Purpose:
This study investigated the beam quality dependence of a radiophotoluminescent glass dosimeter (RGD) in megavoltage photon and electron beams.

Methods:
The RGD response for 4-18 MV photons and 6-20 MeV electrons was investigated by comparison with ion chamber measurements and Monte Carlo (MC) simulations in solid water phantom. The beam quality response in electron beams was determined at reference depth. The energy response for photon and electron beams was calculated with EGSnrc/egs_chamber and cavity user-codes, respectively. The photon energy dependence was also analyzed according to Burlin's cavity theory. The fraction of dose due to photon interactions 1-d for Burlin's theory was calculated with a modified version of egs_chamber, which allowed discarding electrons generated in surrounding medium and entering the detector.

Results:
The calculated and measured RGD response in photons was lower by up to 2.5% with increasing beam quality in a range of 4-18 MV. The RGD response of 20×20 cm2 for 5×5 cm2 increased by 4% in 4 MV. The RGD response as function of depth was constant within 1% except for dmax in a range of 4-18 MV. The dose in RGD resulting from 1-d decreased with increasing photon energy and with decreasing the field size. 1-d is related to the photon energy response of RGD. The RGD response at dref in electron beams was constant within 1% but 4% lower than that for 6 MV photons. The RGD response estimated by comparison with the ion chamber measurements agreed within 1% with the MC calculations.

Conclusions:
The energy dependence of RGD depends on the photons energy and the field size. In electron beams, the beam quality dependence at a reference depth is insignificant but was 4% lower than 6 MV photons. The beam quality dependence depends on 1-d in RGD, demonstrating its behavior according to Burlin's theory.