposes of these regulations, be assumed to result from a total fluence of twenty-five million neutrons per square centimeter incident upon the body. If sufficient information exists to estimate the approximate energy distribution of the neutrons, the licensee may use the fluence rate per unit dose equivalent or the appropriate Q value as provided in this paragraph to convert a measured tissue dose in gray or rad to dose equivalent in sievert or rem as follows:

	Neutron energy (MeV)	Quality factor ^{A/} (Q)	Fluence per unit dose equivalent ^{B/} (neutrons cm ⁻² rem ⁻¹)	Fluence per unit dose equivalent ^{B/} (neutrons cm ⁻² Sv ⁻¹)
(Thermal).....	2.5x10 ⁻⁸	2	980x10 ⁶	980x10 ⁸
..	1x10 ⁻⁷	2	980x10 ⁶	980x10 ⁸
	1x10 ⁻⁶	2	810x10 ⁶	810x10 ⁸
	1x10 ⁻⁵	2	810x10 ⁶	810x10 ⁸
	1x10 ⁻⁴	2	840x10 ⁶	840x10 ⁸
	1x10 ⁻³	2	980x10 ⁶	980x10 ⁸
	1x10 ⁻²	2.5	1010x10 ⁶	1010x10 ⁸
	1x10 ⁻¹	7.5	170x10 ⁶	170x10 ⁸
	5x10 ⁻¹	11	39x10 ⁶	39x10 ⁸
	1	11	27x10 ⁶	27x10 ⁸
	2.5	9	29x10 ⁶	29x10 ⁸
	5	8	23x10 ⁶	23x10 ⁸
	7	7	24x10 ⁶	24x10 ⁸
	10	6.5	24x10 ⁶	24x10 ⁸
	14	7.5	17x10 ⁶	17x10 ⁸

	20	8	16×10^6	16×10^8
	40	7	14×10^6	14×10^8
	60	5.5	16×10^6	16×10^8
	1×10^2	4	20×10^6	20×10^8
	2×10^2	3.5	19×10^6	19×10^8
	3×10^2	3.5	16×10^6	16×10^8
	4×10^2	3.5	14×10^6	14×10^8

^AValue of quality factor (Q) at the point where the dose equivalent is maximum in a 30-centimeter diameter cylinder tissue-equivalent phantom.

^BMonoenergetic neutrons incident normally on a 30-centimeter diameter cylinder tissue-equivalent phantom.

(C) For the purpose of Chapter 3701:1-38 of the Administrative Code, activity is expressed in the SI unit of becquerel, Bq, or in the special unit of curie, Ci, or their multiples, or disintegrations or transformations per unit of time.

(D) Radiation protection programs.

- (1) Each licensee or registrant shall develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed or registered activities to ensure compliance with the provisions of this chapter. Record keeping requirements are provided in paragraph (B) of rule 3701:1-38-20 of the Administrative Code.
- (2) The licensee or registrant shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable.
- (3) The licensee or registrant shall, at intervals not to exceed twelve months, review the radiation protection program content and implementation.
- (4) To implement the ALARA requirements of paragraph (D)(2) of this rule, and notwithstanding the requirements in rule 3701:1-38-13 of the Administrative Code, a constraint on air emissions of radioactive material to the environment, excluding radon-222 and its daughters, shall be established by licensees, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 0.1 millisievert (ten millirem) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the amount exceeding the dose constraint as provided in paragraph (C) of rule 3701:1-38-21 of the Administrative Code and promptly take appropriate corrective action to ensure against recurrence.

Five Year Review (FYR) Dates: 07/01/2015 and 07/01/2020

CERTIFIED ELECTRONICALLY

Certification

07/01/2015

Date

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