

necessary to set a wastewater loading limit for this chemical.

3. What Was EPA's Approach to Conducting the Ecological Risk Assessment?

We conducted a screening analysis to estimate whether there might be significant impacts from these constituents on ecological receptors. This analysis was limited to evaluating the impact of contaminated groundwater discharging into surface waters and potentially affecting aquatic life and consumers of aquatic life. We did not assess potential impacts from vapor emissions to air because we did not have inhalation health benchmarks for ecological receptors.

The evaluation of potential impacts on surface waters consisted of modeling the increase in constituent concentrations in surface waters due to the discharge of groundwater contaminated by dyes and/or pigments production wastes into those waters. We used EPA's Ambient Water Quality Criteria (AWQC) to calculate allowable loadings of the potential constituents of concern (Table III-1) for this pathway. For all constituents, the allowable loadings calculated using the AWQC were above the loadings derived using human health toxicity benchmarks. This means that the loading limits calculated to protect human health are also protective for aquatic life. Therefore, we did not find any significant impact from these constituents in this ecological screening analysis.

4. What Is the Uncertainty in the Risk Results?

Liner Infiltration Rates

The infiltration rates used in calculating releases from lined landfills were significant sources of uncertainty in our modeling results. In modeling releases from landfills with liners, we had to rely on limited data for infiltration rates through various liner systems. To account for the expected variability in infiltration rates, we incorporated distributions of rates for composite liners with synthetic components (our SL scenario). The data available were limited both in terms of the number of lined units from which we collected data, and also in terms of the length of time the liner systems were in place. Most of the landfills from which infiltration data was obtained had initial waste placement between 10 and 15 years ago (between 1987 and 1992). Liner systems may suffer increased releases from a variety of causes, such as liner failure due to improper installation, faulty materials,

or long-term degradation of the liner system. These factors would tend to increase infiltration rates.

Our concern about the representativeness of the length of time the infiltration data represents is somewhat balanced by our assumption that biodegradation occurs in MSWLFs. We accounted for biodegradation for all organic constituents of concern. The half-lives we used for the organic constituents are relatively short. We estimate that the mass loading of these constituents would biodegrade over the landfill life to low levels. The slowest degradation rate we evaluated is 9.6E-04 per day, which corresponds to a half-life of 2 years. After 10 years of degradation at this rate, 97 percent of the constituent mass would have degraded (ignoring for this example the competing processes of leaching and volatilization). Therefore, almost all of what is placed into the landfill during the first 20 years of operation (as well as most of what is landfilled during the last 10 years) would be degraded by the time the landfill is closed. We think, therefore, that our data on infiltration rates reasonably represents liner performance for this limited period of time.

In addition, there are other factors that we did not account for in our modeling that would tend to decrease releases of constituents of concern from landfills with composite liners. Our modeling did not account for the effect of a leachate collection system, which would tend to decrease leachate release; this is a required element in the design of a composite MSWLF liner (§ 248.40(b)). Nor did we consider that a final cover would tend to decrease infiltration rates after the unit is closed. The closure regulations for a MSWLF unit (§ 258.60) include a requirement for a low permeability final cover, but our data set did not include many closed units. Note that these final covers are often constructed using geomembrane liners, which are generally more impermeable to surface infiltration than earthen or clay liners. While a cover may also degrade over time, post-closure regulations (§ 258.61) require the owner to maintain the integrity of the cover for 30 years (the post-closure period may be extended, if deemed necessary). In addition, while not required under the part 258 regulations, many landfill units are equipped with additional liners, *i.e.*, units may have a double composite liner system. This is apparent from the units from which the infiltration data were collected (the units had a secondary liner in place, thus allowing the infiltration from the top liner to be measured). Also,

information submitted by an industry group in comments on the 1999 proposed listing for dyes and/or pigments wastes indicates that over half of the landfills receiving the wastes in question reported having some kind of double liner in place.³⁸

Other Sources of Uncertainty

This section discusses other major areas of risk assessment uncertainty: scenario uncertainty, model uncertainty, and parameter uncertainty.

Scenario uncertainty results from the assumptions we make regarding how receptors become exposed to contaminants. This uncertainty occurs because of the difficulty and general impracticality of making actual studies of all activities involved in the management of a waste and the human activities that occur around the waste management unit.

This risk assessment, like other recent listing risk assessments (*e.g.*, see the proposal for paint manufacturing wastes at 66 FR 10060; February 13, 2001) does not consider the additive risk from exposure to multiple constituents. Chemical mixtures can display both synergistic and antagonist behavior with regard to risk. In general, however, the overall risks of a mixture are very likely to be greater than that of exposure to a single chemical. Therefore not adding exposures across the chemicals is an area of uncertainty that leads to an underestimate of total risk.

We did not calculate the additive effects from co-disposal of dyes and/or pigments nonwastewaters since the available information from TRI on the mass loading and co-management of particular constituents of concern in dyes and/or pigments production wastes indicated that such co-disposal by multiple generators in landfills was not a significant occurrence.

Also, certain contaminants from these industries may also be present in the environment as a result of both natural processes and anthropogenic activities. Under these circumstances, receptors potentially receive a "background" exposure that adds to the exposure resulting from release of contaminants from the waste. For a national analysis like this assessment, the inclusion of background concentrations as part of the analysis is difficult because of the lack of data on national background concentrations for each constituent and the potential high variability of background concentrations.

³⁸ See comments by Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers, Attachment A, October 21, 1999, placed in the docket for today's proposal.