

very thick bituminous coatings applied in molten condition. The best results are obtained by applying the bituminous coatings over a standard priming coat such as red lead or a bituminous paint, and for long service it has been found that after the bituminous coatings are applied, a wrapping of asbestos fabric saturated with bitumens will prevent movement and displacement of the bituminous coatings, and add greatly to the length of time satisfactory protection will be maintained.

### Cathodic Protection

Protection is obtained by rendering the structure cathodic to the surrounding water or soil by means of a controlled difference of potential. This method, which has proved satisfactory and economical on a number of gas and oil pipe lines underground, has also been applied with some success to the protection of the inside of water storage tanks and other structures that are in contact continuously with water. Protective coatings that insulate a large portion of the metal surface will reduce very materially the total amount of protective current that must be impressed on bare anodic areas to arrest corrosion.

Because of differences in environmental conditions, it is necessary to determine or estimate the minimum current density required for each structure, and design the anode or anodes so that the necessary protection can be obtained most economically. In water having relatively high electrical conductivity such as in sea water, this is comparatively easy compared with fresh water. In the latter, the composition of the water is a major factor. It is therefore desirable to obtain an accurate estimate of the minimum current density required. The current is then controlled by the potential between the anode and the structure to be protected.

Rectifiers have generally proved to be the most practical means for supplying the necessary current for protection of surfaces in contact with neutral waters.<sup>38</sup>

### HANDLING WATER TREATING CHEMICALS

Virtually all the chemicals used in water conditioning are injurious if taken internally in large doses. Many also cause severe skin irritation. Thus, they should be handled with caution.

Caustic soda, lime, and concentrated sulphuric acid will burn the flesh. In addition, if mixed with small amounts of water, sufficient heat may be generated so that spattering occurs or the container becomes too hot to handle.

The chlorophenol compounds, even in the low concentrations used in water conditioning, have been reported<sup>39</sup> to produce dermatitis. Chrom-itch is not uncommon among workers handling chromates. The amines are said to be absorbed through the skin.<sup>40</sup> Morpholine is said to cause kidney and lung trouble when so absorbed.

Chlorine gas irritates the skin, eyes, and mucous membranes. Concentrations as low as 0.004 percent by volume in air cause dangerous illness in 0.5 to 1 hour.

When relatively large amounts of the non-gaseous chemicals are to be handled, protective clothing, including goggles, should always be provided, and a shower head or its equivalent provided at or very near the point where the chemicals are mixed. *Chemicals should always be washed from the skin with large volumes of water.*

For the handling of chlorine and chlorinators, the U. S. Public Health Service<sup>41</sup> stipulates the following safety requirements:

1. Suitable gas masks and a small bottle of ammonia for testing for leaks should be kept at convenient points immediately outside the room or enclosure in which chlorine is being stored or is in use. Gas masks should be inspected at regular intervals and kept in serviceable condition. Note:—All-purpose masks offer adequate protection only when the concentration of acid gases does not exceed two percent—see Safe Practices Pamphlet #64 National Safety Council.

2. Chlorinating equipment and cylinders of chlorine should be housed preferably in separate buildings above the ground level.

3. The room or building housing chlorinators in service should be maintained at a temperature above 60 F, but never in excess of the normal summer temperature. The cylinders of chlorine should be shielded, where necessary, from excessive heat or cold. Direct heat should not be applied to cylinders of chlorine, nor should hot water be poured over them or come in contact with the cylinder valve.

4. Adequate ventilation should be provided for all enclosures in which chlorine is being fed or stored.

5. All joints of tubing connecting chlorine cylinder and chlorinators should be kept absolutely tight and inspected frequently to insure tightness. Tubing should slope upward from the cylinder.

TABLE 7. RECOMMENDED MAXIMUM ALLOWABLE CONTENT IN WATER SUPPLY\*

| SUBSTANCE                     | MAX. CONCENTRATION, ppm | SUBSTANCE                     | MAX. CONCENTRATION, ppm |
|-------------------------------|-------------------------|-------------------------------|-------------------------|
| Copper.....                   | 3.0                     | Arsenic.....                  | 0.05                    |
| Iron & Manganese (Total)..... | 0.3                     | Selenium.....                 | 0.05                    |
| Magnesium.....                | 125.0                   | Phenols (Total).....          | 0.001                   |
| Zinc.....                     | 15.0                    | Poly-phosphate of Sodium..... | 10.0                    |
| Lead.....                     | 0.1                     | pH Value @ 25C.....           | 10.6                    |
| Fluorine.....                 | 1.0                     |                               |                         |

\* U. S. Public Health Service.

### LEGAL REGULATIONS

In a number of states, the water used for humidification, even in industrial plants, is required to meet drinking water standards insofar as bacteriological quality is concerned. A ruling of the U. S. Department of Agriculture, Meat Inspection Division, prohibits the use of chromate in water used for air washing when the air later contacts foodstuffs.<sup>42</sup>

There is an ever growing consciousness on the part of public health officials, of the necessity for regulations to protect potable water supplies. Attesting this is an ordinance<sup>43</sup> now in effect in Detroit, Michigan, which stipulates in part:

"No physical connection shall be maintained between lines carrying city water and pipes, pumps, or tanks supplied from any other source. Where dual supplies are necessary or desired, lines carrying city water must be protected against back flow of polluted water by an atmospheric gap. Secondary supplies and emergency sources shall include: surface waters from rivers, lakes, ponds, lagoons, and reservoirs; well waters both deep and shallow; any supply of water which has been stored, held, or reserved after being used for industrial purposes; cooling water, or water which has in any way been treated, processed, or has been subjected or exposed to any contamination of a bacteriological or chemical nature; and water from any other source than the city supply."

The U. S. Public Health Service stipulates:

"Salts of barium, hexavalent chromium, heavy metal glucosides, or other substances with deleterious physiological effects, shall not be allowed in the water supply system."

The same agency recommends that the concentration of the substances listed be held below the values cited in Table 7. The Board of Directors