

# Electrolysis Area Testing – Industry Guide

## 1.0 Introduction

Energy Safe Victoria (ESV) is responsible in the State of Victoria for the protection of underground and underwater structures from the corrosive effects of stray electrical currents.

Part 2 section 6(d) of the *Electricity Safety Act 1998* (ESA) requires Energy Safe Victoria (ESV) “to protect underground and underwater structures from corrosion caused by stray electrical currents”. This overarching responsibility extends to any buried or submerged metallic structure (such as pipelines, pipes, tanks, cables, posts, pylons, and steel-reinforced structures) that is at risk of corrosion from stray currents from an electrical source (such as railways, tramways, substations, and other electrical installations).

The purpose of this guide is to provide guidance to authorities and service providers in achieving these objectives in a timely manner from the electrolysis area testing program.

## 2.0 Objectives

The objectives of an electrolysis area test, as defined in the VEC Code of practice for electrolysis mitigation and cathodic protection is to:

- Measure the effect of stray current on all underground metallic structures within the area of one or more adjacent traction substations.
- Adjust and balance the electrolysis mitigation system such that each test point on each structure is cathodic to the soil line, within an acceptable testing timeframe.
- Determine recommendations to modify or install new electrolysis mitigation systems

Each traction substation is nominally tested on a 5 to 6 yearly cycle. Coordinated area testing schedule is advised by the Technical Sub Committee (TSC). The schedule is subject to change due to railway or tramway construction schedules and/or traction system abnormalities, or other factors.

## 3.0 Key points

The primary point of this guide is to ensure accurate and timely data is presented to the electrolysis area test coordinator prior to, and during the area test.

To do this authorities and service providers should ensure that information is provided in a timely manner, equipment is calibrated and fit for purpose (refer to the VEC Code of practice for further detail).

Personnel must have the requisite experience, qualifications and are competent for the task. This will ensure the electrolysis area test can be completed successfully.

All personnel involved in the area test must comply with the health and safety requirements of the traction system operator and structure owners, as appropriate.

The TSC recommends the coordinated area test program that meets the performance targets (KPI), ESV then coordinates testing to meet the KPI targets.

## 4.0 Specific detail

### 4.1 Traction Authorities/Operators

- Traction authorities/operators will be advised by the VEC Traction Industry representative of the scheduled commencement of an area test and the substations to be monitored during the area test. The traction operator will also be advised who the designated ESV area test coordinator will be and the location of the ESV mobile site office.
- Loading between Substations should be balanced prior to an area test commencing, especially in the case of any new substation installations.
- Nominated substations shall be monitored as early as practicable prior to any area test commencing. Monitoring devices (data loggers or chart recorders) should record:
  - substation load
  - rail to earth voltage

And, where applicable:

- drainage current
- thyristor drainage unit (TDU) output voltage

All devices used shall be calibrated and checked for operation prior to use.

- Any TDUs should be calibrated and tested for correct operation prior to the area test commencing, and during an area test as requested by the area test coordinator. X-Y recordings should be provided to the ESV area test coordinator for each TDU on the commencement of the test, subsequent to any changes made during the test and on completion of the test.
- Where there is a TDU in a railway substation in the area under test, arrangements will be made through the traction industry representative to have this switched off from 15:00 hours on the Friday proceeding the first weekend and until 12:00 hours on the first Monday. TDU's in Tramway substations are not switched off by the Control Centre over the first weekend of the area test.
- At the beginning of the area test, the traction industry representative is to arrange for the overnight switching period of the TDU's in the area under test, to be increased from 1 hour (default setting is 02:00 hours to 03:00 hours) to 2 hours (02:00 hours to 04:00 hours) to allow for the switching of cathodic protection units to occur during the TDU off period and define the effect of adjoining TDUs.
- Railway and Tramway substation charts/data must be provided to the area test coordinator on a daily basis, no later than 12:00 hours (midday), and include the overnight 'switched' period, as mentioned above.
- Any issues affecting the normal operation of the TDU and associated electrolysis infrastructure (i.e. electrolysis feeders) should be communicated as soon as possible to the traction industry representative who will advise the ESV area test coordinator.
- Any requests for changes to Substation loads and/or Railway TDU settings will be communicated by the traction industry representative to the traction operators. These changes should be made within 24hrs for TDU's, and within 3 days for substation loads, so as to reduce downtime on the area test.
- TDU's in tramway substations are adjusted by ESV personnel.

## 4.2 Other authorities

### 4.2.1 Area Test preparation

The area test map will be provided to the relevant authorities no later than **10 business days** prior to the test commencement, along with a list of all drainage bonds in the area, and any previous area test data available. The authorities will need to determine which locations within the map boundary require monitoring. A complete list of the selected test locations is to be provided to the area test coordinator, in an excel format, no later than **5 business days** prior to the test commencement.

The area test coordinator will review all maps and determine the area test numbers for each location. These numbers are allocated per area test.

As soon as the area test numbers are determined, the area test coordinator will provide the relevant authorities the area test address sheet containing the allocated numbers which must be applied accurately to the data logger chart identification.

### 4.2.2 Data logger setup and use

- All data loggers should be calibrated and checked that they are operating correctly prior to the electrolysis area test commencing. The data logger battery condition must be sufficient for the duration of the test, otherwise replaced. Any previous data should be cleared from the data logger memory.
- Personnel assigned to the electrolysis area test should be familiar with the test locations and assets being tested. Preferably, they should have relevant plans and/or data associated with the testing locations and structures.
- Data loggers should be installed in the nominated locations as detailed in the ESV area test address sheet. Any alteration must be communicated to the area test coordinator as soon as possible.
- Structures with drainage bonds associated with the substations being tested must have both a potential and current chart installed. All data logger current shunt connections should be made in the authorities test point.
- The test locations should be surveyed prior to the area test to determine if the test equipment can be accommodated, or if modification are required, e.g. replacement of test point box.
- If access to the test point is not possible, and the location is at an electrolysis drainage cabinet, the area test coordinator may give permission for the test equipment to be installed within the electrolysis drainage cabinet.

**Note:** access to the electrolysis drainage cabinet is restricted to ESV, MTM and YT personnel only, access by all others parties can only be permitted if ESV has granted approval.

- Data loggers should be installed and operating prior to the area test commencing (under normal circumstances on the Friday, assuming the starting day is the following Monday).
- All connections should be clean and tight, particularly the shunt connections. Shunts should be of as low a resistance as possible and leads in series with shunts should be adequately lugged. Correct scaling should be confirmed prior to the area test commencing.
- Data loggers should be set up with the correct title/heading, i.e. allocated ESV number, followed by the address, then structure size or test point number.

- **Example 1**, Melbourne Water 1150mm MSWM pipeline at test point number ES36789 at the location of St Georges Rd and Hutton St, and assigned the test number of M10 by the area test coordinator, should be setup as,

M10 St Georges Rd & Hutton St 1150 ES36789

If this was at a North/South insulating flange (unbonded), and this was installed on the northern side of the insulating flange, it would be setup as,

M10N St Georges Rd & Hutton St 1150 ES36789 N (North),

- **Example 2**, MGN 450mm TP MSGM at test point number 04/L40 at the location of Heatherton Rd and Stud Rd, and assigned the test number of T8 by the area test coordinator, should be setup as,

T08TP Heatherton Rd & Stud Rd

If this was at a regulator pit, and the outlet pipework was a 150mm HP MSGM at test point number 06/05H140 at the location of Heatherton Rd and Stud Rd, and assigned the test number of T8 by the area test coordinator, should be setup as,

T08HP Heatherton Rd & Stud Rd

- **Example 3** (Current Charts), Western Water 450mm MSWM at Shields St east of railway, and assigned the test number of W27 by the area test coordinator, should be setup as,

W27# Shields St E of rail (followed by test point number if known)

- Data logger file numbers should be saved as 2 or 3 digits, i.e. M7 should be saved as M07. This assists with the processing and reviewing of the data in numerical order.
- Weekend charts should be for a minimum of 72hrs, i.e. they must capture the Friday afternoon peak to Monday morning. This is to allow the area test coordinator to establish the weekend overnight soil lines for each structure.
- When installing a data logger, a ‘spot’ potential reading with a calibrated multimeter should be recorded at the time of installation, to confirm the data logger is capturing the data accurately.
- All data charts shall be submitted daily and must be presented to the area test coordinator no later than midday. Any delays should be communicated to the area test coordinator as soon as possible.
- It is the responsibility of the structure owner to ensure reliable data loggers and a communications platform is being used to meet the requirement of submitting daily accurate information.
- Data logger charts should be submitted with the correct polarity (i.e. Positive (upwards) to Negative (downwards) voltage on the Y axis.
- At the completion of the area test, when removing shunts from bonded structures, ensure that cables are reconnected correctly and tightened appropriately.

#### 4.2.3 Personnel and other related items

- Any changes to personnel involved in the area test should be, suitable qualified as specified in “Key points”, and communicated to the area test coordinator as soon as possible. Ideally, the same individual / individuals should commence, and complete an area test.
- Spare equipment / data loggers should be available to the assigned area test personnel to minimise any downtime or lost time due to logger failures.
- No additional test locations, which were not included in the original address sheet, can be added during the area test without prior notification to the area test coordinator, whereby a new area test number will be assigned.

- All Cathodic Protection units (ICCPU) should be continuously “on” (i.e. not switching off, or being interrupted), all time switches and ICCPU circuitry are to be checked for correct operation at the commencement of the test.
- All ICCPU should be operating at their normal operating output (within registered permitted output). The area test coordinator must be informed if a unit is not operating, or is operating at a reduced output.
- ICCPU should only be interrupted upon request from the area test coordinator. The area test coordinator will advise which “off” times are required.
- The test coordinator should be informed of any other issues which may impact the test.
- No other works such as: coating defect surveys; coiling surveys; CP interference test; current injection tests; and bonding/un-bonding should be carried out in the area under test without the consent of the area test coordinator.
- Persons representing their company at the final meeting should have the required level of authorisation to agree to the draft recommendations and the test being concluded.

## References

Electrical Safety Act.

VEC Code of Practice 2015 v7

ESV Electrolysis Investigation Test Procedures TRIM Ref: DOC/13/57049

## Document Information

Version	Date	Revision Information	Author	Edited by	Authorised by
1.0	26/02/2019	New Procedure	P Chiaravalloti		
1.1	09/07/2019	Draft - issued for comment	P Chiaravalloti	Lou Ioan	
2.0	21/07/2020	For industry comment	P Chiaravalloti	Peter Wade	
3.0	24/09/2020	Industry comments incorporated	P Chiaravalloti	Peter Wade	Peter Wade