Digital Imaging and Communications in Medicine (DICOM)

Supplement 191: Patient Radiation Dose Report (P-RDSR)

Prepared by: WG-28 Physics

1300 N. 17th Street, Suite 900

Rosslyn, Virginia 22209 USA

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Foreword

This supplement to the DICOM standard introduces a template for Patient – Radiation Dose Reporting in DICOM. The concepts of Structured Reporting will be used in this context.

This document is a Supplement to the DICOM Standard. It is an extension to the following parts of the published DICOM Standard:

PS 3.2	Conformance
PS 3.3	Information Object Definitions
PS 3.4	Service Class Specifications
PS 3.6	Data Dictionary
PS 3.16	Content Mapping Resource
PS 3.17	Explanatory Information

This work was undertaken in liaison with the America Association of Physicists in Medicine (AAPM) and European Federation of Medical Physicists (EFOMP).

Scope and Field of Application

This Supplement is creating a structured report to contain the information concerning the recording of the estimated radiation dose to a patient.

This includes radiation dose from CT, projection X-Ray, and radiopharmaceutical administration (diagnostic and therapeutic). Occupational radiation exposures and dose from external beam therapy, ion beam therapy, or brachytherapy is out of scope.

There are multiple methodologies and models that can be used to estimate patient dose and these methods are rapidly changing. Yet, once an estimate of the radiation dose absorbed by a patient is performed, the storing and transferring in a standard format is needed for the radiation source data, method used, parameters used within the method and the resulting dose estimate.

The approach taken here for the Patient Radiation Dose Structured Report (P-RDSR) is to define a new Structured Report (SR) object template and SOP Class. This SR object, independent of the images or the MPPS, could be routed to an appropriate Dose Information Reporter System. A system that claims conformance to such an SR object would then be expected, as a concomitant of the conformance claim, to appropriately deal with such data items.

This SR dose object allows the data flow and data management of patient estimated radiation dose reports to be disentangled from the data flow and data management of images.

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CLOSED Issues

Item	Response
1	Consider a summary of use cases, specific how an EMR, etc. may use this data. This would be an IHE Task and no revisions were made to the Supplement
2	Data missing in current Radiation Dose SR needs to be addressed to support this P-RDSR. This is an ongoing WG28/WG02 task and will continue after this Supplement is in the Standard
3	References to proprietary model, version, etc. may be needed to be put into separate containers. This is now covered in prdsrCD082, DCM, "Radiation Dose Estimate Method Reference," see TID prdsrT04 Dose Estimate Methodology

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Changes to NEMA Standards Publication PS 3.2-xxxx

Digital Imaging and Communications in Medicine (DICOM)

Part 2: Conformance

Item #01: Add new SOP Classes in Table A.1-2

Table A.1-2
UID VALUES

UID Value	UID NAME	Category
…		
1.2.840.10008.5.1.4.1.1.88.x	**Patient Radiation Dose SR**	**Transfer**
…		

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132 # Changes to NEMA Standards Publication PS 3.3-xxxx

Digital Imaging and Communications in Medicine (DICOM)

134 # Part 3: Information Object Definitions

Add the following column in PS 3.3 Section A.1.4, Table A.1-3 Composite Information Object Modules Overview - More Non-Images

IODs **Modules**	**PRD** **SR**
Patient	**M**
Clinical Trial Subject	**U**
General Study	**M**
Patient Study	**U**
Clinical Trial Study	**U**
SR Document Series	**M**
Clinical Trial Series	**U**
Synchronization	**C**
General Equipment	**M**
Enhanced General Equipment	**M**
SR Document General	**M**
SR Document Content	**M**
SOP Common	**M**

Item #02: Add PS3.3 Section A.35.X:

A.35.X P-RDSR Information Object Definition

A.35.X.1 P-RDSR Information Object Description

The P-RDSR IOD is used to convey the information used in the calculations for estimating the radiation dose to an individual patient. The complexity of the calculations and the precision of the resulting dose estimate will vary depending on the need.

This IOD is not meant for determining patient dose from therapeutic use of radiation in oncology settings. The therapeutic dose in oncology settings is reported by the RT Dose IOD.

A.35.X.2 P-RDSR IOD Entity-Relationship Model

The E-R Model in Section A.1.2 of this Part applies to the P-RDSR IOD. Table A.35.X-1 specifies the Modules of the P-RDSR IOD.

A.35.X.3 P-RDSR IOD Module Table

Table A.35.X-1
P-RDSR IOD MODULES

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	SR Document Series	C.17.1	M
	Clinical Trial Series	C.7.3.2	U
Frame of Reference	Synchronization	C.7.4.2	C - shall be present if system time is synchronized to an external reference. May be present otherwise.
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Document	SR Document General	C.17.2	M
	SR Document Content	C.17.3	M
	SOP Common	C.12.1	M

A.35.X.3.1 P-RDSR IOD Content Constraints

A.35.X.3.1.1 Template

The document may be constructed from Baseline TID prdsrT01 "Patient Radiation Dose Report" invoked at the root node.

A.35.X.3.1.2 Value Type

Value Type (0040,A040) in the Content Sequence (0040,A730) of the SR Document Content Module is constrained to the following Enumerated Values (see Table C.17.3-7 for Value Type definitions):

TEXT
CODE
NUM
DATETIME
UIDREF
PNAME
COMPOSITE
IMAGE
CONTAINER

A.35.X.3.1.3 Relationship Constraints

Relationships between content items in the content of this IOD may be conveyed by-value. Table A.35.X-2 specifies the relationship constraints of this IOD. See Table C.17.3-2 for Relationship Type definitions.

Table A.35.X-2
RELATIONSHIP CONTENT CONSTRAINTS FOR P-RDSR IOD

Source Value Type	Relationship Type (Enumerated Values)	Target Value Type
CONTAINER	CONTAINS	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, IMAGE, COMPOSITE, CONTAINER
CONTAINER	HAS OBS CONTEXT	DATETIME, CODE, TEXT, UIDREF, PNAME
TEXT, CODE, NUM	HAS OBS CONTEXT	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, COMPOSITE
CONTAINER, IMAGE, COMPOSITE	HAS ACQ CONTEXT	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, CONTAINER.
any type	HAS CONCEPT MOD	TEXT, CODE
TEXT, CODE, NUM	HAS PROPERTIES	TEXT, CODE, NUM, DATETIME, UIDREF, PNAME, IMAGE, COMPOSITE, CONTAINER.
PNAME	HAS PROPERTIES	TEXT, CODE, DATETIME, DATE, TIME, UIDREF, PNAME
TEXT, CODE, NUM	INFERRED FROM	TEXT, CODE, NUM, DATETIME, UIDREF, IMAGE, COMPOSITE, CONTAINER.

Note: The SOP Classes to which an IMAGE or COMPOSITE Value Type may refer, is documented in the Conformance Statement for an application (see PS 3.2 and PS 3.4).

Changes to NEMA Standards Publication PS 3.4-xxxx

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Part 4: Service Class Specifications

Item #05: Add SOP Class to Table B.3-3

Table B.3-3
STANDARD AND RELATED GENERAL SOP CLASSES

SOP Class Name	Related General SOP Class Name
…	
P-RDSR	
	Comprehensive SR

Item #06: Add SOP Class to Table B.5-1

B.5 STANDARD SOP CLASSES

Table B.5-1
STANDARD SOP CLASSES

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
…		
P-RDSR	**1.2.840.10008.5.1.4.1.1.88.X**	**P-RDSR IOD**

Item #07: Add Structured Reporting SOP Class to Section B.5.1.5

B.5.1.5 Structured Reporting Storage SOP Classes

The requirements of Annex O apply to the following SOP Classes:

- …
- **P-RDSR**

Item #08: Add SOP Class to Table I.4-1

I.4 MEDIA STORAGE SOP CLASSES

Table I.4-1
Media Storage Standard SOP Classes

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
…		
P-RDSR	**1.2.840.10008.5.1.4.1.1.88.X**	**P-RDSR IOD**

Item #09: Add SOP Class to Section I.4.1.2

I.4.1.2 Structured Reporting Storage SOP Classes

The requirements of Annex O apply to the following SOP Classes:

- …
- **P-RDSR**

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218 # Changes to NEMA Standards Publication PS 3.6-xxxx

Digital Imaging and Communications in Medicine (DICOM)

220 # Part 6: Data Dictionary

Item #10: Add the following row to Table A-1

UID Value	UID Name	UID Type	Part
…			
1.2.840.10008.5.1.4.1.1.88.X	**P-RDSR**	**SOP Class**	**PS 3.4**
…			

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232 # Changes to NEMA Standards Publication PS 3.16-xxxx

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234 # Part 16: Content Mapping Resource

Item #11: Add new Section to Annex A

P-RDSR IOD TEMPLATES

The templates that comprise the P-RDSR are interconnected as in Figure A-x.

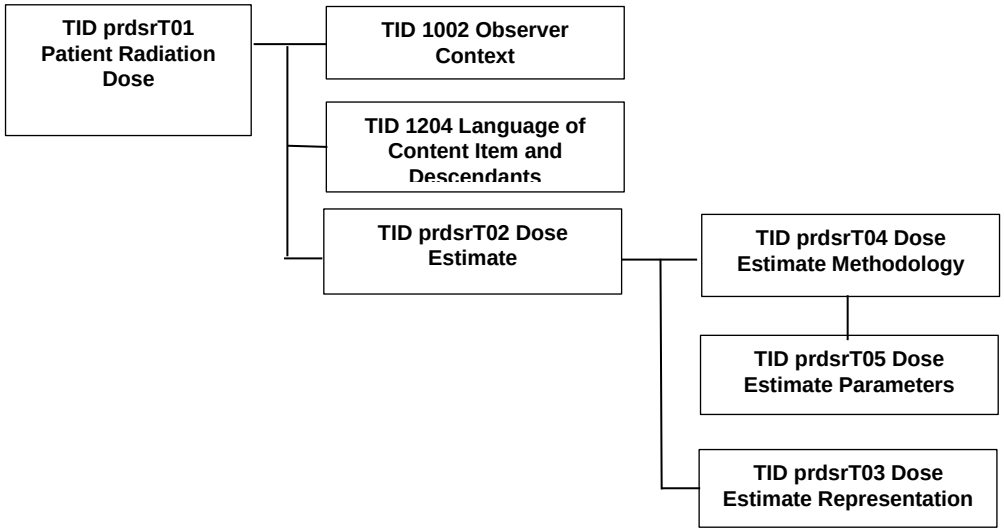

Figure A-x: P-RDSR IOD Template Structure

TID prdsrT01 Patient Radiation Dose

This template defines a container (the root) with subsidiary content items for determining an estimated radiation dose to a patient.

TID prdsrT01
Patient Radiation Dose
Type: Extensible
Order: Non Significant
Root: Yes

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (prdsrCD001, DCM, “Patient Radiation Dose Report”)	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	DTID 1204 “Language of Content Item and Descendants”	1	M		
3	>	HAS OBS CONTEXT	INCLUDE	DTID (1002) Observer Context	1-n	M		
4	>	CONTAINS	INCLUDE	DTID (prdsrT02, “Dose Estimate”)	1	M		
5	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

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Content Item Descriptions

Row 3	Identify all observers and devices involved with organ estimations included in this P-RDSR.

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TID prdsrT02 Dose Estimate

254 The dose estimate is used to record the results from one analysis method from one or more radiation sources. Organ dose estimates are calculated from one or more irradiation events to a patient. The output
256 from one or more sources of radiation can be used separately or combined to estimate the dose to a patient or individual organs.

258 **TID prdsrT02**
Dose Estimate
260 **Type: Extensible**
Order: Non Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	EV (prdsrCD002, DCM, “Dose Estimate”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV (prdsrCD003, DCM, “Dose Estimate Name”)	1	M		
3	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		
4	>	CONTAINS	INCLUDE	DTID (prdsrT04, DCM, “Dose Estimate Methodology”)	1	M		
5	>	CONTAINS	INCLUDE	DTID (prdsrT03, DCM, “Dose Estimate Representation”)	1-n	U		
6	>	CONTAINS	CONTAINER	EV (113517, DCM, “Organ Dose Information”)	1-n	M		
7	>>	CONTAINS	CODE	EV (T-D0060,SRT, “Organ”)	1	M		DCID prdsrCI12 “Organs for Dose Estimations”
8	>>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		
9	>>	CONTAINS	NUM	EV (prdsrCD113, DCM, “Absorbed Dose”)	1	M		UNITS = EV (mGy, UCUM, “mGy”)
10	>>>	HAS CONCEPT MOD	CODE	EV (121401, DCM, “Derivation”)	1	M		DCID prdsrCI02 “Dose Derivation Types”
11	>>>	HAS PROPERTIES	NUM	DCID 225 “Measurement Uncertainty Concepts”)	1-n	U		UNITS = EV (mGy, UCUM, “mGy”)

12	>>>>	HAS PROPERTIES	TEXT	EV (prdsrCD111, DCM, “Reference to Uncertainty Determination Method”)	1	U		
13	>>	CONTAINS	NUM	EV (prdsrCD112, DCM, “Equivalent Dose”)	1	U		UNITS = EV (mSv, UCUM, “mSv”)
14	>>>	HAS CONCEPT MOD	CODE	EV (121401, DCM, “Derivation”)	1	M		DCID prdsrCI02 “Dose Derivation Types”
15	>>>	HAS PROPERTIES	NUM	DCID 225 “Measurement Uncertainty Concepts””)	1-n	U		UNITS = EV (mSv, UCUM, “mSv”)
16	>>>>	HAS PROPERTIES	TEXT	EV (prdsrCD111, DCM, “Reference to Uncertainty Determination Method”)	1	U		

Content Item Descriptions

Row 10	The meaning of the Dose Derivation Types values is defined by the method recorded in Row 5.
Row 13	Equivalent Dose is an international quantity and includes the use of a Radiation Weighting Factor to compensate for the radiation type, e.g., photon, neutron, alpha or beta particle, etc. Stating equivalent dose is not recommended in almost all dosimetry situations, except in Radiopharmaceutical dose. This is not Effective Dose.

TID prdsrT03 Dose Estimate Representation

Different representations (e.g., images) of the distribution of absorbed energy allow a better understanding of how this energy may affect tissue.

TID prdsrT03
Dose Estimate Representation
Type: Extensible
Order: Non Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (prdsrCD012, DCM, “Dose Estimate Representation”)	1	M		
2	>	CONTAINS	CODE	EV (prdsrCD013, DCM, “Distribution Representation”)	1	M		DCID prdsrCI13 “Dose Estimate Distribution Representation”
3	>	CONTAINS	IMAGE	EV (prdsrCD014, DCM, “Dose Representation Data”)	1	MC	XOR Row 4	
4	>	CONTAINS	COMPOSITE	EV (prdsrCD014, DCM, “Dose Representation Data”)	1	MC	XOR Row 3	

5	>	CONTAINS	CODE	EV (T-D0060,SRT, “Organ”)	1-n	M		DCID prdsrCI12 “Organs for Dose Estimations”
6	>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

Content Item Descriptions

Row 3 and 4	Reference to an Instance that contains the dose representation, e.g., surface segmentation, mesh, parametric map, RT dose IOD’s, Secondary Capture, etc.
Row 5	The organs in the representation. The organs in this Row shall be present in Row 6 of TID prdsrT02 “Dose Estimate”.

TID prdsrT04 Dose Estimate Methodology

This template includes the information specific to the organ dose calculation methodology used when estimating dose to individual organs, entire body or a phantom from imaging studies that use ionizing radiation.

TID prdsrT04
Dose Estimate Methodology
Type: Extensible
Order: Non Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (prdsrCD015, DCM, “Dose Estimate Methodology”)	1	M		
2	>	CONTAINS	COMPOSITE	EV (prdsrCD016, DCM, “SR Instance Used”)	1-n	M		
3	>>	CONTAINS	COMPOSITE	EV (prdsrCD047, DCM, “Spatial Fiducial”)	1-n	U		
4	>>	HAS PROPERTIES	UIDREF	EV (prdsrCD029, DCM, ”Event UID Used”)	1-n	MC	IFF some Events in the Structured Report were not used in calculating the dose.	
5	>	CONTAINS	CONTAINER	EV (prdsrCD100, DCM, “Patient Dose Model”)	1	M		
6	>>	CONTAINS	CODE	EV (prdsrCD017, DCM, “Patient Model Type”)	1	M		DCID prdsrCI03 “Patient Model Type”.
7	>>	CONTAINS	CODE	EV (prdsrCD020, DCM, “Radiation Transport Model Type”)	1	M		DCID prdsrCI04 “Radiation Transport Model Type”.
8	>>	CONTAINS	IMAGE	EV (prdsrCD025, DCM, “Patient Dose Model Data”)	1	UC	XOR Row 9, 10	

9	>>	CONTAINS	COMPOSITE	EV (prdsrCD025, DCM, “Patient Dose Model Data”)	1	UC	XOR Row 8, 10	
10	>>	CONTAINS	UIDREF	EV (prdsrCD025, DCM, “Patient Dose Model Data”)	1	UC	XOR Row 8, 9	
11	>>	CONTAINS	TEXT	EV (prdsrCD026, DCM, “Patient Dose Model Reference”)	1	U		
12	>>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		
13	>>	CONTAINS	CONTAINER	EV (prdsrCD027, DCM, “Patient Model Demographics”)	1	M		
14	>>>	CONTAINS	NUM	EV (prdsrCD028, DCM, “Model Minimum Age”)	1	MC	IF model requires minimum age to be defined	DCID 7456 “Units of Measured Age”
15	>>>	CONTAINS	NUM	EV (prdsrCD030, DCM, “Model Maximum Age)	1	MC	IF model requires maximum age to be defined	DCID 7456 “Units of Measured Age”
16	>>>	CONTAINS	CODE	EV (prdsrCD037, DCM, “Model Patient Sex”)	1	MC	IF model requires sex to be defined.	DCID 7455 “Sex”
17	>>>	CONTAINS	NUM	EV (prdsrCD038, DCM, “Model Minimum Weight”)	1	MC	IF model requires minimum weight to be defined	UNITS = EV (kg, UCUM, “kg”)
18	>>>	CONTAINS	NUM	EV (prdsrCD041, DCM, “Model Maximum Weight”)	1	MC	IF model requires maximum weight to be defined	UNITS = EV (kg, UCUM, “kg”)
19	>>>	CONTAINS	NUM	EV (prdsrCD039, DCM, “Model Minimum Height”)	1	MC	IF model requires minimum height to be defined	UNITS = EV (cm, UCUM, "cm")
20	>>>	CONTAINS	NUM	EV (prdsrCD042, DCM, “Model Maximum Height”)	1	MC	IF model requires maximum height to be defined	UNITS = EV (cm, UCUM, "cm")
21	>>	CONTAINS	CONTAINER	EV (prdsrCD056, DCM, “Patient Model Registration”)	1-n	UC	IF spatial information used from Radiation SR or Patient Model	
22	>>>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		
23	>>>	CONTAINS	CODE	EV (prdsrCD046 DCM “Registration Method”)	1	M		DCID 7100 “RCS Registration Method Type”
24	>>>	CONTAINS	COMPOSITE	EV (prdsrCD044, DCM, “Spatial Registration”)	1	MC	IFF Row 8, 9 or 10 are present and FOR is defined	
25	>	CONTAINS	CONTAINER	EV (prdsrCD057, DCM, “X-Ray Beam Attenuator”)	1-n	MC	IF Attenuators used in estimation	
26	>>	CONTAINS	CODE	EV (prdsrCD058, DCM, “Attenuator Category”)	1	M		DCID prdsrCI07 “Attenuator Category”

27	>>	CONTAINS	CODE	EV (prdsrCD065, DCM, “Equivalent Attenuator Material”)	1	M		DCID 10006B “Radiation Attenuator Materials”
28	>>	CONTAINS	NUM	EV (prdsrCD069, DCM, “Equivalent Attenuator Thickness”)	1	MC	IF the attenuator is of uniform thickness	UNITS = EV (mm, UCUM, “mm”)
29	>>	CONTAINS	TEXT	EV (prdsrCD068, DCM, “Attenuator Description”)	1	U		
30	>>	CONTAINS	CONTAINER	EV (prdsrCD072, DCM, “X-Ray Beam Attenuator Model”)	1	U		
31	>>>	CONTAINS	CODE	EV (prdsrCD020, DCM, “Radiation Transport Model Type”)	1	U		DCID prdsrCI04 “Radiation Transport Model Type”
32	>>>	CONTAINS	TEXT	EV (prdsrCD074, DCM, “X-Ray Beam Attenuator Model Reference”)	1	U		
33	>>>	CONTAINS	IMAGE	EV (prdsrCD070, DCM, “X-Ray Attenuator Model Data”)	1	UC	XOR Row 34, 35	
34	>>>	CONTAINS	COMPOSITE	EV (prdsrCD070, DCM, “X-Ray Attenuator Model Data”)	1	UC	XOR Row 33, 35	
35	>>>	CONTAINS	UIDREF	EV (prdsrCD070, DCM, “X-Ray Attenuator Model Data”)	1	UC	XOR Row 33, 34	
36	>>	CONTAINS	CONTAINER	EV (prdsrCD075, DCM, “X-Ray Beam Attenuator Model Registration”)	1-n	U		
37	>>>	CONTAINS	CODE	EV (prdsrCD046 DCM “Registration Method”)	1	M		DCID 7100 “RCS Registration Method Type”
38	>>>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		
39	>>>	CONTAINS	COMPOSITE	EV (prdsrCD044, DCM, “Spatial Registration”)	1	MC	IFF Row 33, 34 or 35 are present and FOR is defined	
40	>	CONTAINS	CONTAINER	EV (prdsrCD076, DCM, “Radiation Dose Estimate Method”)	1-n	M		
41	>>	CONTAINS	CODE	EV (prdsrCD077, DCM, “Radiation Dose Estimate Method Type”)	1	M		DCID prdsrCI10 “Estimate Method Types”
42	>>	CONTAINS	INCLUDE	DTID prdsrT05 “Dose Estimate Parameters”	1	U		

43	>>	CONTAINS	TEXT	EV (prdsrCD082, DCM, “Radiation Dose Estimate Method Reference”)	1	U		

286 **Content Item Descriptions**

Row 2	Reference to Radiation Dose SRs or Radiopharmaceutical Administration Dose SRs used in the dose estimation. At least one SR shall be referenced. Note: If an SR does not exist, one must be created from estimated data.
Row 3	Reference to fiducial IOD that is used to register the FOR of the Radiation Dose SR.
Row 4	Reference to Irradiation Event UIDs or Radiopharmaceutical event UIDs used in the Dose Estimate Methodology. This shall not be present if all events in the SR are used.
Rows 8 and 9	Reference to an instance that contains the model used when determining the radiation transport and deposition of energy within a patient, e.g., Surface Segmentation, Mesh, Parametric Map, etc.
Row 10	Reference to the series of images that contains the model used when determining the radiation transport and deposition of energy within a patient,, e.g., CT, MRI, etc.
Row 11	Reference to Publication describing the model used. If proprietary, reference the manufacturer model and version of software used.
Rows 13 through 20	Provide the demographics used in the patient model to estimate dose. These are not necessarily the demographics of the actual patient.
Row 21	Contains the Spatial Registration from each Source Radiation Dose SR FOR to the patient model FOR. The FOR of patient model is defined by the space of model coordinates. The FOR of the Source Radiation Dose SR is the FOR of the acquired patient images. If no FOR of the acquired patient images exists, fiducials can be used to define FOR in both the equipment space, i.e., Source Radiation Dose SR, and the Patient Model space and referenced in Row 5. If RCS Registration Method Type is Visual Alignment, it is assumed any translation/rotation information from the visual alignment is added to other alignment translation/rotation information and saved as a single Spatial Registration IOD.
Rows 25	One content per attenuator. This can be information about materials in the radiation beam that is used in the estimation method and that may or may not have been included in the Radiation Dose SR. If the beam Attenuator (e.g., filter) is included here and is also in the Radiation Dose SR it is assumed additional information relative to the beam Attenuator material, shape, size, location was needed and this information was not in the Radiation Dose SR or the Radiation Dose SR information is considered incorrect or incomplete.
Row 27	The estimation method may use an equivalent material rather than the actual material, e.g., a plastic table may be use equivalent aluminum attenuation.
Row 28	If the attenuator is not uniform, a thickness may still be provided and it is expected that Row 29 (Attenuator Description) will clarify how that thickness was determined. The specified equivalent material is identified in Row 27.
Row 29	The attenuator characteristics may be described here. If the attenuator thickness was not provided in Row 28, the attenuator may still be described.
Row 30	Complex attenuators are best described by a model.
Rows 33 and 34	Reference to an instance that contains the model e.g., Surface Segmentation, Mesh, Parametric Map, etc.
Row 35	Reference to the series of images that contains the model, e.g., CT, MRI, etc. This can be spatial fiducials IOD.
Row 36	Contains the Spatial Registration from each Source Radiation Dose SR FOR to the x-ray attenuator model FOR. The FOR of the x-ray attenuator model is defined by the space of model coordinates. The FOR of the Source Radiation Dose SR is the FOR of the acquired patient images. If no FOR of the acquired patient images exists, fiducials can be used to define FOR in both the equipment space, i.e., Source Radiation Dose SR, and x-ray attenuator model space and referenced in Row 30. If RCS Registration Method Type is Visual Alignment it is assumed any translation/rotation information from the visual alignment is added to other alignment translation/rotation

	information and saved as a single Spatial Registration IOD.
Row 32 and 43	Provide name of method, reference to a publication or the manufacturer model and version

TID prdsrT05 Dose Estimate Parameters

This template includes the parameters that are specific to the Dose Estimate Method used in the algorithms when estimating dose to individual organs, phantoms, or the entire body from imaging studies that use ionizing radiation.

TID prdsrT05
Dose Estimate Parameters
Type: Extensible
Order: Non Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (prdsrCD034, DCM, “Dose Estimate Parameters”)	1	M		
2	>	CONTAINS	NUM	DCID rdsrCI06A “Radiation Dose Estimation Parameter”	1-n	MC	IF Row 4 absent	UNITS = DCID 82 “Units of Measurement”
3	>>	HAS PROPERTIES	CODE	EV(prdsrCD064, DCM, “Radiation Dose Estimate Parameter Type”)	1	M		DCID prdsrCI06 “Radiation Dose Estimate Parameter Type”
4	>	CONTAINS	COMPOSITE	EV(prdsrCD036, DCM, “Radiation Dose Composite Parameters”)	1-n	MC	IF Row 2 absent	
5	>>	CONTAINS	TEXT	EV (121106, DCM, “Comment”)	1	U		

Content Item Descriptions

Row 2	These are the parameters of the method specified in Row 43 of TID prdsrT04 Dose Estimate Methodology
Row 4	References to Parametric Map Image, Mesh, encapsulated pdf, or other similar IOD.
Row 5	Describes the contents of the IOD referenced in Row 4

Item #12: Add the following CID’s to Part 16 Annex B:

CID prdsrCI12 Organs for Dose Estimates

Table CID prdsrCI12
Organs for Dose Estimates
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
Include CID 10044 "Radiosensitive Organs"		
SRT	T-D0010	Entire Body
DCM	113681	Phantom

Table CID 225 is included for reference only, no changes required.

CID 225 Measurement Uncertainty Concepts

Measurement Uncertainty Concepts
Type: Extensible Version: 20030327

Coding Scheme Designator	Code Value	Code Meaning
SRT	R-00363	+/-, range of measurement uncertainty
SRT	R-00364	+, range of upper measurement uncertainty
SRT	R-00362	-, range of lower measurement uncertainty

Item #12: Add the following CID's to Part 16 Annex B:

CID prdsrCI02 Dose Derivation Types

Table CID prdsrCI02
Dose Derivation Types
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
SRT	G-A437	Maximum
SRT	R-404FB	Minimum
SRT	R-00317	Mean
DCM	prdsrCD095	Single Dose Value

CID prdsrCI13 Dose Estimate Distribution Representation

Table CID prdsrCI13
Dose Estimate Distribution Representation
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD084	Isodose
DCM	prdsrCD085	Skin Dose Map
DCM	prdsrCD087	3D Dose Map
DCM	prdsrCD088	Dose Gradient
DCM	prdsrCD096	Dose Point Cloud
DCM	121342	Dose Image

CID prdsrCI03 Patient Model Type

Table CID prdsrCI03
Patient Model Type
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD018	Simple Object Model
DCM	prdsrCD004	Anthropomorphic Model
DCM	prdsrCD094	Patient Segmented Model

CID prdsrCI04 Radiation Transport Model Type

Table CID prdsrCI04
Radiation Transport Model Type
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD021	Geometric Radiation Transport Model
DCM	prdsrCD022	Voxelized Radiation Transport Model
DCM	prdsrCD023	Mesh Radiation Transport Model
DCM	prdsrCD024	NURBS Radiation Transport Model
DCM	prdsrCD097	Measured Radiation Dose
DCM	prdsrCD006	BREP Radiation Transport Model

Table CID 7456 is included for reference only, no changes required.

Table CID 7456. Units of Measure for Age

Table CID 7456
Units of Measure for Age
Type: Non-Extensible Version: 20020904

Coding Scheme Designator	Code Value	Code Meaning
UCUM	a	year
UCUM	mo	month
UCUM	wk	week
UCUM	d	day
UCUM	h	hour
UCUM	min	minute

Table CID 7100 is included for reference only, no changes required.

CID 7100 RCS Registration Method Type

Table CID 7100
RCS Registration Method Type
Type: Extensible Version: 20040115

Coding Scheme Designator	Code Value	Code Meaning
DCM	125021	Frame of Reference Identity
DCM	125022	Fiducial Alignment
DCM	125023	Acquisition Equipment Alignment
DCM	125024	Image Content-based Alignment
DCM	125025	Visual Alignment

Item #12: Add the following CID's to Part 16 Annex B:

CID prdsrCI07 Attenuator Category

Table CID prdsrCI07
Attenuator Category
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD059	Table
DCM	prdsrCD060	Table Core
DCM	prdsrCD061	Table Outer Liner
DCM	prdsrCD062	Table Pad
DCM	prdsrCD063	Patient Protection Shield

DCM	prdsrCD031	Beam Block
DCM	prdsrCD092	Patient Support
DCM	113771	X-Ray Filters

CID 10006B Radiation Attenuator Materials

Table CID 10006B
Radiation Attenuator Materials
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
Include Table CID 10006 X-Ray Filter Materials		
DCM	prdsrCD066	Carbon Fiber or Carbon Fiber compound
SRT	C-139F9	Tin or Tin compound

CID prdsrCI10 Estimate Method Types

Table CID prdsrCI10
Estimate Method Types
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD078	Monte Carlo
DCM	prdsrCD079	Tabular Data
DCM	prdsrCD080	Analytical
DCM	prdsrCD081	Empirical

CID prdsrCI06A Radiation Dose Estimation Parameter

Table CID prdsrCI06A
Radiation Dose Estimation Parameter
Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD005	Breast Thickness
DCM	111634	HVL
DCM	111046	Percent Fibroglandular Tissue
DCM	prdsrCD007	Normalized Mean Glandular Dose (DgN)
DCM	prdsrCD008	Patient AP Dimension
DCM	prdsrCD009	Patient Lateral Dimension
DCM	prdsrCD010	f-s Coefficient
DCM	prdsrCD011	Backscatter

DCM	113981	Water Equivalent Diameter Representative Value
DCM	113982	Water Equivalent Diameter Integrated Across Scan Range
DCM	113983	Water Equivalent Diameter From Raw Data
DCM	113984	Water Equivalent Diameter From Localizer
DCM	prdsrCD033	Tissue Air Ratio

CID prdsrCI06 Radiation Dose Estimate Parameter Type

Table CID prdsrCI06

Radiation Dose Estimate Parameter Type

Type: Extensible Version: yyyymmdd

Coding Scheme Designator	Code Value	Code Meaning
DCM	prdsrCD052	Correction Factor
DCM	prdsrCD053	Curve Fit Parameter
DCM	prdsrCD055	Homogeneity Factor
DCM	prdsrCD122	Normalization Factor
DCM	prdsrCD123	Offset Factor
DCM	112031	Attenuation Coefficient
DCM	prdsrCD126	Tissue Fraction
DCM	prdsrCD127	Distance Correction
DCM	prdsrCD128	Conversion Factor
DCM	121206	Distance
DCM	111634	HVL

Item #: Add the following Coded terms to Part 16 Annex D: Table D-1

372 **Table D-1. DICOM Controlled Terminology Definitions**

Code Value	Code Meaning	Definition	Notes
prdsrCD001	Patient Radiation Dose Report	Report title for the report of estimated absorbed energy from ionizing radiation to a patient.	
prdsrCD002	Dose Estimate	Estimate of absorbed energy from ionizing radiation.	
prdsrCD003	Dose Estimate Name	Name used to identify a dose estimate.	
prdsrCD004	Anthropomorphic Model	A mathematical description of a patient model for estimating radiation dose that describes or is thought of as having a human form or human attributes.	
prdsrCD005	Breast Thickness	Thickness of the breast	
prdsrCD006	BREP Radiation Transport Model	Boundary based representation of the model for the estimation of radiation transport and absorbed dose in materials.	
prdsrCD007	Normalized Mean Glandular Dose (DgN)	Conversion value used to calculate the absorbed dose from radiation to the fibroglandular tissue component of the breast from the exposure in air.	
prdsrCD008	Patient AP Dimension	The size of a patient in the anterior-posterior dimension	
prdsrCD009	Patient Lateral Dimension	The size of a patient in the lateral dimension	
prdsrCD010	f-s Coefficient	Conversion factor for Size Specific Dose Estimate (SSDE) calculations from $CTDI_{vol}$	
prdsrCD011	Backscatter	Scattering of radiation in a direction opposite to that of the incident radiation	
prdsrCD012	Dose Estimate Representation	The description of the representation of the estimated absorbed energy to an organ, a set of organs or the whole body, e.g., surface segmentation, mesh, parametric map, RT dose IOD's, Secondary Capture, etc.	
prdsrCD013	Distribution Representation	The form of the representation used to describe the distribution of the radiation dose.	
prdsrCD014	Dose Representation Data	The absorbed energy data created by the estimation method.	
prdsrCD015	Dose Estimate Methodology	The methodology and parameters used to estimate the radiation dose to an organ, the whole body or a phantom.	
prdsrCD016	SR Instance Used	Reference to an SR instance used.	

prdsrCD017	Patient Model Type	The type of model used to define the shape, size, location of objects, etc. to represent a patient or phantom for use in radiation transport analysis.	
prdsrCD018	Simple Object Model	A simple object used to model a patient or organ, e.g., cylinder for estimating radiation dose	
prdsrCD020	Radiation Transport Model Type	The type of model used to estimate energy transport and absorbed dose in materials	
prdsrCD021	Geometric Radiation Transport Model	A model that uses geometrical shapes for the estimation of radiation transport and absorbed dose in materials	
prdsrCD022	Voxelized Radiation Transport Model	A model that uses volumetric pixels for the estimation of radiation transport and absorbed dose in materials	
prdsrCD023	Mesh Radiation Transport Model	A model that uses a mesh structure representation for the estimation of radiation transport and absorbed dose in materials	
prdsrCD024	NURBS Radiation Transport Model	A model that uses surfaces of a non-uniform rational B-spline (NURBS) based representation for the estimation of radiation transport and absorbed dose in materials	
prdsrCD025	Patient Dose Model Data	The data from the model used to estimate radiation dose to a patient or organ	
prdsrCD026	Patient Dose Model Reference	A reference to the methodology or rationale for the model used in the estimation of radiation dose	
prdsrCD027	Patient Model Demographics	The demographics for which the patient model used by the radiation dose estimation method is intended	
prdsrCD028	Model Minimum Age	The minimum age used by the patient model in the radiation dose estimation method	
prdsrCD029	Event UID Used	Unique Identifier of an event used	
prdsrCD030	Model Maximum Age	The maximum age used by the patient model in the radiation dose estimation method	
prdsrCD031	Beam Block	A material placed in the radiation beam that is used to completely attenuate the beam in a specific region of the field of view	
prdsrCD033	Tissue Air Ratio	Ratio of the absorbed dose at a given depth in tissue to the absorbed dose at the same point in air.	
prdsrCD034	Dose Estimate Parameters	The parameters used in the algorithms for determining the radiation dose to a patient, organs, or any material	
prdsrCD036	Radiation Dose Composite Parameters	Reference to IOD that describes the parameters and values used in the algorithms for determining the radiation dose to a patient, organs, or any material	

prdsrCD037	Model Patient Sex	The sex used by the patient model in the radiation dose estimation method	
prdsrCD038	Model Minimum Weight	The minimum weight used by the patient model in the radiation dose estimation method	
prdsrCD039	Model Minimum Height	The minimum height used by the patient model in the radiation dose estimation method	
prdsrCD041	Model Maximum Weight	The maximum weight used by the patient model in the radiation dose estimation method	
prdsrCD042	Model Maximum Height	The maximum height used by the patient model in the radiation dose estimation method	
prdsrCD044	Spatial Registration	Reference to the Spatial Registration instance or Deformable Spatial Registration instance	
prdsrCD046	Registration Method	Name of the method to register the frame of reference for two or more data sets	
prdsrCD047	Spatial Fiducial	Reference to spatial fiducial instance	
prdsrCD052	Correction Factor	A factor used to make an adjustment to a calculation to account for deviations	
prdsrCD053	Curve Fit Parameter	A value used in a mathematical statement from the empirical determination of a curve or function that approximates a set of data	
prdsrCD055	Homogeneity Factor	A value used to describe the uniformity or composition of a data set or a material that relates to the same degree of variability	
prdsrCD056	Patient Model Registration	The spatial registration used by the patient model in the radiation dose estimation method	
prdsrCD057	X-Ray Beam Attenuator	Attenuator in the radiation beam that may alter the estimated radiation dose to the patient or organ	
prdsrCD058	Attenuator Category	The type of object in the radiation beam that may alter the estimated radiation dose to the patient or organ	
prdsrCD059	Table	The table a patient is sitting, standing, or lying on and that is in the radiation beam such that it may alter the estimated radiation dose to the patient or organ	
prdsrCD060	Table Core	The core material of a table a patient is sitting, standing, or lying on and that is in the radiation beam such that it may alter the estimated radiation dose to the patient or organ	

prdsrCD061	Table Outer Liner	The outer shell of a table a patient is sitting, standing, or lying on and that is in the radiation beam such that it may alter the estimated radiation dose to the patient or organ	
prdsrCD062	Table Pad	The padding on a table a patient is sitting, standing, or lying on and that is in the radiation beam such that it may alter the estimated radiation dose to the patient or organ	
prdsrCD063	Patient Protection Shield	A patient-protective material placed within the radiation beam that may alter the estimated radiation dose to the patient or organ	
prdsrCD064	Radiation Dose Estimation Parameter Type	Parameters used in mathematical, simulation, or empirical calculations	
prdsrCD065	Equivalent Attenuator Material	The equivalent material used in the methodology to estimate the radiation dose to the patient or organ	
prdsrCD066	Carbon Fiber or Carbon Fiber compound	A material consisting of thin, strong crystalline filaments of carbon	
prdsrCD068	Attenuator Description	An explanation of the actual attenuator material and how it was used in the estimation of radiation dose	
prdsrCD069	Equivalent Attenuator Thickness	The thickness of a specified material that provides the same attenuation as the actual attenuator	
prdsrCD070	X-Ray Attenuator Model Data	The stored data from the model used to represent the X-Ray beam attenuator	
prdsrCD072	X-Ray Beam Attenuator Model	Model of the attenuator used in the estimation of radiation dose	
prdsrCD074	X-Ray Beam Attenuator Model Reference	Reference to the methodology or rationale for the model of the beam attenuator used in the estimation of radiation dose	
prdsrCD075	X-Ray Beam Attenuator Model Registration	Spatial registration of the beam attenuator model	
prdsrCD076	Radiation Dose Estimate Method	Name of the grouping of radiation dose estimation methods and parameters for a set of organs, tissues or phantoms	
prdsrCD077	Radiation Dose Estimate Method Type	Type of method used to estimate the radiation dose to a patient or organ	
prdsrCD078	Monte Carlo	Algorithms that rely on repeated random sampling to obtain numerical results.	
prdsrCD079	Tabular Data	Algorithms that use a table of values indexed by a key.	

prdsrCD080	Analytical	Algorithms that use mathematical models that have a deterministic result.	
prdsrCD081	Empirical	Algorithms that use mathematical models that use parameters derived from observation.	
prdsrCD082	Radiation Dose Estimate Method Reference	A reference to the methodology or rationale for the estimation methodology used for the estimation of radiation dose.	
prdsrCD084	Isodose	Representation of radiation dose of equal intensity as a surface, curve, or line	
prdsrCD085	Skin Dose Map	Representation of radiation dose of where the intensity at the surface on the skin	
prdsrCD087	3D Dose Map	Representation of radiation dose as a 3D shape or object	
prdsrCD088	Dose Gradient	Representation of the change in radiation dose with respect to the change in another variable. Often represented as a change with respect to time or distance.	
prdsrCD092	Patient Support	Device used to support a patient during an imaging study	
prdsrCD094	Patient Segmented Model	A patient model for estimating radiation dose defined from the actual patient anatomy or characteristics	
prdsrCD095	Single Dose Value	Radiation dose specified at a single location. This can be at the reference point.	
prdsrCD096	Dose Point Cloud	Radiation dose represented as a distribution of points	
prdsrCD097	Measured Radiation Dose	The measured amount of energy that is deposited in a material by ionizing radiation	
prdsrCD100	Patient Dose Model	A computational representation of a human body or other object used to simulate the attenuation of radiation in human tissue	
prdsrCD111	Reference to Uncertainty Determination Method	A reference to the methodology used to determine the uncertainty in the estimation of radiation dose.	
prdsrCD112	Equivalent Dose	Absorbed dose to a tissue or organ multiplied by a quality factor to normalize the dose to the type of radiation that is depositing the dose	
prdsrCD113	Absorbed Dose	Energy from ionizing radiation absorbed per unit mass	
prdsrCD122	Normalization Factor	A factor that is used to make an adjustment to a calculation to normalize the data set	

prdsrCD123	Offset Factor	A factor that is used to make an adjustment to a calculation to translate or move the data set in a defined manner	
prdsrCD126	Tissue Fraction	The amount of a specific tissue content in a material	
prdsrCD127	Distance Correction	A correction factor for a measurement or a location	
prdsrCD128	Conversion Factor	A numerical ratio to express a measurement from one unit to another unit	

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382 # Changes to NEMA Standards Publication PS 3.17-xxxx

Digital Imaging and Communications in Medicine (DICOM)

384 # Part 17: Explanatory Information

Item #15: Add Patient Radiation Dose Reporting Use Cases Annex

XXX P-RDSR Document (Informative)

This Annex contains examples of the use of Patient Radiation Dose templates within P-RDSR Documents

XXX.1 Skin Dose Map Example

The following example shows the report of the skin dose map calculated from the dose delivered during an X-Ray interventional cardiology procedure.

The calculation uses a Radiation Dose SR provided by a Single Plane X-Ray Angiography equipment of the manufacturer “A”. The Radiation Dose SR is created during one procedure step, corresponding to the coronary stenting of an adult male of 83 kg and 179 cm height.

The skin dose calculations are performed by an application on a separated workstation of the manufacturer “B”, operated by the medical physicist, who is logged into the workstation at the time of the creation of the P-RDSR document.

The dose calculation application generates a P-RDSR document and a Secondary Capture containing an image of the dose distribution over the deployed skin of the patient model.

The dose calculation application uses the following settings and assumptions:

RDSR Source Data:

- All the Irradiation Event UIDs are used in the calculation of the skin dose map.

Patient Model:

- The patient model is a combination of two elliptic cylinders to represent the chest and neck of the patient.
- The actual dimensions of the model are determined by the age, gender, height, and weight of the patient.
- In this example the exact height and weight of the patient are used to the creation of the model. The resulting elliptic cylinder for the chest of the model is 31 cm in the AP dimension and 74 cm in the lateral dimension.
- The application creates internally a 3D voxelized model that is stored in a DICOM Instance.

Patient Model Registration:

- The distance from the top of the patient’s head to the head of the table (measured during the procedure) is known. The location of the patient head and table head are stored in a Spatial Fiducial instance.
- The application uses fiducials to register the patient model with the data of the source Radiation Dose SR.
- A-priori knowledge of the distance from the table head to the system Isocenter at table zero position is calibrated offline.
- The table tilt, cradle, and rotation angles are ignored because the description of the acquisition geometry is incomplete in the Radiation Dose SR. Only table translations relative to the Isocenter are considered in the calculations.

Beam Attenuators:

- A-priori knowledge of the model of the table and mattress (i.e., shape, dimensions, and absorption material) is calibrated offline, and it’s referenced internally by the application. The model contains the same coordinate system as the one used in the equipment referenced in the Radiation Dose SR, so there is no need of another registration instance.

- The X-Ray filter information from the source Radiation Dose SR is used by the application. There is no other a-priori knowledge of the X-Ray filtration.

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Table XXX.1-1. Skin Dose Map Example

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Node	Code Meaning of Concept Name	Code or Example Value	TID
1	Patient Radiation Dose Report	*<CONTAINER>*	TID prdsrT01
1.1	Language of Content Item and Descendants	(En, IETF4646, “**English**”)	TID 1204
1.2	Observer Type	(121007,DCM, ”**Device**”)	TID 1002
1.3	Device Observer UID	<UID of Physicist Workstation>	TID 1004
1.4	Device Observer Name	**MedPhys-01**	TID 1004
1.5	Device Observer Manufacturer	**Manufacturer B**	TID 1004
1.6	Device Observer Model Name	**DW**	TID 1004
1.7	Observer Type	(121006, DCM, "**Person**")	TID 1002
1.8	Person Observer Name	**Doe^John^^Dr^PhD**	TID 1003
1.9	Person Observer's Role in the Organization	(C1708969, UMLS, “**Medical Physicist**”)	TID 1003
1.10	Dose Estimate	*<CONTAINER>*	TID prdsrT02
1.10.1	Dose Estimate Name	**Skin Dose Map**	TID prdsrT02
1.10.2	Comment	**Single Plane XA**	TID prdsrT02
1.10.3	Dose Estimate Methodology	*<CONTAINER>*	TID prdsrT04
1.10.3.1	SR Instance Used	<UID of Radiation Dose SR #1>	TID prdsrT04
1.10.3.1.1	Spatial Fiducial	<UID of “**Spatial Fiducial**”>	TID prdsrT04
1.10.3.2	Patient Dose Model	*<CONTAINER>*	TID prdsrT04
1.10.3.2.1	Patient Model Type	(prdsrCD018, DCM, “**Simple Object Model**”)	TID prdsrT04
1.10.3.2.2	Radiation Transport Model Type	(prdsrCD022, DCM, “**Voxelized Radiation Transport Model**”)	TID prdsrT04
1.10.3.2.3	Patient Dose Model Data	<UID of 3D Voxelized Patient Model>	TID prdsrT04
1.10.3.2.4	Patient Dose Model Reference	**DOI:1.2.3.4**	TID prdsrT04
1.10.3.2.5	Comment	**Combined Elliptic Cylinders**	TID prdsrT04

Node	Code Meaning of Concept Name	Code or Example Value	TID
1.10.3.2.6	Patient Model Demographics	*<CONTAINER>*	TID prdsrT04
1.10.3.2.6.1	Model Minimum Age	**18** (a, UCUM, "**year**")	TID prdsrT04
1.10.3.2.6.2	Model Maximum Age	**90** (a, UCUM, "**year**")	TID prdsrT04
1.10.3.2.6.3	Model Patient Sex	(M, DCM, "**Male**")	TID prdsrT04
1.10.3.2.6.4	Model Minimum Weight	**83** (kg, UCUM, "**kg**")	TID prdsrT04
1.10.3.2.6.5	Model Maximum Weight	**83** (kg, UCUM, "**kg**")	TID prdsrT04
1.10.3.2.6.6	Model Minimum Height	**179** (cm, UCUM, "**cm**")	TID prdsrT04
1.10.3.2.6.7	Model Maximum Height	**179** (cm, UCUM, "**cm**")	TID prdsrT04
1.10.3.2.7	Patient Model Registration	*<CONTAINER>*	TID prdsrT04
1.10.3.2.7.1	Comment	**Distance from the top of patient's head to the head of the table = 10 cm**	TID prdsrT04
1.10.3.2.7.2	Registration Method	(125023, DCM, "**Fiducial Alignment**")	TID prdsrT04
1.10.3.2.7.3	Spatial Registration	<UID of "**Spatial Registration**">	TID prdsrT04
1.10.3.3	X-Ray Beam Attenuator	*<CONTAINER>*	TID prdsrT04
1.10.3.3.1	Attenuator Category	(prdsrCD059, DCM, "**Table**")	TID prdsrT04
1.10.3.3.2	Equivalent Attenuator Material	(prdsrCD066, DCM, "**Carbon Fiber or Carbon Fiber compound**")	TID prdsrT04
1.10.3.3.3	Equivalent Attenuator Thickness	**100** (mm, UCUM, "**mm**")	TID prdsrT04
1.10.3.3.4	Attenuator Description	**X-Ray Table with Mattress**	TID prdsrT04
1.10.3.3.5	X-Ray Beam Attenuator Model	*<CONTAINER>*	TID prdsrT04
1.10.3.3.5.1	Radiation Transport Model Type	(prdsrCD021, DCM, "**Geometric Radiation Transport Model**")	TID prdsrT04
1.10.3.3.5.2	X-Ray Beam Attenuator Model Reference	**DOI:1.4.2.3**	TID prdsrT04
1.10.3.4	Radiation Dose Estimate Method	*<CONTAINER>*	TID prdsrT04
1.10.3.4.1	Radiation Dose Estimate Method Type	(prdsrCD080, DCM, "**Analytical**")	TID prdsrT04
1.10.3.4.2	Dose Estimate Parameters	*<CONTAINER>*	TID prdsrT05
1.10.3.4.2.1	(prdsrCD033, DCM, "**Tissue Air Ratio**")	**1.06** ({ratio}, UCUM, "**ratio**")	TID prdsrT05

Node	Code Meaning of Concept Name	Code or Example Value	TID
1.10.3.4.2.1.1	Radiation Dose Estimate Parameter Type	(prdsrCD128, DCM, "**Conversion Factor**")	TID prdsrT05
1.10.3.4.2.2	(prdsrCD008, DCM, "**Patient AP Dimension**")	**31** (cm, UCUM, "**cm**")	TID prdsrT05
1.10.3.4.2.2.1	Radiation Dose Estimate Parameter Type	(121206, DCM, "**Distance**")	TID prdsrT05
1.10.3.4.2.3	(prdsrCD009, DCM, "**Patient Lateral Dimension**")	**74** (cm, UCUM, "**cm**")	TID prdsrT05
1.10.3.4.2.3.1	Radiation Dose Estimate Parameter Type	(121206, DCM, "**Distance**")	TID prdsrT05
1.10.3.4.2.4	(MyCode001, MyScheme001, "**Linear attenuation coefficient of the table and mattress**")	**0.010536** (/cm, UCUM, "**/Centimeter**")	TID prdsrT05
1.10.3.4.2.4.1	Radiation Dose Estimate Parameter Type	(112031, DCM, "**Attenuation Coefficient**")	TID prdsrT05
1.10.3.4.3	Radiation Dose Estimate Method Reference	**DOI:4.2.13.4**	TID prdsrT04
1.10.4	Dose Estimate Representation	*<CONTAINER>*	TID prdsrT03
1.10.4.1	Distribution Representation	(prdsrCD085, DCM, "**Skin Dose Map**")	TID prdsrT03
1.10.4.2	Dose Representation Data	<UID of Secondary Capture>	TID prdsrT03
1.10.4.3	Organ	(T-00009, SRT, "**Skin**")	TID prdsrT03
1.10.4.4	Comment	**2D map of the dose on the deployed skin**	TID prdsrT03
1.10.5	Organ Dose Information	*<CONTAINER>*	TID prdsrT02
1.10.5.1	Organ	(T-00009, SRT, "**Skin**")	TID prdsrT02
1.10.5.2	Comment	**Skin in the area of the chest and neck**	TID prdsrT02
1.10.5.3	Absorbed Dose	**3000** (mGy, UCUM, "**mGy**")	TID prdsrT02
1.10.5.3.1	Derivation	(G-A437, SRT, "**Maximum**")	TID prdsrT02
1.10.5.3.2	(R-00363, SRT, "**+/-, range of measurement uncertainty**")	**750** (mGy, UCUM, "**mGy**")	TID prdsrT02
1.11	Comment	**Skin Dose Map Report**	TID prdsrT01

XXX.2 Dual-source CT Organ Dose Example

The following example shows the report of the organ dose calculated for a dual-source CT scan.

The calculation uses a Radiation Dose SR provided by a CT system that has dual x-ray tubes. The Radiation Dose SR is created during the acquisition of Neck DE_CAROTID CT scan of an adult male of 75 kg and 165 cm height.

The dose calculations are performed on the CT system. The dose calculation application generates a P-RDSR document and a Dose Point Cloud containing an image of the dose distribution for the patient model.

The dose calculation application uses the following settings and assumptions:

RDSR Source Data:

- The Irradiation Events associated with the CT Localizer Radiograph are excluded.
- The Irradiation Event UID from the helical CT series is used in the calculation of the organ dose.

Patient Model:

- The patient model is a stylized anthropomorphic model of the patient.
- Organs are represented by simple geometric shapes described by mathematical equations. The parameters of the equations describing the location, shape, and dimension of the organs are stored in a DICOM Instance.
- In this example the gender and age of the patient are used to select the appropriate phantom from the existing phantom library.

Patient Model Registration:

- Instance Image Content-based Alignment between the CT images FOR and the 3D stylized model FOR is used for registration.

Beam Attenuators:

- Additional Aluminum filtration is used in the methodology and the equivalent HVL for the scanner model used in the method is given.

Table XXX.2-1. Dual-source CT Organ Dose Example

P-SR-1

Node	Code Meaning of Concept Name	Code or Example Value	TID
1	Patient Radiation Dose Report	*<CONTAINER>*	TID prdsrT01
1.1	Language of Content Item and Descendants	(En, IETF4646, "**English**")	TID 1204
1.1.1	Country of Language	(CA, ISO3166_1, "**Canada**")	TID 1204
1.2	Observer Type	(121007, DCM, "**Device"**)	TID 1002
1.3	Device Observer UID	**xxxxx**	TID 1004
1.4	Device Observer Name	**RUMC-xxxxx**	TID 1004
1.5	Device Observer Manufacturer	**Manufacturer X**	TID 1004

Node	Code Meaning of Concept Name	Code or Example Value	TID
1.6	Device Observer Model Name	**Scanner X**	TID 1004
1.7	Dose Estimate	*<CONTAINER>*	TID prdsrT02
1.7.1	Dose Estimate Name	**Dual-source Neck DE_CAROTID CT scan Tube A&B**	TID prdsrT02
1.7.2	Comment	**Tube A and B combined**	TID prdsrT02
1.7.3	Dose Estimation Methodology	*<CONTAINER>*	TID prdsrT04
1.7.3.1	SR Instance Used	<UID of Radiation Dose SR>	TID prdsrT04
1.7.3.1.1	Event UID Used	**1.3.12.2.xxxxxx**	TID prdsrT04
1.7.3.2	Patient Dose Model	*<CONTAINER>*	TID prdsrT04
1.7.3.2.1	Patient Model Type	(prdsrCD004, DCM, "**Anthropomorphic Model**")	TID prdsrT04
1.7.3.2.2	Radiation Transport Model Type	(prdsrCD021, DCM, "**Geometric Radiation Transport Model**")	TID prdsrT04
1.7.3.2.3	Patient Dose Model Data	< UID of "**Patient Dose Model Data**">	TID prdsrT04
1.7.3.2.4	Patient Dose Model Reference	**Cristy et al. 1987**	TID prdsrT04
1.7.3.2.5	Patient Model Demographics	*<CONTAINER>*	TID prdsrT04
1.7.3.2.5.1	Model Minimum Age	**18** (a, UCUM, "**year**")	TID prdsrT04
1.7.3.2.5.2	Model Maximum Age	**18** (a, UCUM, "**year**")	TID prdsrT04
1.7.3.2.5.3	Model Patient Sex	(M, DCM, "**Male**")	TID prdsrT04
1.7.3.2.5.4	Model Minimum Weight	**75** (kg, UCUM, **"kg"**)	TID prdsrT04
1.7.3.2.5.5	Model Maximum Weight	**75** (kg, UCUM, **"kg"**)	TID prdsrT04
1.7.3.2.5.6	Model Minimum Height	**165** (cm, UCUM, **"cm"**)	TID prdsrT04
1.7.3.2.5.7	Model Maximum Height	**165** (cm, UCUM, **"cm"**)	TID prdsrT04
1.7.3.2.6	Patient Model Registration	*<CONTAINER>*	TID prdsrT04
1.7.3.2.6.1	Registration Method	(125024, DCM, "**Image Content-based Alignment**")	TID prdsrT04
1.7.3.2.6.2	Spatial Registration	<UID of "**Spatial Registration**">	TID prdsrT04
1.7.3.3	X-ray Beam Attenuator	*<CONTAINER>*	TID prdsrT04

Node	Code Meaning of Concept Name	Code or Example Value	TID
1.7.3.3.1	Attenuator Category	(113771, DCM, "**X-ray Filters**")	TID prdsrT04
1.7.3.3.2	Equivalent Attenuator Material	(C-120F9, SRT, "**Aluminum or Aluminum compound"**)	TID prdsrT04
1.7.3.3.3	Equivalent Attenuator Thickness	**1.4** (mm, UCUM, **"mm"**)	TID prdsrT04
1.7.3.3.4	Attenuator Description	**Mean equivalent Aluminum thickness of bowtie filter**	TID prdsrT04
1.7.3.3.5	X-ray Beam Attenuator Model	*<CONTAINER>*	TID prdsrT04
1.7.3.3.5.1	Radiation Transport Model Type	(prdsrCD021, DCM, "**Geometric Radiation Transport Model**")	TID prdsrT04
1.7.3.4	Radiation Dose Estimate Method	*<CONTAINER>*	TID prdsrT04
1.7.3.4.1	Radiation Dose Estimate Method Type	(prdsrCD078, DCM, "**Monte Carlo**")	TID prdsrT04
1.7.3.4.2	Dose Estimate Parameters	*<CONTAINER>*	TID prdsrT05
1.7.3.4.2.1	(111634, DCM, "**HVL**")	**8.5** (mm, UCUM, "**mm**")	TID prdsrT05
1.7.3.4.2.1.1	Radiation Dose Estimate Parameter Type	(111634, DCM, "**HVL**")	TID prdsrT05
1.7.3.4.3	Radiation Dose Estimate Method Reference	**Simulation package XX version YY**	TID prdsrT04
1.7.4	Dose Estimate Representation	*<CONTAINER>*	TID prdsrT03
1.7.4.1	Distribution Representation	(prdsrCD096, DCM, "**Dose Point Cloud**")	TID prdsrT03
1.7.4.2	Dose Representation Data	<UID of "**Dose Representation Data**">	TID prdsrT03
1.7.4.3	Organ	(T-D0010, SRT, "**Entire Body**")	TID prdsrT03
1.7.5	Organ Dose Information	*<CONTAINER>*	TID prdsrT02
1.7.5.1	Organ	(T-28000, SRT, "**Lung**")	TID prdsrT02
1.7.5.2	Absorbed Dose	**9.6** (mGy, UCUM, "**mGy**")	TID prdsrT02
1.7.5.2.1	Derivation	(R-00317, SRT, "**Mean**")	TID prdsrT02