Aboveground Storage Tanks CP Modelling

Elsyca's innovative computational modelling provides groundbreaking technological solutions

The application of Cathodic Protection (CP) to mitigate soil side corrosion on aboveground storage tanks has mixed success costing the industry a few hundred million dollars per annum. Elsyca's specialty engineering services enable cost-effective and reliable CP system designs and performance evaluations in line with international standards and all of the PHMSA requirements for corrosion and safety.

The Market Needs

AGSTs are complex CP structures based upon API RP2003, API 651, NACE SP0193 and EN 14505 requirements and typical analytical calculations based upon remote earth do not work. In addition to the CP, Vapor Corrosion Inhibitors (VCI) are potential considerations for AGSTs but these introduce new uncertainties in the protection performance of these hybrid systems.

A typical tank outage incurs costs due to loss of production (storage), UT scanning and high repair costs ranging from $45,000/day up to several million dollars or more when unscheduled shutdowns occur, and tank floors need to be replaced.

Challenges

Analytical formulae for the CP design of an AGST are often inadequate for a variety of reasons:

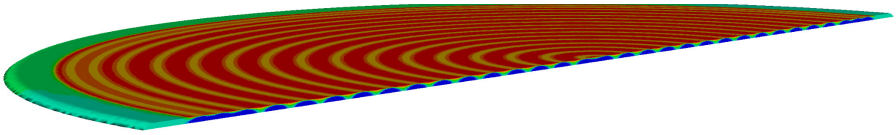
- CP behaves differently in confined spaces where leak detection, HDPE liners/barriers, and double floors apply;
- tank pads do not have uniform soil properties influencing the CP current distribution;
- anodic/cathodic polarization is not accounted for in the calculations;
- current may leak to plant system earthings and other extraneous groundings.

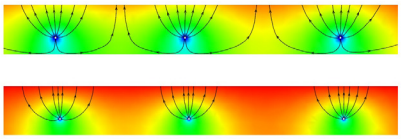
The actual potentials and current distribution remains unknow, and asset owners and operators rely on a few reference electrodes that typically account for less than 5% of the area under the tank to determine the level of protection.

Why Computational Modelling

Elsyca's Engineering Services enables cost effectively solutions in order to mitigate current design issues and to meet the client's needs. Computational modelling of the tank bottom plates, CP system and foundation details, effectively account for all of the following:

- Calculates the tank and anode potentials and current distribution for various settings;
- Demonstrates the CP effectiveness by visualizing anodic and cathodic areas;
- Determines the electrolyte conductivity based upon measured input potentials and voltage gradients in order to determine the effectiveness of the VCI's;
- Compliant with all NACE SP0193 Section. 4.3.1.1-3 acceptance criteria;
- Determines the optimized anode layout, location of UT coupons, etc.;
- Troubleshoots existing CP systems by calibrating the models based upon as-built and site gathered data and measurements;
- Investigates the impact of broken anodes/positive connections;
- Determines the efficacy of the proposed CP design prior to implementation.

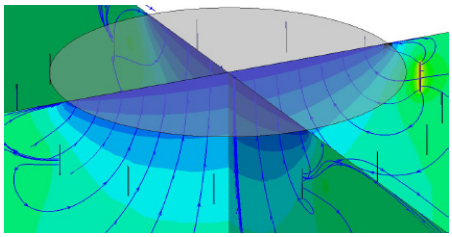


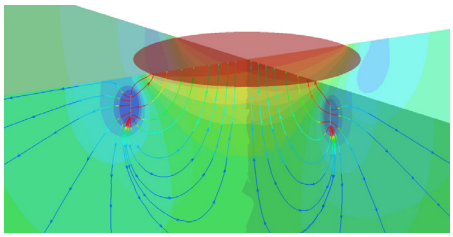


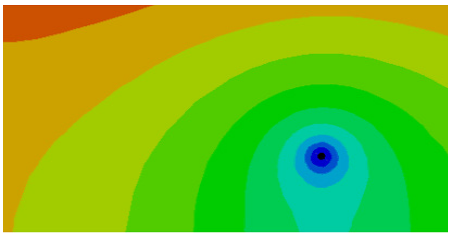
Elsyca's Engineering Key Features

- The potential and current distribution can be modelled for the entire tank surface area;
- The precise anode, tank foundation and ring wall or annular ring construction dimensions can be replicated in the 3D models;
- The electrolyte properties that affect the potential and current distribution and the protection levels are considered (uniform or nonuniform);
- Tank and anode specifications (material properties, dimensions, etc.) are accurately defined and used to ensure that all voltage drops and resistive loads are accounted for;
- The anode current distribution through the electrolyte is visualized and areas of under-protection are readily determined;
- The net flow of current to the cathode (tank floor) from the various anodes is visualized, to ensure that optimal anode placement has occurred. The number and distribution of anodes are adapted based upon the electrolyte conductivity and levels of protection;
- The dimensions, depth and spacing of concentric ring anodes and anode grid systems are effectively validated and verified prior to purchasing materials and prior to any installation;
- Full visualization of current flowing to AGST and the effect of extraneous earths on the tank potential and current distribution;
- The anode current density and associated consumption rates are determined along the length of each anode;
- Positive cable runs and connections to the anodes are verified and optimized from both a commercial and technical perspective.

Complex, confined and complicated tank floor corrosive environments are all electrochemically computed, pragmatic solutions engineered and this is visualized using powerful 3D computational modelling. Contact an Elsyca subject matter expert now.







All of the PHMSA requirements are met by making use of Elsyca's groundbreaking technology, real world input parameters, and visualizing the design before its implementation. Compliance and protection are no longer left to uniform inputs and chance.

Elsyca's trusted global electrochemical expertise, cutting-edge technology and engineering proficiency, provides long term industrial solutions to a complicated AGST environment.