

**TABLE 13.11**  
**Incidence of Tumors after Application of Shale Oils**

Shale Oil	Dose and Frequency	Total Dose Per Week (mg)	Number of Animals with Tumors
OCSO No. 6	10 mg, 4 times	40	2
	20 mg, 2 times	40	4
	40 mg, once	40	13
PCSO II	10 mg, 4 times	40	11
	20 mg, 2 times	40	17
	40 mg, once	40	19

*Source:* From Reference 24.

### 13.13 CONCLUSION

Many variables affect percutaneous absorption and subsequent dermal toxicity. Increased concentration of an applied chemical on skin increases the body burden, as does increasing the surface area and the time of exposure. The opposite also holds true, namely, dilution of a chemical will decrease the effects of the applied concentration, provided other factors do not change (such as diluting the chemical but spreading the same total dose over a larger surface area). The body burden is also dependent on the frequency of daily application and on possible effects resulting from long-term topical exposure. Dose accountability (mass balance) completes a dose-response study.

The current data provide a skeleton of knowledge to use in the design and interpretation of toxicological and pharmacological studies to increase their relevance to the most typical exposures for man. In essence, we have just begun to define the complexity of the interrelationships between percutaneous absorption and dermatotoxicology (Table 13.12) (25, 26). Until an appropriate theoretical

**TABLE 13.12**  
**Factors in the Dose-Response Interrelationships of Percutaneous Absorption**

Concentration of applied dose ( $\mu\text{g}/\text{cm}^2$ )
Surface area of applied dose ( $\text{cm}^2$ )
Total dose
Application frequency
Duration of contact
Site of application
Temperature
Vehicle
Substantivity (nonpenetrating surface adsorption)
Wash-and-rub resistance
Volatility
Binding
Individual and species variations
Skin condition
Occlusion

*Source:* From Reference 25.