

was not a significant factor for any of the constituents of concern. We used the highest 9-year average leachate concentration predicted by the partitioning model as input into EPA's Composite Model for Leachate Migration with Transformation Products (discussed in section ii below).

In modeling biodegradation, we used anaerobic degradation rates that were available in our primary reference.<sup>30</sup> This reference did not provide biodegradation rates for seven constituents of concern: aniline, azobenzene, benzaldehyde, 4-chloroaniline, 2,4-dimethylaniline, 1,2-phenylenediamine, and o-toluidine. For these chemicals, we selected conservative surrogates for assigning biodegradation rates. In selecting surrogates, we considered likely degradation pathways, potential interim products, and chemical structure. We used surrogates that were similar in structure and had similar or identical functional groups; in some cases, the surrogates were closely related isomers with the same chemical formula (e.g., we used the rate for 1,4-phenylenediamine for 1,2-phenylenediamine). The use of surrogates is discussed in more detail in the Risk Assessment Background Document. We solicit comment on the use of surrogates for estimating biodegradation rates. We believe that using appropriate surrogates is preferable to assigning a default value of zero for the biodegradation rate. However, we also modeled these seven constituents by assuming a zero degradation rate for comparison. The mass loading limits resulting from modeling landfill releases without the surrogate biodegradation rates for these constituents are shown in Table IV-4 in section IV.A.4.

The partitioning model incorporates other assumptions intended to improve the efficiency of the model. These assumptions are described in detail in the Risk Assessment Background Document. The assumptions included the lack of lateral transport between cells, simulation of only a single cell and then aggregation of results based on the time each cell is filled, and the assumption that waste is added at a constant concentration and at a constant rate.

We do not believe that the wastes evaluated for the landfill scenario will contain or form nonaqueous phase liquids (NAPLs). NAPLs would be a

problem only for wastes containing high concentrations of liquid organic material. Regulations for municipal landfills restrict the placement of any bulk or containerized liquids in a MSWLF unit (§ 258.28). Further, we have no information to indicate that such wastes would be destined for disposal in landfills. For example, the TRI releases reported for the constituents of concern do not suggest large quantities of organics are disposed in landfills. We expect wastes with high organic content to undergo thermal treatment, such as energy recovery. Therefore we did not model NAPL migration.

*Surface Impoundment Partitioning Model.* The surface impoundment model simulates the disposal of liquid wastes in a surface impoundment and the releases of chemicals during the lifetime of the unit. We also used this model in the September 14, 2000 proposed listing determination for inorganic chemical manufacturing wastes (65 FR 55684) and the February 13, 2001 proposed listing determination for paint production wastes (66 FR 10060). The entire time series of leachate concentrations are then used as input into EPA's Composite Model for Leachate Migration with Transformation Products (see section ii) which estimates the movement of the plume through the saturated and unsaturated zone over a 10,000 year time period. The time series of emissions for both vapors and particulates are also utilized along with air dispersion modeling results to estimate ambient air concentrations. We assume that the impoundments are properly designed and operated such that runoff and erosion do not occur. We assume that the unit is not covered. The model assumes that the waste in the impoundment consists of two phases: Aqueous liquid and sediment. The model simulates the changes at the bottom of the impoundment over time as settled solids fill pore space in native soils and act to reduce chemical transport to underlying soils and groundwater. In addition, the model allows for a fraction of each surface impoundment to be aerated, which enhances biodegradation and increases volatilization of some chemicals. The surface impoundment is assumed to operate 50 years and then undergoes clean closure (that is, all the waste is removed from the unit).

We modeled three liner systems for the surface impoundments: No liner, clay liner, and composite liner. The infiltration rates for unlined and clay-lined units were calculated internally by the groundwater model we used (EPACMTP). For the composite-lined

surface impoundment, we calculated infiltration rates assuming a distribution of leak densities assembled from a survey of composite-lined units.<sup>31</sup> This approach is described in the Risk Assessment Background Document.

Based on the design assumptions, the surface impoundment module simulates annual release of leachate to the unsaturated zone and volatile emissions to the air. The model does not account for redeposition of volatiles into the unit from precipitation. The model accounts for various biological, chemical, and physical processes in the liquid phase, including hydrolysis, volatilization, sorption, settlement, resuspension, growth and decay of solids, and activated biodegradation (degradation which is dependent on the amount of biomass present). For the solid phase, the model accounts for anaerobic biodegradation in the sediments and has the ability to account for hydrolysis, although the hydrolysis rates for the constituents of concern were all zero. As noted above for the landfill partition model, we lacked biodegradation rates for seven constituents. As described previously, we used surrogates to estimate aerobic and anaerobic biodegradation rates for these constituents.

*Tank Emissions Model.* The tank model simulates time-varying releases of constituents to the atmosphere. The treatment tank is divided into two primary compartments: A liquid compartment and a sediment compartment. Mass balances are performed on these primary compartments at time intervals small enough that the hydraulic retention time in the liquid compartment is not significantly impacted by the solids settling and accumulation. In the liquid compartment, there is flow both in and out of the waste management unit (WMU). Solids generation occurs in the liquid compartment due to biological growth; solids destruction occurs in the sediment compartment due to sludge digestion. Using a well-mixed assumption, the suspended solids concentration within the WMU is assumed to be constant throughout the tank. However, some stratification of sediment is expected across the length and depth of the WMU so that the effective total suspended solids (TSS) concentration within the tank is assumed to be a function of the WMU's TSS removal efficiency rather than equal to the effluent TSS concentration. The liquid (dissolved) phase

<sup>30</sup> Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meyland, E.M. Michalenko, and H.T. Printup (ed.). 1991. *Handbook of Environmental Degradation Rates*. Lewis Publishers.

<sup>31</sup> "Characterization of Infiltration Rate Data to Support Groundwater Modeling Efforts," Draft Final. Tetra Tech, Inc. September 28, 2001.