LEAD INDUSTRIES ASSOCIATION

Graybar Building, 420 Lexington Avenue
New York, N. Y.

August 25, 1936

To Members of the Lead Industries Association:

Subject: Relative Merits of Lead and Lead Substitutes

Substitutes have made heavy inroads in the use of lead for calking water lines. We have been requested by several members to provide them with useful data showing the merits of lead compared with other available calking compounds. There are many strong reasons why lead is a preferred calking material, and to help calking lead manufacturers meet the arguments of sulphur and sand, or cement substitutes, we have prepared a memorandum, as per copy attached, on the subject.

Extra copies of this memorandum will be supplied upon request.

Very truly yours,

F. L. Robinson
Secretary.

Memorandum on the Relative Merits of Lead and Lead Substitutes

for Jointing Bell and Spigot Pipe

Of the lead substitutes most commonly encountered, Leadite, Hydrotite and Mineralead are simply mixtures of sulphur and sand. They do not contain any lead. Cement is also frequently used in certain areas. All of these materials make joints that are stronger, harder and more brittle than lead.

Practically every pipe line is subject to ground subsidence, movement or vibration. For instance, traffic causes vibration, dry weather causes contraction of the soil, freezing weather causes it to swell, and building excavations and many other causes result in subsidence or other movement.

Pipe lines that use these jointing materials are made of rigid, and usually brittle, materials themselves, largely cast iron. If the joints are then made with lead substitutes, there is virtually no provision for movement of any kind in the pipe line. As a result, either the hard jointing materials crack, spall and leak or the pipe itself is over-strained and breaks.

On the other hand, lead, being soft and flexible, permits movement without either leakage at the joint or undue strain being placed on the pipe.

When joints made of substitutes for lead leak, it is necessary to remake the entire joint in order to effect repairs. This is not only a troublesome and lengthy job, but it means that the water supply through the pipe must be temporarily shut off. If the pipe is deflected sufficiently, however, to cause lead joints to leak, simple calking repairs them, effecting a saving in time and expense, and making shutting off of the water unnecessary.

Of far greater seriousness, however, is the replacement of failed sections of pipe. The rigid jointing materials cause heavy strains to be placed on the pipe when ground movement occurs. If the joint itself does not fail, often the pipe will, as something must give to relieve these strains. Since lead joints are flexible, they do not cause undue strain to be placed on the pipe and consequently protect the pipe against this kind of breakage. Water works' engineers may have had many pipe failures which they blamed on the pipe. Investigation, however, would frequently show that the pipe was not faulty but that lead substitutes had been used for joints and had caused excessive strains on the pipe.

Cast iron pipe is installed with the expectation that it will last 100 years or more. None of the lead substitutes has been used for joints for nearly that long a period and it is, therefore, not known whether they will be as durable as the pipe. Indications are that, under certain conditions at least, they will not. Lead has been used for several hundred years for joints in cast iron pipe and many pipe lines are still in use with original lead joints 100 or more years old. It is, therefore, known that lead will last as long as the pipe line is expected to last.

The following material will serve to substantiate the statements already made:

An investigation at the Engineering Experiment Station of Ohio State University conducted by Prof. John C. Prior, in cooperation with a committee of the American Standards Association and the Columbus (Ohio) Water Department, was reported in a bulletin entitled "Deflection Tests of Cast-Iron Water Pipe Bell and Spigot Joints with Special Reference to Bell Strength", published in 1932. This report stated that "Judging from the action of the hard jointing materials - sulphur compounds and Portland cement - during the tests, it may be concluded that these joints would have had excessive leakage well in advance of the time of maximum bell strain". It was found that with a certain deflection at the joint, lead substitutes leaked, whereas with approximately the same deflection, lead joints remained tight. Cement, Leadite and Hydrotite all cracked and spalled badly when the joint was deflected. Mineralead was not tested but would doubtless have acted in the same way.

A paper entitled "Operating Economies in Water Works Systems", by W. A. MacDonald, City Water Works Engineer, Ottawa, Canada, published in the August, 1932, Journal of the American Water Works Association, pointed out that the substitutes for joints were considerably cheaper to use than lead because they do not require calking, but further states, "As against this saving in initial cost of main laying, the engineer has to carefully consider the many merits of the use of lead as a jointing material. The use of lead permits of greater flexibility in the pipe line than most of the jointing compounds. During the past summer, this fact was very noticeable during the excessively dry period owing to the shrinkage of the earth. We experienced more than twenty fractures through the transverse section of the pipe immediately adjacent to the old time rigidly made spigot and faucet joint.

"The past summer witnessed the greatest number of fractures in our distribution system during the past twenty years and it is a matter of record that not one break occurred in close proximity to a lead calked joint."

In San Francisco, Cal., in 1930, a 16 in. cast iron pipe line with about 1000 joints was laid. Part of the joints were made with lead and part with cement. In August, 1932, about 50 breaks occurred and between that time and October, 1933, about 150 more. All of these breaks were in or near the bell of the pipe where lead substitutes had been used for joints. Fifty of the lead joints were examined and found to be faultless. The pipe line was re-layed using lead joints exclusively.

Relative Merits of Lead and Lead Substitutes.

Large diameter concrete pipe as used by the Metropolitan Water District of Southern California employs lead caulked joints. Since the manufacturers of concrete pipe rely on lead for the necessary flexibility in their pipe lines, it seems absurd that some water departments use cement or other hard substitutes for lead joints in cast iron pipe, which is just as rigid as concrete.

The October, 1933, issue of Chemical and Metallurgical Engineering contained an article entitled, "Bacteria Destroy Pipe Line in California". It shows that certain bacteria attack the sulphur in joint compounds like Leadite, Hydrotite and Mineralead, causing them to become porous and fail in a relatively short time. A specific case of this happening is described and clearly shows that, at least under certain conditions, lead substitutes can not be expected to last as long as cast iron pipe lines.