Australasian Corrosion Consultants Pty Ltd – Stray Current Corrosion

The results of STRAY CURRENT CORROSION failure can be costly due to loss of product; interrupted supply of product; unscheduled manufacturing shut down, company goodwill and cost of repair. Stray current corrosion may cause dangerous situations to arise resulting in a hazard to the community and the environment. For example, failure due to corrosion of a power earthing system may constitute a major hazard to persons operating commercial or domestic electrical appliances. Pipeline failure will cause loss of product and in the case of a gas main, will endanger the public. Loss of steel reinforcement in concrete may cause catastrophic failure of the concrete element, which may place the occupiers at risk.

STRAY-CURRENT CORROSION is caused by an externally induced direct electrical current (DC). Some examples of sources of stray current are rail transit systems, cathodic protection systems, electric DC distribution systems and the operation of electrical machines.

Stray currents (or interference currents) are defined as those currents that follow paths other than their intended circuit. Stray current discharges that are very local and concentrated ensure accelerated corrosion will occur. Currents leave their intended path because the current finds a path with lower resistance, such as a buried metal pipe, other metal structures, or an electrolyte with a low electrical resistance. The current then flows to and from that structure and causes accelerated corrosion whenever it leaves a metallic structure and flows into an electrolyte as shown in figure 1.

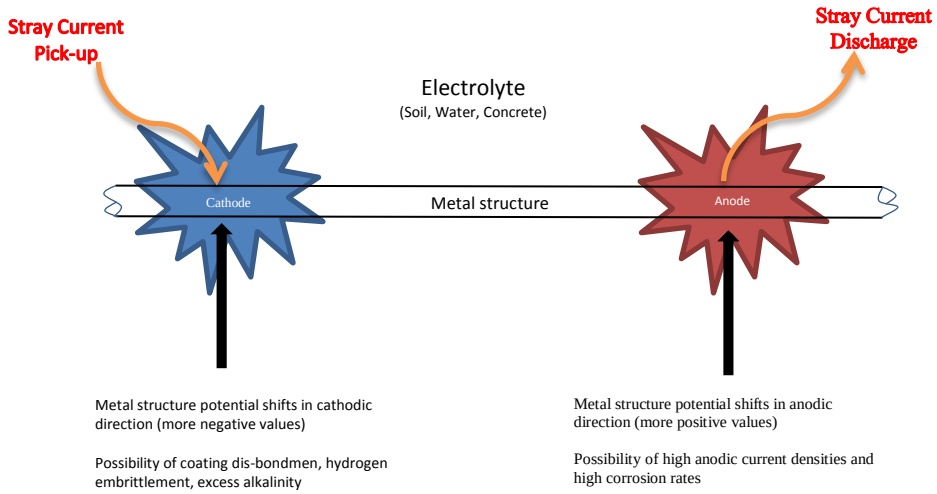

Figure 1

The major effects of stray currents can be:

- corrosion and subsequent damage of metallic structure where DC stray currents leave the metallic structures;
- the risk of overheating, arcing and fire and subsequent danger to equipment and people not necessarily within the Infrastructure Controller's area of responsibility;
- influence on non-immunised electrical control and communications systems;
- influence on unrelated cathodic protection installations; and
- Influence on unrelated AC and DC power supply systems.

The infrastructure elements which may be adversely affected by DC stray currents include all adjacent metallic structures both on and off the Infrastructure Controller's easement or site such as:

- pipelines;
- moored boats and yachts;
- cable armouring and screening systems, towers and stanchions;
- tanks and vessels;
- earthing systems;
- reinforced concrete constructions;
- buried metallic structures;
- signalling systems; and
- other critical metal equipment.

There are three principal measures available to minimise stray current emission from a DC electrical system:

- insulation of the electrical return circuit with respect to earth;
- provision of, or improvement of the conductivity of the return circuit; and
- design of the electrical power supply systems.

The location of the discharge can be detected with careful measurement because the metal structure-to-electrolyte potential is relatively very low at that point.

Australasian Corrosion Consultants' (ACC) principal, engineers and technicians have over 50 years' experience in investigation of stray current corrosion. In this period, Principal Mr Bill Gerritsen was employed by the Australian Telecommunication Commission (Telecom) for 18 years in the Companies Electrolysis Section, initially investigating for stray current effects and mitigation thereof and for the latter 7 years representing Telecom on the Technical Sub-Committee. Bill was instrumental in facilitating the introduce of technology known as a variable conductance drainage bond (VCDB) to the Victorian Electrolysis Committee to mitigate stray currents caused by re-generative trams operating in the greater Melbourne area.

A portion of ACC's time is spent in representing the interests of a number of companies from the water supply and petroleum industries in Newport, Paisley, Yarraville, Sunbury and Bendigo in managing the stray traction currents caused by the operation of electrical trains, light rail and trams.
ACC have carried out stray current corrosion investigations and have in the recent past been instrumental in consulting on or designing mitigation systems for the following structures and vessels:

- Coal loading wharf pile corrosion, North Sangatta, East Kalimantan, Indonesia – caused by incorrect welding practices and lack of appropriate electrical bonding.
- Hobart Tasmania, re-designing a cathodic protection system on a water main which was causing corrosion problems on domestic power earthing systems.
- Melbourne Northern Suburbs School, copper fire main corrosion – caused by the incorrect operation of a water company's cathodic protection system.
- Central Victoria, power earthing system and steel fence corrosion – caused by the incorrect placement of a cathodic protection anode groundbed.
- Melbourne Northern Suburbs Tertiary School Campus, water services and gas supply service corrosion – caused by the operation of an extended rail service in the area.
- Electrification of the Sunbury Railway in Victoria, representing the interests of Western Regional Water in mitigating stray traction currents adversely affecting a 400 MSCL water main.
- J.P Williams & Associates, moored yacht, corrosion of through hull bolted on "Dynaplate" – caused by incorrect wiring.