LIA09869

To Members of the Metallic Lead Products Division:

We are enclosing copies of two reprints from the Corrosion Forum Section of "Chemical Engineering," as follows:

(1) From the September, 1947, issue discussing the performance of lead in contact with sulphur dioxide.

(2) From the December, 1947, issue discussing the performance of lead in contact with sodium chloride.

These are the fourth and fifth in a series of articles, the first three of which were covered by Chemical Bulletins Nos. 2, 9 and 12.

Very truly yours,

Robert L. [illegible]

Secretary

N3127

LIA09870

Sulphur Dioxide versus Construction Materials

Cornell thermostatic precipitator (left) used to remove sulphuric acid mist from sulphur dioxide gas. Both the precipitator and the ducts are made of lead supported by steel structure.

LEAD

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SINCE 1746, when the first lead chamber was used in Birmingham, England, for making oleum, lead has proved its worth in handling sulphur dioxide and related compounds, such as sulphuric acid, sulphurous acid, sulphur chloride and sulphur trioxide. Lead suffers practically no corrosive effects from SO_2 gas, whether cold and dry or in hot, moist condition up to 390 deg. F. In fact, lead is the standard material for handling the above corrosives.

The magazine, Lead, a publication of the Lead Industries Assoc., carried an article in its issue of July-August, 1946, on the replacement of a lead duct in the sulphuric acid plant of a southern chemical company. A 28-ft. lead duct, 42 in. in diameter, had given 29 years of excellent service before being replaced. The sheet lead was not appreciably corroded and the only signs of failure necessitating replacement were near the steel supporting bands. Vapors pass through at temperatures of approximately 235 deg. F. at the top where they leave the Glover tower and 205 deg. F. at the bottom where they enter the nitre pot carrying a mixture of sulphur dioxide and sulphur trioxide. To form the new duct, 10-lb. sheet lead was wrapped around mandrels of the proper size, welded longitudinally and supported by lead covered steel bands on 4-ft. centers. The duct, when welded in place and supported by a steel structure was ready to give at least another 30 years service. Throughout this period of uninterrupted service the lead duct conveyed hot corrosive vapors while being exposed to the atmosphere on its external surface.

From the roasting of lead, zinc, and iron sulphides large amounts of hot SO_2 vapors with other oxidation products are handled in lead ducts and in lead lined equipment. The actual conversion of the SO_2 to concentrated sulphuric acid is accomplished by the contact process, but extensive use of sheet lead is made in the purification of the hot gas coming from the roasters prior to its conversion. In one plant of this type a corrosive liquor saturated with SO_2 and at 125 deg. F. has been handled in lead equipment with little or no corrosion since 1937. Among other corrosives in the liquor are sulphuric acid, 56.5 g. per L; chlorine, 1.9 g. per L; and ferrous iron, 4.1 g. per L.

In the manufacture and handling of sulphurous acid for the sulphite paper process lead has many uses. The hot SO_2 gas is taken through a cooling system which usually consists of 100 or 200 ft. of 8 or 12-in. lead pipe undergoing a continuous cold water spray. Lead fans impell the gas countercurrent to a water stream through limestone packed towers to form the sulphite liquor which usually contains 1 percent SO_2 combined with lime and 5 percent free SO_2. Sulphite liquor and wood chips are brought into a digester with a lining of acidproof brick set in a cement made of litharge (PbO), sand, and glycerine. Here temperatures vary from 250-300 deg. F. and pressures are 75-125 psi. At the digester top 1 in. antimonial lead covers 36 in. in diameter, have given good service at 250 deg. F. at 20 percent of the cost of covers previously used.

Lead digester relief valves, usually 2 or 4 in. in diameter, have been successfully used on the digester cover where relatively low velocities of steam and SO_2 are encountered. Lead is not suitable for relief regulating valves for digesters as steam and SO_2 are encountered at 250 deg. F. and pressures of 75-125 psi. Other materials, much harder than lead, are rapidly cut to pieces in this service where the valves are never fully opened. Thousands of feet of antimonial lead pipe are used in digester relief lines in the various sulphite mills throughout the country. These lines are immersed in cooling water for a great part of their length so that the SO_2 gas will be more readily absorbed in the recovery tower. Lead pipe has proven to be the most satisfactory and economical material available for digester relief lines. In addition, quite a few lead lined wooden tanks and lead pipe lines are used in the sulphite pulp industry to handle the sulphurous acid, SO_2 gas, and also the acid alum which is used in paper making.

Lead lined equipment has proven very satisfactory for neutralizers, evaporators, and settlers used in the manufacture of potassium metabisulphite (see *Chem. & Met.*, Nov. 1945, p. 231), a product which demands high purity and freedom from soluble lead salts because of its use as a fermentation arrester in wineries and as a preservative for photographic solutions. An excess of sulphur dioxide is encountered in the construction of wood and lead lined constructions.

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LEAD

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EXCELLENT service records are characteristic of metallic lead products when used to resist corrosion by salt water, spray or seaside atmospheres. There is some corrosion of lead from sodium chloride but this is so slight that years of useful life are obtained from lead pipe, valves, boat keels, sinkers, and sheet lead in various forms. The latter serves as tank linings, protective roofing, caps for wood piling, and a host of other uses where the low corrosion rate of lead means a long life of protective service.

Lead shows only slight corrosion (4 or 5 mils per yr.) when exposed to 1 normal sodium chloride and practically no corrosion when exposed to salt spray. Corrosion resistance of lead to salt water is well illustrated by the wide use of lead pipe in handling sea water supplies to aquariums throughout the country. Tropical salt water fish were put on display in 1927 in the Miami (Fla.) Floating Aquarium. The original piping was not lead and served only 18 months before requiring replacement. Corrosion in the original pipe so clouded the water that the specimens could not be distinguished. This was completely corrected by the use of lead pipe, cocks and valves throughout.

Among an extensive list of aquariums using lead for salt water corrosion resistance is the Shedd Aquarium in Chicago which was completed in 1929 or 1930. Aquarium authorities recently asserted as there is no question but that lead pipe had given satisfactory service. The only physical change observed is that an undisturbed lining of lead oxide or lead oxychloride has formed within the pipes. All the water used for both fresh and salt water fish is handled in lead pipe and valves ranging in size from ¼ in. to 6 in. This water, shipped from off the Florida coast, is circulated through literally miles of lead pipe. Unsightly staining of the white Georgia marble building from moisture is prevented by liberal use of lead for roofing and decorative trim. (This practice is especially typical of seashore areas subject to salt spray.)

Over a period of four years lead bars were exposed in Bristol (England) Channel and the corrosion rates for soft lead and 1.6 percent antimonial lead were less than 0.1 mils per yr. There was no localized attack on these bars which were submerged 93 percent of the time.

Another use for lead in contact with sea water is for soil and waste pipes aboard ocean-going liners where fresh water must be conserved and salt water is used for flushing with a resulting corrosion problem. In the four 17,000-ton luxury liners built in 1932 for the Cosmo Line, extensive use was made of lead for handling salt water. Space is at a premium in shipbuilding and flexible lead pipe is easily bent around obstacles and is less subject to damage from engine vibration and ship movement than building. Aboard ship sheet lead was also used to line refrigerator rooms and for flashing in the joiner work on deck for its high resistance to sea air and sea water corrosion.

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