VICTORIAN ELECTROLYSIS COMMITTEE

CODE OF PRACTICE

Version 3

08 Dec., 04

Index

1 Code of Practice

The Electricity Safety Act 1998 (the Act) was assented to by the Parliament of Victoria in May 1998.

Part 9 of the Act relating to cathodic protection and mitigation of stray current corrosion was proclaimed in May 1999.

Sections 155 and 157 of the Act give the authority to make Regulations.

The Electricity Safety (Stray Current Corrosion) Regulations 1999, Statutory Rule No. 50/1999 came into operation on 3 May 1999.

There is a need to define the operating procedures and organisation of the Victorian Electrolysis Committee and therefore this Code of Practice has been produced to satisfy this need.

The Victorian Electrolysis Committee may review and amend the Code of Practice as required.

The Code of Practice was last revised in November 2004 and the amendments are shown in bold within the document.

2 Electricity Safety Act 1998

The Electricity Safety Act 1998 (the Act) was assented to by the Parliament of Victoria in May 1998.

Part 2 of the Act establishes the Office of the Chief Electrical Inspector (OCEI) to administer the electricity safety regulations within the State of Victoria.

Section 7(d) of the Act provides that it is one of the objectives of the OCEI "to protect underground and underwater structures from corrosion caused by stray electrical currents".

Part 9 of the Act establishes the Victorian Electrolysis Committee (VEC).

Section 91 of the Act defines the composition of the VEC as 7 persons representing the OCEI, Traction, Electricity, Water, Gas, Telecommunications and the Oil industries. The Minister appoints these persons for a period not exceeding 3 years, from nominations or selections by the Ministers responsible for each industry.

The Minister appoints one of these persons to be chairperson of the VEC.

Each member of the VEC may nominate an alternate member, who may act in their place should the member be unable to attend a meeting.

Under section 92 of the Act the functions of the VEC are to –

(a) establish and maintain standards for systems for cathodic protection and for the mitigation of stray current corrosion; and

(b) provide advice to the OCEI on any matter related to electrolysis and the regulations relating to cathodic protection and to the mitigation of stray current corrosion, when requested to do so by the OCEI; and

(c) encourage the development of new methods and technology to increase the efficiency of systems for the mitigation of stray current corrosion.

The VEC operates –

- in areas, particularly in the Melbourne metropolitan region, where underground metallic structures are shown to be affected by stray traction currents;
- where cathodic protection systems are used; and
- where requested by the public to provide advice on corrosion caused by stray electrical currents.

To assist in this work, Section 94 of the Act requires " a person who is the operator of a railway or tramway system must ensure that that system is designed, installed, operated and maintained in such a manner as to minimise the risks to safety of any person and the risks of damage to property arising from the leakage of stray electrical currents from that system."

3 Definitions and Abbreviations

3.1 Definitions

Definitions are in accordance with the Electricity Safety Act 1998, the Electricity Safety (Stray Current Corrosion) Regulations 1999 and the Australian/New Zealand Standard "Cathodic protection of Metals - Part 1 Pipes and Cables, AS/NZS 2832.1:1998", as amended from time to time.

For the purposes of the Code of Practice, the following additional definitions apply –

Area test	is a co-ordinated monitoring program of all underground metallic structures in the vicinity of a traction substation, which may be affected by the stray currents from the operation of the traction system.
Electrolysis	is the effect of stray electrical currents on buried metallic structures.
Mitigation system	comprises the feeder cables, the substation equipment and drainage bonds connected to such feeders, installed to minimise the effects of stray traction currents. This includes the TDU, VCDB and/or Direct Current (DC) supplies for VCDBs connected to the system and also the electrolysis box and panel at the structure connection point.
Feeder	is defined as the total length of the feeder cable from the connection to the traction system (substation or rail) to the drainage point at the underground structure.
Licensed pipeline	is a pipeline licensed under the Victorian Pipelines Act 1967.
Underground structures	are metallic objects buried underground, such as water or gas pipes, telecommunication or power cables, metal tanks, etc.

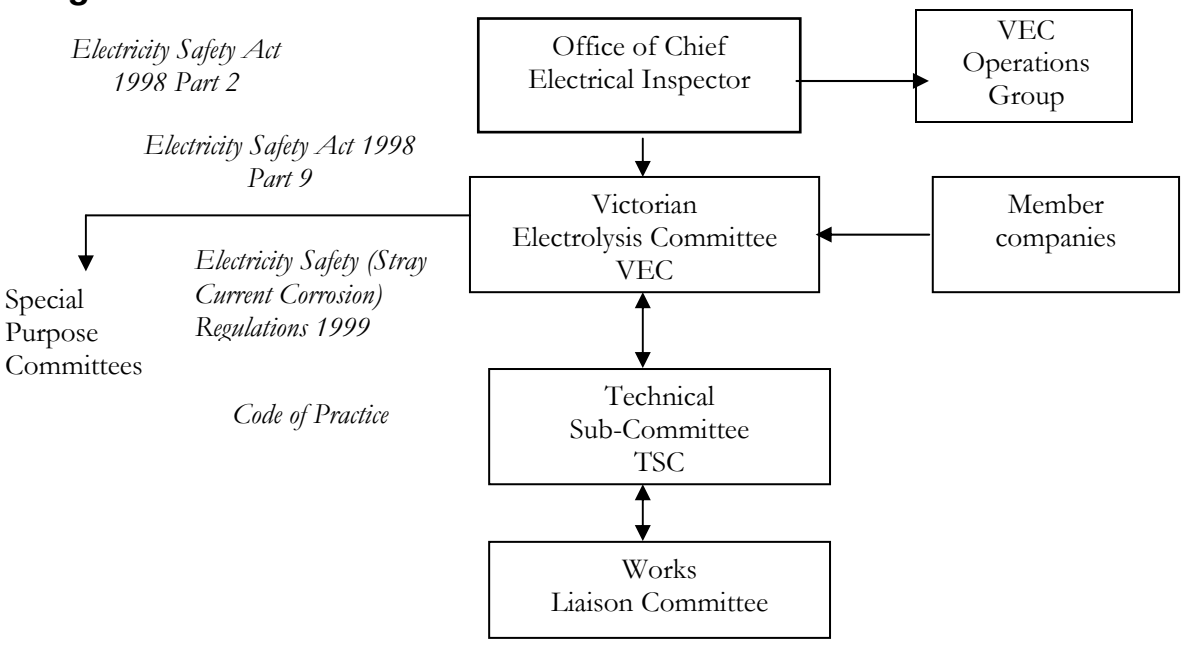
A cathodic protection system, using galvanic anodes, comprises one or more anodes connected at a single point to a primary structure**.**

An impressed current cathodic protection system comprises a ground bed and transformer rectifier power supply connected at a single point to a primary structure.

3.2 Abbreviations

OCEI	Office of the Chief Electrical Inspector
VEC	Victorian Electrolysis Committee
VECOG	Victorian Electrolysis Committee Operations Group
TSC	Technical Sub-Committee
TDU	Thyristor drainage unit
VCDB	Variable conductance drainage bond
DB	Drainage bond

4 Organisation



4.1 Office of the Chief Electrical Inspector

4.1.1 Functions

Under the Electricity Safety Act 1998, the Office of the Chief Electrical Inspector's objectives include the protection of underground and underwater structures from corrosion caused by stray electric current.

4.1.2 Activities

To achieve the function, the OCEI –

1. Registers cathodic protection systems.
2. Registers mitigation systems.
3. Develops and implements regulation relating to stray current corrosion.
4. Establishes VECOG with sufficient resources, including financial, human resources, transportation and accommodation requirements, to ensure it can meet VEC performance targets.
5. Provides an annual budget for activities of the VEC.
6. Reports expenditure against budget to each VEC meeting.
7. Provides reports on VEC activities as required.
8. Provides a Secretary for the Victorian Electrolysis Committee.
9. Holds ownership of assets, including cost details, on behalf of the VEC. (This excludes railway stanchions and electricity poles, which remain in the ownership of either the electricity distribution or the traction businesses).
10. Adequately insures these assets on behalf of the VEC.
11. Appoints a Chairperson for the TSC.
12. Provides a dispute resolution process.
13. Maintains a register of cost details, including industry contributors, associated with mitigation systems and cathodic protection systems installed in lieu of drainage.
14. Directs persons to install mitigation systems.
15. Directs operators of cathodic protection systems or mitigation systems to perform tests and modify or replace systems
16. Requires persons to contribute towards the costs of actions in relation to mitigation systems in the amounts determined by the OCEI after consultation with the VEC

4.2 Victorian Electrolysis Committee

4.2.1 Functions

Under section 92 of the Act the functions of the VEC are to –

(a) establish and maintain standards for systems for cathodic protection and for the mitigation of stray current corrosion; and

(b) provide advice to the OCEI on any matter related to electrolysis and the regulations relating to cathodic protection and to the mitigation of stray current corrosion, when requested to do so by the OCEI; and

(c) encourage the development of new methods and technology to increase the efficiency of systems for the mitigation of stray current corrosion.

4.2.2 Activities

The activities of the VEC shall include –

1. Holding a minimum of 4 meetings each year.
2. Ratifying the annual OCEI costs and performance targets at the first meeting of each calendar year.
3. Consulting with the OCEI in determining the cost sharing agreement between members to recover the costs of actions related to the mitigation systems.
4. Establishing the TSC and defining its composition and activities.
5. Setting and monitoring the performance criteria of the TSC and VECOG.
6. Reviewing the activities and the expenditure compared with the performance targets and budget at each meeting. Establishing the TSC and defining its composition and activities.
7. Administering the Code of Practice for the operations of the VEC.
8. Establishing special purpose sub-committees as necessary.

4.2.3 Members Responsibilities

The VEC members are required to provide the necessary resources to enable their full participation in the activities of the VEC.

Each member will provide resources, including –

- A share of the cost of the OCEI activities relevant to the operations of the VEC;
- A share of the capital costs of installing remedial measures; and
- The monitoring of their assets during VEC testing.

4.3 Technical Sub-Committee (TSC)

4.3.1 Functions

1. The TSC shall comprise the technical representatives nominated by each industry group of the VEC.

   Note – Each industry should nominate representation to adequately cover its assets;

   - These representatives should have suitable technical qualifications; and
   - Be authorised by their company or industry group to make the financial commitments for remedial works up to a total project cost of $20,000 at the TSC meetings.

2. Be chaired by a person appointed by the OCEI.
3. Meet on a monthly basis (with the exception of January).
4. Require the presence of all involved parties before determining the remedial action to be taken to overcome a problem.
5. Maintain a co-operative approach to determine the most effective and economic solution to the identified problem. Consensus agreement is the desirable outcome.
6. Nominate the annual performance targets.
7. Approve remedial works.

4.3.2 Activities

The activities of the TSC shall include –

1. Investigation of a corrosion problem where a person claims adverse effects from stray electrical currents.
2. Institution of a testing program to determine the cause and effects of the corrosion problem.
3. Promotion of a co-operative approach in determining the most effective and economic remedy to the corrosion problem.
4. Implementation of the remedy and verification of its effectiveness.
5. Reviewing of the processed cathodic protection applications.
6. Ratification of all recommendations from an area test.
7. Reviewing of the processed mitigation system applications.
8. Consulting with the OCEI in establishing a funding agreement between relevant parties for all works constructed on behalf of the VEC. Projects in excess of $20,000 will require written approval, including the necessary funding arrangements from all members involved.
9. Consulting with the OCEI concerning contributions to all cathodic protection systems recommended to offset the effects of stray traction current.
10. Monitoring the performance of VECOG against the targets nominated by the VEC.
11. Ensuring the prompt submission of accounts from the service providers for the VEC's portion of stray traction mitigation works.
12. Proposing research and development projects to the VEC and the OCEI.
13. Establishing a Works Liaison Sub-Committee and defining its composition and activities
14. Setting performance criteria and monitoring the performance of the Works Liaison Sub-Committee.

4.4 Victorian Electrolysis Committee Operations Group (VECOG)

4.4.1 Functions

The functions of the VEC Operations Group are

1. To manage the resources to perform or co-ordinate the operations required by the VEC in the pursuit of its aims and objectives.
2. To ensure staff are sufficiently trained and developed for VECOG activities.
3. To process cathodic protection system applications on behalf of the OCEI.
4. To process applications for mitigation systems on behalf of the OCEI.

4.4.2 Activities

VECOG's activities shall include –

1. Carrying out the programmed testing, as nominated by the TSC.
2. Co-ordinating the testing necessary to define and resolve the problems raised at the TSC.
3. Monitoring and auditing the mitigation systems connected to members' assets to ensure continuity of operation and effectiveness.
4. Maintaining the cathodic protection system register on behalf of the OCEI.
5. Auditing cathodic protection systems on behalf of the OCEI.
6. Maintaining the mitigation system register on behalf of the OCEI.
7. Forwarding to members' representatives a notice of meeting and agenda for all TSC and other nominated meetings.
8. Forwarding the minutes from the above meetings within 2 weeks of the meeting date.
9. Informing the members of abnormalities and faults on the mitigation system within 24 hours of notification.
10. Presenting the members at each TSC meeting with a summary of monitoring activities.

4.5 Works Liaison Sub-Committee

4.5.1 Functions

The Works Liaison Sub-Committee

1. Shall comprise suitably qualified technical representatives nominated by members of the TSC to ensure adequate coverage of the industry's assets.
2. Be chaired by a person appointed by the TSC.
3. Meet on a monthly basis, approximately 2 weeks prior to each TSC meeting.

4.5.2 Activities

The Works Liaison Sub-Committee's activities shall include –

1. Reviewing and updating each of the construction projects listed on the Works Schedule.
2. Reviewing the abnormalities on the stray current mitigation systems.
3. Discussing and arranging co-ordinated minor testing.
4. Organising the commissioning of the constructed works.

4.6 Other Special Purpose Sub-Committees

Other special purpose sub-committees as may be convened from time to time which shall carry out the activities defined for them by the VEC or the TSC.

Examples of the Sub-Committees that have been convened are:-

1. New Technology - A sub-committee set up to ensure that new technology is reviewed and applied throughout the workings of the VEC

2. Code of Practice Working Group – A sub-committee that reviews on an annual basis that the Code of Practice is addressing the operating procedures and organsiation of the VEC.

3. Resource Manual Working Group – A sub-committee set up to ensure that the operating procedures associated with VEC testing are maintained.
4. Safe Working Group. – A sub-committee set up to ensure all VEC testing is completed in a safe manner

5 Performance Targets

5.1 Victorian Electrolysis Committee Operations Group

VEC members have requested the OCEI ensure the following performance targets are met for **a 3 year period (2004/2005 to 2006/2007) –**

1. Number of area tests completed - all tests completed to satisfaction of members within given time frames with aim to complete 22 per annum, unless otherwise agreed by VEC.
2. Each TDU is tested a minimum of 10 times during the year.
3. Each DB is tested a minimum of 10 times during the year.
4. Minor testing is completed within 1 month of receipt of request from the VEC members.
5. Cathodic protection Certificates of Registration are to be issued within 5 working days of approval by the CEI.
6. Prepare documentation for presentation at the TSC and Works Liaison meetings.
7. Prepare reports of the TSC and Works Liaison meetings within 2 weeks of the meeting.
8. Audit the cathodic protection database, by either paper or on-site testing during area tests. Verification of output and ownership of impressed current and galvanic anode systems to progress towards ensuring all Certificates of Registration are within the 10-year renewal period.
9. Cuprosolvency investigations, including written report to be completed within 1 month of receipt of request from retail water distribution companies.

5.2 Traction Operators

1. Unplanned interruptions to mitigation system - VECOG to be advised within 5 business days.
2. Re-instatement of the mitigation system - within 1 month of notification, unless otherwise agreed by the TSC.
3. Planned interruptions to mitigation system - VECOG to be advised 2 weeks before commencement of the work.
4. Projects should be completed within a 12 month period of TSC approval, unless otherwise agreed by the TSC. Inspection of these projects should take place within a 1 month period of TSC endorsement, unless otherwise agreed by the TSC.

5.3 Structure Owners

1. Maintenance/modification of the mitigation system (including faults) - repair or advice to VECOG of status within 1 month of notification.
2. Projects should be completed within a 12 month period of TSC approval, unless otherwise agreed by the TSC.

6 Cost Sharing Agreement

The philosophy of the original cost sharing agreement was that –

- The traction operators pay a greater share of the cost as they are the major generators of the stray traction currents;
- the electricity distributors pay a greater share because their multiple earth neutral system distributes the stray traction currents throughout the whole metropolitan area; and
- the telecommunications, water, gas, and oil industries pay a lesser share as their assets suffer the adverse effects of the stray traction currents.

6.1 Operational Costs

Operational costs are shared between members of the VEC as follows –

Traction Industry	(36.4%)	**Connex Trains**	21.8%
		Yarra Trams	14.6%
Electricity Industry	(24.5%)	**Alinta Networks**	6.4%
		TXU	2.6%
		Citipower	6.4%
		AGL Electricity	8.0%
		Powercor	1.1%
Water Industry	(10.3%)	Yarra Valley Water	2.9%
		City West Water	1.1%
		South East Water	2.2%
		Melbourne Water	4.1%
Gas Industry	(10.3%)	Multinet Gas	3.6%
		Victorian Gas Distribution	2.6%
		TXU	2.6%
		GasNet Australia	1.5%
Telecommunications Industry		Telstra	10.3%
Oil Industry (AIP)	(8.2%)		
		BP	0.7%
		Esso	0.5%
		Caltex	0.2%
		Shell	3.5%
		Mobil	3.3%
		Total	100%

6.1.1 Other Contributors

Coliban Water Authority	**$5,800/annum**
Bendigo Tramway Trust (Tourist/voluntary)	$500/annum

These are payments related to the remote monitoring of the Bendigo Tramway drainage system.

6.1.2 Drainage Bond Monitoring for Non-Members

Non-members of the VEC shall be charged at $500/drain/month.

6.2 Capital Costs

6.2.1 New Mitigation Systems

1. Following approval by the OCEI, new mitigation systems shall be installed by the traction operators. Alternate service providers, as appropriate, may be used.
2. Extensions to the traction systems should incorporate provision for mitigation systems and their associated costs within the project budget.
3. (a) Costs associated with mitigation systems shall be shared between all industry groups, who have metallic assets within the substation area (1 share each), a non-member asset owner (2 shares) and the traction industry (2 shares). If only one industry group is present in the substation area, then the sharing shall be on an equal basis between the asset owner and the traction industry.

   (b) Members who own metallic assets which have been demonstrated during testing to be neither affected by, nor interfering with other assets in the area, may with the OCEI's agreement not contribute to the construction.
5. Costs of cross-bonds between companies within an industry are covered by that industry.
6. Costs of cross-bonds between different industries shall be shared as per 6.2.1.3
7. Installation of test points shall be the responsibility of the structure owner.

6.2.2 Modification to Existing Mitigation Systems

1. Any member connecting to an existing mitigation system in which they have shared costs shall be charged as per 6.2.1.3.
2. Any member connecting to an existing mitigation system to which they have not shared costs shall be charged the actual costs of the connection plus one (1) share of the present day replacement costs of the relevant part of the mitigation system as per 6.2.1.3.
3. Non-member asset owners wishing to connect to an existing mitigation system shall be charged the actual costs of the connection plus two (2) shares of the present day replacement costs of the relevant part of the mitigation system as per 6.2.1.3.
4. All monies collected from the shared portion in 6.2.2.2 and 6.2.2.3 shall be credited to the original contributors according to their respective share.

6.2.3 Cathodic Protection Systems in Lieu of a Mitigation System

1. Following agreement by the TSC that a cathodic protection system should be installed to provide structure protection in lieu of a mitigation system, the TSC shall determine the proportion of the cathodic protection, that is required to offset the anodic traction effect.

To enable the TSC to determine the split of costs, the proponent of the cathodic protection system must submit a test report to the TSC for approval, prior to the installation of the cathodic protection system.

The report must include:-

- **scope of the test work that was carried out,**
- **charts taken to show the condition of the structures expected to be protected by the cathodic protection system,**
- **a current demand test to show the required output of the cathodic protection system to overcome the traction effects,**
- **the cost breakdown for the cathodic protection system, and**
- **the conclusions.**

In general, the Committee will contribute to the cost of the cathodic protection system in line with the ratio of the current to overcome traction and any additional protection current.

To assist members and their consultants in determining the likely cost split, the following examples are provided:-

Example 1 – If a cathodic protection system is installed only to overcome the anodic traction effect, the Committee will contribute 100% of the costs associated with the installation of the system.

Example 2 – If a cathodic protection system of greater capacity is installed to provide additional protection, the Committee will contribute to the costs in line with the ratio of the current required between the traction and additional protection.

i.e. Current required to overcome traction – 10 amps
Current output of cathodic protection system installed – 20 amps

Therefore Committee would contribute 50% of the costs associated with the system.

2. The actual costs shall be apportioned in accordance with 6.2.1.3. The costs shall include provision for mitigating cathodic protection interference to the structures of other asset owners.

6.2.4 Volunteer Traction Authorities

When the works proposed involve a volunteer operated traction system, the cost sharing shall be agreed between all parties prior to the work commencing, after consideration of all possible sources of funds.

6.3 Maintenance

After agreement with the VEC, maintenance costs on the mitigation system, incurred by the traction operators and other service providers, shall be incorporated in the mitigation works invoice and shared on the same basis as per 6.2.1.3.

7 Registration of a Cathodic Protection System

The guidelines set out the procedure for an applicant to obtain a Certificate of Registration to operate a cathodic protection system and should be read in conjunction with the Regulations.

Procedure for Granting of a Certificate of Registration

Applications will be accepted up to the close of business on the Friday preceding each meeting. Applications, together with cheques for the appropriate fees made payable to the "Office of the Chief Electrical Inspector" should be submitted as follows –

Office of the Chief Electrical Inspector
Attention Manager
Electrolysis Mitigation
15A Ceylon Street
Nunawading 3131

All applications received by the OCEI will be tabled for consideration at the following monthly meeting of the TSC. These meetings are held on the first Wednesday of each month, except for the month of January, when no meeting is held. Applications received prior to the December meeting will be reviewed in light of there being no meeting in January.

If there are no objections to the cathodic protection system by adjacent structure owners, the applications will be endorsed at the subsequent meeting of the TSC.

For the purposes of these guidelines, a cathodic protection system, using galvanic anodes, comprises one or more anodes connected at a single point to a primary structure.

For the purposes of these guidelines, an impressed current cathodic protection system comprises a ground bed and transformer rectifier power supply connected at a single point to a primary structure.

To assist members and their consultants in determining the number of Certificates of Registration applicable, the following examples are provided:-

Example 1 – A tank farm with multiple tanks, with the base of each tank being protected by a separate transformer rectifier unit, having a separate negative connections between the tank base and transformer rectifier - This is seen as requiring one Certificate of Registration per tank.

Example 2 – A tank farm with multiple tanks that are all protected by one transformer rectifier, with a single ground bed and a connection between the ground bed and the transformer rectifier – This is seen as requiring one Certificate of Registration.

Example 3 – A single tank, which has multiple transformer rectifiers protecting the tank base, using a single ground bed and one negative connection to each transformer rectifier – This is seen as requiring one Certificate of Registration.

Example 4 – A pipeline protected by one cathodic protection system, but incorporating multiple circuits to protect or bond other adjoining underground metallic structures into the system - This is seen as requiring one Certificate of Registration.

The above examples are provided as guides only with the TSC making the ultimate determination of the number of Certificates of Registration for each site in line with the definition in Section 3.1 of this Code of Practice.

7.1 Cathodic Protection Systems with a Total Output up to & Including 250 Milliamperes

1. Applications should be submitted to the OCEI on the application form and accompanied by –
   (a) the prescribed fee of $137.50; and
   (b) relevant information, including a map showing the location of the proposed system, the metallic structure to be protected; and
   (c) drawings detailing the proposed system; and
   (d) any information which the applicant deems beneficial to the application.
2. After endorsement by the TSC, a Certificate of Registration of a cathodic protection system may be issued to the structure owner, because its type, location and level of operating current is unlikely to cause interference to any foreign structure.

Within the corrosion industry, it is an accepted practice for galvanic anode installations with a total output of 250 milliamaperes or under to be connected upon completion of the construction work as an efficient use of resources. As these units rarely cause interference to adjoining structures, permission is granted for this practice to continue with notification to the OCEI as soon as possible after commencement of operation.

It is recommended that galvanic anodes be installed at least one metre away from an adjoining underground structure.

7.2 Cathodic Protection Systems with a Total Output of (a) over 250 milliamperes and up to and including 2 amperes and (b) over 2 amperes

1. The applicant must notify in writing the owners of all structures, which may be affected by such system.

   Each owner must be provided with two copies of a map showing the location of the proposed system, the structure it is to protect and details of the system (such as the proposed output current, type of ground bed, soil resistivities and type of installation I/C or G/A). If the proposed system is to protect the metallic base of a tank, then the drawings shall indicate whether the tank base is or will be insulated from the pipework connected to the tank.
2. Applications should be submitted to the OCEI using the application form and accompanied by –
   (a) the prescribed fees of –
      - $275 for units over 250 mA & up to and including 2 Amps or
      - $550 for units over 2 Amps.
   (b) a map showing the location of the proposed system, the structure to be protected and all structures likely to be affected by the proposed system.
   (c) a drawing detailing the proposed system which should include a circuit diagram indicating what facilities are provided for interrupting the cathodic protection current for test purposes.
   (d) Should the ground bed be fully or partially submerged in water, the owner should for electrical safety reasons, refer to the Australian/New Zealand Standard AS/NZS 2832.2 Clause 5.2(c)(ii).
   (e) any relevant additional information which the applicant may deem beneficial to the permit application.
3. Within 20 business days of receipt of the notice, each notified owner is required to inform the applicant in writing of agreement or of disagreement with reasons to the proposed system. Also, one copy of the map previously provided should be returned, showing the location of any metallic structure of that owner which is likely to be affected by the proposed system.
4. Following the completion of the period, the applicant must advise the OCEI in writing of any objections received, together with any additional metallic structures identified, and any alteration to the map provided to the OCEI.

5. After endorsement by the TSC, the CEI will issue either:-

   (a) a Certificate of Registration of a cathodic protection system may be issued to the structure owner, because its type, location and level of operating current is unlikely to cause interference to any foreign structure, or

   (b) a letter of no objection will be issued to the structure owner: stating there is no objection to the installation of the system, because its type, location and level of operating current may require testing to determine the level of interference to any foreign structure.

6. After receipt of the Certificate of Registration of a cathodic protection system, the owner must give the OCEI at least 5 business days notice of intention to commence operation of the system to enable the cathodic protection register to be maintained.

7. Following receipt of the letter of no objection to the installation of a system, the owner shall install the system and carry out testing and within 20 business days of the completion of the testing, prepare and forward a report to the OCEI.

   The report must include the following information –

   (a) the operating current of the system as set during the test; and

   (b) the anodic and cathodic potential changes with respect to earth caused by the operation of the system as measured on the structure to which the system is connected and all other affected structures in the area; and

   (c) details of any modification made or proposed to be made as a result of the testing; and

   (d) details of agreement or modification proposed between the primary structure owner and the owners of affected structures.

   If the OCEI considers there could be a complex interference problem, he may direct the VEC to co-ordinate testing. Otherwise, this interference testing is to be done by the applicant, in conjunction with the affected owners.

   After completion of testing, the unit shall be left "off".

8. After consideration by the OCEI of the report of the testing, a Certificate of Registration may be issued to operate the system at the stated level of operating current determined during testing.

9. If a Certificate of Registration is not granted, then the applicant will be advised in writing giving reasons and/or modification to be carried out.

7.3 General

1. Certificates of Registration are granted for a period of 10 years from the date of approval. A new Certificate of Registration will be granted at the end of this time period at no cost after verification of ownership, output current and operational status.

2. The holder of a Certificate of Registration must give the OCEI details of any change of the owners' name or address within 20 business days of the change.

3. If the owner of a cathodic protection system either changes, becomes aware of any change in the operation of the system or removes the system completely, they must notify the OCEI verbally within 4 business days and in writing within 10 business days.

4. If the owner of a cathodic protection system proposes to make any of the following changes, an application form should be forwarded following the procedures, described in Section 7.1 or 7.2, –

- To increase the operating current, where the change alters the fee category; or
  Note: when the change does not alter the fee categary, no payment is required
- To change the type of system from galvanic anode to impressed current; or
- To relocate the anode ground bed,

5. If the owner of a cathodic protection system proposes to –

- renew the existing anode ground bed in the same location; or
- reduce the operating current; or
- alter the connection to foreign structure bonds;

they must notify the OCEI (without the payment of fees) for information only.

8 Registration of Mitigation Systems

Regulation 6 of the Electricity Safety (Stray Current Corrosion) Regulations 1999 states "a prescribed mitigation system uses electrolysis DBs and associated apparatus, cable and drainage equipment."

The mitigation system register, in Regulation 27, is defined in respect to the individual traction substation and is recorded on traction operator drawings and on the DB test sheets held by the VEC.

Process for Registration of a Mitigation System

1. All applications for registration of a mitigation or modification to an existing mitigation systems will be referred to the TSC.

   Note: It is expected that the majority of new applications or modifications will originate from the co-ordinated area testing program.

2. The TSC will investigate and nominate the required testing.
3. VECOG will co-ordinate testing in conjunction with the appropriate VEC members.
4. A site meeting, comprising representatives of the structure owners, the traction operators and VECOG, will agree upon technical recommendations.
5. VECOG will prepare a test report and submit it to the representatives of the structure owners and the traction operators for discussion at the following TSC meeting.
6. The TSC will discuss, endorse the technical recommendations and the funding arrangements.
7. Endorsed recommendations will be added to the VEC works schedule.
8. The Works Liaison Committee of the VEC will determine the priority of the works and arrange estimates from the service providers for total works projects over $20,000.
9. If the total project cost is estimated in excess of $20,000 then the project must be referred to the TSC for specific endorsement and written approval obtained from all members involved to the proposed funding arrangements.
10. The traction operators and / or alternate service providers will construct the new mitigation system or modify an existing mitigation system. It is expected the projects will be completed within 12 months of OCEI approval, unless otherwise agreed by the VEC.
11. After the construction has been completed, commissioning will be co-ordinated by VECOG.
12. The mitigation system register (traction operator drawings and DB test sheets) is amended. The DB test sheets are re-issued to representatives of the VEC members.

9 Health and Safety Issues Relevant to Committee Activities

9.1 Substation Entry Requirements

Access is only available to personnel who are –

- appropriately trained and authorised by the traction operator/s;
- issued with an access key; and
- follow the necessary entry procedure.

9.2 Electrolysis Drainage Bond Boxes Requirements

(a) Access is only available to personnel who are –

- issued with an access key; and
- comply with the conditions nominated below.

Persons requiring entry into the electrolysis drainage box should –

- visually check the physical condition of the box
- be aware that 240 volt connections can be in the box
- visually check that the resistance wire has not melted
- not touch the resistance wire in the box as it can be hot
- sign the card to show that entry has been made
- ensure the electrolysis drainage box is locked at the completion

(b) The following design guidance should be used in relation to the location of a new or replacement of electrolysis drainage bond boxes. The box -

(i) should preferably be ground mounted
(ii) size should consider all foreseeable future needs within the box
(iii) location should consider the proximity of 240 volt power supply
(iv) should have potential leads from underground structures installed
(v) should not be mounted on concrete poles with high-voltage power conductors attached.
(vi) mounting must comply with the various applicable statutes to protect the public from inadvertent contact.
(vii) must be appropriately labelled for the safety of the electrical workers working in the vicinity of the boxes and feeders.

(c) Traffic Management Systems, shall be implemented by each person requiring access to the test point on their structure or the electrolysis drainage bond box, as appropriate. The measures should allow safe access to the test point or box without causing difficulties to the traffic in the immediate vicinity of the equipment or endangering the safety of the person performing the test.

9.3 Member's Installations (Such as Gas Regulator Pits, Telstra Pits and Manholes, Electricity Pits, etc.)

Access shall be restricted to authorised personnel only.

9.4 Temporary Connection of Drainage Bonds

Only appropriate personnel trained and authorised by the VEC can perform the connections.

9.5 Temporary Connection of Drainage Bonds to the Traction System

Only VECOG personnel in conjunction with a representative of the traction operators in attendance can perform the connections.

10 Testing Standards and Criteria

10.1 Area Testing

Area Testing or co-ordinated testing within traction substation areas has been shown to be the most appropriate method of testing the mitigation system. This method involves all structure owners and the traction operator in a co-ordinated test within one or more adjacent traction substation areas.

The aim of an area test is to –

- minimise the effect of stray current on the underground metallic structures, whilst keeping the amount of stray current flowing within the earth to a minimum.
- to adjust and balance the mitigation system towards the objective of each test point on every structure being cathodic to the soil line, within an acceptable testing timeframe.
- test all traction substation areas in an orderly sequence within a 5-6 year interval between successive tests.

10.1.1 Advantages of Area Testing

To traction operator's

(a) allows an assessment of the electrical loadings between their adjacent substations to be made on a regular basis.

(b) enables the identification of defects on the traction system associated with the negative return and the mitigation system.

(c) allows electrolysis equipment to be checked for its compliance with ratings.

To structure owners

(a) provides opportunity for stray electrical currents to be monitored on a co-ordinated basis by ensuring all structures are monitored in the same time interval.

(b) provides the opportunity for co-ordinated solutions to be determined to solve problems found during the test work.

(c) provides the opportunity for structure owners to verify the electrical continuity of their structures, including the status of their insulated flanges.

(d) provides the opportunity to audit cathodic protection systems within the area for compliance with the interference criteria and the Certificate of Registration current.

(e) provides the structure owners with the opportunity to ensure the effectiveness of their cathodic protection systems.

10.1.2 Area Testing Procedure

The TSC determines the schedule and priority of the area tests.

Each area test will involve all structure owners and traction operators in the production of a composite map of their assets under test within that area.

The VECOG and VEC members shall organise the site testing by –

- the establishment of a site office (caravan).
- the appointment of an area test co-ordinator for the testing work.
- monitoring of the traction substation by the submission of charts on a daily basis to the co-ordinator.
- monitoring the structures by the submission of daily charts to the co-ordinator. Paper or real-time accessible charting is required at each DB with data loggers being acceptable at remote test points. Data loggers used on an area test must comply with the specification in Appendix 2.
- assessment of the traction system loadings and their effect on the drainage system.
- adjustment of the drainage system to minimise the traction effects.
- conducting a site meeting to discuss testing and develop the recommendations for changes to the mitigation system.
- obtaining an agreement to the completion of the testing of this area.
- producing an area test report and submitting it to the TSC for ratification.

10.1.3. Criteria to be used for Assessment of the Submitted Charts

The major criteria to be used in the assessment of the structure charts are % anodic or cathodic to the soil line (ie. cathodic, 10% anodic, 25% anodic, 50% anodic, 75% anodic and 100% anodic).

The soil line is defined as the potential of the structure to earth when the rail to earth voltage at the traction substation is zero and the mitigation system is isolated.

The soil line is determined by the co-ordinator as soon as possible after the start of the area test.

Average anodic excursions of 20 mV or less are considered insignificant.

10.1.4 Other Factors and Resolution Needs

When assessing the submitted charts, as well as criteria listed in 10.1.3, other factors to be considered include –

- % anodic to the cathodic protection criteria in Australian/New Zealand Standard AS 2382 Part 1
- the scaling of the charts being assessed with 1 volt as the minimum full scale.
- the magnitude of the current required to achieve the criteria nominated above.
- the magnitude of the anodic excursions shown on the charts.
- the magnitude of the interference excursions shown on the charts.
- the magnitude of the cathodic excursions shown on the charts.
- the continuity of the structure and whether bonding is an option.
- the priority of the structure (a pipeline licensed under the Victorian Pipelines Act versus other structures and the future use of those structures).
- the integrity of the structure (coating, earths, fault history).
- the limitations of the drainage and traction system.

10.1.5 Methods of Mitigation

10.1.5.1 **Straight drainage** can be used to protect the structure to the soil line, where a structure is made positive to earth under the influence of a negative to earth rail. This can be by a feeder system to the local rail or to the negative bus at the traction substation, utilising a diode, relay and contactor or a VCDB.

10.1.5.2 **Assisted drainage** is used where straight drainage is insufficient to reduce the potential of the included structure to the soil line. Types of assisted drainage available are by the use of –

(a) **A TDU** is a controlled output transformer rectifier device, usually connected in series between the substation negative bus and a common connection to the drainage feeders (drainage bus). The TDU causes the potential of the structures connected to the feeder system to become more negative with respect to the negative bus or rail.

As the TDU output comprises 3 adjustable components, the following should be considered in the settings –

Offset, which is the pre-set minimum voltage output of the TDU when the traction substation load is zero. Generally this is set at 2.5 volts.

Maximum output is the maximum imposed voltage needed to protect the structures. This is dependent upon the feeder lengths of the drainage system, the measured rail to earth voltages, the amount of circulating currents and the equipment rating. Generally set at 15-25 volts for train network and 8-10 volts on the tram network.

Slope, which defines the rate of TDU output in relation to the substation load / rail to earth potential. Generally the maximum slope for a TDU operating on substation load is 0.06 or for a unit operating on rail to earth potential is 3:1.

(b) **A VCDB** with a direct current supply is used when the potential of the structure –

(i) does not co-relate directly with the load of the traction substation (ie. when trams are applying re-generative brakes).

(ii) is localised and relates to the local rail conditions.

These units are nominally set at 50mV below the soil line at the location.

The units maybe used to prevent over-drainage and can be used either individually as a straight DB or on a feeder system with a DC power supply to overcome the feeder resistance and diode forward breakdown voltage. The nominal output of the DC power supply would be 10 - 15 volts.

10.1.5.3 Bonding between structures

Electrical bonding of structures may increase the effectiveness of the mitigation system by overcoming insulated flanges, electrical discontinuity and discharge between adjacent structures.

Bonding between different structures within an "industry" is by agreement between the connecting owners.

If the cross-bond is between structures in different "industries", then the bond should be installed in a cabinet and monitored by VECOG.

If the location is remote from the traction system, then bonding to another structure may be used if the effect is shown to be beneficial to the respective structures.

10.1.5.4 Cathodic protection

If all of the above methods are shown to be unable to improve the condition of the structure, then cathodic protection may be a viable option. Agreement should be reached at the area test site meeting and the recommendation included in the area test report for consideration and ratification at the TSC meeting.

10.2 Thyristor Drainage Unit Calibration Checks

1. At the conclusion of each area test, the technical representatives agree to a TDU setting (offset, slope & maximum output). This becomes the "agreed" setting for the TDU and a final curve, using an X-Y characteristic plot, is taken.
2. The TDU calibration check verifies the static X-Y characteristic plot taken at the site matches the set "agreed" curve.
3. At completion of the testing, the TDU is left at the "agreed" setting and the output of the TDU is operating in line with the variation of the substation loading / rail potential.
4. In conjunction with the traction operator's control room, a functional check is carried out on the control and indication equipment attached to the TDU to verify its correct operation.
5. Reports are provided to members at each TSC meeting to show any variation from the "agreed" curve for each TDU.

Note:

(a) With regard to the TDU installed at the Bendigo Tramway Trust, a contract is in place with charts being produced on a weekly basis using remote monitoring facilities, to ensure the TDU is operating in the "agreed" manner.

(b) The personnel performing the testing shall have the requisite experience and qualifications, including being authorised by the traction operators to enter into the traction operator's electrical substations.

(c) The instrumentation and measuring equipment shall be of an appropriate type and accuracy and have a valid calibration certificate. Calibration of the equipment shall be carried out to the required level of accuracy at appropriate intervals.

10.3 Drainage Bond (Diode, Contactor or VCDB) Testing

1. At each DB, a physical inspection is carried out on the whole installation. This inspection verifies any vandalism or severe mechanical or electrical damage to the cables and box.
2. The electrical components of the DB (diode, varistor, resistance wire, capacitor or other electronic components in the case of VCDB) are tested and compared with the results agreed upon at the end of the area test.
3. Most faulty or damaged items are replaced whilst on-site. The remainder are reported to the relevant representative for action.
4. The drainage current is measured and recorded.
5. A list of faulty items, together with a summary of test work, is submitted to the TSC meeting.

Note –

(a) The instrumentation and measuring equipment shall be of an appropriate type and accuracy and have a valid calibration certificate. Calibration of the equipment shall be carried out to the required level of accuracy at appropriate intervals.

(b) The personnel responsible for the testing shall have the requisite experience and qualifications to perform the duties.

10.4 Cathodic Protection Interference Testing

The limits within these guidelines (Appendix 1), whilst not mandatory, are agreed as being generally tolerable on secondary structures. They may be varied by agreement between all parties concerned.

Recommended Guidelines

1. Anodic interference - maximum potential change of 20 mV.
2. Cathodic interference - maximum potential change of 200 mV.

Note: For amphoteric metals such as lead, if the structure is at a potential more negative than -1400 mV, the cathodic interference should be limited to 50 mV.

11 Dispute Resolution Process

11.1 Role of the Conciliator

The Conciliator's role is to facilitate constructive discussions between the parties on the cause of a dispute and to assist the parties in reaching agreement on a mutually acceptable solution to a dispute where the processes in 11.2 have been observed. If requested by the parties involved in the dispute, the Conciliator will recommend a basis for resolving the dispute and will assist the parties in reaching agreement on the arrangements for ending the dispute.

11.2 Conciliation procedure

(1) Subject to this Code, the Conciliator shall determine his own procedures

(2) Where a dispute arises between parties, then the parties shall undertake the following steps:

(a) The complainant shall raise the matter in writing with the other party and make every effort to resolve the dispute fairly. They must engage in good faith discussions with the bona fide object of resolving the dispute by agreement or by agreeing on a process to resolve the dispute other than by litigation (eg. Mediation, arbitration, expert determination, etc.)

(b) If the dispute is not resolved in accordance with sub-clause 2(a) then either party may refer the matter to the VEC. Any costs incurred associated with the involvement of the VEC shall be apportioned, as determined by the Committee.

(c) If the dispute is not resolved in accordance with sub-clause 2(b), then either party can refer the matter to the Chief Electrical Inspector. The Chief Electrical Inspector shall appoint a Conciliator for the purpose of resolving the particular dispute. Any costs incurred associated with the involvement of the Chief Electrical Inspector shall be apportioned, as determined by the Office.

(3) The matter shall be referred to the Conciliator in manner determined by the Conciliator, which may include, for example

- the appointment of an independent mediator
- the appointment of independent technical expertise
- the performance of independent technical testing
- the exchange of submissions, documentation and information

(a) The proceedings shall be as informal as is consistent with the proper hearing of the matter.

(b) Parties shall not be allowed legal representation. The complainant and the other parties to the dispute may appear personally or be represented by an employee (if a firm) or his representative.

(c) The parties shall agree that:

- Everything which occurs before the Conciliator shall be in confidence and in closed session;
- The discussions are without prejudice
- Neither party may call no documents brought into existence for the purpose of the conciliation process into evidence in any further litigation.
- All costs involved in this process shall be borne by the parties involved in the dispute.

(d) The Conciliator shall:

- Act fairly, in good faith and without bias and shall treat matters brought before him in confidence
- Give each party the opportunity of adequately stating their case, and correcting or contradicting any relevant statement prejudicial to their case;
- Ensure that relevant documents, which are looked at by the Conciliator are disclosed to the parties to the dispute subject to their acquiescence
- Make appropriate recommendations for resolution of disputes between the parties.

(e) The parties shall report back to the Conciliator within 14 days on actions taken on the Conciliator's recommendations.

(f) The Conciliator shall deal with matters referred to it in (e) as expeditiously as possible but no later than 14 days after the matter has been referred to it.

(4) It the Conciliation process fails to resolve the dispute, the Chief Electrical Inspector may issue a direction, as defined in section 96 of the Electricity Safety Act 1998

Appendix 1 Guidelines for Interference Limits in Cathodic Protection Design

The suggested values should be taken as interference levels, which a prudent designer of cathodic protection systems normally would not exceed without prior agreement.

1 Recommended Guidelines

Anodic Interference - maximum potential change of 20 mV.

Cathodic Interference –maximum potential change of 200 mV.

2 Brief Discussion of Interference

Interference occurs when cathodic protection currents applied to a primary structure influence secondary structures so that their potentials are altered. Interference may be either cathodic or anodic. Where cathodic, the potential of the secondary structure is made more negative. Where anodic, the potential of the structure is moved in the positive direction.

Soil potential changes are caused by a voltage gradient in the vicinity of the primary structure or cathodic protection groundbed resulting from the application of cathodic protection and are usually most pronounced close to the groundbed. Current flow may be induced in secondary structures where the current passing through the soil takes the path of least resistance. At points where current is collected by the secondary structure the potential changes in the cathodic direction. Where it is discharged the potential changes in the anodic direction. These zones may be significantly remote from the primary structure or the groundbed.

In general, major cathodic interference effects are experienced where a secondary structure intersects the local field of a cathodic protection system near a cathodic protection groundbed. Anodic interference may be observed at points remote from the cathodic pickup zone or in regions influenced by the electrical field around a protected structure.

The current flow on secondary structures due to interference varies very widely due to several factors such as –

(a) relative positions of the cathodic protection groundbed, and the primary and secondary structures;

(b) soil resistivity in the vicinity of the secondary structure;

(c) potential change of the secondary structure; and

(d) quality of coating on the secondary structure including size and extent of holidays.

The current picked up by secondary structures may cause interference on other structures which may not be directly in the local field of the cathodic protection system but are intersected by the current discharged from a secondary structure. Great care needs to be taken with cathodic protection where large currents are used within a relatively small area as their interference effects may extend well beyond their apparent local field.

The corrosive effect of interference currents is difficult to assess because it is not possible readily to measure the current flow. Equally, the current density at the discharge (anodic) points is not known. As a rough guide, a change of 70 mV in the steel to soil interface potential will change the corrosion rate by a factor of 10. However, on many structures the potential measurement may include a substantial component caused by the flow of current through the environment. This is commonly called the "IR drop". As a consequence the change in the potential at the interface may be far less than indicated by that measured from the ground surface.

A more accurate method of measuring the effect of interference would be to determine the true interface potential of the structure before any interference is present and then measure it some time after the interference has occurred. Then when the change is anodic the ten-fold change in corrosion factor for a 70 mV potential change could be applied. However, the measurement of interface potentials has many technical difficulties and cannot generally be determined practically and conveniently.

Similarly, the adverse effects of cathodic interference are not well defined. The alkalinity generated at the metal to environment interface by the cathodic reaction may be largely responsible for cathodic disbonding of some coatings. Hence, cathodic interference may accelerate this reaction. In the case of amphoteric metals such as lead and aluminium, negative potentials beyond certain limits may result in the dissolution of the metal.

3 Guidelines of Tolerable Levels of Interference

3.1 Anodic Interference

The degree of anodic interference, which can be tolerated, will vary greatly depending on the circumstances of each individual case. For example, an anodic potential change of 200mV may be regarded as acceptable on a cathodically protected pipeline with a protected potential of - 1600 mV, but almost certainly could not be accepted on one operating at - 900 mV.

It is recommended that anodic interference should be controlled to less than a change of 20 mV as measured conventionally when the interfering current is being switched on and off.

Note: These changes in potential are measured between the exposed metal at a coating defect and the environment. A reference electrode positioned more than a few mm away will contain some error depending upon the adjacent soil characteristics, defect size and soil resistivity. In high resistivity soils the majority of the 20 mV will tend to be due to voltage drop in the soil caused by the interfering current, but where the resistivity is very low the majority of this voltage change will tend to be across the metal to environment interface.

3.2 Cathodic Interference

The majority of cathodic interference effects are experienced adjacent to cathodic protection groundbeds and are due to the intense local fields in this area.

The level of interference regarded as acceptable will depend greatly upon individual circumstances. It must be remembered that the cathodic change has to be accompanied by anodic changes, though large cathodic changes may not necessarily imply large anodic changes. The accompanying anodic changes may be quite small and within acceptable limits. This is because the cathodic pickup takes place over a relatively small area, whereas the anodic discharge areas may be over a much greater area of current discharge.

It is recommended that the cathodic interference on secondary structures should be limited to less than 200 mV.

Note: For amphoteric metals such as lead, if the structure is at a potential more negative than -1400 mV, the cathodic interference should be limited to 50 mV.

3.3 Method of Measurement

The above recommendations assume normal methods of measurement and also assume that the sources of the interfering current can be controlled by switching so that their effects can be determined. In those areas where other factors render the values obtained from conventional methods of measurement grossly inaccurate, other methods may need to be adopted. Such areas are the Melbourne metropolitan area where there are stray traction currents from the suburban railway and tramway systems. In addition, areas with high resistivity soils also need special attention.

4 Interference may be controlled

Interference may be controlled by –

4.1 Anodic Interference

4.1.1 The installation of crossbond(s) between the affected structures and the structures receiving cathodic protection. Sufficient current from the cathodic protection system is bled through the bond(s) to alleviate the anodic potential change(s).

Where resistances are required to control the magnitude of the current flow they must be sufficiently robust to withstand surges from any source.

4.1.2 An alternative is the installation of a cathodic protection system on the affected structure with a current capacity sufficient to offset the anodic potential changes.

The method(s) employed to offset the interference needs to be agreed to by all the parties involved.

4.2 Cathodic Interference

This is normally not controlled except where the potential change is considered to be excessive. The procedures adopted for control are subject to agreement between the owners of the structures and can include –

- Reduction of output current.
- Repositioning of the ground bed.
- Installation of a shield wire.

Appendix 2 Specification of Dataloggers used on Area Tests

1 Scope

These specification details the current VEC requirements for dataloggers and associated software developed for use in VEC area testing activities. The aim of this specification is to ensure that developments in equipment and software comply with a common set of guidelines. Such developments will necessitate changes to this specification as experience is gained.

Note: It is intended that the operation of the VEC does not become solely dependent on any particular equipment or software. It is further intended that adopting a common set of guidelines does not hinder the ongoing development of appropriate technology and tools to improve the VEC's operations.

Any comments, suggestions or amendments to this specification should be forwarded to the following –

Chairman
Victorian Electrolysis Committee
PO Box 262 Collins Street West, Vic. 8007

2 Approval

Equipment for use in VEC area testing shall comply with the requirements of this specification and shall be approved by the VEC. Such approval of equipment and software is required to ensure compatibility with systems used to carry out area testing.

(a) All equipment shall meet the technical requirements in terms of functionality and accuracy.

(b) All software used by the VEC members shall be compatible with equipment in use for area testing.

Features critical to the basic operations are mandatory. Other features have been included, while being desirable, are not compulsory.

3. Dataloggers

All dataloggers used in area testing shall meet the requirements listed below.

Dataloggers shall be capable of –

(a) Recording continuous voltage and current charts of 72-hr duration comparable with the capability of the commonly used elavi-script recorders. Providers should acquaint themselves with the essential characteristics.

(b) Produce compatible data files, which can be read, processed, viewed and retained by the software products used by the VEC.

The structure data produced shall be with respect to the reference. (ie. the structure is connected to the positive terminal of the datalogger, thus producing negative readings with respect to the reference).

With the aim of meeting these general requirements the following technical requirements have been adopted.

4 Data Compression

If data compression is used, only approved methods are permitted. This will ensure that software developers can accommodate all approved formats.

While the selection of a single data format would reduce software development costs, a single format would preclude improvement and development of better technologies.

5 File Naming

The following standardised system of file naming shall be adopted for all electronic charts submitted to the VEC by structure owners. This will ensure compatible filing and retrieval of electronic charts.

Discs shall be standard 3½ double-sided double density discs clearly labelled with the area test name, year of the test, and structure owner. e.g. Fitzroy 96.- Multinet Gas

The following directory and file naming conventions shall be used –

(a) Directories Date of test yymmdd
eg 00960521

(b) Filenames Identifying the test point in the format.

AxxSSSSt where –

A identifies the structure owner

A	for Telstra
M	for Melbourne Water
C	for City West Water
S	for South East Water
Y	for Yarra Valley Water
G	for GasNet Australia
T	for Multinet Gas
K	for Vic Gas Distribution
U	for TXU Gas
C	for Coliban Water Authority
E	for Electricity Supply Companies
X	for Caltex
R	for Mobil
P	for PRA
S	for Shell
B	for BP
W	for WAG
O	for Esso

xx is the VEC point number identified by 2 digits eg 15

SSSS identifies the structure, diameter, pressure or direction eg 1350

t (the eighth character) identifies the type of chart

C	for current charts
V	for voltage charts
eg	M121350V identifies a voltage chart on a 1350 mm diam water main at M12 G05MSTPC identifies a current chart on a transmission pressure gas main at G5 A25____V identifies a voltage chart from a Telstra cable at A25.

6 Standard Header Information

The first 12 lines of datafiles shall be compatible with the following requirements. This will assist in identification and processing of electronic charts submitted during VEC area tests. Actual readings shall commence on the 13th line. Each line shall be terminated with CR-LF characters.

Line 1Datalogger identifier and serial number

Formats to be approved by the VEC. This identifier is the primary means used by software to identify the type of logger being used and hence provides key decisions on data compression etc. eg CS-GF-C014.

Line 2Location number and description

Characters up to the first space identify the VEC designated site number eg G23 followed by a description of the location and/or structure details. eg Williams St at Station St, 750mm MSGM.

Line 3Type of recording with offset or shunt values

First word "Voltage" or "Current" to identify the type of recording followed by the required scale factor.

For voltage recordings an offset value or earth stake reading shall follow.
All recorded voltage readings shall have this number subtracted.

For current recordings a multiplier or shunt value (Amps per 10 mV) shall follow. All recorded current readings shall be multiplied by this number times 10.

Line 4No readings, log interval, start

Line starts with the total number of readings recorded in the data may follow such as in the example line
Maximum = 1535 mV 99.5% = 1533 mV

Line 10 Minimum reading (inc 5 percentile optional)

To contain the minimum reading outside of the window-wall times. The minimum shall be "a space delimited number in ascii format following the first equal sign".

The preferred structure of this line is
Minimum = 1003 mV

Other data may follow such as in the example line
Minimum = 1409 mV 0.5% = 1421 mV

Line 11 Reserved line - scale factors

To contain relevant scale factors if applicable. Leave blank in not required. The weekend soil line shall be saved in this line.

An example use of this line is
Gain: 7 Calib: *20159 / 8192 mV Weekend = 723 mV

Line 12 Reserved line - other required information

Reserved to record other information if required. Leave blank if not required.

An example use of this line is
1 9851 (channels, bytes in block) Polarity +ve to structure

Line 13 Start of recorded data

7 Software

All software used in VEC area testing shall be designed for use on IBM compatible PC and laptop computers, support commonly available peripheral devices such as screens, printers, mice, disk drives, etc and meet the compatibility requirements detailed in this specification.

In particular they shall be capable of –

(a) Producing a datafile confirming the naming, header and data compression requirements detailed in this specification.

(b) Being rewarded for flexibility in being able to handle the setting up and downloading using all approved formats.

(c) Meet the expectations for user interfacing and graphical presentation required during area testing (especially for setting up loggers and downloading of logger datafiles).

(d) Meet the technical capability for viewing recorded data without disturbing the 24 hr recordings.

(e) Provide the essential features for the presentation, processing and analysis of recordings for VEC area testing.

(f) Be able to identify most commonly encountered errors, which can then be handled by the user. User to be easily able to escape from most situations.

(g) Windows based software is desirable due to ease of use, operator familiarity and ability to switch to other functions.

(h) Communication errors to be checked for and corrected where possible.

The data display should be capable of being switched between "dots" and "lines".

The following sections detail the various aspects of user software in more detail. The areas addressed include file naming, header information, datalogger user interface, file output, graphical display and real time interrogation.

8 Graphical Display

Display near full screen graph of recorded data on 24 hour time base (unanchored).

Include location, type of recording and statistical data on the graph.

Option for scaling graphs to include –

- full auto-scaling.
- auto-ranging to selected scales (1, 2.5, 5 and 10 volt ranges).
- fixed scale (display all charts on a defined scale).

with saved user preferred defaults.

Rapid display of data should rate high in performance criteria.

Ease (minimum number of keystrokes) to display charts, find and retrieve files, adjust datum or zoom parameters.

Optional features include –

- Adjustable datum which displays the percentage under the value (high priority).
- Zoom box to display parts of a chart (high priority).
- Optional use of dots or connected lines between readings (high priority).
- Display multiple charts for comparison (high priority).
- Include a weekend soil line datum (medium priority).
- Exclude/remove selected parts of the chart (medium priority).
- Optional polarity, with facility to change/invert polarity (medium priority).
- Produce histograms of recorded data (low priority).
- Display moving averages of recorded data (low priority).

9. Real Time Interrogation

Where dataloggers are used at locations where the VEC test co-ordination staff require access on site to the data (ie. drainage bonds), the structure owner must also meet the following criteria

(a) The data logger must be capable of real time access

(b) Suitable software, communication cables and training must be provided to enable VEC co-ordination staff to access the data on site

OR

The structure owner's staff must be provided to facilitate the viewing of the data by the VEC co-ordination staff

(c) Allow interrogation of recorded and current data and readings without upsetting the 24-hour recording requirements

(d) Software to rapidly and easily access, download and display recorded data in real time.

(e) Software to be compatible with MS Windows operating system running on an IBM compatible PC.

(f) Interrogation and downloading not to interfere with 24-hour recording of data

(g) Ease (ie. minimum number of keystrokes) to set up, interrogate, display graphs, adjust datum or zoom parameters.

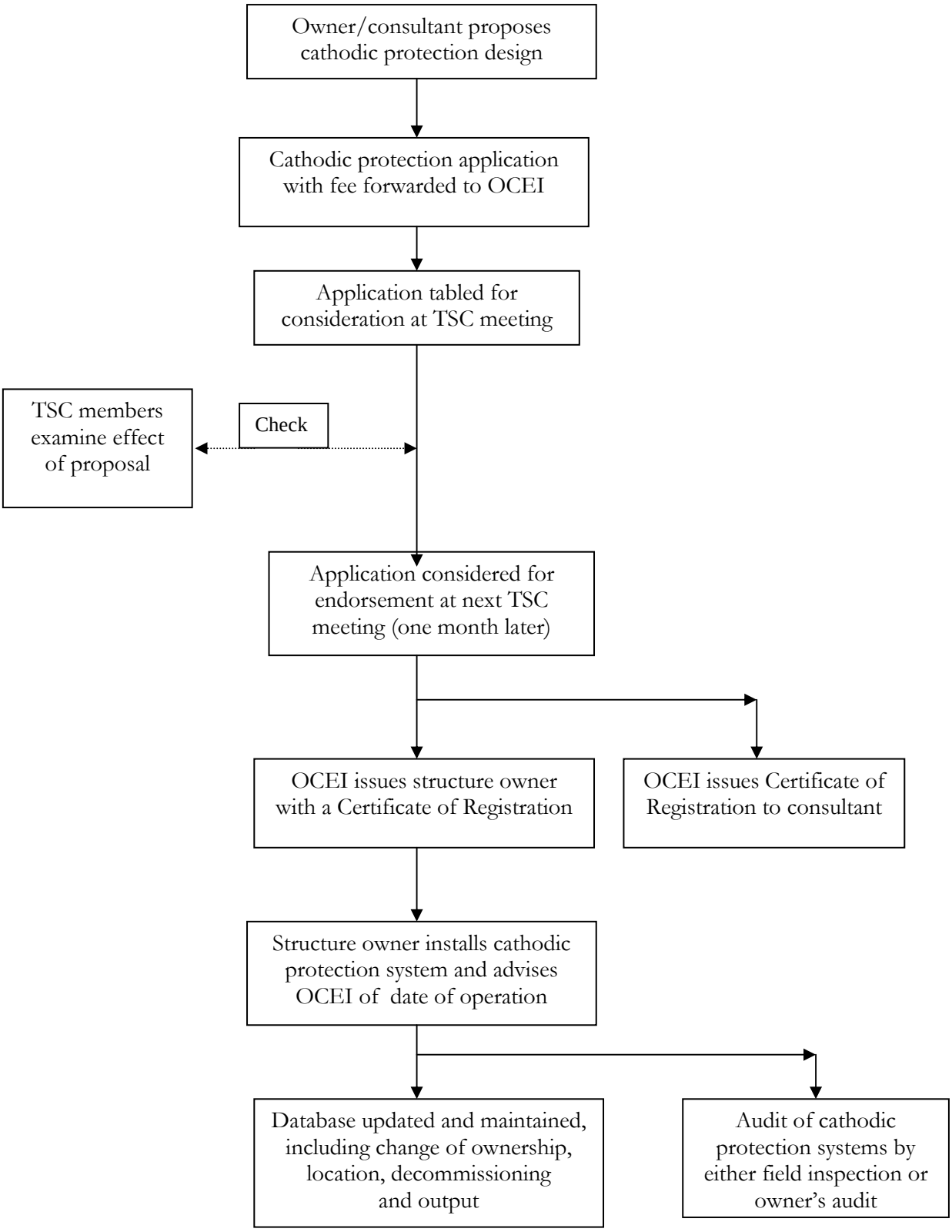
(h) To include a pre-saved default time (eg. Last hour for downloading and displaying)

Optional features include –

- Variable datum with the percentage under value displayed.
- Vary timebase from and/or change default.
- Display location, type and statistical information.
- Scaling features to include –
  - full auto-scaling
  - auto-ranging to selected scales. (1, 2.5, 5 and 10 volt ranges)
  - fixed scale (display all charts on a defined scale).
- Real time updating of graphical display.
- Saving snapshots for comparison elsewhere.

Appendix 3 Flow Diagrams for Cathodic Protection Applications

Application Process for Cathodic Protection Systems with a Total Output up to and including 250 mA



Application Process for Cathodic Protection Systems with a Total Output Over 250 mA