

# The Toxic Effect of Chlorine Skin Absorption. Hazards in the Bath & Shower.

A five-year study by the Environmental Protection Agency concurred. Studies by Dr. Julian Andelman, Professor of Water Chemistry, University of Pittsburgh Graduate School of Public Health, found less chemical exposure from drinking chlorine contaminated water than using it to wash the clothes or take a shower.

## SKIN PENETRATION

H.S. Brown, Ph.D.; D.R. Bishop, MPH, and C.A. Rowan, MSPH, report that: "Assessments of drinking water safety rely on the assumption that ingestion represents the principle route of exposure." Skin penetration rates for solvents are remarkably high, and the stratum corneum is a

less effective barrier to penetration than traditionally assumed. Based on published skin absorption rates, these 3 researchers used Fick's Law to determine permeability constants for selected compounds. Then they calculated dose per kilogram for 9 different exposure situations and compared this to the oral dose per kilogram. They found that skin absorption contributed from 29 to 91 percent of the total dose, averaging 64

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percent. **The researchers concluded that skin absorption of contaminants in municipal water has been underestimated and that ingestion may not constitute the sole or even primary route of exposure. In addition to penetration of contaminants through the skin to the body as a whole, the contaminants can adversely affect the skin itself.** Chlorine chemically bonds with proteins in the hair, skin and scalp. Hair can become rough and brittle and lose color. Skin can dry out with itchy, flaky scalp occurring. Chlorine can aggravate sensitive areas in the eyes, nose, throat and lungs.

## INHALATION

Chloroform (a Trihalomethane or THM) and trichloroethylene (TCE) are two highly volatile toxic chemicals that have been identified in many municipal drinking-water supplies.

The National Academy of Sciences has estimated that 200 to 1000 people may die in the U.S. each year (1986) from cancers caused by ingesting these contaminants in water.

However, the major threat caused by these water pollutants is far more likely to be as air pollutants in the home, according to a study by Dr. Julian Andelman. He found that in the shower when temperature and chemical concentrations increase and diameter of shower head hole decreases, volatilization increases. His data indicate that hot showers (109F) can liberate about 50% of the dissolved chloroform and 80% of the dissolved TCE into the air. Both the heat and the large surface-to-volume ratio of small droplets increase vaporization. Chlorine, TCE, chloroform, benzene and others are readily absorbed through the lungs into the bloodstream.

## CONTAMINANTS

The contaminants mentioned in this article are not necessarily in your tap water. However, if chlorine is present in the water it is most certain that other contaminants are also. Chlorine combines with organic substances forming Trihalomethanes including Chloroform. The most common volatile compounds in drinking water supplies as found by the EPA are as listed: trichloroethylene, tetrachloroethylene, carbon tetrachloride, benzene, 1,1,1-trichloroethane, 1,2-dichloroethane, ethylene chloride, 1,1-dichloroethylene, bis-1,2-dichloroethylene, vinyl chloride, trans-1,2-dichloroethylene, chlorobenzene, dichlorobenzene, & trichlorobenzene.

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