

values in the assessment, made the low HQs questionable. Other commenters indicated there was a potential for bioaccumulation in several forms of wildlife.

EPA believes the SERA is adequate to predict hazards to wildlife species from dioxins in land-applied sewage sludge. The SERA was designed to be consistent with EPA's Guidelines for Ecological Risk Assessment (USEPA, 1998). See the Technical Background Document (TBD) for a discussion of the SERA (USEPA, 2003a). Because the ecological analysis was a screening analysis intended only to indicate the potential for adverse ecological effects, EPA considers the qualitative uncertainty analysis to be adequate. The uncertainty discussion identifies sources of uncertainty, discusses their implications for the outcome of the analysis, and, where possible, indicates whether the uncertainty is likely to cause an over or underestimation of risk. Screening-level ecological risk assessments are designed to provide, for those chemicals and receptors that pass the screen (as in dioxins), a high level of confidence that there is a low probability of adverse effects to ecological receptors.

The SERA provides insight into the potential for ecological effects from dioxins in land-applied sewage sludge. The approach used shows that the exposures to animals in terrestrial and water body margin habitats do not exceed protective ecological benchmarks (that is HQs do not exceed one), suggesting that dioxins in land-applied sewage sludge do not pose a high potential for adverse ecological effects.

#### *D. Indications From the 2001 Survey of Dioxins in Sewage Sludge*

In response to comments on the proposal that EPA needed data more current than the 1988 National Sewage Sludge Survey (NSSS) data, EPA conducted a national sampling and analysis effort to measure dioxins in sewage sludge in 2001 (USEPA, 2002b). The EPA 2001 Dioxin Update of the NSSS provides data that support the calculation of unbiased national estimates (*i.e.*, based on a stratified random selection of publicly owned treatment works) for dioxin and dioxin-like compounds in sewage sludge. In addition to being more recent, the 2001 data also include concentrations of coplanar PCB congeners, along with dioxin and furan congeners. Coplanar PCB congeners were not analyzed in the 1988 NSSS.

EPA sampled sewage sludge from a stratified random sample of 94 POTWs selected from the sample of 174 POTWs surveyed in the 1988 NSSS, stratified into four size categories: those with a daily flow of less than one million gallons per day (MGD), 1–10 MGD, 10–100 MGD, and greater than 100 MGD. The 174 POTWs selected in 1988 had been selected from the approximately 11,000 POTWs in existence at that time that had secondary treatment. The 11,000 were sampled according to stratified probability design (*i.e.*, by size based on wastewater design flow). The sample for the 2001 Dioxin Update to the National Sewage Sludge Survey was a subset of the sample for the 1988 NSSS and thus resulted in a statistically valid national estimate of dioxin

congener concentrations in the Nation's sewage sludge. EPA considers dioxin and dioxin-like congener concentrations used in the revised risk assessment to be representative of dioxins congener concentrations in sewage sludge nationwide because of the sample design. See Section III, Statistical Support Document for the Development of Round 2 Biosolids Use or Disposal Regulations (USEPA 2002b).

The sewage sludge samples were processed to produce a single representative sample for each facility. In addition, the data reflect probability-based survey weights based on the numbers of POTWs in the four strata defined on the basis of quantity of flow. Since the few POTWs in the flow group receiving more than 100 MGD of influent wastewater produce the largest amounts of sewage sludge, the probability-based sample design incorporated an over-sampling of large POTWs. The survey weights reflect this feature.

The 2001 dioxins update survey was designed based on the 1988 NSSS in order to allow comparability of statistically valid national estimates, although, as explained later, a number of factors limit the degree of comparison that is possible. A comparison of results for dioxin and furan congeners obtained in the 1988 and 2001 surveys is presented in Table 2. This table summarizes the results using alternative methods for handling non-detect measurements. These comparisons do not include coplanar PCB congeners because the 1988 NSSS did not collect coplanar PCB congener data.

TABLE 2.—NATIONAL ESTIMATES (NANOGRAMS/KILOGRAM DRY MATTER BASIS) FOR DIOXIN AND FURAN CONGENERS IN THE EPA 2001 DIOXIN UPDATE SURVEY AND 1988 NSSS

Method for handling nondetects (estimate)	Zero for nondetects		½ minimum level of quantitation (ML) for nondetects		ML for nondetects	
	2001	1988	2001	1988	2001	1988
Mean .....	21.70	46.50	21.70	67.30	21.80	88.20
Std. dev. ....	47.5	153.0	47.5	153.0	47.5	157.00
Maximum .....	682.00	1870.00	682.00	1870.00	682.00	1870.00
99th% .....	100.00	450.00	100.00	453.00	100.00	466.00
98th% .....	54.40	402.00	54.40	404.00	54.40	455.00
95th% .....	33.30	301.00	33.30	303.00	33.30	340.00
90th% .....	31.40	56.70	31.60	152.00	31.70	226.00
50th% .....	15.50	5.68	15.50	34.20	15.50	52.40

The EPA 2001 dioxin survey suggests that dioxins levels in sewage sludge have decreased from 1988 to 2001. In addition, the upper percentile values obtained in the EPA 2001 dioxins update survey are lower than those obtained in the 1988 NSSS. See Statistical Support Document for the

Development of Round 2 Biosolids Use or Disposal Regulations (USEPA, 2002b) for a full discussion of the 2001 updated dioxins survey.

It is not possible to draw firm conclusions with regard to changes in dioxin concentrations in sewage sludge nationally, due to differences in the two

surveys caused by changed circumstances since 1988 (13 years between surveys). During this time, changes may have occurred at POTWs, and there have been changes and improvements in analytical methods. Nevertheless, as discussed in the NODA, EPA has made a number of