3. There is a significant delay between the time they are released into the environment and the time their full effects on the ecosystem finally appear.
4. They are concentrated as they pass to higher trophic levels in terrestrial and aquatic food chains.

Increasing Generation of Persistent Pollutants

Materials such as pesticides, chemical fertilizers, petroleum by-products, and heavy metals are widely used in the production of food and industrial goods. With rising population and technological advance, the number and the quantity of the materials being used has increased substantially. Figure 6-2 illustrates the historical global production of six toxic heavy metals: chromium, lead, nickel, mercury, cadmium, and arsenic. The production of these materials increased an average of about 350 percent between 1945 and 1970, or 5 percent per year during that period. Over the fifteen-year period 1951–1966, global phosphate, nitrate, and pesticide use increased 75 percent, 146 percent, and 300 percent, respectively (SCEP 1970, p. 118). Global petroleum use has exhibited a historical increase of about 6 percent per year. The generation of radioactive materials as inputs to and by-products of energy production will expand enormously for at least the next thirty years. The projections summarized in Figure 6-3 suggest that the growth rate in nuclear waste generation will be between 15 and 20 percent per year over the foreseeable future.

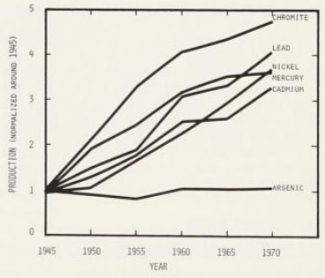

Figure 6-2 Growth in the global production of six toxic heavy metals, 1945–1970
Source: Production data from *Commodity Yearbook* 1950–1970.

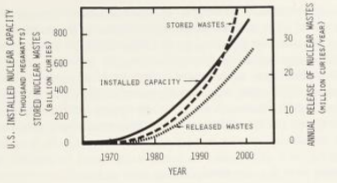

Figure 6-3 Projected generation of radioactive wastes from the operation of U.S. nuclear power plants, 1970–2000
Sources: Installed capacity to 1975 from AEC 1971; installed capacity to 2000 from Starr 1971; stored nuclear wastes calculated from specifications for 1.6-thousand megawatt plant in Calvert Cliffs, Maryland.

It is generally anticipated that these trends will continue. Even if the per capita consumption rates were to remain constant, the projected growth in population would bring substantial increases in the production of persistent materials. However, three factors combine to increase their use at an even faster rate than the rate of population growth alone. First, increasing affluence leads each individual to demand more energy, food, and material goods. For example, global annual petroleum production is expected to reach four times its 1960 level by 1980, although the global population will not quite double over that period (Figure 6-4).

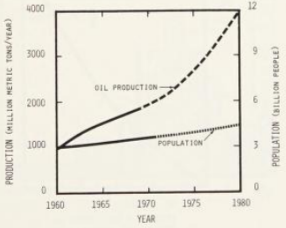

Figure 6-4 Actual and projected global crude oil production and human population, 1960–1980
Sources: Oil production data from SCEP 1970, p. 266; population data from U.N. 1969, p. xxvii.