# Publication 156
# Paediatric Mesh-type Reference Computational Phantoms
(Task Group 103 - In Press)

ICRP 2023
6-9 NOVEMBER 2023 • TOKYO, JAPAN

## Mandate

The mandate for Task Group 103 is to convert the current voxel-type reference computational phantoms into a high-fidelity mesh format to address the limitations of the voxel-type phantoms in some dose coefficient calculations.

Specific work will include:

1. development of ICRP mesh-type reference computational phantoms which have all source and target tissues including the details of the eyes and skin and the thin target issues (8–300 micron) of the alimentary and respiratory tract organs,
2. use of these mesh-type phantoms to calculate external dose coefficients and specific absorbed fractions for internally emitted radiations and assess the differences from the current dosimetry methodology especially for target regions representing the cells at radiogenic risk within the eye, skin, alimentary and respiratory tract, and urinary bladder for weakly penetrating radiations, and
3. demonstration of phantom posture and body-size change and related dose coefficient calculations.

## Members


**Chan Hyeong Kim (Chair)**, Hanyang University, Korea
**Yeon Soo Yeom**, Yonsei University, Korea
**Chansoo Choi**, University of Florida, USA
**Bangho Shin**, Hanyang University, Korea
**Haegin Han**, Hanyang University, Korea
**Suhyeon Kim**, Hanyang University, Korea
**Wesley E. Bolch**, University of Florida, USA
**Nina Petoussi-Henss**, Federal Office for Radiation Protection (BfS), Germany
**Maria Zankl**, Helmholtz Zentrum München, Germany
**Choonsik Lee**, National Cancer Institute, USA
**Beom Sun Chung**, Ajou University, Korea
**Keith Eckerman**, Oak Ridge National Laboratory (ORNL), USA
**Derek Jokisch**, Francis Marion University, USA
**Rui Qiu**, Tsinghua University, China
**Nguyen Tat Thang**, Hanoi University of Science and Technology, Vietnam
**Franklin Eze (Technical Secretary)**, Mercy Radiology, New Zealand

**Keith Tchadwick Griffin (Mentee)**, National Cancer Institute, USA
**Jaehyo Kim (Mentee)**, Hanyang University, Korea
**Hyeonil Kim (Mentee)**, Hanyang University, Korea
**Sungho Moon (Mentee)**, Hanyang University, Korea
**Gahee Son (Mentee)**, Hanyang University, Korea


## Adult and Paediatric Reference Phantoms

The adult (male and female) and paediatric (newborn, 1-, 5-, 10- and 15-year-old males and females) reference computational phantoms in Publications 110 (2009) and 143 (2020) have been converted to mesh-type reference computational phantoms (MRCPs) (see figure 1). The MRCPs include all source and target regions required for evaluating effective dose, even the micron-thick target and source regions in the respiratory and alimentary tract organs, skin, and urinary bladder wall (see figure 2), assimilating the supplemental stylised models. The MRCPs can also be directly implemented in Monte Carlo codes without voxelisation, fully maintaining the fidelity of the mesh phantoms.

## Current Status

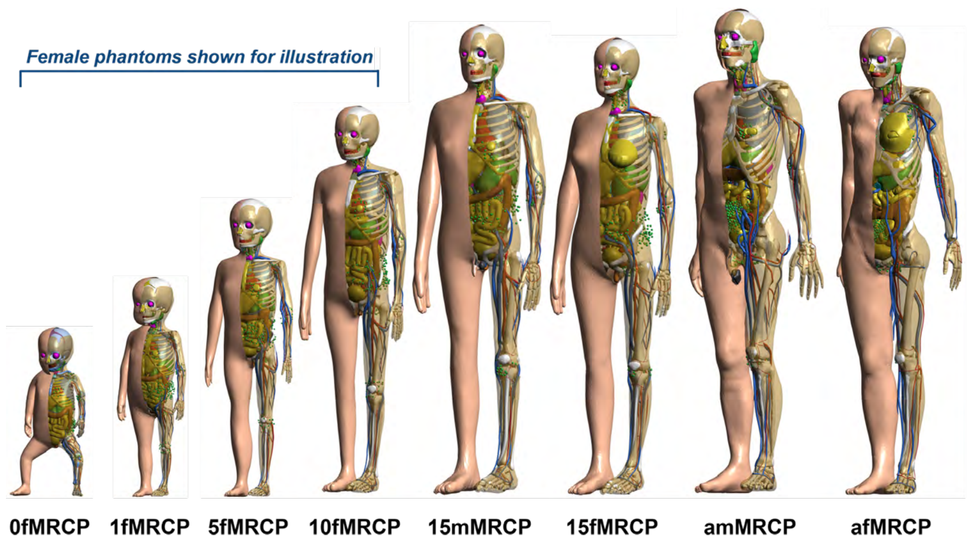


*Fig 1. Adult and paediatric MRCPs*

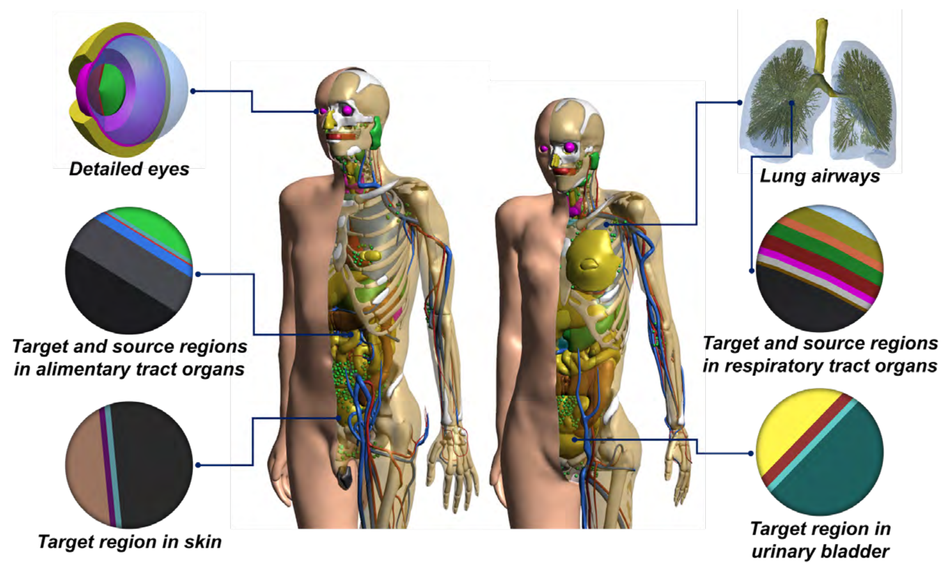


*Fig 2. Micron-thick target and source regions in adult MRCPs*

One of the main advantages of the MRCPs is the high deformability. The MRCPs can be easily deformed into different body sizes and postures, allowing various practical approaches to individualise phantoms. Taking the advantage of the high deformability, the Task Group has developed additional adult phantoms that represent different body sizes (10th and 90th body height/weight percentile of Caucasian adults) and postures (i.e., walking, bending, kneeling, squatting, and sitting), investigating the variations in dose values from individual differences (see figure 3).

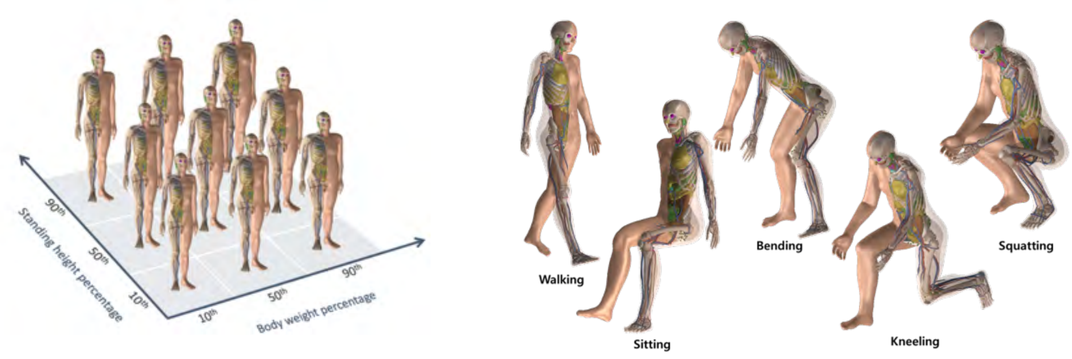


*Fig 3. Percentile-specific (left) and posture-dependent (right) adult phantoms*

The adult MRCPs are released in Publication 145 (2020) and Publication for the paediatric MRCPs is now under preparation. On completion of the adult and paediatric MRCPs, the Task Group also developed the pregnant-female MRCPs (see ICRP 2023 Symposium poster entitled: Advancing Fetal Radiation Dosimetry: Development of ICRP Reference Pregnant-female MRCPs).

## Schedule

**Q4 2017:** Completion of adult MRCPs (done)
**Q4 2020:** Publication for adult MRCPs (done)
**Q2 2020:** Completion of paediatric MRCPs (done)
**Q3 2023:** Completion of pregnant-female MRCPs (done)
**Q1 2024:** Publication for paediatirc MRCPs (expected)
**Q4 2024:** Publication for pregnant-female MRCPs (expected)