

Purpose: This work has been conducted in order to quantify multiple dependencies which may bear an effect on results of studies utilizing Gafchromic XR-QA2 radiochromic film for applications within diagnostic energy ranges. **Method and Materials:** Data were collected for five external factors thought to commonly contribute the film response in normal clinical experimentation: exposure energy; ambient light; film orientation; post-irradiation readout time; and film storage temperature. Experiments were devised to test each of the aforementioned factors using a GE Lightspeed VCT scanner for irradiation steps and an Epson 10000XL flatbed RGB scanner in conjunction with ImageJ software for analysis of film red channel pixel value (RCPV) response. **Results:** This work succeeded in quantification of contributions by external factors—temperature, ambient light, and energy—to the RCPV response of XR-QA2 Gafchromic film. Additionally, null results identify those external factors—time and orientation—which may not contribute significantly to film response over the ranges tested in this study. When compared with control films, differential RCPV responses of as much as $\pm 38\%$, $\pm 15\%$, and $\pm 8\%$ were seen for temperature, ambient light, and energy, respectively. **Conclusion:** Through the results of this comprehensive study, a reference has been established to aid future studies utilizing XR-QA2 film in both clinical and experimental applications at diagnostic energy ranges. The maintenance of optimal experimental conditions in terms of external influence factors for studies utilizing Gafchromic XR-QA2 film is the major contribution of this study, that is, to provide a practical guideline for clinical use.