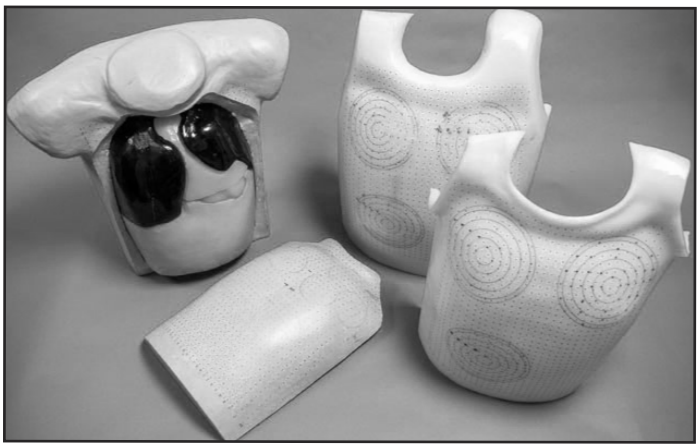
RSD
Radiology Support Devices, Inc.

Lawrence Livermore Realistic Phantom



WORLDWIDE REFERENCE STANDARD FOR IN-VIVO COUNTING

The Lawrence Livermore Realistic Phantom was developed under the direction of the U.S Department of Energy, primarily as a reference standard for the in vivo counting of emissions from low-energy transuranic nuclides. The organs of interest are the lungs, liver and lymph nodes. Each of these may be radioactive or inert. These organs are accommodated in a male thorax generally similar to average adult males. This phantom contains a synthetic bone skeleton molded within a soft-tissue-equivalent material.

Applications

Calibration standard for the quantitation of in vivo radioactivity

Detector calibration for photons deposited in human organs

In vivo counting of emissions from various isotopes

Organ bioassays for various isotopes

Organs: All organs are made of soft-tissue equivalent materials. Lungs are available with nuclides uniformly dispersed throughout the lung molding material. Optional organs (developed by RSD and not part of the original DOE specifications) are inert but have holes in 2cm2 grids. These either can be filled with inert plugs or with active capsules to establish any desired distribution within the lungs.

The liver has the same loading flexibility with an additional option designed for use with solutions having relatively short half-lives. This liver is a hollow shell with a fill/drain port. If the liver is not required, it may be replaced with the Abdominal Contents, which are also available with a hole matrix, or active.

Chest Overlay Plates: Transuranic emissions from individuals with varying amounts of muscle and/or adipose tissue may be so attenuated as to be undetectable. Chest overlay plates were developed to ensure the validity of in vivo counting of such individuals. There are three sets of plates, each in four graded thicknesses. One set is equivalent to 87% adipose and 13% muscle, another is equivalent to 50% adipose and 50% muscle, and the third is equivalent to 100% muscle. Plates of each material and/or each thickness are available separately.

Targets: Three sets of concentric circles are drawn in permanent black ink over the torso cover and over each chest overlay plate. They range in 1 in. increments from 1 in. to 5 in. in diameter, with a 5.5 in. diameter outer circle. One set of circles is placed over each lung region, with the outer circle tangent to the inferior aspect of the clavicle and protruding over the sternum. The third set is placed over the liver. A 2cm2 grid is projected in red ink over most of the chest surface by the same technique that is used for the circles. All targets are consistent among all phantoms.

Isotopes: RSD routinely manufactures active organs with isotopes to suit users' needs. Active capsules to fit into the gridded holes are available, or empty capsules can be supplied to be filled by the user. RSD usually supplies the required isotopes, but users may furnish them if so desired. Some isotopes are manufactured only at intervals throughout the year, so delivery is subject to availability. In some cases, calibration costs from governmental sources are subject to wide fluctuations. Isotopes are most often received as calibrated solutions, traceable to the NIST. Organ loading is controlled by micropipetting aliquots from the calibrated solutions. Uraniums and plutoniums are traceable to the NIST by mass. Other isotopes are usually traceable by activity.

Specifications

Packing Size	Packing Weight
51W x 51D x 51H cm	34 kg
20W x 20D x 20H in	75 lb.

Model Numbers

Model No.	Product Description
RS-500	Lawrence Livermore Realistic Phantom

Publication References: 1) Acha R, Brey R, Capello K. A Monte Carlo Simulation of the in vivo measurement of lung activity in the Lawrence Livermore National Laboratory torso phantom. Health Phys. 2013 Feb;104(2):211-7. DOI: https://doi.org/10.1097/HP.0b013e3182765834. PMID: 23274824. 2) Ahmed AS, Capello K, Kramer GH. Assessment of the chest wall thickness of the lawrence livermore torso phantom using a voxel image. Health Phys. 2011 Jun;100(6):574-82. DOI: https://doi.org/10.1097/HP.0b013e3181ff952f. PMID: 22004927.