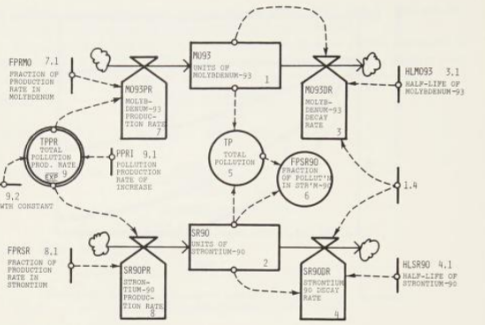
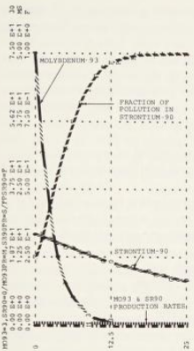


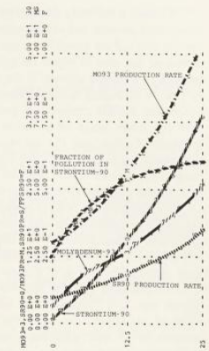
Figure 6-18 DYNAMO flow diagram of a simple model of pollution accumulation and assimilation
Note: Appendix C to this chapter lists the DYNAMO equations of this model.

tent pollution remaining in the system consists of Sr-90, and the effective half-life of the material is 25 years, the half-life of Sr-90. Figure 6-19B, the second simulation of this simple model, illustrates the shift in the composition of persistent pollution that takes place over time when pollution generation is increasing. We start with essentially no pollution in the system and with pollution increasing exponentially at 5 percent per year. Of this newly generated pollution, 75 percent is the short-lived Mo-93 and 25 percent is Sr-90. It can be seen that the composition of the total persistent pollution level gradually shifts from 25 percent Sr-90 to 65 percent Sr-90 at time = 25 years. Initially, the effective half-life of the total pollution is about 6 years; at year 25 it is nearly 20 years.

Although the tendency of effective half-lives to increase with composition changes is potentially important, we concluded that our current knowledge of the future composition of persistent pollution and of the assimilation half-lives that actually characterize persistent materials is too incomplete to warrant incorporating a time-dependent influence on the assimilation half-life in World3. Given the lack of data, incorporating in World3 a tendency for AHL to increase as a function of time due to shifts in the composition of pollutants would not improve the overall projective utility of the model. Although AHL does tend to increase during each simulation of World3, that increase is the consequence of continued growth in the generation and



A. the shift in the composition of total pollution over time with no inputs and initial ratios of 75 percent Mo-93 (halflife =2 years) and 25 percent Sr-90 (half-life = 25 years)



B. the shift in the composition of pollution over time with negligible pollution initially and exponentially increasing inputs of 75 percent Mo-93 (half-life = 2 years) and 25 percent Sr-90 (half-life = 25 years)

Figure 6-19 Secular shifts in the composition of total pollution in a simple two-pollution model when the half-lives of the two pollutants are unequal

appearance of persistent pollutants; it is unrelated to a shift in the global composition of persistent materials.

The second influence on the assimilation half-life in the real world is the geographical distribution of the pollutants. The rate of radioactive decay does not depend upon an isotope's concentration. However, where physical sedimentation, biological degradation, or chemical reaction is involved in the assimilation of persistent materials, the physical distribution of the pollutants may have a marked influence on the rate at which they can be assimilated. We chose to ignore this influence in formulating the equation for AHL in World3. By omitting any distributional parameter in the equation that defines AHL, we implicitly assumed that the future distribution of persistent materials around the globe will remain approximately as it was in 1970. While one can argue that the distribution of pollution sources will change in the future, the World3 pollution sector represents the effects of materials that persist long enough to be transported great distances by the globe's air and water streams. Thus the assumption of a constant distribution is not sufficiently in error to alter the utility of the pollution sector.