

transformation products disappear much faster than they are formed. Our evaluation, summarized below, concurs with the petitioner's conclusion that atmospheric transformation of MEK emissions may not reasonably be anticipated to cause adverse effects to human health.

First, we assessed whether there would be elevated ambient concentrations near individual sources of MEK. Next, we estimated the ambient concentrations of these HAP resulting from transformation of MEK from multiple sources in urban areas. We then estimated the potential for any of these concentrations to cause adverse human health effects. Since the atmospheric chemistry for these pollutants is complex and not fully understood, we made conservative assumptions in the analysis in order to over- rather than under-estimate the concentrations of acetaldehyde and formaldehyde that could result from MEK transformation. Please refer to the docket for our complete analysis.

In the first step of the analysis, we applied tier 1 dispersion modeling (SCREEN3) to the worst-case facility presented in the petition, and assuming a conservative average wind speed of 3 miles per hour, we determined that the MEK plume from any given source will travel about 650 miles over MEK's 9-day half-life. Even at one tenth this duration (*i.e.*, about 21 hours), still assuming a wind speed of 3 miles per hour, the plume will have traveled about 63 miles. In this plume, we estimated the unreacted MEK concentration after 21 hours to be approximately  $1.6 \times 10^{-3}$  mg/m<sup>3</sup>.

As it disperses, MEK transforms relatively slowly into acetaldehyde and formaldehyde and, in turn, these compounds decompose much more quickly into by-products, including carbon dioxide, carbon monoxide, and water. We estimated that about 7 percent of the MEK would have transformed into acetaldehyde and possibly formaldehyde after 21 hours. Accordingly, we estimated that the maximum concentrations of acetaldehyde and formaldehyde due to MEK transformation at this point (21 hours after being emitted) would be roughly  $7 \times 10^{-5}$  mg/m<sup>3</sup> and  $5 \times 10^{-5}$  mg/m<sup>3</sup>, respectively. For acetaldehyde, that translates into a lifetime excess cancer risk of  $1 \times 10^{-7}$ . For formaldehyde, the lifetime excess cancer risk is  $7 \times 10^{-7}$ . Calculating noncancer hazard quotients, we see that the HQ for acetaldehyde is 0.008. This means that the level of acetaldehyde to which people are exposed is 0.8 percent of the RfC. For formaldehyde, the HQ is 0.005, which

means that the exposure level is 0.5 percent of the appropriate reference level, the Maximum Risk Level (MRL)<sup>1</sup>. Thus, since the cancer risks associated with the transformation products are below 1 in 1 million, and the noncancer exposures are less than 1 percent of the reference concentrations, we may not reasonably anticipate adverse health effects to occur from transformation of MEK into acetaldehyde and formaldehyde around MEK emissions sources. We note here that risk levels in the upwind part of the plume (*i.e.*, the risks from the transformation products close to MEK emission sources) must be lower than what we estimated since the analysis did not account for degradation of acetaldehyde and formaldehyde. Further, we note that typical ambient levels of MEK are higher than they are in the plume at this point, indicating that the "plume," as such, would no longer exist, having already merged indistinguishably with the ambient background. This turns our attention to the analysis of transformation products in the ambient background.

To evaluate the potential of acetaldehyde and formaldehyde to form from ambient concentrations of MEK significantly downwind of multiple emission sources, we looked at ambient monitoring data to determine the typical ambient level of MEK in urban environments. We then estimated the maximum concentrations of acetaldehyde and formaldehyde that could be transformed from this MEK, using conservative, steady-state assumptions. Based on available monitoring information, we determined that at the 95th percentile, the ambient concentration of MEK is  $4.3 \times 10^{-3}$  mg/m<sup>3</sup>. Using an estimated degradation rate of 14 times greater than MEK for acetaldehyde, we estimated the ambient concentrations of acetaldehyde from transformed MEK to be  $1.8 \times 10^{-4}$  mg/m<sup>3</sup>. For formaldehyde, we estimated that it degrades at a rate of 72 times faster than MEK and, thus, calculated that the ambient concentration due to MEK transformation is  $2 \times 10^{-5}$  mg/m<sup>3</sup>. These very small concentrations do not represent significant health threats as they translate into lifetime excess cancer risks of  $4 \times 10^{-7}$  for acetaldehyde and  $3 \times 10^{-7}$  for formaldehyde.

We do not expect adverse noncancer health effects to occur from the transformation of MEK. The HQ for acetaldehyde is 0.02 which corresponds to an exposure which is 2 percent of the

RfC. For formaldehyde, the resulting HQ is  $2 \times 10^{-3}$  which represents an exposure of 0.2 percent of the MRL. Therefore, we may not reasonably anticipate adverse noncancer effects to occur due to exposures to these outdoor ambient concentrations of acetaldehyde or formaldehyde. Based on the analysis, we conclude that atmospheric transformation of MEK into acetaldehyde and formaldehyde may not reasonably be anticipated to cause significant human health risks.

#### G. Public Comments and EPA Responses

As part of the notice announcing receipt of a complete petition to delist MEK (64 FR 33453, June 23, 1999), we requested interested parties to provide us with data or comments. Copies of the public comments have been included in the docket for this action and have been considered in our review of the petition. Substantive comments are discussed below.

**Comment.** One commenter expressed concern about the overall appropriateness of the IRIS RfC as a decision criterion for determining human health effects. The commenter maintained that the IRIS RfC is itself uncertain and, therefore, the petitioner's proposed revision is without merit. To support this position, data from a single long-term toxicity study which included MEK was cited. That study was published since the IRIS validation and reports adverse health effects as measured by decreased neural condition velocities for a set of workers (41 exposed, 63 controls) exposed over a period of  $14 \pm 7.5$  years to levels of MEK ranging from 149 to 342 mg/m<sup>3</sup>.

**Response.** The EPA's National Center for Environmental Assessment (NCEA) and National Health and Environmental Effects Research Laboratory (NHEERL) reviewed the referenced study as a part of our technical review. Their review demonstrated that the study has multiple and serious methodological shortcomings that greatly reduce its meaningfulness. Very few methodological details were presented in the study, making it virtually impossible for EPA reviewers to determine what had been done. It is not clear what factors were "matched" when the control groups were selected or how comparable the groups were on factors other than age. In addition, the study did not include important factors that are relevant to interpreting the results, including such factors as the type of work (*e.g.*, office versus physical work); lifestyle factors (*e.g.*, drinking, smoking, etc.); and height and weight of the subjects (important for nerve

<sup>1</sup> There is no EPA RfC for formaldehyde. However, the Agency for Toxic Substances and Disease Registry has calculated a noncancer health effects level, called a MRL. The MRL for formaldehyde is 0.01 mg/m<sup>3</sup>.