

Chapter 12

Radioactive Contamination of Natural Waters

Abstract Industrial nuclear technology, which frequently requires the utilisation of very considerable amounts of water, is the main cause of radioactive contamination of natural waters. Surface and underground waters become contaminated with radioactive materials when industrial effluents are discharged into them, or where there is leakage from industrial complexes concerned with the production and enrichment of radioactive materials, treatment of nuclear fuels or the manufacture of fuel rods for industrial and research nuclear reactors. The nature and properties of radioactive effluents, future developments in nuclear technology and disposal of effluents are discussed in this chapter. Migration of radioactive-effluent components through soil and ground, natural minerals and organic sorbents is also analysed.

12.1 Sources of Radioactive Contamination of Water

Industrial technology frequently requires the utilisation of very considerable amounts of water. The associated changes in acidity, salt and bacterial composition, colour, temperature and so on, may be so considerable that the water cannot be used again in the manufacturing cycle and if the regeneration is very expensive or cannot be carried out at all then the water is usually discharged into natural or artificial reservoirs or outlets (seas, lakes, ponds rivers, canals, etc.) or into surface or dipper geologic formations. The surface formations that can be used for this purpose are either natural or artificial basins (enclosed depressions, filtration fields, ditches, shallow drains).

The deeper geological formations that can be used are water-bearing or abandoned oil beds, karst structures, zones of fissuring, crust or weathered crystalline basements and so on. In the latter case, however, special arrangements are necessary (injection wells, deep absorbing drains, and so on). Quite frequently, industrial effluents contain undesirable components in concentrations, even after preliminary purification, considerably exceeding permissible levels. This means that the water must be stored until it has been subjected to the necessary processing. When the volume of this water is very considerable, the only way to store it is to discharge it into geologic formations.