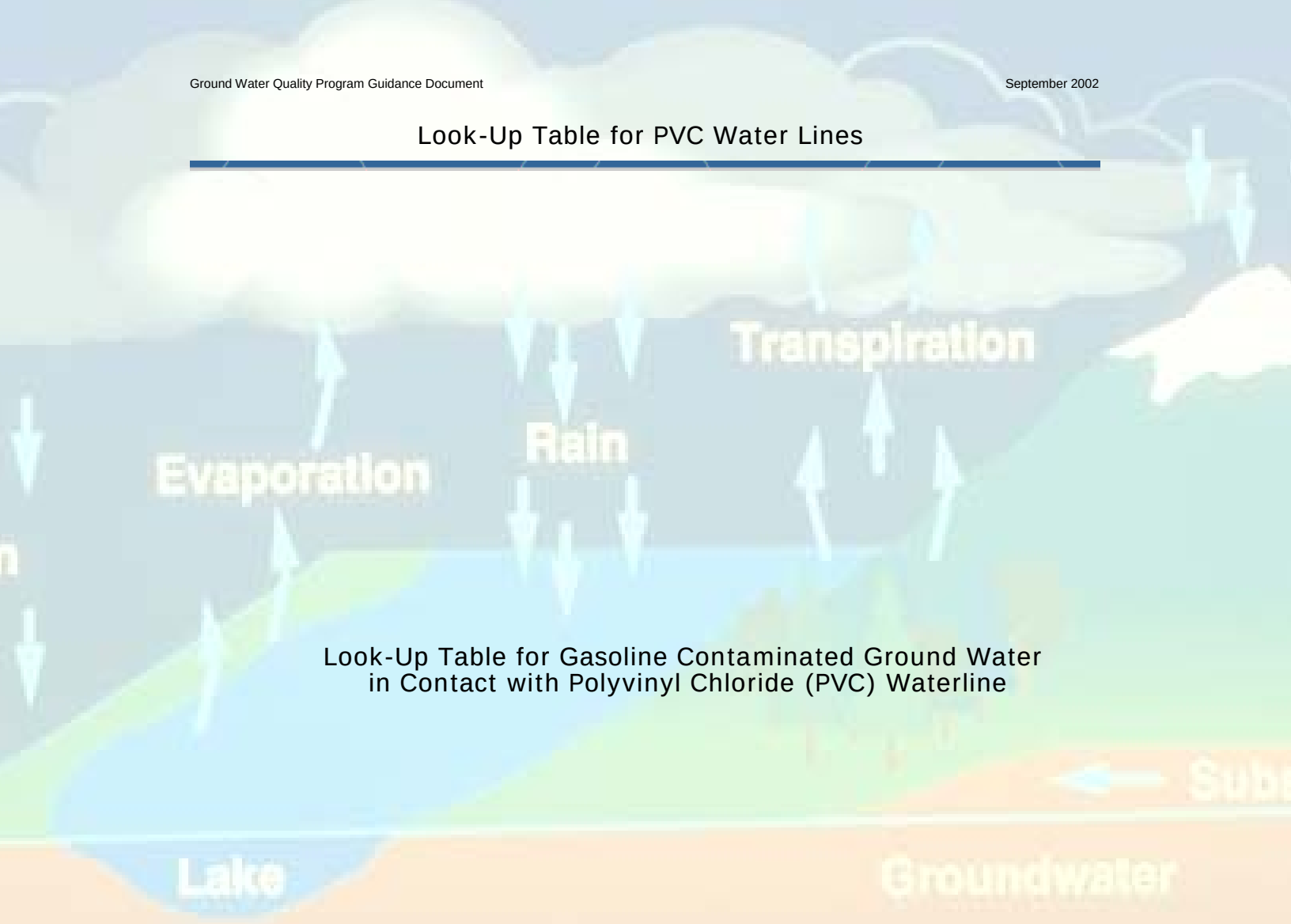
Look-Up Table for PVC Water Lines



Look-Up Table for Gasoline Contaminated Ground Water in Contact with Polyvinyl Chloride (PVC) Waterline

South Dakota Department of Environment and Natural Resources
Ground Water Quality Program
Pierre, SD 57501

Look-Up Table for Gasoline Contaminated Ground Water in Contact with Polyvinyl Chloride (PVC) Waterline

Chemical of Concern[1]	Max. Solubility in Water (mg/l @ 20^0 C) [2]	Average % in Gasoline[3]	Equilibrium Concentration in Ground Water (mg/l)	Activity [4] [5]	Maximum Allowable Concentration in Ground Water (mg/l)
Benzene	**1780**	**1.8**	**32**	**0.1**	**3.2**
Toluene	**515**	**12.3**	**63**	**0.1**	**6.3**

[1] Based on a review of the experimental literature for the permeation of polyvinyl chloride **(**PVC) pipe the Department believes that benzene and toluene represent the most concern, (i.e., softening of PVC).

[2] Montgomery, John H., Welkom, Linda M., Groundwater Chemicals Desk Reference, (Chelsea, Michigan: Lewis Publishers, Inc.), 640 p., (1990).

[3] W. Emile Coleman, Jean W. Munch, Robert P. Streicher, H. Paul Ringhand, and Frederick C. Kopler, 1984. The Identification and Measurement of Components in Gasoline, Kerosene, and No. 2 Fuel Oil that Partition into the Aqueous Phase after Mixing. Arch. Environ. Contam. Toxicol. 13, 171-178.

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(4) Predictions regarding the possible permeation of an organic compound through plastic pipes should be based on the activity of that compound rather than the concentration. If possible, non-ideal effects in unsaturated organic vapors and in unsaturated aqueous solutions of organic compounds with low solubility can be neglected, the activity of an organic compound can be calculated quite simply in terms of concentration (Vonk, 1985):

$$a = C_w/C_{w,m}$$

with : a = activity (0=a=1)
C_w = concentration in water (mg/l)
$C_{w,m}$ = maximal solubility in water (mg/l)

(5) The more conservative activity of 0.1 is being used since toluene may have slightly permeated PVC pipe at an activity of 0.11 in the laboratory experiments conducted by Vonk, 1985. In addition, since the synergistic effects of a mixture of gasoline constituents was not investigated in the laboratory experiments, the Department feels the more conservative activities are warranted for both constituents.

Note: The development of a look-up table for gasoline constituent (i.e., benzene, toluene, ethylbenzene, and xylenes) contaminated soil in contact with PVC waterlines is not feasible because it is necessary to know more site-specific information than just the concentration of the contaminants in soil. It has been shown that the relative organic chemical concentration in the soil pores controls the permeation rate. This requires the soil to be analyzed in such a way that the relative organic chemical concentration in the soil pores can be predicted. In order, to properly make this prediction site specific data such as soil organic carbon content, soil water content and soil porosity must be measured. For further discussion on the above analysis refer to the document published by the University of California at Berkley on Permeation of Plastic Pipes by Organic Chemicals, pages 303-305.

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