

unlikely that every farm in America has a fish pond receiving dioxins runoff from land-applied sewage sludge. A few other commenters believe that EPA's assumptions were not sufficiently conservative, for example, that the percentage of home grown food in the diet was too low. Comments concerning the HEI also said that the risk assessment did not consider the possibility that farmland would be developed and that houses or schools could be built on farmland.

EPA disagrees with comments that assumptions for the modeled HEI population are too conservative and should be changed. Regarding the comment that the amount of food grown on sludge-amended land consumed by farm families as modeled in the revised risk assessment is too conservative, EPA disagrees. The values that EPA used to estimate the proportion of the farmer's diet that is home produced were taken from Table 13-71 (Fraction of Food Intake that is Home Produced) of the Exposure Factors Handbook (USEPA, 1997), a peer reviewed source of data for use in risk assessments. For similar reasons, EPA also disagrees with comments that EPA's estimates of home grown food consumption are not sufficiently conservative. In addition, as some commenters pointed out, the risk assessment should model the "reasonably maximum exposed" individual. EPA believes that the HEI modeled in the risk assessment meets this description, and that "reasonably maximum exposed" is not equivalent to "maximum exposed." Although one could conceive of the possibility that someone may consume up to 100% percent of their diet from home grown products, EPA does not believe it is reasonable to use this assumption in the risk assessment.

One commenter stated that houses could be built on farmland in the future and that EPA should factor this in (presumably to address families living on sewage sludge amended soil). However, because the risks associated with the scenario that EPA evaluated (the farm family as the highly exposed population) are greater than the risks EPA would estimate for a residential land use scenario, there is no need for EPA to evaluate residential exposure. In addition, the Agency evaluated the risks associated with a child's ingestion of sewage sludge amended soil, which could be typical of a residential scenario. Those risks are lower than those for a child's ingestion of contaminated beef and dairy products as in the modeled farm family described herein. (USEPA, 2003a).

Another commenter stated that it is unreasonable to assume that every farm has a fish pond receiving dioxins from runoff of land-applied sewage sludge. Fish consumption by an adult recreational fisher on the farm was one of the pathways used in the exposure model. EPA agrees that while it is unlikely that every farm will have a waterbody from which fish are caught and consumed, it is a possible scenario and a valid one to include in the analysis. In any case, the risk assessment indicates that the consumption of fish from a stream receiving dioxins runoff in land-applied sewage sludge results in minimal influence on the risk estimate.

2. Other Assumptions in the Risk Assessment: In addition to the revised modeled HEI population assumptions (USEPA, 2003a), other assumptions were used in the revised risk assessment. Again, these assumptions, to the extent possible, are presented as a range of values, which were modeled using a Monte Carlo probabilistic method. A number of assumptions concern farming practices and sewage sludge application rates. For sewage sludge application rates, EPA assumed a distribution ranging from 5 to 10 metric tons of sludge per hectare applied every other year for a period of time ranging from once to 40 years (that is, EPA assumed that there would be from one to 20 applications of sewage sludge). Half the acreage on the modeled farm was assumed to be in tilled crop production and half permanently in untilled pasture. EPA assumed that row crops are tilled three times per year, and that tilling incorporates sewage sludge into the top 20 cm of soil. EPA assumed that sewage sludge that is applied to pasture is not tilled. We used these assumptions because they are typical of agricultural application situations for soil amendment products by convention.

Many of the assumptions and values used in the revised risk assessment differed from those in the 1999 risk assessment for the proposed rule. The revised risk assessment includes new exposure pathways and mechanisms to more accurately portray farm conditions for the modeled HEI population. For example, the 1999 risk assessment assumed that pastured animals only eat sewage sludge-amended soil containing dioxins; this was assumed to be the animals' only route of exposure. In contrast, the revised risk assessment assumed that cattle ingest dioxins from several sources: leaf surfaces containing dioxins volatilized from the top two centimeters of soil; sewage sludge particles that remain on the leaf

surfaces; and direct ingestion of sewage sludge-containing soil. The revised risk assessment also included chickens and assumed that they ingest soil from a buffer area that receives dioxins through erosion of surface soils from adjacent sewage sludge-amended pasture and crop.

EPA requested comments on the specific assumptions outlined in the revised risk assessment, and received a variety of public comments. Some commenters believed that these assumptions, like those concerning the HEI, were too conservative and reflected a worst-case scenario. Others wanted EPA to evaluate additional exposure pathways and scenarios (*i.e.*, dermal exposure, risks for breast-fed infants combined with risks for child and adult receptors, and soil ingestion rates that reflect potentially different soil contact behavior for crops and pasture). Other commenters believed EPA underestimated risk of cancer from exposure to dioxins in land-applied sewage sludge. EPA received several comments on the conceptual site models and exposure scenarios. These comments included statements that the risk assessment did not account for harvesting and land-use restrictions, or variation in sludge application rates among different crops and regions. Other commenters stated that modeling assumptions such as the HEI modeled farm family being exposed to dioxins from multiple pathways were questionable (uncertainty inherent in application of models and use of many "average" values imbedded in the assessment) and the vapor dispersion model may underestimate vapor concentration.

The revised risk assessment for dioxins in land-applied sewage sludge does not include additional exposure pathways, however, EPA has summed the risk from all pathways to estimate the overall risk to a given receptor. As explained later in this notice, EPA evaluated the risks to the adult, child, and nursing infant in the farm family. In addition to ingestion of breast milk for the infant, the risk assessment evaluated up to six additional exposure pathways and exposure routes: (1) Inhalation of ambient air; (2) incidental ingestion of soil in the buffer; (3) ingestion of above- and below-ground produce grown on the crop land; (4) ingestion of beef and dairy products from the pasture; (5) ingestion of home produced poultry and eggs from the buffer; and (6) ingestion of fish from the nearby waterbody. More detailed descriptions of the revised risk assessment assumptions and methodologies are presented in the TBD, Section 5.