

emission.¹² The short lifetime of nPB complicates the calculation of its ODP because it is not valid to make the standard simplifying assumption that concentrations are "well mixed" in the troposphere. Thus, a meaningful comparison can be made between the ODP of nPB and the longer-lived compounds already controlled under the Montreal Protocol only by using the results from a 3-D model that bases calculations on longitude, latitude, and altitude to augment the ODP calculation using a 2-D model.

Generally, a compound emitted in the troposphere travels toward the equator and into the tropics before rising convectively into the stratosphere. As a result, a compound emitted at high latitudes, such as the northern United States or the southern tip of Brazil, will take longer to reach the stratosphere than one emitted in the tropics. For a long-lived chemical, this difference in travel time is insignificant. But for a short-lived compound such as nPB, which is subject to degradation in the troposphere, the latitude of emission can have a significant impact on the amount of ozone-destroying bromine that is delivered to the stratosphere.

Using a combination of 2-D and 3-D models, Wuebbles *et al.* (2001) estimated the ODP to be between 0.016 and 0.019 for nPB emissions over the United States. In the tropical latitudes, over India, Southeast Asia and Indonesia, nPB emissions have a larger ODP of 0.087 to 0.105. A more recent paper by Wuebbles found that the ODP of nPB emissions from the United States would be closer to 0.013–0.018, while nPB emissions in the tropics would have an ODP of 0.071 to 0.100 (Wuebbles, 2002).

In proposing to list nPB as an acceptable substitute for CFC-113, methyl chloroform and HCFC-141b, EPA has considered that the ODP for nPB at the latitude of the continental U.S. is substantially less than the ODPs for the chemicals it would replace (0.8 for CFC-113, 0.1 for methyl chloroform, and 0.11 for HCFC-141b). Given that fact, we do not believe that nPB's ODP is a compelling reason to list it as an unacceptable substitute for CFC-113, methyl chloroform, and HCFC-141b for use in the U.S.

While advances in modeling are producing more specific methods to better estimate nPB's ODP, the value will never be pinpointed to a single number that may be applied to all latitudes. EPA notes that if the ODP were as high in the U.S. as it is in the tropics (0.071 to 0.100), we would have

found it unacceptable as a substitute. When making regulatory determinations, governments or users in other latitudes should consider the ODP at their latitude as well as the toxicity of other solvents available for use. For example, users in other counties may find nPB preferable to carbon tetrachloride, which has a high ODP (1.1) and is highly toxic. On the other hand, users in the tropics should realize that nPB at their latitude has an ODP comparable to substances controlled by the Montreal Protocol (methyl chloroform or HCFC-141b). EPA also recommends that any decisions on the use of nPB outside the U.S. should be based on latitude-specific ODPs and volumes of the chemical projected to be used in those regions.

Few commenters on the ANPRM discussed the ODP of nPB. However, the Agency agrees with two commenters who stated that nPB's low ODP should be balanced against the much longer atmospheric lifetime of other choices.

We have attempted to gather and assess all available information from the full range of experts on nPB's ODP. EPA continues to be interested in receiving from the public any other information pertaining to the atmospheric effects and ODP of short-lived atmospheric chemicals, especially nPB. In the event that data become available after final rulemaking that are contrary to the current scientific understanding, section 612 of the CAA allows the Agency to reconsider our decision under the SNAP program.

C. Global Warming Potential

The global warming potential (GWP) index is a means of quantifying the potential integrated climate forcing of various greenhouse gases relative to carbon dioxide. Thus, the GWP of carbon dioxide is, by definition, equal to one. Since GWP is a measure of the climate forcing integrated over time, the value of the index depends on the choice of time horizon. The standard GWP used for making climate-related policy decisions is based on a 100-year time horizon (called the 100yr GWP).¹³

The 100yr GWP of nPB is 0.31 (Atmospheric and Environmental Research, Inc., 1995). This is a relatively low GWP, representing a climate forcing approximately one third that of carbon dioxide, by weight. Estimations of the net climate impact must take into consideration the amount of the

compound expected to be emitted. As will be discussed in section V.B. below, nPB will most likely be emitted in small enough quantities worldwide that there should not be a concern about its causing climate change. Additionally, the GWP of nPB is considerably lower than that of the chemicals it potentially replaces. (100yr GWP values are 6000 for CFC-113, 140 for methyl chloroform and 700 for HCFC-141b.)¹⁴ Therefore, we conclude that the use of nPB as a substitute for CFC-113, HCFC-141b, or methyl chloroform should not be restricted based on its GWP.

D. Flammability

nPB forms flammable mixtures in air within only a narrow range. All estimates that EPA reviewed fall somewhere within the range of 3.5%–9%. Most, but not all, of the material safety data sheets we reviewed state that nPB has no flashpoint. The 1998 Report of the United Nations Environment Programme's Solvents, Coatings and Adhesives Technical Option Committee stated that "under certain test conditions, using standard flash point testing apparatus, pure nPB has demonstrated a flash point at -10°C * * * [O]ther ASTM test methods have resulted in no observed flash point" (UNEP, 1999). In response to information requests in the nPB ANPRM, various commenters asserted that nPB has a flashpoint of 10°C , 14°C , and 21°C – 25°C , 70°F (21°C), and 70°C . These data are inconclusive about the flashpoint of nPB and whether nPB is likely to be flammable under normal use conditions.

In addition, we are aware that many manufacturers of foam cushions use adhesives containing nPB because it is essentially non-flammable compared to many other solvents used in adhesives, such as acetone or heptane. Also, one company has submitted a fire suppressant containing nPB as the active ingredient for review by the SNAP program. (We are not addressing this incomplete submission in today's proposed rule.) It is not surprising that nPB would have little or no flammability, given that many organic compounds containing bromine have little or no flammability, such as halons or hydrobromofluorocarbons.

Based on the full range of available information, we do not currently believe that the use of nPB as a substitute for CFC-113, methyl chloroform, or HCFC-141b should be restricted because of flammability. EPA, however, invites

¹³ The 100yr GWP is the index recommended by the Intergovernmental Panel on Climate Change (IPCC) for comparing the climate impacts of various global warming gases. The United States employs the standard 100yr GWP index for making climate policy decisions and reporting of greenhouse gases.

¹⁴ All GWPs (other than that of nPB) discussed in this NPRM are taken from the *Scientific Assessment of Ozone Depletion: 1998* (WMO, 1999).

¹² Wuebbles *et al.*, 1998; Wuebbles *et al.*, 2000.