essential to the endosteal dose, considering the small volume and the short range of these electrons (*8*).

A particular result of the study was that the backscatter at the bone-to-bone marrow interface increased the absorbed dose maximally 10%. Besides this "anatomical heterogeneity," "radionuclide distribution heterogeneity" is an important issue, for which, for example, a point kernel approach can be applied. So far, it does not seem possible to design models that account for both heterogeneities. Perhaps future dosimetric models will be able to do so or may indicate which issue has the most profound effect on the absorbed dose distribution.

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REPLY: Thank you for the opportunity to respond to the questions posed by Dr. van Dieren and his colleagues at the Free University Hospital, Amsterdam. Their questions address two issues. The first is the applicability of our model to trabecular bone in humans, while the second is our implementation of the EGS4 radiation transport algorithms.

Our results will have limited application to dose distributions in small trabecular cavities with thin walls. Our model described the backscatter dose enhancement near a cortical bone wall that was thick compared to the range of the electrons of interest. We did not address the potential for a buildup of dose across a comparatively thin trabecular structure. We did calculate dose factors in cortical bone at depths corresponding to the mean thickness of the trabecular structures (200–300 μm) (*1,2*). Those dose factors could be used to estimate the dose to endosteal tissue on the far side of a thin trabecular wall, but it would be better to modify the geometry of the model and calculate them directly.

It is unlikely that the marrow dose across trabecular cavities would be uniform because of significant contributions of atomic electrons near the source. This would be particularly true for ^{153}Sm because of its relatively large atomic electron component and low mean beta energy. We have calculated dose factors for ^{166}Ho using a cylindrical geometry. The source was deposited on the inside wall of a marrow-filled cylinder of cortical bone having an inside radius of 2000 μm (*3*). Our finding was that the dose distribution across the cavity becomes roughly uniform (within ±20%) beginning 75 μm from the cylindrical wall and extending through the center of the cylinder. We have not yet determined dose factors for ^{153}Sm or ^{186}Re in this geometry.

In our implementation of EGS4, we included source radiations having electrons of energy less than 10 keV. As Dr. van Dieren and his colleagues noted, the model does not transport these electrons. Neither does it summarily discard them. Instead, it allows the user to decide their fate (*4*). In our model, once the energy of an electron fell below 10 keV, we deposited the residual energy in the current dose region. Only then did we discard the particle. For an electron that started below the 10 keV threshold, we deposited its energy in the dose region of the source.

The lateral correlation algorithm (LCA) improves computing efficiency by allowing for long electron transport steps along a boundary (*5*). When a computer model transports an electron in a long, straight step near a boundary, it may incorrectly deposit all expended energy in a single region. In reality, the electron represented by the model may wander back and forth across that boundary, depositing energy on both sides. In EGS4, the LCA compensates for that wandering. In our implementation, the dose regions are very thin (10 μm thick near the source), and we limit the maximum transport step (ESTEP in Table 1) (*6*) so that LCA is not required.

Although we have not addressed heterogeneity of radionuclide distribution in our model, it could be added. We are also considering extending our model to calculate dose factors for sensitive tissues in complex irregular structures, such as nerve tissue in the vertebral column. The versatility of models like EGS4 makes them attractive tools for a variety of complex dosimetry calculations. The increased availability of fast and relatively inexpensive computer hardware makes direct dosimetry calculations in complex circumstances both efficient and affordable.

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