

pipes for conveying water in dwellings. The conditions under which lead is dissolved by water are very complicated, and by no means perfectly understood, but the following broad generalizations are justified by facts. Where water contains nitrates in any considerable amount, and in general where water is essentially soft in character—such as rain-water—the danger of lead being dissolved from the pipe is very great, and poisoning has frequently occurred from this source, as little as one-tenth of a grain per gallon being a poisonous quantity when the water is continually used, since lead is a cumulative poison. Water containing less than one-fourth of this amount has been known to cause sericus and dangerous illness. In presence of carbonates, sulphates or phosphates, a thin coating of the carbonate, sulphate or phosphate of lead is formed on, and adheres to, the inner surface of the pipe. Since these salts are practically insoluble they protect the lead pipe from contact with the water and render its use quite safe. Fortunately most natural waters contain a sufficient amount of dissolved carbonic acid or carbonates to prevent danger from the use of lead pipes in their conveyance. It is, however, advisable always to allow water to run freely for a short time where it has been stored in lead service pipes over night, or for any considerable time, especially at a temperature such as is usual in dwellings.

The second illustration of increased solubility due to the presence of a substance in solution is the case of chalk in water containing free carbonic acid. The large glass vessel before you contains water partially saturated with slaked lime. On passing carbonic acid gas from the generator into this water the first effect is the conversion of some of this lime into carbonate of lime or chalk; and the great insolubility of this compound causes its separation with formation of a dense white precipitate which gradually settles down to the bottom of the vessel if allowed to stand at rest. On continuing, now, to pass the carbonic acid gas, after all the lime has been converted into carbonate, we observe this curious effect. The liquid gradually loses its turbidity, and in a few minutes is as clear and transparent as at the first. The excess of carbonic acid gas has caused the precipitated chalk to pass into solution. We have now what is known as *hard* water, and its effect with soap will be apparent from the following