

QRM-ICRU-Tissues

Tissue Equivalent Materials

QRM-Tissue

QRM ICRU-Tissues are solid plastics mimicing human tissues with respect to their physical X-ray attenuation properties.

QRM tissue-equivalent materials are available in diverse shapes as rods, slaps, cubes, spheres and custom designs providing the physical X-ray attenuation properties of bone and soft tissue of human organs as specified by the ICRU in Report 44 and 46.

These materials can be used for custom phantom design as well as single samples dedicated for calibration and research purposes in diagnostic X-ray imaging and radiation therapy.

Elemental composition, electron density or stopping power can be provided on demand.

Examples of tissues as specified in the Report 44 and 46 of the ICRU can be seen in the table on the right hand side. CT-values (HU) are calculated using the tables of photon cross sections at [www.nist.gov\(XCOM\)](http://www.nist.gov/XCOM).

Additional tissue equivalents are available on request.

Please ask for more information:
qrmphantoms@ptwdosimetry.com

References

ICRU 1989 Tissue substitutes in radiation dosimetry and measurement Report 44 (Bethesda, MD: International Commission on Radiation Units and Measurements)

ICRU 1992 Photon, electron, proton, and neutron interaction data for body tissues Report 46 (Bethesda, MD: International Commission on Radiation Units and Measurements)



QRM-Tissue equivalent samples

| ICRU tissue | $\rho \text{ g/cm}^3$ | 80 kV | 100 kV | 120 kV | 140 kV |
|-----------------------------------|-----------------------|-------|--------|--------|--------|
| Water | 1,00 | 0 | 0 | 0 | 0 |
| Adipose tissue | 0,95 | -95 | -82 | -75 | -70 |
| Muscle (skeletal) | 1,05 | 45 | 44 | 43 | 42 |
| Skin | 1,09 | 71 | 73 | 74 | 75 |
| Brain | 1,04 | 40 | 39 | 38 | 37 |
| Breast (Fibroglandular) | 1,02 | -9 | -3 | 1 | 3 |
| Eye lens | 1,07 | 45 | 48 | 49 | 50 |
| Blood (whole) | 1,06 | 60 | 58 | 56 | 55 |
| GI tract (intestine) | 1,03 | 22 | 23 | 23 | 23 |
| Heart (blood filled) | 1,06 | 60 | 58 | 56 | 55 |
| Kidney | 1,05 | 45 | 44 | 44 | 43 |
| Liver | 1,06 | 56 | 54 | 53 | 53 |
| Spleen | 1,06 | 57 | 56 | 54 | 54 |
| Testis | 1,04 | 37 | 36 | 36 | 35 |
| Thyroid | 1,05 | 112 | 93 | 80 | 73 |
| Lung (deflated) | 1,05 | 48 | 46 | 45 | 44 |
| Lung (inflated) | 0,26 | -740 | -741 | -741 | -742 |
| Lymph | 1,03 | 31 | 29 | 29 | 28 |
| Muscle (skeletal) | 1,05 | 45 | 44 | 43 | 42 |
| Ovary | 1,05 | 48 | 47 | 46 | 45 |
| Pancreas | 1,04 | 31 | 32 | 32 | 32 |
| Skeleton-cartilage | 1,10 | 116 | 107 | 101 | 98 |
| Skeleton-yellow marrow | 0,98 | -70 | -55 | -47 | -42 |
| Skeleton-red marrow | 1,03 | 4 | 10 | 12 | 14 |
| Skeleton-spongiosa | 1,18 | 392 | 325 | 283 | 258 |
| Skeleton-femur | 1,33 | 762 | 627 | 544 | 495 |
| Skeleton-cortical bone (mandible) | 1,68 | 1516 | 1253 | 1092 | 998 |
| Air | 0,0 | -1000 | -1000 | -1000 | -1000 |

Available ICRU tissues
(density and corresponding CT-numbers in HU)