

and services related to radioisotope and radiation use, such as detection and measurement instrumentation, shielding material, handling equipment, etc. From this overall viewpoint, it can be seen that radioisotopes are generating commercial activity in the United States at a level of several hundred million dollars annually. Thus in both nature and magnitude a new industry has been created.

As an indication of the breadth and depth of the influence that radioisotopes have had on industry, I would now like to take a close look at such typical radioisotope applications as tracing, gauging, radiography, and radiation processing.

Tracer studies

The use of radioisotope tracers is one of the most common applications of isotopes in industry. The majority of tracer studies are performed in laboratory research programs, but many large-scale investigations of the movement of objects or the flow of fluids are carried out in pilot-plant or production facilities. In addition to studies of the physical movement of matter, tracers are used in the chemical analysis of complex mixtures. Some examples of tracer uses should illustrate their importance.

The use of radioisotope tracers for wear studies is especially valuable to manufacturers of machine tools. One such firm used tracers to develop improved cutting fluids for milling and turning operations, and its studies also provided information on the optimum combination of tool material, preparation and geometry, cutting speed, feed rate, vibration, and rigidity effects on various metals and alloys. As a result, the manufacturer was able to recommend to his customers the most efficient methods of using the machine tools. Moreover, some of the tracer studies of the effect of vibration on tool wear led to improvements in machine-tool design.

A manufacturer of earth-moving machinery used neutron-irradiated steel rollers to simulate the conditions of gear wear and studied the amount of radioactivity removed from the steel surface by the lubricating oil. In a study of the performance of engine gaskets, a tracer was added to the cooling system, and the gasket leakage was measured by monitoring the build-up of radioactivity in the engine lubricating oil. Afterwards the gaskets were autoradiographed to locate the imperfections causing the seal's failure. A manufacturer of large diesel engines has studied cylinder wear by irradiating areas of the cylinder