of the high stresses expected in service. This firm has invested about $2 million in equipment and employs 90 people for inspection services, mainly radiography, to carry out its extensive program of nondestructive testing. Both X-ray machines and radioisotopes are used.

The large cobalt-60 camera is considerably less expensive than the supervoltage X-ray units; the former costs about $55,000 installed, and each of the latter costs $225,000. Moreover, it takes six times longer to radiograph a 6-inch-thick weld with a 1-Mev X-ray machine than it would take with a 2,500-curie cobalt source. However, a 2-Mev X ray is necessary for inspecting sections greater than 6 inches because the energy of cobalt gamma rays is too low for this purpose.

As an example of savings resulting from isotope radiography, a small company that previously lacked nondestructive testing facilities spent about $13,000 a year on destructively testing 1,000 castings annually. The firm has now installed a radioisotope radiography unit, and its savings are estimated at $8,000 a year. Another firm, which manufactures railroad car wheels, estimates a saving in reduced scrap of $18,000 annually.

Other specific applications of radiography include:

- Study of nonmetallic inclusions in steel.
- Measurement of the thickness of walls.
- Inspection of welded joints in ship structure.
- Detection of flaws in metal castings.
- Inspection of penstock segment weldments.
- Inspection of welds in continuous pipelines.

A new and promising type of radiography uses neutrons as the penetrating radiation. Neutron radiography complements the other types because of its ability to examine materials impervious or insensitive to X rays and gamma rays. X rays and gamma rays interact with an atom's electrons, and their attenuation is proportional to material density and atomic number. Neutrons, however, interact with the nucleus, and their attenuation is proportional not only to the thickness of a material but also to its neutron absorption coefficient. Neutrons, therefore, can examine materials that are rich in hydrogen, such as plastics and rubber, even when encased in heavy elements like lead.