

regional meteorological factors can, however, cause ground-level O₃ concentrations to be lower in many such areas, particularly in the western United States. For example, O₃ concentrations in the heavily populated Los Angeles area tend to be lowest at the coast and increase inland; in this case, smog-related O₃ would be providing the least shielding where the potential for exposure to UV-B radiation is the highest. The extensive data base on human activity patterns, which was used in the assessment of respiratory effects, does not generally include parameters that relate to people's movement through the types of outdoor microenvironments that are relevant to the assessment of UV-B radiation exposure.

One comment referenced specific EPA data bases that now contain activity pattern data for limited types of outdoor recreation locations, such as tennis courts and golf courses, suggesting that data are now available to better address human activity patterns in microenvironments relevant to assessing UV-B radiation-related exposures and risk. While EPA recognizes that data bases have recently expanded to include additional relevant human activity information, it also notes that the expanded data bases still fall far short of what would be needed to comprehensively project population activity patterns over time and space—in shaded, partially-shaded, and sunny environments. Additional data are still needed to conduct an exposure analysis that could account for the fraction of UV-B radiation exposure that is incurred, for example, during outdoor recreational activities in various non-shaded or partially-shaded microenvironments. The EPA continues to believe that sufficient data on relevant activity patterns are still not currently available, and that reliable estimation of the change in UV-B radiation exposure associated with reducing ground-level O₃ would be significantly hindered by not taking such factors into account.

(iv) Effects of variable behaviors on effective dose of UV-B radiation. Another important factor to be considered in assessing the potential UV-B radiation-related effects of a change in ground-level O₃ is that human behavior affects UV-B radiation exposures. When people choose to shield themselves from UV-B radiation exposure with clothing and sunscreens, and by timing their outdoor activities to avoid peak sun conditions, they are affecting a parameter that is important in assessing UV-B radiation-related effects. The generally well-known risks

associated with too much sun exposure are such that many people limit their own as well as their children's exposure through such measures, regardless of the status of the protective stratospheric O₃ layer or variable amounts of ground-level O₃ pollution. While some sun exposure is generally beneficial to health, limiting excessive sun exposure would remain important for a person's health even if the stratospheric O₃ layer were fully restored to its natural state.⁵⁵

Since sun-seeking or sun-avoidance behaviors can tend to maximize or minimize exposure to UV-B radiation, not factoring such behavioral data into an area-specific exposure assessment would hinder reliable estimation of the increased exposure associated with reducing ground-level O₃. Changes in behavior in the past, specifically increases in sun-seeking behaviors, are believed to be the primary reason for the increases in skin cancer incidence and mortality observed in the U.S. by the 1980's (U.S. EPA, 1987). Conversely, future rates of skin cancer could be reduced to the extent that people choose to change their behavior by increasing sun-avoidance behaviors.

Public awareness of the risks associated with overexposure to UV radiation seems to be having an effect on behavior. In 1987, EPA noted that behaviors causing increased UV-B radiation exposure were apparently reaching an upper limit (U.S. EPA, 1987, ES-35). The effect of increased awareness of the health consequences of UV-B radiation exposure on decreasing the number of harmful exposures is not likely to show up, in terms of reducing the incidence and mortality rates of skin cancers, for many years. Nevertheless, ignoring its effects would tend to bias exposure estimates in an area-specific assessment of the UV-B radiation-related effects of smog reduction strategies.

A few commenters noted that variable behaviors would also affect the assessments of respiratory-related

exposure and risk, and that not having such information to assess exposure and risk of UV-B radiation-related effects would not introduce any additional uncertainty beyond what is incorporated in the assessments of respiratory effects. The EPA believes that these commenters are not taking into account the extent to which EPA's respiratory-related exposure and risk analyses did incorporate effects of variable respiratory-related behaviors of people as they move through space and time, and through different microenvironments, in that such behaviors are part of the human activity pattern data base used in those assessments. The human activity pattern data base incorporates respiratory-related parameters derived from human activity studies in which subjects report the types of activity they engage in as a function of location and time throughout the day, which are then linked to variable breathing rates that affect the likelihood that specific O₃ exposures are likely to result in adverse respiratory effects.⁵⁶ In contrast, the available human activity pattern data base does not include parameters related to dermal exposures to UV-B radiation, such as time spent in sunny, partially shaded, and shaded locations, nor does it include parameters related to the likelihood that people in sensitive groups exhibit sun-avoidance or sun-seeking behaviors while in such microenvironments. Thus, EPA disagrees with comments asserting either that its respiratory-related exposure and risk analyses did not take into account relevant variable behavior patterns or that there is now sufficient information available on UV-B radiation-related variable behaviors to take such factors into account in an area-specific assessment of UV-B radiation-related exposure and risk mediated by changes in ground-level O₃.

In the proposed response to the remand, EPA specifically solicited comment on the factors related to area-specific assessments of UV-B radiation-related effects that are discussed above (66 FR 57284). Beyond the specific comments on each factor noted above, commenters did not generally challenge the appropriateness of these factors in the development of such area-specific assessments, or the importance of

⁵⁵ Because of the high baseline risk of effects under natural conditions, as well as the increased risk posed by stratospheric O₃ depletion, medical authorities and governmental bodies have developed campaigns to effect such changes in behavior. The EPA and the National Weather Service (NWS) developed the UV Index. The Index provides a forecast of the expected risk of overexposure to the sun and indicates the degree of caution that should be taken when working, playing, or exercising outdoors. The EPA also developed the SunWise School Program to be used in conjunction with the UV Index. This program is designed to educate the public, especially children and their care givers, about the health risks associated with overexposure to UV radiation and encourage simple and sensible behaviors that can reduce the risk of sun-related health problems later in life (U.S. EPA, 1995a, b).

⁵⁶ The EPA recognizes that these data bases may not contain the most current information on respiratory-related avoidance behaviors that may now be occurring in response to EPA's new Air Quality Index health advisories or local community ozone action day programs. Any such updated information appropriately will be included in analyses conducted as part of the periodic review of the O₃ NAAQS that is now underway.