

ENVS4450 Rhine Coursework

In 1986, a catastrophic fire broke out in a chemical warehouse in Schweizerhalle, a suburb of Basel, Switzerland. Hearing the sirens that blared during the night, residents of Basel thought that WW III had broken out. Unfortunately, the water used to put out the fire broke the dike surrounding the warehouse and tons of chemicals were washed into the Rhine River which was close to the warehouse. The principal toxic component was the insecticide disulfoton ($C_8H_{19}PS_4$) [CAS 298-04-4]. The following data are relevant to the incident:

amount released in the spill, 3.3 metric ton (1 ton = 1000 Kg)
mean flow velocity of the Rhine at Schweizerhalle, 1.0 m s^{-1}
mean depth of the Rhine at Schweizerhalle, 5.0 m
width of the Rhine at Schweizerhalle, 250 m
duration of the spill, 12 h

- a) Calculate the volumetric flow rate (discharge) of the Rhine River in $\text{m}^3 \text{ s}^{-1}$ and L s^{-1} .
- b) Calculate the volume of water that flowed during the incident.
- c) Estimate the concentration of disulfoton in the contaminated river water in $\mu\text{g L}^{-1}$ and ppb.
- d) Comment on the biological consequences of the accident. Useful data on the toxicity of disulfoton can be found at the EXTOX Web site.
- e) The flow at Loblith, close to the mouth of the Rhine and 700 km downstream from Schweizerhalle, is $2300 \text{ m}^3 \text{ s}^{-1}$. When the polluted plume reached Loblith, the concentration of disulfoton was $2.7 \mu\text{g L}^{-1}$. Was dilution a major source for the reduction of the disulfoton concentration or were other factors responsible? Briefly discuss.