

## Uniform Tissue Names for Use in RTOG Advanced Technology Clinical Trials

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This document describes work in progress within the RTOG Advanced Technology Integration Committee (ATIC) and the Advanced Technology QA Consortium (ATC) to develop consistent nomenclature for structures used in radiation oncology treatment planning and plan review in ATC-supported clinical trials. Interest in and use of this information outside this scope is encouraged, but should acknowledge NCI U10 Grant CA021661 (RTOG) and U24 Grant CA081647 (ATC), which have supported this work.

### Background

Consistent naming of contoured structures used in radiotherapy treatment planning is essential to facilitate the comparison of dose-volume statistics across patients for quality assurance and outcomes analysis. Maintaining consistency in structure names is particularly important (and challenging) in multi-institutional clinical trials, in which treatment planning data are collected from many participating institutions. Differences in treatment planning techniques and local languages are among the factors that contribute to variations in the names used to identify structures.

The Image Guided Therapy QA Center (ITC) has developed a Digital Data Integrity QA process to examine submitted RT treatment planning data for completeness and consistency. This process involves resolving discrepancies between submitted and protocol-specified structure names. For some data sets, the mapping between submitted and protocol-specified structure names is obvious, and the process of assigning standard names using ITC tools is straightforward. Other cases, however, require visual inspection of images and contours to identify structures. For trials involving disease sites with many organs at risk, e.g., H/N IMRT, the effort required to correctly identify all structures can be substantial.

### Efforts to Date

To encourage the use of protocol-specified structure names in submitted data, the ITC publishes lists of standard structure names for each ATC-supported trial on the ATC web site (<http://atc.wustl.edu>). The collection of names has grown incrementally as RTOG Advanced Technology (AT) trials covering new disease sites were added. Rapid growth in the number and scope of AT protocols, however, has motivated the effort to address some inconsistencies and limitations in the current protocol-specified structure names.

To this end, a list of standard OAR and TV names was compiled from the OAR and TV names for RTOG AT protocols on the ATC web site. This list was distributed for comments within the Advanced Technology Integration Steering Committee. Responses are summarized below:

1. Use of anatomic (Right, Left), is preferred over target-volume-relative (Ipsi, Contra) indicators for laterality in paired organs.
2. Compact labels (“R”, rather than “RT” or “RIGHT”) should be used, where possible.
3. Historical use of indices to distinguish multiple target volumes (PTV1, PTV2, etc.) is inconsistent: PTV1 is used for low-dose TVs in some protocols and for high-dose TVs in others. Thus, target volumes should be labeled with prescription dose level (e.g., PTV\_5200, PTV\_6600, etc.).
4. Names for geometric extensions of contoured structures used for treatment planning, i.e., Planning Risk Volumes (PRVs), should encode the size of the margin used if it is uniform, e.g., “SPINAL\_CORD\_PRV5” for a PRV around the Spinal Cord with a 5mm margin.
5. Consistency in label *format (delimiters, units, precision)* is important for reliably matching corresponding structures in different patients. Thus, target-volume dose will be expressed as an *integer value* in units of cGy, e.g., “PTV\_5240”. This format retains sufficient precision and avoids inconsistencies resulting from the use of (fractional) Gy values, i.e., “PTV52” vs. “PTV\_52.4”.

A scheme for uniform naming of contoured structures based on these principles is outlined below.

#### A. Organs at Risk

1. A list of base names for organs at risk is given in **Table 1**. This list is not exhaustive. It is expected that it will be extended in a consistent manner as new protocols are written.
2. For paired organs, right or left organs are identified by appending “\_R” or “\_L” to the base name. E.g., LUNG\_L
3. For geometric extensions of organs (PRVs) with *uniform margin*, a suffix of “\_PRV $m$ ” is appended to the base name, where  $m$  is an integer indicating the size of the margin in mm, e.g., SPINAL\_CORD\_PRV5. *Non-uniform* PRVs are identified using the suffix “\_PRV”, i.e., *without margin size*.

#### B. Target Volumes

1. Target volumes are constructed using the ICRU designation as the base name.
2. To distinguish targets receiving different prescription doses, a suffix of “\_ $d$ ” is appended to the base name, where  $d$  is the prescription expressed as an integer in units of cGy, e.g.,

“PTV\_5040” is used for a planning target volume receiving a total prescription dose of 5040 cGy (50.4 Gy).

- To distinguish *primary* and *nodal* targets receiving the same prescription dose, append “p” or “n” respectively to the target volume base name, e.g., “PTVp\_5580” or “PTVn\_5580”.
- If multiple instances of primary or nodal targets receiving a given prescription dose must be distinguished, an integer may be appended after the “p” or “n” to distinguish the particular target. Thus: PTVn1\_5400, PTVn2\_5400, etc.

**Table 1.** Base names for organs at risk. Where paired organs are indicated, laterality is indicated by appending “\_L” or “\_R” to the base name. Geometric extensions of these structures are indicated by appending “\_PRVm”, where *m* is the nominal margin (mm) used to extend the structure.

Structure Name	Paired?
ANAL_CANAL	
BLADDER	
BRAC_PLX	_L / _R
BRAIN	
BRAINSTEM	
BREAST	_L / _R
BRONC_TREE	_L / _R
CARINA	
CAUDA_EQUINA	
CEREBELLUM	_L / _R
CEREBRUM	_L / _R
CHIASM	
CN_VII	_L / _R
CN_VIII	_L / _R
COCHLEA	_L / _R
CORNEA	_L / _R
DUODENUM	
EAR_MID	_L / _R
EAR_EXT	_L / _R
ESOPHAGUS	
FEMUR	_L / _R
GLOBE	_L / _R
GLOTTIS	
GREAT_VESS	
HEART	

Structure Name	Paired?
MAIN_BRONC	_L / _R
OPTIC_NRV	_L / _R
ORAL_CAVITY	
OVARY	_L / _R
PAROTID	_L / _R
PENILE_BULB	
PERINEUM	
PHARYNX	
PITUITARY	
PROSTATE	
RECTUM	
RETINA	_L / _R
RIB	
SACRUM	
SEM_VES	
SKIN	
SM_BOWEL	
SPINAL_CORD	
STOMACH	
SUBMND_SALV	_L / _R
TEMP_LOBE	_L / _R
TESTIS	_L / _R
THYROID	
TM_JOINT	_L / _R
TONGUE	

KIDNEY	_L/ _R
LG_BOWEL	
LARYNX	
LAC_GL	_L/ _R
LENS	_L/ _R
LIPS	
LIVER	
LUNG	_L/ _R
MANDIBLE	

TRACHEA	
URETHRA	
VULVA	

## Changes

1. Shorten RIGHT/LEFT suffixes to “\_R” and “\_L” (JOD, VS 5/19/2008)
2. Specify the margin used for geometric extensions (PRVs) as “\_PRVm” where *m* is an integer indicating the size of the margin in mm, e.g., SPINAL\_CORD\_PRV5; *additional OAR names* (LAD 5/21/2008)
3. Use the suffix “\_PRV”, i.e, without a margin size, to denote non-uniform PRVs. (YX 9/18/2008)
4. Distinguish primary and nodal targets receiving the same prescription dose (but with differing dosimetric constraints) by append “p” or “n” respectively to the target volume base name, e.g., “PTVp\_56” or “PTVn\_56”; *additional L/R on OARs* (LP 9/29/2008)
5. Use prescription doses in cGy for target volume labels to maintain precision with uniform format. (ATIC/SC call 2/13/09).
6. Approved for use in upcoming RTOG AT protocols (ATIC/SC call 2/13/09).

## Open Issues

1. **Length of structure names (WRB 10/17/2008):** What is the maximum length of structure names that can be supported in treatment planning and review software?

## Survey of PTV for RTOG Advanced-Technology protocols (10/2008):

1. PTV
2. PTV1, PTV2, PTV3
3. PTVA, PTVHD , PTVLD, PTVLN, PTVPR, PTVVAG
4. PTV\_BLADDER, PTV\_PELVIS, PTV\_BOOST, PTV\_ED, PTV\_HD, PTV\_ID, PTV\_EVAL
5. PTV42, PTV45, PTV50, PTV60, PTV63, PTV66, PTV70
6. PTV59.4
7. PTV\_54, PTV\_58, PTV\_66
8. PTV\_59.4
9. PTV\_2CM

Comments and suggestions for improving this scheme are welcome. Please direct communication to Walter R. Bosch, D.Sc., Director, ITC ([bosch@wustl.edu](mailto:bosch@wustl.edu)).