

DICOM Correction Item

Correction Number CP-484	
Log Summary: RT Brachytherapy Source Strength	
Type of Modification Omission	Name of Standard PS 3 2004
<p>Rationale for Correction:</p> <p>The item Reference Air Kerma Rate (300A,022A) is only applicable if the Source is a Gamma emitting Source. For Beta emitting Sources the Source Strength is specified as dose rate in water at a specified reference point. The standard needs to be modified to account for Beta-emitting sources. The modifications in this Change Proposal add this support without invalidating existing implementations that support non-gamma sources.</p>	
<p>Sections of documents affected</p> <p>PS 3.3, C.8.8 (Radiotherapy modules) PS 3.6 Section 6 (Registry of DICOM Data Elements)</p>	
Correction Wording:	

In PS 3.3, C.8.8.15, RT Brachy Application Setups Module, Table C.8-51 (RT Brachy Application Setups Module Attributes), add or modify the following attributes as indicated in bold:

Attribute Name	Tag	Type	Attribute Description
Source Sequence	(300A,0210)	1	Introduces Sequence of Sources to be used within Application Setups. One or more items may be included in this sequence.
...
>Source Isotope Half Life	(300A,0228)	1	Half-life of Isotope (days).
>Source Strength Units	(300A,0229)	1C	<p><u>Measurement unit of Source Strength.</u> <u>Required if the source is not a gamma-emitting (photon) source. May be present otherwise.</u> <u>Enumerated Values:</u> <u>AIR KERMA RATE = Air Kerma Rate if Source is Gamma emitting Isotope.</u> <u>DOSE RATE WATER = Dose Rate in Water if Source is Beta emitting Isotope.</u></p>
>Reference Air Kerma Rate	(300A,022A)	1	Air Kerma Rate in air of Isotope specified at Air Kerma Rate Reference Date (300A,022C) and Air Kerma Rate Reference Time (300A,022E) (in $\mu\text{Gy h}^{-1}$ at 1 m). <u>Value shall be zero for non-gamma sources.</u>

> Source Strength	(300A,022B)	1C	Source Strength of Isotope at Source Strength Reference Date (300A,022C) and Source Strength Reference Time (300A,022E), in units specified in Source Strength Units (300A,0229). Required if the source is not a gamma-emitting (photon) source. See C.8.8.15.12.
>Air Kerma Rate Source Strength Reference Date	(300A,022C)	1	Reference date for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.
>Air Kerma Rate Source Strength Reference Time	(300A,022E)	1	Reference time for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.
...
>Total Reference Air Kerma	(300A,0250)	1	Total Reference Air Kerma for current Application Setup, i.e. the product of Air Kerma Rate of all Sources in all Channels with their respective Channel Times (μGy at 1 m). Value shall be zero for non-gamma sources.

In PS 3.3,C.8.8.22, RT Brachy Session Record Module, Table C.8-58 (RT Brachy Session Record Module Attributes), add or modify the following attributes as indicated in bold:

Attribute Name	Tag	Type	Attribute Description
Recorded Source Sequence	(3008,0100)	1	Introduces Sequence of Sources to be used within Application Setups. One or more items may be included in this sequence.
...
>Source Isotope Half Life	(300A,0228)	1	Half-life of Isotope (days).
> Source Strength Units	(300A,0229)	1C	Measurement unit of Source Strength. Required if the source is not a gamma-emitting (photon) source. May be present otherwise. Enumerated Values: <u>AIR KERMA RATE = Air Kerma Rate if Source is Gamma emitting Isotope.</u> <u>DOSE RATE WATER = Dose Rate in Water if Source is Beta emitting Isotope.</u>
>Reference Air Kerma Rate	(300A,022A)	1	Air Kerma Rate in air of Isotope specified at Air Kerma Rate Reference Date (300A,022C) and Air Kerma Rate Reference Time (300A,022E) (in $\mu\text{Gy h}^{-1}$ at 1 m). Value shall be zero for non-gamma sources.

> <u>Source Strength</u>	<u>(300A,022B)</u>	<u>1C</u>	<u>Source Strength of Isotope at Source Strength Reference Date (300A,022C) and Source Strength Reference Time (300A,022E), in units specified in Source Strength Units (300A,0229).</u> <u>Required if the source is not a gamma-emitting (photon) source. See C.8.8.15.12.</u>
>Air Kerma Rate <u>Source Strength</u> Reference Date	(300A,022C)	1	Reference date for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.
>Air Kerma Rate <u>Source Strength</u> Reference Time	(300A,022E)	1	Reference time for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.
...
>Total Reference Air Kerma	(300A,0250)	1	Total Reference Air Kerma for current Application Setup, i.e. the product of Air Kerma Rate of all Sources in all Channels with their respective Channel Times (μGy at 1 m). Value shall be zero for non-gamma sources.

In PS 3.3, add the following note after C.8.8.15.11:

C.8.8.15.12 Reference Point for calibration of beta emitting isotopes

For beta emitting isotopes, the Source Strength (300A,022B) shall be defined at reference point (r_0, θ_0) , where r_0 is the radial distance of 2 mm from the source longitudinal axis, and θ_0 is the angle of 90 degrees between the source longitudinal axis and the line defined by the center of the source and the reference point. Refer to:

- **IEC 60601-2-17 (Medical electrical equipment – Particular requirements for the safety of automatically-controlled brachytherapy afterloading equipment), where the beta source strength is defined as: ABSORBED DOSE RATE [Gy s^{-1}] in water at 2 mm along the perpendicular bisector from a RADIOACTIVE SOURCE emitting beta RADIATION.**
- **Nath et. al.: Intravascular brachytherapy physics: Report of the AAPM Radiation Therapy Committee Task Group No. 60, Med. Phys 26 (2) Feb 1999, pp 119-152.**

In PS3.6, Section 6, add the following new attributes:

Tag	Name	VR	VM
<u>(300A,0229)</u>	<u>Source Strength Units</u>	<u>CS</u>	<u>1</u>
<u>(300A,022B)</u>	<u>Source Strength</u>	<u>DS</u>	<u>1</u>

In PS3.6, Section 6, modify the following attributes as indicated in bold:

Tag	Name	VR	VM
(300A,022C)	Air Kerma Rate Source Strength Reference Date	DA	1
(300A,022E)	Air Kerma Rate Source Strength Reference Time	TM	1