waters from Massachusetts. (Engineering News, Dec. 1, 1904.)

It is by no means new to distinguish between the "solution" of lead and that "erosion" of the metal which some waters exercise, whereby insoluble lead salts are formed with appreciable increase in the turbidity of the water.

Such classification of the action upon lead has been developed by the report of the London Local Government Board with great care.

For our purposes it will suffice to note that "erosion" does not occur in the absence of oxygen, and we are also to remember that from the sanitarian's point of view "erosion" may be fully as objectionable as "solution" if no opportunity for clarification be furnished. In fact, the former may readily be the greater evil of the two, because of its involving the possibility of the ingestion of large quantities of lead salts held in suspension.

Piping water in tubes of galvanized iron is very common, and, as zinc is often more easily attacked than lead, it is pertinent to ask if it be equally dangerous. So far as our present experience can guide us towards a correct solution of this question, the reply must be a negative one, and the following opinions are presented in support of such contention:—

In the journal of the German Society of Gas and Water Engineers for 1887, H. Bante collected statistics to show "that the use of galvanized pipes should be in no way detrimental to health."

Similar views are entertained by V. Ehumann, director of the Water Supply of Wurtemburg. (J. Fk. Inst. Nov., 1890.)

According to Thresh (Examination of Waters and Water Supplies, page 85): "There is no doubt that waters containing traces of zinc are used continuously for long periods without causing any obvious ill effects. The water supply to a small hospital with which I was connected for some years always contained a trace of zinc, probably never more than half a grain of the carbonate per imperial gallon (7.1 parts per million), but I never observed any indications of its being deleterious, although such effects were looked for."

In the Massachusetts Board of Health report for 1900, page 495, the following table is given, showing amounts of zinc in sundry public supplies, the metal having been dissolved from pipes of galvanized iron or brass during ordinary use. The results are averages, and are in part per million:—

West Berlin	18.46	Lowell	0.33
Milbury	3.08	Webster	0.28
Newton	1.25	Sheffield	8.65
Marblehead	0.85	Palmer	2.90
Grafton	0.73	Beverly	2.71
Wellesley	0.68	Fall River	0.07
Fairhaven	0.52		

The first of the above, West Berlin, drew its water through four thousand feet of galvanized iron pipes. The quantity of metal dissolved therefrom was certainly large, but appears to have produced no evil results. "As far as is known the amount of zinc present in these waters as used is not sufficient to have any effect upon the health of the consumers of the water."

"The Board has investigated the question of the presence of zinc in drinking water supplies where galvanized iron pipes are used, and, except in case of the use of some ground waters, containing very large amounts of free carbonic acid, which dissolves zinc and many other metals very freely, the amount of zinc found in ordinary water supplies, where galvanized pipes are used, is not sufficient, in the opinion of the Board to give anxiety." (Massachusetts Board of Health, 1902, XLIII.)

In a private letter of more recent date the president of the above-mentioned board says: "If there had been any harmful effects of the presence of zinc in the public drinking waters of the State that fact would have undoubtedly been brought to our attention. No statement to this effect has been made, nor has there seemed to this board reason for suspecting serious danger from this source."

As an instance of long-continued use of a water containing much zinc the case of Brisbane, Queensland, should be quoted. In that city rain water tanks built of galvanized iron are found in all the houses. The water, which is in common use, contains about 17.1 parts per million of zinc, yet no harmful effects have been observed. (Hazen. Engineering News, April 4, 1907.)

In his experience the writer has been unable to trace any evil effects due to the presence of zinc in drinking water, even when the quantity rose as high as 23 parts per million in a water which is in constant use. It might be well to add that in the particular case just cited the zinc was derived from a long stretch of galvanized iron pipes, and the amount of the metal present was subject to great and frequent fluctuations for reasons that were not apparent.

It must be admitted, however, that, even on the assumption that the presence of zinc is of no sanitary significance, its being there is nevertheless not desirable, and the probability of a water being able to dissolve it should be determined and reported upon.

What can now be said with reference to some convenient and standard method of reporting the possible action of water upon any of the common metals?

The suggestion offered is this: Let the action, whether of solution or erosion, be stated in parts per million, and let it be that of one litre of water acting upon one square decimeter of bright metal for one hour at 15 degrees Centigrade.

The mode of procedure followed by the writer is to submerge a piece of bright sheet metal, one decimeter square, in two litres of water contained in a wide-mouthed bottle. The water is occasionally given a gentle motion, and is kept at 15 degrees for one hour, after which time the metal in solution or suspension is determined. One hour is sufficient time to allow of the watching of metallic solvency, and let it be added, the limiting of the time of action to the standard point is important for the reason that the rate of action of the same water is not only variable, but the ratio of the total action during the different lengths of time is not a simple one. Thus, the quantity of metal attacked in ten hours is by no means ten times that acted upon during one hour.

In conclusion, let it be said that, although we know in a general way that softness, acidity, dissolved gases and the presence of much chloride or nitrate will tend towards metallic action, while alkalinity and hardness are rated as protective agents, yet it is far better to actually test a water with reference to its behavior towards metals than to attempt any prophecy of its action based upon analytical knowledge of what the water may contain.

Waterworks Engineer Fellowes, of Toronto, says that the engines at the main pumping station could be so arranged that one set of engines could operate them instead of the three sets now employed. The arrangement would also make room for the sixth engine, which could be placed without any difficulty. The work of rearranging the plant would cost about $100,000.

The world's record for economy and efficiency of waterworks pumping engines is held by the plant at Bissel's Point, St. Louis, Mo., built by Allis-Chalmers Co., of Milwaukee. The duty reached at the official test was 181,068,605 foot pounds. In order that engineers may know exactly how these figures were reached the company printed in bulletin form complete retails of the test. These and other bulletins containing information not usually made public, but of great value to those interested in water-works, were distributed among the members of the American Waterworks Association by Allis-Chalmers-Bullock, Limited, in a handsome souvenir cover.