placed on opposite sides of a tank or other vessel. Overfilling causes a sharp attenuation of the radiation reaching the detector, and underfilling gives an intensified radiation signal. The input and output of the vessel can be controlled to maintain the detector signal at an intermediate value, which causes the liquid to be maintained at a predetermined level.

Some examples of gauging applications may be of interest.

In the steel industry, for example, as specifications for dimensional tolerances have become more rigid, radiation gauges have become generally accepted for monitoring the thickness of steel sheets. Virtually all steel rolling mills are now equipped with this type of instrumentation. A major related application for gauges which has received almost uniform acceptance and which uses isotopic sources of radiation is in the manufacture of galvanized sheet. Beta-ray-reflectance gauges are used to monitor the thickness of the zinc coating on each side of the steel. The industry reports a much greater degree of product uniformity since installing this equipment, and tangible dollar savings result from the smaller quantities of zinc used per unit area of the product. These reductions in quantity are reported to average approximately 10% of the total metal used when compared with previous practice.

The production of coke is an integral part of the operation of any iron and steel complex, and isotope gauging is finding some important applications in this area. Gamma-ray gauges have been effectively used to determine the bulk density of coal, thus permitting coking ovens to be loaded with coal to optimum capacity. One steel company found that the capacity of a coke oven complex could be increased by over 5%, or 24,000 tons per year, by using gamma-ray gauges.

The use of density and level gauges by major chemicals and plastics companies for process control has been growing at a rate of about 25% per year, and it is significant that instrumentation engineers in the larger chemical companies now regard these techniques as conventional.

The payout period on isotope density and level gauges ranges from four months to three years in most chemical companies, the average being about six to nine months. For example, in a polymer synthesis process, it was found that an appreciable fraction of the product was spilling over into the raw material recovery unit because of faulty operation of