comparison with known radioisotope energies and half-lives or by comparison with standards that have been activated under identical conditions. The advantages of this technique arise mainly from its extreme sensitivity; in favorable cases it can detect concentrations as minute as a few parts per billion. As an example of the industrial uses of neutron activation analysis, it can detect traces of vanadium in the feedstock to oil refinery catalytic crackers; small amounts of this element can poison the catalyst with disastrous effects.

A potential industrial use of neutron activation analysis can be found in the manufacture of detergents. Materials used in the production of detergents include monosodium phosphate and disodium phosphate. In the production of suitable detergents, the ratio of sodium to phosphorus should be 1.67, within a few tenths of one percent. Current production methods require that a batch be held up until a chemical analysis can indicate that the mixture is within limits. A technique that could yield a reliable on-line measurement would eliminate substantial time in manufacture, as well as the need for mixing tanks and holdup of batches. Neutron activation analysis appears to be a solution to this problem since both sodium and phosphorus can be activated to yield radioisotopes that decay with the emission of rather short-lived gamma rays. Measurement in a matter of a few minutes or less should be possible to provide the desired process-control information.

These are only a few of the many tracer applications in industry. The following list of additional tracer uses should provide an indication of the great variety of industrial applications.

- Mixing of ingredients and additives in production.
- Location of leaks in storage tanks and pipelines.
- Determination of the degree of impregnation of wood with fungicides.
- Activation analysis of metals in pulp.
- Tracing of the diffusion of sulfur in cable rubber.
- Application of radioactive tracer techniques to fabric-washing efficiency studies.
- Study of detergents in sewage.
- Measurement of traffic paint abrasion.
- Location of gas leaks in underground gas pipes.
- Study of the rate of penetration of sulfate ions into cement mortars.
- Determination of the uniformity of mixing of Portland cement.
- Studies of intermetallic diffusion.
- Studies of diffusion in semiconductors.
- Detection of leaks in telephone cables.
- Leak testing of hermetically sealed components.