

Environmental Toxicology Program
Bureau of Health
State House Station 11
Key Bank Plaza, 8th Floor
Augusta, ME 04333

W-99-18 NODA Comment Clerk
Water Docket (MC-4101)
USEPA
1200 Pennsylvania Ave., N.W.
Washington, DC 20460
Via Email to: OW-Docket@epamail.epa.gov

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The State of Maine Bureau of Health, Environmental Toxicology Program, appreciates this opportunity to comment on USEPA's Exposure Analysis for Dioxins, Dibenzofurans, and CoPlanar PCBs in Sewage Sludge (Exposure Analysis). We have been asked to review the Exposure Analysis on behalf of the Maine Department of Environmental Protection, which operates a program overseeing the agronomic utilization of residuals including sewage sludge. Due to competing obligations, our review of this analysis is in the beginning stages. However, we have identified one issue that we would like to bring to your attention.

USEPA has conducted a Monte Carlo analysis of risks from dioxin-like compounds in biosolids. The data on concentrations of dioxin-like compounds that are used in the analysis are derived from a survey (the National Sewage Sludge Survey) of publicly owned treatment works (POTWs) nationwide. In the sampling design for the survey, POTWs were categorized into four strata by the volume of influent flow, presumably as a surrogate for sludge production volume.

In the survey, USEPA sampled a greater proportion of high volume facilities, reflecting the fact that these facilities produce the lion's share of sewage sludge. It appears that USEPA intended to develop a distribution of concentration data that reflects levels in the total volume of sludge that is available to be applied to agricultural lands. In fact, in the Exposure Analysis, USEPA stated that the NSSS sampling data were weighted by quantity produced for the purposes of estimating a risk distribution.

From our review of the text and tables, it appears that USEPA may have inappropriately weighted the concentration data from the NSSS in the Monte Carlo analysis of risks. In Section 4.2.1, item 2, USEPA states that the "frequency with which a facility was selected from the distribution of sample data was weighted according to the quantity of biosolids produced by the facility". However, based on the report, it appears that the sampling data were *not* weighted based on quantity produced, but rather were weighted

based on the number of facilities in the four strata. In fact, it appears that the weighting scheme used by USEPA weights the sampling data *inversely* with quantity produced; in other words, samples are selected for use in the risk calculations more frequently if the samples were taken from small-production POTWs¹.

The weighting system would be unimportant if the concentrations of dioxin/furan/coplanar PCBs in sludges are relatively constant across all four strata. However, USEPA notes in the Federal Register Notice, “The levels of dioxins in sewage sludge from treatment works with a wastewater flow of 1 MGD or less was measurably less than the levels of dioxins in sewage sludge from facilities with a wastewater flow greater than 1 MGD” FR 67 (113):40574. If it is true that USEPA’s weighting scheme resulted in disproportionately more samples being drawn from the smallest facilities, it is possible that the resulting risk estimates may have been understated. Without recalculating the risk distribution using a more appropriate weighting method, it is not possible to predict the magnitude of the underestimation. We recommend that USEPA recalculate the risks associated with dioxin-like compounds in sewage sludge using a more appropriate, quantity-based weighting scheme for the data from the NSSS survey.

Further detail on the weighting scheme used by USEPA and an example of a weighting system based on sludge quantity produced are given below.

Background:

The Technical Background Document details the stratum weights used in the risk assessment. Below we review the weights reported in the document, and contrast them with an example weighting scheme that would weight samples by the quantity of sludge produced by facilities in each stratum. In the Technical Background Document, USEPA reports that facilities were grouped into strata based on their production, and the strata were given weights of 0.0035, 0.03902, 0.23027, and 0.71921 (p. 4-2). As one peer reviewer noted, these stratum weights do not sum to one (sum = 0.992). In addition to this problem, it appears that the weights reflect POTW populations from the 1988 survey rather than the 2001 survey.

The reader is referred to Appendix B for further detail on the weighting method. Appendix B reports that there are four strata and gives stratum weights for the 2001 NSSS data based on the fraction of POTWs in each stratum, as shown below:

¹ If USEPA *intended* to weight the smaller production facilities more heavily (if, for example, sludges from small production facilities are more likely to be applied to agricultural lands), then this should be clearly stated in the text and the appropriate data supporting this decision should be provided.

Stratum (h)	Sample Size (nh)	Operating POTWs in Sample	Adjusted Stratum (Nh)	Sampling Fraction (nh/Nh)	Stratum Weight (Nh/N)	Calculated Stratum Weight* (Nh/N)
1	11	11	27	11/27	27/7201	0.003749
2	30	30	301	30/301	301/7201	0.0418
3	36	35	1787	35/1787	1787/7201	0.24816
4	24	22	5086	22/5086	5086/7201	0.70629
Sum	101	98	7201			

*Column does not appear in original table.

The weights reported in the text are not consistent with those reported in the table above for the 2001 sampling event. It appears that the weights reported in the text may have been derived from the 1998 survey. Appendix B reports the number of POTWs in each stratum from the 1988 population; these appear to be the weights that are reported in the main body of the report (p. 4-2, with a possible transcription error for stratum 3):

Stratum	Definition	Number of POTWs in Stratum (Nh)	Stratum Weight (Nh/N)	Calculated Stratum Weight (Nh/N)*
1	Flow > 100 MGD	27	27/7714	0.0035
2	10 MGD < Flow < 100 MGD	301	301/7714	0.03902
3	1 MGD < Flow < 10 MGD	1838	1838/7714	0.23827
4	Flow < 1 MGD	5548	5548/7714	0.71921
Sum		7714		

*Column does not appear in original table.

As the above tables clearly show, the weights assigned to the sampling data from the NSSS survey result in disproportionately more samples (e.g., about 70% of the distribution of samples) being selected from the smallest production facilities (< 1 MGD). Conversely, a very small number of samples is drawn from the highest production facilities (< 0.4%). If, as suggested in the text, the samples were weighted by quantity of sludge, the weighting would be reversed (i.e., more samples would be drawn from the facilities producing the greatest quantities of sludge).

It seems to us that, if the intent is to weight the concentration data by the quantity of sludge produced by the sampled facility, a more appropriate weighting scheme would use an estimate of total sludge production (across all facilities in all strata) as the denominator of the weighting fractions. Each fraction would be calculated as the product of the number of facilities in the stratum and the average sludge production of facilities in the stratum. Assuming that influent flow volume is a reasonable measure of sludge production, this parameter could serve in lieu of actual sludge production. The table below shows an example approach to weighting by sludge volume.

Stratum (h)	Operating POTWs in Sample	Adjusted Stratum (Nh)	Average Influent Flow Volume in MGD (V)	Total Influent Flow for Stratum (Nh*Vh)	Total Influent Flow for Stratum (Nh*Vh)	Stratum Weight (Nh*Vh/ (N*V))	Stratum Weight (Nh*V h/ (N*V))
1	11	27	500	27*500	13500	13500/40028	0.3373
2	30	301	50	301* 50	15050	15050/40028	0.376
3	35	1787	5	1787*5	8935	8935/40028	0.223
4	22	5086	0.5	5086*0.5	2543	2543/40028	0.0635
Sum	98	7201			40028		

As the final column in this table shows, weighting fractions using this approach would be very different from those used in USEPA's analysis and would result in a distribution of dioxin/furan/coplanar PCB concentrations that better represents the distribution of dioxin-like chemicals in all sludges produced in the US. If the concentrations of dioxin-like compounds in sludges are in fact higher when the sludges are derived from high volume facilities, then this weighting approach would also result in higher risk predictions.

A paper copy of these comments will be forthcoming.

Sincerely,

Andrew E. Smith, S.M., Sc.D.
State Toxicologist and Director

Heather Carlson-Lynch, S.M.
Toxicologist

Environmental Toxicology Program
Maine Bureau of Health

cc: David W. Wright, Maine Department of Environmental Protection