

aquifer type as a single set of parameters. We believe that, for example, allowing the climate from one location to be paired with the depth to groundwater from another location could result in a scenario that would not represent reality.

We set some of the parameters in the probabilistic analysis as constant values because (1) there are insufficient data to develop a probability distribution function, and (2) from previous listing determinations, the analysis has been shown to be insensitive to the value of the parameter.

a. What Waste Management and Release Scenarios Were Modeled?

We evaluated three waste management units that represent plausible management scenarios that are likely destinations for dyes and/or pigments production waste. The modeled units were nonhazardous landfills, surface impoundments, and wastewater treatment tanks. Section III.E describes in detail why these waste management units were selected for evaluation in the risk assessment. The waste management scenarios for each of these units were created using publicly available information reported and provided by industry on the management of their dyes and/or pigments production wastes. In addition, we used information on the national distributions of waste management unit characteristics (e.g., size and waste capacity) collected with surveys conducted for other rulemakings to establish the characteristics of the waste management units.

As noted in section III.E.2, we originally believed that facilities managed dyes and/or pigments wastes in onsite or offsite nonhazardous landfills that are not MSWLFs, *i.e.*, Subtitle D "industrial landfills." Thus, our initial modeling of landfill scenarios used a distribution of landfills that included a small fraction of industrial units (91 percent MSWLFs and 9 percent industrial landfills). Further review of the available information showed that we did not have any evidence that industrial landfills were currently in use for these wastes. Therefore, subsequent risk analyses used a landfill distribution made up of MSWLFs only. As previously discussed, the differences between the industrial and MSW landfill scenarios were relatively minor; this change did not have a significant impact on the risk results. Also, in the initial analyses, we inadvertently used a landfill life of forty years, while for subsequent modeling we corrected this to a thirty-year life. We have used a thirty-year life in recent

listings, and we believe a thirty-year life is more appropriate for MSWLFs.²⁷ Comparisons of some modeling runs using the different landfill lives and distributions showed that these were not significant factors.

We have developed distributions for each type of waste management unit that characterizes the units' capacities and dimensions (e.g., area and depth). These dimensions and operating characteristics are important determinants of the extent to which a contaminant may be released from the unit. We assume specific operational lifetimes (between 30–50 years) for each type of waste management unit, as well as different lengths of time during which constituents are assumed to be released from these units.

We determined that releases from all of the waste management units (tanks, landfills, and surface impoundments) can occur through release of vapor emissions to the air. We evaluated air releases for organic constituents that had a toxicity benchmark for the inhalation exposure route. Seventeen of the 30 organic constituents assessed did not have adequate benchmarks for such analysis. We did not assess the metals for vapor emissions because they do not volatilize. We assumed that particulate emissions to the air from solids disposed in landfills would be minimal because municipal landfills are typically required to have daily cover (see regulations for daily cover at § 258.21). Therefore, we did not consider particulate emissions for either organic or metal constituents in this assessment.

For landfill and surface impoundment scenarios, we determined that releases could also occur through leaching of waste contaminants into the subsurface to both groundwater and surface water. The Agency assumed that landfills and surface impoundments followed standard construction and operational requirements such that runoff and water erosion did not occur. We assumed that tanks were sufficiently impermeable that they were highly unlikely to release any significant amount of waste to the subsurface.

b. What Exposure Scenarios did EPA Evaluate?

We assumed that exposure from vapor emissions would be through inhalation of ambient air, while exposure to contaminants in groundwater would be through drinking and through inhalation of volatile contaminants released during showering. We did not add the risks from vapor releases and

from groundwater contamination because vapor releases reach nearby residents in a matter of hours, while releases to groundwater take many years to migrate to nearby wells. For adults, we did add risks from both drinking and showering with contaminated groundwater. We assumed small children took baths instead of showers, so we did not model the risk of inhaling volatile chemicals while showering with groundwater for them. Previous analyses have indicated that exposure to chemicals volatilized from groundwater during household uses other than showering are very low compared to exposures in the bathroom during and immediately after showering. Therefore, we did not model exposure from other household uses of groundwater.

As noted above, particulate emissions to the air from solids disposed in landfills would be minimal because municipal landfills are required to have daily cover. In addition, releases from landfills or surface impoundments through volatilization are unlikely to lead to significant deposition and food chain uptake because this release pathway would only be significant for constituents that are more volatile than those of concern for dyes and/or pigments production wastes.

c. How did EPA Quantify Each Receptor's Exposure to Contaminants?

The amount of contaminant ingested or inhaled by a receptor is a function of the concentration of the contaminant in the water or air and various exposure factors, such as how much drinking water the receptor consumes each day (the intake rate), how much air the receptor breathes, the number of years the receptor is exposed (the exposure duration), and how often the receptor is exposed (the exposure frequency). Another important exposure factor affecting risk is the body weight of the receptor, since most toxicity measures are expressed as dose per unit of body weight. Our primary source of exposure factors is the "Exposure Factors Handbook" published by EPA in August 1997.

The one situation where we do not calculate dose to determine risk is the case when we use the reference concentrations (RfCs) to assess health impacts. RfCs are expressed as ambient air concentrations which are protective of human health; as such, they already have the appropriate exposure factors (inhalation rate, body weight) included in their derivation.

Children are an important sub-population to consider in a risk assessment because, compared to adults, children drink more water and breathe more air per unit of body weight.

²⁷ "Calculation of Municipal Landfill Active Life." U.S. EPA. November 10, 2003.