

SELF-CORROSION, NOT STRAY CURRENT ELECTROLYSIS

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In view of the general impression that much of the damage to cast iron water piper (where near electric car tracks) is due to electrolysis, the following article by Mr. W. Nelson Smith is of special interest not only because of its contradiction to the electrolysis idea but because of its claim that it is self-corrosion that does the damage.

In Western Canada, the corrosive action of the so-called alkaline salts, which are widely distributed through the soil of the three prairie provinces, has been acknowledged to be very destructive to all underground structures of concrete made with Portland cement; but it is only recently that suspicion has been directed to those same salts as being responsible for a large proportion of the damage to cast iron water pipes which has been occurring in Winnipeg for the last 15 years or more. So long as there was an electric railway in operation, stray current from which could be charged with the responsibility for damage to pipes and cables, no one took the trouble to investigate the possibilities of self-corrosion of metal structures in the presence of neutral solutions of the so-called alkaline salts mentioned below, until the matter was taken up actively last year by the writer as Consulting Electrical Engineer of the Winnipeg Electric Railway Company.

The development of engineering science, especially within the last few years, has carried with it an increasing appreciation by engineers of the importance of chemical knowledge in dealing with even the simplest and commonest materials of engineering construction. As engineers have become more familiar with advances in chemical science, particularly in recent researches in the electro-chemistry of metals, the range of application of chemistry to engineering problems, particularly on the subject of corrosion of metals, has been very greatly broadened.

Evidence is constantly accumulating that cast iron pipe is not the indestructible material that it was formerly supposed to be, even by engineers; and under certain conditions, lead and copper are found to be as vulnerable to self-corrosion, as cast iron.

The recognition by responsible chemists and engineers of the possibilities of self-corrosion cannot fail to cultivate a more scientific point of view in determining the responsibility of stray currents from electric railways for causing corrosion damage to underground metal structures. Hitherto it has always been the fashion to attribute all corrosion to an electric railway, if there was one near enough, while cases that could not be so explained, have rarely, if ever, come to the knowledge of the public.

The fact that the gas pipes in Winnipeg, though usually near to the electric railway tracks than the water pipes, have suffered no destructive damage while the latter have suffered severely, also shows that there are some special electro-chemical conditions favorable to the gas pipes that do not exist in the case of the water pipes; though from the point of view usually taken by electrolysis experts, one set of pipes ought to be damaged as badly as the other.

The only scientific explanation of this fact thus far advanced, is that for some reason or other, there is less moisture in the soil next the gas pipes than in that next the water pipes.

Neither set of pipes has been electrically drained to the railway power station for many years, but both sets of pipes have been equally exposed to access of stray current.

Now that self-corrosion of cast iron pipe is found to be perfectly possible under soil conditions hitherto thought to be harmless, more interest will be taken in the use of testing

equipment which has been recently developed for determining with accuracy whether a buried conductor is really positive to the earth, which is the only condition where stray current can be blamed for corrosion damage.

An examination by a competent electro-chemist can be depended upon to determine the possibility of self-corrosion, in instances where stray current cannot be found to which to attribute it, or where the current is flowing into a pipe and not out of it. The results of research work now being conducted along these lines will be of especial interest when completed, because in connection with the electrical testing methods recently developed, it will now be possible to settle an electrolysis controversy on a basis of readily established electrical and chemical facts, instead of the conjecture, fear or prejudice which often control procedure in such a situation. The article follows, prefaced by interviews with Winnipeg city officials.

The attention of my readers is called to the news item below, taken from the Manitoba Free Press of Winnipeg, Manitoba, Canada, of May 28th, 1921, describing the finding of corrosion upon a water main in the neighboring town of Selkirk that had been buried for 7 or 8 years, in a locality where stray current from an electric railway could not have caused the corrosion.

As the water supply system of the hospital is secured from wells drilled on the property to a depth of 250 to 300 feet, and the piping system is entirely separated from the Selkirk water supply, and as the hospital is more than half a mile from the western outskirts of the town, and not less than $1\frac{1}{4}$ miles from the northern extremity of the Selkirk trolley line, it was said to be quite outside any possible path of stray current from the electric railway. The only electric current on the property is a 60-cycle alternating current for lighting, and the United States Bureau of Standards, it was pointed out, had proved by exhaustive and long-continued experiment, that it was impossible for an electric current of this character to cause destructive electrolytic action on buried metal structures.

The pipes examined, although they had not been laid for more than eight years, were shown to be affected by some corrosion of the cast iron, well advanced in many spots. Several members of the party dug the products of the corrosion out with their pocket knives, to a depth of one-sixteenth to one-eighths of an inch, not only near the joints but in the middle of the pipe.

The progress of corrosion was observed in its various stages, and the corroded metal in the pits eaten into the pipes was similar in appearance to the products of corrosion observed on damaged water pipes in Winnipeg. All such damage, wherever it had happened in the city, it was stated, had always been attributed solely to electrolysis from stray currents leaking from the electric railway tracks.

The soil on and near the pipe was examined and found to compare very closely, in general appearance and composition, with the soils in which the Winnipeg water pipes are buried, many samples of which from various parts of Winnipeg and adjoining municipalities, have been examined during the past year both by Mr. Blackie and Dr. Shipley.

The presence of soluble salt crystals in considerable quantity was also observed by all the party on clay freshly excavated from new trenches in the street in front of the hospital. The similarity of this clay and its salt content, to the clay and its contained salts as met with all over Winnipeg and vicinity was remarked upon by all present.

The water pipe had thus been imbedded in earth containing salts that are known to be chemically active, and