Digital Imaging and Communications in Medicine (DICOM)

Supplement 150: Radiation Dose Summary Information in Radiology Reports

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Scope and Field of Application

This supplement to the DICOM standard introduces a template for including radiation dose summary information and relevant section headings in DICOM Structured Reports.

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

PS 3.16Content Mapping Resource

PS 3.20 Transformation of DICOM to and from HL7 Standards

The additional DICOM SR templates are based on the report structure and contents of PS 3.16 TID 2000 "Basic Diagnostic Imaging Report".

Additional information is contained in sections that extend the basic TID 2000 structure and contents:

- basic information about the current imaging procedure.

- relevant medical history data, information on the current request (i.e. clinical question that is expected to be answered by the requested procedure) and impressions on the current imaging procedure that has been performed.

- Summaries of the radiation dose for imaging procedures using ionizing radiation.

The approach taken, unlike in the existing TID 2000, which refers to a table of potential section headings defined as a context group, is to follow the same structure but mandate the presence of specific section headings.

This supplement also considers transformation into HL7 CDA documents.

Individual nations may have legal requirements or local content standards that require specific information be present. In Europe the Euratom Directive specifies the general aspects of documentation of the radiation exposure of a person.The transcription of this directive to national German law requires written report for X-ray and nuclear medicine examinations, but the German X-Ray and Radiation Control Regulation („Röntgenverordnung", „Strahlenschutzverordnung") does not specify the content of the report. The German national standard DIN 6827-5, „Recording in medical application of ionizing radiation – Part 5: Radiological report" specifies the medical content of the report and describes how to optionally document radiation exposure and protection content which can be entered manually or automatically populated from documents such as SR modality dose reports. This template is also intended to satisfy California SB 1237.

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82 **Changes to NEMA Standards Publication PS 3.16-2011**

Digital Imaging and Communications in Medicine (DICOM)

84 **Part 16: Content Mapping Resource**

Item #0: Add new Section to Annex A

TID 2006 Imaging Report With Conditional Radiation Exposure and Protection Information

This template is used for general imaging reports for both radiation producing and non-radiation producing modalities.

For radiation producing modalities, radiation exposure and protection information is required, such as to support nationally-specific legal or standard requirements.

It contains mandatory sections, each of which may appear only once in objects instantiated from the template, including the medical content of the report that comprises relevant medical history data, information on the current request (i.e. clinical question that is expected to be answered by the requested procedure), impressions on the current imaging procedure that has been performed, and radiation exposure and protection information.

This template is a specialization of TID 2000, in that it uses the same structure of headings and content, but mandates the presence and order of specific headings, and extends the subordinate content with specific content items.

TID 2006
IMAGING REPORT WITH CONDITIONAL RADIATION EXPOSURE AND PROTECTION INFORMATION
Type: Non-Extensible Order: Non-Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	BCID (7000) Diagnostic Imaging Report Document Titles	1	M		Root node
2	>	HAS CONCEPT MOD	CODE	EV (121058, DCM, "Procedure reported")	1-n	U		
3	>	HAS CONCEPT MOD	INCLUDE	DTID (1204) Language of Content Item and Descendants	1	M		
4	>	HAS CONCEPT MOD	INCLUDE	DTID (1210) Equivalent Meaning of Concept Name	1-n	U		
5	>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	M		
6	>	CONTAINS	CONTAINER	EV (121064, DCM, "Current Procedure Descriptions")	1	M		
7	>>		INCLUDE	DTID (2007) Imaging Procedure Description	1	M		
8	>	CONTAINS	CONTAINER	EV (121066, DCM, "Prior Procedure Descriptions")	1-n	MC	IF relevant prior procedures have been performed.	
9	>>		INCLUDE	DTID (2007) Imaging Procedure Description	1	M		
10	>	CONTAINS	CONTAINER	EV (121060, DCM, "History")	1	M		
11	>>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		

12	>>		INCLUDE	DTID (2002) Report Narrative	1	M		
13	>	CONTAINS	CONTAINER	EV (121062, DCM, “Request”)	1	M		
14	>>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		
15	>>		INCLUDE	DTID (2002) Report Narrative	1	M		
16	>	CONTAINS	CONTAINER	EV (121072, DCM, “Impressions”)	1	M		
17	>>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		
18	>>		INCLUDE	DTID (2002) Report Narrative	1	M		
19	>	CONTAINS	INCLUDE	DTID (2008) Radiation Exposure and Protection Information	1	MC	IF the current procedure exposes the patient to ionizing radiation.	
20	>	CONTAINS	CONTAINER	BCID (7001) Diagnostic Imaging Report Headings	1-n	U		
21	>>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		
22	>>		INCLUDE	DTID (2002) Report Narrative	1	M		

No content items other than those defined in Observation Context TID 1001 may be the target of a HAS OBS CONTEXT relationship when TID 2006 is invoked.

Content Item Descriptions

Row 2	Even though this information is related to the content of Row 6 in TID 2007 Current Procedure, it is present here for consistency with other report templates.
Row 5	Information on at least one of the following person observers is mandatory: 1) “Performing Physician” 2) “Performing Technologist”. (For those person observers, requirement types as specified in TID 1003 apply. That means that “Person Observer Name” is the only mandatory attribute).
Row 20	Each heading (concept code from CID 7001) may appear only once, and may not repeat the headings (concept codes) used when instantiating any other rows of this template.

TID 2007 Imaging Procedure Description

Contains information related to the procedure.

TID 2007
IMAGING PROCEDURE DESCRIPTION
Type: Extensible Order: Non-Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		
2		CONTAINS	TEXT	EV (123014, DCM, “Target Region“)	1	MC	XOR with Row 3	
3		CONTAINS	CODE	EV (123014, DCM, “Target Region“)	1	MC	XOR with Row 2	DCID 4028, DCID 4030, DCID 4031

4		CONTAINS	TEXT	EV (121065, DCM, “Procedure Description”)	1	M		
5		CONTAINS	DATE	EV (111060, DCM, ”Study Date”)	1	M		Shall be equal to the Study Date (0020,0020) in the General Study Module in the images to which this report applies.
6		CONTAINS	TIME	EV (111061, DCM, ”Study Time”)	1	U		If present, shall be equal to the Study Time (0020,0030) in the General Study Module in the images to which this report applies.
7		CONTAINS	COMPOSITE	EV (113701, DCM, “X-Ray Radiation Dose Report”)	1-n	U		

TID 2008 Radiation Exposure and Protection Information

Contains information related to the radiation exposure and protection of the patient, as is required by national legal requirements or standards.

Other information about the current procedure is described in TID 2006 and not repeated here.

TID 2008
RADIATION EXPOSURE AND PROTECTION INFORMATION
Type: Extensible Order: Non-Significant

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (113923, DCM, “Radiation Exposure and Protection Information”)	1	M		
2	>	HAS OBS CONTEXT	INCLUDE	DTID (1001) Observation Context	1	U		
3	>	CONTAINS	CODE	EV (111532, DCM, “Pregnancy Status”)	1	MC	IF female patient of child-bearing age	DCID (6096) Pregnancy Status
4	>	CONTAINS	TEXT	EV (121109, DCM, “Indications for Procedure”)	1	M		
5	>	CONTAINS	PNAME	EV (113850, DCM, “Irradiation Authorizing ”)	1	M		
6	>	CONTAINS	TEXT	EV (113921, DCM, “Radiation Exposure“)	1	MC	IFF ionizing radiation is applied in the context of the current procedure	
7	>	CONTAINS	TEXT	EV (113922, DCM, “Radioactive Substance Administered”)	1	MC	IFF radioactive substance is administered in the context of the current procedure	

Content Item Descriptions

Row 5	The clinician responsible for determining that the irradiating procedure was appropriate for the indications.

Row 6	A textual, human-readable description of the radiation exposure is all that is required by this template (such as is sufficient to comply with, for example, German law). Detailed specification of exposure is out of the scope of this template. Such information may be given in a separate SR instances such as described in TID 10001 Projection X-Ray Radiation Dose or TID 10011 CT Radiation Dose, and referenced from TID 2007.

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Item #1: Add the following Definitions to Annex D

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DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

Code Value	Code Meaning	Definition
113921	Radiation Exposure	The amount of ionizing radiation to which the patient was exposed.
113922	Radioactive Substance Administered	Type, amount and route of radioactive substance administered.
113923	Radiation Exposure and Protection Information	Exposure to ionizing radiation and associated preventive measures used to reduce the exposure of parts of the body like lead apron or eye, thyroid gland or gonad protection.

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134 **Item #2: Extend the Context ID 7001**

Context ID 7001
Diagnostic Imaging Report Headings

Type: Extensible Version: ~~20050615~~ yyyymmdd

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	121060	History
DCM	121062	Request
DCM	121064	Current Procedure Descriptions
DCM	121066	Prior Procedure Descriptions
DCM	121068	Previous Findings
DCM	121070	Findings
DCM	121072	Impressions
DCM	121074	Recommendations
DCM	121076	Conclusions
DCM	121078	Addendum
DCM	121109	Indications for Procedure
DCM	121110	Patient Presentation
DCM	121113	Complications
DCM	121111	Summary
DCM	121180	Key Images
DCM	**113923**	**Radiation Exposure and Protection Information**

Item #3: Add new terms in PS 3.16, Annex E

Add in PS 3.16 Annex E French Language Meanings of Selected Codes used in the DCMR (Normative)

Coding Scheme Designator	Coding Scheme Version	Code Value	Code Meaning English Language	Code Meaning French Language
DCM		**121109**	**Indications for Procedure**	**Indications de la procédure**
DCM		**113850**	**Irradiation Authorizing**	**Médecin responsable de l'indication**
DCM		**111532**	**Pregnancy Status**	**Grossesse**
DCM		**113921**	**Radiation Exposure**	**Exposition aux rayonnements**

DCM		113923	Radiation Exposure and Protection Information	Exposition aux rayonnements et informations de radioprotection
DCM		113922	Radioactive Substance Administered	Substance radioactive administrée
DCM		123014	Target Region	Région cible

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Item #4: Add a new Annex in PS 3.16

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150 **Annex X German Language Meanings of Selected Codes used in the DCMR (Normative)**

Coding Scheme Designator	Coding Scheme Version	Code Value	Code Meaning English Language	Code Meaning German Language
LN		11528-7	Radiology Report	Radiologischer Befundbericht
DCM		121066	Prior Procedure Descriptions	Frühere Untersuchungen
DCM		111532	Pregnancy Status	Schwangerschaft
DCM		121109	Indications for Procedure	Indikationen für die Untersuchung
DCM		123014	Target Region	Körperregion
DCM		121064	Current Procedure Descriptions	Untersuchungstechnik
DCM		111060	Study Date	Datum der Untersuchung
DCM		111061	Study Time	Zeitpunkt der Untersuchung
DCM		110180	Study Instance UID	Study Instance UID
DCM		121060	History	Krankengeschichte
DCM		121062	Request	Fragestellung
DCM		121071	Finding	Beschreibung
DCM		121072	Impressions	Wertungen
DCM		121075	Recommendation	Empfehlung
DCM		113850	Irradiation Authorizing	Indikationsstellender Arzt
DCM		113921	Radiation Exposure	Strahlenexposition
DCM		113922	Radioactive Substance Administered	Verabreichter radioaktiver Stoff
DCM		113923	Radiation Exposure and Protection Information	Informationen zum Strahlenschutz

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Item #5: Add a new Annex in PS 3.20

Annex X Imaging Report With Conditional Radiation Exposure and Protection Information Transformation Guide

X.1 SCOPE AND FIELD OF APPLICATION

DICOM SR documents based on DICOM SR Template 2006 can be mapped to HL7 CDA Release 2 Diagnostic Imaging Reports. DICOM Template 2006 specifies the "Imaging Report With Conditional Radiation Exposure and Protection Information" (PS 3.16), a DICOM SR report template based on the report structure and contents of PS 3.16 TID 2000 "Basic Diagnostic Imaging Report".

The approach taken, unlike in the existing TID 2000, which refers to a table of potential section headings defined as a context group, is to follow the same structure but mandate the presence of specific section headings.

X.2 MAPPING REQUIREMENTS

This document specifies a mapping between unencrypted completed DICOM SR Template TID 2006 based "Imaging Reports With Conditional Radiation Exposure and Protection Information" (PS 3.16) and HL7 CDA Diagnostic Imaging Reports (HL7 CDA R2 DIR IG, R1-2009). Only TID 2006 based reports of single human identifiable patient subjects, single enterer, single verifier, without digital signatures and without spatial and temporal coordinates are supported. The constraints in section A.3.2.2 Mapping Requirements for TID 2000 also apply to DICOM SR "Imaging Reports With Conditional Radiation Exposure and Protection Information" that are mapped to CDA Diagnostic Imaging Reports.

X.3 HL7 CDA RELEASE2 DIAGNOSTIC IMAGING REPORT TARGET STRUCTURE

The structure of DICOM SR Template TID 2006 based "Imaging Reports With Conditional Radiation Exposure and Protection Information" (PS 3.16) is similar to DICOM SR TID 2000 based basic diagnostic imaging reports. References to the SR Diagnostic Imaging Report Transformation Guide (PS 3.20, Annex A) are used where the transformation of TID 2006 based reports is identical to that of basic diagnostic imaging reports. Details are outlined where new specific mapping requirements exist.

"Imaging Reports With Conditional Radiation Exposure and Protection Information" transformations that are identical to the "Diagnostic Imaging Report Transformation Guide" specification (PS 3.20, Annex A):

- Transformation of DICOM header module attributes as specified in section A.5.1.1 "Header (Level 1)" of PS 3.20, Annex A.
- General transformation of DICOM sections as specified in section A.5.1.2 "Section (Level 2)" of PS 3.20, Annex A.
- Transformation of "Structured Body (Level 3)" artifacts as specified in section A.5.1.3 of PS 3.20, Annex A, A.5.1.3) for : "Coded Observations", "Text Observations", "Image References and Measurements within Section", "Quantity Measurement + DICOM Composite Object References" (Use the linear measurement SNOMED code mapping as specified in table A.5.1.3-4. Information on relevant DICOM objects referenced within the CDA target document's body and on the original DICOM SR document shall be included in the CDA DICOM object catalog section.).
- Transformation of "DICOM SR Observation Context" as specified in section A.5.1.4 of PS 3.20, Annex A and the following subsections of this document: "Subject Context" (section A.5.1.4.1), "Procedure Context" (section A.5.1.4.2) and "Observer Context" (section A.5.1.4.3).

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PS 3.20, Annex A also contains information on HL7 data types mapping in section A.8.

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X.4 TID 2006 "IMAGING REPORT WITH CONDITIONAL RADIATION EXPOSURE AND PROTECTION 198 INFORMATION" SPECIFIC MAPPING REQUIREMENTS

In addition to the transformations listed in section X.3 "HL7 CDA Release2 Diagnostic Imaging Report 200 Target Structure". TID 2006 specific contents shall be mapped as outlined below.

Study Date and Study Time in TID 2007 "Imaging Procedure Description":

202 The study date and time observation is modeled as a CDA section component and shall be encoded as a section entry.

204 **Table X.4-1 Study Date and Time Observation**

Attribute	Data Type	Multiplicity	Value
classCode	CS	1..1	OBS
moodCode	CS	1..1	EVN
code	CE	1..1	<"113014" as code property, "1.2.840.10008.2.16.4" as codeSystem property, "DCM" as codeSystemName property, "Study" as displayName property>
effectiveTime	TS	1..1	"Study Date" value (DATE Value Type) and if present "Study Time" value (TIME Value Type)
languageCode	CE	0..1	Not used at entry level.
value	ANY	0..1	Not used.

206 The syntax of Point in Time (TS) is "YYYYMMDDHHMMSS.UUUU[+|-ZZzz]" where digits can be omitted from the right side to express less precision. If only "Study Date" is available from TID 2007, the form 208 "YYYYMMDD" can be used.

210 **Reference to Composite Objects in TID 2007 "Imaging Procedure Description":**

References to Composite Objects are used for DICOM objects that are not DICOM Images or Waveforms, 212 for instance to SR Documents or to HL7 Structured Documents. Composite object reference observations are modeled as CDA section components and shall be encoded as section entries. The mapping of 214 SopInstance references for composite objects is identical to image SopInstance references (please refer to PS 3.20 Annex A, "SR Diagnostic Imaging Report Transformation Guide" for detailed information).

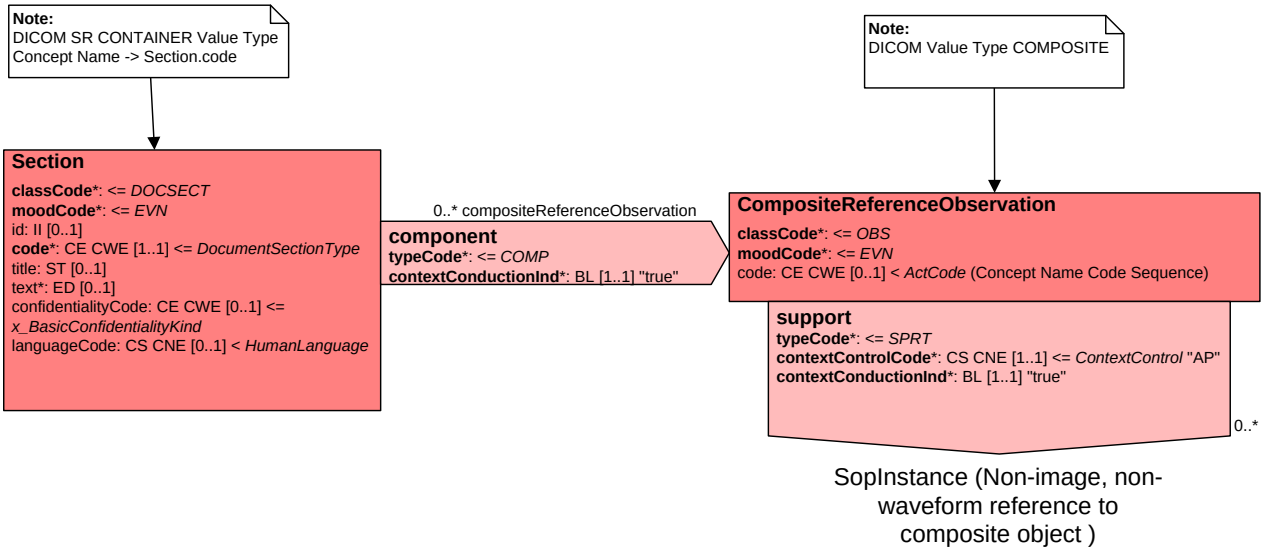

Fig X.4-1: Composite Object References

Table X.4-2 Composite Object Reference Observation

Attribute	Data Type	Multiplicity	Value
classCode	CS	1..1	OBS
moodCode	CS	1..1	EVN
templateId	LIST<II>	1..*	
code	CE	0..1	Concept Name Code Sequence (0040,A043) of COMPOSITE Content Item (required if the Purpose of Reference is conveyed in the Concept Name): <code value as code property, coding scheme designator as codeSystemName property, code meaning as displayName property>
effectiveTime	TS	0..1	Not used.
languageCode	CE	0..1	Not used at entry level.
value	ANY	0..1	Not used.

The following Observation.code values shall be used for TID 2007 references to DICOM SR X-Ray radiation dose reports: <"113701" as code property, "1.2.840.10008.2.16.4" as codeSystem property, "DCM" as codeSystemName property, "X-Ray Radiation Dose Report" as displayName property>.

"Irradiation Authorizing" (Value Type PNAME) in TID 2008 "Radiation Exposure and Protection Information"

The attributes of the "Irradiation Authorizing" PNAME content item are mapped to the ServiceEvent performer participation, associated role and entities as specified in Tables X.4-3 to X.4-5.

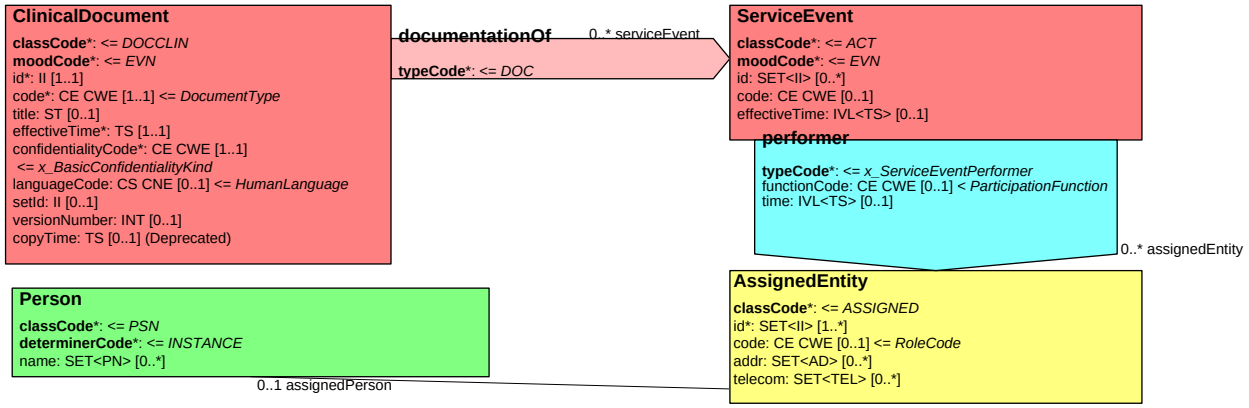

Fig X.4-2: Irradiation Authorizing Service Event Participation

Table X.4-3
PERFORMER PARTICIPATION

Attribute	Data Type	Multiplicity	Value
typeCode	CS	1..1	PRF
functionCode	CE	0..1	Shall not be sent.
time	IVL<TS>	0..1	Shall not be sent.

Table X.4-4
ASSIGNED ENTITY

Attribute	Data Type	Multiplicity	Value
classCode	CS	1..1	ASSIGNED
id	SET<II>	1..*	Use null flavor value “NI” (No Information) if the value cannot be obtained from some other source.
code	CE	1..1	Concept Name Code Sequence (0040,A043) of PNAME Content Item: <”113850” as code property, "1.2.840.10008.2.16.4" as codeSystem property, "DCM" as codeSystemName property, “Irradiation Authorizing” as displayName property>.
addr	SET<AD>	0..*	Shall not be sent.
telecom	SET<TEL>	0..*	Shall not be sent.

Table X.4-5
PERSON

Attribute	Data Type	Multiplicity	Value
classCode	CS	1..1	PSN
determinerCode	CS	1..1	INSTANCE
name	PN	1..1	Person Name (0040,A123)