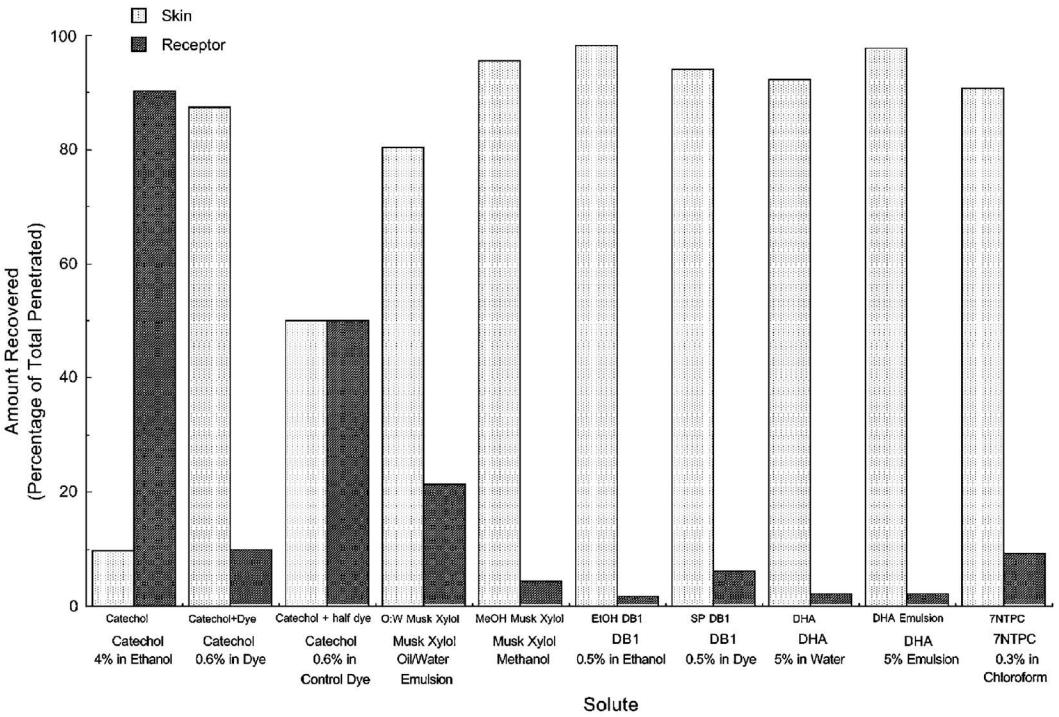

FIGURE 4.15 Comparison of the amount of solute retained in human skin to that penetrating into receptor fluid as a percentage of the total amount penetrated. (Data from References 45, 52, and 53.)

However, a cautious adoption of the present guidelines would suggest that it is the reservoir effect in the viable epidermis and dermis that is of most interest in dermal exposure risk assessment. Of note, it may be that all of the skin will eventually be seen to be important. At this stage there are insufficient data available to be definitive. Yourich et al. (45) point out that when the sun tanning color additive dihydroxyacetone and a fluorescent brightening agent 7-(2H-naphthol[1,2-d]triazole-2-yl)-3-phenylcoumarin are applied to human skin in vitro for 24 hours, the amount remaining in the viable epidermis and dermis constituted 50% or more of the dose calculated to have penetrated. Neither dihydroxyacetone nor 7-(2H-naphthol[1,2- d]triazole-2-yl)-3-phenylcoumarin was metabolized, and only 5% of dihydroxyace- tone was covalently bound to protein. In contrast, the comparable fractions of the amount in the viable epidermis and dermis relative to dose penetrated for the dye agents disperse blue 1 and catechol were small (45, 52). Further, Jung et al. (52) showed that whereas 7% of a catechol dose is absorbed from an ethanol vehicle, less than 0.5% of catechol is absorbed in a consumer permanent hair dye product, with the lower absorption reflecting oxidation of catechol in the latter product. Yurich et al. (45) suggest that it is appropriate to add skin levels to receptor fluids to gain a more realistic measure of dermal absorption when movement of the chemical from the skin to the receptor fluid is known to occur. They further suggest that significant retention in the skin occurs for both polar and nonpolar solutes. Figure 4.15 shows some examples of the relative percentages of solutes penetrating the skin that were recovered in the skin itself and in the receptor fluid. Accordingly, they suggest that further characterization and quantification of the skin reservoir are needed in dermal exposure assessment.

4.13 CONCLUSION

The skin or transdermal reservoir effect is a well-established phenomenon that is both dependent on the amount accumulating in the skin and evident at some time after the original application by application of some type of skin enhancement such as reocclusion or a chemical enhancer.