Health problem addressed
These systems are used mainly for treatment of cancer and related diseases.

Product description
Computer workstations that typically consist of a computer, software for dosage calculation, and input and output devices (e.g., keyboards, monitors, printers) for graphic and alphanumeric data. These systems use x-ray image data and dosimetric data to help clinicians determine the optimum treatment parameters to match the prescribed dose and constraints. Planning systems are available for all types of radiation treatment delivery.

Principles of operation
Various computer algorithms are used to model the interactions between the radiation beam and the patient’s anatomy to determine the spatial distribution of the radiation dose. Different algorithms are necessary to account for the different types of radiation and computational complexity. With the increase in computational performance available today, improved algorithms are being developed. All treatment planning systems use x-ray based image data since the x-ray data is necessary for the dosimetry calculations. Most treatment planning systems today use inverse planning, which works backwards from the prescribed treatment volume to determine the optimum beam angles and collimation.

Operating steps
The first step in treatment planning is to identify the planning target volume and the organs at risk. This is done by the oncologist using the contouring tools available on the planning system. Automatic contouring tools can help in outlining organs or regions of bulk density. Depending on the type of lesion, it may be necessary to use multiple images from different sources. Alignment can be achieved using either implanted fiducial markers or anatomic structures. Dose calculation is central to all treatment planning systems.

Reported problems
Several issues have been reported involving treatment delivery errors due to incorrect calibration among third-party equipment, treatment planning systems, and treatment delivery equipment. These errors can affect multiple patients. Therefore, all those involved in radiation oncology should be alert to any anomalies.