1958 Pathology of Minamata disease identified.

1959 Connection between Minamata disease and mercurial effluent from factory established.

In another example (Johnels and Westermark 1969), Swedish scientists traced the use of mercurial fungicidal seed treatments to contamination of the food chain, including land-based, seed-eating birds and their predators:

1940 Mercurial seed treatment came to be extensively used in Sweden.

1950s Initial reports of mercury contamination in birds and their predators.

1965 Connection between mercurial seed dressings and contamination of the food chain is confirmed; the use of these seed dressings is halted.

In this instance it is clear only that the transmission delay was less than 10 years.

Notice that in these local cases the social response to pollution is delayed much more than the appearance of the pollution. For mercury in Japan the response delay was more than 6 years. In Sweden the response delay was 15 years. The response delay is not explicitly represented in the standard model, but is incorporated in simulation analyses of the pollution sector in this chapter and in Chapter 7. The simulations show that the social response delay has very important implications for policies intended to limit the damage caused by persistent materials.

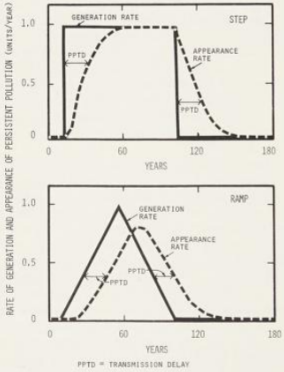

Figure 6-14 The relation between two persistent pollution generation rates and the persistent pollution appearance rates they would produce when the transmission delay is 20 years

More precise information on the magnitude of the transmission delays associated with characteristic persistent materials may be obtained through simulating the actual diffusion and concentration processes involved in the movement of these materials through the environment. To provide information on the transmission delays associated with several persistent materials we developed simulation submodels of DDT and mercury. These models are described in detail in the second volume of our report (Meadows and Meadows 1973). Here we will simply present the conclusions of each model without defending its structure or coefficients.

Earlier theoretical studies of DDT have indicated the presence of important lags in the movement of the chemical through the environment (Harrison et al. 1970, Woodwell et al. 1971). Our simulation model of DDT transport supports these findings and provides more detailed information on the probable magnitudes of the delays (Randers 1973). Figure 6-15 illustrates the delay that would be observed

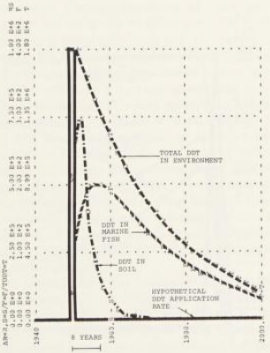

Figure 6-15 An illustration of the transmission delays associated with the diffusion of DDT through the global environment—the relation between the rate of DDT application over croplands and the level of DDT in marine fish tissue

Note: Appendix B to this chapter lists the changes required in the standard DYNAMO program of the DDT model to obtain the results illustrated in this figure.